Congress, demonstrating the difficulty the NSF would have getting funds from Congress to provide the needed program in scientific research or in scholarships to train future scientific leadership. Shortly after Roosevelt died, however, a research agency was created within the Navy, called the Office of Naval Research (ONR). Though originally formed with a different purpose in mind, this agency took up the task of funding basic research in science and technology in a number of U.S. universities. Describing how this agency gave its grants out, Sapolsky writes (pg 7): For a few years, in the late 1940s, ONR functioned as the federal government's only general science agency. Sapolsky documents the ONR's support for the independence of scientists and scientific inquiry. Among the innovations of the ONR was the appointment of scientists as program managers who would choose the projects and the scientists they funded [Sapolsky, pg 7.]: ONR's unique contribution to the management of research, rarely appreciated within the Navy, was its ability to attract program specialists who did what no management system has been able to do -- bridge the large gap that exists between the worlds of the Navy and of academic science. However, several vocal spokespeople for the scientific community continued to challenge what they believed to be an inadequacy of support for basic research in science and technology in the U.S. There were investigations into the reasons that the Services were reluctant to support modern technological and scientific research. Dr. Lloyd V. Berkner who played an important role in the Lincoln Project Study funded by the U.S. Department of Defense, on this issue. J.C.R. Licklider, who would later be the first head of a new basic research office for computer science, was part of this study. The study criticized the Air Force for its policy of relying on strategic bombing as a defensive strategy. The Lincoln Project Study recommended that there was a need for an effective system of air defense based on support for research and technological breakthroughs (Price, pg 142). However, the Air Force rejected this recommendation. Despite his concern that he would be penalized by the Air Force for public criticism of their policy, Berkner continued to challenge their decision. Presenting his views in a speech at the University of Minnesota, he criticized the plan for strategic bombing and argued instead for an effective system of air defense based on technological breakthroughs. In various committee hearings before the U.S. Congress, like the Riehlman Committee hearings (June 1954), the Symington Air Power Hearings in June 1956 and in a report by the Rand Corporation, there were analyses of the nature and reasons for the technical and scientific weakness of U.S. research and development. An article written by James Killian of MIT was quoted at a Riehlman Committee hearing as a warning of the (Barber, pg. I- 24): tendency for the military to keep R and D at arm's length and to ignore it in defense planning, largely because they failed to understand it. Killian proposed the need for a serious basic research program supported by the U.S. government: I'm talking about research that in general is directed toward new concepts, new principles, rather than producing a piece of hardware. It is the yet unanticipated unconceived discoveries which may determine our military strength tomorrow.... Those interested in the problem of scientific research for military developments were also wary of the possible loss of scientific independence by the science community. They were wary of the "hazards in the 'closed politics' of scientific advice not subject to political checks and balances," and were reluctant to become embroiled in a situation where they were responsible for upholding a "party line". [Barber, pg I-22, See also C.P. Snow's talk at MIT in 1961, described in Greenberger, pg 3-13] 5. Soviet Union Launches Sputnik On October 4, 1957, the Soviet Union launched Sputnik. And in May 1958, Sputnik III was launched, weighing 7000 pounds. To the scientific community concerned with these events, this situation "demonstrated that the Soviet Union had both the booster and the guidance capability to send ICBM's to the U.S." [Barber, pg. I-22] Advocates for scientific research like MIT's Killian utilized this opportunity to stress that the only way to counter the danger posed to national security was to develop a program of support for basic research in science and technology. In a speech given on February 23, 1959 to the Economic Club of Detroit, Killian warned [Barber, pg. I-26]: The future of the United States, to an extraordinary degree, is in the hands of those who probe the mysteries of the atom, the cell and the stars. Especially is this true of that tiny part of our creative effort which we inadequately term basic research....Such a serious inbalance is a hazard to the economy, the safety, and the health of this country. If we are to continue to maintain an overall defense strength second to none, if we are to prevent Sputnik surprises in the future, we must augment this effort.

Navy.

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Larry Warren Navy Intelligence

Navy interviewed Bob Lazar for his S-4 job

Lazar's W-2 Wage & Tax statement for 1989 United States
Dep't of Naval Intelligence Washington D.C.

support of science, the President and the armed forces could no longer wait for the organization and initiation of much needed postwar research.[80] The dispersion of OSRD functions began. To assure continuance of long-range medical research begun during the war, Bush, on January 1, 1946, transferred twenty-three of the CMR contracts to the Surgeon General of the Army and forty-two other medical contracts to the Public Health Service under Rolla Dyer, Director of the National Institute of Health.[81] Several months before, an Academy-Research Council Committee on Insect and Rodent Control had taken over the functions of the OSRD committee of the same name.[82] In an effort to prevent the scientific isolation of the services that had followed World War I, the Navy perpetuated its OSRD underwater research through the establishment in the Research Council of a Committee on Undersea Warfare.[83]

With the discharge of the Research Council's wartime committees on military medicine in June 1946, the Surgeons General of the Army and Navy and the Administrator of the Veterans Administration requested their reconstitution as advisory committees under contract to guide the postwar medical programs of their departments. The Veterans Administration further contracted for a new Committee on Veterans Medical Problems in the Research Council to advise on clinical follow-up studies and other research for war casualties in their hospitals. A third contract with the Navy Air Surgeon and the Navy

[80] For an excellent account of federal assumption of new responsibilities for scientific research, see Albert C. Lazure and Andrew P. Murphy, Jr. (eds.), *Research and Development Procurement Law* (Washington: Federal Bar Journal, 1957).

[81] Irvin Stewart, *Organizing Scientific Research for War: The Administrative History of the Office of Scientific Research and Development* [OSRD, *SCIENCE IN WORLD WAR II*] (Boston: Little Brown & Co., 1948), pp. 313–317, 319; C. J. Van Slyke, "New Horizons in Medical Research," *Science 104*:559–567 (December 13, 1946); George Rosen, "Pattern of Health Research in the United States, 1900–1960," *Bulletin of the History of Medicine 39*:220 (May–June 1965).

[82] NAS, *Annual Report for 1944–45*, pp. 25–26.

In July 1946, in order to make widely available its amassed data on chemical compounds with biological significance, the committee was reorganized as the Chemical-Biological Coordination Center [NAS, *Annual Report for 1946–47*, pp. 39–40 *et seq.*; NAS Archives: EX Bd: Chemical-Biological Coordination Center; E. C. Andrus, *et al.* (eds.), *Advances in Military Medicine* [OSRD, *SCIENCE IN WORLD WAR II*] (Boston: Little, Brown & Co., 1948), Vol. II, pp. 542–545, 621–645; NAS-NRC, *News Report 2*:67–69 (September–October 1952)].

[83] NAS, *Annual Report for 1946–47*, pp. 37, 43 *et seq.* NAS Archives: EX Bd: Committee on Undersea Warfare. See also NAS-NRC Governing Board, "Minutes," 7.4.1–7.4.2 (September 20, 1969).

Bureau of Medicine and Surgery continued the wartime research in aviation medicine.[84]

Early in 1946, the Joint Chiefs of Staff gave consideration to the establishment of a Joint Research and Development Board that would provide coordination of research and development of the two Services on a continuing peacetime basis. The new committee would, in effect, carry on the work of the Joint Committee on New Weapons and Equipment (JNW) that the Joint Chiefs of Staff had set up under charter in May 1942. It consisted of Bush as Chairman and one general officer of the Army and one flag officer of the Navy. The JNW had operated so effectively during the war that the Joint Chiefs wanted a similar organization in the postwar period, again to be headed by Bush. Bush, however, felt that any new committee should have a clear delegation of authority that would enable it to resolve differences other than by reference to a superior body, in this case the Joint Chiefs. After several months of discussion, the matter was finally resolved when Secretary of War Robert P. Patterson and Secretary of the Navy James V. Forrestal decided that the new committee should be a committee of the two departments rather than of the Joint Chiefs of Staff.

The two Secretaries in a letter of June 1, 1946, signed jointly, asked Dr. Bush to serve as Chairman. After some further discussion Bush accepted and the Joint Research and Development Board (JRDB) was created by charter of June 6, 1946.[85]

The unification acts creating the National Military Establishment in 1947 and its successor, the Department of Defense in 1949, contained provision for a Research and Development Board to replace the JRDB.

[84] NAS, *Annual Report for 1945–46*, pp. 52–53 *et seq.*, and NAS Archives files of the committees. For the organization of an NAS-NRC medical advisory council to the Medical Departments of the Army and Navy and to the Veterans Administration, see NAS, *Annual Report for 1946–47*, p. 69; NAS Archives: Jewett file 50.725.

Of thirty-six Academy-Research Council committees acting for the Department of Defense and the AEC in 1954, almost half had their source in the divisions of OSRD. See report, "Summary of Activities of the Academy-Research Council Supported Wholly or in Part by Department of Defense or Atomic Energy Commission" (NAS Archives: ORG: Activities: Summary of Activities . . . : 1954).

[85] Stewart, *Organizing Scientific Research for War*, pp. 47, 50.

On the Joint Research and Development Board, Conant headed the Committee on Atomic Energy; Hartley Rowe, the Aeronautics Committee; Karl Compton, the Committee on Guided Missiles; Julius A. Stratton, Professor of Physics at MIT, the Committee on Electronics; Roland F. Beers, geophysicist at MIT, the Committee on Geophysical Sciences; and Charles H. Behre, Jr., Columbia geologist, the Committee on Geographical Exploration [*Science 105*:89–91 (January 24, 1947)].

The new Board, comprising two representatives each from the Army, the Navy, and the Air Force, operated under the successive chairmanships of Bush, Karl Compton, William Webster, and Walter G. Whitman. It continued its advisory and coordinating functions until 1953, when it was abolished and its place taken by a new Assistant Secretary of Defense for Research and Development.[86]

On August 1, 1946, President Truman signed the law creating the Office of Naval Research (ONR).[87] The origin of ONR went back to the Army–Navy conference in April 1944 that had resulted in the establishment of the Academy's Research Board for National Security (RBNS). A group of young scientists in the Navy's Office of the Coordinator of Research and Development, with the counsel of Jerome Hunsaker and Rear Adm. Julius A. Furer and the support of Vannevar Bush, began planning an "Office of Naval Research" to function with RBNS and, eventually, with the projected federal science agency.

In September 1945, a month before the brief reactivation of RBNS by the Army and Navy Secretaries, the Navy group drafted a bill, subsequently sponsored as H.R. 5911 by Representative Carl Vinson of Georgia, Chairman of the House Armed Services Committee, for the establishment of an Office of Naval Research. Its "main features and philosophy were to embody many of the recommendations of the Bush report," a Navy spokesman reported, its "primary mission . . . in principle the same as that envisaged by the Wilson Committee for the RBNS, namely, to retain the collaboration of top level civilian scientists in all fields of research having a bearing on national security."[88]

The Navy worked out a contract arrangement acceptable to the universities that were to undertake the research. The agreements specifically assured to the scientists involved a maximum of freedom and permitted them to initiate projects "in fundamental research without restrictions" in nuclear physics, medicine, physics, chemistry, mathematics, electronics, mechanics, and meteorology; to explore new avenues; to publish their findings; and to continue their teaching.[89]

[86] U.S. Congress, House, Committee on Government Operations, *Organization and Administration of the Military Research and Development Programs. Hearings before a Subcommittee of the House Committee on Government Operations*, 83d Cong., 2d sess., June 1954; Don K. Price, *Government and Science: Their Dynamic Relation in American Democracy* (New York: New York University Press, 1954), pp. 144, 151–152.

[87] Public Law 588, 79th Cong., 60 stat., 779; 10 U.S.C., 5150–5153.

[88] John E. Pfeiffer, "The Office of Naval Research," *Scientific American 180*:11–15 (February 1949).

[89] *Ibid.*

The Naval Research Advisory Committee of ONR was formalized by charter on January 14, 1947; its members, under Chairman Warren Weaver, included Detlev Bronk, Arthur Compton, Karl Compton, Richard J. Dearborn, Luis De Florez, Lee A. DuBridge, William S. McCann, Philip M. Morse, and Lewis A. Strauss. Two months later, ONR, under Adm. Harold G. Bowen and his civilian deputy, Yale physicist Alan T. Waterman, "found itself the sole government agency with the power to move into the void created by the phasing out of the OSRD. . . ."[90]

The War Department counterpart of ONR was the Research and Development Division, established in the spring of 1946. With a panel of consultants drawn from science, education, and industry, it was to direct research in War Department laboratories and coordinate it with programs in other military laboratories and in private institutions.[91]

The dispersion of OSRD activities continued through 1947. The Applied Physics Laboratory of the Johns Hopkins University, which had produced the proximity fuze, continued to operate under contract with the Navy. Operations analysis functions that OSRD had initiated were carried on in the Operations Research Office (ORO) set up under Army contract with the Johns Hopkins University; in the Operations Evaluation Group under Navy contract with MIT; and in the RAND Corporation under Air Force sponsorship at Santa Monica, California.[92] Little seemed to remain for a science foundation except some residual basic research and a scholarship program.

The Steelman Report

Truman was irritated at the impasse over science legislation in Congress, and on October 17, 1946, he appointed the President's Scien-

[90] The Bird Dogs (Bruce S. Old *et al.*), "The Evolution of the Office of Naval Research," *Physics Today 14*:35 (August 1961); Furer, *Administration of the Navy Department in World War II*, p. 805; NAS Archives: AG&Depts: Navy: ONR: Naval Research Advisory Committee: 1946. For the Research Council's ONR advisory committees in mathematics, geophysics, and astronomy, see NAS, *Annual Report for 1947–48*, p. 55.

[91] Dwight D. Eisenhower, "Memorandum for Directors and Chiefs of War Department General and Special Staff Divisions and Bureaus and the Commanding Generals of the Major Commands: Subject, Scientific and Technological Resources as Military Assets," April 30, 1946 (NAS Archives: Jewett file 50.729); "War Department Research and Development Division," *Science 104*:369 (October 18, 1946).

[92] The promise of operations analysis and the concept of the "think tank" as a new applied science useful to the military led the Research Council in the spring of 1951 to appoint a Committee on Operations Research under Horace C. Levinson, Chairman of

tific Research Board to be headed by the Assistant to the President, John R. Steelman, Director of the Office of War Mobilization and Reconversion. The members of the Board were: Robert P. Patterson, Secretary of War; James Forrestal, Secretary of the Navy; Julius A. Krug, Secretary of the Interior; Clinton P. Anderson, Secretary of Agriculture; W. Averell Harriman, Secretary of Commerce; John D. Goodloe, Administrator, Federal Loan Agency; Watson B. Miller, Administrator, Federal Security Agency; Maj. Gen. Philip B. Fleming, Administrator, Federal Works Agency; Charles R. Denny, Jr., Chairman, Federal Communications Commission; Jerome C. Hunsaker, Chairman, National Advisory Committee of Aeronautics; Vannevar Bush, Director, Office of Scientific Research and Development; David Lilienthal, Chairman, Atomic Energy Commission; Gordon R. Clapp, Chairman, Tennessee Valley Authority; Gen. Omar N. Bradley, Administrator, Veterans Administration; and J. Donald Kingsley, who was named Executive Secretary. The Board was to report on the research programs of federal scientific agencies, the nature of nonfederal research and development in the nation, and the interrelation of federal and nonfederal research.[93] It seemed possible that with the current large-scale federal support of basic research projected for ONR, the Army's research division, and the National Institute of Health, and in view of the increased support of scientific research voted by Congress to some fifty other federal agencies, the immediacy of the need for a national science foundation had passed.

Steelman reported otherwise: "The drying up of European scientific resources, the disruption of normal international exchange of scientific knowledge, and the virtual exhaustion of our stockpile of basic knowledge" made a national science foundation imperative. Federal support of research and development, particularly of basic research and health and medical research in the universities, industry, and government, must be accelerated as rapidly as possible, so that before the end of a decade expenditures for these purposes would be at least 1 percent of the national income. The foundation, under a director appointed by the President and a part-time advisory board of eminent scientists and educators equally divided between government and nongovernment representatives, should support basic research and medical research outside the purview of other agencies and institutions, develop a long-range federal program of science scholarships and fellowships, and assist the universities in expanding their laboratory facilities and acquiring research equipment.[94]

Word of the preparation of the Steelman report brought on a rash of bills to create the science foundation. One, introduced by Senator Elbert D. Thomas (S. 525), was identical to the Kilgore–Magnuson bill (S. 1850) that had passed the Senate the previous session. Another, introduced by Senator H. Alexander Smith (S. 526), was a return to the original Magnuson bill. Four bills identical to Smith's S. 526 were also introduced in the House, among them Representative Wilbur D. Mills's H.R. 1830.[95]

Challenged by the new legislative activity, a coalition of the scientific community, under the auspices of the American Association for the Advancement of Science, resolved to present a united front before Congress. Its moving spirits saw with concern the extent to which federal research was becoming firmly established in military hands and that the repeated failure of the scientists to come to any agreement among themselves had prevented Congress from creating the foundation.

On February 23, 1947, representatives of almost seventy scientific societies, the members of the disbanded Bowman committee, and those of the still-active Committee for a National Science Foundation came together in the Inter-Society Committee on Science Foundation Legislation. The group included Chairman Edmund E. Day, President of Cornell; Vice-Chairman Harlow Shapley, President of AAAS; an Inter-Society Executive Committee, including Dael Wolfle, Isaiah Bowman, Ralph W. Gerard, Henry Allen Moe, and W. Albert Noyes, Jr.; and invited representatives of the Joint Research and Development Board, the President's Scientific Research Board, the U.S. Public Health Service, and the Office of Naval Research. They met to consider the chief point of contention in science legislation, the administration of the proposed foundation. By vote, 63 percent of the

the Board of Tele-Rama, Inc., to study its application to industry, business, and government, and to offer the committee's services as a clearinghouse for its promotion and organized support. During the Korean War, operations research became of special concern to the Science Advisory Committee (SAC) in the Office of Defense Mobilization. See NRC report "Operations Research with Special Reference to Non-Military Applications," April 1951, and "Scientists and Mobilization: Some Views of the Science Advisory Committee on the Role of Academic Scientists," September 11, 1951 (NAS Archives: EXEC: ODM: SAC); Don K. Price, *Government and Science*, pp. 126–128.

[93] Copy of Executive Order 9791, October 17, 1946, in OSRD Box 32; NAS Archives: EXEC: President's Scientific Research Board: 1947.

[94] The President's Scientific Research Board, *Science and Public Policy. A Report to the President by John R. Steelman*, vol. I, *A Program for the Nation* (Washington: Government Printing Office, 1947), pp. 3–7, 69–71.

[95] *Science 105*:171 (February 14, 1947); NAS Archives: CONG: Bills: NSF: 1947. S. 525 and S. 526 were compared in *Science 105*:253–254 (March 7, 1947).

members of the Inter-Society Committee supported a Presidentially appointed director; 18 percent a large Presidentially appointed (forty-eight-member) board that would select the director; and 18 percent a small AEC-type board.

Chairman Edmund Day reported the results of the poll to Representative John H. Wolverton's House Committee on Interstate and Foreign Commerce at hearings held early in March.[96] The hearings were otherwise notable only for Vannevar Bush's predictable support of Mills's H.R. 1830, Dr. Bronk's strong support of research in the social sciences, and Dr. Jewett's continued resistance to any science foundation. Jewett felt that for fundamental research and education in science to be left to the foundation as a federal agency would be to make them completely vulnerable to all kinds of social and political pressures. He saw the foundation as duplicating Academy functions, since both basic research and education were already well provided for in the Academy's National Science Fund and its National Research Fellowships program, which wanted only augmentation, preferably through changes in the tax statutes to increase the attractiveness of voluntary personal contributions.[97] In time, however, Jewett came to see that supervision of a national program of either basic research or science education was not within the scope of the Academy, and that the very proliferation of new science agencies, the acceleration of federal support of science, and the consequent extension of the frontiers of science would stretch the capabilities of the Academy to their utmost.

Of the plethora of bills then before Congress, Senator Smith's S. 526, after some tinkering, was to raise the greatest hopes for a science foundation that would be satisfactory to the Administration. In its original form, the bill provided for a governing board of twenty-four Presidentially appointed members from science, engineering, education, and public affairs, and an executive committee

[96] *Science 105*:227 (February 28, 1947); U.S. Congress, House, Committee on Interstate and Foreign Commerce, *National Science Foundation. Hearings before the Committee on Interstate and Foreign Commerce, on H.R. 942, H.R. 1815, H.R. 1830, H.R. 1834, and H.R. 2027*, 80th Cong., 1st sess., March 6–7, 1947, pp. 63–64.

[97] Jewett's extended views appeared in *National Science Foundation. Hearings*, March 6, 1947, pp. 73–76, 91–110, and in a fifty-eight-page privately printed pamphlet, "The Case for Continuing Private Support of Fundamental Science," March 18, 1947 (NAS Archives: CONG: Bills: National Science Foundation).

Dr. Jewett in his late sixties had his share of "fixed ideas" and sometimes found it difficult "to accommodate himself to developments in the present very rapidly shifting scene in which science and engineering find themselves" [Merriam H. Trytten, Director, NRC Office of Scientific Personnel, to Bronk, July 17, 1947 (NAS Archives: *ibid.*)].

of nine, elected by the board, which would appoint the director. The National Academy and leading education associations were to recommend nominations for board members to the President, and the bill included a provision that the unexpended funds and the remaining contracts of OSRD were to be transferred to this "successor agency," enabling it to begin operations shortly after its establishment.

On May 1, Edmund Day wrote Senator Smith and Representative Wolverton offering the Inter-Society Committee's endorsement of S. 526, with amendments reducing the size of the board from twenty-four to nine members and calling for Presidential appointment of the director after consultation with the board. The second of these amendments, that calling for Presidential appointment of the director, was adopted by the Senate, as was one providing for distribution of part of the funds on a geographic basis. The bill passed the Senate late in May, and the Academy, assured of the President's interest in establishing a foundation without delay and certain that the bill represented an acceptable compromise, canvassed its membership for nominations for the twenty-four members of the foundation, as called for by the bill.[98]

On July 15, 1947, a House version of S. 526 was passed and in conference the two amendments were struck from the Senate's bill. It was the original S. 526 that both houses passed that summer and sent to the White House. The President, deeming it basically the same as the Magnuson bill, which had the director responsible to a part-time board rather than to the President, withheld his approval. It died by pocket veto on August 6.[99]

The veto shocked many of the leaders of science into accepting the fact that the nation's scientific enterprise, with a current budget of more than one billion dollars and the Steelman projection of twice that sum within the next decade, could no longer be considered apart from national policy and politics. Science was not merely auxiliary to the development of industry, medicine, and national defense, free to operate under the direction of existing organizations with a minimum of control by Congress and the President. It had become a national resource, subject to national planning, and responsible to the President. The veto registered a further shock, for by default it left the

[98] Jewett to Bush, June 5, 1947 (NAS Archives: ORG: NAS: Com on Nominations for Proposed National Science Foundation).

[99] Truman report on S. 526, August 6, 1947 (NAS Archives: CONG: Bills: National Science Foundation: 1947); Meyerhoff, "The Truman Veto," *Science 106*:236–237 (September 12, 1947); Dael Wolfle, "The Inter-Society Committee for a NSF: Report for 1947," *Science 106*:529–533 (December 5, 1947).

control of federal funds for research grants in the hands of the Army, Navy, and Air Force.[100]

In November 1947, Harlow Shapley organized a committee that included Academy members Conant, K. T. Compton, Arthur L. Day, and Luther P. Eisenhart, who agreed that Truman's insistence on his appointment of the foundation director must be complied with.[101] As Vice-President of the AAAS Inter-Society Committee, Shapley also met with Senator Smith, Congressman Wolverton, representatives of the Bureau of the Budget, and Vannevar Bush, and urged the legislators to prepare new bills based on the Senate's amended version of S. 526.[102]

The brief hearings that June on identical bills, S. 2385 (Smith) and H.R. 6007 (Wolverton), were chiefly remarkable for the almost total absence of representatives of the scientific community and for Dr. Jewett's objections submitted to the legislators, which included a reprint of Samuel Johnson's *Rambler No. 91* (1751), on the hazards to scientific research of dependence upon government support:

> The Sciences, after a thousand indignities, retired from the palace of Patronage, and having long wandered over the world in grief and distress, were led at last to the cottage of Independence, the daughter of Fortitude; where they were taught by Prudence and Parsimony to support themselves in dignity and quiet.[103]

The hearings came at a bad time. Congress was fighting a rising tide of inflation and developing legislation for Truman's European Recovery Program. In the further distraction of a Presidential election year, neither science bill was acted on.

A Restatement of Academy Policy

The ultimate creation of a national science foundation, Dr. Jewett felt, would enhance rather than diminish the need for the National

[100] *Science and Public Policy*, Vol. I, pp. 12, 13; *Science 106*:141 (August 15, 1947); Washington Association of Scientists, "Towards a National Science Policy?", *Science 106*:385–387 (October 24, 1947).

[101] Shapley to Bronk, November 5, 1947 (NAS Archives: CONG: Bills: National Science Foundation: 1947).

[102] Wolfle, "Inter-Society Committee for a NSF," *Science 107*:235 (March 5, 1948).

[103] U.S. Congress, House, Committee on Interstate and Foreign Commerce, *National Science Foundation. Hearings before the Committee on Interstate and Foreign Commerce, on H.R. 6007 and S. 2385*, 80th Cong., 2d sess., June 1, 1948, pp. 118–123.

Academy of Sciences. "It is clear," he wrote, "that the Academy and Research Council should be kept in a virile state."[104]

The Academy's limited endowment, however, did not provide funds sufficient to support an expansion of the Research Council's activities. Jewett knew that the increased importance of science and technology to the nation would mean a growing need for the services of the Research Council. Additional income and office space would be necessary. Preliminary discussions with foundation trustees were encouraging, but Jewett realized that any formal request needed to be supported by a clear statement of the Research Council's unique capabilities, its intended activities, and its projected needs.[105]

He had become increasingly concerned, also, about problems of internal organization disclosed by the wartime activities of the Academy. The rules governing the operations of the Research Council had served fairly well during the war, but had proved cumbersome at times and not sufficiently specific with respect to authority and responsibility. This had been particularly evident in the many activities in the Academy and Research Council in which both had interests, and whose smooth operation, as Dr. Jewett said, had depended upon the good personal relationship of the President of the Academy and the Chairman of the Research Council.[106]

In December 1945, at Dr. Jewett's request, Ross G. Harrison, Chairman of the Research Council, appointed a committee to survey the functions of the Research Council, its future activities, and its relationships. The members were: Lewis H. Weed (Chairman), Chairman of the NRC Division of Medical Sciences; Luther P. Eisenhart, Vice-President of the Academy and Chairman of the NRC Division of Physical Sciences; and William W. Rubey, Chairman of the NRC Division of Geology and Geography.

The Weed report a month later called for a maximum of autonomy in Research Council operations, closer personal contact with federal officials, and appointment of a full-time Chairman of the Council.[107] In May, Jewett turned these recommendations over to a special

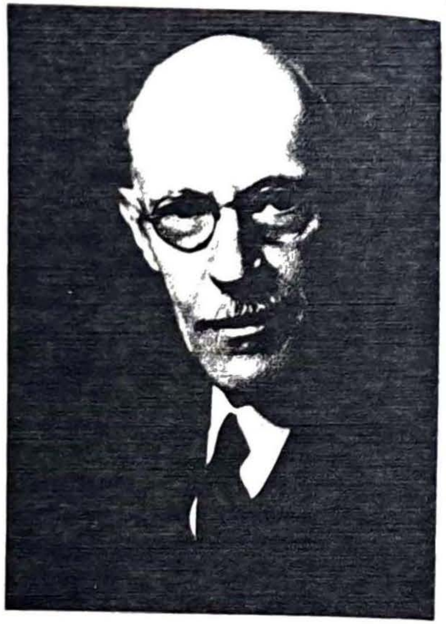
[104] NAS, *Annual Report for 1945–46*, pp. 6–7.

[105] Jewett to Ross G. Harrison, May 28, 1945 (NAS Archives: ORG: NAS–NRC: Reorganization).

[106] Jewett to members of the Council of the NAS, April 19, 1946 (*ibid.*).

[107] [Weed report], "Report of Committee to Survey Functions of Research Council," February 28, 1946 (*ibid.*).

As Dr. Jewett said, "The National Academy of Sciences had been negligent in this obligation [to implement the Executive Order establishing the Research Council] and should be more active in the National Research Council" (NAS, *Annual Report for 1946–47*, p. 16).



Ross Granville Harrison, Chairman of the National Research Council, 1938–1946 (Photograph courtesy Sterling Memorial Library, Yale University).

committee under Isaiah Bowman. The principles for the reorganization of the Research Council, "to strengthen [it] as the chief operating agency of the Academy," were approved by the Council of the Academy a month later. In July new Articles of Organization and Bylaws, besides ensuring the Research Council of stronger support by the Academy and the greater autonomy it needed in its operations, redefined the duties of the Research Council's Executive Board and its Chairman, the functions of its committees, and of officers of divisions.[108]

Proposing this autonomy and an improved NAS–NRC relationship, Jewett earlier that year had asked Detlev Bronk whether he would consider becoming full-time Chairman of the Research Council. Bronk had recently left his post as Coordinator of Research in the Office of the Army Air Surgeon to return to the University of Pennsylvania as head of its Johnson Research Foundation. Bronk felt

[108] Jewett to Bowman, Bush, Adams, Weed, May 17, 1946, and "Comments from Members of Informal Committee . . ." (NAS Archives: Jewett file 50.71); NAS, *Annual Report for 1945–46*, pp. 3–4, 12; *1946–47*, pp. 161–165. For the revision, see *1948–49*, pp. 11, 17–19, 121–135.

that he must reserve some time for the Foundation and for his own research, but he agreed to accept the appointment, effective July 1, 1946.[109]

Jewett's presidency, Bush wrote to him that spring, had been a notable one, for the pages he had written in the war record of the Academy, for his "remarkable" success in putting Academy finances in order, and for the order he had brought into the Academy–Research Council structure and relationship.[110]

The last months of 1946 and the following spring were a time of reappraisal and restoration, as the new Academy–Research Council administration took stock of its mission and attempted to restore its premises, both literally and figuratively, from the neglect of the war years. The whole of the interior of the building was then undergoing repair and repainting, and extensive landscaping was being done. Except for the Committee on Medical Research, which remained until January 1947, the offices of OSRD and other wartime agencies had departed; but their places were immediately taken by the expanding activities of the Research Council and its new committees. Indeed, one committee had to be housed in the Munitions Building across the street, and the temporary partitions in the exhibit rooms, the auditorium balconies, and the library had to remain in place.[111]

Reappraisal of the Research Council mission appeared in Bronk's first report and a similar reassessment of the Academy in Jewett's farewell address to the membership at the autumn meeting in 1947.

Dr. Bronk, who was to give something more than half his time to the chairmanship, was not to make the Research Council "the most powerful centralized scientific institution in the Nation," as Jewett had said a full-time chairmanship promised.[112] But he did set the Research Council firmly to the task at hand. The postwar world of science had "burdened and tempted the Council" with enormous challenges, but it had already begun, and would continue, its "efforts to avoid large-scale administrative operations which can be done better by other agencies and which distract the Council from its primary scientific objectives." As Bronk said, the NRC was recognized as a cooperative agency in the nation for the promotion of military

[109] Jewett to Bronk, March 28, 1946; Jewitt to members of the NAS Council, June 11, 1946 (NAS Archives: Jewett file 50.71); Bronk to Jewett, June 10 and 26, 1946 (NAS Archives: ORG: Appointments: Chairman NRC).

[110] Bush to Jewett, April 26, 1946 (NAS Archives: Jewett file 50.71, Reorganization of NRC).

[111] NAS, *Annual Report for 1945–46*, pp. 19–20; *1946–47*, p. 24.

[112] Jewett to Bronk, March 28, 1946 (NAS Archives: Jewett file 50.71).

security and general welfare, but more important, "a powerful agent for the furtherance of scientific research, for the development of national research, and for the translation of scientific knowledge into socially useful achievements."[113]

At the same time that Bronk was resetting the course of the Research Council, Dr. Jewett, reflecting on his eight years as President of the Academy, worked on his last address to the membership, a position paper on the role of the Academy in its relation to the federal government.[114]

Before a full meeting of the Academy members in closed session that November, he called on them to look again at the Act of Incorporation. No other legislative directive in the history of the federal government, he said, compared in brevity, simplicity, sweeping powers, and consummate flexibility with that "astounding document." Equally remarkable, nothing in its wording contained the slightest attempt to shackle the Academy to the problems or to the philosophy of 1863. It was extremely doubtful whether anything like it could have succeeded in the halls of Congress at any time in the years since.

> In less than forty words the Act of Incorporation in effect created in the whole domain of science a supreme court of final advice beyond which there was no higher authority in the Nation and ensured that so far as was humanly possible its findings would be wholly in the public interest uninfluenced by any elements of personal, economic, or political force.[115]

[113] NAS, *Annual Report for 1946–47*, pp. 31–33, 38.

For example, the Committee on Growth of the Division of Medical Sciences had recently accepted responsibility for dispersing funds of the American Cancer Society for cancer research and training. In the next eleven years a total of $25 million was disbursed on the recommendation of the committee [NAS, *Annual Report for 1945–46*, p. 46 *et seq.*; R. Keith Cannan, "Cancer Research and the Committee on Growth, 1945–1956," NAS–NRC, *News Report* 6:53–57 (July–August 1956)].

Besides eliminating a number of unnecessary committees in the Research Council that first year, Bronk restructured the fellowship program; expanded the Committee on Radioactivity, making it the Committee on Nuclear Science; established a Chemical-Biological Coordination Center and a Pacific Science Board; saw activated a Committee on Atomic Casualties, a Committee on Undersea Warfare, and a Building Research Advisory Board; and appointed a Committee on UNESCO. NAS, *Annual Report for 1946–47*, pp. 34–38.

[114] Foreshadowed in the Academy's report for 1946–47 (pp. 1, 16), Jewett's paper, "The Academy—Its Charter, Its Functions and Relations to Government," was read at the November 17, 1947, business session of the Academy. It was subsequently published in NAS, *Proceedings 48*:481–490 (April 15, 1962).

[115] *Proceedings, ibid.*, p. 482.

If the federal government in the past had not made full use of the Academy it created, the Academy had also failed to promote its availability. The mobilization of science in the war just ended had demonstrated as never before the enormous range and effectiveness of the Academy and the Research Council when responding to its obligations to the government. And the recent reorganization within the Academy sought to assure continuation of that effectiveness by

> confining Academy committees to those which are wholly concerned with matters of advice at top scientific level and assigning all others to the Research Council . . . [and by conferring] on the Research Council the maximum of autonomy compatible with the fact that it is a Committee of the Academy; that its power to serve effectively stems from the authority of the Academy Charter; and that in the last analysis the Academy is responsible for its acts.[116]

Jewett also banished the long-held notion that the Academy could act for the government only when called upon and had no power of initiative or privilege of providing advice. The "whenever called upon" provision in the Charter related only, he said, to the obligation of the government to reimburse the Academy for expenses incurred in government service, and neither in theory nor in practice, except as the Academy so elected, had ever possessed any validity.[117]

The Charter of the Academy was still, after eighty-four years, the source of its opportunity for service, and only as its Constitution and Bylaws acted in any way to modify the intent and operation of its Charter was there any limit on the future activities of the Academy.[118]

[116] *Proceedings, ibid.*, pp. 483, 487.

[117] *Proceedings, ibid.*, p. 488.

Dr. Bronk, in his *Annual Report for 1946–47* (pp. 31–32), agreed that a time of revolutionary changes confronted the nation and that the Research Council was beginning a new period in its history. Henceforth it would be "more than a waiting agency through which governmental and private organizations [might] seek assistance from the scientists of the country." The Council intended to be "adventurous in seeking opportunities for leadership and useful action in all fields."

[118] Knowing that Dr. Jewett was to discuss Academy policy that day, Joe H. Hildebrand, head of the University of California department of chemistry, concluded the day's meeting with some remarks that he hoped would pave the way for a change in the concept of the office of the President. Although Jewett had already raised and answered many of his questions, why, Hildebrand asked, had the Academy given way to another agency in time of war? Why did its opinions seem to be expressed only when the government thinks to ask for them? It was the business of the officers of the Academy to execute policy, but why should not Academy policies be more imaginative and aggressive? Why, above all, had Academy members no opportunity to discuss questions of science and public policy? (NAS Archives: ORG: NAS: Meetings: Autumn: 1947).

Dr. Jewett's restatement of the Academy mission was unequivocal. But he was still not certain that in the recent reorganization of the Research Council he had found the best solution to the "multiple Academy–Research Council dilemma," namely, the relationship between the President of the Academy and the Chairman of the Research Council. Would it ensure greater Academy effectiveness to make the Research Council chairmanship a career job and the presidency an honorary position, or perhaps to provide two Vice-Presidents of the Academy, one to succeed the President and the other to preside over the Research Council? Or should the direction of the Academy and the Research Council be combined under a single head? Should the head of the Research Council be required to be a member of the Academy?

> I know there are two schools of thought in the Academy and I sympathize with both. My eight years as President has taught me, however, that some of the things the ivory tower boys would like are impossible as things are now set up. Possibly Richards [the new Academy President] or his successor can find an answer which will satisfy all the members and all the conditions but I doubt it.[119]

Dr. Jewett's personal conviction that the Chairman of the Research Council ought also to be a member of the Academy and so automatically a member of the Academy Council would be met a decade later. So, too, would the question of Academy initiative in serving the government on "any subject of science or art."

[119] Jewett to Yerkes, May 7, 1947; Jewett to Carmichael, May 26, 1947 (NAS Archives: Jewett file 50.71).

15 *The Years between the Wars*

ALFRED NEWTON RICHARDS (1947–1950)

After the dynamic wartime presidency of Frank B. Jewett, that of Alfred Newton Richards was in the nature of an interregnum, low-keyed and lasting just three years. Yet, during that brief period the Academy and its President were involved in some of the most urgent and intensive inquiries in its history.

Trained at the turn of the century in the new science of physiological chemistry, Richards had been for almost forty years Professor of Pharmacology at the University of Pennsylvania. His was a career with few interruptions apart from a brief tour of duty in 1918 setting up a field laboratory for the study of problems of chemical warfare at Chaumont, France.

Behind Richards's deceptive gravity of mien lay a lively sense of humor and a pungent wit. He delighted in teaching and frequently declared it as important to him as his research. His classroom manner and even his research papers were characterized by a lifelong habit of

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APPENDIX E

Officers and Members of the Council of the National Academy of Sciences, 1863–1963

OFFICERS[1] OF THE NATIONAL ACADEMY OF SCIENCES, 1863-1963

OFFICERS

I PRESIDENTS

1863–1867	Alexander Dallas Bache
1868–1878	Joseph Henry
1879–1882	William Barton Rogers
1883–1895	Othniel Charles Marsh
1895–1900	Wolcott Gibbs
1901–1907	Alexander Agassiz
1907–1913	Ira Remsen
1913–1917	William Henry Welch
1917–1923	Charles Doolittle Walcott
1923–1927	Albert Abraham Michelson
1927–1931	Thomas Hunt Morgan
1931–1935	William Wallace Campbell
1935–1939	Frank Rattray Lillie
1939–1947	Frank Baldwin Jewett
1947–1950	Alfred Newton Richards
1950–1962	Detlev Wulf Bronk
1962–1969	Frederick Seitz

II VICE PRESIDENTS

1863–1865	James Dwight Dana
1866–1868	Joseph Henry
1868–1871	William Chauvenet
1872–1878	Wolcott Gibbs
1878–1883	Othniel Charles Marsh
1883–1889	Simon Newcomb
1889–1891	Samuel Pierpont Langley
1891–1897	Francis Amasa Walker
1897–1903	Asaph Hall
1903–1907	Ira Remsen
1907–1917	Charles Doolittle Walcott
1917–1923	Albert Abraham Michelson
1923–1927	John Campbell Merriam
1927–1931	Frederick Eugene Wright
1931–1933	David White
1933–1941	Arthur Louis Day
1941–1945	Isaiah Bowman
1945–1949	Luther Pfahler Eisenhart
1949–1953	Edwin Bidwell Wilson
1953–1957	George Washington Corner
1957–1961	Farrington Daniels
1961–1965	Julius Adams Stratton

III FOREIGN SECRETARIES

1863–1873	Louis Agassiz
1874–1880	F. A. P. Barnard
1880–1886	Alexander Agassiz
1886–1895	Wolcott Gibbs
1895–1901	Alexander Agassiz
1901–1903	Ira Remsen
1903–1909	Simon Newcomb
1909–1910	Alexander Agassiz
1910–1921	George Ellery Hale
1921–1934	Robert Andrews Millikan
1934–1936	Thomas Hunt Morgan
1936–1942	Lawrence Joseph Henderson
1942–1945	Walter Bradford Cannon
1945–1950	Detlev Wulf Bronk
1950–1954	Roger Adams
1954–1958	John Gamble Kirkwood
1958–1961	Howard Percy Robertson
1962–1974	Harrison Brown[2]

IV HOME SECRETARIES

1863–1872	Wolcott Gibbs
1872–1878	Julius Erasmus Hilgard
1878–1881	J. H. C. Coffin
1881–1883	Simon Newcomb
1883–1897	Asaph Hall
1897–1901	Ira Remsen
1901–1913	Arnold Hague
1913–1918	Arthur Louis Day
1919–1923	Charles Greeley Abbot
1923–1931	David White
1931–1951	Frederick Eugene Wright
1951–1955	Alexander Wetmore
1955–1965	Hugh Latimer Dryden

V TREASURERS

1863–1881	Fairman Rogers
1881–1887	J. H. C. Coffin
1887–1898	John Shaw Billings
1898–1902	Charles Doolittle Walcott
1902–1911	Samuel Franklin Emmons
1911–1919	Whitman Cross
1919–1924	Frederick Leslie Ransome
1924–1928	George Kimball Burgess
1928–1932	Joseph Sweetman Ames
1932–1940	Arthur Keith
1940–1948	Jerome Clark Hunsaker
1948–1960	William Jacob Robbins
1960–1968	Lloyd Viel Berkner

[1] NOTE: Term of office changed from six to four years in 1918.

[2] Appointed in January 1962 to replace Howard Percy Robertson, deceased.

Survey Group of the Department of State," prepared by an NRC committee under the chairmanship of Douglas Whitaker, Dean of Graduate Studies, Stanford University, and "Statement of December 19, 1949, by the NRC Committee on International Scientific Unions," prepared under the direction of John A. Fleming, Chairman of the committee.[94]

Academy members who made personal studies of various kinds were: Karl T. Compton, James B. Conant, J. Robert Oppenheimer, and Merle A. Tuve.

On April 26, 1950, Roger Adams informed President Richards that his review committee had unanimously approved in principle the report submitted to it by Dr. Berkner, *Science and Foreign Relations*; and with this endorsement from the Academy, Berkner forwarded it on April 28 to James E. Webb, Acting Secretary of State. A few days later, President Richards sent Webb a brief report of the observations of the Adams committee on the desired distribution of the Berkner report and on the implementation of its recommendations.[95]

The premise of the Berkner report reflected the international tensions of the times:

> The international science policy of the United States must be directed to the furtherance of understanding and cooperation among the nations of the world, to the promotion of scientific progress and the benefits to be derived therefrom, and to the maintenance of that measure of security of the free peoples of the world required for the continuance of their intellectual, material, and political freedom.[96]

Further supporting that shield of science, the report recommended establishment of a science office in the State Department under a highly qualified scientist who would maintain liaison between the Department and scientific activities in this country and render scientific and technological advice where appropriate in the formulation of foreign policy.

The report urged establishment, with full diplomatic status, of overseas science attachés in the major diplomatic missions abroad, including those in occupied Germany and Japan. Their function

[94] Whitaker, "NRC Report on Studies for the International Science Policy Survey Group of the Department of State," January 7, 1950 (NAS Archives: IR: ISP Survey for State Department); correspondence in NAS Archives: AG&Depts: State: ISP Survey; *Science & Foreign Relations*, p. viii.

[95] Roger Adams to Richards, April 26, 1950; Lloyd Berkner to Webb, April 28, 1950; and Richards to Webb, May 1, 1950, in *Science & Foreign Relations*, pp. iii–v.

[96] *Science & Foreign Relations*, p. 2.

would be similar to that of the science groups of the State Department and Office of Naval Research already in London, that is, to speed the flow of scientific information between nations and help as necessary with current and future exchange and assistance programs.[97]

Accepting the counsel of Berkner's committee, the State Department, upon the recommendation of the Academy, appointed Joseph Koepfli, research associate in chemistry at CalTech, who had recently served as Senior Science Officer in the American Embassy in London, to head the new Office of Science Adviser and maintain close relations with the Academy and the National Science Foundation.[98]

The Berkner report recommended, as well, increased utilization of the National Research Council's Division of International Relations (prior to 1947, known as the Division of Foreign Relations). To this end, Bronk reorganized the division, replacing its society representatives and members-at-large with an eight-member Policy Committee and a Committee on Science Policy, both chaired by Roger Adams, Foreign Secretary of the Academy and, as such, Chairman of the division.

A full-time Executive Secretary for the division, Wallace W. Atwood, Jr., former Professor of Physiography at Clark University and then with the Research and Development Board, was brought in to maintain continuing relations with the State Department, with the national academies and research councils abroad, the international scientific unions, and scientific representatives of other countries here in the United States. Also assisting Adams was a twenty-six-member board of consultants, comprising the heads of the major Research

[97] *Ibid.*, pp. 2, 9–14, 33–34, 65, 75; NAS, *Annual Report for 1949–50*, pp. 4–5, 29–30, 60–61.

[98] Succeeding Joseph Koepfli in the post were James Wallace Joyce, Navy Department geophysicist, Acting Science Adviser (1953–1954); and, after an interim, Wallace R. Brode, chemist and Associate Director of the National Bureau of Standards (1958–1960); Walter G. Whitman, head of the Department of Chemical Engineering at MIT (1960–1962); and Ragnar Rollefson, Professor of Physics at the University of Wisconsin (1962–1964).

In the period 1954–1958, stripped of funds and staff for reasons of economy, the Office was ably served by Walter M. Rudolph, a career economist in the State Department, who, preparatory to and during the International Geophysical Year, undertook all Department arrangements made through the embassies and scientific attachés abroad for the use of facilities and cooperation of foreign scientists.

See NAS, MS Annual Report for 1955–56, pp. 228–229; "What's Happened to Science in State?" *Chemical and Engineering News* 34:112–115 (January 9, 1956); "Science and International Relations," *Science* 123:1067 (June 15, 1956); Daniel S. Greenberg, *The Politics of Pure Science* (New York: New American Library, 1967), p. 275, note.

Council units and representatives of governmental agencies and nongovernmental organizations actively involved in international activities.[99] With increased funding from the Department of State, on July 1, 1952, the Division of International Relations—no longer fitting the traditional divisional pattern—became the NAS–NRC Office of International Relations, with greatly broadened functions.[100]

Although the Office of Science Adviser in the State Department never attained the high goals set for it in the Berkner report, Koepfli's appointment was nevertheless a milestone in the long effort of the Academy to make scientific counsel available on a continuing basis at the highest levels of government.

The brief years of Dr. Richards's presidency were marked by unprecedented changes in Academy affairs. At the outset government departments, still adjusting to the peculiar peace, had made "only two direct requests . . . to the Academy," as Richards observed in his first *Annual Report*, but three years later, with U.S. involvement in the Korean War, the Academy was overwhelmed with requests.[101]

Once again, office space on Constitution Avenue became inadequate and committee staff were housed in rented quarters nearby. The staff of the Academy, from the postwar low of slightly more than two hundred, rose to almost five hundred. Already expending more funds than it had at any time during World War II, Academy disbursements for staff operations, for administration of government contracts, and of funds from private resources more than doubled in that period, from $2,731,000 to $5,719,000.[102] They would continue upward.

Those years witnessed that significant function of the Academy–Research Council to define and catalyze research. It was the unique capability, stated four decades earlier in the order creating the National Research Council:

> To survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.[103]

[99] *Science & Foreign Relations*, pp. 100–101; NAS, *Annual Report for 1950–51*, pp. x–xi, 41–44.
[100] NAS, *Annual Report for 1951–52*, pp. 50–53.
[101] NAS, *Annual Report for 1947–48*, p. 1; *1950–51;* pp. ix, 12.
[102] NAS, *Annual Report for 1945–46*, p. 64; *1950–51*, p. 82.
[103] "National Research Council Executive Order Issued by the President of the United States, May 11, 1918" (NAS, *Annual Report for 1946–47*, p. 161); reprinted here as Appendix F.

A Break with Precedent

The "uncertain, unstable" times that held "little promise of peace" nevertheless weighed on Dr. Richards. On January 7, 1950, he asked the Academy to accept his resignation, a year before his term ended, believing, as he said, "that the increasing responsibilities of the Academy and opportunities for usefulness require the energies of a younger person."[104] He was nevertheless the longest lived of Academy presidents up to that time. His retirement to his home in Bryn Mawr, Pennsylvania, lasted sixteen years, quietly ending two days after his ninetieth birthday.

At a meeting of the Council of the Academy with the Committee on Nominations two weeks after giving notice of his resignation, President Richards called attention to a two-page list recently prepared in his office on the duties of the President. To it Richards had added one more, to have future consequences, that "he should assume the privilege of initiating discussions with those in public office on matters of science which affect the public welfare." The list had been compiled in response to a proposal on December 28, 1949, from Council member Joel H. Hildebrand that would alter the nature of the Academy presidency dramatically. In view of the accretion of presidential obligations, Hildebrand proposed that the office carry a salary of $15,000 annually. The duties of the office had become "so extensive and onerous as to require practically full time," and the field of choice for candidates was "now practically limited to the few men, mainly emeriti," likely to be willing to undertake the job without remuneration.

In the discussion it was agreed that the membership of the Academy should be made aware that "the presidency is no longer simply an honor but an important full-time working job," and the potential nominees should be so informed. And in view of the coming task of the Committee on Nominations, which as customary would propose only one man for the office, the four-member Committee was doubled in size.[105]

At the annual meeting of the Academy in April 1950, the Nominating Committee announced its selection of James B. Conant.

[104] NAS, *Annual Report for 1949–50*, p. 9. The quoted words in assessment of the times were Dr. Bronk's, not Richards's, in *1948–49*, p. 35, and *1949–50*, p. 47.
[105] "Conference of the Council of the Academy with the Committee on Nominations," January 22, 1950 (NAS Archives: ORG: NAS: Committee on Nominations). Joel Hildebrand's and Richards's notes on the duties of the President are in NAS Archives: ORG: NAS: Council of the Academy: Meeting: January 22, 1950.

Navy:

Air Intelligence Report dated December 10, 1948, and originally classified Top Secret revealed that the Directorate of Intelligence of the Air Force and the Office of Naval Intelligence had concluded a study and analysis of flying saucers incidents in the U.S. They considered the reports serious and speculated that the objects had foreign origins

Coral Lorenzen (Aerial Phenomena Research Organization) gets letter from their Brazilian rep., Dr. Olavo Fontes, who had acquired metal fragments from a small UFO that disintegrated over Utatuba, Brazil (Feb 27, 1958)
- two men visited him showing credentials indicating Naval Intelligence

Dr Eric Wang head of (1949) Special Studies at WPAFB worked at length with members of "Office of Naval Intelligence" according to Wang's widow he worked for Henry Kissinger who headed all special programs

lls Resist Chemicals

Scientists find evidence that cancer cells may build up ice to certain chemicals. Use of new experimental ani- e Chinese hamster, made the research possible.

ER TISSUES, like DDT-resistant build up groups of cells that the presence of chemicals for- to hold them in check.

ing patients and working with animals, for example, doctors d that the chemical, aminopterin, for a time, but only for a time. to another chemical, perhaps six- urine, may again control the can- nly for a period and not indefi-

rch at the Children's Cancer Re- oundation, Boston, Drs. George and C. Livingston found that cells in a given tumor show a ge of difference in the structures rry" hereditary traits, the chromo-

of these constantly occurring changes, or mutations, there is a at new cancer strains may develop s "immune" to regular chemo- c treatment. This may lead to -ups of "controlled" tumors, Dr. said.

preliminary observations prove said, researchers will have to step arch for more and better chemo- ics, just as insect fighters are now g their search for insecticides.

Dr. Yerganian gave a report of this research at the American Institute of Biological Sciences meeting in East Lansing, Mich.

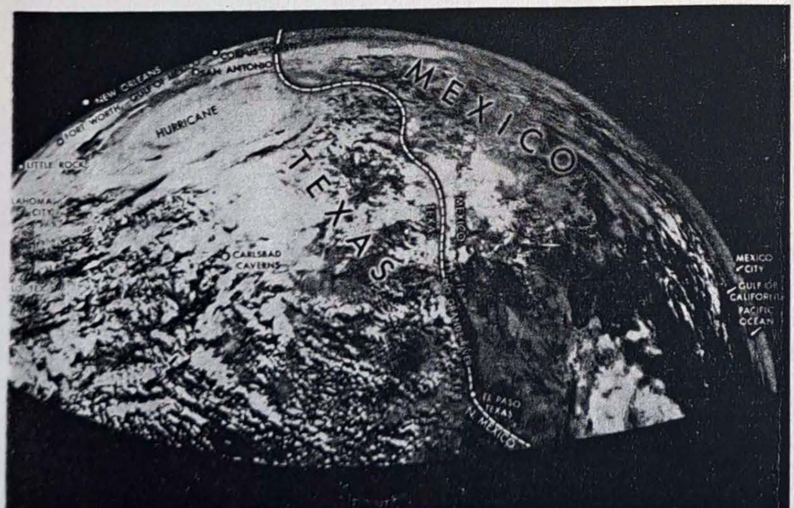
Use of a new experimental animal made detailed study of hereditary structures in tumors possible, he said. The rats, mice and Golden hamsters usual in such experimental work have relatively large numbers of chromosomes in each cell and nucleus, making observation very difficult. The new laboratory animal, the Chinese hamster, has only 11 pairs of chromosomes. Each is clearly distinguishable from the other.

Using the drug colchicine makes the chromosomes even more easily observable, Dr. Yerganian said, and the scientists were able to watch abnormal cell division in tumor cells of the hamsters.

When the tumor cells divided, there were often different numbers of chromosomes in the daughter cells. There were several of one kind of chromosome present in the new cell, when normally there is only one of each, or there were none at all in others.

This great variation in hereditary structure means that new mutations are constantly appearing in hamster tumors, including the possibility of chemical-resistant strains.

Science News Letter, September 17, 1955



LANET EARTH—From about 100 miles above the earth's surface, mposite photograph shows what you might see. About one and a million square miles are visible in the picture, made up of 310 prints 16-mm film shot from an Aerobee rocket fired by the Naval Research ory of Washington at White Sands Proving Grounds, Las Cruces, ., last year. The Navy believes it is the largest earth area ever photographed from one spot at one time.

BIOLOGY

Males Become Mothers But Have Sons Only

➤ SCIENTISTS have found a means to do away with the necessity for females of the species—females of a toad species, anyway.

Drs. Emil Witschi and C. Y. Chang of State University of Iowa told the American Institute of Biological Sciences meeting in East Lansing, Mich., that they were able to change male *Xenopus* toads into egg-laying females, and without the turncoats losing their male hereditary constitution.

To make this switch, the scientists place male embryos under the influence of a female hormone, estradiol. The male toads develop into behavioristic females.

All of the eggs of these sex-reversed toads fertilized by normal males will develop into males only, since the "mothers" retained their original male hereditary make-up.

When the need to replenish a new all-male generation comes, all the scientists have to do is add a little estradiol to the aquarium water to get a new crop of potential mother toads.

"Thus," said the scientists, "the true, genetic females can now be dispensed with."

One week's treatment with the sex hormone in aquarium water is enough to change a young male tadpole's future sex for life.

Science News Letter, September 17, 1955

CHEMISTRY

Rare Earths Successfully Separated as Free Ions

➤ THE FIRST successful separation of rare earth elements as free ions, or charged particles, rather than as complicated molecules is reported by Dr. M. Lederer of the Curie Laboratory's Institute of Radium in Paris.

Five of these rare earth elements appeared as separate small spots on paper when viewed under ultraviolet light. They have the tongue-twisting names of lanthanum, europium, yttrium, dysprosium and erbium.

Chromatographic methods were used to separate them, Dr. Lederer reports in *Nature* (Sept. 3). Chromatography is fundamentally as simple as blotting ink or sopping up spilled milk.

It is a process in which extracts separate into two or more bands, sometimes of different colors, as they seep out on absorbent paper.

The 15 rare earth elements all have chemical reactions so similar they are considered as one element in the periodic table. They have so far proved very difficult to separate for study. Some are formed in nuclear reactors as waste products from the burning of atomic fuel.

Dr. Lederer also reported that promethium produced at Britain's Atomic Energy Research Establishment at Harwell was separated from cesium and europium impurities it contained by the chromatographic method.

Science News Letter, September 17, 1955

ASTRONOMY-GEOPHYSICS

Launch Earth Satellite

United States announces plans to blast a small, un-nned satellite into orbit around earth during International ophysical Year in 1957-58.

[AN'S ANCIENT DREAM of reaching planets is seen much closer to reality the announcement the United States crack the space barrier by launching a ll earth satellite during the International physical Year in 1957-58.

ıct will start to catch up with fiction n man for the first time breaks free, if for a short time, from the sea of air is the earth's atmosphere. Although small object will be unmanned, not ıpied even by a mouse, it will be fol-ed by others.

the information gained from the first later circling satellites shows that man d probably survive in outer space, hu-ıs will follow the test animals as in-itants of space satellites.

hen later, they may man space ships will reach first for the moon, next for planets. This is for the future, but just far in the future it is hard to tell.

[any scientists believe it impossible for ı ever to reach even the moon. Others l that at least the moon and the planets be visited eventually, but centuries in future. A few more enthusiastic are ing that outer space can be pierced at t as far as our moon within 100 years.

'he mythological boy named Icarus who lted his wax wings by flying too close the sun may have been the first to illus-e man's yearning for the stars.

n the last 30 years the possibility of ching beyond the earth's atmosphere has n seriously studied by some scientists. th the advent of atomic power an energy rce that might power space vehicles was seen.

)etails of the space satellite as announced practically identical with those first re-ted exclusively in the SCIENCE NEWS TTER of March 27, 1954. (See also SNL, y 15, 1954, p. 306, June 12, 1954, p. 381, l May 7, p. 295.)

The technical problems involved in nching the earth's first small satellite are ny. They have been solved individually, not collectively.

A WAC Corporal shot from the nose of V-2 rocket over White Sands, N. M., on b. 24, 1949, rose to a height of 250 miles, ut the height at which the earth's first ificial moon will circle. She stayed there t a short time, however.

Numerous rocket flights to lower altitudes ce then have resulted in improved tech-ques for radioing back to earth informa-n on conditions high in the atmosphere.

Dr. Athelstan F. Spilhaus, a member of United States National Committee for International Geophysical Year, said that at the present time scientists could learn as much from looking at the satellite as from having the satellite so instrumented that it would look at the earth.

Visible Over Equator

➤ THE EARTH SATELLITE will be visible to persons near the equator. The basketball-sized, man-made moon will be painted white, and will travel around the equator, SCIENCE SERVICE learned.

Scientists would rather have the satellite travel a polar route around the world, but for political reasons, the first try will be equatorial. By traveling in an orbit around the equator, the man-made satellite will be circling the earth without infringing on many great powers. A polar route would be better, as the equatorial route is over more water, thus complicating the matter of observation stations.

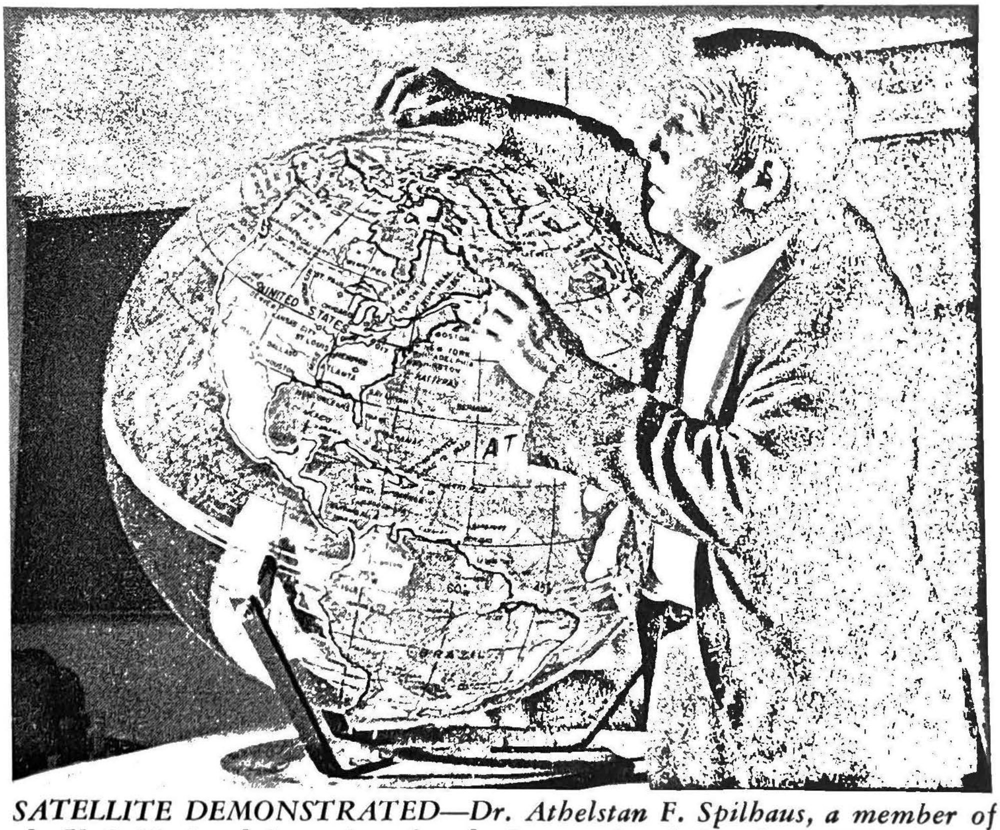
Traveling at the proposed speed of 18,000 miles per hour, 200 to 300 miles in outer space, the satellite will take about 90 minutes to make a complete revolution. It will be visible for about 15 to 20 minutes from any one spot near the equator. Although it will not be easily seen with the naked eye, it will be visible through small telescopes or high-powered binoculars.

The satellite will be a very fleeting object as it travels through the sky. To see it, a person would have to know exactly where to look. It is possible, however, to predict the exact path of the man-made moon, giving its position in the sky at any time. This information could be published in the newspapers for those who wish to view man's first attempt at outer space travel with an unmanned satellite.

Painted white for tracking, the satellite will reflect the sun's rays in the same manner the moon does. Best time to see it will be twilight.

It was also learned that sodium has not proved effective in tests to date as a further means for tracking the object through the heavens. It had been suggested that sodium, such as common table salt, be sprayed from the rocket to enable scientists to make a trail for easier tracking view at all times. The tests indicate, however, that sodium is effective only at lower altitudes.

Science News Letter, August 6, 1955



SATELLITE DEMONSTRATED—Dr. Athelstan F. Spilhaus, a member of the U. S. National Committee for the International Geophysical Year, demonstrates over a large globe of the world the height at which the proposed earth satellite would circle earth. He is using a piece of chalk to represent the basketball-sized moonlet the United States will launch sometime between July, 1957, and December, 1958.

III. History of MK-ULTRA. CIA program on Mind Control.

- Started during WWII with research on hypnosis for interrogation, secure courier duties, and reducing fatigue. Also research into effects of primitive drugs like barbiturates and cannabis as far as drug-assisted interrogation goes.

- George Estabrooks was the leading proponent of hypnosis as the be-all and end-all of manipulating peoples minds. His book, 'Hypnotism', published in the early forties, has been decried as too fantastic and improbable in terms of describing the capabilities of hypnosis with certain very suggestible subjects, but his arguments and examples remain valid to this day.

NEW!

Estabrooks admitted in 1971 to creating hypnotic couriers and programmed multiple personalities for Military Intelligence purposes in this 1971 Science Digest article. MUST READ!!

- Start of Cold War and Korean War in particular gave a big boost to mind control research with the emergence of 'Brain Washing' as a common term. Supposedly a development of the dastardly Chi-Coms, the term was actually coined by a magazine writer later found to be on the CIA payroll as an agent of influence. Postulating a 'brainwashing gap' The CIA got the go-ahead for research into countering communist mind control efforts and developing their own to aid in the espionage wars.

- Hypnosis, drugs, and psycho-surgery; separately and combined, were the tools of this quest for the ultimate truth serum on the one hand, and the capability to create an agent who could not have his or her mission tortured out of them, or even be aware that they were carrying secret information given to them in an altered state of consciousness. More and more sophisticated drugs were experimented with, such as LSD, Ketamine, and Psilocybine. Lobotomy and the implantation of electrodes were considered as methods for creating a compliant agent. Electro-Convulsive Shock, combined with LSD, sedation for days at a time, and constantly replaying the patient's own voice through helmet-mounted headphones was a notorious Canadian researcher's recipe for mind control.

- One of the most remarkable cases of mind control involves a famous model of the late 40's and 50's named Candy Jones. In the book, "The Control of Candy Jones" the author reviewed hours of tapes made by Candy Jones and her husband which revealed a systematic program to create and manipulate alter personalities as the foundation for programmed couriers resistant to torture, where the primary personality would not even be aware of the secret information being carried. The information could be summoned forth via a post-hypnotic command or response to a pre-programmed cue.

- Research continued into early 70's by CIA's own admission during the Church hearings. John Marks, author of the best study of CIA mind control experiments, makes the subtle differentiation that the CIA congressional witnesses might truthfully say that all research done by the TSS Directorate had ended, since the programs were moved into other areas once operational techniques had been developed. Many of the names mentioned in reference to mind control research turn up in the few references to supposed dead-end research in ESP.

- There have been persistent rumors of Navy research involving attempts at telepathy from submarines under water, the Nautilus being the most famous of these. Detection of enemy submarines, and communicating with our own, has continued to be an important area of conventional research for the Navy, so it is no surprise that researching the use of ESP for these purposes would be of interest. Communicating with a submerged submarine is the only kind of communications where the very act of receiving puts the receiver in danger, since submarines must normally stick an antenna out of the water for high speed radio traffic, or rely on trailing a long wire antenna under water relatively near the surface to receive very slow speed traffic using ELF radio waves. Newer techniques may involve the use of blue-green wavelength lasers, but evidently penetration to any depth is still a problem.

If you look at telepathy as a problem in the transfer of information in a very noisy environment, then certain existing solutions suggest themselves: There have already been experiments in the transmission of five distinct symbols via telepathy, namely Zener card symbols. I suggest that there is already a way of transmitting information using two symbols only, namely Morse Code. Current ELF or VLF radio transmission methods for communicating with fleet ballistic missle submarines to issue them their launch orders involve very low data transfer rates, on the order of 3 to 30 bits per minute, if I am not mistaken. Messages are very short, consisting of pre-formulated action or targeting codes. I suggest that telepathic 'Zener Morse' is an operational technique for information transfer under severe signal to noise conditions. In fact the use of five Zener symbols would increase data transfer rates, but at the expense of a higher error rate due to the problems in discriminating between five and just two symbols.

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THE FLYING SAUCER MYSTERY - SOLVED

by James W. Moseley

There have been several exciting new developments in the flying saucer field since I published last month's feature article, "The Wright Field Story".

On a tip from Len Stringfield of CRIFO, I have interviewed a nuclear scientist living in the New York area. This scientist, who has worked at the Los Alamos atomic energy plant, holds the highest possible government security clearances, and has made a detailed study of flying saucers. He is firmly convinced that the saucers are a secret weapon of the United States government - probably the Navy. His belief is based on many factors, including classified documents and photographs that have been made available to him because of his position. He has also made a careful study of saucer sightings according to area, and believes that a definite correlation can be established between the location of military bases and the location, direction, etc. of saucer flights. He also feels that the Air Force's lack of alarm about saucers indicates clearly that our top military leaders are well aware of what the saucers are and of why these so-called saucers can never be a menace to the United States.

Meanwhile, over in Norway, two sisters are claiming that they have not only had a close look at a flying saucer, but that they talked to its "dark-skinned, long-haired" pilot. According to these women, the saucer-man stepped out from behind some bushes and approached them. They were frightened at first, but the stranger appeared to be friendly. They addressed him in English, German, French, and Norwegian, but he didn't seem to understand a word. He attempted to communicate with them by drawing circles and what looked like pictures of heavenly bodies on a piece of paper. He finally led them to his craft, which looked like "two deep saucers sandwiched together", about 15 feet across. He opened the hatch and crawled into the disc. Moments later the craft rose from the ground and began rotating, first slowly, then increasingly faster. Then it disappeared at incredible speed.

The newspapers say that these women have a reputation for honesty in their home town. But the most amazing part of this Norwegian story is that an American pilot named Billie Faurot, who is based in Stuttgart, Germany, claims to be the man these sisters saw! He confirms that while flying over northern Norway he landed and met two women. However, he was supposedly flying a helicopter, rather than a saucer! If his story is basically true, then it is quite obvious that he was not flyurgent defensive or investigative action might be required. It was further stipulated that each report had to indicate whether the object sighted was deemed a threat to the security of the United States and Canada and their forces. This, of course, leaves open the possibility that once a report was deemed not to be a threat, the matter could be dropped or perhaps passed to another authority.

Interestingly, the directive requested that every effort be made to obtain photographs. It even went so far as to say that film would be processed and one copy of each print, along with a new roll of film, would be given back to the individual. However, U.S. accounts of sightings are filled with incidents in which film was never returned, returned damaged, or altered in some way.

The address given for the submission of such photographs was the U.S. Director of Naval Intelligence, Washington, D.C., or the Director of Naval Intelligence, Department of National Defence, Ottawa. Lieutenant Commander James Stewart Bremner, the man who put Wilbert Smith in touch with Dr. Sarbacher, was of course navy, and it was a naval officer, Rear Admiral Tate, who had advised Bremner of the atomic-powered aircraft. It is conceivable that while the Director of Air Intelligence was at the front line, so to speak, to receive and answer reports, the hard case reports were actually being handled by Naval Intelligence in both countries.

In 1963, in response to a series of questions from Canada's Parliament, the Chief of the Air Staff responded that Canada did co-operate with the United States for the investigation of UFO reports. The investigation, if warranted, was "conducted by Air Defence Command. In the normal course of events NORAD Headquarters would receive a copy of the report."[1] He further stated that no code name was applied to such reports, and certainly not Project Magnet.

The reply stated that Project Magnet was headed by Wilbert Smith. Since Smith was a Department of Transport employee, any related files belonged to Transport and not the Department of National Defence, and therefore the availability of those files could not be counted upon. No mention of Project Second Storey appeared in the response. Thus, DND could successfully evade the issue by passing it on to Transport. But why would they want to? Is this evidence of a cover-up or was the department keeping the matter quiet on behalf of the Americans?

Certainly, other correspondence on file suggests evasive answers were being provided either to get pesky inquirers off the department's back or simply to avoid publicity. For example, the following was noted in one file: "The proposed reply . . . is quite lengthy and informative (though not specific) in the hope that it may discourage further inquiries . . ."[2] But instead the tactics would backfire and invite publicity, implying there was a cover-up.

On February 25, 1964, the RCAF finally stated:

> The RCAF, through the Air Officer Commanding Air Defence Command, is charged with the military investigation of unidentified flying object (UFO) reports. It is policy to investigate in detail reports of UFO's which cannot be readily identified as man-made or natural phenomena.[3]

For all the negativism of earlier correspondence, the RCAF was finally admitting to officially investigating, not just collecting, UFO reports. The letter added that all reports to date had been identified as either man-made or natural phenomena known to scientists but perhaps not the general public.

It is clear from the comment about natural phenomena that only a few scientists were aware that some rather extraordinary sightings existed, sightings which simply could not be explained

Navy

Date: Fri, 27 Sep 1996 04:36:56 -0500
From: Grant Robert Cameron <gcameron@cc.UManitoba.CA>
To: ccb104@psuvm.psu.edu
CC: gcameron@cc.UManitoba.CA
Subject: (no subject)

This is a multi-part message in MIME format.

---------------1397C1A83B
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

http://www.iufog.org/updates/964281105.shtml

---------------1397C1A83B
Content-Type: text/plain; charset=us-ascii; name="964281105.shtml"
Content-Transfer-Encoding: 7bit
Content-Disposition: inline; filename="964281105.shtml"

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OFFICE OF NAVAL RESEARCH COVER-UP

May, 28, Tuesday. 1996

From:

Wed, 1 May 1996 11:01:26 -0400 (EDT)

News Bulletin:

The Office of Naval Resaerch has been exposed in a cover-up that goes back at least 20 years. The cover-up involves their knowledge in 1957 of an alleged World War II experiment in optical and radar cloaking technology in 1943. Up to this time ONR scientists have been on record as saying that such experiments could "only be possible in the realm of science fiction." On May 2, the Biological and Physical Sciences Department of Columbus State Community College, Columbus, Ohio, will present a colloquium by researcher, Marshall Barnes, that proves otherwise. In a stunning and simplistic lecture based upon naval military tactics of the period, known optical physics, reproducible experiments, and the same college physics text used at the college itself, Barnes will take the audience on a journey that matches all the evidence with the alleged account of what happened and even shows that light can be manipulated in the exact alleged fashion to produce transparency and invisibility effects. The presentation has already been seen by audiences in Cleveland and St. Catharines, Ontario, Canada, where even skeptics were stunned by the results. The colloquium will be at 2:45pm in Delaware Hall room 121 on the campus of Columbus State Community College. Marshall will be speaking about his work live on the Art Bell radio show 11pm Pacific Standard Time today. The Art Bell radio program is heard on 264 stations nationwide and is also available on Real Audio on Art Bell's home page

http://www.artbell.com/index.html

For more information contact Sean Madden at telephone # 614 229 3524 .

commitment been better exemplified than in ONR's long-standing participation in the support of nuclear research. The benefits to the Navy from nuclear research have come not so much from the research results themselves as from the derivative technology, which has resulted from the fact that accelerator design and particle-detection instrumentation have continually pressed the state of the art in areas of technology which have proved important to the Navy and to the military services generally.

For example, the first high-power klystrons were designed specifically to power the Mk III linear accelerator at Stanford, increasing by a factor of 1000 the power available from such microwave generators when the development was first started in 1947. In the meantime, the linac itself has become a commercial device of considerable importance both for medicine and for industrial radiography, including incidentally the radiography of very thick objects, such as missile propellants *in situ*. The electron linac development also provided an important impetus to the more general development of microwave technology. A variety of microwave components, such as attenuators, phase shifters, and high-power windows, and new microwave measurement and calibration techniques, were developed in connection with these machines. All of this microwave technology has been of great significance in connection with modern high-power radar. Of course, this technology did not emerge from Navy-supported work alone, but the fact that the Navy was one of the earliest in the field contributed to the rapid importation of these techniques into defense technology.

Nuclear physics early generated exacting requirements in the area of fast pulse electronics, and the demand for extremely short resolving times in coincidence counting of particles has stimulated many circuit developments which have interacted fruitfully with parallel research in computer technology. The most widely used commercial oscilloscopes were developed originally to fill the needs of nuclear physicists.

The Cost of Science, Harvey Brooks MIT Press 1968.

A decade ago, the increased use of scintillation counting led physicists to press for the development of very sensitive photomultiplier tubes. They advised the government on developmental contracts with industry to develop tubes specifically tailored to the needs of nuclear physicists. Similar tubes now find application as the most sensitive detectors of faint light in many areas of military and civilian technology.

It is doubtful whether any of these new technologies would have been developed as rapidly or as economically by any other means, because at the time the developments were started, the need for them in other areas than nuclear physics could not have been foreseen sufficiently clearly to provide the necessary focus and incentive for the development effort. This is only one of many examples of how the tools of basic research anticipate the needs of other more everyday technologies, and thus serve as a stimulus to bring forth the art and science that become available for other uses when the time is right. In my opinion the military services ought to use this technique much more frequently than they do, in order to cultivate the technologies that are likely to be needed ten to fifteen years from now.

Today nuclear physics and elementary-particle physics are challenging technology in new directions. One example is the marriage of microwave technology with cryogenics to produce higher efficiency microwave power components, an area in which an ONR-sponsored contractor is currently the leader. Another example is the development of sophisticated data processing techniques for "on-line" experimentation and "pattern recognition" of bubble chamber and other particle-detection patterns. Some of this work has been and still is ONR-supported, giving the Navy a "window" on new technologies likely to be of profound significance for future military applications, but in ways not now clearly foreseeable. As the Navy's fractional commitment to the national nuclear and high-energy physics program has decreased over the years to less than 7 percent, it must be more and more selective in its support of this area, but it seems doubtful whether its participation could drop much lower than at present and still afford it a meaningful window on the field.

The current conventional wisdom has it that nuclear and elementary-particle physics are "useless" subjects, worthy of support, if at all, only for their "cultural" value. This is why I deliberately chose the Navy's nuclear physics program as an illustration of the value of a listening-post commitment to a few of the most vital frontiers of advancing science. This is not an argument for indiscriminate support of *any* basic science on the part of mission-oriented agencies. What I have tried to emphasize is that the ecology of the scientific effort is far more complex than the naïve connections which can be made between pure science and applications before the fact. These connections are often not direct but proceed through many layers of neighboring sciences and instrumental and industrial technology. While I am all for projects like Hindsight which attempt to trace the origins of modern weapons systems, I would warn that such efforts are very likely to lose the trail just at the most interesting point when it disappears into the general scientific background and sophistication of the times.

As one reviews the history of American science and technology in the last twenty years, one cannot fail to be struck by the strategic role which ONR-sponsored work has played. In fact, when one considers its present tiny *fiscal* role in research support compared with what it was in the early days, one is surprised at its still major importance and influence. Wherever the most important advances are being made, one still seems to find ONR present with at least token support. A mere catalogue of areas in which ONR-sponsored scientists have pioneered shows how frequently ONR has been there with the right science at the right time even though few foresaw the usefulness and relevance when ONR first began to sponsor it. Let me merely list a few examples:

1. The discovery of the Van Allen belt, and the development of a research satellite which was available to take data in connection with the Starfish nuclear test when such data were needed quite unexpectedly and urgently.
2. The metallurgy of high-temperature moly alloys, which proved to be vital in connection with the Polaris program.
3. The development of the thermochemistry of titanium and its compounds, which proved to be a bible of valuable information when titanium became of practical importance.
4. The early launching of an Arctic research program, data from which suddenly proved vital when it became necessary to install the DEW line.
5. Early support of work in Bayesian statistical analysis that proved to be of great value as more sophisticated methods of detection of signals in noise became increasingly important in radar and sonar.
6. The development of the mathematical theory of diffraction and scattering of electromagnetic waves from large obstacles, which became later very important in application to the problem of minimum radar return from missiles and decoys.
7. Support of the earliest work in the field of time-shared computer systems.
8. Support of the early fundamental work on the propagation and phase stability of very low frequency electromagnetic waves, which led directly to feasibility of VLF radio-navigation systems — incidentally, a fine example of cooperation between extramural, Navy, and other government laboratories.
9. Support of fundamental work on the theory of wind-generated waves, which led eventually to operationally useful techniques for forecasting ocean waves.

10. The discovery of microplankton in the oceans, and the realization of the importance of small organisms in affecting acoustic propagation and scattering in the ocean medium.
11. The invention and development of a method for the rapid freezing of blood.
12. The support of fundamental work in oceanic geophysics, which led directly to the development of a useful geophysical navigation technique.
13. Support of the earliest work on numerical modeling of the atmosphere, which is now beginning to lead toward a practical method of numerical weather forecasting.
14. The discovery of the so-called deep sound channel as an outgrowth of fundamental investigations in underwater sound propagation by an oceanographic laboratory.
15. The development of the concept of an integrated fleet air defense system.
16. The support of early fundamental work on shock tubes and shock dynamics, which was the direct forerunner of the use of shock tubes in the study of re-entry problems and the development of practical nose cone material — a primary example of a basic research tool which, through remarkable prescience, was ready to be applied in testing and development programs when needed, even though nobody had conceived the ICBM when the work was first supported.
17. The development of the plastic cornea for eye repair, an example of assiduous and inspired follow-up on an initially fortuitous observation.

One could go on with this list indefinitely, but I think I have recited enough examples to make my point. On the other hand, we should not fall into the trap of believing that the basic idea is everything. I suspect many of these ideas would have been lost in the general noise if there had not been alert and in-

telligent program officers and Navy scientists who had the wisdom to appreciate their potential and see that it was further developed. The accomplishments of ONR-sponsored research must be a source of pride not just to the scientists who did the pioneer work but to the creative administrators and naval officers who cultivated their scientific gardens so fruitfully. I think too many of us in the scientific community have recently been too inclined to forget the importance of this role; and on the other side, too many in the policy-making positions of government, while giving lip service to basic science, have been too inclined to forget that scientific results cannot always be whistled up to order when needed. They have to have been brewed years before, and in military development there is nothing more costly than the basic scientific results that were not available when the time was ripe for their use.

SIX □ Future Needs for the Support of Basic Research

In the spring of 1964 the National Academy of Sciences was asked by the Subcommittee on Science, Research, and Development of the House Science and Astronautics Committee to prepare a report for Congress concerning future national needs for the support of basic research. The Academy was requested to address itself to two specific questions:

1. What level of federal support is needed to maintain for the United States a position of leadership through basic research in the advancement of science and technology and their economic, cultural, and military applications?

2. What judgment can be reached on the balance of support now being given by the federal government to various fields of scientific endeavor, and on adjustments that should be considered, either within existing levels of overall support or under conditions of increased or decreased overall support?

The President and Council of the National Academy assigned the task of preparing such a report to the Academy's recently organized Committee on Science and Public Policy (COSPUP), then chaired by Dr. George Kistiakowsky, professor of chemistry at Harvard University, and formerly Special Assistant to the President for Science and Technology in the last two years of the Eisenhower Administration.

COSPUP delegated the task to an ad hoc group whose membership was drawn about half from COSPUP itself and half from scientists outside COSPUP, including two economists. This group, instead of preparing the usual type of consensus report, chose instead to produce a series of "criticized essays" by the individual members. Each of the personal essays was reviewed in face-to-face sessions with all the other members of the group, but the author was free to accept or reject the criticisms and suggestions as he saw fit.

The following chapter is a very slightly edited version of my contribution to that report, which appeared under the title "Basic Research and National Goals."

In common with most of the other essays in that volume, my paper gives no specific answers to the questions posed by the House committee, but rather attempts to set forth some of the considerations and criteria that should be used in arriving at tentative answers on a continuing basis.

INTRODUCTION

The two questions posed by the House committee are exceedingly difficult to answer in any precise quantitative way. The general approach taken by this paper is that the answers can only be arrived at by successive approximations. We thus try to suggest some of the considerations and some of the mechanisms of choice that ought to be considered in determining levels of support for science.

I begin my paper discussing some of the problems involved in interpreting research and development statistics. Since current statistics must provide the basis for any future planning for science it is important that the limitations of these statistics be fully understood.

The second section deals with some of the reasons why the support of basic research is considered to be in the national interest, and why this support must be primarily a federal responsibility. In this section I suggest some possible guidelines for future overall support of academic research.

In section III a conceptual scheme for considering the "science budget" is suggested. This involves an attempt to separate the requirements of big science from those of the individual investigator in the university. It suggests that the problem of relative allocation to fields is not one to be centrally determined, but rather a question of setting up suitable mechanisms for continuing decentralized choice. This section is concerned mainly with academic research.

The fourth section attempts to describe the difference between academic research and organized institutional research, and to explain the different mechanisms of choice and criteria that should apply to the latter as compared with the former.