Fiscal Year 2001
Budget Request Overview

The National Science Foundation requests $4.572 billion for Fiscal Year 2001, $675 million or 17.3% over FY 2000. The FY 2001 Budget Request will invest in the innovative ideas, outstanding people and cutting-edge tools that our nation needs for a 21st Century research and education enterprise – an enterprise that paves new roads to discovery, addresses national science and engineering priorities, and commits itself to a world-class science, engineering, and technology workforce. NSF's investments reflect the Foundation's three strategic goals:

- Ideas - Discovery at and across the frontier of science and engineering, and connections to its use in the service of society.
- People - A diverse, internationally competitive and globally-engaged workforce of scientists, engineers and well-prepared citizens.
- Tools - Broadly accessible, state-of-the-art information bases and shared research and education tools.

NSF's investments in Ideas, People and Tools work in concert to support the agency's mission to maintain U.S. leadership in all aspects of science and engineering research and education. Funding levels associated with the Foundation's three strategic goals are shown in the table below.

NSF Funding by Strategic Goal
(Millions of Dollars)

	FY 2000 Current Plan	FY 2001 Request	Percent Change
Ideas	1,972.62	2,424.92	22.9%
People[1]	801.06	887.54	10.8%
Tools	934.41	1,044.83	11.8%
Administration and Management	189.09	215.11	13.8%
Total, NSF	$3,897.18	$4,572.40	17.3%

[1] Does not include $33 million in FY 2000 and $31 million in FY 2001 from H-1B Nonimmigrant Petitioner Fees.

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

NSF Funding by Appropriation
(Millions of Dollars)

	FY 2000 Current Plan	FY 2001 Request	Percent Change
Research and Related Activities	2,958.46	3,540.68	19.7%
Education and Human Resources [1, 2]	690.87	729.01	5.5%
Major Research Equipment	93.50	138.54	48.2%
Salaries and Expenses	148.90	157.89	6.0%
Office of Inspector General	5.45	6.28	15.2%
Total, National Science Foundation	$3,897.18	$4,572.40	17.3%

[1] Does not include $33 million in FY 2000 and $31 million in FY 2001 from H-1B Nonimmigrant Petitioner Fees.
[2] While EHR is the major focus of NSF's investment in education and training and increases by 5.5%, NSF's total investment in People increases by 10.8%.

Everyone marvels at the speed and vitality of today's powerful, high-tech economy that has created unprecedented wealth and millions of new, high paying jobs. The United States today is in the midst of the longest peacetime economic expansion in our history. In a speech last spring, Federal Reserve Chairman Alan Greenspan said that the "phenomenal" performance of the U.S. economy, with its strong growth, low inflation, low unemployment, and high business profits, is due in large part to technological innovations.

Today's innovations are the outgrowth of discoveries made in the fundamental scientific and engineering disciplines over the last quarter century or longer. For example:

- Microelectronics and related industries, enabled by 50 years of discoveries in condensed matter physics, materials science and engineering, and electrical engineering and computer science, account for millions of jobs in the United States today.

- Understanding the structure and properties of DNA — a process that has been on-going since the 1950's — is today the basis for a new and dynamic biotechnology industry that has made dramatic contributions to agriculture, the environment, and human health.

- Information technology — from its infancy with the computer ENIAC in the 1940's, to bar code scanners in supermarkets, to the Internet — is in the process of transforming all sectors of life, leisure, learning, research, and the economy.

NSF investments in ideas, people, and tools have produce world-class achievements throughout the latter half of the 20th century. NSF-supported researchers have been awarded over 100 Nobel Prizes in physics, chemistry, physiology, and economics; and over half of the Turing awardees have received NSF support. (The Turing Award recognizes contributions of lasting and major technical importance to the computer field.) Just as today's economic success is fueled by yesteryear's science and engineering achievements, so our dreams for tomorrow will be enabled by today's achievements. As Vannevar Bush wrote 50 years ago, *"Science is an endless frontier;"* there will be more exciting opportunities in the future because of research investments made today. For example:

- Nanoscale science and engineering is allowing us to build nanometer machines so small that they are rapidly approaching the scale of human cells. A nanometer is to an inch what an inch is to 400 miles. We are on the verge of building machines on the nanometer scale — atom by atom, molecule by molecule.

- Quantum computing or DNA computing may revolutionize the way in which we collect, process, store and distribute information in the future.

- Advances in the mathematical sciences increasingly underpin and enable advances in all areas of science, engineering and technology. For example, mathematics is expanding the impact of digitalization afforded by powerful computational tools, increasing the ability to analyze massive data collections, increasing the richness of simulation models, and providing powerful new ways to handle probability and uncertainty issues.

- The rapid pace at which new technologies are deployed is having a dramatic social and cultural impact. Understanding the impacts of technological change could change the scope and manner in which new technologies are deployed, improving our lives and the lives of our children.

In the new century, NSF faces daunting challenges and breathtaking possibilities: responding to emerging opportunities, broadening scientific participation by all members and regions of our nation, strengthening the connections between scientific discovery and technological innovation, modernizing the nation's research and education infrastructure, and positioning the U.S. to benefit from the global investment in science, engineering, and technology. The FY 2001 Budget Request will allow the NSF to meet these challenges with a combination of strengthened support of core investments and focused initiatives that address particular opportunities.

Highlights and Priorities

The FY 2001 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.

Investing in People

People are NSF's most important product. At NSF, placing research and learning hand in hand is our highest priority, and the people involved in our projects represent both the focus of our investments and the most important products of them. Across the Foundation's programs, NSF provides support for almost 200,000 people, including teachers, students, researchers, post-doctorates, and trainees. Support for programs specifically addressing NSF's Strategic Goal of "People — A diverse, internationally competitive and globally-engaged workforce of scientists, engineers and well-prepared citizens" totals more than $887 million in FY 2001, an increase of almost 11 percent over FY 2000. A major focus for these activities is in the Education and Human Resources (EHR) account. The EHR efforts are integrated with complementary activities across the Foundation where the research directorates contribute over $300 million of the $887 million toward the People goal. Moreover, about 40 percent of the funding for research grants — an amount approaching $1 billion in FY 2001 — provides support for researchers and students, including more than 61,000 post-doctorates, trainees, and graduate and undergraduate students.

Strengthening Core Investments

The request devotes $320 million to increases in core disciplinary research that extends the frontiers of science and engineering. These activities sustain the flow of new discoveries that fuel the development of new technologies, lead to new markets and new tools for discovery and learning, and make possible interdisciplinary initiatives. For example, we are now relying increasingly on fundamental mathematics to understand key aspects of living systems – such as how microbes develop drug resistance and how viruses (e.g. HIV) can become dormant and undetectable for long periods.

Examples of investment in core research include:

- Links between quantum theory and fundamental mathematics: mathematicians and physicists together are gaining insight into diverse topics, such as the fundamental makeup of matter, the nature of the chemical molecular bond, and the development of new materials.

- Research on the key physical, chemical and geologic cycles within the Earth System: including improved understanding of the primary processes involved in the large-scale water cycle, which will provide knowledge of the regional distribution of water and enhance the ability to predict and prepare for droughts and floods.

- Research in the psychological, cognitive, and language sciences: to provide a sharper picture of how human language is acquired and how it is used, both for thought and communication, thus laying the foundation for progress in many areas of national importance, from teaching children how to read to building computers that can talk.

- Research in functional genomics: developing and applying methods for linking genetic sequence data to intercellular and organismal functions has great practical value for biotechnology applications.

These funds will support merit-reviewed research across the full NSF portfolio and will help provide balance across all science and engineering fields. The $320 million increase, coupled with the $355 million increase for focused initiatives, described below, will support a greater number of researchers and educators who will help enable tomorrow's breakthroughs. Grant size and duration will also be increased to improve the efficiency and effectiveness of the academic research enterprise. In addition, NSF will pay increased attention to broadening and diversifying participation in all of its programs, including increasing the proportion of research grants going to new investigators – an ongoing goal for the Foundation.

Focused Initiatives

In FY 2001, in addition to support for core research, education and tools, NSF will emphasize priority investments in four interdependent initiative areas - **Information Technology Research (ITR), Nanoscale Science and Engineering, Biocomplexity in the Environment (BE),** and **21st Century Workforce.** These areas combine exciting opportunities in research and education with immense potential to generate important benefits to society. Because the Foundation is committed to these areas, $135 million has been reallocated from the base to be added to $355 million of new funding.

- **Information Technology Research (ITR).** NSF is the lead agency for the multi-agency IT R&D program. Advances in software, networking, scalability, high-end computing, mathematics, research applications, wireless networking, communications and remote sensing will enable the entire science and engineering community to work more productively and to examine issues that were previously too complex to address with the existing information technology. Investments in IT will deliver tools and capabilities that will benefit every field, every discipline and people at every level of education. For example, sophisticated techniques for designing and constructing software could ultimately be used by the private sector to develop new markets and to speed reliable and robust information appliances to consumers and information systems to industry. Understanding the social and cultural impacts of technological change could change the scope and manner in which new technologies are deployed, improving our lives and the lives of our children.

- **Nanoscale Science and Engineering.** Nanoscale science and engineering promise to yield a dominant technology for the 21st Century because the control of matter at the nanoscale underpins innovation in critical areas from information technology and medicine to manufacturing and the environment**.** To capitalize on this opportunity advances in fundamental knowledge, innovation, and technique must be made before many of the practical benefits can be realized. Possible future uses of nanotechnology include artificial photosynthesis for clean energy and computer chips capable of storing trillions of bits of information on an area the size of a pinhead.

- **Biocomplexity in the Environment (BE).** BE is a multidisciplinary approach to understanding our world's environment. The FY 2001 BE budget request capitalizes upon FY 1999 and FY 2000 investments in support of focused initiatives aimed at understanding the many complex systems that are structured or influenced by living organisms or biological processes. Due to the advent of new tools and technologies, investigators are poised to gain a better understanding of how these systems function together across widely varying scales of time (milli-seconds to epochs) and space (individual cells to large ecosystems). This investment will have enormous payoff in the years ahead, including increased understanding of the relationship between the environment and human health, discoveries relevant to growing industries such as biotechnology, and enhanced predictability of environmental systems that will assist environmental decision makers.

- **21st Century Workforce.** This initiative builds on NSF's FY 2000 theme of *Educating for the Future: A 21st Century Workforce*. The long-term goal is to generate a 21st Century workforce that is second to none, and to bring increased understanding of science, mathematics and technology to citizens of all ages. Research on the science of learning, development of the instructional workforce and diversifying the general workforce are the foci of this initiative. Improving understanding of how people think and learn will establish a knowledge base for educators to use in developing more effective teaching/learning methods for citizens of all ages and cultures. Fully engaging the broad spectrum of America's diversity is necessary to create this 21st Century science and engineering workforce.

Funding levels for each of these initiative areas are shown in the table below:

NSF Funding by Initiative
(Dollars in Millions)

Initiative	FY 2000 Current Plan	FY 2001 Base Reallocation	FY 2001 New Funding	FY 2001 Request	Percent Change
Information Technology Research	126.00	20.91	180.00	326.91	159.5%
Nanoscale Science and Engineering	97.30	50.35	69.00	216.65	122.7%
Biocomplexity in the Environment	50.00	20.31	66.00	136.31	172.6%
21st Century Workforce	73.66	43.39	40.00	157.05	113.2%
Total, Initiatives	$346.96	$134.96	$355.00	$836.92	141.2%

Additional FY 2001 Highlights

Major Research Equipment. In the Major Research Equipment account we will add over $45 million including almost $30 million to begin two new projects - EarthScope: USArray and San Andreas Fault Observatory at Depth (SAFOD) and the National Ecological Observatory Network (NEON). EarthScope: SAFOD/USArray is an array of instruments that will allow scientists to observe earthquake and other earth processes at much higher resolution. NEON is a pole-to-pole network with state-of-the-art infrastructure platforms and equipment to enable 21st Century ecological and biocomplexity research. In addition, support will be provided to continuing projects.

Cyber Security for the 21st Century – Critical Infrastructure Protection (CIP). In FY 2001 NSF, in partnership with the Office of Personnel Management, is developing a new program that will offer college scholarships to students with concentrations in information security in exchange for their public service after graduation. This program will create a new generation of computer security specialists who will work to defend our nation's computer systems and networks. For this interagency initiative, NSF will invest $11.2 million. In addition, NSF will invest approximately $33 million for research on computer security.

GLOBE. NSF continues its participation in the interagency Global Learning and Observations to Benefit the Environment Initiative (GLOBE) program, providing $2 million in FY 2001. GLOBE provides environmental science education to K-12 students in more than 3,500 schools and 45 countries.

H1-B Nonimmigrant Petitioner Fees. As provided in recent legislation to strengthen the technology workforce, $31 million is provided from H1-B nonimmigrant fees for scholarships, enrichment courses, and systemic reform activities, consistent with other NSF investments in advanced technological education.

EPSCoR. Funding for EPSCoR (the Experimental Program to Stimulate Competitive Research) will total up to $73 million. This includes $48 million provided through the Education and Human Resources appropriation, and up to $25 million provided through NSF's Research and Related Activities account, to enable EPSCoR researchers to participate more fully in NSF research activities.

Celebrating 50 Years

When NSF was founded, we understood very little about many things that we take for granted today. For example, we did not know what biological mechanisms controlled genetic changes; computers — the handful that existed — were made from vacuum tubes; much of the inner workings of the brain were a mystery; lasers, if they could be imagined at all, were subjects only of science fiction; and most of the revolutionary knowledge that we have today about the cosmos has been discovered in the last 25 years.

In May 2000, NSF will celebrate its 50th birthday, and in so doing, will celebrate the outcomes of investments made during its lifetime. In commemoration of its 50th birthday, NSF is compiling fifty examples of societal achievements that span its existence. This compilation will be published and placed on NSF's website later this year.

With such a broad range of accomplishment over the years it has been difficult to select just fifty specific examples, let alone one. The following case in point describes one of the many outstanding successes that is the culmination of work by several NSF supported researchers over a period of time.

NSF's role in addressing fundamental problems can be traced back to its first cohort of five grants made in 1951. One of these awards — for $5,000 — entitled "Mechanisms Underlying Genetic Recombination in Bacteria", went to Dr. Max Delbruck, a physicist who had been studying genetic changes in the most simple of organisms, bacteria.

The results of Delbruck's work and teaching contributed to the rise of modern molecular genetics. Delbruck won the Nobel Prize in 1969. One of Delbruck's students, Dr. James Watson, went on to discover the structure of the DNA molecule — for which he and Francis Crick won the Nobel Prize in 1962. Another Delbruck student, Renato Delbecco, with David Baltimore and Howard Temin, won a Nobel Prize in 1975 for their adaptation of Delbruck's techniques to the study of animal viruses.

Today we are reaping the fruits of this important early work. We are in the midst of an age of genomics, the biotechnology industry is a multibillion-dollar industry, and the United States is the world leader in biotechnology with applications from agriculture to aquaculture to pharmaceuticals. The genomics revolution is enabling the study of whole genomes rather than single genes, giving us a perspective on living systems that we've never had before.

Fundamental questions such as the mystery of the genome were unlocked only through the imagination, daring, and dedicated work of very talented scientists and engineers. Such work required long-term support, much of it by the National Science Foundation and other federal agencies. Indeed, history has demonstrated that many federally supported discoveries have echoed throughout the years, spawning even greater breakthroughs and innovations.

The National Science Policy Report — endorsed by the House of Representatives in 1998 — captured this very point.

The federal investment in science has yielded stunning payoffs. It has spawned not only new products, but also entire industries. To build upon the strength of the research enterprise we must make federal research funding stable and substantial, maintain diversity in the federal research portfolio, and promote creative, groundbreaking research.

Looking ahead, NSF will continue to invest in the most promising areas of science and engineering research and education. We can be certain that the results will enhance the nation's future in profound and as yet unimagined ways.