

CRS Report for Congress

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U.S. National Science Foundation: An Overview

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Summary

The National Science Foundation (NSF) was created by the National Science Foundation Act of 1950, as amended (PL. 81-507). The NSF has the broad mission of supporting science and engineering in general and funding basic research across many disciplines. The majority of the research supported by the NSF is conducted at U.S. colleges and universities. Approximately 82.5% (\$1,900.2 million) of NSF's FY1996 \$2,303.1 million research and development (R&D) budget was awarded to U.S. colleges and universities.¹ Estimated data reveal that in FY1996, the NSF provided approximately 49.5% of all federally funded **basic** research conducted at the nation's colleges and universities, with the exclusion of biomedical research sponsored by the National Institutes of Health. In addition, the NSF provides approximately 30% of the total federal support for science and mathematics education

Background

The NSF's primary responsibility is to maintain the health and vitality of the U.S. academic science and engineering enterprise. In addition to ensuring the nation's supply of scientific and engineering personnel, the NSF promotes academic basic research and science and engineering education across many disciplines.² Other federal agencies, in contrast, support mission-specific research (i.e., health, agriculture, defense).

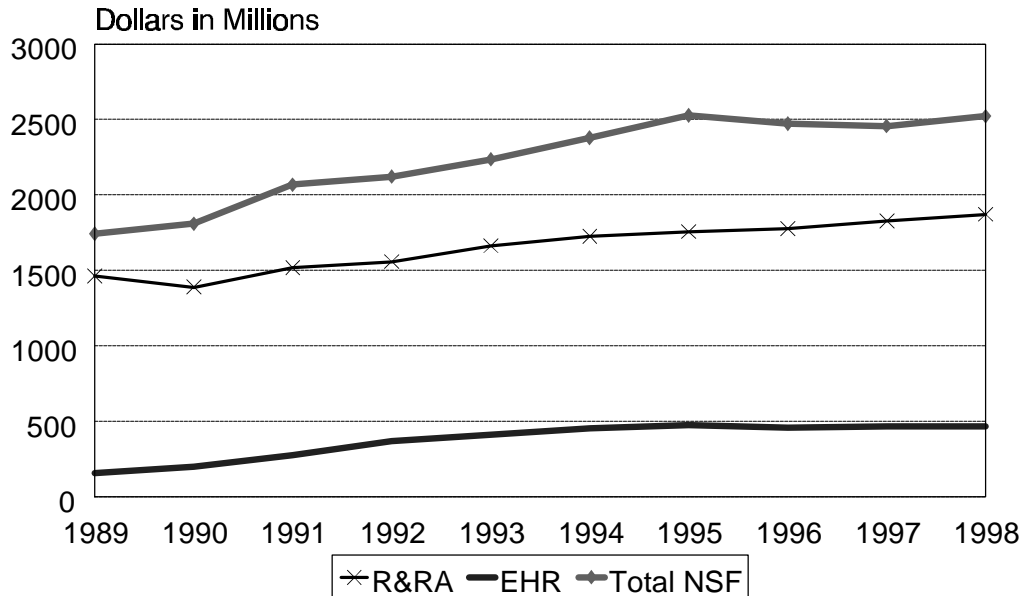
The NSF provides support for investigator-initiated, merit-reviewed, competitively selected awards, state-of-the-art tools, instrumentation and facilities. The agency receives approximately 60,000 proposals annually, for research, graduate and postdoctoral fellowships, and science, mathematics, and engineering projects, and funds roughly one-

¹ National Science Foundation, *Federal Support for Research and Development: Fiscal Years 1994, 1995, and 1996*, Detailed Statistical Tables, NSF 97-302 (Washington, 1997) p. 57-60.

² The NSF does not provide funding for research in clinical medicine, commerce, social work, or the arts and humanities.

third of them. Support is provided to academic institutions, industrial laboratories, private research firms, and major research facilities and centers. While the NSF does not operate any laboratories, it does support Antarctic research stations, selected oceanographic vessels, and national research centers. Additionally, the NSF supports university-industry relationships and U.S. participation in international scientific ventures.

Figure 1. NSF R&D Support in Constant 1987 Dollars: FY 1989-1998



The NSF is an Independent agency of the executive branch under the leadership of a presidentially appointed Director and the National Science Board (NSB) which is composed of 24 scientists, engineers, universities and industry officials involved in research.

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The NSF is an independent agency in the executive branch and under the leadership of a presidentially appointed Director and a National Science Board composed of 24 scientists, engineers, and university and industry officials involved in research and education. The Board and the Director make policy for the NSF.

³ While the FY1996 R&D appropriation of \$2,303.1 million was only 3.3% of the FY1996 federal R&D budget, the agency plays an important role in maintaining the university-based research enterprise. The NSF provided 15% of all federally supported basic research and 16.9% of federal academic R&D. NSF was the second largest federal supporter of academic R&D in FY1996, eclipsed by the Department of Health and Human Services, which provided 56.7%. The Department of Defense, the third largest supporter of academic R&D, provided 11.2%. *Federal Funds for Research and Development: Fiscal Years 1994, 1995, and 1996*, p. 98-99 and p. 156.

Organization and Fiscal Year 1999 Budget

The NSF has enjoyed considerable growth during a period of constrained R&D budgets. When measured in current dollars, its total appropriations almost doubled in 10 years — FY1989, \$1,885.9 million; FY1994, \$2,982.8 million; and FY1998, \$3,429 million. Even when inflation is taken into account, its growth increased (in constant fiscal year 1987 dollars) by 44.7% during this 10 year period. The FY1998 appropriation provides support to several interagency strategic initiatives that the Administration has determined to be relevant to national priorities. Included in the appropriation for FY1998 is \$2,545.7 million for the research and related activities (R&RA). Growth for selected activities of the NSF, in constant dollars, is depicted in the chart above.

The FY1999 budget request for the NSF is \$3,773 million, a 10% increase over the FY1998 estimate. Included in the FY1998 appropriation is \$2,846.8 million for R&RA, a 11.8% increase over the FY1998 estimate. If the proposed budget is enacted, it would be the largest dollar increase in the history of the NSF. The FY1999 request supports seven major directorates and other programs and activity accounts.⁴ The directorates are the Biological Sciences; Computer and Information Science and Engineering; Education and Human Resources; Engineering; Geosciences; Mathematical and Physical Sciences; and Social, Behavioral, and Economic Sciences. Six of the seven directorates are contained in the R&RA. In addition to the directorates, the R&RA includes the U.S. Polar Research Programs (\$182.4 million), U.S. Antarctic Logistical Support Activities (\$62.6 million), and the Critical Technologies Institute (\$2.7 million). The seven major directorates are described below.

Biological Sciences (BIO). The FY1999 budget request of \$417.8 million for the BIO Directorate supports programs structured to improve scientific understanding of biological phenomena, ranging from the study of fundamental molecules of living organisms to the complexity of biological systems. Types of support provided include research workshops, symposia, conferences, the improvement of research collections, purchase of scientific equipment, and operation of research facilities.

Computer and Information Science and Engineering (CISE). The CISE Directorate, proposed at \$331.1 million in the FY1999 request, supports programs focused on the fundamental understanding of computing and information processing, and the use of state-of-the-art computational techniques in scientific and engineering research. Currently, areas of research emphasized are parallel processing, automation and robotics, large-scale integrated electronic systems, scientific computing, and networking.

Education and Human Resources (EHR). The FY1999 budget request is \$683 million for EHR; this directorate plays a major role in the support of science, engineering, mathematics, and technology education. People receiving support from the EHR include senior researchers, postdoctoral associates, graduate and undergraduate students, and teachers and students at the precollege level. More than 150,000 people are involved in the various activities and programs of the EHR.

⁴ For expanded discussion of the various programs and activities of the NSF, see Congressional Research Service, *Research and Development Funding: Fiscal Year 1999*, by Michael E. Davey, Coordinator, IB98011, 14 p.

Engineering (ENG). The ENG, with a request of \$400.6 million for FY1999, is directed toward enhancing the long-term economic strength and security of the Nation by fostering innovation and excellence in engineering education and research. It focuses on integrating education and research in interdisciplinary areas such as information and communication technologies, design and manufacturing, biotechnology, and environmental research.

Geosciences (GEO). The FY1999 request of \$507.3 million for the GEO Directorate provides support to programs that promote knowledge and discussions concerning earth, including the sun, atmosphere, continents, oceans, and interior, and the linkages among them. One of the objectives of the GEO is to expand the knowledge of the biological, chemical, geological, and physical processes in the ocean, and at its boundaries, with the atmosphere and the earth's crust.

Mathematical and Physical Sciences (MPS). The FY1999 request of \$792 million for the MPS would fund programs designed to increase the knowledge base in the relevant sciences; improve the quality of educational programs, with emphasis at the undergraduate level; improve the rate at which research efforts are translated into societal benefits; and increase the diversity of approaches and individuals in the mathematical and physical sciences.

Social, Behavioral, and Economic Sciences (SBE). The SBE Directorate, requested at \$150.3 million for FY1999, supports programs directed at developing basic scientific knowledge about human behavior, culture, interaction, and decisionmaking, and about social, political, and economic systems, organizations, and institutions. The SBE also serves as the nation's primary data source on science and engineering human, institutional, and financial resources.

Other Program Activities and Accounts

The Major Research Equipment (MRE) account is proposed at \$94 million in the FY1999 budget request. The MRE, established in FY1995, supports the construction of major research facilities that are at the "cutting edge of science and engineering." Five projects are supported by this account: start up construction funds for the Large Hadron Collider (\$22 million), support for the development phase of the Millimeter Array (\$9 million), construction of the Polar Cap Observatory (\$21 million), ongoing modernization of the South Pole Station (\$22 million), and funding for the reconfiguration of the Polar Support Aircraft (\$20 million). The construction-funding phase for the Laser Interferometer Gravitational Wave Observatory, once contained in the MRE, was completed in FY1998.

Research project support in the FY1999 request totals \$2,126 million. Funding is provided to individuals and small groups conducting both disciplinary and cross-disciplinary research. Included in the total for research projects is support for centers, proposed at \$224 million in the FY1999 request. Center support will provide an additional \$3 million to establish two new Engineering Research Centers. The planned phase-down of the Science and Technology Centers (STC) will provide support for a FY1999 competition of 10 new STCs. In addition, an increase of \$4 million for Materials Research Science and Engineering Centers (MRSEC) will allow for support of four new MRSECs.

The science and engineering education activities of the NSF are supported by the EHR Directorate **and** in selected activities in other directorates. Support is provided at the precollege, undergraduate and graduate level. The FY1999 request proposes \$683 million for the EHR, an 8% increase above the FY1998 estimate. Support at the various levels is as follows: precollege, \$414.9 million; undergraduate, \$122.7 million; and graduate, \$81 million. The slight decline in funding for the EHR beginning in FY1995 followed a period of rapid growth for science education activities. NSF officials determined that a period of assessment was needed to evaluate the effectiveness of the programs already in place. The main components of the portfolio for EHR programs in FY1999 are : (1) precollege systemic reform to achieve standards-based, inquiry-centered science and mathematics education; (2) development of resources that support standards-based education; (3) advanced training of scientists, mathematicians, and engineers for the 21st century; (4) increased scientific and technological literacy; and (5) integration of research and education.

Policy Issues

There are concerns about future options for the U.S. Antarctic Program and the South Pole Station. On March 12, 1997, the House Science Committee held hearings to assess U.S. policy and polar research activities. The committee was interested in determining, among other things, if maintaining a year round presence in Antarctic was essential to U.S. interests, and determining the feasibility of creating an external panel to explore options for sustaining polar activities within realistic funding levels.

In September 1997, the NSF, in compliance with the Government Performance and Results Act (GPRA), released its strategic plan.⁵ The NSF plan presents a set of key investments for each of its programmatic outcome goals. The outcome goals for NSF's investment portfolio are:

- Discoveries at and across the frontier of science and engineering;
- Connections between discoveries and their use in service to society;
- A diverse, globally-oriented workforce of scientists and engineers;
- Improved achievement in math and science skills needed by all Americans; and
- Timely and relevant information on the national and international science and engineering enterprise.⁶

In addition to complying with GPRA, Neal Lane, director, NSF, stated that the agency is facing increased pressures and rising expectations from various stakeholders. The increase expectations include assisting the Environmental Protection Agency with its grant system, participating with other Federal agencies in research on the Next Generation Internet and the National Plant Genome Initiative, and studying the feasibility of establishing and operating a National Institute for the Environment. There is question as to how NSF can maintain a robust research enterprise while simultaneously responding to additional pressures.

⁵ National Science Foundation, *GPRA Strategic Plan: FY1997-FY2003*, September 1997, <http://www.nsf.gov/gpraplan/gpraplan.htm>, 33p., The GPRA-compliant strategic plan is based on *NSF in a Changing World*, the strategic plan approved by the NSB in 1994.

⁶ *Ibid.*, p. 4.

In December 1997, the National Science Board, the policy-making arm of the NSF, issued a working paper in which it criticized the manner in which science policy is coordinated.⁷ The Board maintains that the weak coordination and inconsistent prioritization across the agencies hinders the development of a coherent science policy. The Board was set up originally to advise the Administration and Congress on science policy in its broadest sense. However, Richard Zare, director of the Board, noted that with NSF accounting for \$2 billion of the \$17 billion spent on basic research in the United States, the Board is interested in advising the government on science policy beyond the confines of the agency. The working paper does not specify who should identify or implement scientific priorities. It is the position of the Board that priority setting should be done jointly, with all the stakeholders actively involved.

On February 13, 1998, President Clinton nominated Neal Lane to succeed John Gibbons in the position of science and technology advisor and director of the White House Office of Science and Technology Policy. Gibbons announced his retirement, effective March 15, 1998. Rita Colwell, president, University of Maryland Biotechnology Institute, has been nominated to succeed Lane as director of NSF.

On May 12, 1998, the Senate Committee on Labor and Human Resources passed H.R. 1273 (in lieu of S. 1046), the National Science Foundation Authorization Bill of 1998. The House, which passed a different version of H.R. 1273 during the first session of the 105th Congress, is expected to vote on this current version in the near future. The Senate-passed version of the three-year authorization provides a total of \$3,505.6 million for NSF in FY1998, \$3,773 million in FY1999, and \$3,886.2 million in FY2000. The NSF has been without authorization legislation since 1989 when a 5-year authorization bill was passed.

On June 25, 1998, the House Committee on Appropriations reported its version of the VA, HUD, and Independent Agencies Appropriations Bill, FY1999. The Senate Committee on Appropriations had passed its version on June 11. The House bill provides a total of \$3,697 million for the NSF in FY1999, \$68 million more than the FY1998 level, \$76 million less than the Administration's request, and \$53 million more than the Senate's recommendation. For R&RA, the House version proposes \$2,815 million, \$269 million above the FY1998 level, \$32 million less than the request, and \$90 million above the Senate's recommendation. For the EHR Directorate, the House provides a total of \$642.5 million in FY1999, \$10 million above the FY1998 level, but \$40 million below the request and Senate proposal of \$683 million. House and Senate floor action is expected on this appropriations bill during the middle of July.

⁷ National Science Board, *Government Funding of Scientific Research: A Working Paper of the National Science Board*, NSB97-186, December 1997, 15 p.