Integration of Medical Research and Health Policies

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When the U.S. Senate, with Presidential approval, voted recently to create a new agency to lead a new crusade to conquer cancer (*1*), those in charge of the government's principal health research agency, the National Institutes of Health (NIH), shook their heads in worried disapproval; but old Matt Neely saluted from the grave.

Senator Matthew M. Neely (D–W.Va.) tried repeatedly throughout his long service in the Senate and the House of Representatives to get the government to wage war on cancer. It was, he said in urging the Senate to approve his cancer bill of 1928, "more terrifying than any other scourge that has ever threatened the existence of the human race." Cancer was a monster, "loathsome, deadly, and insatiate" (*2*).

His first bill on the same subject had been introduced a year earlier and was a simple one that would have offered a $5-million reward "to the first person who discovered a practical and successful cure." The Senate did not actively consider that measure, but the bill attracted wide public notice. Within a year's time, Neely had received some 2800 letters from persons who claimed to possess infallible cures for cancer. One lady in Ohio, assuring the Senator that she wasn't just after the money, sent him an anointed handkerchief and directed him "to lay it over the cancer in the name of Jesus." She added that, if it didn't work, "it is because you have no faith" (*3*). Others variously prescribed arsenic, egg whites, soot from wood stoves, South African boggo, and stone flower juice. All they accomplished was to convince Neely that "the plan to offer a reward for the cure of cancer set forth in my [previous] bill was imperfect, if not utterly futile" (*3*, p. 9050).

Neely's revised plan was to authorize the National Academy of Sciences "to investigate the cancer subject and report to Congress in what manner the federal government could assist in coordinating all the cancer research and in conquering this most mysterious and destructive disease" (*3*, p. 9050). That kind of approach was much more acceptable to the medical science community, then as now; and it is worth stressing that that kind of approach was also more acceptable to the Congress, then as now. The only objection to the plan, in fact, came from a small health science bureaucracy—those people in charge of the Hygienic Laboratory, which was then spending $25,000 per year on cancer research. They thought the Hygienic Laboratory should be designated along with the National Academy; and in the end it was.

Nearly a decade later, when members of Congress started talking about creating a National Cancer Institute, the scientist-administrators directing the National Institute of Health (*4*) opposed the idea. They later cooperated with Senator Homer Bone (D–Wash.) in order to avoid what they considered to be the less desirable consequences of a particular alternative bill. Still another decade passed, and progress continued to be slow. In 1946, the director of the National Institute of Health was asked by a congressional committee if a lack of resources were retarding the cause, if the Institute could use more money for cancer research. The answer was no: the Institute had programmed an expenditure of about $1 million per year for the next 5 years, and no more than that could be effectively used. Neely, back in Congress on the House side after a term as governor of West Virginia, was incredulous. He quickly introduced a bill to authorize an open-ended expenditure of up to $100 million for cancer, the money to be used as rapidly as it beneficially could be. Furthermore, he recommended that a new agency be created to oversee the effort and the spending. The National Institute of Health proposed a compromise: it would double the size of its cancer research budget for fiscal year 1947 and would ask for $14 million the following year.

Viewed against this anecdotal background, the importance of the Senate's recent action becomes clearer. The action underscores the recurrent concern of those "proximate policy makers" (*5*) (members of the U.S. Congress) who have been the main movers and shakers throughout most of the recent history of the national health research effort. Specifically, it points up the fact that the strongest governmental supporters of the medical research enterprise have always demanded that it be relevant to social needs and to human problems.

Medical Research Policy: 1950 to 1970

What constitutes national policy is a much-debated issue. National policy is usually recognized as such when it is synoptically developed, enunciated by the President, or both. Thus, after President Kennedy's declaration in 1961 that we would attempt to land a man on the moon before the end of the decade, there was no question of what our space policy would be for that period. On the other hand, even a President's stated intentions, unless a consistent effort is made to implement them, may not be tantamount to governmental policy. Even when national goals are stated and accepted, and when machinery is set up to achieve them, a long-term functional policy may not result. No wonder people ask whether there really ever was a War on Poverty.

Sometimes specific policies fail, but those who feel incriminated by accepting the verdict of failure say that "we never really had a policy." Avowed critics of particular national policies sometimes refuse to admit that policy makers have made policy: their charge that no policy exists suggests that confusion does, and that is usually considered to be a more damning indictment than the assessment that there is a policy but the policy is wrong.

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In the case of the national medical research enterprise over the last 20 years, critics of various aspects often comment, with varying motives, that there is no governmental policy (researchers and university administrators made the comment laughingly until a couple of years ago). What is apparently meant by that particular charge is that there has been no single summary statement of what has nonetheless developed into a recognizable governmental commitment, and perhaps that there was some divergence of view about what the main thrusts of the policy were and should be. Some people—notably those in the executive branch, and especially some in the Bureau of the Budget (who take the position that they certainly know a policy when they make one)—were simply bothered about terming anything that emanated from congressional concerns and actions a "policy."

But policy, Daniel Greenberg reminds us, "is essentially an ordering of priorities" (*6*). To accept that definition is to accept the possibility either that policy may be made according to a logical, synoptic process, which necessitates explicit agreements and goals, or that policy can evolve out of a series of marginal moves and uncoordinated decisions, which necessitates only vague agreement on broad goals. Policy, that is, can evolve de facto out of an aggregate of decisions and commitments that are only indirectly related to one another.

I argue that we have had a medical research policy over the last two decades and that it has been a relatively coherent one. Where it is popularly considered to have failed is principally where its purposes have been misinterpreted.

The Early Context

The rapid buildup of federal dollars for medical research and development (R & D), which began in the early 1950's, was prompted by positive and negative factors in both the scientific and the political environment. Some of these factors were carried over from the preceding era. The success of well-organized and generously funded research during World War II made a lasting impression on the public, particularly on Congress. The story of the rapid development and mass production of penicillin, told over and over before congressional committees, suggested to the proximate policy-makers that medical R & D could become a very important means of improving the health of the American people. They perceived, and scientists did not seek to dissuade them at that point, that biomedical science was ready for extensive expansion.

It was not Congress alone that recognized the possibilities of medical research. President Truman's Scientific Research Board had, in 1946, recommended the formulation of a national policy on medical research and a gradual increase in research funds for "the conquest of disease," with the aim of attaining an annual national expenditure, from all sources, of $300 million by 1957 (*7*). (By 1957, the NIH alone was spending about $187 million, and the overall national goal set by the Steelman Report had been surpassed.)

Another positive and most unusual factor that gradually came into play was a special-interest group, a "citizens lobby" organized by Albert and Mary Lasker. This group harnessed professional biomedical expertise and added professional advertising techniques in an attempt to secure a commitment from the federal government to spend whatever it might take to conquer cancer and other dread diseases. Like other lobbyists, the Laskers spent money in several persuasive ways, including campaign contributions. But among their principal weapons were (i) the development of data comparing the cost (to the economy) of various diseases to the cost of concerted research efforts to overcome them; and (ii) an absolute conviction of the importance of their cause and an unusual ability to persuade others, in and out of government, that they were right.

The negative incentives are almost as well known. Many Americans were believed to be anxious to have the government move forward on the health front, to move out beyond the traditional role of supporting "public health" programs aimed at the control of chronic diseases and occasional epidemics of communicable diseases. Hospital construction was the first such step forward, and Truman wanted to open up other fronts by creating a national health insurance system, by significantly expanding the federally supported biomedical research effort, and by providing for direct support of medical education through grants to medical schools and through scholarships to medical students. This comprehensive plan had one advantage: the American Medical Association (AMA) was so vehemently opposed to the national health insurance plan that it concentrated its multimillion-dollar attack on that plan (and later on the plan to support medical education) and indicated its neutrality on federal involvement in research.

The AMA's continued intransigence about, and its expanding war chest to fight, national health insurance and federal support of medical education redounded to the benefit of health research. Public concern about health problems remained great or grew greater, according to polls that were taken periodically; but, aside from public health and the new facilities construction program, research was one of the few areas in which a congressman could cast a vote for health. "Medical research," said Representative Melvin Laird (R–Wis.) "is the best kind of health insurance" (*8*). It was, in any case, the only kind of national health insurance that the government would underwrite.

Meanwhile, a debate over the best way for the government to support science research held up decisions about the best way to direct biomedical science toward specific ends. People involved mainly in biomedical science decided not to wait until the issue of a national science foundation was resolved, but to go to work to build up the existing National Institute of Health.

In Congress, Representative Frank Keefe (R–Wis.) and Senator Edward Thye (R–Minn.) broke out of the bind Truman was trying to put the Congress in: they added dollars to the medical research budget proposed by the President in 1948, and in so doing started a tradition that was to continue for two decades, regardless of which party controlled the White House and which the Congress. The medical research lobby was impressed, and they put up money for their friends' reelection campaigns.

In large measure, then, medical research became an important national effort in the postwar years because scientific talent, political interest, popular concern about health, and potential federal dollars for health had virtually no other place to go. The NIH became the most important vehicle for federal support; in fact, it soon became the center of a new research empire. In the 7 years after World War II ended, the NIH budget climbed from somewhat

over $7 million to $70 million, a pattern of growth that would continue for almost two decades.

The importance attached to medical research after World War II made health an exception among all fields of domestic concern. The steady, even heavy growth of federal spending for R & D from the 1940's into the mid-1960's was related mainly to the R & D budgets of the Defense Department, the Atomic Energy Commission, and, later on, the National Aeronautics and Space Administration. That is, only where R & D was perceived as a weapon to counteract a threat to the nation—whether collective, as in the case of possible war or another country's superiority in space; or personal, as in the case of the widespread impact of dread diseases—was its importance widely accepted and, hence, its funds assured. The importance of consistent and large-scale support of scientific research that is not related to given practical problems is something that the American people and most of their elected representatives have never completely accepted. (The difficulties in getting the National Science Foundation established in the first place, and its growth at a snail's pace from 1950 until recent years is testimony to that fact.)

If this is a correct assessment, it explains why medical research has been politically popular for so long and suggests the possibility that newly perceived threats (environmental pollution, for example) may make R & D for domestic agencies other than the Department of Health, Education, and Welfare (HEW) an ever more salable commodity in days to come. The sales pitch for targeted development will be more easily understood, just as R & D directed toward new techniques in the health field has always been more easily understood. For this reason, the dependence of applied R & D on basic knowledge (that is, continued research in basic science) must continually be stressed.

For better or for worse, the public's fear of disease did not motivate the executive branch of the government to mount a national program against disease. The reaction of the citizenry to the introduction of a bill to create a National Cancer Institute in 1937 amounted to a spontaneous national referendum. Thousands of letters and telegrams flooded Congress after Warren Magnuson (D–Wash.) introduced the bill in the House at the request of Bone, who had introduced the bill in the Senate (*9*). The outpouring of popular support was such that the House and Senate committees to which the bills had been referred decided to hold joint hearings. They did so, reporting out a slightly revised bill that passed both houses of Congress so quickly that the executive agencies (including the Bureau of the Budget) which had been requested to offer comments on the measure found the hearings almost completed before they had time to do so. In 1948, Mary Lasker got Surgeon General Leonard Scheele to draft a bill establishing the National Heart Institute and got Senators Claude Pepper (D–Fla.) and Styles Bridges (R–N.H.) to sponsor it. These senators introduced the bill in May, and Truman signed it into law the next month.

Somehow, the reason that the bill passed so swiftly was not widely understood in the executive branch, either among those who guarded the purse or those who supervised laboratory research. Despite the progressive spirit of Scheele, most people in key positions at NIH feared and sometimes even fought expansion of their activities, especially if such expansion was based on concern about disease. Despite congressional interest, which reflected national interest, in accelerating the pace of health research, the Bureau of the Budget treated the activity as it treated all other activities not related to defense: it regularly recommended incremental increases in ongoing programs and, at first passively (in the late 1940's and early 1950's) and later actively, opposed the opening of new fronts.

It was in this context that, after Senator Lister Hill (D–Ala.) and Representative John Fogarty (D–R.I.) took over the Senate and the House appropriations subcommittees that provided funds for medical research within HEW, the budget of the NIH rose at a pace that left it winded. From 1950 to 1960, the NIH budget, which constituted 65 percent of the federal government's expenditures on health research, went from $52 million to $430 million.

Congressional interest in biomedical research was spurred by many factors. It was, first of all, a reflection of national interest. Every opinion poll ever taken on the subject showed that Americans thought more money should be spent on finding cures for disease, and one taken in the mid-1950's found that 62 percent of the people would be willing to pay more taxes in order to increase funds for medical research (*10*). A small but smooth, ubiquitous, and powerful interest group, composed of lobbying professionals and professional lobbyists, fed congressmen the results of those opinion polls, statistics on morbidity and mortality, and campaign funds, thus helping congressmen to keep their eyes on the goal and their interest high. The executive branch's lack of interest, particularly in the early and later Eisenhower years, left Congress an open field in which to work its will.

The Eisenhower Administration tried to seize the initiative in the middle period, 1955 and 1956, when HEW Secretary Marion Folsom proposed significant increases in the NIH budget, the first time an Administration official had voluntarily done so. Congressional advocates of medical research were pleased but puzzled, even suspicious. Only a few weeks before Folsom appeared before Hill's subcommittee to present the proposed 1957 budget of $125 million, which constituted a $15 million increase for NIH, James Shannon, the director of NIH, had told the same subcommittee, with regard to the delayed appropriations for 1956, that the NIH could not possibly use the extra $100,000 that the subcommittee wanted to give it. Hill got Shannon to say, for the record, that the subcommittee had been right, and NIH "grossly in error," about proper funding levels for the medical reserach enterprise (*11*).

In the end, Congress was impressed that the executive branch had begun to see the light, and it was grateful for Folsom's role in the Administration's conversion. However, it did not fall in line with the intention of Folsom's plan, which was to seize the initiative in policy planning and budget formulation in medical research. Hill, Fogarty, and their colleagues on the Senate and House subcommittees were more impressed with what they saw as a concession to their own wisdom over the years than with that wisdom newly found by the Administration. That year, as in those past and those to follow, Hill's subcommittee recommended still further increases in the federal budget for medical research.

Folsom left HEW the following year, and with his departure the Administration stuck its head in the sand. For the last three Eisenhower years, the Administration proposed as the NIH budg-

et whatever amount the Congress had approved the previous year.

As they became educated by their involvement in the field of biomedical research, key members of Congress increasingly expanded the parameters of the goals they sought. Both appropriations subcommittees took an interest in the development of training programs to insure the availability of researchers. Construction of research facilities was also a persistent concern. Basic research became almost as important a consideration to key congressional supporters of medical research as it was to agency officials, university scientists, or spokesmen for science.

Despite superficial appearances, the legislative approach to medical research was not simply to automatically increase appropriations. More and more, the legislative approach was based on substantive knowledge, certainty of goals, and sophistication of means. Whereas the executive branch took an old-fashioned, incremental approach to the budget, Congress evidenced flexibility. Accepting guidance from medical and medical science professionals within and without the government, and examining the possibilities suggested by the citizens' lobby, congressional leaders came to provide for the long run, as well as for the direct, the dramatic, and the immediately appealing. They acceded to the needs of researchers and research administrators, while continuing to scout for new possibilities. Where odds seemed reasonable, they pushed the normally conservative NIH faster than it might have gone if left to its own pace. The sophisticated congressional proponents of medical research knew that funds for medical research were building medical school budgets and increasingly supporting medical school faculties. On the whole, the approach was balanced as well as bold.

To achieve the ultimate goal of conquering disease and improving and extending the people's health, the biomedical enterprise must be built up, and institutions and individual researchers must be supported. That would take great amounts of money, and Congress was willing, even determined, to spend whatever it might take to move the enterprise to optimum productivity as quickly as possible. Fogarty's colleagues would not necessarily go all the way with him in his vow to make sure every competent investigator had as much money as he needed, but most of them agreed with his aim.

The Senate Appropriations Subcommittee report for 1960 summed up the situation (*12*):

> In essence, though it has not been so stated, there has come into being a national policy that calls for a sustained and expanded research attack against disease. Under that policy the Federal Government has assumed a share of the total responsibility for a strong medical research effort, as reflected primarily in increased appropriations for the activities of the National Institutes of Health.
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> . . . Congressional action taken in connection with these appropriations is the most important decision affecting medical research in the Nation and has a profound though indirect effect on the education processes in our schools that train our physicians, dentists, and other health professionals. Moreover, because of the work supported, the scientists trained, and the institutional stability engendered by a consistent pattern of congressional support, the action of Congress on these appropriations determines in no small measure the rate of acquisition of new knowledge which will lead to a more precise understanding of the nature of the many fatal or disabling diseases which afflict our people, thus hastening the day when these may be prevented, cured, or ameliorated.

Zenith and Decline

The government's financial commitment to medical research continued to rise in the 1960's. It rose spectacularly in undiscounted dollars (in which the decreasing value of the dollar, because of inflation, is not calculated); $1 billion was added to the NIH budget between fiscal 1960 and fiscal 1968, when federal spending for medical research reached its zenith of $1.6 billion.

When the boom suddenly stopped, many people were caught off guard. Among those most surprised and most hurt (psychically as well as financially) were the researchers and academic administrators, those chief beneficiaries of federal largess who had never really understood the policy bases for that largess. Some persons had warned before the middle of the decade that the second billion dollars for medical research was going to be more difficult to justify than the first. But even Shannon, who had presided over the construction of the national medical research empire from the mid-1950's to 1968, was confident, as late as 1962, that total national expenditures for health research would top $3 billion by 1970. Instead, the aggregate national dollar commitment to medical research got stuck at about $2.5 billion in 1968, and there it remains in 1971. Marginal increments have been offset by inflation, so that dollar levels remain static, if not retrogressive.

Perhaps it is inevitable that the sustaining of medical research as an important national priority ran out of steam in the latter 1960's. A 10-year period of sustained enthusiasm or unquestioning acceptance by the majority is usually as much as the advocates of any great program can hope for before major troubles develop. Various national endeavors, from foreign aid to the space effort, have seemed to operate for about a decade in unthreatened environments before other causes were considered more important to the public or damaging challenges were posed and their budgets began to level off or decline.

There were, however, concrete reasons for the 1967 slowdown in federal spending for biomedical research. Several can be singled out as especially important. First, there is no question that the costs of the war in Viet Nam took dollars away from health research, just as war costs hurt other domestic programs. Only four times between 1948 and 1968 did Congress fail to provide more money for NIH than the executive branch asked for, and three of those years were war years: 1950, 1951, and 1967.

Second, a wholesale questioning of the productivity (and, in that sense, the relevance) of R & D began in the middle 1960's. Special congressional committees began to investigate federal R & D programs to determine, for one thing, whether there was "unnecessary waste and duplication" and, for another, what the results were of the then annual expenditure of $16 billion (*13*). In response to the latter question, the National Aeronautics and Space Administration, whose total budget was placed in the category of "R & D Expenditures," could easily point with pride to great achievements in space, but it had to struggle (some would say juggle) to produce evidence that space research had benefited the public in their daily lives. The Defense Department's "Project Hindsight," which analyzed a variety of basic and otherwise nontargeted research efforts supported by the department, revealed that there had been minimal advantages for practical, nonmilitary purposes.

Third, latent differences among the priorities of Congress, the medical science establishment outside of government, and the NIH surfaced just at the point of the alliance's greatest suc-

cess. The research lobby, which included medical doctors outside of government as well as prominent, enterprising laymen, began to push for breakthroughs, which, it felt, would result from bolder approaches to R & D. The directorate of NIH resisted. The Congress held to a middle position. To break the impasse, the research lobby enlisted the aid of President Johnson.

There was no question in any of the research advocates' minds about how disease would be conquered: they all knew it would take the development of a broad base of knowledge, the sophistication of scientific techniques, and the training of large numbers of scientific and medical personnel. However, the members of the research lobby believed that, once a relatively solid base was established, the next moves should be bold ones. Every promising lead should be followed up. Money should not be a problem; nor should the niceness of definition of a problem, the exquisiteness of scientific approach.

The biomedical scientists, on the other hand, felt uncomfortable with a goal that was at once so specific and so grandiose. The conquest of disease was a result to be hoped for, but there were more immediate problems to be attacked, and they had to be attacked carefully and systematically. The problem with the approach of the zealots, Shannon suggested, was simply that there was "no broad general theory, such as exists in the physical sciences," on which a massive assault on specific maladies could be solidly mounted. Thus, he said, "the development of diagnostic, therapeutic, and preventive capability will continue to be dependent upon empirical approaches, serendipity, and the brilliance of too few gifted individuals" (*14*). Targeted research was, in Shannon's view, not only the most expensive, but certainly the most uncertain, and often the most wasteful kind of research. Not only dollars, but scientific efforts as well would be wasted, for research efforts rigidly aimed at single targets could restrict the beneficial effects of the internal dynamics of science and could artificially skew the production of new biomedical scientists.

Getting nowhere with the directorate of NIH, and suspecting it of falling back into the syndrome of resisting outside suggestions about new directions or a different pace, the research lobby got Johnson in June 1966 to ask NIH to double-check to see whether any possible boons to the nation's health were being kept "locked up inside the laboratory." The President asked whether "too much energy was being spent on basic research and not enough on translating laboratory findings into tangible benefits for the American people" (*15*).

The President's initiative caused an explosion among scientists and universities (*16*). It also brought to a head the tension that had been building up within the old alliance. A year later, in an obvious effort to mollify outraged scientists who thought their fortunes were threatened, Johnson helicoptered to NIH to praise the agency and its work as a "billion-dollar success story."

During that year-long period of tension, Fogarty died and Representative L. H. Fountain (D–N.C.) launched another broadside at NIH management. Hill retired at the end of 1968, and Laird, who for a number of years had been Fogarty's strongest ally and who had exerted particular leadership after Fogarty's death, left the House at the beginning of 1969 to become Secretary of Defense. These personal notes also constitute specific and very important reasons for the failing fiscal health of medical research in the last years of the decade.

But to those essentially negative conditions must be added a positive reason for the declining federal interest in the enterprise: Other avenues for federal involvement in improving the people's health had been opened up. In 1963, Congress finally took a small but direct step toward federal aid for medical and paramedical education—it passed the Health Education Development Act, which made possible grants and loans to schools that train health practitioners. In 1965, Congress and the Administration finally broke the AMA's traditional stranglehold on *any* plan for federally underwritten health for *any* group of American civilians by enacting Medicare and Medicaid.

In the decade before Medicare and Medicaid, HEW's medical research budget had climbed from $87 million out of a total health budget of $228 million in 1955, to $947 million out of $2.771 million in 1965. By 1970, the medical research component of the total HEW budget had gone past the billion-dollar mark; but with Medicare and Medicaid on the books, HEW's health budget had jumped to more than $15.8 billion.

Medical research was clearly the darling of the federal health department in earlier years. It represented 38 percent of HEW's health expenditures in 1955, and 34 percent in 1965. By 1970, it had been shoved out of the limelight, primarily by the two new giant programs, and its budget represented only 10 percent of HEW's health dollars.

An Assessment of Results

Federal biomedical research and related programs have carried a heavy burden over the last 20 years. Without the real thing, medical research has been forced to serve as national health insurance. Lacking a comprehensive system for applying the existing knowledge and techniques of health care to all persons specifically in need of them, the country seemed to expect that the results of medical research and the increased research within medical schools and hospitals would ultimately suffice to produce better health for the American people generally. And many persons thought that health research funds alone would serve the needs of medical schools and universities.

Such were the additional expectations that rode on the back of a policy which, despite its lack of highly centralized direction and explication, has been very consistent and even very straightforward. It has called for federal support of "a sustained and expanded attack against disease," through the construction of a great biomedical science system based largely on three modes of action: "direct support of research," "support of training," and "construction of research facilities." The policy would, Congress thought, have "a profound though indirect effect upon the educational process in our schools that train our physicians, dentists, and other health professions."

What have been the results of that policy? Has it succeeded, or failed, or merely muddled along?

Judging the success or failure of national policies is a difficult proposition. Some people will define success, in order to prove that it has or has not been achieved, according to their agreement or disagreement with a given policy. Beyond that, except where policy goals are narrowly discrete, unchanging, and "one-time," standards of measurement are necessarily vague. (When Armstrong, Aldrin, and Collins reached and returned from the moon, there was no question that a specific policy goal

had been attained.) In most policy areas, even when broad purposes remain constant, component targets may shift, expand, or contract, according to new needs and new knowledge. Thus, a given policy should ordinarily be expected to attain only proximately its stated goals.

In any case, it is clear that the federal government's conscious, consistent, and heavy support of medical research since the 1950's has resulted in the construction of a national biomedical research network of great size and enormous importance. At its zenith, the NIH, which is the bulwark of the enterprise, supported more than 67,000 senior research investigators, sustained academic science programs in more than 2000 universities and medical schools, and provided advanced training in basic science and various clinical specialties for approximately 35,000 individuals. Almost 50 percent of the medical faculty members in this country receive federal support for salaries or research. Built largely on federal dollars, the research budgets of some American medical schools dominate the overall budgets for universities.

Both the scientific work performed within the NIH and that work supported by NIH in academic and research institutions and in teaching hospitals have received almost universal acclaim. Some studies praising the agency and its work have been discounted because members of the study committees or commissions were known to be friendly to NIH, if not actually medical research lobbyists anxious to move the enterprise on to wider, richer plains. Yet even the apparently neutral studies of the Wooldridge Committee of 1965 and the AMA's Whittaker Commission of 1967, as well as the critical Fountain Committee investigations, all concluded that, whatever faults there may be with operational aspects of the agency and whatever needs may exist in the future, the scientific quality of the work supported under NIH auspices has been remarkably high.

There is other evidence that the goal of building an excellent medical-science research establishment has been achieved. A suggestive trend that began in the late 1930's and accelerated in the immediate pre- and postwar years has become accepted as fact: the United States is the acknowledged leader in biomedical science in the world today. The number of Nobel laureates in the United States has increased dramatically in recent years. Among them are a number of scientists who have been supported through federal grants, and two recent ones (Marshall Nirenberg in 1968 and Julius Axelrod in 1970) have conducted their research in the intramural program of NIH.

Advances in basic biomedical knowledge have been made so rapidly that it is hard to keep up with them. The year 1970 may be remembered as "the year of the gene," for in rapid succession scientists isolated one of "those fundamental units of inheritance," successfully synthesized a gene in the laboratory, and then experimented with "genetic surgery" and "genetic therapy" to try to overcome genetic deficiencies that cause diseases (*17*). In September 1970, the director of the National Cancer Institute described a "new unified cancer theory" that was based on evidence that certain enzymes harbor latent cancer viruses (*18*). In November it was reported that "the secret of the hormone that makes bones strong or weak has been deciphered" (*19*).

Still, whether national medical research policy, and the pace of it, have brought us close to the conquest of disease is a more difficult matter to judge than whether or not a first-rate biomedical science system has been created. No one, however, has disputed the broad statement of John A. D. Cooper, president of the Association of American Medical Colleges, that knowledge accumulated over a 20-year period has "revolutionized the range of diagnostic, therapeutic, and preventive capabilities of medicine" and has made it possible for physicians to offer more favorable prognoses to patients suffering from many diseases (*20*).

Some advances seem dramatic on the surface. The infectious diseases that formerly plagued millions are now virtually unknown, but public health measures are as responsible for this as medical research results are. Forty years ago, physicians could cure only one out of five cases of cancer. Today, using new techniques and new knowledge in radiotherapy, surgery, chemotherapy, and virology, the rate of cure is put at one out of every three cases (*21*, p. 2; *22*) ("cure," however, means only that the patient is still alive after 5 years). Nonetheless, it is estimated that almost 1.5 million Americans who have had a major form of cancer are leading normal lives. Many people would agree with the assertion that "advances in treatment of the mentally and emotionally ill have been revolutionary" (*23*). Largely because new drugs have enabled doctors to treat more people on an outpatient basis, the number of patients in state mental hospitals has been reduced by more than 100,000 between 1960 and 1970. Less widespread but nonetheless serious diseases, such as German measles and Parkinson's disease, have had some of their terror stripped away by recent medical breakthroughs.

In the final analysis, progress in most areas remains slow, and the national phenomenon of increasing life expectancies constantly produces more medical problems to be solved. However, the national medical research enterprise seems to be inching steadily toward the ultimate goal of conquering disease.

Medical Research and Medical Education

There is also the question of whether federal medical research policy, including its component of the training of new scientists, has had, as Congress hoped, "a profound though indirect effect upon the education process in our schools that train our physicians, dentists, and other health professionals." The answer is an unqualified yes, but it is not an unqualifiedly happy answer.

Medical school budgets, fed by federal research and related programs, have increased by many orders of magnitude in the past two decades. Aware of that phenomenon, some officials—both of the government and the receiving institutions—have apparently believed that, without clear-cut federal support for medical education, national research policy and federal research dollars have permitted medical schools to use research funds for other than strictly research purposes.

Harvard Medical School's total institutional budget climbed from $3.245 million in 1950 to $28.720 million in 1970, an increase of almost 800 percent. Federal funds, which amounted to 21 percent of Harvard Medical School's budget 20 years ago, now amount to 58 percent of the total, and federal *research* funds (of which NIH funds consistently make up the dominant portion) amount to 41 percent of the total budget (*24*).

Case Western Reserve University Medical School's total budget grew from $2.2 million in 1950 to $16.4 million in 1970, with federal funds amounting to 34 percent of the total

then and 59 percent of the total now. Research funds made up 30 percent of Case Western Reserve's budget in 1950, and in 1970 they constituted 40 percent of the total. Baylor Medical College's budget rose from a little over $700,000 in 1950 to over $21 million in 1970, largely because of federal funds, which have increased from $80,000 in 1950 to $14.8 million in 1970. Federal funds amount to about 70 percent of Baylor Medical College's budget at present.

At the Medical College of Alabama, federal funds amounted to 80 percent of the institution's total budget of $27.6 million in 1970, up from 50 percent only 12 years ago. Funds from NIH alone constitute 65 percent of the Medical College of Alabama's budget in the 1970–71 academic year. At the University of Pennsylvania Medical School, where there is a long tradition of research, federal research funds comprised almost 65 percent of the total institutional budget of $27.9 million in 1970–71.

Most people involved in medical and biomedical education believe that the quality of that education has advanced significantly in the last two decades. Thomas B. Turner, while dean of the Johns Hopkins Medical School, convinced the AMA's Whittaker Commission that "teaching enrichment" resulted from medical research programs. He further pointed out that, within a 15-year period (1951 to 1966), the full-time medical faculty had increased from about 3500 members to over 17,000 (*25*). That this dramatic increase is largely the result of federal expenditures on medical research and training can be shown more clearly by the fact that, by 1970, fully one-half of the total medical faculty in the country received at least part of their salaries from federal sources.

But growth does not inevitably result in strength, and what is good for the country is not necessarily good for given institutions.

With federal research and related funds, the medical schools at Harvard, Case Western, Baylor, Alabama, and Pennsylvania have experienced enormous growth in their budgets over the last 20 years. All of them have increased their full-time medical faculties by roughly 200 percent. Yet the number of students enrolled in courses of study leading to the M.D. degree has increased only marginally between the early 1950's and 1970: by 16 percent at Harvard, 5 percent at Baylor, and 12 percent at Case Western. At Alabama, the number of M.D. students increased significantly, rising from 219 in 1950 to 348 in 1970. At most medical schools, it appears that, for most of the last 20 years, the small increase in M.D. students would probably have occurred without federal research funds. Medical schools are now in trouble as severe as, if not more severe than that of 1949 and 1950.

If one assumes the support of medical education through medical research funds to be an implicit goal of national medical research policy, one would have to rate the policy less than successful in that goal. Yet the support of medical education in general, and particularly the production of M.D.'s, has not been an explicit component of medical research policy—nor has support of medical schools per se.

In 1949 and again in 1951, the Congress specifically rejected a proposal for federal support of medical schools, through institutional grants, and of medical students, through scholarships and loans. There was universal acknowledgment of the financial plight of medical schools. Albert Lasker testified, on the basis of personal contact with "the heads of the greatest medical schools in the United States," that they were "on the verge of financial catastrophe" (*26*). Alan Gregg, director of medical sciences for the Rockefeller Foundation, warned that: "Unless our medical schools receive substantially larger sums for their essential expenses, we shall not in the future have the care which modern medicine could provide" (*27*).

Though everyone recognized the institutions' financial trouble, some doubted the need for more doctors. Louis H. Bauer, chairman of the AMA's Board of Trustees, told the Senate that, while the country needed more doctors, "we are getting them steadily." Besides, he added, "You must remember that illness is diminishing." Furthermore, the proposal to support medical schools with federal funds "would give the Government a foot in the door—in fact, probably two feet in the door—for Federal control of medical education" (*28*).

The ultimate refusal of Congress, at the end of the 2-year fight, to provide a direct solution to the problem of adequate financing for medical education did not cause the problem to go away. Instead, throughout that decade high-level committees and commissions reiterated the problem and the need and proposed direct federal aid. The Magnuson Commission report in 1952, the Bayne-Jones Report in 1958, the Bane Report in 1959, and the Jones Report in 1960 all warned of impending crises in medical school finances and in health professions' manpower (*29*). Yet there was to be no action or national policy to meet these crises for several years. Indirect strategies were attempted, but they were necessarily limited in scope and purpose. Even those policy makers concerned about the shortsightedness of existing policy warned NIH to follow policy directives strictly. Fogarty cautioned in 1957 that funds for medical research were not to be spent for broad support of medical schools and medical education. His committee, he said, "does not doubt that most medical schools need some additional financial assistance; however, funds appropriated to the National Institutes of Health are not for the purpose of general assistance to medical schools . . . " (*30*).

In 1963, with the enactment of the Health Professions Educational Assistance Act, Congress took a first, small step toward providing direct support for medical and paramedical education. Such support was limited to grants for facilities construction and student loans. The authority of that legislation was broadened in 1965 and 1966, and a more comprehensive means of federal support was provided in the Health Manpower Act of 1968. Under these authorities, a total of over $1.3 billion has been appropriated, from fiscal year 1963 through fiscal year 1971, for direct support of medical schools and allied health professional schools. In the same period over $5.2 billion was appropriated for extramural research grants.

In 1968, the Bureau of Health Professions Education and Manpower Training of HEW was placed within the NIH. Under the guidance of Kenneth M. Endicott, who earlier directed the National Cancer Institute, the new programs and new organizational arrangement may now begin to produce more balanced, hence altogether more beneficial, results from federal dollars invested in medical schools. In the last 2 years, the Physician Augmentation Program has made possible the addition of almost 450 places in 29 medical schools for first-year medical students.

The new programs, however, have not been funded at anything like their authorized levels, and policy commitments must be measured by program

dollars as well as statements of intent. From fiscal 1969 to the present, the annual appropriations have been roughly $100 million less than the authorization. Despite much talk, federal programs to provide financial assistance for medical students have not advanced in the last several years; nor is there any solid reason to believe that they will, without new, more comprehensive policies covering the whole subject of federal support of medical schools and medical education.

Meanwhile, there had been, all the while, a direct governmental mandate to produce additional medical researchers. To train them would cost institutions money; therefore, with governmental approval, the Heart, Cancer, and Mental Health institutes began in the early 1950's to allow to be included faculty salaries in the cost of training grants. By fiscal 1960, about $125 million of the NIH budget—about one-fourth of its total appropriation of $430 million, and one-half of its budget for extramural research grants —was being spent for training grants and fellowships. Growth of those programs continued; the proportion of increase did not. In 1970, approximately $200 million was being spent for training grants and fellowships, a sum that represented approximately one-seventh of the total NIH appropriation, but over one-third of its extramural grant appropriation (*31*).

Hence, although the output of M.D.'s increased relatively slightly from 1950 to 1970, the production of biomedical research scientists increased markedly. The number of students seeking the M.D. degree at Harvard Medical School rose from 502 in 1950 to 583 in 1970, but the number of Ph.D. students rose from 50 to 171 in the same period, a 240 percent increase. The medical faculty, of course, taught both groups. The number of M.D. students at Case Western Reserve Medical School rose from 323 to 364 between 1950 and 1970, while the number of Ph.D. students rose from zero to 132. At the University of Pennsylvania Medical School, the number of M.D. students increased by only 8 percent from 1960 to 1970, but the number of Ph.D. students increased by 80 percent. Alabama and Baylor medical schools had no students seeking the Ph.D. degree in 1950; in 1970 they had 150 and 99, respectively. Nationwide, the National Academy of Sciences reported that, for the academic year 1968–69, "medical students constituted less than half the total educational responsibilities" of medical schools and their teaching faculties (*32*).

In short, federal research and training funds going into medical schools have followed fairly closely the purposes originally stated: they have supported biomedical research, and they have supported the training of great numbers of additional researchers. Federal research funds *have not* supported medical schools or medical education per se. Instead, the federal government has used medical schools and other institutions to support those functions essential to the central purposes of national research policy. Having been designed for other purposes, it is no wonder that research policy has only imperfectly produced benefits for medical education, and that it has caused as many problems for medical schools as it has produced progress in the health sciences.

Congress generally may have felt, and key congressmen certainly hoped, that medical research policies and programs would produce beneficial fallout for medical education. But as has been suggested, the mere enunciation of policy goals does not produce policy. Whatever else is involved, a clear statement of purpose, a working consensus to achieve it, and the continued, direct financial support of integral programs are three ingredients that are essential to real policy. None of those elements has obtained in the matter of supporting medical research in the hope of thereby benefiting medical education.

Integrating Research and Other Health Programs

Clearly the federal government's health thrusts in the middle and late 1960's comprised a more balanced approach to the health needs of the nation than its earlier reliance primarily on medical research, hospital construction, and public health programs. That approach will be even more balanced and comprehensive if other fronts are opened up in the near future. The opening up of new fronts is likely, for the ingredients that produce national concern exist, and broad national concerns produce political action.

The high costs of health care for all citizens, the continuing unavailability to some citizens of any effective medical care, and the failure of the "health system" to reduce morbidity and mortality rates among various groups all combine to constitute a "health crisis." This situation is perceived by ever-growing numbers of citizens as a national threat that is both collective and personal. It is precisely the kind of situation which not only demands action, but which will produce popular support for whatever reasonable, comprehensive action is proposed and taken. A popular political base exists for political leaders who will propose bold, focused policy, and people will not care whether such policy emanates from the legislative or the executive branch of government.

The major battle of 1971 is over national health insurance. The old alliance of the 1940's—organized labor, key liberal senators, and Mary Lasker —has reappeared, reinvigorated. The new plan is not dissimilar to the one of a quarter of a century ago. Introduced in January 1971 by Senator Edward Kennedy (D–Mass.) for himself and 24 other senators, it proposes health insurance coverage for every resident of the United States. The cost is unclear, but Kennedy stated that, if the plan had been in effect in 1970, it would have covered 70 percent of actual expenditures for health care, 70 percent of that amount being $41 billion. The necessary funds would come from a payroll tax and from the general treasury (*33*).

The Nixon Administration has responded to the problem with a considerably more limited approach regarding the number of persons who would be covered, and hence more limited in terms of dollars. The plan would require employers to provide health insurance coverage for all employees, and, through the Family Health Insurance Plan, the poor and near-poor would be provided protection.

The AMA is seeking a new image, and thus is altering its posture slightly. It has now canceled its own, self-supported research effort and no longer confidently touts its ability to secure enough funds to provide scholarships and loans to all medical students who need them. Although the organization still spends an enormous part of its budget and its official deliberations on public relations, it has finally agreed that federal support of medical research is good, that there is a shortage of doctors, and that federal aid for medical education is necessary. Further, it has proposed that the medical profes-

sion itself inaugurate efforts to ensure that the poor do not go without medical service and that the profession further "innovate" by such means as group practice. The AMA has proposed its own version of a health insurance plan, but if the choice narrows to either the Kennedy proposal or the Nixon plan, prominent members of the AMA can be expected to support the President.

The private health insurance industry has become the liberals' main villain in the battle. But like the AMA, that industry seems to recognize that federally subsidized medical insurance for a large number of American citizens is bound to come, for rather than uniting to mobilize opposition to any such plan, some of its representatives have worked with the Administration on draft legislation.

The Nixon health plan is, in another sense, more comprehensive in structure than the "Health Security" insurance proposal advanced by Kennedy. For example, it would provide for the training of the additional medical and paramedical personnel who will obviously be required, whatever version of federally subsidized health insurance is finally adopted. Kennedy did not focus on that problem in presenting his health insurance plan because, he stated, "without something like a Health Security program to galvanize us into action," the government's approach to health manpower and health facilities will probably comprise efforts "to patch the present system" (*33*).

Few persons concerned about improving the American people's health would argue that there are higher priorities at present than the development of a system to bring medical care within the reach of all who need it by means of a federally financed insurance system. But unless attention is also focused on other important health issues (some of them component parts of any comprehensive health security system), debate over the more difficult and dramatic topic may lead only to continuing nonintegration of health policies and programs, and even to other health crises.

For example, even without a national health insurance system, the present shortage of medical doctors in the United States is put at 50,000 (a widely accepted, if somewhat arbitrary, figure); and the medical schools continue in a state of chronic, increasingly critical, financial ill health. In the last several years, the federal government has gradually, if disjointedly, added new mechanisms for providing federal funds for medical schools, including a small program of "emergency grants" to institutions in severe financial distress. Until now—halfway through the first session of the 92nd Congress—the government has not adopted as a specific policy goal the elimination of the shortage of doctors (which will become more acute upon passage of a national health insurance scheme), let alone adopted a comprehensive plan for attaining that goal. Up to the present, the government has not approached straightforwardly and on a significant scale the medical schools' continuing need for direct, predictable federal help, a need that must be met if those institutions are to remain viable, productive components of an effort to bring better health to all citizens. That situation may soon change.

President Nixon specified manpower programs as a part of his broader health scheme. In his February health message, the President proposed several ways of increasing the production of medical and allied health personnel, including "capitation grants" to encourage medical schools to produce more doctors quicker. The Administration's proposals do attempt to integrate a number of heretofore separately considered health programs. On the other hand, the overall Nixon plan proposes a much lower level of aid for health manpower than does the Comprehensive Health Manpower Training Bill of 1971, which was developed and recently steered though the House of Representatives by Paul G. Rogers (D–Fla.), chairman of the House Subcommittee on Public Health and Environment. Similar to the Rogers bill is a bill recently reported by Kennedy's subcommittee of the Senate Labor and Public Welfare Committee. The subcommittee's bill was drafted in cooperation with the Association of American Medical Colleges and was strongly commended by the full committee chairman, Harrison Williams (D–N.J.). The President's proposed budget for fiscal year 1972 would, in fact, reduce spending in such health manpower fields as nurse training and grants for construction of new educational facilities. Altogether, performance to date by the executive branch could lead to skepticism about new promises.

In any case, the government now seems poised to take a large, positive step toward federal support for medical education and medical schools—a step it has been nervously avoiding for years, even decades. The government seems ready to recognize what the Carnegie Commission on Higher Education documented in its October 1970 report: that less than half the graduates of medical schools are practicing in the state in which they received the M.D. degree; that there is thus no direct relationship between a state's investment in the education of M.D. candidates and the social return to the state; and, in short, that it is a national need that exists, and the social return is on a national basis. If the Rogers bill or a facsimile of it becomes law, the national responsibility will finally have been assumed.

Passage of a comprehensive health manpower bill prior to, but in anticipation of, the adoption of some national health insurance program will entitle Congress to high marks for logical sequence in policy making. Such a sequence will suggest that we may well be developing an integrated approach to the health needs of the nation.

Reintegrating Medical Research Efforts

At the same time that efforts are being made to integrate all national health policies and programs into a more coherent approach, efforts must be made to reintegrate the loosely related components of national medical research policy.

The Senate's recent action in approving a new Conquest of Cancer Agency was the direct outgrowth of the report of the National Panel of Consultants on the Conquest of Cancer, which was organized by Senator Ralph Yarborough (D–Tex.) early in 1970 with the advice and support of Mary Lasker. The hope was that the work of this cancer panel would bolster the chances of launching a major new attack on cancer, as well as Yarborough's chances for reelection. The latter hope was not realized, Yarborough losing a primary election in the spring of 1970. Thereafter, he made the cancer panel's work his primary concern until it reported to the Senate in November 1970. Comprising 13 medical scientists and 13 laymen, the cancer panel recommended the creation of a National Cancer Authority to organize an all-out attack on "the implacable foe."

The medical research lobby's hand was very much in the work of that panel and in the successful efforts to secure Presidential support and Senate passage of the panel's recommendations. But the existence of popular interest and concern is no less real for that. The cancer panel reported that "a poll taken in 1966 showed that 62 percent of the American public feared cancer more than any other disease." That is an understandable fear, because, the panel stated, "of the 200 million Americans alive today, 50 million will develop cancer at the present rate of incidence, and 34 million will die" (*21*, p. 1).

If it were not already obvious at the time the Yarborough panel reported, it was soon made perfectly clear that widespread political interest in conquering cancer had not dissipated. The House of Representatives had passed in 1970 a resolution calling for a national crusade against cancer. The Nixon Administration in the two preceding years had increased NIH's budget for cancer research, while holding steady, if not decreasing, the funds for many other fields of research. Kennedy immediately took up the cancer panel's challenge and introduced a bill to carry out its recommendations.

The NIH promptly and predictably opposed the establishment of a separate cancer agency. To separate cancer research from "interplay with other research in the diseases of man" would be wasteful and wrong, said NIH Director Robert Q. Marston.

Nixon at first supported the agency on that point; or, to look at it another way, he opposed Kennedy on that point. But, to the amazement of the NIH directorate in particular, the President personally reopened the proposed NIH budget for fiscal 1972 and, in his State of the Union address, announced that he had added an extra $100 million for "an intensive campaign to find a cure for cancer." Said the President: "The time has come when the same kind of concentrated effort that split the atom and took man to the moon should be turned toward conquering this dread disease. Let us make a total national commitment to achieve this goal" (*34*).

In part because of the urgings of Elmer Bobst (a member of the cancer panel, ancient ally of Albert and Mary Lasker and, fortunately, the man whom Nixon refers to as "my foster father"), the President decided that a new, largely independent agency was required. The compromise proposal acceptable to the President and to Kennedy—with the Conquest of Cancer Agency working side by side with the institutes of NIH, but with a director appointed by, and directly responsible to, the President—is that which passed the Senate on 7 July 1971, by the decisive vote of 79 to 1.

On the House side, there is some opposition to the measure in its present form and the *New York Times* and the Washington *Post* have editorially tried to rally support against it. No matter whether the crusade against cancer is directed by a new agency or remains under NIH jurisdiction, many scientists and administrators believe that such a national crusade, forcing millions of dollars down what seems like one narrow track, is misdirected. They are certain that money will be wasted, and they are afraid that broad, basic biomedical research will be retarded.

It could happen. If it does, scientists and science administrators must recognize that they bear some of the responsibility for having separated basic research from targeted research in the layman's mind, thus affecting outlays from the public purse.

The Wooldridge Committee, in its report on the NIH in 1965, stated clearly the approach that scientists prefer to take toward biomedical research—possibly because it employed 77 scientists to gather data, and they gathered it, in part, by visiting 600 other scientists. The "primary *de facto* mission" of the agency was simply "the stimulation and support of a very broad range of health related or biomedical research." Hence, "such labels as 'heart, cancer, neurological diseases and blindness' and the like, in the titles of the major organizational units of NIH, suggest more of an orientation to specific diseases than actually exists." The Wooldridge Committee lauded the directorate of NIH for "making a scientifically inappropriate organizational structure an effective arrangement for performing its real mission." (*35*).

Given the history of national medical research policy, and specifically the history of the postwar development of NIH, such an interpretation seems naïve. As much as scientists may applaud the sentiment, it will not help the biomedical science enterprise to achieve greater understanding and support from the public. Indeed, the Wooldridge Report's recurrent emphasis on a primary de facto mission of supporting broad basic research endeavors was seen as representing precisely the kind of "science by and for the scientist" syndrome that had, for example, so long delayed the establishment of a national science foundation after World War II. In more recent times, the same syndrome had fed the suspicions of nonscientist supporters of the biomedical research enterprise that scientists really didn't care about disease problems.

The history of biomedical research in this country tells us that the American people and their elected representatives have been willing to support basic research because they have believed that it *is* relevant to the attainment of ultimate health gains. For most of the last two decades, key congressional leaders have explained to their colleagues that the support of basic research is essential in order to underpin targeted, disease-focused efforts, and almost every year their colleagues have approved the whole package. Congressional leaders and officials of the Bureau of the Budget (renamed in 1970 the Office of Management and Budget) have known perfectly well that funds appropriated for the National Institute of Neurological Diseases and Blindness support some research of such an open-ended nature that the results, if any, may relate to another field entirely. But especially in times when, right or wrong, relevance is the criterion and a genuine popular concern, "pure science," whose relationship to real and present problems is denied by the scientist, is probably not going to rate very high on the revised list of national priorities.

The problem could be said to relate to the language of the 1930 act that created the NIH. The statute says that funds are to be expended "for study, investigation, and research in the fundamental problems of the diseases of man." While some people, especially political figures, want to stress "diseases of man," others, especially the working scientists, inevitably prefer to emphasize "fundamental problems." The differing emphasis, and hence the tension, will no doubt continue as long as the scientist and the public officials perform their separate roles.

In the present circumstances, however, for the health of the biomedical research enterprise and the health of the nation, both scientist and public official must now enter a new agree-

ment—if only an agreement to embrace the whole purpose of those statutes establishing the federal biomedical research institutes. That purpose, and the ultimate policy goal, has been, and will no doubt continue to be, to reduce and, if possible, to eliminate disease.

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36. Research supported by grants from the Commonwealth Fund and the Ford Foundation. The full study will be published by Howard University Press in 1972.

Physiological Role of Pleasure

A stimulus can feel pleasant or unpleasant depending upon its usefulness as determined by internal signals.

Michel Cabanac

The living organism receives information about the external environment and its changes through a certain number of sensitivities. Receptors or free nerve endings act as detectors, then this information is carried to the central nervous system. In man, some of these sensitivities give rise to a phenomenon of consciousness that is referred to as sensation. A sensation will therefore bring information about the existence of a certain variable of the "milieu exterieur" and/or its modifications. The physical and chemical characteristics of the stimulus are translated into nervous impulses describing the nature and the magnitude of this stimulus, and the sensation is related to the stimulus according to a certain law. Sensation is therefore descriptive. These analytical characteristics are not the only aspect of the conscious phenomenon created by a stimulus. Sensation can also have an affective aspect, described in common language as pleasure or displeasure.

The importance of this sensory pleasure-displeasure has been pointed out as an important determinant of behavior (*1*), since in itself this factor can explain many behaviors just by the attractiveness or the repulsiveness of the stimulus. For example, sucrose stimulus is rewarding at all concentrations and quinine is aversive at all concentrations. Indeed, pleasure or displeasure could be stimulus bound. We shall now see that, in fact, this is not quite true; the pleasure or displeasure of a sensation is not stimulus bound but depends on internal signals, at least with regard to thermal, olfactive, and gustative stimulations.

Thermal Sensations

In thermal sensation, the peripheral signal is skin temperature. Skin detec-

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