National Science Foundation Fiscal Year 2002 Budget Request Overview

The National Science Foundation requests $4.47 billion for Fiscal Year 2002, $56.1 million or 1.3 percent over FY 2001. This investment in the nation's future will train young scientists and engineers, create new knowledge, and develop cutting-edge tools that together will fuel economic prosperity and increase social well-being in the years ahead. NSF will provide leadership in the President's Math and Science Partnership, and sustained investments in NSF's core programming will contribute to progress across science and engineering.

Nothing is more central to the nation's prosperity than the ability to create and make use of knowledge. The technological innovation that is driving productivity gains in American industry depends increasingly on fundamental scientific research. Over the past five years alone, the information technology sector, which accounts for 8.3 percent of U.S. GDP, accounted for almost one-third of U.S. economic growth.

Today, however, global communications and rapid technological change have raised the bar on competition. Scientific knowledge is becoming the most sought after commodity in the world. The U.S. ranks only 6th among OECD nations in the share of GDP devoted to research and development. And, the latest results of international testing confirm that we need to strengthen math and science education at all levels. A 24-year-old in Japan is three times more likely than one in the U.S. to hold a bachelor's degree in engineering. In South Korea, the figure is 2.7 times; and in the European Union, 1.6. Securing U.S. world leadership in science and technology has never been more important to the future of the nation.

The productivity of the U.S. scientific and engineering community – the fruits of which can be seen in the information technology, communications, and biotechnology industries – depends critically on NSF support of fundamental research. Although NSF accounts for under 4 percent of federal research and development spending, it supports roughly 50 percent of the non-medical fundamental research at our colleges and universities. With these same investments, NSF supports the training of scientists and engineers who will provide the highly skilled workforce required in the new knowledge-based economy. NSF's programs directly enable the work of nearly 200,000 scientists, engineers, teachers, and students each year.

Funding levels for each of NSF's five appropriation accounts are shown in the table below.

NSF Funding by Appropriation
(Millions of Dollars)

	FY 2001 Current Plan	FY 2002 Request	Percent Change
Research and Related Activities	3,342.63	3,326.98	-0.5%
Education and Human Resources [1]	785.62	872.41	11.0%
Major Research Equipment	121.33	96.30	-20.6%
Salaries and Expenses	160.54	170.04	5.9%
Office of Inspector General	6.27	6.76	7.8%
Total, NSF	$4,416.39	$4,472.49	1.3%

Totals may not add due to rounding.
[1] Does not include $121 million in FY 2001 and $144 million in FY 2002 from H-1B Nonimmigrant Petitioner Fees.

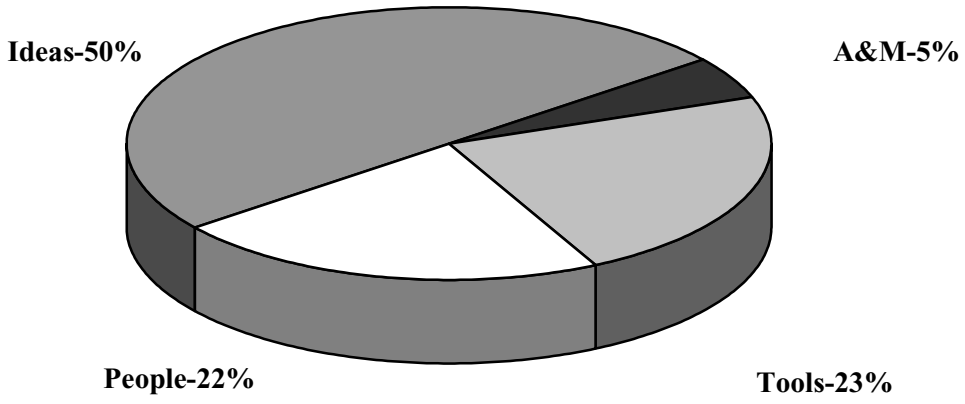
People, Ideas and Tools: NSF Strategic Goals

The FY 2002 Budget Request reflects NSF's strength – a broad base of research and education activities that provides the nation with the People, the Ideas, and the Tools needed to fuel innovation and economic growth. These are the three goals identified in the NSF strategic plan:

- **People –** *A diverse, internationally competitive and globally-engaged workforce*
- **Ideas –** *Discovery across frontiers, connected to learning, innovation and service to society*
- **Tools –** *Accessible, state-of-the-art information bases and shared tools*

People are NSF's most important product. They represent both the focus of our investments and the most important products of them. Support for programs specifically addressing NSF's Strategic Goal of People totals more than $1.0 billion in FY 2002, an increase of 12.8 percent over FY 2001. A major focus for these activities is in the Education and Human Resources (EHR) account. The EHR efforts are integrated with complementary efforts across the Foundation where the activities in the Research and Related Activities account contribute over $300 million of the $1.0 billion toward the People goal. Moreover, about 40 percent of the funding for research grants – an amount approaching $900 million in FY 2002 – provides support for researchers and students, including approximately 60,000 post doctorates, trainees, and graduate and undergraduate students. People generate the Ideas that are the currency of the new knowledge-based economy. Tools enable scientific discovery and provide access to unique education opportunities. They also open new opportunities for innovative applications well beyond the research arena. Advances in information technology are a striking example of this.

FY 2002 Budget Request of $4.47 Billion



These goals support NSF's mission to promote progress across all of science and engineering research and education. Funding levels associated with the Foundation's three strategic goals are shown in the table below.

NSF Budget by Strategic Goal
(Millions of Dollars)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate
People	816.11	888.31	1,002.19
Ideas	1,962.49	2,251.11	2,219.84
Tools	955.44	1,060.95	1,023.69
Administration and Management	189.32	216.03	226.77
Total, NSF	$3,923.36	$4,416.39	$4,472.49

Totals may not add due to rounding.
Does not include $25.1 million in FY 2000, $121 million in FY 2001, and $144 million in FY 2002 from H-1B Nonimmigrant Petitioner Fees.

HIGHLIGHTS AND PRIORITIES

The FY 2002 Budget Request builds on NSF's strength as the only agency of the federal government exclusively devoted to promoting basic research and education at all levels and across all fields of science and engineering.

Math and Science Partnership Initiative

The FY 2002 Budget Request proposes $200 million for the President's new Math and Science Partnership initiative. The purpose of this investment is to ensure that all K-12 students have the opportunity to perform to high standards. The Partnership initiative will provide funds for states and

local school districts to join with institutions of higher education, particularly with their departments of mathematics, science, and engineering, to strengthen K-12 math and science education. To accomplish this, the initiative will support a variety of partnership structures and approaches to address these issues:

- too few teachers who have been trained to teach math and science;
- too few schools offering a challenging curriculum with textbooks to support it; and
- too few students taking advanced course work.

The initiative will promote the development and use of effective, research-based approaches that can raise math and science standards for students, improve the quality of teachers and teaching materials, and create innovative ways to reach underserved schools. It will also emphasize the development of appropriate mechanisms to measure progress and assess accountability.

Financial Support for Graduate Students

The FY 2002 Budget will provide approximately $8.0 million (depending upon the number of awardees) to increase stipends for the Graduate Research Fellowships, the Graduate Teaching Fellowships in K-12 Education, and the Integrative Graduate Education and Research Traineeship programs. Stipends will increase from $18,000 to $20,500 for academic year 2002-2003. Financial support for graduate students in the science, mathematics, engineering, and technology disciplines is a critical component of ensuring a diverse and globally competitive workforce of scientists and engineers. Increasing stipends is one strategy to attract more U.S. citizens, nationals and permanent residents to graduate education in science and engineering. Currently, the average stipend level for graduate students in science and engineering disciplines is less than half the average wage for bachelor's degree recipients. This wide disparity may be a significant factor in declining graduate school enrollments for science and engineering disciplines. Between 1994 and 1997, first-time graduate school enrollments dropped 12.6 percent; enrollment figures for African-Americans fell 19.6 percent. A recent survey found that 57 percent of baccalaureate recipients did not apply to science and engineering graduate programs for financial reasons. Those with the largest undergraduate debt were least likely to continue on to graduate school. Underrepresented minorities were far more likely to borrow for undergraduate study and thus, account for a larger percentage of those citing financial reasons for not continuing their education.

Core Investments

NSF's "core" research and education activities sustain the health and vitality of the nation's science and engineering research and education in all fields and education at all levels. These funds support merit-reviewed research and education across the full NSF portfolio and will help provide balance across all fields. Investments in core research and education activities are essential to developing a diverse science and engineering workforce, and to advancing the frontiers of knowledge on a broad front.

A centerpiece of NSF's core investments in FY 2002 is the Interdisciplinary Mathematics program funded at $20.0 million. This emphasis on the mathematical sciences recognizes its increasingly critical role in advancing interdisciplinary science. Because mathematics is both a powerful tool for insight and a common language for science and engineering, this increased investment will accelerate exchange with other disciplines, bringing cutting-edge mathematics to problems in the physical, biological and social sciences. In FY 2002, NSF will focus on the management of large data sets, the modeling of uncertainty, and the modeling and prediction of complex non-linear systems. Some examples of the latter include studies of brain function, communication networks, modern economic behaviors, and the prediction of weather and ocean circulation.

Priority Areas

In addition to its investments in core research and education, NSF identifies and supports emerging opportunities in priority areas that hold exceptional promise to advance knowledge. The FY 2002 Budget Request emphasizes investments in four interdependent priority areas – Biocomplexity in the Environment (BE), Information Technology Research (ITR), Nanoscale Science and Engineering, and Learning for the 21st Century.

- **Biocomplexity in the Environment (BE)**. BE is a multidisciplinary effort that draws on new scientific and technological capabilities to investigate the interactions among ecological, social, and physical earth systems. The primary goal is to tackle the major challenge of synthesizing environmental knowledge across fields, systems, time, and space and forecasting the outcomes of those interactions. Computational and information technologies, real time sensing techniques, and genomics are some of the new probes of the dynamic web of interrelationships that arise when living things at all levels interact with their environment, that is, for understanding biocomplexity. The FY 2002 BE budget request builds on past investments in the core programs and in biocomplexity. For example, recently funded investigators are studying complex interactions shaping ecosystems of freshwater bays and lagoons, contaminant flux of the lower Mississippi River, dynamics of an invasive non-native species on the Pacific Coast, and marine mammal abundance in the western Arctic Ocean. BE will also invest in the development of new research instruments and software that will advance cross-disciplinary studies in the environment.

- **Information Technology Research (ITR)**. This priority area deepens research on software, networking, scalability, and communications to improve ways to gather, store, analyze, share, and display information. Because fundamental advances are possible in many areas where information technology meets other scientific disciplines (the effect of IT on molecular biology and medicine is a striking example), the FY 2002 ITR budget request expands fundamental research in multidisciplinary areas. Studies will explore how to make large-scale networking, software, and systems more reliable, stable, and secure to enable applications from telemedicine, to interactive education, to the remote operation of experimental apparatus. Other research will improve our understanding of human-computer interactions, and investigate the impact of IT on our society, on our economy, and on our educational system. Because the information technology sector has contributed substantially to recent U.S. economic growth, these investments remain a top priority. A specific emphasis area for FY 2002 is the interface of IT and biological research to evoke new cyber-information infrastructure.

- **Nanoscale Science and Engineering**. This priority area explores phenomena at molecular and atomic scales and new techniques to facilitate a broad range of applications. Recent advances have already begun to spawn useful new materials and promising innovations that will touch every part of our lives, from our medicine cabinets – with targeted drug delivery systems, vaccines, and electronic biosensors to detect cancer in its earliest stages – to our workplace, with faster, more efficient computers and networks. As countries currently compete for global preeminence in these technologies, this investment will strengthen U.S. leadership and boost efforts to build a nanotech-ready workforce. Activities range from investigation of biologically based systems that exhibit novel properties (useful for developing materials for implants) to the study of nanoscale control of structure and composition in new materials, as well as studies of the potential impact of nanotechnology on society.

- **Learning for the 21st Century**. The FY 2002 budget request for this priority area funds activities to expand our fundamental knowledge base on learning, explore the potential of information technology to facilitate and enhance learning, and integrate new understanding of learning and

technology into formal and informal educational settings. Research in cognitive neuroscience, computational linguistics, human-computer interactions, and learning environments will advance understanding of how students learn, frame questions, solve problems and employ skills to derive answers. Research, development and testing of educational tools incorporating information technology will provide a better understanding of how they can be used effectively in the classroom. Investments in Centers for Learning and Teaching, which link K-12 and higher education, will provide opportunities for teachers to gain new skills in the use of information technology in education, new knowledge in science and mathematics, and will allow them to integrate these with new research on learning. Applications of research results will increase opportunities for higher achievement for all students and produce a workforce able to meet the challenges of rapid scientific and technological change.

Funding levels for each of these priority areas are shown in the table below.

NSF Funding by Priority Area
(Dollars in Millions)

Priority Area	FY 2001 Current Plan	FY 2002 Request	Percent Change
Biocomplexity in the Environment	54.88	58.10	5.9%
Information Technology Research	259.43	272.53	5.0%
Nanoscale Science and Engineering	149.68	173.71	16.1%
Learning for the 21st Century	121.46	125.51	3.3%
Total, Priority Areas	$585.45	$629.85	7.6%

Totals may not add due to rounding.

Additional FY 2002 Highlights

Children's Research Initiative (CRI). Support for the Children's Research Initiative (CRI) is maintained at $5.0 million in FY 2002. The CRI focuses on theory-driven, policy-related research on children, learning, and the influence of families and communities on child development. The CRI also will support research related to enhancing literacy and improving math and science skills.

EPSCoR. Funding for EPSCoR (the Experimental Program to Stimulate Competitive Research) will total nearly $100.0 million. This includes $74.81 million provided through the Education and Human Resources appropriation, and up to $25.0 million provided through NSF's Research and Related Activities account, to enable EPSCoR researchers to participate more fully in NSF research activities.

H-1B Nonimmigrant Petitioner Fees. As provided in recent legislation to strengthen the technology workforce, approximately $144.0 million is anticipated from H-1B nonimmigrant fees for:

- Computer Science, Engineering and Mathematics (CSEM) Scholarships that provide a wide range of opportunities for study and training; and
- Private-Public Partnerships in K-12, covering activities in a range of areas such as the development of instructional materials, student externships, and professional development for math and science teachers.

Major Research Equipment. The Major Research Equipment account for FY 2002 will fund three continuing projects:

- Network for Earthquake Engineering Simulation ($24.40 million). The George E. Brown Jr. Network for Earthquake Engineering Simulation is a national collaboratory of approximately 20 geographically-distributed, shared-use experimental research equipment sites linked by a high performance Internet network and designed to facilitate earthquake engineering research and education.

- Large Hadron Collider ($16.90 million). The Large Hadron Collider, an internationally funded collaboration, is a superconducting particle accelerator that will advance fundamental understanding of matter. One example is a search for the Higgs particle, the existence and properties of which will provide a deeper understanding of the origin of mass of the known elementary particles. It will also enable a search for particles predicted by a powerful theoretical framework known as supersymmetry which will provide clues as to how the four known forces evolved from different aspects of the same "unified" force in the early universe.

- Terascale Computing System ($55.0 million). Funding supports the new terascale computing systems that will enable U.S. researchers in all science and engineering disciplines to gain access to leading edge computing capabilities in order to address problems of scope and scale that are inaccessible on current systems.

Plant Genome Research Program. The FY 2002 budget provides $65.0 million to support ongoing research on genomics of plants of major economic importance. The long-term goal of this program is to understand the structure, organization and function of plant genomes important to agriculture, the environment, energy and health.

2010 Project. With the completion of the genome of the model plant *Arabidopsis* in FY 2001, researchers began a systematic effort to determine the functions of the 20,000 to 25,000 genes of this flowering plant. Knowledge of the functions of the *Arabidopsis* genes will be of great value in understanding the basic biological processes in all flowering plants and in creating better products for society, from food to pharmaceuticals to environmentally benign agricultural and waste-treatment processes. The 2010 project is funded at $20.0 million in FY 2002.

Science and Technology Centers. The FY 2002 budget provides $25.62 million to initiate a new cohort of Science and Technology Centers in topics that span the range of disciplines supported by NSF.

Graduate Fellowships for K-12 Education (GK-12). The FY 2002 budget request for the GK-12 program totals $26.17 million. This program puts graduate students in K-12 classrooms, and exposes them to the opportunities and challenges of K-12 teaching, while introducing K-12 students and teachers to active researchers.

Increasing Management Efficiency.

The FY 2002 Budget Request provides $170.04 million for Salaries and Expenses, an increase of $9.50 million, or 5.9 percent, over FY 2001. This increase will improve NSF's ability to administer and manage its growing portfolio of program activities. Over the past decade, funding for NSF administration and management has remained relatively flat, despite robust increases in program responsibilities and budgets. While NSF has compensated for an increased workload by investing in information technology,

workload pressures are mounting in the areas of systems and data management, program management, and staffing and resource management. This year, NSF will complete work on a 5-year workforce plan, based on an already completed workforce planning study, that will delineate future needs in this area.

With the aim of further increasing efficiency, NSF will evaluate the need for management reforms in several other areas.

- NSF will complete a study, with the assistance of U.S. academic research universities, to determine whether increasing the average NSF grant size and duration would produce greater efficiency in the research process. One focus will be an assessment of whether time spent in writing proposals detracts significantly from time that would otherwise be spent conducting research.
- To enhance its capacity to manage multi-year, large facility projects, NSF is developing a plan to strengthen its ability to estimate costs and provide oversight of project development and construction. The plan will address the steps needed to expand current capacity and systems to accommodate new projects awaiting approval for funding. This management tool will help ensure that NSF is able to meet cost and schedule commitments for an expanded portfolio of major facility projects.

- In addition, NSF will work in partnership with NASA to convene a Blue Ribbon Panel to assess the effectiveness of the current organization of Federal support for astronomical sciences. NASA and NSF will turn over the undertaking of the study to the National Academy of Sciences.

Conclusion

Scientists, engineers, and educators in almost every field are on the threshold of new discoveries that could fundamentally change the products and processes of industry, spawn whole new sectors of the economy, and revolutionize teaching and learning at all levels. The investments proposed in NSF's FY 2002 Budget Request will help ensure that the U.S. keeps pace with these expanding opportunities in science and technology.