Order Code 95-307
Updated July 3, 2008

CRS Report for Congress

U.S. National Science Foundation: An Overview

Christine M. Matthews
Specialist in Science and Technology Policy
Resources, Science, and Industry Division

Summary

The National Science Foundation (NSF) was created by the National Science Foundation Act of 1950, as amended (P.L. 81-507). The NSF has the broad mission of supporting science and engineering in general and funding basic research across many disciplines. The agency provides support for investigator-initiated, merit-reviewed, competitively selected awards, state-of-the-art tools, and instrumentation and facilities. The majority of the research supported by the NSF is conducted at U.S. colleges and universities. Approximately 82.7% ($3,094.8 million) of NSF's FY2006 $3,740.6 million research and development (R&D) budget was awarded to U.S. colleges and universities.[1] The America COMPETES Act was signed into law on August 9, 2007 (P.L. 110-69). The COMPETES Act authorizes a total of $22,058.0 million for the NSF for a three-year period — FY2008 ($6,600.0 million), FY2009 ($7,326.0 million), and FY2010 ($8,132.0 million). Priorities to be addressed in the authorization include those of supporting successful K-12 science, mathematics, and engineering education programs, promoting university-industry partnerships, balancing funding between interdisciplinary and disciplinary research, and improving funding rates for new investigators.

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).

---

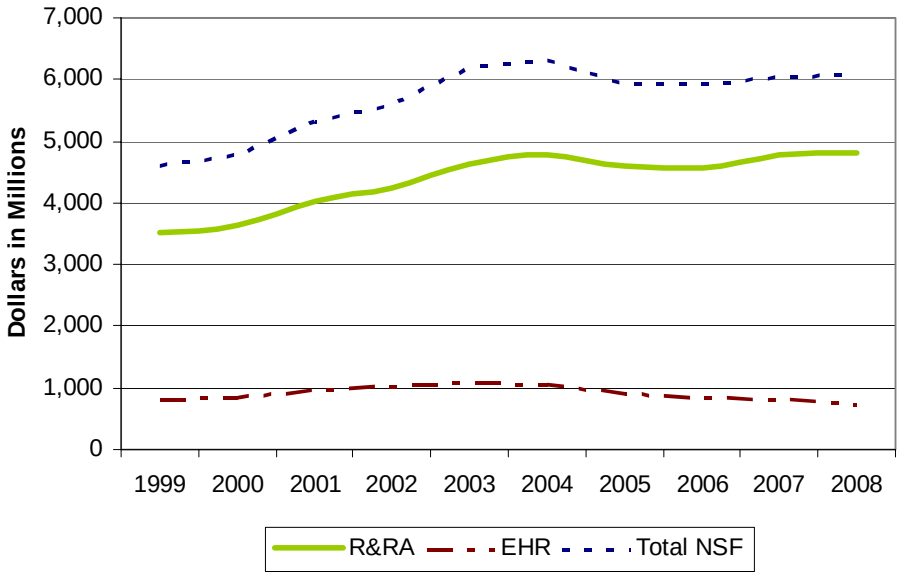
[1] National Science Foundation, *Federal Funds for Research and Development: Fiscal Years 2004- 2006*, Detailed Statistical Tables, NSF07-323, Arlington, VA, June 2007, Table 10.

[2] The NSF does not provide funding for research in clinical medicine, commerce, social work, or the arts and humanities. However, its investments in basic research contribute to scientific advances in drug delivery, regenerative medicine, and the design and manufacturing of pharmaceuticals.

The NSF provides support for investigator-initiated, merit-reviewed, competitively selected awards, state-of-the-art tools, instrumentation and facilities. NSF receives approximately 42,000 proposals for research, graduate and postdoctoral fellowships, and science, mathematics, and engineering projects annually, and makes about 10,000 new funding awards. Support is provided to academic institutions, industrial laboratories, private research firms, and major research facilities and centers. While NSF does not operate any laboratories, it does support Antarctic research stations, selected oceanographic vessels, and national research centers. Additionally, NSF supports university-industry relationships and U.S. participation in international scientific ventures.

The majority of the research supported by the NSF is conducted at U.S. colleges and universities. Approximately 82.7% ($3,094.8 million) of NSF's estimated FY2006 $3,740.6 million research and development (R&D) budget was awarded to U.S. colleges and universities. Preliminary data reveal that in FY2006, NSF provided approximately 59.8% 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.[3]

Figure 1. NSF R&D Support in FY2008 Constant Dollars FY1999-FY2008



Source: *National Science Foundation FY2009 Budget Request to Congress*, Summary Tables - 18.

---

[3] While the FY2006 R&D appropriation of $3,740.6 million for NSF was only 3.5% of the total federal R&D budget, the agency plays a significant role in maintaining the academic research enterprise. Preliminary FY2006 data reveal that the NSF provided 13.1% of all federally supported basic research and 12.9% of federal academic research. In addition, NSF was the second largest federal supporter of academic research in FY2006, eclipsed by the Department of Health and Human Services, which provided 66.3%. The Department of Defense, the third largest supporter of academic research, provided 7.8%. *Federal Funds for Research and Development: Fiscal Years 2004-2006*, Tables 10 and 29.

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

Organization and FY2009 Request. The NSF has witnessed considerable growth during a period of constrained research budgets. When measured in current dollars, its total appropriation increased approximately 64.3% in 10 years — FY1999, $3,690.3 million; FY2003, $5,369.3 million; and FY2008, $6,065.0 million. Even when inflation is taken into account, its growth increased 32.3% during this 10-year period. The FY2009 request for the NSF is $6,854.1 million, a 13% increase ($789.1 million) over the FY2008 estimate of $6,065.0 million. President Bush has proposed doubling the NSF budget over 10 years, from FY2007 to FY2016, as part of his American Competitiveness Initiative (ACI). The FY2009 request represents another installment toward that doubling effort. NSF has identified several strategies in the FY2009 budget request: to maintain a portfolio with "powerful momentum" across all disciplines; to build a world-class science and engineering workforce; to perform effectively with the highest standards of accountability; and to support potentially transformative research. Transformative research is described as "cutting edge" and revolutionary and several reports have recommended that funds be allocated specifically for this type of research.[4] NSF contends that in the global environment of science and engineering, support for transformative, high-risk, high-reward research is critical to U.S. competitiveness.

The FY2009 request provides support for seven major directorates and other programs and activity accounts. The Research and Related Activities (R&RA) account is funded at $5,594.0 million in the FY2009 request, 16% above ($772.5 million) the FY2008 estimate. R&RA funds research projects, research facilities, and education and training activities. R&RA includes Integrative Activities (IA), and is a source of funding for the acquisition and development of research instrumentation at U.S. colleges and universities, disaster research teams, Partnerships for Innovation, and the Science and Technology Policy Institute. The FY2009 request for IA is $276.0 million. The Office of Polar Programs (OPP), funded in the R&RA, is proposed at $490.1 million in the FY2009 request. 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 in the R&RA account. The seven major directorates are described below.

Biological Sciences (BIO). The FY2009 request of $675.1 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 to be provided include research workshops, symposia, conferences, the improvement of research collections, purchase of scientific equipment, and operation of research facilities.

---

[4] FY2008 appropriation report language directs NSF to review its polices concerning transformative research. Appropriators have directed the agency to issue a report suggesting how transformative research can be included in NSF's portfolio of research activities.

Computer and Information Science and Engineering (CISE). The CISE Directorate is proposed at $638.8 million in the FY2009 request. Programs in CISE focus 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 emphasis include parallel processing, automation and robotics, large-scale integrated electronic systems, scientific computing, and networking.

Education and Human Resources (EHR). The FY2009 request of $790.4 million for EHR supports science, engineering, mathematics, and technology education at all educational levels. People receiving funding from the EHR include senior researchers, postdoctoral associates, graduate and undergraduate students, and teachers and students at the precollege level. Additional support is provided to individuals through informal science activities.

Engineering (ENG). The activities of the ENG, at $759.3 million in the FY2009 request, are directed at enhancing the long-term economic strength and security of the nation by fostering innovation and excellence in engineering education and research. The ENG is focused on integrating education and research in interdisciplinary areas such as information and communication technologies, biotechnology, and environmental research.

Geosciences (GEO). The FY2009 request of $848.7 million for the GEO Directorate is to support 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 FY2009 request of $1,402.7 million for the MPS is to 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, proposed at $233.5 million in FY2009, is to support 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 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 and Facilities Construction (MREFC) account is funded at $147.5 million in the FY2009 request, a decrease of $73.2 million from the FY2008 estimate. The MREFC supports the acquisition and construction of major research facilities and equipment that extend the boundaries of science, engineering, and technology. First priority for funding is directed at ongoing projects, and second priority is given to new starts. The FY2009 request supports three ongoing projects: Advanced Laser Interferometer Gravitational Wave Observatory ($51.4 million), Atacama Large Millimeter Array ($82.3 million), and the

IceCube Neutrino Observatory ($11.3 million). The request also provides $2.5 million to support design activities for a new start, the Advanced Technology Solar Telescope.[5]

The FY2009 request for the EHR Directorate is $790.4 million, $64.8 million (8.9%) above the FY2008 estimate. The EHR portfolio is focused on, among other things, increasing the technological literacy of all citizens; preparing the next generation of science, engineering, and mathematics professionals; and closing the achievement gap of underrepresented groups in all scientific and technical fields. Support at the various educational levels in the FY2009 request is as follows: research on learning in formal and informal settings (including precollege), $226.5 million; undergraduate, $219.8 million; and graduate, $190.7 million. Priorities at the precollege level include research and evaluation on education in science and engineering ($42.0 million), informal science education ($66.0 million), and Discovery Research K-12 ($108.5 million). Discovery Research is structured to combine the strengths of three existing programs and encourage innovative thinking in K-12 science, technology, engineering, and mathematics education.

Policy Issues. In September 2006, the NSF released the report, *Investing in America's Future- Strategic Plan FY2006-2011*.[6] The report addresses the accelerating pace of scientific discoveries that are occurring in a more competitive international environment. The *Strategic Plan* lists several investment priorities that are targeted for increased emphasis or funding over the next five years. The investments include furthering U.S. economic competitiveness; promoting transformational, multidisciplinary research; improving K-12 teaching and learning in science and mathematics; developing a comprehensive, integrated cyberinfrastructure; and strengthening the nation's collaborative advantage through unique networks and innovative partnerships.

There has been considerable debate in the academic and scientific community and in Congress about the management and oversight of major projects selected for construction and the need for prioritization of potential projects funded in the MREFC account. One continuing question has focused on the process for including major projects in the upcoming budget cycle. In a management report on major projects, NSF contends that because of the changing nature of science and technology, it is necessary to have the flexibility of reconsidering facilities at the various stages of development.[7] In addition, NSF asserts that it must be able to respond, effectively, to possible changes in interagency participation, international and cooperative agreements, or co-funding for major facilities. NSF maintains that while some "concepts" may evolve into major research projects, others may prove infeasible for project support.

---

[5] For expanded discussion of the MREFC account see CRS Report RS21267, *National Science Foundation: Major Research Equipment and Facility Construction*, by Christine M. Matthews.

[6] National Science Foundation, *Investing in America's Future-Strategic Plan FY2006-2011*, NSF06-48, Arlington, VA, September 2006, 19 pp.

[7] National Science Board, *Setting Priorities for Large Research Projects Supported by the National Science Foundation*, NSB05-77, Arlington, VA, September 2005, 31 pp.

In February 2008, NSF released its third annual *Facility Plan*.[8] The *2008 Facility Plan* covers readiness stage projects through those projects that are in the process of completion. The *Facility Plan* describes NSF's goals and strategies for incorporating the existing approaches and practices into a system for selecting, managing, and overseeing large facility projects to make certain that a large facility is both constructed properly and is the appropriate facility to build. All projects seeking funding in the MREFC move through a "progressive sequence of increasingly detailed development and assessment steps" in order to be considered for construction support. The *Facility Plan* is consistent with the vision detailed in NSF's report, *Investing in America's Future, FY2006-FY2011*.

Several pieces of competitiveness legislation have been introduced in the 110th Congress to strengthen science and mathematics education. There are concerns about the nation's continued ability to compete in world markets and to produce a scientific and technical workforce that would ensure economic prosperity and military capability. A priority of the NSF is to advance the productivity of research for students and teachers and to increase the number of U.S. students pursuing scientific and technical disciplines. However, the FY2009 request proposed reductions for some science education programs. The America COMPETES Act authorized increased funding for selected science and mathematics education programs, and the establishment of some new programs. Several of these programs did not receive the authorized level of funding in the FY2009 budget request that was contained in the COMPETES Act.[9] Support for EHR has declined from $849.9 million[10] in FY2004 to $790.4 million in the FY2009 request. Questions are being raised as to whether the NSF can effectively continue in its explicit mission and responsibility to improve science and mathematics education.[11]

On June 25, 2008, the House Committee on Appropriations approved the Commerce, Justice, Science, and Related Agencies Appropriations Bill for FY2009. The House Committee-approved draft bill would provide $6,854.1 million for the NSF in FY2009, $789.1 million above the FY2008 enacted level and the same as the President's request. The R&RA would receive $5,554.0 million, a $722.7 million increase above the FY2008 level and $49.9 million below the request. Additional funding in the House bill includes $840.3 million for the EHR and $147.5 million for MREFC. The Senate-reported bill of June 19, 2008, would provide $6,854.1 million for the NSF, the same as the House bill and the request. R&RA would be funded at $5,594.0 million, $40.0 million above the House bill and the same as the President's request. The Senate-reported bill would fund the EHR and the MREFC at $790.4 million and $152 million, respectively.

---

[8] National Science Foundation, *2008 Facility Plan*, NSF08-24, Arlington, VA, February 2008, 44 pp.

[9] See CRS Report RL34396, *The America COMPETES Act and the FY2009 Budget*, by Deborah D. Stine.

[10] Excludes funding for the Experimental Program to Stimulate Competitive Research (EPSCoR) for comparability. In FY2008, EPSCoR was transferred from the EHR to the R&RA account.

[11] See for example National Science Board, *A National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System*, NSB07-114, Arlington, VA, October 30, 2007, 92 pp.