CHAPTER I

Biomedical Science and the Culture Warp

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One winter's night in Helsinki during the 1970s, I was guest of honor at a dinner in the American Embassy for a group of distinguished Finnish academicians. The ambassador, under the nom de théâtre of Mark Evans, had been producer and host of a popular television talk show in Washington. After dinner, brandy in hand, I found myself responding to the announcement of the master of ceremonies that I was going to explain how medical science was supported in the U.S. by the National Institutes of Health.

My discourse wandered from intramural research to study sections and finally to public participation in the governance of science. I noted that the national advisory councils are one example of such public participation. I also pointed to the national commissions that were devoted to the study of specific diseases such as diabetes and arthritis. These were established by congressional orders and had emerged from concerns of citizens suffering from those diseases. Finally, I outlined the congressional hearings on the annual appro-

priation for the NIH. As I described how the congressmen would later invite testimony from lay witnesses about our performances, the president of the Finnish Academy of Sciences abruptly rose from his seat. He could not imagine such public interference in the conduct of science in Finland, nor for that matter, in any other European society. All the other listeners seemed to share his judgment. There was a moment of silence as I groped about for a metaphor to save the situation. Pointing at one of the tapestries on the embassy wall, I likened the acquisition and organization of wisdom to weaving. Consider the gathering of threads of knowledge as the *weft*, I suggested, and the orthogonal *warp* threads stretched in the loom as essential support for making the fabric. In my country, I continued, the strength of this warp and the tension upon it came from many sources, by no means limited to scientists. Our scientific research therefore was woven on a *culture warp*, I ended, insisting that, despite the great number of hands involved in the setting of the loom, production was actually amplified and accelerated.

A distinguished task force of the Carnegie Commission on Science, Technology, and Government concerned with long-term federal science and technology goals has recently issued a thoughtful report.[1] The report's principal recommendation is the creation of a forum of "individuals from industry, academia, nongovernmental organizations, and the interested public to explore and seek consensus on long-term [societal] S&T goals...." The National Academy of Sciences (NAS) is suggested as a possible venue. This proposal for obtaining better advice on a rational deployment of federal support addresses a dilemma as old as the republic: that is, there is no constitutional prescription specifically linking science *per se* to the public purse. By opening with the traditional reference to Vannevar Bush's *Science: The Endless Frontier*,[2] the Carnegie report reminds me of Bush's earlier experience in convening a forum of the elite of industry, academia, and researchers to design a new departure in federal policy toward science. Bush's report was written almost 50 years ago toward the end of World War II. His plan for creating a

single agency to underwrite basic research in the private sector with federal funds eventually resulted in the creation of the National Science Foundation. Bush's original design, however, was upset and materially changed by unforeseen interventions that illustrated the limitations of any one group—however expert and well-meaning—in defining societal goals. Although this history has been several times told,[3-6] it merits retelling. The generation that remembers well the roots of today's system of support for biomedical research—and the accompanying growth of our country's academic institutions to their present size and research capacity—is becoming emeritus. This tale also contains instruction on the nature, complexity, and durability of the culture warp of biomedical science.

SCIENCE FOR WAR

The Establishment of the OSRD (1941)

Vannevar Bush was a Yankee of remarkable accomplishments. He was an inventor (the Bush differential analyzer enabled the start of modern computer analysis), an educator (dean of engineering at MIT), and scientific leader (president of the Carnegie Institution of Washington and director of the Office of Scientific Research and Development (OSRD) (1941-1946)). In 1940 when war had broken out in Europe, Bush discussed with some of his friends, including Karl Compton, James Bryant Conant, and Frank Jewett, the need to mobilize American science for preparedness in the event the country was drawn into the hostilities. These men first convinced President Roosevelt and Congress to form a National Defense Research Committee (NRDC). This committee was established on July 2, 1940, and was chaired initially by Bush.[7] In June 1941, at Bush's insistence, the President issued an executive order establishing the OSRD to coordinate and supervise all research related to the national defense; Bush was named as director.[8] The NRDC became a subdivision of the OSRD, concerned with weapons development, and Conant became the director. Keeping his office in the Carnegie headquarters, Bush looked to the National Academy of Sciences

(NAS) and the National Research Council (NRC) to assist in the task of helping to select scientists or laboratories for projects with very specific objectives and which were to be supported by contract. The import and nature of some of the research involved can be judged by the presentation of the Atomic Pioneers Award to Bush, Conant, and General Leslie Groves by President Nixon in 1970.

Committee on Medical Research. Research in medicine was one of the high wartime priorities. The Germans had cornered the quinine supply, and new antimalarials had to be found. With only sulfonamides to treat infections, new chemotherapeutic agents were needed. Many other problems had to be tackled, such as improving the treatment of shock, and methods of transfusion, augmenting supplies of plasma and other blood products, understanding the physiology of high altitude aviation, motion sickness, and anoxia, and even developing new kinds of clothing.

In his memoirs,[9] Bush recalled that he had felt then that "he had nothing to do with medical research, and did not want to have...." However, as Presidential Counselor Judge Samuel Rosenman prepared the order setting up the OSRD, the Committee on Medical Research (CMR) was added after the president, weary of an office full of medical organizations each demanding to set up a medical research committee, ordered that "he wanted this medical show put under Bush and he didn't want to hear a damn thing more about it."[9] Bush then established the CMR on his own terms. He insisted that the CMR have strong attachment to the Division of Medical Services of the National Research Council (DMS-NRC), even basing it in the NAS building on Constitution Avenue. The more than forty committees and subcommittees of the DMS soon began to function as "study sections."[8] DMS members sometimes initiated proposals, outsiders initiated others. DMS reviewed each proposal and sent them to CMR with a recommendation. CMR in turn sent its own recommendations up to OSRD, where Bush's signature on the folio indicated final approval. The contracts tended to be categorical, with highly specific objectives. Their duration was short, sometimes for six months, and never for more than a year before review for possible renewal. The committees of the DMS were populated by

high-level academics, including members of the NAS, and many elite clinician advisors, about one-third of whom were members of the "Old Turks," the Association of American Physicians.[10] The chairman of the DMS, Lewis Weed, a professor of anatomy at Johns Hopkins Medical School, wanted to head the CMR, but Bush wanted a scientist of stature with impeccable qualifications. He personally picked A. Newton Richards, professor of pharmacology, vice president for medical affairs of the University of Pennsylvania Medical School, and a pioneer in micropuncture studies of the kidney.[9] Bush later summed up his selection: "It was a fortunate choice...I concluded that, of all the able men I've known, [Richards] was the most fully respected, yes, the most beloved by his colleagues and by everybody who knew him."[6]

The members of the CMR were seven: one each designated by the secretary of war, the secretary of the navy, and the head of the Federal Security Agency (then the parent agency of the Public Health Service), and four civilians appointed by the President. The latter were Chairman Richards, A. R. Dochez, chairman of bacteriology at Columbia College of Physicians & Surgeons, A. Baird Hastings, professor of biochemistry at Harvard Medical School, and Professor Weed. Surgeon General Thomas Parran designated the director of NIH to fill his chair. Initially this was Lewis R. Thompson, who was followed in 1942 by Rolla E. (Gene) Dyer. Over its life, the CMR dispensed $24 million in some 600 contracts to 133 universities, foundations, and industrial laboratories, involving the research of over 1500 doctorates and 4000 laboratory personnel.[7]

The Dismantling of the OSRD (1944-45)

Bush had always believed that OSRD must go out of business as soon as the war was won. The exigencies of war were one thing, but like many of his contemporaries, Bush appears to also have had some deep-seated misgivings about government support of science in peacetime. At Cold Spring Harbor in 1960, before an audience at a dedication of a new laboratory building, Bush articulated the Carnegie Institution's resistance to accepting government support and described his fears that government subsidies would result in

federal control over individual scientific efforts.[11] By August 1944, Bush was certain that he would like to see OSRD wind down as soon as the course of the war permitted and he let this be known to his advisory committees and presented the President with a program for the termination of OSRD. There was movement among the leaders of the armed services to maintain a capability for military research. Secretary of War Stimson favored the NAS's assuming responsibility for a Research Board for National Security to continue contracts for defense science. However, because of the NAS desire to protect its independent status and negative reaction from elsewhere in government, nothing came of this.

The CMR was informed as early as August 3 of Bush's demobilization decision and discussed at length its implications during its next meeting on August 17. The navy representative said that his service would not be able to take over any war research contracts. The surgeon general of the army and Dyer of the Public Health Service felt that the CMR should continue to the end of the war. Because, as we shall see later, the Public Health Service had earlier in 1944 received new research authority, Dyer also stated that the Public Health Service would have no legal problem in continuing projects appropriate to its functioning.[12]

Throughout the next twelve months, CMR sporadically requested further instruction on demobilization, and Bush from time to time assured Richards that OSRD and CMR were going to close but left the fate of the contracts uncertain. The ambiguity of the situation was suddenly increased in November by a fateful communication to Bush from the President.

The Roosevelt Letter of November 17, 1944

The President's letter to Vannevar Bush requested answers to four questions. The first was how the scientific achievements of the OSRD during the war could be called to the attention of the public. The fourth requested plans for increasing the number of research workers. But the two others that thereafter received the most attention asked how federal support for scientific research in public and private institutions—in medicine, on the one hand, and in the

rest of science, on the other—might be continued in peacetime, a radical reversal of longtime government policy.[13]

Before turning to the answers and the drama of their development, one should pause to wonder why Franklin Roosevelt had come to write such a letter to Bush. Roosevelt was not hostile to science, but did not possess any discernible science policy. In addition, he had just been through his fourth presidential election and was bearing a crushing burden of running a war and planning for peace. Historians have tended to shy away from one available explanation. In a 1960 biography of Albert Lasker, John Gunther wrote that Mrs. Mary Lasker, just commencing her lifelong advocacy of government support for medical research in 1944, sent a note to FDR requesting the government to consider continuing medical research in peacetime. The letter went to the President through Anna Rosenberg, a member of the War Mobilization Advisory Board who had an office in the East Wing of the White House. The President is said to have then passed it on to Judge Rosenman, who in turn drafted the note to Bush.[14] In 1961 Calvin Baldwin, a former NIH colleague of mine, while doing research at Harvard on the origins of NIH, wrote a letter to Judge Rosenman, asking him about the authenticity of this story. The judge replied that he knew "nothing at all, one way or another..." about Gunther's reference.[15] This reply, along with a request for her recollections, was sent to Mrs. Rosenberg. It elicited a prompt letter in reply:

> John Gunther's reference ... as to how the National Institutes of Health came about is completely correct. I remember clearly this incident because I often thought about how the Institutes grew and became so important....Judge Rosenman did so many things at that time that he may not recall this particular letter, but I distinctly remember it.[16]

In his authoritative source on the origin of the National Science Foundation, J. Merton England has sifted the other evidence indicating that sources closer to Bush were at least also involved.[17] Carroll Wilson, an OSRD administrator, responded to a series of queries on the subject that "Bush did not write it [FDR's letter] nor did he ask for it, but he had the opportunity to see it before it was sent and made some suggestions which were incorporated." England

further noted that "at least there is evidence that the letter came from outside the OSRD" and suggests a prominent possibility as Oscar Cox, a lawyer who had worked with Bush on setting up the NDRC and OSRD. Other sources indicate Bush met with Cox and the OSRD general counsel concerning the draft letter.

Whatever his involvement and personal opinions on several of the questions in the letter, Bush was a loyal public servant and a superb organizer. He quickly mobilized four teams of advisers and widely canvassed his powerful friends to help him frame answers for the President.

The Bowman Committee. Bush first turned to Isaiah Bowman to organize a committee to answer the President's broadest (third) question. Bowman, a geographer and member of the scientific elite, was president of The Johns Hopkins University as well as vice president of the NAS. An advocate of government support of science, Bowman had been chairman of the NRC during Roosevelt's first term. In an effort to stimulate federal subsidy of research, he had been instrumental in inducing FDR to form a Science Advisory Board (SAB). The short-lived SAB (1933-35), chaired by Karl Compton of MIT, was a chimeric creature of the NAS and a source of great controversy within the NAS because FDR had blithely overridden the NAS hard-won and jealously guarded prerogative to appoint its own committees.[18] As we shall see later, the SAB also became a vehicle for conveying an early pitch for more funding for the Public Health Service.

Third: What can the Government do now and in the future to aid research activities by public and private organizations. . .? [13]

The membership of the blue-ribbon Bowman Committee included at least two distinguished researchers, the inventor and industrialist Edwin Land and physicist I. I. Rabi, then at MIT. Seven members were deans or presidents from the galaxy of research universities. Industry was further represented by the director of Bell Laboratories and the chairmen of Standard Oil of Indiana and Dewey and Almay Chemicals. Also among the members were one or two government officials, including the director of the U.S. Geological Survey. There were no biomedical people aboard and, at its

first meeting, the Bowman Committee noted that *clinical* medicine—subject of a direct presidential question—was assigned to another committee. The members set aside the social sciences as "to be handled as a special issue" and elected to confine themselves to peacetime research in the natural sciences, agriculture, and engineering in academic and nonprofit institutions.[19]

The final report of the committee—included as one of the main sections of Bush's report—provided a thoughtful and extensive assessment of the state of research in the U.S. during the depression of the 1930s.[2,18] It noted that, while industrial research had survived well and was continually increasing, the growth rate of private sources of financial support for nonprofit institutions had gone into a serious decline. Such sources included the Rockefeller and Carnegie foundations and their related funds that had accounted for much of the growth of the major research universities since the turn of the century and also had established two great nonprofit research institutes, the Rockefeller Institute and the Carnegie Institution. Over the decade of the 1930s, expenditures for research by colleges and universities had risen feebly, from only $21 million in 1930 to $41 million in 1940, while expenditures by nonprofit research institutes had actually fallen from $5.2 million in 1930 to $4.5 million in 1940. There was a sense of frustration, perhaps particularly among researchers in many of the natural sciences. The committee observed that medical research had been able to attract more private support than any other discipline and that it was only the American medical schools that could compete with the great European universities in both fundamental as well as practical or applied research.

The Bowman Committee found the temptation of peacetime government support to be a source of great anxiety, largely centering around the fear that federal aid would mean the imposition of federal control.

> It is the firm conviction of the Committee that centralized control of research by any small group of persons would be disastrous; if this small group were backed by the power and the prestige of the federal government and open to political influence, it would be catastrophic...[18]

The possibility that scientific freedom could thus be corrupted

was accompanied by worry that federal aid might drive away the existing sources of funds, that private endowments might cease, the great foundations might turn to other fields, and states might reduce support given their large institutions. In the end, however, the pluses outweighed the negatives. The Bowman Committee members swallowed their fears and recommended that a National Research Foundation (NRF) be created under conditions that would minimize the perceived hazards. It would have to be governed by a board of scientists and their sympathizers, who would choose—and control—a compliant federal director.[18]

The Medical Advisory Committee

A day after receiving the President's letter, Bush informed Richards that he felt the CMR was overburdened and that he needed to get other opinions to help him answer the President's second question.[20] Bush asked the CMR to give him a list of possible advisers, which it worked assiduously to assemble. After the CMR had compiled a primary list of ten, it drew up a list of 150 more experts who might advise Bush. When this was done, someone, perhaps as an afterthought, advanced a resolution to the effect that, if a federal employee were included, it should be Gene Dyer. No sooner did this pass when the army and the navy representatives complained that should one service be included, all should be.[21] It was then decided that only names of civilians would be forwarded.

Second: With particular reference to the war of science against disease, what can be done now to organize a program for continuing. . .the work which has been done in medicine and related sciences?[13]

Within a few days, Bush wrote Walter Palmer, Bard professor of medicine at Columbia, and Homer Smith, professor of physiology at NYU,[22] requesting them to be chair and secretary, respectively, of his Medical Advisory Committee (MAC). The other members Bush chose were equally well-known academicians: William B. Castle, Edward A. Doisy, Ernest Goodpasture, Alton Ochsner, Linus Pauling, Kenneth B. Turner, and James J. Waring. Two invitees, Arthur Bloomfield and H. S. Gasser, declined. The advisers, who included five members of the NAS, a Nobel

Laureate (Doisy, for physiology or medicine in 1943), and one future Laureate (Pauling, for chemistry in 1954), were as blue-ribbon as the Bowman Committee and included more working scientists. Bush then wrote Richards to inform him of what he had done and reminded him,"it is well understood that OSRD and CMR go out of existence at the end of the war."[23] At the same time, however, CMR instructed division chiefs to present proposals to run beyond June 30, 1945.[8]

Not everyone believed that the opinions of the MAC would be useful. Bush's friend Frank Jewett, an industrial engineer of distinction and director of Bell Laboratories, was president of the NAS between 1939 and 1946, and he offered Bush the following candid opinion:

> If medical science is going to struggle with each one of these [diseases] as it takes the center of the stage (as I assume it will) its problems will exist forever. As fast as one specific thing is conquered another will crop up... as in the case of medicine, it seems to me questionable if a 'must' case for Federal support can be sustained as the only solution.[24]

On March 8, 1945, the first plenary meeting of the advisers gathered in Bush's office in Washington.[25] Homer Smith had already tipped the hand of the MAC in a letter to Bush.[26] Walter Palmer nevertheless read a prospectus written by Turner that gave the MAC opinion as unanimously favoring a separate agency for medical research, something on the lines of the British Medical Research Council (MRC). The MAC predilection for the British MRC as a model was understandable but perhaps only partially on target.[27,28] On the plus side was the fact that this medical science agency was relatively venerable (having been established in 1911) and from the first was operating with an absolute minimum of government interference. The highly university-oriented MAC members did not appear to realize, however, that a high proportion of MRC funds have always been committed to a large intramural program, which included The National Institute for Medical Research and a cadre of full-time employees in laboratories located at universities, but independent of them, such as the celebrated Molecular Biology Laboratory at Cambridge.

Bush, much displeased by this threat of insurrection, asked the MAC members if they had contacted the Public Health Service (PHS), since the interrelationship of such a new body and the PHS would have to be clear in order for Congress to go along with it.[24] Palmer and Smith indicated that their view had been endorsed by 350 representatives of 75 of the nation's medical schools, research institutions, pharmaceutical industries, and philanthropic foundations. Bush's staff, however, backed him up with a barrage of inter-office memos harshly criticizing the MAC position;[29] the Director's disapproval continued to trickle down to the drafters through Bush confidantes in New York who were assigned to help with the completion of the MAC report. The final revision of this document, submitted to Bush on April 15, was accompanied by a letter from Palmer that stated, "it becomes more and more evident to us in New York that our recommendations for an independent agency may be too idealistic and impractical..."[30] The final version of the MAC report that is published with the Bush Report nevertheless still contains the separatist views. Bush ignored the proposal and insisted that medical research would be retained in the new agency he had in mind. However, a number of the lyrical phrases about the achievements and promise of medical research in the MAC report were selected by Bush as part of the text of the body of *Science: the Endless Frontier.* The full MAC report, like the extensive reports of the Bowman Committee and the committee on scientific manpower (headed by Henry Allen Moe), was included in the appendices.

The Designs for the Purse

Who Should Run It? In seeking to immunize the new research agency from noxious influences of government management, the Bowman Committee specified that the new autonomous and independent body to be created by Congress should be "composed of men of the highest integrity, ability and experience, and with thorough understanding of the problems of science." They were to be "empowered to give sustained, far-sighted assistance to science with some form of assurance of continuing support." The Bowman Committee also recommended the establishment of a National Science Board to

concern itself with a global surveillance and rationalization of government support of science, a need that the Carnegie Commission has so lately readdressed in its 1992 report.[1] The MAC recommended that its National Federation of Medical Research should be administered by a board of trustees appointed by the President, with Senate confirmation, and a technical board of experts with aides and committees to oversee distribution and watch how the money was used. Everyone feared a strong administrator and demanded a passive one, beholden to the board.

How to Give Away the Money. The Bowman Committee and the MAC converged on one recommendation. The bulk of the funds was to be given to the universities to be locally administered at the discretion of the institutions. Such an arrangement, opined the MAC, "could relieve the central agency of the overwhelming task of administering small grants-in-aid." The Bowman Committee argued that funds should be available to accredited universities, colleges, and engineering schools "in a manner which will be virtually automatic." Once accepted in the plan, and as long as its bookkeepers knew the money was going for research, "[the institution] would expect to receive the grant as a regular annual appropriation." The Committee also felt the board must "be freed from the burden of investigating a large number of potential recipients [proposals] and judging the merits and defects of each." Each advisory group laid plans for provision of fellowships and grants, but these were to be smaller shares of the annual outlay.

One of the features of the Bowman Committee recommendations (that did not occur to the MAC) was the preference that universities obtain their money only on a *matching* basis. Was this to mean that the "Bowmanites," emboldened by the potential of the federal treasury, were regressing to the memories of an earlier pre-depression period? In the heyday of the Rockefeller Foundation, in 1910-1920, matching had been the primary mode of philanthropy. Abraham Flexner, who had a large role in assisting the Rockefeller philanthropies, had operated by a set of firm principles.[31] The first of these stipulated that "a large foundation should operate on a large plan, making its gifts by wholesale and not by retail." One of his corollary

rules was that "a foundation can best justify its strategic position in our society by stimulating gifts from others, through the device of requiring that its gifts be matched." In recent times, the NSF has employed matching or *leverage* in some of its large award programs. Given the tightness of money in 1945, it would have been an inequitable way to start a new government program based on merit.

How to Cut a Pie

Bush proceeded to finish his reply to the President in the first week of June, 1945. His proposed NRF would have five divisions and be run by a board to whom the director would report. His divisions and their projected budgets (in $ millions) were:

	1st yr	5th yr
Medical Research	5	20
Natural Sciences	10	50
National Defense	10	20
Scientific Personnel and Education	7	29
Publications and Administration	1.5	3.5
Totals	33.5	122.5 [2]

Release of the Report

On June 14, Bush met with President Truman for about 15 minutes to gain the President's reaction to the report and obtain permission for its release. The President had read and liked the report.[17] The report was released to the press on July 19, 1945.[32,33] On the ABC radio network, the popular commentator Raymond Gram Swing was highly laudatory, and the press was generally favorable. *The New York Times*, however, ruffled feathers by an editorial position that the NRF seemed an inadequate instrument for overall government science planning. For this, publisher Arthur Hays Sulzberger received a rebuke from Conant,[34] and from his privileged view as a member of the Advisory Committee of the OSRD, James Phinney Baxter III advised the publisher that "Bush and Conant in the past five years have had experience vouchsafed to few of the difficulty of getting enough freedom inside the government structure to permit

scientists to do their work effectively."[35]

The President was by now in Potsdam. His first meeting with Josef Stalin occurred shortly before he was informed of the successful first test of the atomic bomb at Alamagordo. This testimony to the potentially awesome power of government-funded S&T also must have been much on the mind of Vannevar Bush throughout this same period, for as OSRD director he was intimately involved with secret discussions, at the highest level, on how a successful experiment should be used to bring the war most quickly to an end.[36]

The description of the OSRD activities during the war, which was the first request in FDR's letter, had been of considerable importance to Vannevar Bush because he sought to counter a barrage of criticism directed at OSRD by Senator Harley Kilgore (D-W.Va.). Since 1942, Kilgore had attempted to pass legislation directed toward both tightening the government management of OSRD and broadened federal sponsorship of research, under conditions that Bush and many others steadfastly opposed.[17] By the time the Bush report was formally submitted to the President on July 25, a fresh draft of a new bill was released by Senator Warren Magnuson (D-Wash.); it filled Bush's prescription for the new science agency.[32]

Other Ambitions

Under a section entitled "Means to the End," Bush placed in his report stringent views on the competition for what was to be the National Research Foundation:

> There are within Government agencies many groups whose interests are primarily those of scientific research...These groups should remain as they are...they cannot be made the repository of new and large responsibilities for science which belong to the Government and which the Government should accept....Nowhere in the governmental structure receiving its funds from Congress is there an agency adapted to supplementing the support of basic research in universities.[2]

The National Institute of Health

In the early 1940s, there were over forty government research laboratories, and work in many of these was supported by OSRD

contracts. Temporary laboratory buildings for this purpose had been erected on the 100-acre campus of the National Institute of Health in Bethesda, Maryland. The several hundred scientists in this facility were engaged in research in basic sciences, such as chemistry, physiology, nutrition, and microbiology. Scientists in other laboratories were concerned with the applied sciences, some related to "control" activities associated with the mandates of the United States Public Health Service. A large number of the scientists were PHS career officers, who worked alongside civilian scientists, a tradition maintained today. Many of the scientists had entered the PHS immediately upon receiving their advanced degrees. Some had acquired most or all of their scientific training in the PHS. Very few were trained for, or interested in, clinical medicine. Although a few were internationally recognized specialists in their disciplines, the majority of the scientific workers were on career paths less glamorous than those of the professors and academicians from the great universities and medical schools who made up the Bowman and MAC groups of advisors.

Nevertheless, the NIH scientists of the 1940s were no less jealous than the professors and academicians of the academic freedom accorded them at the NIH. They adhered to the proud and solid tradition of the Hygienic Laboratory that was opened in 1887 by the Marine Hospital Service, and which had been the predecessor of the NIH. Some of the older staff members had been among those opposed to the attempts of Senator Joseph Ransdell (D-La.) in the late 1920s to expand the Hygienic Laboratory.[37] Ransdell was pursuing a dream of creating a great medical research institution in which hundreds of scholars would work on the underlying basis of all the diseases of humankind. The scholars would be generously equipped, have access to a big library, and be surrounded by an army of research fellows and other trainees.[38]

Intramural opposition to Ransdell's ambition had existed within the scientific leadership of the Hygienic Laboratory. Arthur Stimson, head of the PHS Division of Scientific Research, was negatively inclined. Gene Dyer, a PHS-trained expert in rickettsia and acting director of the Hygienic Laboratory, thought that the expansion of

a good laboratory should "... [proceed] in the light of a slow or deliberate growth rather than growth of a mushroom type."[37]

The Ransdell Act finally passed in 1930, but unfortunately at the very time when the nation was in the trough of the Great Depression. The legislative prize was reduced to a change of the name of the laboratory, a few hundred thousands of dollars for a new building, and the right to accept gifts. Authority for fellowships was granted, but with little in the way of funds to support them. Unseated at the next election, Ransdell dedicated several years to a fruitless pursuit of support, receiving a deaf ear from corporations and private givers alike.[36]

In the cadre of PHS officers at headquarters in the 1930s, however, there were some who were much less conservative than the majority, and they desired that considerably more attention be paid to the service's ability to fulfill its mandate to guard the public health. One group was particularly interested in the field operations. Another, smaller group was more desirous of enhancing basic and clinical science. Much later this difference of opinion would be expressed in the dominance of the bench scientists and bedside clinical researchers in Bethesda, with the more traditional public health field workers migrating to other posts. The latter group was exemplified by Joseph Mountin, an ebullient epidemiologist and inventive scientist who was considered by his peers as a "genius in the field."[39] Mountin became the "father" of what is today the Centers for Disease Control, an offshoot from NIH that moved to Atlanta in the early 1940s.

Thompson and Parran

Among those who dreamed of a great expansion of the scientific capabilities of the PHS in 1930, undoubtedly the most active was L. R. Thompson, who had just become chief scientist of the PHS. A kindred spirit was Thomas Parran, who had come to Washington in 1926 as head of the Division of Venereal Diseases. Both Thompson and Parran were visionaries, comfortable with the New Deal philosophy of federal activism that would come to Washington with the election of Franklin Delano Roosevelt in 1932. The names of

Thompson and Parran, along with that of Gene Dyer, are little-known to the present generation of medical scientists. Yet they constituted the trio of Public Health Officers destined to realize Ransdell's vision with creation of the modern NIH.

Thompson. Lewis Ryer Thompson, known universally as "Jimmie," was born in 1883.[40-42] His first job after graduating from Louisville Medical College was that of a quarantine officer in the Philippine Constabulary. After joining the PHS in 1910, his schooling in epidemiology, stream pollution, and disease control was highly practical and confined to field investigations. Thompson came to Washington in 1921 and was made the first chief of Industrial Hygiene Investigations in the PHS Division of Scientific Research. By the time he succeeded Stimson as chief of the latter division in 1930, he had already compensated for a lack of academic scientific training by a steadily growing mastery of the operations of the Congress and the federal bureaucracy.

Parran. The eventual achievements of Thomas Parran place him today in the first rank of all the surgeons general of the United States. He described himself as "coming from an impecunious, but proud background" in southern Maryland, and he never attended a formal school, receiving all of his education at home from an aunt-in-law before he entered St. John's College in Annapolis.[43] He graduated from Georgetown University Medical School in 1915. "Those days," he later recalled, "there were only three places in the country where a young physician could do good research, the Mayo Clinic, the Rockefeller Institute, and the Hygienic Laboratory. The Public Health Service was about the only place where one could do good research and receive some, what I call proper, pay for it."[42] Entering the PHS in 1917 after a year's internship in a private hospital in Washington, Parran obtained some microbiology training at the Hygienic Laboratory and soon after concentrated on field work in venereal diseases.

Parran and Thompson shared instinctively a commonality of interests in promoting the Public Health Service and were thus effective boosters of the fledgling NIH. They were willing to pull the tail of the establishment to further this ambition. An early act of

collusion occurred immediately after passage of the Ransdell Act, when Thompson and Parran were among those dispatched to survey the proposed site of the new building at 25th and E Streets in Washington. The two returned with a dismal report, protesting that many times the available amount of space would be needed. Surgeon General Hugh Cumming and NIH Director George McCoy vigorously disagreed and were supported by their superior, Treasury Secretary Andrew Mellon, who felt that the several acres on the site would be enough for at least fifteen years.[44]

In 1930 Parran left Washington for Albany. New York's Governor Franklin Roosevelt had requested Surgeon General Cumming to detail an officer for the position of State Health Commissioner, and Parran was chosen. Parran was highly regarded in New York and proved to be an activist in awakening the state to the danger of denying that venereal disease was a serious health problem. On one occasion he said that he was abruptly taken off the air by CBS and replaced by piano music for uttering the word "syphilis" in a speech.[38] More important, as he worked among the hospitals and people of New York, Parran had experiences that reinforced a growing conviction that no time should be lost in starting a vigorous assault on the chronic diseases.

As the mortality among the young declined with increasing control of the infectious diseases, there was a reciprocal and sharply rising proportion of the burden of illness and disability in degenerative heart disease, cancer, and mental illness. Parran soon also realized that the campaign must begin with more research on these diseases, including clinical investigation, a view that much of the medical community felt was highly premature.

The friendship that evolved between Governor Roosevelt and Parran led in 1936 to Roosevelt's appointment of Parran to succeed Cumming as surgeon general. Long before he returned to Washington, Parran was kept busy drawing up plans for health reorganization in the administration of the newly elected President of the United States.

Jimmie's Capers

The Science Advisory Board. Thompson, described in a 1934 news clip as a "silver-haired official with golf-tanned arms...a cool official in a cool office on the third floor of the Public Health Service Building...,"[45] made the most of this office, which was conveniently located in the surgeon general's headquarters in the Treasury Department, the parent agency of the PHS from its inception as the Marine Hospital Service in 1798.

Thompson was in the halls of Congress before 1930 when Senator Ransdell needed a hand during the birth of the NIH.[46] The record abounds with instances when Thompson was able to make key plays in attempts to benefit PHS science.[47] For example, in 1934 Thompson was present when Compton's Science Advisory Board met with the Bureau of the Budget and Secretary of Agriculture Henry A. Wallace. Wallace, who had been brought up in a family business in developing corn hybrids, had more of a scientific bent than most persons who attain a cabinet post. He remarked that he favored "a very limited amount" of federal money as grants to universities for research. This statement caused Thompson considerable anxiety because he feared that the PHS might miss a possible opportunity to increase its own research funds in the wake of such a program. Wallace's subsequent suggestion to the President that the SAB membership include medical orientation allowed Thompson opportunity to engineer, through Secretary of the Treasury Henry A. Morganthau, two appointments. One of these was Parran, the other was Milton Rosenau, a Harvard epidemiologist and director of the Hygienic Laboratory between 1899 and 1909.

Thompson went further, again apparently inducing Secretary Morganthau to suggest to chairman Compton that the SAB detail a subcommittee to examine the research strength of the PHS.[47] Compton graciously agreed to do so and assigned the study to a Committee on Medical and Public Health Problems, consisting of the three physicians who had been newly appointed to the SAB, Parran, Rosenau, and NAS member Simon Flexner, nearing the end of his long and distinguished term as director of the Rockefeller Institute.[48] Thompson, unhappy with a copy of a draft report of the

study he received from Rosenau, arranged to draft the report himself and sent it to Parran for approval of the other two members.[46]

The report of the committee on medicine and public health, released in March 1935, was all of twelve double-spaced pages and has to be regarded from today's perspective as a fairly naive "puff-piece."[49] The report began by listing some of the more outstanding discoveries of the PHS, which included important work on typhus and discovery of the cause of pellagra. Following this brief recital, however, the report abruptly ended in a recommendation that the funds for the scientific work of the PHS in the coming year be increased by $2 million. There was no plan or analysis of how this money was to be used, although it was a huge sum in those days, considering that the total budget of the PHS was $10 million, and most of it dedicated to maintaining the Marine Hospital Service. The final report of the SAB itself, which expired in December 1935, avoided mention of the health subcommittee's efforts.[48,50] The National Academy of Sciences wasted no time in replacing the SAB with a successor Government Relations & Science Advisory Group, a move that prevented the White House from again appointing an NAS committee, thereby overriding the academy charter established by President Woodrow Wilson.[51] The NAS just as promptly took steps to assure that non-NAS members Parran and Rosenau were not appointed to the SAB successor.[52]

NIH Moves to Bethesda. The PHS received no answer to its plea for increased funds through the SAB. Thompson also had no success in inducing the administration to take on one of the list of seventy "initiatives for new PHS research," which he released in August 1935.[53] Nevertheless, his connections and public relations skills paid off handsomely when, in the mid-1930s, another letter to the President came to his attention. This time it was an offer from the Luke Wilson family in Bethesda to donate some of their land to a worthy government purpose. Thompson arranged through Surgeon General Cumming to visit the Wilson family. At first, Thompson had in mind an animal farm for the NIH, still located in two adjacent buildings on the crowded site in Washington. As they grew to share Thompson's enthusiasm, however, the Wilsons eventually donated

nearly 95 acres, the bulk of their estate, for relocation of the entire NIH from its Washington location.[39]

In 1937 Surgeon General Parran made the NIH his scientific division and appointed Thompson as director to succeed George McCoy, the nation's leading expert in leprosy, who had stubbornly resisted further expansion of NIH.[54] With Parran's White House connections, enough money was found to build two buildings. Parran turned the first spade in January 1938, and the cornerstone of Building One was laid in July. The trowel was given to Secretary Morganthau by the surgeon general.

The earliest NIH buildings bear the mark of Thompson's predilections in several ways. In 1936 Thompson had extended his attendance at an industrial hygiene meeting in Geneva to a three-month tour of state-supported research institutions in Europe and Scandinavia. His reports to the surgeon general were scholarly and analytically sound, as well as candid. He considered the Pasteur Institute to be a "benign dictatorship under Roux," the "salaries entirely inadequate," and the laboratories poorly supported.[55] One is compelled to believe, however, that Thompson had also carried back some favorable images of the world-famous institute, when one observes the mansard roofs and sizes of the first buildings constructed on the NIH campus. They too much resemble (in Georgian style) the architecture of the Pasteur and DuClaux buildings that face each other across the rue Dr. Roux in Paris. A further sign of Thompson's laboratory orientation is the official names he gave to the now-familiar first buildings on the campus: "Industrial Hygiene" for Building Two, "Public Health Methods" for Building Three, while Four and Five were the "Infectious Disease Buildings."

Cancer

The evidence that Congress was ready to use federal money to back medical research in public and private institutions—without benefit of the views of a Bowman Committee—was apparent before 1945.[56] Indeed, there had been vigorous congressional tugging on the biomedical science culture warp since the 1920s. By 1944, there was enough evidence of increasing tension—in the moves to expand the

NIH—to give pause to those laboring to create a single agency for federal support of all science. If a relatively modest sector was being reserved for medical science, its subject matter was primed to expand explosively and could leave the fledgling NRF a shambles. The ultimate complicity of the medical academicians of the CMR and MAC in Bush's unitary theme can partly be attributed to Bush's strong personality. But possibly it was also related to a prevailing opinion that "public health research," as represented by the NIH, was mainly sanitary engineering, vaccination, and vital statistics, and not serious "fundamental" medical science. Whatever the cause, the NRF architects were deaf to the drums beating in the Congress.

Humanity's Most Deadly Scourge

"... a monster that is more insatiable than the guillotine, more destructive to life, health and happiness than the World War ... more irresistible than the mightiest army."

Senator Matthew Neeley, May 1928. [55]

In 1927 Senator Matthew Neeley (D-W.Va.) introduced a bill (S. 5589) to authorize a federal award for the cure to cancer. Rebuffed, a year later he proposed authorizing generous funding for the NAS to determine how the federal government should engage this enemy, which he described as "humanity's most deadly scourge" in a vivid polemic before the Congress.[55] At that time, Ransdell pointed out to Neeley that the PHS had been studying cancer since the early 1920s (including a cancer research unit at Harvard Medical School) and reminded him of the augmentation of such research already inherent in his drafts for upgrading the Hygienic Laboratory. The passage of Ransdell's bill in 1930 temporarily deflated the congressional pressure to mandate the support of a single disease.

When he became surgeon general, Parran was aware of both the concerns of Congress and the urging of a small but powerful group of public supporters. He therefore provided the Congress with the outlines of a national program for cancer control, which he believed must include stepped-up clinical research.[57] At about the same time, Dudley Jackson, a Texas internist, induced Congressman Maury Maverick (D-Tex.) to ask the NIH Director to help draft a bill for establishment of a National Cancer Institute (NCI), but no answer

came from director George McCoy. Maverick persisted without such support and in April 1937 submitted a bill to create a cancer institute. It was just a few days after that a bill was submitted by Senator Homer Bone (D-Wash.), who had been assisted by Parran. A companion bill was submitted from the House by Congressman Magnuson.

At a joint hearing on the Cancer Act, Senator Bone remarked:

> I have received hundreds of letters urging passage of this bill. People all over the Nation are interested in any move to make real progress toward discovering the causes of this disease.[58]

His cosponsor, Senator Roy Copeland (D-N.Y.), added:

> The (bill is) introduced in the Senate jointly for myself and *for every member of the Senate.* In the 15 years during which I have been in the Senate, I have never known such a thing to happen before.[57]

On July 27, 1937, the House approved the Senate's joint National Cancer Act, and President Roosevelt made it law on August 5.[59] The new institute was fitted with a National Advisory Cancer Council (NACC), similar to the National Advisory Health Council (NAHC) established for the NIH in 1930. The NACC was to approve extramural grants made for cancer research. This key provision of the National Cancer Act did not receive adequate funding until about 1945.

The cancer movement thus was now established within the NIH. The restless anxiety of its fervent supporters would reappear again and again in the future, creating tension with the attempts of the NIH leadership to maintain an integrated program of research on human biology and disease. Such separation early manifested itself in a movement to have a hospital for cancer alone in Bethesda. More serious was the barely averted schismatic movement in the early 1970s, arising from efforts to increase cancer funding.[60]

On the other hand, parochial stimulation of more support for cancer frequently has proved to be a boon for the whole of biomedical research, because of the "Venetian structure of NIH" created by the early grants program officers. This means that on the surface each of the major disease categories is visible; beneath, the support is

largely miscible, allowing growth of all the biomedical disciplines.[61] By 1944 "The Most Deadly Scourge" had become the strongest thread in the medical science culture warp.

Public Law 78-410.

When the U.S. entered World War II, the Public Health Service had to turn its attention to greatly expanded responsibilities, but planning for increasing capacity was not entirely neglected. In 1942 Dyer succeeded Thompson as NIH director and assumed his seat on the CMR. Though ailing, Thompson became in charge of legislative matters and for several years concentrated on assisting Congressman Alfred Lee Bulwinkle (D-N.C.), who was chairman of a subcommittee of the House Interstate and Foreign Commerce Committee that was seeking to straighten out the "messy structure" of public health laws. Hearings, beginning July 1, 1944, on a Public Health Service Act featured a long appearance by Parran and a good deal of careful chairmanship by Bulwinkle to reassure some conservative Republican members that several new authorities proposed for the surgeon general were not novel but derived from existing law.[62] In this way, the National Cancer Act became particularly helpful because Congressman Bulwinkle could point out that if the law allowed NCI to award extramural research grants, of course this authority should also be given to the NIH. In the language of the new legislation, the NCI—at Parran's insistence—was bound firmly into the family, as a ninth division of the NIH.

Section 301 in this act gave the PHS, through the surgeon general, almost unlimited authority to perform and support extramural biomedical research. The new powers derived from what became Public Law 78-410 had yet to be tested before the President's November 1944 letter initiated the actions of Vannevar Bush.

"(d) Make grants-in-aid to universities...and other public or private institutions, and to individuals for such research projects as are recommended by the NAHC or NACC."
From Section 301, Public Law 78-410 (1944)

The surgeon general had also not neglected other plans for peacetime expansion. Two weeks before the President's letter to Bush, Parran issued a "Ten Year Postwar

Program" for the PHS. It was cast in the frame of the activist New Deal adherent that he was. The plan advocated that "...there be available to everyone all medical and health services," public funds for implementation of a national medical care program, and, inter alia, public support of research. Plans for $23 million in new construction were detailed for the first postwar year. The top priority was allotted to a 500-bed hospital on the NIH campus.[63]

Letter to A. N. Richards. When the intent to demobilize the OSRD was taken up in the August 1944 meetings of the CMR, Gene Dyer, emboldened with the brand-new strength of P.L. 78-410, had expressed the view that the Public Health Service could take over contracts appropriate to its functions. A week later, with the concurrence of the surgeon general, he wrote a letter to Richards,[64] pointing out in detail the new authorities now held by the surgeon general and committing the PHS to assume the financial and scientific responsibilities of the (expiring) CMR. Dyer offered to appoint the personnel from DMS now advising the CMR to an advisory committee created for the National Advisory Health Council.

The letter was annexed to the minutes of the next CMR meeting, and referred to by Bush in a letter to Richards on September 18.[65] The PHS position was supported by some members of the CMR staff. James Moore, a top staff executive, wrote Bush's executive officer that if OSRD was to go, the CMR should be continued by a governmental body, "alternatively the NAS+NRC [sic] or the USPHS." Moore was fully aware of the new PHS authorities but noted that PHS policies would have to be "retooled," especially the relationships between the PHS research and that supported by extramural grants.[66] Perhaps because Bush was now busy with preparing a new agency, the CMR—and the PHS—waited for months for some signal of further demobilization. By May 1945, the DMS division chiefs decided to recommend that all contracts be transferred to other agencies at the end of the year. In June, Bush asked the CMR to stay fluid but by August 24 he sent Richards a set of principles by which the contracts should be organized for possible demobilization. These guidelines specified that military projects should be transferred to the military. Nonmilitary projects should be divided into one of

three groups: (1) projects for private sponsorship by groups willing to be responsible for them; (2) projects properly within the scope of the PHS and which the PHS is willing to undertake; these would carry the funds budgeted for their continuance during the current fiscal year; and (3) projects which could best be furthered under the auspices of a federal agency will be continued with the expectation that such a federal agency will be created by the Congress.[64] Vannevar Bush's precise deadline for release had passed into the hands of Congress.

LEGISLATIVE CONFLICT

Different Concepts of an NRF

Four days after Senator Magnuson and others had introduced S.1285 to establish in law the Bush blueprint for the NRF, Sen. Harley Kilgore (D-W.Va.) and several colleagues introduced S.1297, a bill with a different model. This bill reflected what some considered a more populist or "socialist" view of government support of science, ideas that Kilgore had been revising and refining since 1942 in a legislative attempt to have the government more actively control the OSRD.[67] Kilgore's scheme called for a strong director, government retention of patents on discoveries arising from government-supported work, a distribution of 25 percent of the funds to the states for their tax-supported and land grant schools, not less than 15 percent of the total for medical research, and inclusion of the social sciences.[68] Most of this was anathema to Bush, but President Truman let it be known in a public statement that he favored the inclusion of the social sciences and certain other aspects of the Kilgore bill. Bush wrote a long letter to President Truman discussing the two bills and his opposition to Kilgore's version. He also complained to the President that, although he was nominally the science advisor, he had not been consulted by Truman before his recent message to Congress on science and research. The President and Bush had a conference on these differences,[69] but, as Bush complained later, he and the President never had a comfortable relationship.[9]

The Scientists Mobilize. Overwhelmingly in favor of the Magnuson version, the scientists and institutional leaders organized to support it. Many of them testified in Congress, wrote the President, and signed petitions to back Bush.[70]

In November, as the hearings bogged down, a Committee Supporting the Bush Report was founded by Isaiah Bowman. Its members tended to be the scientific elite including the MAC. However, the scientists were not of one mind as to tactics. Within a short time, another committee organized by Harold Urey and Harlow Shapley and supported by Einstein, Fermi, and Oppenheimer backed a compromise bill.[17] The Bowman committee sent a letter to the President endorsed by its adherents. By December 1945, the signatories numbered 1377 academicians. More than half (727) of these were deans, department heads, professors, and staff of medical schools; others were biologists (295), chemists (150), and physicists (104). This letter opposed the inclusion of the social sciences as well as the appointment by the President of a strong director; the letters also insisted that the governing authority should rest with the board.[69]

One of the many who testified in Congress for the Magnuson bill was Milislav Demerec, director of both the Biological Laboratory and the Carnegie Department of Genetics at Cold Spring Harbor:

> Moreover, it has been found in practice that placing fundamental research under the control of agencies that anticipate practical applications seriously limits and restrains the freedom of thought essential for basic advances.[71]

These sentiments could not have gone unnoticed in Bethesda. There was no doubt, however, that many basic scientists were alarmed that a section of the Magnuson bill included a Section 5, that read:

> (1) A Division of Medical Research: Programs relating to research in the biological sciences, including medicine and related sciences.

To soothe the basic scientists' fears, Homer Smith wrote a letter on behalf of the Medical Advisory Committee pointing out that the MAC "had never considered the biological sciences within its scope."[72] After the hearings, a compromise bill (S.1850) was approved by both

sides. It appeared that the OSRD was to be transferred to a National Science Foundation. The compromise bill passed the Senate, but the House adjourned while the bill was still before a committee.[73]

Contracts Released

As the Congress deliberated through August, time seemed to be running out. The division chiefs pushed for transfer of the contracts lest they all expire before a new agency was created. They would use the classification that Bush had ordered. In the first week of September 1945, Dyer received notice from A. N. Richards:

> In order that disposition of active CMR contracts can be arranged, it is desirable that a meeting of the CMR Division Chiefs and yourself or your authorized representative be held...at the NAS on September 5.[74]

The minutes of the next CMR meeting on September 6 are anticlimactic.[75] There is attached without comment an annex reading:

> 2. Disposition of our Contracts. DIV I Medicine Recommended for Transfer to US PHS. Medicine, (39 contracts) for $662,000; blood studies, (5) for $65,000; chemistry, (2) for $12,000.

The total of all CMR contracts outstanding came to $2,127,000, about two-thirds of which were marked as reserved for "to new foundation," or "to be kept by CMR." The minutes were bare of details and suggested none of the high drama as related by A. Baird Hastings. This charter member of the CMR delighted in describing the final moments thus: "As Richards offered up each contract, only Gene Dyer made a bid, and afterwards he calmly walked home with the bundle."[76]

THE BATON IS PASSED

Ambivalence

It is obvious that the transfer of the CMR contracts to the NIH on September 6 were not perceived, either by the scientists in general or the biomedical community in particular, as the beginning of the Millennium. Presumably most still believed that the Bush model would emerge within the next Congress. None could foresee that

during 1946 the legislators would have to concentrate on the creation of a new government keeper to husband the mixed blessing of atomic fission. The establishment of the Atomic Energy Agency also put in place an unforeseen new mission agency for science. A year later, President Truman, determined to have an NSF director responsible to him and not to a board, vetoed the NSF legislation. The accouchement of NSF was beset with unbearably prolonged labor pains.

The two major science advisory councils responsible to the NIH were equally nonplussed by the opportunity that had been thrust upon their agency and the challenge of shaping future biomedical research. On September 29, nearly a month after the CMR contracts had been moved, a joint meeting of the National Advisory Health Council and the National Advisory Cancer Council was convened. The agenda featured a debate over the new Division of Medical Sciences of the NRF in the plan proposed by Vannevar Bush. Dr. Parran informed the council members of the transfer of CMR grants to NIH that had very recently taken place. In a seemingly routine performance of its statutory duties, the NAHC reviewed and approved the renewal of the contracts Dyer had brought home as well as the seeking of a supplemental appropriation of about $900,000 that would be necessary to meet this obligation.

However, when the question was considered of whether the Public Health Service should take on the responsibility for grants in medical research, the majority of the members were against the idea on the grounds that the responsibilities for such grants were: (a) too great an added burden for the PHS, and (b) more appropriately belonged to the agency administering similar programs in other scientific fields, including the basic sciences related to medical science. A subcommittee consisted of the leading basic scientist on each council: Andrew Ivy, the famed physiologist from Chicago, and the biochemist William C. Rose, a pioneer in essential amino acids at the University of Illinois. The two were appointed to draw up a resolution. The drafters produced a statement that both advisory councils thought the PHS should retain its independence and expand its *own* [emphasis mine] research. The resolution passed.[77]

Appropriations Test. Gene Dyer, the son of a clergyman, went to Kenyon College and the University of Texas Medical School. He had most of his years in the PHS in the Hygienic Laboratory and there had acquired a national reputation as an expert on epidemic typhus.. Old-timers at NIH describe him as an introspective man, reserved, polite, and the "quintessential bench scientist." Most seemed quite unaware of the tiger poised behind this dignified facade. Guided by Parran, Dyer was unperturbed by the criticism and ambivalence of both the NIH advisory councils and the greater biomedical community. He immediately turned to "get funds for them" (the contracts) and "see to it that the program was put into the hands of scientists and kept there honestly."[78]

The OSRD had convinced the Bureau of the Budget that money should be transferred to the Public Health Service to cover a one-year renewal of the contracts it had taken home. The House appropriations subcommittee, however, objected to this tactic, and insisted upon hearing a proposal for a supplemental appropriation to the PHS Fiscal '47 budget that had previously been approved. On April 10, 1946 Dyer appeared before Congressman Albert L. Engel (R.-Mich.), the ranking minority member of the appropriations subcommittee responsible for the Federal Security Agency, which in 1939 had become the location of the PHS. Engel, who had been intimately involved in the funding of the work on the atom bomb and other high technology projects through service on another appropriations subcommittee, was thoroughly familiar with the OSRD. Thus the following colloquy between the two men, here presented in its entirety, can be passed off as merely a good example of the genre of congressional theater known as "making a record." To those, however, who like to savor the historical symbolism of American biomedical science passing from a shallow and uncertain bay into deep and unlimited waters, the following has a Homeric quality:

Mr. Engel: What was the supplemental of $1,178,000 for in FY '46?

Dr. Dyer: $817,000 of that was a supplemental appropriation for research grants.

Mr. Engel: Grants-in-aid to the States?

Dr. Dyer: Not grants-in-aid to the States, but . . . for research work. We took over contracts for OSRD at their request.

Mr. Engel: What is the OSRD?

Dr. Dyer: The Office of Scientific Research and Development. That was the office which handled the atomic bomb research, medical research and other research.

Mr. Engel: What was the date you took over this work?

Dr. Dyer: On the 1st of January (1946).[79]

Philosophical Adaptations

The surgeon general established a Division of Research Grants in 1946. Dyer chose C. J. Van Slyke, a former field worker in venereal disease control, to take responsibility for the grants. One of the reasons for Dyer's choice was that Van Slyke, a gruff and capable man, was free because he was just recovering from a myocardial infarction and Dyer thought the job would not take too much of his day. Van Slyke, in turn, chose Ernest Allen and a few other helpers. They wasted no time in assembling study sections. By mid-1946 10 study sections were established and more added rapidly to make 21 by the end of the year. The sections covered *basic science disciplines* such as pharmacology and bacteriology; *diseases*, like syphilis and malaria; and *systems,* such as cardiovascular, which included both basic science and clinical medicine.

From the first day, the study section membership was siphoned from elite pools, including many advisers from the DMS committees that had assisted the CMR. Of the 75 medical scientist members of the NAS in 1946, 12 were members of the first study sections.[80,81] James A. Shannon, then at the Squibb Institute, was the chairman of the malaria study section, and Johns Hopkins' E. Cowles Andrus chaired the cardiology section. These were roles they had played for the CMR. About 1000 proposals were received the first year, and the amount awarded came to $5.5 million.

Among the dozen or so study fields in the first year, syphilis was the leader in dollar volume of grants, followed by cardiology and physiology. The leading states in terms of number of grantees were,

in descending order, New York, Massachusetts, Illinois, Pennsylvania, and California.[80]

The ascent of the annual NIH obligations for extramural research grants was swift. The approximately $4 million in fiscal year 1947 rose to $15.6 million in fiscal year 1950, to $36.6 million in 1955, and by 1960 was $203 million. This last figure represented two-thirds of all NIH obligations in 1960 ($338 million).[82]

By 1948 officials from the Bureau of the Budget and the Federal Security Agency were urging NIH to resist cloning of the institute model for any more diseases.[83] A Mental Health Institute had already been authorized, with pressure on the Congress from professionals and laymen.[84] A single anecdote may suffice to illustrate the ferment of the late forties. Leonard Scheele, who served as director of the Cancer Institute from July 1947 until he was appointed surgeon general in April 1948, later recalled his participation in the following notes as recorded by his interviewer:

> Mary Lasker [asked] 'Len, why shouldn't there be a Heart Institute?' Len wrote the bill [slightly revising the National Cancer Act]... Dyer gave OK...,Parran blessing... Lasker got bill to [Senator] Styles Bridges...on President's desk 'for weeks'.[85]

There were many others in addition to Mrs. Lasker who contributed to the accelerated pluralization of the NIH. This was a period of giddy growth that saw both heart and dental institutes arrive in 1948. Before long, many citizen activists urged a willing Congress to eventually extend the attack on all diseases, as had been Ransdell's dream. These expansive adjustments of the culture warp are themes for other essays and beyond the scope of this story.

Project or Institutional Grants. Almost reflexly, Van Slyke and his team had adopted the project grant as the principal basis for the extramural program. There is very little evidence that the Congress initially planned this approach, although it has been pointed out by Donald Price, who was on the scene, that Congress recognized it would have a difficult time making awards to institutions with their different public and private, sometimes religious origins. It was easier to let the peer review process make the choices with delegation of the final responsibility to the advisory councils that also had

public representatives.[86]

It is often pointed out that project grant had become the preferred mechanism of support by the largest philanthropic organizations before the war, after the bulk grant to institutions had become both boring and no longer financially feasible. One of the impresarios of such support for small groups of gifted investigators was the Rockefeller Foundation's Warren Weaver, a member of the Bowman Committee.[87] He and his fellow foundation administrators had promulgated a "best science" tradition that has dominated funding of science for this century. The probable reason for the NIH project grant choice was that NIH wanted to take over where the OSRD had left off, to choose individuals or small groups of investigators for individual awards. In Van Slyke's 1946 description of the intent of the NIH extramural program, he described it as resting "on the integrity and independence of research workers, and their freedom from control, regimentation and outside interference."[88] Dyer later echoed these sentiments: "...emphasis is placed not on the goal, but upon the scientist pursuing interests as distinct from bureaucratic control over those interests."[89] Doubtless they firmly believed these concepts, but they also were aware that the scientific community was scrutinizing them carefully for any of the dread signs of the predicted inability of a government mission agency to run a grants program adhering strictly to the already established "best science" tradition.

Roger L. Geiger viewed this community reaction as a natural one. The Depression had ended the dependence of the university basic research on philanthropic sources; the superimposition of any federal funding agency on the existing system would be intolerable if it failed to allow the scientists and their institutions "to retain freedom of scientific research, peer control and the autonomy of the universities."[90] To be sure, the 'autonomy' of the universities was initially altered greatly by the NIH granting practices. A peer-regulated decision process operating distal to the universities was put in place to determine which of their faculty members would be supported to do research work. The institutions would not make that decision at home.

At first, neither the early NIH administrators, who were busy establishing their credibility as effective heirs of the OSRD, nor the outside community, which was busy monitoring the NIH performance, were paying proper mind to the future. It seemed likely that in the long run the strictly categorical, highly targeted project grants appropriate for the OSRD would not give the ideal coverage of science that could be obtained on broader long-term support for the best minds. This may have justifiably bothered some supporters of broad institutional support even though the NIH approach pleased the rank and file of scientists. With the exception of the needs of fledgling scientists and others caught between grants, most scientists today probably believe that the university is not in the best position to allocate support to its faculty investigators strictly on merit. However, in 1955 there was a short-lived attempt to resurrect the arguments for institutional-based funding held by the Bowman Committee and the MAC.

Brief Revolt. Soon after she took over as overseer of the Public Health Service in 1953, Secretary Oveta Culp Hobby of the Department of Health, Education, and Welfare ordered an outside study of the NIH research programs. In accord with its recent mandate,[91] the National Science Foundation, which had at last been created in 1950, was given responsibility for the study. The agency convened a special committee for this purpose consisting of university scientists under the chairmanship of C. N. H. Long, dean of Yale's medical school. The committee recommended that the NIH extramural grant program be severed from the intramural program. Furthermore, the Long committee indicated that the desired mode of research support was through "unrestricted institutional grants" to the school. However, events had overtaken this simpler vision, vintage 1945.

James A. Shannon, then the NIH director, thundered against such a fission of NIH. A new HEW Secretary, Marion Folsom, appointed his own investigating committee, headed by Dr. Stanhope Bayne-Jones, who had been another Yale dean. Senator Lister Hill (D-Ala.), now in the chair of both the Senate authorizing and appropriations subcommittees with jurisdiction over NIH, asked an educator, Dr. Boisfeuillet Jones, to conduct his own study for the

Congress. Both reviews disagreed strongly with the NSF study committee. The committee report, never officially published, lies in the archives.[92]

Basic v. Applied Research. In 1947 nearly everyone in the academic community appeared to share a canonical belief that, as Bush implied in his report (and Demerec and others had echoed in testimony and private sentiments), an agency doing applied research could not be entrusted with handling basic research. In fact, one of Bush's five principles for operation of the new agency was that it was not to operate any laboratories of its own.[2] As Homer Smith's disclaimer [72] revealed, the members of the MAC in 1945 seemed astonishingly unaware of the concept that between the most fundamental biology and clinical research there stretches an uninterrupted continuum. From ancient times, medicine has always been one of the best tutors of biology. Yet the former cannot survive without constant refreshment from the deeper wells of fundamental discovery. The several founders of the modern NIH left little written evidence that they understood completely how close was the interrelationship, but in their actions they helped anneal forever the linkage between basic and applied biomedical research.

The story of how they built the largest laboratory in the world for unequivocal demonstration of this linkage is too long to tell here. It is important to note, however, that it was during the same appropriations hearings in which Dyer had carried the OSRD contracts over the great divide, that he and Parran also pledged to return the following year to obtain a commitment to build the NIH Clinical Center. The opportunity to do so had been opened by the insertion of another clause into Section 301 of P.L. 78-410 that allowed patients to be admitted for purposes of research only.

" (f) For purposes of study, admit and treat...persons not otherwise eligible. . . "
Section 301, Public Law 78-410

In the planning for the hospital, Parran and Dyer instinctively had to defend what is today recognized as a major principle of biomedical research, i.e., that maintaining the unity of biomedical and behavioral research in the immediate environment of clinical studies is the most effective way to understand disease. Repeatedly

these two pioneers had to intervene to convince cancer and mental health researchers that one hospital was better than three.

Ground was broken in 1948 for an enormous new focus of the intramural program—a house that was described by one of its principal architects, Jack Masur, as containing "500 beds wrapped in a thousand laboratories." Construction would cost more than twice the sum expended by the CMR during the entire duration of the war. It frightened many of the NIH scientists at the time, just as Ransdell's plan had done decades before. Arthur Kornberg was one of those who left and provided a reflection on why in a recent book:

> The decision to go...turned out to be [two] errors in judgement. First I believed that the advent of the Clinical Center and the disease-oriented institutes would stifle basic research at NIH...[93]

Many in the academic community were angered by the building of so colossal a facility. Their representatives on the MAC had already expressed their opinion to Bush, which he had included in his report.

> "...we should set out to improve the research staffs and facilities of the present medical schools before we undertake the establishment of new institutions."

Now that the full support of the government had swung to biomedical research, this reading of the situation by the medical elect was too narrow.

When the Clinical Center opened in 1953, clinical investigation in America had indeed moved a great distance from the turn of the century. In 1910, a time when philanthropy provided what government would not, the Hospital of the Rockefeller Institute was opened as a unique model for the world.[94] The timing was right. Clinical research laboratories appeared in teaching hospitals in the Northeast: Philadelphia (1885), Baltimore (1907), New York City (1910-20), Boston (1922-25), and had become incubators for clinical researchers.[27] By 1950 one could say that the gap between the bedside and the laboratory was nearly closed. The difference ultimately provided in Bethesda was an interface between basic science and

clinical research of such overwhelming density that the conversion of clinical investigation from an avocation to a full-time profession was greatly accelerated.[95] The virtue of fostering fundamental research in the vicinity of clinical medicine soon became a necessity for the advances against chronic diseases that had finally begun. The return of increasing numbers of scientists from the Clinical Center to the medical schools helped scatter across the nation, and to many parts of the world, the paradigm of how best to focus the knowledge available on human diseases.

Vannevar Bush deserves the high esteem that history has accorded him for singular achievements in times when the culture of American scientific endeavor and the associated institutions were changing from a predominately private mode to a public one. Those who assisted Bush in this transition made important contributions to laying out the defense of the scientific method and of the limits of its adjustment to the forces that support it. In doing so they positively influenced the transition to a partnership with the state and passed on passionate instruction on principles that endure today. Credit for the effective translation of these principles is owed to a small group of PHS officers, like Thompson,[96] Parran,[97] Dyer, and Van Slyke, who had the vision, character, and sense of public duty necessary to make the system work.

The culture warp too endures. Inseparable from the support and the substance of the weaving of knowledge, it will forever be a part of scientific inquiry. The complex network of forces involved in the public support and associated governance of biomedical science have together achieved a remarkable result in America.

Nevertheless, as the tapestry thickens and becomes more intricate, so does the warp. Capricious adjustments in the loom have become common. Too often, unthinking or selfish moves are made that increase the tension and the danger of snags that may seriously threaten the integrity and completeness of the fabric of knowledge. Because the loom belongs to civilization, anyone who attempts to change the function to suit his own design can put at risk all the generations yet to come.

Notes

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54. Armstrong (38) and Harden (36) describe reactions of the old guard to Thompson's persistent attempts to "change the NIH into a major medical machine to fight chronic diseases." Director McCoy observed to his deputy Dyer that "We've got two buildings and NIH needs no more space than that."
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Voegtlin, NIH cancer researcher in a letter to SG Cumming, in 1929 strongly disagrees with the position of Dr. James Ewing, of New York's Memorial Hospital that more fundamental research must precede clinical research in cancer. Letter Surgeon General Parran to Senator Homer Bone, March 19,1937.
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74. National Archives RG 227 OSRD Records of the CMR Box 32 General Records 1940-46. Folder "Dyer, R.E."
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96. In his cornerstone memoir (40), Thompson wrote: "I do not know of any other officer of my own times and I doubt if there will be many in the future to have the pleasure, excitement and good luck to be personally instrumental in the development of an institution such as the National Institutes of Health...."
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