Science Policy: Budget Cuts Prompt Closer Look at the System

The scientists' winter of discontent over cutbacks in federal support of research has caused a number of prominent scientists to cast a cold eye on the federal support system itself.

Until recently, many knowledgeable scientists have regarded the budgetary troubles as a temporary malaise attributable to spending on the Vietnam war, but increasingly, in public and private discussions, scientists are analyzing the crisis in science in terms of new social priorities and changing public attitudes toward science and technology.

It was a sign of the times that the National Academy of Sciences devoted a full day in late April to a symposium on the Crisis in Federal Funding of Science. One of the participants, Yaron Ezrahi, teaching fellow in political science at Harvard University, struck a note sounded by several other panelists when he said, "I believe that the present crisis in the federal funding of science is but part of a profound cultural and institutional crisis in what one may term the 'social support system of science' in America. My point is that, whereas gaps in the funding of science can perhaps be corrected in future years, the healing of the social support system of science is a more complex and difficult task.

"The breakdown in the social support system of science refers both to the premises and the institutional arrangements through which science has been supported and legitimated from the outside by the larger society, and the delicate social mechanisms through which the scientific community regulates and orients the cooperative scientific effort from within."

It is symptomatic that a proposal for a cabinet-level science agency put forward in a report recently released by the Daddario research subcommittee in the House of Representatives is getting an unusual measure of attention. The idea of giving cabinet status to a science superagency is, after all, one of the hardiest of perennials on the Washington science scene, and what the interest signifies is an increasing tendency to question the arrangements for making and implementing science policy which have prevailed for more than 2 decades.

The present system of federal support of research grew, of course, out of the mobilization of scientists during World War II and was influenced by the views of Vannevar Bush and his colleagues expressed in the famous end-of-the-war report *Science: The Endless Frontier.* The postwar system was based implicitly on the importance of science to national security; the funding of basic research was justified by recollections of the decisive impact of radar, rockets, the atomic bomb, and other wartime developments on the outcome of the conflict.

Fundamental to the marriage settlement between science and government was the commitment by the government to support basic research in the universities. The premise was, on the one hand, that only the universities could produce the new knowledge and trained research workers necessary to preserve national security. On the other hand, it was assumed that the relationship would ensure the independence of the scientist and strengthen the universities. During the years of the Korean war, Soviet development of the hydrogen bomb, building of the intercontinental air defense system and the ICBM, the appearance of Sputnik and the ensuing space race between the United States and the Soviet Union, there was relatively little questioning of the quid pro quo arrangement.

Pluralistic Funding

The system of federal support which evolved in that period differed in some important respects from the *Endless Frontier* blueprint, notably in the way basic research was funded. There was a lag in the creation of a "National Research Foundation," which was envisioned by Bush and others as the chief fount of funds and source of direction for basic research and science education. When the National Science Foundation (NSF) was established at the beginning of the 1950's, Congress allowed it relatively slow growth as a funding agency. In the interim, mission-oriented agencies, including the Defense Department and the Atomic Energy Commission, had started major programs of basic research support, and the universities developed a considerable measure of dependence on these operating agencies.

Another crucial result of this period of improvisation was that research funds were used to give de facto support to graduate education, to construction of university facilities, and in some cases even to the underwriting of faculty salaries.

Thus developed the pluralistic, decentralized system of federal support which has been the glory and, more recently, the misery of American science. A very large scientific establishment was created which achieved international preeminence in many fields of science, and a generation of American scientists was produced which were able to equate their work with the public weal and to expect a continued flow of federal funds on terms of accountability rather more relaxed than those that prevail in other fields.

Faltering Momentum

The momentum of growth, however, began to falter in the mid-1960's—first, simply because the sheer size of the rapidly increasing R & D budget and the basic research portion of it attracted congressional attention. Then the rising costs of the Vietnam war and the competition for funds created by the war on poverty and new education and health care programs caused the curve of science funding to follow a virtually horizontal line. But even more important than the difficulties over funding has been the debate on national priorities caused by the serious perturbations in American society in this decade.

The implications for science of the events of the 1960's were rather grimly appraised by Philip Handler, president of the National Academy of Sciences and chairman of the National Science Board, in a speech in mid-April at the meeting of the Federation of American Societies for Experimental Biology.

Science does not have, and may not even warrant, a very high priority in the United States in 1970. Generate your own list of the truly major problems of American society. Mine would include terminating the war, the search for a stable peace, implementation of a national and worldwide population policy, learning how to deal with political terrorism and the challenge to the legitimacy of government, achieving some progressive modus vivendi in our racial problems, understanding the real roots of youthful disaffection includ-

ing the startling rise in drug usage, learning how to minimize the social cost of the drug problem whatever its origins, understanding and coping with the increasing frequency of violence and criminal action, learning how to salvage [the] central city and upgrade the quality of urban life, alleviation of our biological and physical environmental problems, and development of an adequate system for the delivery of health care.

Even recognizing the limitations of the best of current health care, and the need for far greater understanding and for new therapeutic approaches to the major killers of mankind, one can only conclude that science—fundamental biological and physical science—can make only relatively small contributions to these other major problems. And for that reason, in the competition for national resources, science is likely to be placed on the back burner by the nation for some years. I do not mean that the national apparatus for the conduct of science will be dismantled. I am aware of no such intent and will fight such wherever it may appear. But the possibility of renewed growth of the scientific enterprise is minimal and, for a few years, we will be fortunate simply to maintain existing capabilities, because our counter-arguments are less than persuasive.

The Handler speech was a wide-ranging one; it included an unusually candid recital of sins of commission and omission by scientists, which he sees as having contributed to the present problems of science. He was critical of his profession and did not spare himself for having, for example, acquiesced to the back-door financing of graduate education and for other activities. He chided some scientists for their "entrepreneurial tastes." And he directed a barb at the news department of *Science* for "news stories written by a small group of non-scientists as rather personalized editorials, and which occasionally recount scandal large or small, seemingly without compunction and seemingly almost enjoying the embarrassment or discomfiture of some element of the house of science."

Alarm over Mansfield Amendment

Like many of his colleagues, Handler finds particular cause for alarm in the so-called Mansfield amendment (*Science*, 20 March), section 203 of last year's Defense procurement authorization act which forbade Defense Department funding of "any research which does not bear a clear and apparent relation to a specific military function or operation." This provision and its potential effect on mission-agency funding of basic research on campus perhaps as much as any single factor has spurred academic scientists to reevaluate the research support system.

Carnegie Institution Names Abelson

Philip Hauge Abelson, editor of *Science*, has been named the next president of the Carnegie Institution of Washington.

Dr. Abelson will succeed Caryl P. Haskins, who will retire at the end of June 1971. Dr. Haskins has held the presidency since 1956; he will remain as a trustee of the institution.

Dr. Abelson became editor of *Science* in August 1962. Since that time he has expanded the News and Comment section, increased the number of articles in each issue, reduced the interval between receipt and publication of technical reports, and started the Research Topics section. When asked about his future role as editor of *Science*, Dr. Abelson said, "It is likely that I will continue in that position."

In 1953 he became head of the Carnegie Institution's Geophysical Laboratory, a post he will give up on becoming president.—N.G.

The Handler speech was less a report on the pathology of the present situation of science than a plea for a revision and revitalization of federal science policy.

For his own part, he said, "I would advocate a federal agency for Research and Higher Education with a cabinet level Secretary." In a number of respects, the agency Handler suggested resembles the National Institute of Research and Advanced Studies (NIRAS) proposed in the report issued by the House Subcommittee on Science, Research, and Development chaired by Representative Emilio Q. Darradio (D–Conn.). The report is the product of a staff study based on hearings on "Centralization of Federal Science Activities" held last year. Witnesses at the hearings constituted a virtual Who's Who of science policy in government and the universities. Significantly, some influential people, including Presidential Science Advisor Lee A. DuBridge who last year expressed opposition to the idea of concentrating authority over research and graduate education in a single agency, are said to be now somewhat more receptive to the idea.

The NIRAS proposal calls for creation of an agency founded on a reconstituted NSF and the extramural and education programs of the National Institutes of Health (NIH), together with the National Foundation on the Arts and Humanities, relevant sections of the Department of Health, Education, and Welfare, and a newly created National Institute of Social Sciences and National Institute of Ecology.

A major cause of opposition to concentration of power over research funding in a single agency has been the fear that poor judgment or bias in that agency could foreclose the chances of support for some investigators. To meet these objections and to preserve the options of multiple sources of funding, the NIRAS proposal advocates leaving perhaps 50 percent of funds for academic research in control of mission-oriented agencies.

Seek Political Independence

One continuing aim of the architects of federal science establishment has been to ensure its "nonpolitical" character. In line with this tradition, the NIRAS proposal plumps for raising a science agency to cabinet level but giving it independent agency status rather than making it a full department with a cabinet secretary heading it. The political point of this distinction is that a cabinet secretary serves at the pleasure of the President and is expected to support and advance the views of the President and his party, whereas the head of an independent agency could, for example, serve for a fixed term not coterminus with the President's and could in other ways avoid the political limelight.

Another factor that may well be contributing to the livelier interest in a science agency is the rather remarkable decline in interest and advocacy with respect to science and technology in Congress in recent years. The death of Representative John Fogarty and retirement of Senator Lister Hill, peerless champions of biomedical research funding, occurred at a time when the trajectory of funding was flattening. In the 1960's Congress made several attempts to institutionalize its interest (which had strong elements of self interest) in science and technology. But the tide of concern has ebbed as the Senate Sub-

NEWS IN BRIEF

• **POLLUTION KIT**: Representative Henry Reuss (D–Wis.) has prepared a "do-it-yourself" kit for citizens wanting to bring legal action against polluters. The kit includes provisions of the 1899 Refuse Act, an outline of enforcement procedures for an individual, a list of Corps of Engineers offices, a list of U.S. Attorneys offices, and House Report 91-917 entitled "Our Waters and Wetlands: How The Corps of Engineers Can Help Prevent Their Destruction and Pollution." The 1899 Refuse Act prohibits anyone from discharging refuse into navigable waters or their tributaries; penalties include heavy fines, half of which is given to persons who furnish information to the U.S. Attorney leading to the conviction of the polluter. So far, Reuss's office has distributed about 1000 of the kits; requests have come in at the rate of a hundred a day since an Associated Press story at the end of April. Most of the requests have come from educators, particularly college professors, but many have also come from individuals who complain about specific polluters and say they want to bring legal action. Reuss's office has received only one report of legal action to date.

• **MARIHUANA REPORT**: The House Select Committee on Crime has published a report on the hazards and effects of the use of marihuana based on hearings in 1969 in six cities with witnesses including former users, sociologists, teachers, law enforcement officials, doctors, and clergymen. Among the findings of the report are that (i) marihuana can cause psychological dependence; (ii) use of marihuana can introduce persons to a drug culture, which in turn may lead to experimentation with other drugs; (iii) the effect of marihuana depends in large part on the mental set and milieu of its users; (iv) 8 to 12 million persons in the United States have tried it at least once; and (v) courts customarily exercise leniency, especially with first offenders. The Select Committee has asked the Surgeon General to prepare a report on marihuana similar to the one issued on the hazards and medical effects of smoking cigarettes, and has recommended that the federal government reduce the penalties for possession of the drug. The report is available for 50¢ from the U.S. Government Printing Office, Washington, D.C. 20402.

• **NAS ELECTS FOREIGN ASSOCIATES**: The National Academy of Sciences (NAS) has elected ten scientists as foreign associates of the academy. Election as a foreign associate is one of the highest honors that can be bestowed by the NAS on a scientist who is not a United States citizen. Elected were: Charlotte Auerbach, University of Edinburgh, Scotland; Derek H. R. Barton, Imperial College of Science and Technology, England; Hendrik B. G. Casimir, N. V. Philips' Gloeilampenfabriken, Netherlands; Albert F. Frey-Wyssling, Swiss Federal Institute of Technology, Switzerland; Izrail M. Gel'fand, Soviet Academy of Sciences, U.S.S.R.; San-Ichiro Mizushima, Tokyo University, Japan; Sir Rudolph Peierls, Oxford University, England; Max F. Perutz, University Postgraduate Medical School, England; Sir George W. Pickering, Oxford University, England; Emilio Rosenblueth, National University of Mexico, Mexico.

• **NATIONAL ACADEMY OF ENGINEERING ELECTIONS**: Clarence H. Linder has been elected as the first full-time president of the National Academy of Engineering (NAE) succeeding Eric A. Walker, president of Pennsylvania State University. Linder's former positions include vice president of the NAE and president of the American Institute of Electrical Engineers. He will serve a 1-year term.

Chauncey Starr has been elected vice president of the academy. Starr, who is dean of the College of Engineering and Applied Science at UCLA, has served as vice president of North American Aviation and on the academy council. Starr will serve a 4-year term.

Thomas C. Kavanagh and J. H. Mulligan, Jr., were reelected as treasurer and secretary, respectively, of the academy.

• **CIGARETTE ADS**: The President has signed a bill banning cigarette advertising on radio and television after next 1 January. The cutoff date will permit cigarette advertisements on the telecasts of football games on New Year's Day. The bill also prescribes a stronger warning label for cigarette packages, and gives the Federal Trade Commission authority to require a health warning in other advertisements after 1 July 1971, provided Congress has been notified 6 months in advance.

committee on Government Research headed by Senator Fred R. Harris (D–Okla.) was deactivated last year, and Representative Henry R. Reuss (D–Wis.), who headed a House Subcommittee on Research and Technical Programs, has concentrated on environmental issues. Representative Emilio Q. Daddario, chairman of the House Subcommittee on Science, Research, and Development and the legislator who is the best informed and most sympathetic interpreter of science and its problems in Congress, has announced his retirement from the House to seek the governorship of Connecticut. Senator Ralph Yarborough (D–Texas), chairman of the Senate Labor and Public Health Committee and a friend to the cause of biomedical research, was defeated for renomination in the recent Texas senatorial primary. Senator Edward Kennedy (D–Mass.), chairman of the Subcommittee on NSF Fund Authorizations, is seeking an increase in financing for the foundation, but Kennedy is probably too heavily committed elsewhere to be able to concentrate his efforts on defending science.

In the executive branch the change of Administration has brought some shifts in power over science affairs, although the full consequences are not yet evident. An increase in the size of the White House staff at least potentially implies some lessening in the decision-making power of the Bureau of the Budget over science spending. Furthermore, it appears that the departure from the bureau of some veterans of the science management section has brought in top men whose policy views are not yet clear. One reported result is that the advisory influence of the Office of Science and Technology (OST), which has not been regarded as enormous, seems to have declined.

Decentralization and pluralism in federal science have always been blamed for the chronic weakness of science planning and program coordination in the federal system. NSF and then OST have been successively designated to exercise policy-making and coordination powers, but both agencies have let the cup pass. The NIRAS proposal asks for a strengthening of OST in both manpower and authority and makes other recommendations to improve the science policy apparatus, but the recommendations sound like old remedies that have been proved safe but not particularly effective.

One practical alternative to NIRAS would probably, in the view of many

scientists, be the planned growth over a reasonably short period of the NSF budget to a billion dollars. The billion dollar figure, which would mean a doubling of the present NSF funds for academic research and graduate education, might alleviate the crisis that is threatening the careers of many scientists, particularly younger ones, and might in fact salvage the prevailing federal support system.

But the talk of new machinery and more money diverts attention from what Ezrahi calls the "cultural and institutional crisis" afflicting science. The relationship between government and the university is obviously the key issue. The scientists who negotiated the original postwar arrangement with the government sought to ensure the independence of the university. The confrontations of the 1960's shattered the idea of the campus as a cloister. However overheated the rhetoric and extreme the current readiness to use science as an all-purpose scapegoat, it is nevertheless evident that many students and young scientists believe that universities played Faust to the federal Mephistopheles.

That the relationship between government and the universities is changing has been evidenced in recent years by the altered behavior of university scientists commenting on public issues in Washington and elsewhere. In the past, scientists tended to serve as technical experts, but in recent years an increasing number have acted as critics, often quite antagonistic critics, of government policy. Their impact has been particularly pronounced on environmental issues and in the recent debates on the ABM.

Science policy until recently meant a somewhat parochial analysis of institutions, programs and funding, and discussion of who in science should get how much. Science policy, however, is no longer something that can be settled by the scientific community's ambassadors to Washington. What will really count more is not changes in science policy machinery but change in the universities.—JOHN WALSH

Last weekend, the report of the President's Task Force on Science and Technology, chaired by TRW president Ruben F. Mettler, was released by the White House. Copies of the report were not available at the time of the Science *deadline. The report* Science and Technology: Tools for Progress *is likely to further stimulate the present discussion on science policy.*

Contraceptive Technology: Advances Needed in Fundamental Research

A decade ago, birth-control technology leaped forward with the development of the oral steroid pill and the plastic intrauterine device (IUD). The pill and the IUD gave rise to hopes among some population specialists that the search for an ideal means of contraception might be drawing to a successful conclusion. But this was not to be. Today the search continues, and both basic and applied research in the fields of reproductive biology and contraception and abortion are receiving increasing support from the federal government and leading foundations.

Concern about the "population explosion" in the less-developed countries has caused Congress to earmark substantial foreign aid funds for birth-control programs. And, although neither the Administration nor Congress has yet pressed the Department of Health, Education, and Welfare to mount a maximum effort in contraceptive research, HEW's program in this field is expanding and soon may become somewhat more "product oriented" than it has been in the past.

Furthermore, "zero population growth" is now being advocated as a goal for the United States by environmentalists, a number of members of Congress, and even some high-ranking Nixon Administration officials such as HEW Secretary Robert H. Finch and Science Advisor Lee DuBridge. While an effort to attain such a goal would pose complex questions of motivation and possibly require major changes in life styles, the development of better and simpler contraceptive methods is a part of the problem. In the short run, the budgetary stringencies now affecting nearly all federal agencies may impede growth of support for contraceptive research, but, in the longer term, the prospects seem bright.

The "ideal contraceptive," as defined by specialists such as Philip A. Corfman, director of the Center for Population Research at the National Institutes of Health, is one that would be effective, safe, inexpensive, reversible, easy to use, and acceptable to a diversity of people and cultural groups. This ideal is far from being attained, and the prevailing view is that development of a contraceptive meeting all of these criteria is unlikely.

The problems involved in the use of the pill and the IUD have been pointed up by events in the United States and overseas. The health risks and side effects associated with the pill were widely publicized at the hearings conducted early this year by a Senate subcommittee chaired by Senator Gaylord Nelson of Wisconsin. And, even though it appears that a woman using the pill takes far less risk than one who undergoes pregnancy and childbirth (especially in the less-developed countries), there has been considerable official and unofficial resistance to the use of oral contraceptives in the family-planning programs of India and a number of other nations. The IUD has been officially promoted in countries such as Taiwan, South Korea, India, and Pakistan, but many women who accepted IUD's initially no longer use this contraceptive method, frequently because of side effects which, while not dangerous, are annoying.

In fiscal 1969 funds from United States sources totaling $45.5 million were committed to contraceptive research and development, with $19.9 million provided by federal agencies, $8.4 million by voluntary agencies (chiefly the Ford and Rockefeller foundations and the Population Council), and $17.2 million by the drug industry. In addition, $5.4 million was committed to research on the side effects caused by contraceptives. Most of the basic