

National Science Foundation in the FY 2001 Budget

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HIGHLIGHTS

- The President's FY 2001 request for the National Science Foundation (NSF) is \$4.6 billion. This represents an increase of \$675 million, or 17.3 percent, over the estimated FY 2000 level of \$3.9 billion (see Table II-7). If appropriated by Congress, this increase would represent the largest increase in a single year ever received by NSF and double the largest dollar increase ever proposed previously.
- Most of the proposed \$675 million increase would go to four major initiatives that involve each of the seven NSF directorates: Information Technology Research (\$327 million), Nanoscale Science and Engineering (\$217 million), Biocomplexity in the Environment (\$136 million), and 21st Century Workforce (\$157 million). However, nearly half of the increase—\$320 million—would strengthen core research programs.
- The Information Technology Research (ITR) initiative seeks to bring about advances in software, networking, scalability, high-end computing, mathematics, research applications, wireless networking, communications, and remote sensing. The goals are to make the entire science and engineering enterprise more productive and examine issues that were previously too complex to address with existing information technology.
- The Nanoscale Science and Engineering initiative hopes to bring about advances in man's ability to develop micro- and

George L. Leventhal

submicroscopic devices that will have applications in many fields, from information technology and medicine to manufacturing and the environment.

- Biocomplexity in the Environment (BE) is a multidisciplinary approach to understanding the world environment. It investigates the many complex systems that are structured or influenced by living organisms or biological processes.
- The 21st Century Workforce initiative emphasizes research on the science of learning, development of the instructional workforce, and diversifying the general workforce.

AGENCY OVERVIEW

NSF's Mission. In May, 2000, NSF will celebrate its 50th anniversary. During that period of time, the Foundation has had an extraordinary impact on American scientific discovery. Despite its small size, it is the only federal agency with responsibility for research and education in all major scientific and engineering fields. Approximately 95 percent of the agency's total budget goes directly to support the actual conduct of research and education, while less than five percent is spent on administration and management.

NSF Support. NSF plays a crucial role in the support of university research. Although NSF represents less than four percent of the total federal budget for research and development, it accounts for approximately 20 percent of all federal support for basic research at academic institutions. In several fields, it is the lead federal source.

NSF funds approximately 10,000 research, education, and training projects through grants, contracts, and cooperative agreements to more than 2,000 colleges, universities, and other research and/or education organizations in all parts of the U.S. Nearly 200,000 people are involved directly in NSF programs and activities. In FY 2001, these are projected to include nearly 40,000 senior researchers and other professionals; more than 61,000 postdoctoral, graduate, and undergraduate students; 11,390 K-12 students; and 80,830 K-12 teachers.

NATIONAL SCIENCE FOUNDATION IN THE FY 2001 BUDGET

The agency does not operate its own laboratories, but does support national research centers, user facilities, oceanographic vessels, and Antarctic research stations. NSF also supports university-industry research partnerships, U.S. participation in international scientific efforts, and efforts to improve K-12 through postsecondary education.

Agency Structure. NSF is an independent federal agency run by a presidentially appointed, Senate-confirmed director and deputy director. The agency's policy direction is established by the National Science Board, which consists of 24 scientists, mathematicians, engineers, top university officials, and industry leaders.

NSF has a staff of roughly 1,200 people and is divided into seven directorates. Six of the directorates are directly responsible for funding discipline-oriented basic and applied research: Biological Sciences; Computer and Information Science and Engineering; Engineering; Geosciences; Mathematical and Physical Sciences; and Social, Behavioral and Economic Sciences. The remaining directorate is responsible for overseeing the Education and Human Resources activity.

Congressional Support. NSF has traditionally enjoyed broad Congressional support. While the agency's appropriation dipped slightly between FY 1995 and FY 1996, the total appropriation has increased each year since then, even when other agencies under the VA, HUD and Independent Agencies appropriations bill were cut. In FY 1998, the appropriation for NSF actually exceeded the Administration's budget request by \$159 million. In FY 1999, Congress provided the agency with an increase of 7.1 percent over the previous year, which was considered a significant show of support, and was greater than the increases received by any other scientific research agency with the exception of the National Institutes of Health (NIH). Congress provided a similarly significant budget increase (6.9 percent) in FY 2000. However, it remains to be seen whether the Administration's ambitious request for FY 2001, representing more than twice the size of annual budget increases in the last few years, will win the support of Congress.

George L. Leventhal

RESEARCH AND RELATED ACTIVITIES

Research and Related Activities (R&RA) would receive \$3.5 billion, an increase of 19.7 percent over the FY 2000 plan of \$3.0 billion (see Table II-7 for full details of NSF funding). Below are details of R&RA funding by directorate.

Biological Sciences (BIO): \$511 million (up 23.3 percent). More than 80 percent of BIO funding goes toward investigator-initiated, fundamental research, primarily at colleges and universities. In FY 2001, BIO expects to make 3,230 awards with an average annualized award size of \$145,000 per year and an average duration of three years.

The Plant Genome Research Subactivity, supporting research that will advance understanding of the structure, organization, and function of plant genomes, is proposed to receive \$60 million in FY 2001, the same amount as in FY 2000.

In FY 2000, the BIO Activity supports three Science and Technology Centers, which are projected to phase down and receive final funding of \$3.5 million in FY 2001, a decrease of 19 percent below FY 2000. The BIO Activity also supports the Center for Ecological Analysis and Synthesis, projected to receive \$2 million in FY 2001 (the same amount as in FY 2000), and 21 Long Term Ecological Research (LTER) sites in a variety of different climatic locations around the world. Support for these 21 LTER sites would total \$14 million in FY 2001, the same amount as in FY 2000. Finally, NSF plans to devote \$31 million to Plant Genome Virtual Centers in FY 2001, the same amount as in FY 2000.

Computer and Information Science and Engineering (CISE): \$529 million (up 36.2 percent). Although all seven NSF directorates are projected to participate in the ongoing Information Technology Research (ITR) Initiative, CISE, for the second year in a row, would receive the largest share of funds under this initiative. As a result, it would receive the largest increase of any NSF directorate in FY 2001. In FY 2001, CISE would provide \$190 million to support ITR. In FY 2001, CISE expects to make 2,000 awards with an average annualized award size of \$137,500 per year and an average duration of 3.3 years. (For more information on ITR, please see Chapter 24.)

NATIONAL SCIENCE FOUNDATION IN THE FY 2001 BUDGET

Engineering (ENG): \$457 million (up 19.6 percent). NSF provides about 36 percent of the total federal support for academic engineering research and education. In FY 2001, ENG expects to make 3,150 awards with an average annualized award size of \$78,000 per year and an average duration of three years.

Geosciences (GEO): \$583 million (up 19.5 percent). GEO is the principal source of federal support for academic research in atmospheric, geological, and oceanographic science. In FY 2001, GEO expects to make 3,100 awards with an average annualized award size of \$78,000 per year and an average duration of three years. Funding for the National Center for Atmospheric Research (NCAR) would increase by 10 percent to \$76 million. The Academic Research Fleet would receive \$54 million in FY 2001, an increase of 15 percent. Approximately 2,500 scientists and students use the fleet's 28 ships annually, accounting for about 75 percent of its total use. (Please see Chapter 17 for more information on atmospheric and ocean science, and Chapter 18 for more information on geological science.)

Mathematical and Physical Sciences (MPS): \$881 million (up 16.3 percent). NSF provides about two-thirds of government support for ground-based astronomy, including almost all federal support for radio astronomy, and over half for core mathematics. In other MPS subfields, NSF support accounts for between 25 and 100 percent of federal funding of basic research. In FY 2001, MPS expects to make 4,300 awards with an average annualized award size of \$110,000 per year and an average duration of three years.

Facilities would receive \$191 million in FY 2001, a decrease of 1.1 percent. Support would continue to be provided for the Gemini Observatories, three major astronomical facilities, the Laser Interferometer Gravitational-Wave Observatory (LIGO), Cornell Electron Storage Ring, Michigan State University's National Superconducting Cyclotron Laboratory, the National High Magnetic Field Laboratory, National Astronomy Centers, and several other facilities.

Total center funding would increase 14.9 percent, to \$87 million. MPS supports three Science and Technology Centers, 28 Materials Research Science and Engineering Centers, four Chemistry Centers, and three

George L. Leventhal

Mathematical Sciences Research Institutes. (Please see Chapter 15 for more information on physics, Chapter 16 for more information on astronomy, Chapter 20 for more information on chemistry, and Chapter 23 for more information on mathematics.)

Social, Behavioral and Economic Sciences (SBE): \$175 million (up 19.8 percent). SBE is one of the primary sources of support of basic research in the social, behavioral, and economic sciences. For fields such as anthropology, archaeology, and political science, NSF is the sole source of federal research support. In other fields, such as sociology and social psychology, NSF provides more than half of all federal support. NSF supports more than one-third of federal support for basic research in economics. In FY 2001, SBE expects to make 2,050 awards with an average annualized award size of \$72,500 per year and an average duration of 2.3 years.

Funding for centers would increase 40 percent to \$6.5 million. SBE-supported centers include the Science and Technology Center for Cognitive Science at the University of Pennsylvania, the National Consortium for Violence Research, and two research centers on the Human Dimensions of Global Change at Indiana University and at Carnegie Mellon University. SBE also provides support for Long Term Ecological Research sites, although these are primarily supported by the BIO directorate.

U.S. Polar Programs: \$285 million, up 12.8 percent. The FY 2001 request for U.S. Polar Programs includes \$223 million for U.S. Polar Research Programs and \$63 million for U.S. Antarctic Logistical Support. The extreme environments and geographically unique characteristics enable research to be performed in both the Arctic and Antarctic that is not feasible elsewhere.

Arctic programs conducted by NSF include Arctic and sub-Arctic Long Term Ecological Research (LTER) sites in Alaska, field stations and large instrument facilities in Alaska, Greenland, and Arctic Canada, and research ships, submarines, planes, helicopters, and other field support.

Each year, about 650 science personnel from institutions in 30 states travel to Antarctica for research purposes. NSF facilities there include

NATIONAL SCIENCE FOUNDATION IN THE FY 2001 BUDGET

the Center for Astrophysical Research at the South Pole and two Antarctic LTER sites, one near Palmer Station that focuses on marine research and another in the Dry Valleys near McMurdo Station, that study polar desert oases and permanently ice-covered lakes.

Integrative Activities: \$119 million, down 7.7 percent. Integrative Activities (IA) was created in FY 1999 within the Research and Related Activities appropriation to support cross-disciplinary research efforts and major research instrumentation. The Integrative Activities program also supports the Science and Technology Policy Institute (STPI), a Federally-Funded Research and Development Center established in 1992 that provides analytical support to the Office of Science and Technology Policy (OSTP) and the National Science and Technology Council (NSTC) for the development and implementation of science and technology policy.

In FY 2001, the Major Research Instrumentation program is projected to receive \$50 million, the same amount as in the FY 2000 plan. The Opportunity Fund, which supports innovative, cross-disciplinary research and education, is projected to receive \$32 million. For the Science and Technology Centers program, \$20 million is requested to continue support for five centers. Finally, a total of \$13 million is included within Integrative Activities for two additional programs in FY2001. ADVANCE, a new program to increase the participation of women in science and engineering, is proposed to receive \$11 million through IA and a total of \$20 million in FY 2001. The Integrative Graduate Education and Research Training (IGERT) program provides support for universities to engage graduate students in interdisciplinary science and engineering research. It is proposed to receive a total of \$31 million in FY 2001, of which \$2 million would come from IA.

EDUCATION AND HUMAN RESOURCES (EHR)

Education and Human Resources would receive \$760 million, an increase of 5 percent. Of these funds, \$729 million are requested to be appropriated, and \$31 million would come from H-1B Nonimmigrant Petitioner Fees.

George L. Leventhal

The Educational System Reform subactivity would receive \$110 million, a decrease of 3.4 percent. This program seeks to reform science, mathematics, and technology education in school systems across America. Elementary, Secondary and Informal Education activities would receive \$192 million (up 3.9 percent), Undergraduate Education would receive \$141 million (up 20.8 percent), and Graduate Education would receive \$89 million (up 14.4 percent). Under graduate and professional education programs, the traditional Graduate Research Fellowship program would be decreased by \$490,000, to total \$52 million. Meanwhile, a new Graduate Teaching Fellows in K-12 Education (GK-12) program, which supports science graduate students as content resources for K-12 teachers, would increase by \$16 million to a total of \$25 million. A new Office of Innovation Partnerships would receive \$48 million (down 19.2 percent). This office, which was initiated by congressional action in FY 2000, carries out a variety of approaches to developing innovation partnerships, as well as the Experimental Program to Stimulate Competitive Research (EPSCoR) program. For more information on EHR activities, please see Chapter 6.

MAJOR RESEARCH EQUIPMENT

The agency's request includes \$139 million for Major Research Equipment, an increase of 48.2 percent over the FY 2000 plan. Funds will be used to construct and/or support Earthscope: USArray and SAFOD (a distributed instrument array used to understand and simulate earthquake physics; see Chapter 18 for information on these two projects), the Large Hadron Collider (a superconducting particle accelerator to be constructed at CERN laboratory in Switzerland; see Chapter 15), the Millimeter Array (a radio telescope consisting of 64 large antennas; see Chapter 16), the National Ecological Observatory Network (see Chapter 19), the ongoing modernization of South Pole Station, and terascale computing systems (see Chapter 24).