Daddario and Kennedy Recommend Boosts in NSF Budget

Exactly how much money the National Science Foundation will get for fiscal year 1971, beginning 1 July, will not be settled for several months. But recent developments suggest that growing Congressional concern over the state of American science could be translated into significantly more dollars next year. If Congress moves to fix this year's government-wide cuts in Federal support of science research and education, NSF is the agency that will get most of the extra money.

Congressional supporters of science are suggesting that NSF should receive up to $50 million more than the $513 million requested by the Nixon administration. But scientists, worried by budget cuts, should greet these numbers with very guarded optimism at this point. Final Congressional appropriations usually fall short of the early recommendations of Congressmen and Committees interested in particular agencies. Last year the Administration requested $500 million for the NSF. The House Science and Astronautics Committee recommended then that the amount be lowered by about $9 million, and the House Labor and Public Welfare Committee recommended raising the amount, by $0.5 million.

Pressures to limit Federal spending in next year's budget may be greater than usual. Yet, it can also be argued, Congressional supporters of science may have an especially compelling case to present this time.

In the House, NSF's fiscal 1971 authorization hearings were held in February and March by the Subcommittee on Science, Research and Development of the Science and Astronautics Committee. The Subcommittee, chaired by Emilio Q. Daddario of Connecticut, has taken the lead in Congress in examining and trying to alleviate some problems of American science (PHYSICS TODAY, May, page 61). The full Committee has recommended that NSF receive, for 1971, $27.6 million more than the $513 million Administration request. (In this fiscal year NSF will spend about $463 million, although some $20 million of this is carried over from former years. The $513 million figure includes $13 million for the National Sea Grant Program that Congress must authorize separately, and $2 million in excess foreign currencies to be spent abroad.)

In a 63-page report released on 9 April, the Science and Astronautics Committee explained why it thought NSF should get more money next year. The Committee noted that "budget reductions and the influence of section 203" are "causing the mission agencies to terminate academic science projects totaling at least $57.9 million . . . These actions affect colleges and universities in every State of the Union." The Administration budget asked for $10 million for projects transferred from other agencies. The Committee would add another $10 million, which would "permit the National Science Foundation to fund approximately one-third of the high-quality projects already identified as being dropped by other agencies."

The Committee would give NSF $4 million specifically for environmental research in Federal laboratories, a recommendation that reflects growing interest in broadening the traditionally specialized roles of the federal laboratories. "We need laboratories of a certain 'critical mass' to provide comprehensive studies and multidisciplinary approaches."

The Committee recommends adding $9.5 million to the $17.7 million requested to support NSF graduate traineeships. Because of cutbacks in support of predoctoral science education by NASA and other agencies, "fiscal-year 1971 direct federal support for first-year

ALL FOUR MEN who served as Presidential science advisers testified in favor of raising NSF budget at hearings before Kennedy committee on 23 April. From left: Donald Hornig, James Killian, Jr, George Kistiakowsky, current deputy science adviser Hubert Heffner, and Jerome Wiesner.

graduate students is projected at only one-half of the fiscal-year 1970 level," unless NSF takes up some of the slack.

Noting that its efforts to restore NSF traineeship funds only partially offset overall federal cuts in support of graduate students, the Committee noted that cuts in the support of graduate education in the sciences represent "a dangerous and headlong retreat from the prudent policy which we have pursued in the past. This careless action can result in a real crisis for the nation six to eight years from now, when highly trained scientists are needed to solve the complex and constantly changing problems faced by our nation. The surest way of insuring a research gap in the future is to train inadequate numbers of scientists in the present." The Committee urged NSF to "undertake on a priority basis a study of overall Federal policy toward graduate training in the sciences."

Scientific manpower projections six to eight years ahead—when, according to the Committee, students beginning graduate work next year will be ready to go to work—indicate that "the country will need more rather than fewer scientists."

The Committee would add $4 million to the Administration request for $4 million for NSF's College Science Improvement Program, and $130 000 to the $370 000 requested for NSF's state and local intergovernmental science policy program.

With respect to the "PhD glut" and a possible oversupply of scientific manpower the Committee concluded that: "There is no indication that a surplus exists. It is true that patterns of utilization of these highly trained personnel will be different in the future. But this is as it should be, since their talents are badly needed in such areas as liberal-arts college teaching, junior-college teaching, and administration of highly complex technology-oriented organizations in both the Government and the private sector of our economy."

In discussing NSF's support of scientific research, for which a total of $306 million is requested, the Committee observed that "The amount of $31 400 000 for support of physics in fiscal year 1971, an increase of $3 700 000 over fiscal year 1970, will permit the continuation of the Foundation's broad support of physics as well as high-quality programs previously supported by the mission agencies and for which support will either be reduced or terminated in fiscal year 1971."

The Committee noted the central role of physics "in the conceptual unification of all natural sciences." Among promising applications of basic physics research, cryogenics was singled out. A major development under NSF's nuclear and elementary-particle physics programs is very large-scale cryogenic facilities. At Stanford, NSF is helping to support work on a 500-foot superconducting electron linear accelerator. Knowledge gained with very large cryogenic facilities may well have major social and economic impact, the Committee said. Possible future applications of large-scale cryogenics to industrial technology include long-distance power transmission, very high band-width communication, and major cryogenic electronics facilities such as computers. The Stanford-developed superconducting niobium cavities could lead to progress on very high intensity pulsed radar, and to plasma confinement for thermonuclear power generation. Also, "probably any future accelerator in the 1000- to 2000-GeV energy range would make extensive use of low-temperature technology."

In the Senate the NSF authorization came up first before the Special Subcommittee on the National Science Foundation of the Labor and Public Welfare Committee. Chairman of the Special Subcommittee is Edward M. Kennedy of Massachusetts. On 9 April Kennedy introduced a bill that would add $50 million to the Administration's request for NSF—almost doubling the increase recommended by the House Committee. Kennedy noted that, overall, "the percentage of the federal budget going to scientific research and development has dropped from 13% in 1965 to under 9% in 1970." He suggested that an increase of only $27.6 million for NSF was not sufficient. Among other things, Kennedy would add $30 million to the $10 million requested by the Administration to support "academic science projects which are being dropped by DOD, NASA, and other Federal agencies."

The Special Subcommittee began its NSF authorization hearings on 16 April, with appearances by McElroy and National Academy of Sciences President Philip Handler. McElroy, understandably, could not appeal for more money than the Administration had requested for NSF. But his 16 April statement detailed some of NSF's aims for next year. He stressed the need to meet "the challenge posed by the continuing deterioration in the quality of our environment." He noted the extra strain on NSF resources resulting from "the growing shift away from support of fundamental research by the mission agencies of the Federal Government," and declared that "development of the scientific systems approach needed to deal with multidisciplinary investigations" costs more than the support of traditional research projects in single science areas. McElroy said it was too early to assess the full effect of the "Mansfield Amendment" on Defense Department research, but he expected NASA, NIH and AEC, as well as Defense, to make, "further significant reductions" in their support of fundamental research. He said that ". . . there is no planned direct lateral transfer of support from another agency to NSF."

McElroy noted that over the years NSF had supported basic research, and also projects of short-range utility often directed to current problems of society. Now, NSF is "formalizing and developing the short-range relevant type of research, while continuing support of the long-range or basic research." NSF's relatively limited support of work on immediate problems in former years has "usually resulted from unsolicited proposals received from the academic community." But now, as a guide in funding research on particular problems, NSF plans to use technology assessment as "an organizing principle." McElroy interpreted "technology assessment" broadly to include: (1) appraisal of overall effects of current or potential technology on the natural or social environment; (2) development of appropriate methodologies, including "studies of mathematical modeling and simulation, and research on methods of forecasting technological, environmental, and social change;" (3) fundamental and applied research on the natural or social environment; and (4) the "search for new technologies required for solution of environmental or social problems," illustrated by NSF's support of weather-modification research over the last decade. McElroy noted that NSF will actively seek proposals "wherever competence can be found—in universities, in industries, and in nonprofit organizations and professional associations."

On 23 April all four former presidential science advisers—James R. Killian, Jr, George B. Kistiakowsky, Jerome B. Wiesner and Donald F. Hornig—appeared together before the Kennedy committee along with the current deputy science adviser, Hubert Heffner. The former advisers all agreed that the NSF budget needed at least the proposed $50 million increase.

Killian noted NSF's role as a "balance wheel in smoothing the ups and downs in our national basic research budget."

Kistiakowsky deplored the effects of section 203 and suggested that "a close coupling of mission-oriented agencies and extramural programs of basic scientific research is highly desirable and should not be damaged by narrow definition and interpretation of the relevancy of basic research."

Wiesner noted the longer-range economic and other damage of research cuts.

Hornig expects that "in a decade we will pay dearly" for economizing on research now. —JBP

NSF Assistant Directors Nominated by President

President Nixon has nominated four assistant directors of the National Science Foundation. Although the four posts were established by Congress in 1968, they have remained open until now.

Physicist Edward C. Creutz, Gulf General Atomic vice-president for research and development, will become NSF Assistant Director for Research, responsible for roughly half the NSF budget.

Lloyd E. Humphreys, psychology professor at the University of Illinois, will be Assistant Director for Education.

Louis Levin, a biochemist, who is already at NSF as Executive Associate Director, will be the new Assistant Director for Institutional Programs.

Rear Admiral Thomas B. Owen, a physical chemist who is presently Chief of Naval Research, will be Assistant Director for National and International Programs.

The position of NSF deputy director still remains open.

Also recently nominated by the President are nine members for the National Science Board, NSF's policy-making body. Among the nominees: Robert A. Charpie, president of the Cabot Corporation of Boston, and a theoretical physicist; Robert H. Dicke, chairman of the physics department at Princeton; and Frank Press, chairman of the geology and geophysics department at MIT.

National Science Board Prescribes For Health of US Science

The Physical Sciences, prepared by the National Science Board, the 25-member policymaking body of NSF, went to Congress in February. In its preamble the report lists what the NSB considers basic tenets of US science policy: the nation will strive to stay near the forefront in major science areas; every young person's opportunity for advanced education should be limited only by his ability and motivation, and the government is responsible for ensuring the quick and effective use of scientific knowledge in support of national goals.

The report summarizes the present state of astronomy, chemistry and physics. It reviews recent discoveries in the macrouniverse, for example in quasars, relativity, pulsars, and space experiments, as well as new insights into the microuniverse of elementary particles, and atomic and molecular physics and chemistry. The NSB also examines the nature of the physical-science enterprise, noting science-technology interactions, the importance of new ideas, the communication system of science, and the setting of priorities.

The NSB discusses the health of the US effort in the physical sciences, outlining the roles of universities, government and industry in different types of training and research. Among numerous NSB recommendations: greater input by scientists to the process of establishing scientific priorities within the political sectors; government sensitivity to the vital needs of the physical sciences; special attention by all agencies to research programs involving individual investigators and small groups; the establishment of large federally funded research facilities *only* as national or regional resources.

Sixteen specific recommendations are presented for consideration by the Legislative and Executive branches of government. Among these: To help avoid the mediocrity currently threatening the US scientific effort, physical science support levels "should be made comparable to those recommended in the studies of the Committee on Science and Public Policy of the National Academy of Sciences in the fields of astronomy, chemistry and physics." NSF should be able to have more money and more opportunity for initiative in developing physical-science research programs. All agencies should continue to give special attention to small groups of researchers, "many of which are now underfunded to the point approaching stultification." Older or less productive large installations should be selectively phased out to allow construction and operation of new installations "which are closer to the forefront of developments in scientific techniques and capability." The US should work for international participation in planning and utilizing large research facilities. The mission-oriented government agencies "should continue to support basic research in all areas of the physical sciences which show reasonable promise of having a bearing on their missions." The currently declining funding for the scientific aspects of the space program should be reversed. Industry, government and universities should cooperate more effectively "in translating basic science into social utility and in opening up for basic research the new areas which are often suggested by technological problems."

Remote Probes to Study Weather and Atmosphere

Atmospheric Exploration by Remote Probes, a special panel report from the National Research Council, recommends new types of measuring devices for increasing understanding of atmospheric processes and weather predictability. Instruments that can probe the atmosphere at varying distances promise "a major leap in advancing our observational capability." The report notes that theoretical and technological advances now permit the use of radars, radio propagation facilities, and infrared and microwave radiometers to measure conditions of atmospheric structure, wind turbulence, temperature and moisture. The NRC panel, headed by David Atlas (University of Chicago), recommends developing an "atmospheric test range" at NASA's Wallops Island facility, and the use by atmospheric scientists of MIT's Haystack radar facility.

To Understand Earth in Space Make Observations from Ground

Ground-based techniques must be fully exploited for a complete understanding of the earth's space environment, according to a report from the National Research Council's Geophysics Research Board. *Physics of the Earth in Space: The Role of Ground-Based Research,* notes that, while the past decade has greatly advanced understanding of the sun–earth system, many scientific questions require a coordinated program of ground- and space-based techniques. The result of a 1969 summer study by the Committee on Solar-Terrestial Research (supported by NSF, ESSA, the Air Force and NASA), the report discusses the