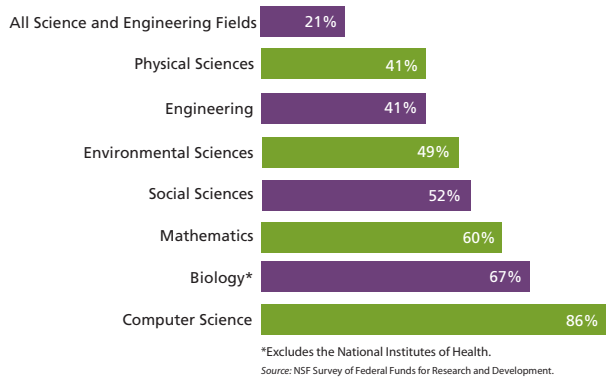
UNITED STATES
National Science Foundation
FY 2008 HIGHLIGHTS

Who We Are and What We Do

The National Science Foundation (NSF), established by Congress in 1950, is the premier federal agency supporting research across all fields of science and engineering and all levels of science and engineering education. NSF funds the best ideas and most promising people, searching out the frontiers of science and engineering to foster high-risk, potentially transformative research that will generate important discoveries, new technologies, and a dynamic workforce. NSF also provides funding for advanced instrumentation and facilities that allow scientists, engineers, and students to work at the forefront of knowledge.

Although NSF's annual budget represents less than 4 percent of the total federal budget for research and development, NSF provides more than 40 percent of the federal support for nonmedical basic research at America's colleges and universities. As shown on the chart (left), in many fields NSF is the principal source of federal academic support. NSF supports research and education through a competitive, merit-based review process.

NSF SUPPORT OF ACADEMIC BASIC RESEARCH
(as a percentage of total federal support)



*Excludes the National Institutes of Health.
Source: NSF Survey of Federal Funds for Research and Development.

Basic research generates new ideas that support productivity growth and an improving quality of life. Basic research underpins the technology that is fueling today's global market. Innovation and technology are engines of the American economy, and advances in science and engineering provide the fuel. NSF-supported discoveries have contributed to the nation's knowledge base, to our economy, and to the high standard of living Americans enjoy. Moreover, the new knowledge and new tools, methods, and processes generated by NSF's investments provide insight into many of today's complex national and global challenges. NSF's task is to kindle the leadership and excellence in basic research and education that keeps America at the leading edge of science, engineering, and technology.

NSF BY THE NUMBERS	
$6.128 billion	FY 2008 Appropriations
4%	NSF's share of total annual federal spending for R&D
44%	NSF's share of federal funding for nonmedical basic research at academic institutions
1,900	Colleges, universities, and other institutions receiving NSF funding in FY 2008
11,162	Competitive awards funded in FY 2008
44,000	Students supported by NSF Graduate Research Fellowships since 1952
44,400	Proposals evaluated in FY 2008 through a competitive merit review process
197,000	People NSF supports directly (researchers, postdoctoral fellows, trainees, teachers, and students)
248,000	Proposal reviews conducted in FY 2008

Return on Investments

Investments in science and engineering generate new knowledge and new industries, create new jobs, and ensure economic and national security. Below and throughout this report are examples of results reported by NSF-supported investigators in FY 2008. Additional results can be found at **www.nsf.gov/discoveries**.

This image shows the unique properties of engineered cementitious composites in both their high ductility and ability to self-heal after fracture.

Credit: Victor Li, University of Michigan Ann Arbor.

Bendable Concrete for Safe, Durable, and Sustainable Infrastructure: NSF-supported investigators at the University of Michigan have designed a new type of concrete called engineered cementitious composite (ECC) that is the most flexible concrete in the world. It maintains all the mechanically advantageous qualities of current composites but its tensile ductility is 300 to 500 times greater. When overloaded, it bends without fracturing, and it exhibits self-healing properties. ECC is also uniquely resistant to damage caused by weather and chemicals, making it ideal for bridges and buildings. Under simulated earthquake conditions, ECC structure elements showed extreme damage tolerance, high energy absorption, and maintenance of load capacity. This work has the potential to establish the United States as the global leader in "designer" cement-based composites as well as impact the future design of sustainable structures resistant to earthquakes and weather events. This work embodies collaboration among several sectors: government, industry, and academic partners.

For more information:

FY 2008 Citizens' Report
www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0903

FY 2008 Annual Financial Report, FY 2008 Annual Performance Report, and FY 2009 Budget Request
www.nsf.gov/about/performance

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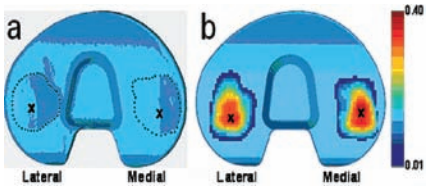
Return on Investments



Comparison of experimental (a) and simulated (b) wear regions for a total knee replacement design after 5 million cycles of walking performed in a knee simulator machine. Xs indicate locations of maximum wear. Dotted lines in (a) indicate boundaries of experimental wear regions. Color bar in (b) indicates depth in millimeters of simulated wear regions.

Credit: B.J. Fregly, University of Florida.

Virtual Prototyping of Artificial Knees: NSF-supported researchers at the University of Florida are addressing a growing need for the aging American population. By one estimate, 40 million Americans will be affected by osteoarthritis in the year 2020. This project could lead to an entirely new approach for designing knee replacements and testing innovative designs using computer software rather than physical simulator machines. This work is unique because of its ability to predict long-term wear characteristics of knee replacement designs in a matter of minutes or hours using computer simulations. High school students from underrepresented groups have been involved in the knee research, through the University of Florida Summer Science Training Program. In addition, an orthopedic implant company has already enlisted the research team to participate in designing the next generation of knee replacements.

Microorganisms from a mud sample collected in Lake Washington.

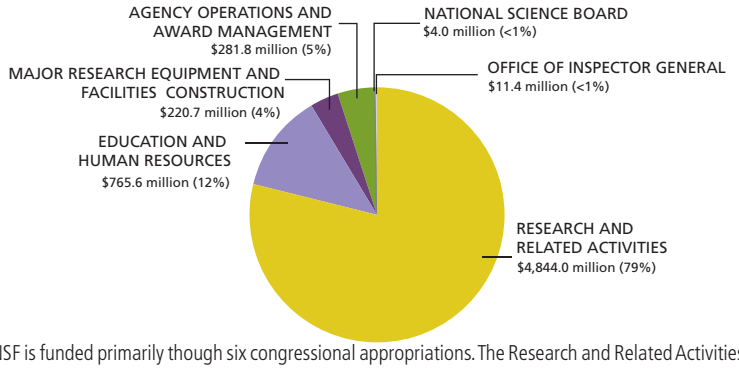
Credit: University of Washington.

Cataloguing Invisible Life: An NSF-supported University of Washington-led team has successfully sequenced a complete genome for an unknown microorganism from a sample of mud collected at Lake Washington. Their method provides a way to discover new microscopic life in complex communities. Using the genetic technique of metagenomics, University of Washington researchers have revealed a possible way to uncover the genomes of unknown species with this approach. This is a particularly important finding for microbial research since few microbes survive in the lab and have therefore gone largely unidentified. Such techniques could allow scientists and engineers to identify microbial species based on particular, desired functions and to develop such microbes for practical applications.

Following the Money

BUDGET STRUCTURE: FY 2008 APPROPRIATION BY ACCOUNTS

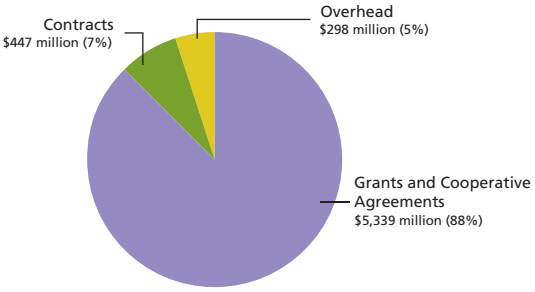
($6,127.5 million)



NSF is funded primarily though six congressional appropriations. The Research and Related Activities appropriation funds basic research and education activities at the frontiers of science and engineering as well as high-risk and transformative research. The Education and Human Resources appropriation supports activities that ensure a diverse, competitive, and globally engaged U.S. science, technology, engineering, and mathematics workforce and a scientifically literate citizenry. The Major Research Equipment and Facilities Construction appropriation supports the construction and procurement of unique national research platforms and major research equipment that enable cutting-edge research. The Agency Operations and Award Management appropriation supports NSF's administrative and management activities. Funding for the operation of the Office of Inspector General and for the National Science Board are each provided in separate appropriations.

HOW IT'S SPENT: AWARD MECHANISMS

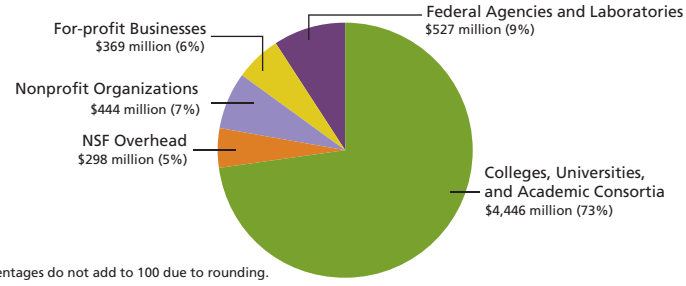
(FY 2008 Budget Obligations—$6,084 million)



Most of NSF's projects are funded using grants or cooperative agreements. Grants can be funded either as standard awards in which funding for the full duration of the project is provided in a single fiscal year, or as continuing awards, in which funding for a multi-year project is provided in increments. Cooperative agreements are used when the project requires substantial agency involvement during the project performance period (e.g., research centers, multi-user facilities, etc.). Contracts are used to acquire products, services, and studies (e.g., program evaluations) required primarily for NSF or other government use.

WHERE IT GOES: INSTITUTIONS FUNDED

(FY 2008 Budget Obligations—$6,084 million)



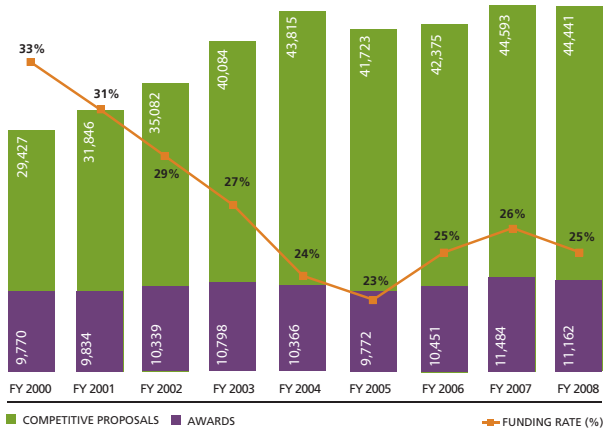
Percentages do not add to 100 due to rounding.

Most NSF awards are to academic institutions. Nonprofit organizations also include state and local governments and international organizations. For-profit businesses include private and small businesses. Federal agencies and laboratories include funding for Federally Funded R&D Centers.

Accountability and Stewardship Highlights

- **Annual Audit Results:** 11 consecutive years of unqualified "clean" opinions from an independent auditor. The FY 2008 audit report noted no material weaknesses or significant deficiencies, and all prior year significant deficiencies have been closed.
- **Grants Management:** NSF is co-managing partner and leader of the research consortium for the Grants Management Line of Business. The recently launched *Research.gov* portal improves service to applicants and grantees by offering a menu of standardized, common grant business process services to partner research agencies.
- **Merit Review:** Over 90 percent of NSF funds are allocated through a competitive, merit-based review process that is recognized throughout government as the exemplar for effective and efficient use of public funds. NSF has supported the research of 183 Nobel laureates, including 29 in the last five years.
- **Financial Management:** NSF consistently receives high ratings on the Department of Treasury Financial Management Service Scorecard and the CFO Council Financial Management "Metrics Tracking" Scorecard.
- **Improper Payments:** NSF has moved to a 3-year reporting cycle because NSF has been reporting improper payments below Office of Management and Budget (OMB) thresholds and instituted a robust post-award monitoring program.
- **President's Management Agenda:** NSF is rated "Green" in the *Financial Performance* and *E-government* initiatives, "Yellow" in *Performance Improvement*, and "Red" in *Human Capital* and *Commercial Services Management*.
- **Information Technology (IT) Security:** NSF's IT environment is aggressively monitored. All major IT systems have current certification and accreditation, and annual security awareness training is mandated for all employees and contractors. For the past 4 years, the Federal Information Security Management Act (FISMA) review has reported no significant deficiencies. In OMB's most recent assessment of federal agency enterprise architecture, NSF was identified as "best in class" among small agencies.

NUMBER OF NSF COMPETITIVE PROPOSALS AND AWARDS AND FUNDING RATES



In FY 2008, NSF awarded 11,162 new grants (from over 44,400 proposals) to colleges, universities, and other institutions throughout the country. Given the intense competition for NSF funds, NSF is pursuing a variety of approaches that balance trade-offs between keeping the proposal workload at a productive and manageable level—for both NSF and the applicant community and—and encouraging the free flow of ideas to NSF.

Return on Investments

Credit: MIT/NSF.

Water Refineries: Using a surprisingly simple, inexpensive technique, Massachusetts Institute of Technology (MIT) chemist Daniel Nocera and his postdoctoral student Matthew Kanan have found a way to pull pure oxygen from water using relatively small amounts of electricity, common chemicals, and a room-temperature glass of water. Because oxygen and hydrogen are energy-rich fuels, many researchers have proposed using solar electricity to split water into those elements—a stored energy source for when the sun goes down. One of the chief obstacles to that green-energy scenario has been the difficulty of producing oxygen without large amounts of energy or a high-maintenance environment. Now these researchers have discovered an efficient way to solve the oxygen problem. This breakthrough discovery has enormous implications for the large scale deployment of solar. This study demonstrates how research is critical for driving American competitiveness in the global energy marketplace. By funding fundamental research in water and renewable energy, we are investing in our economic and environmental futures. Nocera is a member of NSF's Power the Planet, a partnership that NSF forged between MIT, Caltech, and several other institutions as an NSF Chemical Bonding Center in 2005.

Credit: Cindy Barton, Tulsa Community College.

Project SEEDBed—Stimulating Enthusiasm, Exploration, and Discovery through Biotechnology Education—engages middle and high school students and teachers in summer academies held at community colleges. These academies are designed to increase knowledge, stimulate interest in biotechnology among students and teachers, and encourage students to pursue further study, possibly leading to careers as biotechnicians. Teachers are provided with "footlockers" with all of the equipment necessary to conduct new laboratory activities in their classrooms. Evaluation data indicate significant impact on both students and teachers.

Directorates and Offices

The **Directorate for Biological Sciences** provides support for research to advance understanding of the underlying principles and mechanisms governing life.

The **Directorate for Computer and Information Science and Engineering** supports research on computer and information science and engineering, helps develop and maintain national computing and information infrastructure, and contributes to the education and training of the next generation of computer scientists and engineers.

The **Directorate for Education and Human Resources** supports activities that promote excellence in U.S. science, technology, engineering, and mathematics education at all levels and in all settings, both formal and informal.

The **Directorate for Engineering** supports research and education activities that provide a foundation for our nation's global leadership in technology and innovation.

The **Directorate for Geosciences** supports research in the atmospheric, earth, and ocean sciences.

The **Directorate for Mathematical and Physical Sciences** supports research and education in astronomical sciences, chemistry, materials research, mathematical sciences, and physics.

The **Directorate for Social, Behavioral, and Economic Sciences** supports research and education about human cognition, language, social behavior, and culture and on economic, legal, political, and social systems, organizations, and institutions as well as science resources studies.

The **Office of Cyberinfrastructure** coordinates and supports the acquisition, development, and provision of state-of-the-art cyberinfrastructure resources, tools, and services essential to the conduct of science and engineering research and education.

The **Office of Integrative Activities** promotes unity and alignment in support of the Foundation's mission, coordinating and overseeing cross-directorate activities and providing policy support to the Office of the Director.

The **Office of International Science and Engineering** promotes the development of an integrated, Foundation-wide international strategy and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF interests.

The **Office of Polar Programs**, which includes the U.S. Polar Research Programs and U.S. Antarctic Logistical Support Activities, supports multidisciplinary research in the Arctic and Antarctic regions.

The **Office of Budget, Finance, and Award Management** is headed by the Chief Financial Officer, who has responsibility for budget, financial management, grants administration, procurement operations, and related policy.

The **Office of Information and Resource Management** provides human capital management, information technology solutions, continuous learning opportunities, and general administrative services to the NSF community of scientists, engineers, and educators.

How NSF Investments Benefit Society

NSF's investments produce both tangible and intangible benefits that keep the United States at the forefront of science and engineering.

New Knowledge such as quantum computing, nanotechnology, computer visualization techniques, metagenomics, science of science and innovation policy, and plant genome mapping.

World Class Facilities such as the National Center for Atmospheric Research, U.S. South Pole Station, and the Large Gravitational-Wave Observatory.

New Tools, Methods, and Processes such as the Internet, DNA fingerprinting, magnetic resonance imaging, and novel materials.

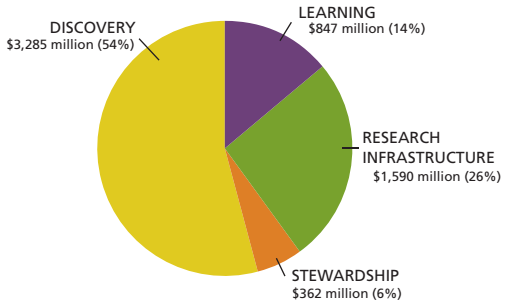
Insight into National and Global Challenges such as green gasoline, climate change, environmental protection, cybersecurity, and homeland security.

A Highly Trained Workforce through Graduate Research Fellowships, Advanced Technological Education, and Louis Stokes Alliances for Minority Participation.

Resources for Teachers and Students such as Graduate Teaching Fellows in K-12 Education, Math and Science Partnership Program, and Curriculum and Laboratory Improvement Programs.

How We Are Doing

FY 2008 BUDGET OBLIGATIONS BY STRATEGIC GOAL
($6,084 million)



FY 2008 STRATEGIC OUTCOME GOALS AND RESULTS

	RESULTS
DISCOVERY: Foster research that will advance the frontiers of knowledge, emphasizing areas of greatest opportunity and potential benefit, and establishing the nation as a global leader in fundamental and transformational science and engineering.	● FY 2004 ● FY 2005 ● FY 2006 ● FY 2007 ● FY 2008
LEARNING: Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.	
RESEARCH INFRASTRUCTURE: Build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure, and experimental tools.	
STEWARDSHIP: Support excellence in science and engineering research and education through a capable and responsive organization. *(New goal in FY 2007.)*	● FY 2007 ● FY 2008

● Indicates successful achievement. Assessments by a committee of external experts determined that NSF achieved its *Discovery*, *Learning*, and *Research Infrastructure* goals. In addition, the assessment process and the performance results under the *Stewardship* goal were verified and validated by an independent external review.