NSF Investments and Strategic Goals

NSF's investments reflect the Foundation's three strategic goals:

- People – Developing "a diverse, internationally competitive and globally engaged workforce of scientists, engineers and well-prepared citizens."
- Ideas – Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."
- Tools – Providing "broadly accessible, state-of-the-art information-bases and shared research and education tools."

NSF's investments in People, Ideas, and Tools work in concert to support the agency's mission to promote progress in all aspects of science and engineering research and education.

NSF Budget by Strategic Goal
(Millions of Dollars)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate
People	816	888	1,002
Ideas	1,962	2,251	2,220
Tools	955	1,061	1,024
Administration and Management	189	216	227
Total, NSF[1]	$3,923	$4,416	$4,472

Totals may not add due to rounding.
[1]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.

People

At NSF, integrating research and learning is our highest priority, and the people involved in our projects represent both the focus of our investments and the most important outcomes of them. Across its science, mathematics, engineering, technology (SMET) research and education programs, NSF provides support for almost 200,000 people, including students, teachers, researchers, post-doctorates, and trainees. Support for programs specifically addressing the People goal is slightly more than $1.0 billion in FY 2002, an increase of 12.8 percent over FY 2001.

A major focus for these activities is the President's Math and Science Parnerships initiative beginning in FY 2002 and funded at $200 million. This initiative is focused in the Education and Human Resources (EHR) activity; however, activities that complement this initiative occur throughout the Foundation.

Overall, the research directorates contribute $306 million 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 more than 60,000 post-doctorates, trainees, and graduate and undergraduate students.

The People goal – facilitating the creation of a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens is NSF's number one priority. In order to achieve this goal, NSF supports improvement efforts in formal and informal science, mathematics, engineering, and technology education at all levels – preK-12, undergraduate, graduate, professional development, and public science literacy projects that engage people of all ages in life-long learning. NSF also supports programs that integrate research and education, such as Integrative Graduate Education and Research Training (IGERT), Research Experiences for Undergraduates (REU) and the Faculty Career Early Development Program (CAREER). In partnership with the research and education community, state and local education agencies, civic groups, business and industry, and parents, NSF fosters the invigoration of research-informed standards-based SMET education at all levels.

NSF is also committed to enhancing diversity in the science and engineering workforce. The Foundation believes that an increased emphasis on enhancing the participation of individuals who are members of groups currently underrepresented in the science and engineering workforce will not only further scientific progress by promoting diversity of intellectual thought, but also meet the need for a technically trained workforce.

Ideas

Investments in Ideas support cutting edge research and education that yield new and important discoveries and promotes the development of new knowledge and techniques within and across traditional boundaries. These investments help maintain the nation's academic institutions at the forefront in science and engineering. The results of NSF-funded projects provide a rich foundation for broad and useful applications of knowledge and the development of new technologies. Support for Ideas also promotes the education and training of the next generation of scientists and engineers by providing them with an opportunity to participate in discovery-oriented projects.

Funding related to the strategic goal of Ideas totals $2,220 million in FY 2002, a decrease of 1.4 percent from FY 2001. This includes support for individuals and small groups devoted both to disciplinary and interdisciplinary research and education. Also included is funding for centers that provide a platform to address those scientific and engineering questions and research problems requiring the long-term, coordinated efforts of teams of scientists and engineers. NSF-funded centers provide an enhanced environment for broad interdisciplinary education at all levels. Support for centers totals $325 million in FY 2002.

Tools

Support related to the strategic goal of Tools totals $1,024 million in FY 2002, a 3.5 percent decrease from FY 2001. As the research issues we face increasingly involve phenomena at or beyond the limits of our measurement capabilities, many of these research areas can only be studied through the use of new generations of powerful tools. NSF investments provide state-of-the-art tools for research and education, such as instrumentation and equipment, multi-user facilities, digital libraries, research resources, accelerators, telescopes, research vessels and aircraft, and earthquake simulators. In addition, resources support large surveys and databases as well as computation and computing infrastructures for all fields of science, engineering, and education. Support includes funding for construction, upgrade, operations, and maintenance of facilities, and for the staff and support personnel needed to assist scientists and engineers in conducting research at the facilities.

Support for these unique national facilities is essential to advancing U.S. research and education and the need is driven predominantly by research opportunities and priorities. Investments in research facilities are necessary for scientists and engineers to do world-class research. NSF-supported facilities also stimulate technological breakthroughs in instrumentation, and are the site of research and mentoring for many science and engineering students. Because of their visibility and accomplishments, these facilities also enhance public awareness of science and the goals of scientific research through allied outreach activities.

Administration and Management

Administration and Management (A&M) totals $227 million in FY 2002, an increase of 5.0 percent over FY 2001. This increase of $10.74 million will provide the resources necessary for management of the agency. Most of the increase is for the salaries and expenses (S&E) and Office of the Inspector General (OIG) accounts to provide resources needed to manage the increased program levels appropriated in FY 2001.

A&M encompasses efforts to adopt advanced information technologies, enhance customer service, and ensure financial integrity. These investments are critical to NSF's performance as it faces a workload that is increasing in quantity and complexity. In addition, A&M provides the operating funds to support the NSF workforce in implementing activities to meet all of the agency's strategic goals.

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Federal Crosscuts

NSF will continue its active participation in federal crosscut areas in FY 2002, supporting research and education in, amongst others, the U.S. Global Change Research Program (totaling $187.30 million) and High Performance Computing and Communications and Information Technology Research (totaling $642.61 million).

Math and Science Partnerships Initiative

In FY 2002, NSF requests $200 million to initiate the President's Math and Science Partnerships initiative. The Parnerships initiative is part of the President's initiative *No Child Left Behind* to strengthen and reform K-12 education.

We know from national and international studies that today too many children are being left behind in math and science education, areas critical to success in an increasingly technological world. Too few of their teachers have the right preparation for teaching math and science; too few of their schools provide a rigorous, challenging curriculum; and, as a result, too few of them take the advanced coursework that leads to future opportunities. The first two of these failings are indicators of problems with the capacity of our education system to provide the prerequisites for learning to high standards that the Math and Science Partnerships initiative will address.

The Partnerships 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 math and science education. It is designed to mobilize the mathematicians, scientists, and engineers of higher education to be part of the solution to K-12 education – to help in raising math and science standards, providing math and science training for teachers, and creating innovative ways to reach underserved schools and students. It emphasizes ensuring that all students have the opportunity to perform to high standards, using effective, research-based approaches, improving teacher quality, and insisting on accountability for student performance. One of its key objectives is to eliminate performance gaps between majority and minority and disadvantaged students.

As the initiative begins, state and local education agencies will be in different stages of readiness for partnering with institutions of higher education, as will the institutions themselves. While many states have already instituted such partnerships, either with individual institutions or with state systems, some will be exploring partnerships of this type for the first time. Implementation of the initiative must recognize these differences in readiness, allowing state and local education agencies and their partnering institutions to determine the challenges they face and to design collaborations that fit their needs.

NSF anticipates two major categories of activity under the Math and Science Partnerships initiative. Each requires the establishment or intensification of partnerships, plans for improving math and science education, and accountability mechanisms. They differ in the nature of the Parnerships and the location of leadership for the activity.

- **Infrastructure Partnerships** will provide a framework for states to partner with institutions of higher education to gauge their current status with respect to math and science education and to develop and implement plans for improvement. Infrastructure activities would be expected to be broad in scope and to be aimed at statewide coordinating functions such as teacher certification and concomitant teacher education programs, data generating capabilities, or aligning assessments to high standards. They would also target areas for more intense activity through other mechanisms.

- **Action Partnerships** will enable partners at state and local levels to act to improve math and science education through design and exploration of new models of action and adaptation of existing models to local circumstances. These awards assume an intensity of action that requires their control to vest locally, presumably in a school district or collection of such.

All activities will result in awards made through competitive processes that use merit review involving a rich mix of mathematicians, scientists, engineers, state and local education officials, teachers, educators, and researchers. Proposers will be asked to describe a plan of action, its importance in meeting the objectives of the Math and Science Partnerships initiative within the state, the research base that supports it, and the immediate and longer-term goals to which they are willing to be held accountable. Reviewers will be asked to give priority to projects that show the greatest potential for meeting the objectives of the Math and Science Parnerships initiative, particularly for addressing gaps in performance between majority and minority and disadvantaged students.

NSF will work with relevant communities to identify areas of action appropriate for the Math and Science Partnerships, to amplify the range of potential activities, to explore the types of accountability that best describe progress, and to identify a research-based set of effective practices to inform the partnerships. These communities are poised to act in a number of areas that are critical to success in the Parnerships initiative, having identified issues and possible mechanisms for action in areas such as:

- improving rigor and alignment of standards, curriculum, and assessments at the state, district, and school levels;
- leadership and support for professional development of teachers based on appropriate standards for teacher knowledge and skills;
- improving the preparation of teachers in math and science content areas as essential to improving student achievement;
- development of replicable or adaptable models of systemic reform for improving math and science achievement; and
- improved assessment and use of data, particularly the ability to disaggregate data by gender, race/ ethnicity, and socioeconomic and educational background.

Long-term funding for the MSDI is as follows:

(Millions of Dollars)

FY 2002 Request	FY 2003	FY 2004	FY 2005	FY 2006
$200	$200	$200	$200	$200

Investments in Selected Priority Areas

The multidisciplinary priority areas for FY 2002 include Biocomplexity in the Environment, Information Technology Research, Nanoscale Science and Engineering, and Learning for the 21st Century. These priority areas are described on the following pages. Many of the activities within these priority areas are interrelated. Each of these priority areas makes investments that address all three of NSF's strategic goals.

Biocomplexity in the Environment

The case for increasing emphasis on fundamental science and engineering-based study of environmental systems derives from a convergence of two trends: the growing urgency of environmental issues and the realistic prospect of new scientific and technological capabilities that will significantly advance our ability to anticipate environmental outcomes and, thus, improve environmental decision-making.

At the close of the twentieth century, scientists and engineers were attentive to the profound dependencies between living and geophysical environmental systems. At the same time, many studies of environments and ecosystems began to document earthquakes, extinctions, and other phenomena characterized by abrupt changes, thresholds, and nonlinearities; in mathematical terms, behavior that is "complex." Concurrent with the emergence of these insights into bio- and geo- sciences, scientists and engineers also became aware of the extent and pervasiveness of human impacts on the environment. Human populations doubled within a human life span for the first time. Observations revealed stratospheric ozone depletion. Changes in land use resulted in dramatic changes in landscapes, water resources, and biodiversity. Awareness of the importance of these three characteristics of natural systems—interdependency, complexity, expanding human influence—led to a call for new ways to study, explore, and model environmental processes.

Fortunately, enabled by developments such as real time sensing techniques, computational and information technologies, and genomics, scientists began to tackle the intricacies of the interactions among biological, ecological, physical and earth systems, and to confront the challenges of forecasting the outcomes of those interactions.

Focusing resources on *Biocomplexity in the Environment* will give NSF the capability to respond to the demand for new approaches to investigating the interactivity of biota and the environment. Investigations are required to be highly interdisciplinary, consider non-human biota and/or humans explicitly, and examine challenging systems that have high potential for exhibiting nonlinear or highly coupled behavior. The term "biocomplexity" refers to the dynamic web of often surprising interrelationships that arise when living things at all levels interact with their environment. The priority area will result in more complete understanding of natural processes, of human behaviors and decisions in the natural world, and ways to use new technology effectively to sustain life on earth.

Funding for the BE priority area is as follows:

(Millions of Dollars)

	FY 2001 Current Plan	FY 2002 Request	Change Amount	Change Percent
Biological Sciences	16.90	16.90	0.00	0.0%
Computer and Information Science and Engineering	6.10	6.10	0.00	0.0%
Engineering	2.69	3.69	1.00	37.2%
Geosciences	21.18	23.00	1.82	8.6%
Mathematical and Physical Sciences	5.35	5.35	0.00	0.0%
Social, Behavioral and Economic Sciences	1.25	1.65	0.40	32.0%
Office of Polar Programs	1.41	1.41	0.00	0.0%
Subtotal, Research and Related Activities	$54.88	$58.10	$3.22	5.9%

Totals may not add due to rounding.

Long-term Goals: For the next three years, NSF will emphasize research and education on the role of *Biocomplexity in the Environment*. This priority area is part of investments and accomplishments within NSF's FY 2002 environmental investment portfolio of over $825 million. The intellectual goals of the effort are to:

- synthesize environmental knowledge across fields, subsystems, time and space;
- discover new methods, theories, and conceptual and computational strategies for understanding complex environmental systems;
- develop new tools and innovative applications of new and existing technologies for cross-disciplinary research;
- integrate human and societal and ecological factors into investigations of the physical environment and environmental engineering and enhance research on decision-making and human environmental behaviors; and
- develop a broad range of infrastructure to support interdisciplinary environmental activities: collaboratory networks, information systems, research platforms, international partnerships, and education activities that enhance and diversify the future environmental workforce.

Long-term funding for the Biocomplexity in the Environment priority area is as follows:

(Millions of Dollars)

FY 2000	FY 2001 Current Plan	FY 2002 Request	FY 2003	FY 2004
$50.00	$54.88	$58.10	$70.57	$83.31

FY 2002 Areas of Emphasis: NSF plans to invest $58.10 million in the interdisciplinary BE activities described below.

- **Dynamics of Coupled Natural and Human Systems –** quantitative understanding of the short- and long-term dynamics of how humans value and influence ecosystem services and natural resources, including consideration of landscapes and land use and the influences of uncertainty, resilience and vulnerability on societal institutions.

- **Coupled Biogeochemical Cycles –** the interrelation of biological, geochemical, geological and physical processes at all temporal and spatial scales, with particular emphasis on understanding linkages between cycles (such as the carbon, nitrogen, or water cycle) and the influence of human and other biotic factors on those cycles.

- **Genome-Enabled Environmental Sciences and Engineering** – the use of genomic information to understand ecosystem functioning and the adaptation of organisms to ecological roles. Genome-enabled environmental research will allow us to study biocomplexity in depth on historical and global scales.

- **Instrumentation Development for Environmental Activities –** the development of instrumentation and software that takes advantage of advances in microelectronics, photonics, telemetry, robotics, sensing systems, modeling, data mining, and analysis techniques to bring recent laboratory instrumentation advances to bear on the full spectrum of environmental biocomplexity questions.

In addition to these primary areas, other focused multidisciplinary research and education activities will be supported, including:

- environmental genomics – emphasis on the functions of genes in plants and in microbes, particularly microbes adapted to hostile environments, such as deep subsurface terrestrial, polar, and submarine habitats;
- earth systems studies – establishment of observatories and study centers that focus on geophysical and biogeochemical processes, including those at the molecular scale;
- materials use science and engineering – a comprehensive approach to materials resources, from natural cycling to recycling, remanufacturing, process redesign, materials design, and consumer use;
- environmental informatics – development of modeling, visualization, data mining, and other methods to integrate, access, and interpret very large data sets of environmental information; and
- social adaptation to hazards – emphasis on predictive capabilities and response to hurricanes, storms, and upper atmosphere disturbances, including the study of environmental Arctic change.

In all the topical areas described above, integration of education, including K-16 levels, is a critical element. Also, special attention will be paid to the inclusion of modeling and simulation methods for complex environmental systems and initiation of international collaborations through establishment of global networks in the major topical areas of the BE priority area.

Information Technology Research

Information Technology (IT) today has an essential role in every aspect of science, engineering, medicine, education, and other societal endeavors. It includes the automated creation and processing of information, as well as theoretical studies of the nature of information and the limits of computation. IT is causing far-reaching but little-explored changes throughout society. NSF's portfolio encompasses all of these areas. In FY 2000, the NSF Information Technology Research (ITR) program stressed fundamental research; in the second year, additional applications in science were added; and in the third year, the program will expand research in multidisciplinary areas, focusing on fundamental research at the interfaces between fields and disciplines.

Funding for the ITR priority area is as follows:

(Millions of Dollars)

	FY 2001 Current Plan	FY 2002 Request	Change Amount	Change Percent
Biological Sciences	5.45	5.45	0.00	0.0%
Computer and Information Science and Engineering	155.48	155.48	0.00	0.0%
Engineering	8.17	9.17	1.00	12.2%
Geosciences	10.90	10.90	0.00	0.0%
Mathematical and Physical Sciences	29.62	29.62	0.00	0.0%
Social, Behavioral and Economic Sciences	3.82	3.82	0.00	0.0%
Polar Programs	1.09	1.09	0.00	0.0%
Subtotal, Research and Related Activities	214.53	215.53	1.00	0.5%
Education and Human Resources	0.00	2.00	2.00	N/A
Major Research Equipment	44.90	55.00	10.10	22%
Total, ITR	$259.43	$272.53	$13.10	5.0%

Totals may not add due to rounding.

Long-term Goals: By expanding basic research in interdisciplinary areas, NSF will amplify the benefits of IT in all areas of science and engineering, and spur progress across the national economy and society. The Information Technology Research program over the next three years will involve seven comprehensive and complementary areas: large-scale networking; high-end computing; high-end computation and infrastructure; high-confidence software and systems; human-computer interaction and information management; software design and productivity; and social, economic, and workforce implications of IT plus IT workforce development.

Long-term funding for the ITR priority area is as follows.

(Millions of Dollars)

FY 2000	FY 2001 Current Plan	FY 2002 Request	FY 2003	FY 2004
$126.00	$259.43	$272.53	$285.00	$297.74

FY 2002 Areas of Emphasis: Investments will emphasize the following research:

- **Large-Scale Networking**. Approximately $27.54 million will be used to support fundamental research in optical networking, simulation of network dynamics, fault tolerance and autonomous management of network resources, wireless networks, and scalability to improve performance and handling of transient interactions among billions of networked devices. Additional research networks will protect user privacy and security of sensitive information. Research will provide networks that are more stable, reliable, and resistant to failures. These higher levels of reliability and stability will contribute, for example, to next-generation air traffic control systems or to telemedicine's potential for remote monitoring, diagnosis, and care for homebound and isolated citizens.

- **High-end Computing**. Approximately $16.05 million will explore new computational substrates (such as quantum or DNA computing), communications, and systems architecture. All of these must be integrated in parallel and distributed systems, which will soon involve millions of processors. Advances in photonics, nanodevices, sensors, actuators, opto-electronics, and smart fabrics make it possible to provide extremely fast and high-density processing power.

- **High-end Computation and Infrastructure**. About $116.35 million will enable terascale computational facilities. Cross-disciplinary collaborations will benefit greatly as research and education in the following applications are explored:
  - protein folding, neural modeling, and gene expression, areas which pose important algorithmic issues and could lead to a comprehensive model of the human body and its components at scales from molecules to organs to systems;
  - interactions between biological and physical components of ecosystems and pollutants, atmosphere, oceans and soil, requiring new models and new methods of data management;
  - meteorological forecasting, requiring new models and more detailed computations;
  - modeling earthquakes, requiring both better understanding and better computation;
  - oceanographic computations linked to biological studies of ocean productivity and biodiversity; and
  - high-end computing tools to accelerate the design and implementation of next generation manufacturing techniques such as photonic crystals, optical and electronic switching devices, sensors and detectors.

- **High-Confidence Software and Systems**. About $17.53 million will support a new generation of highly reliable and trustworthy IT systems, including safe, secure, and dependable information infrastructures and consumer products for an information society. Examples include:
  - hardened networks and information systems that detect and survive attacks;
  - robust software and system design, shared infrastructure, and system middleware to detect anomalous events; and
  - modeling and enforcing stability of software systems and the actual systems they control from safety-critical automotive and avionics systems, to implantable devices and advanced prosthetics.

- **Human-Computer Interaction and Information Management**. About $42.65 million will support research and education on mining and visualizing large data systems. Improved real-time access to databases will accelerate progress and aid in policy-making. Research will help in understanding how to integrate perception, cognition, and computation. Cognitive interfaces will allow people with severe disabilities to participate more fully in society. Interactions between medicine, robotics, and networking offer the hope of designing robotic assistants for the elderly and disabled.

- **Software Design and Productivity**. Funding of $33.07 million will focus on developing theory and technology for large embedded software applications subject to temporal, noise, synchronization and dependability constraints. The key technology components to be developed are: integrated modeling techniques, integrated modeling environments and model-based generators.

- **Social, Economic and Workforce Implications of IT and IT Workforce Development**. Approximately $19.34 million will focus on: universal participation in a digital society; information privacy and intellectual property; the use of technologies for science, education and work collaboration and learning; and how to cultivate a diverse and well educated IT workforce.

Nanoscale Science and Engineering

Nanoscale science and engineering encompasses the systematic organization, characterization, and manipulation of matter at atomic or molecular levels. Novel materials, devices, and systems—on the scale of nanometers—are revolutionizing science, engineering, and technology. Impossible to visualize, a nanometer (one-billionth of a meter) is to an inch what an inch is to 400 miles. With the capacity to manipulate matter at this scale, a revolution has begun in science, engineering, and technology including individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, and microscopic computer chips.

Funding for the Nanoscale Science and Engineering priority area is as follows:

(Millions of Dollars)

	FY 2001 Current Plan	FY 2002 Request	Change Amount	Change Percent
Biological Sciences	2.33	2.33	0.00	0.0%
Computer and Information Science and Engineering	2.20	6.20	4.00	181.8%
Engineering	55.27	70.30	15.03	27.2%
Geosciences	6.80	6.80	0.00	0.0%
Mathematical and Physical Sciences	83.08	88.08	5.00	6.0%
Total, Nanoscale Science and Engineering	$149.68	$173.71	$24.03	16.1%

Totals may not add due to rounding.

The National Nanotechnology Initiative (NNI) began in FY 2001 (http://www.nano.gov). NSF is emphasizing long-term, fundamental research aimed at discovering novel phenomena, processes, and tools; addressing NNI Grand Challenges; supporting new interdisciplinary centers and networks of excellence including shared user facilities; supporting research infrastructure; and addressing research and educational activities on the societal implications of advances in nanoscience and nanotechnology.

NSF has been a pioneer among federal agencies in fostering the development of nanoscale science and technology. In FY 2001, NSF is investing $149.68 million in a wide range of research and education activities in nanoscale science and technology, including approximately 15 nanotechnology research centers, which focus on electronics, biology, and optoelectronics.

This investment will be expanded in FY 2002 to develop and strengthen critical fields and to establish the science and engineering infrastructure and workforce needed to exploit the opportunities presented by these new capabilities. Support will be focused on interdisciplinary research and education teams, national science and engineering centers, exploratory research and education projects, and education and training.

Long-term objectives include laying a foundation of fundamental research for NNI Grand Challenges; ensuring that U.S. institutions will have access to a full range of nano-facilities; enabling access to nanotechnology education for students in U.S. colleges and universities; and catalyzing the creation of new commercial markets that depend on three-dimensional nanostructures. This should result in the development of completely new technologies that contribute to improvements in health, advanced agriculture, conservation of materials and energy, and sustainability of the environment.

Long-term funding for the Nanoscale Science and Engineering priority area is as follows:

(Millions of Dollars)

FY 2001 Current Plan	FY 2002 Request	FY 2003	FY 2004	FY 2005
$149.68	$173.71	$186.18	$198.92	$224.98

FY 2002 Areas of Emphasis: NSF's planned investment for Nanoscale Science and Engineering in FY 2002 is $173.71 million. NSF five programmatic focus areas are:

- **Fundamental Research and Education.** The FY 2002 request includes $107.72 million for fundamental research and education, with special emphasis on:
  - *Biosystems at the Nanoscale* – Approximately $19.0 million to support study of biologically-based or inspired systems that exhibit novel properties and potential applications. Potential applications include improved drug delivery, biocompatible nanostructured materials for implantation, and nanoscale sensory systems, such as miniature sensors for early detection of cancer.
  - *Nanoscale Structures, Novel Phenomena and Quantum Control* – Approximately $36.72 million to create new materials and functional nanoscale structures and to exploit their novel properties. Potential applications include quantum computing and new devices and processes for advanced communications and information technologies.
  - *Device and System Architecture* – Approximately $25.50 million to develop new concepts to understand interactions among nanoscale devices in complex systems, including the physical, chemical, and biological interactions between nanostructures and device components.
  - *Nanoscale Processes in the Environment* – Approximately $9.50 million to support studies on nanoscale physical and chemical processes related to the trapping and release of nutrients and contaminants in the natural environment. Potential benefits include artificial photosynthesis for clean energy and pollution control.
  - *Multi-scale, Multi-phenomena Theory, Modeling and Simulation at the Nanoscale* – Approximately $17.0 million to support theory, modeling, large-scale computer simulation and new design tools and infrastructure in order to understand, control and accelerate development in new nanoscale regimes and systems.

- **Grand Challenges.** Approximately $7.90 million will fund interdisciplinary activities to focus on major long-term challenges: nanostructured materials 'by design,' nanoscale electronics, optoelectronics and magnetics, nanoscale-based manufacturing, catalysts, chemical manufacturing, environment and healthcare.

- **Centers and Networks of Excellence.** Approximately $29.39 million will provide support for four new research and education centers, a multidisciplinary, multi-sectoral network for modeling and simulation at the nanoscale. These funds will support the nanofabrication user facilities to come on line in FY 2002.

- **Research Infrastructure.** Approximately $19.90 million will support instrumentation and facilities for improved measurements, processing and manipulation at nanoscale, and equipment and software for modeling and simulation. University-industry-national laboratory and international collaborations will be encouraged, particularly for expensive instrumentation and facilities.

- **Societal and Educational Implications of Science and Technology Advances.** Approximately $8.80 million will support student assistantships, fellowships and traineeships, curriculum development on nanoscience and engineering and development of new teaching tools. The impact of nanotechnology on society will be analyzed from legal, ethical, social, and economic perspectives. The development and use of nanoscale technologies is likely to change the design, production and use of many goods and services, ranging from vaccines to computers to automobile tires.

Learning for the 21st Century

Learning for the 21st Century addresses two interrelated challenges that are essential to meeting twenty-first century workforce challenges:

- understanding how people learn as individuals, and
- transferring that knowledge for use in collective learning environments and the development of tools for learning and instruction.

Through this priority area, NSF will continue to encourage the science and education communities to better understand learning in disciplinary contexts and to act on that understanding by developing materials, courses, and curricula implemented, such as through digital libraries and other web-based mechanisms. Communities will also develop field-specific methods for bridging levels of education and for maintaining lifelong learning capabilities.

Funding for Learning for the 21st Century priority area is as follows:

(Millions of Dollars)

	FY 2001 Current Plan	FY 2002 Request	Change Amount	Change Percent
Biological Sciences	1.70	1.70	0.00	0.0%
Computer and Information Science and Engineering	1.15	1.15	0.00	0.0%
Engineering	2.70	3.40	0.70	25.9%
Geosciences	2.45	2.45	0.00	0.0%
Mathematical and Physical Sciences	3.00	4.00	1.00	33.3%
Social, Behavioral and Economic Sciences	5.40	5.40	0.00	0.0%
Polar Programs	1.10	1.10	0.00	0.0%
Subtotal, Research and Related Activities	17.50	19.20	1.70	9.7%
Education and Human Resources	103.96	106.31	2.35	2.3%
Total, Learning for the 21st Century	$121.46	$125.51	$4.05	3.3%

Totals may not add due to rounding.

Long-term Goals: The long-term goals of Learning for the 21st Century priority area are:

- to generate the knowledge, people, and tools needed to develop a twenty-first century workforce that is second to none in its ability to use, adapt, and create scientific, mathematical, engineering, and technological (SMET) concepts in the workplace; and
- to develop a SMET workforce that fully reflects the strength of America's diversity.

While emphasizing the long-term objectives, the priority area also includes elements that address the needs of an American workforce able to make an immediate transition to a more technologically-oriented workplace.

Long-term funding for the Learning for the 21st Century priority area.

(Millions of Dollars)

FY 2001 Current Plan	FY 2002 Request	FY 2003	FY 2004	FY 2005
$121.46	$125.51	$137.98	$150.72	$176.78

FY 2002 Areas of Emphasis: Three elements form the underlying core of this priority area.

- **Multidisciplinary learning research** involves cross-cutting research in areas such as design of learning environments, human-computer interactions, cognitive psychology, cognitive neuroscience, computational linguistics, child development, sociology, and complex educational systems. Activities in this element include the Interagency Education Research Initiative (IERI), the newly revamped Research on Learning and Education (ROLE) program, and other research activities related to child learning and cognitive development.

- **Research, development, and testing of IT-enabled tools for learning** will facilitate and enhance learning opportunities. New technologies offer the possibility of providing truly learner-centered, independent learning environments for individuals or teams at any convenient place and time. Two sets of activities currently comprise this element: the National SMET Education Digital Library (NSDL), a prototype IT-based tool designed to increase the quality, quantity, and comprehensiveness of Internet-based education resources, and related development of discipline-focused resources, such as the Digital Library for Earth System Education (DLESE).

- **Activities that enable and strengthen the SMET learning continuum** provide a stronger linkage between formal and informal education. This is critical to developing and maintaining a highly skilled workforce. Preparing the workforce currently takes place largely in the context of formal education systems with well-defined transition points across levels of education. In contrast, developing the workforce takes place through a combination of on-the-job training, established training opportunities and/or formal education. Investments in this core element recognize that learning happens continuously and provide mechanisms to bridge gaps caused by organization of learning into discrete systems of formal and informal education. The Graduate Teaching Fellows in K-12 Education (GK-12) program, which provides graduate students with exposure to the opportunities and challenges of K-12 teaching, while bringing K-12 students and teachers together with active researchers, is an example of activities in this element.

NSF's **Centers for Learning and Teaching** (CLTs) provide lifelong learning opportunities for the nation's instructional workforce. CLTs involve partnerships among universities, school districts, state education agencies, informal science education institutions, as well as business and industry.

The Math and Science Partnerships Initiative also reflects many of the goals of Learning for the 21st Century. The Partnerships initiative emphasizes ensuring that all students have the opportunity to perform to high standards by using effective, research-based approaches, improving teacher quality, and insisting on accountability for student performance.

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Children's Research Initiative (CRI)

Support for the Children's Research Initiative (CRI) will be maintained at $5.0 million annually for the period from FY 2001 through FY 2005. 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 to enhance literacy and improve math and science skills. Support will be provided to centers, teams, and individual investigators to conduct research and related activities in accordance with community-based planning and development efforts. Specifically, the FY 2001 CRI announcement invited proposals in four general categories:

- research centers to conduct multidisciplinary, integrative research;
- incubation or planning grants so that research groups can engage in planning that will lead to collaborative, large-scale, center research projects;
- workshops and small conferences that will help build capacity for integrative, multidisciplinary research; and
- standard research proposals from individual investigators addressing CRI research issues.

CRI competitions will continue with provision made for limited support for incubation and planning activities, as well as workshops and conferences focused on stimulating research and communication across communities. Funding also will be provided for smaller-scale, individual investigator-conducted research projects. In the future, it is anticipated that a larger share of CRI funding will go to multidisciplinary, integrated research centers offering opportunities for advancing fundamental understanding of child development.

Funding for CRI is as follows:

(Millions of Dollars)

FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate
$4.99	$5.00	$5.00	$5.00	$5.00

Strategic Goals and NSF Budget Structure

The following table provides FY 2002 funding for strategic goals and budget accounts.

NATIONAL SCIENCE FOUNDATION
BY STRATEGIC GOAL AND ACCOUNT

(Millions of Dollars)

NSF Accounts	FY 2000 Actual	FY 2001 Current Plan	FY 2002 Request: People	Ideas	Tools	A&M	FY 2002 Request	$ Change Request over Plan	% Change Request over Plan
FY 2000 Actual	**$3,923.36**		**$816.11**	**$1,962.49**	**$955.44**	**$189.32**			
FY 2001 Current Plan		**$4,416.39**	**$888.31**	**$2,251.11**	**$1,060.95**	**$216.03**			
BIO[1]	418.29	485.42	48.55	364.73	64.16	5.67	483.11	-2.31	-0.5%
CISE	388.57	477.90	56.93	288.09	117.62	7.72	470.36	-7.54	-1.6%
ENG	379.82	430.84	69.45	351.67	2.80	7.13	431.05	0.21	0.0%
GEO	487.64	562.19	19.40	318.89	217.28	2.97	558.54	-3.65	-0.6%
MPS	755.88	850.84	97.55	538.02	221.59	6.42	863.58	12.74	1.5%
SBE	162.11	164.44	10.41	120.17	28.03	4.55	163.16	-1.28	-0.8%
OPP	258.33	273.26	3.50	72.41	197.31	3.35	276.57	3.31	1.2%
IA	129.25	97.75	0.00	26.61	54.00	0.00	80.61	-17.14	-17.5%
Research & Related Activities	**$2,979.90**	**$3,342.63**	**$305.79**	**$2,080.59**	**$902.79**	**$37.81**	**$3,326.98**	**-$15.66**	**-0.5%**
Education & Human Resources [1]	**$683.58**	**$785.62**	**$696.40**	**$139.25**	**$24.60**	**$12.16**	**$872.41**	**$86.79**	**11.0%**
Major Research Equipment	**$105.00**	**$121.33**	**$0.00**	**$0.00**	**$96.30**	**$0.00**	**$96.30**	**-$25.03**	**-20.6%**
Salaries & Expenses	**$149.28**	**$160.54**	**$0.00**	**$0.00**	**$0.00**	**$170.04**	**$170.04**	**$9.50**	**5.9%**
Office of Inspector General	**$5.60**	**$6.27**	**$0.00**	**$0.00**	**$0.00**	**$6.76**	**$6.76**	**$0.49**	**7.8%**
Total, National Science Foundation	**$3,923.36**	**$4,416.39**	**$1,002.19**	**$2,219.84**	**$1,023.69**	**$226.77**	**$4,472.49**	**$56.09**	**1.3%**
H-1B Visa	*$25.06*	*$121.00*	*$144.00*				*$144.00*	*$23.00*	*19.0%*
Total NSF, Including H-1B	*$3,948.42*	*$4,537.39*	*$1,146.19*	*$2,219.84*	*$1,023.69*	*$226.77*	*$4,616.49*	*$79.09*	*1.7%*

[1] The agency routinely closes out awards that are past the expiration date. Several awards, including $4 million in BIO and $1.84 million in EHR, were terminated in FY 2000 due to incorrect award expiration dates. The expiration dates on these awards were corrected later in the year and the awards were reopened and the balances restored. The closing of the awards are reported as recoveries and the reopening of the awards are accounted for as upward adjustments to prior year obligations. Therefore, actual obligations for BIO are $418.29 million and for EHR are $683.58 million.