

# NSF Fiscal Year 2010 Budget Request

This article is the 37th in a series of annual reports outlining the president's request to Congress for the budget of the National Science Foundation. Last year's report appeared in the June/July 2008 issue of the *Notices*, pages 711-14.

In May 2009 the National Science Foundation (NSF) released its budget request for fiscal year 2010, which begins October 1, 2009. The request calls for a total budget of US\$7.0 billion, an increase of more than 8 percent above the fiscal 2009 level. Congress appropriated US\$6.5 billion for the NSF for fiscal 2009, an increase of 6.7 percent over the fiscal 2008 level. On top of the fiscal 2009 increase,

the NSF will gain an additional US\$3 billion as part of the American Recovery and Reinvestment Act (ARRA). ARRA is one component of the Obama Administration's effort to stimulate the flagging U.S. economy. With the ARRA money spread across the foundation, the Division of Mathematical Sciences (DMS) stands to receive an estimated US\$98.0 million on top of its appropriated budget of US\$226.2 million. ARRA funds must be spent within two years.

What follows is the NSF news release about the fiscal year 2010 budget request, which provides highlights of the foundation's plans. After the news release is the section of the fiscal 2010

**Table 1: National Science Foundation (Millions of Dollars)**

	2006 Actual	Change	2007 Actual	Change	2008 Actual	Change	2009 Estimate*	Change	2010 Request
(1) Mathematical Sciences Research Support	\$ 199.5	3.1%	\$ 205.7	2.9%	\$ 211.7	6.8%	\$ 226.2 (98.0)	8.9%	\$ 246.4
(2) Other Research Support (Note a)	4483.5	5.2%	4718.9	1.9%	4808.3	6.2%	5108.9 (2802.0)	9.7%	5604.1
(3) Education and Human Resources (Note b)	700.3	-0.6%	695.6	10.2%	766.3	10.3%	845.3 (100.0)	1.5%	857.8
(4) Salaries and Expenses (Note c)	262.5	0.6%	264.1	12.7%	297.7	4.1%	310.0 (2.0)	8.6%	336.7
(5) Totals	\$5645.8	4.2%	\$5884.4	3.4%	\$6084.0	6.7%	\$6490.4 (3002.0)	8.5%	\$7045.0
(6) (1) as a % of the sum of (1) and (2)	4.26%		4.18%		4.22%		4.24%		4.21%
(7) (1) as a % of (5)	3.53%		3.50%		3.48%		3.48%		3.50%

*Tables prepared by Notices staff. Totals may not add up due to rounding. Note a:* Support for research and related activities in areas other than the mathematical sciences. Includes scientific research facilities and instrumentation. *Note b:* Support for education in all fields, including the mathematical sciences. *Note c:* Administrative expenses of operating the NSF, including the National Science Board and the Office of the Inspector General.

budget request that describes the plans of the DMS. Further details may be found on the NSF website at <http://www.nsf.gov/about/budget/fy2010/>. Accompanying this NSF-prepared information are the tables that traditionally appear in the *Notices* each year. (In the tables, the amounts in parentheses indicate the additional funds appropriated under ARRA.)

Mathematics departments might be especially interested in the increased funding for the NSF Graduate Research Fellowship Program. The participation of mathematics in this program has historically been low. In fiscal 2008, just 23 mathematics students received these fellowships, the smallest number for all areas in which the fellowships are given, including psychology, which had 69 fellowships, and the social sciences, which had 98. Just over 300 fellowships went to students in

engineering. The distribution of these fellowships among the various areas is determined by the number of applications received, so the low participation in mathematics is due to the NSF receiving few applications from mathematics students. In fiscal 2009 these prestigious fellowships provide stipends of US\$30,000 per year for three years of graduate study. For further information, consult the website <http://www.nsf.gov/grfp>.

—Allyn Jackson

### News Release: National Science Foundation Requests \$7.045 Billion for Fiscal Year 2010

May 14, 2009

National Science Foundation (NSF) Director Arden L. Bement Jr. today presented the agency's proposed \$7.045 billion budget for fiscal year (FY)

**Table 2: Directorate for Mathematical and Physical Sciences (Millions of Dollars)**

	2006		2007		2008		2009		2010	
	Actual	% of Total	Actual	% of Total	Actual	% of Total	Estimate*	% of Total	Request	% of Total
(1) <b>Mathematical Sciences</b>	\$ 199.5	18.4%	\$ 205.7	17.9%	\$ 211.7	18.1%	\$ 226.2 (98.0)	18.0% (20.0%)	\$ 246.4	17.8%
(2) <b>Astronomical Sciences</b>	199.7	18.4%	215.4	18.7%	217.9	18.6%	228.6 (85.8)	18.2% (17.5%)	250.8	18.2%
(3) <b>Physics</b>	234.1	21.5%	248.5	21.6%	251.6	21.5%	274.5 (96.3)	21.8% (19.6%)	296.1	21.5%
(4) <b>Chemistry</b>	180.7	16.6%	191.2	16.6%	194.6	16.6%	211.3 (103.0)	16.8% (21.0%)	238.6	17.3%
(5) <b>Materials Research</b>	242.6	22.3%	257.3	22.4%	262.5	22.4%	282.1 (106.9)	22.5% (21.8%)	309.0	22.4%
(6) <b>Office of Multidisciplinary Activities</b>	29.9	2.7%	32.6	2.8%	32.7	2.8%	33.2 (0.0)	2.6% (0.0%)	39.1	2.8%
(7) <b>Totals</b>	\$1086.6	100.0%	\$1150.7	100.0%	\$1171.3	100.0%	\$1256.0 (490.0)	100.0% (100.0%)	\$1380.0	100.0%

**Table 3: Compilation of NSF Budget, 2002–2008 (Millions of Dollars)**

	2004 Actual	2005 Actual	2006 Actual	2007 Actual	2008 Actual	2009 Estimate*	2010 Request	2004–2008 Change	2004–2010 Change
(1) <b>Mathematical Sciences Research Support</b>	\$ 200.3	\$ 200.2	\$ 199.5	\$ 205.7	\$ 211.7	\$ 226.2	\$ 246.4	5.7%	23.0%
<i>Constant Dollars</i>	106.0	102.5	99.0	99.2	98.3			-7.3%	
(2) <b>Other Research Support (Note a)</b>	4277.0	4199.7	4483.5	4718.9	4808.3	5108.9	5604.1	12.4%	31.0%
<i>Constant Dollars</i>	2264.2	2150.4	2224.0	2275.9	2233.3			-1.4%	
(3) <b>Education and Human Resources (Note b)</b>	944.1	843.5	700.3	695.6	766.3	845.3	857.8	-18.8%	-9.1%
<i>Constant Dollars</i>	499.8	431.9	347.4	335.5	355.9			-28.8%	
(4) <b>Salaries and Expenses (Note c)</b>	230.6	237.3	262.5	264.1	297.7	310.0	336.7	29.0%	46.0%
<i>Constant Dollars</i>	122.1	121.5	130.2	127.4	138.3			13.3%	
(5) <b>Totals</b>	\$5652.0	\$5480.8	\$5645.8	\$5884.4	\$6084.0	\$6490.4	\$7045.0	7.6%	24.6%
<i>Constant Dollars</i>	2992.0	2806.3	2800.5	2838.0	2825.8			-5.5%	

Current dollars are converted to constant dollars using the Consumer Price Index (based on prices during 1982–84). For Notes a, b, and c, see Table 1.

2010, an 8.5 percent increase over its planned expenditures for FY 2009. The additional \$555 million would increase funding for major investments in the scientific infrastructure, research endeavors, and human capital.

“With this budget, the president makes it absolutely clear that science and engineering research and education are vital to the nation’s future,” Bement said in a presentation to the National Science Board. “NSF has a long history of success in supporting research with far-reaching impacts on the U.S. economy and the well-being of Americans.”

The requested budget will also put the agency on a path to doubling its budget from FY 2006 to FY 2016, as envisioned in the president’s Plan for Science and Innovation, which is designed to sustain the momentum for investing in science and innovation that was generated by the American Recovery and Reinvestment Act (ARRA) of 2009.

Several prominent initiatives and other key investments outlined by President Obama will receive increased support under the requested budget:

**Potentially Transformative Research.** Transformative research involves ideas, discoveries, or tools that radically change our understanding of existing scientific or engineering concepts or educational practices. Such research is risky but can be high-reward if it leads to breakthroughs or creates new paradigms or fields. NSF explicitly recognizes the critical importance of transformative research in its merit review process. In FY 2010, each research division will set aside a minimum of \$2.0 million (\$92.0 million Foundation-wide) to explore methodologies and leverage ongoing activities that foster transformative research.

**New Faculty and Young Investigators.** (11.6 percent increase to \$203.8 million). NSF’s Foundation-wide Faculty Early Career Development (CAREER) program supports junior faculty who integrate top-notch education with outstanding research and will receive an 11.6 percent increase, to \$203.8 million. The five-year awards emphasize exploring new approaches and pursuing potentially transformative activities.

**Graduate Research Fellowship Program.** The prestigious program is the flagship for the federal government in supporting advanced education in a broad array of science and engineering disciplines as well as international research activity. To launch the presidential initiative of tripling the number of new fellowships awarded annually by FY 2013, the request supports 1,654 new fellowships in FY 2010.

**Advanced Technological Education (ATE).** Focusing on two-year colleges, ATE supports partnerships between academic institutions and employers to improve the education of science and engineering technicians. Career pathways between secondary schools, two-year, and four-year colleges

are supported, as are curriculum and professional development activities. Increasing the program’s budget by 24 percent to \$64.0 million in FY 2010 is the beginning of a growth trajectory reaching \$100.0 million in FY 2013.

**Climate Change Education Program.** This new program, which will be funded at \$10.0 million each in FY 2009 and FY 2010, will catalyze activity at the national level and help develop the next generation of environmentally engaged scientists and engineers by supporting awards in the following educational areas: increasing public understanding and engagement; development of resources for learning; informing local and national science, technology, engineering and mathematics (STEM) education policy; and preparing a climate science professional workforce.

Science education and workforce development is also a priority in the requested budget, reflecting the profound impact that scientific knowledge and training can have on the career options of individuals, the economic well-being of families and community, as well as the nation’s competitiveness.

**Integrative Graduate Education and Research Training (IGERT).** This program, which will see a nine percent increase to \$68.88 million, helps prepare doctoral students by integrating research and education in innovative ways that are tailored to the unique requirements of newly emerging interdisciplinary fields and new career options.

**Discovery Research K-12.** This program, which will receive \$108.5 million under the proposed budget, develops more effective tools and resources for teachers and students that will support inquiry-based classroom practices and a more intensive scientifically-based assessment of the efficacy of these resources.

**Robert Noyce Teacher Scholarship Program.** This program, funded at \$55.0 million under the proposed budget, enables institutions to develop and implement programs to prepare STEM undergraduate majors—and mid-career STEM professionals—to become K-12 science and mathematics teachers.

**The Math and Science Partnership (MSP).** Linking K-12 teachers with their colleagues in higher education, this program will receive \$58.2 million in FY 2010, and will continue to build capacity while integrating the work of higher education with that of K-12 to strengthen and reform science and mathematics education. In addition to these initiatives and priorities, the proposed budget will also ensure that NSF is able to continue to make other crucial investments that are integral to NSF’s mission and vision.

**Climate Change Science Program (CCSP).** This interagency program coordinates climate research across 13 departments and agencies, and will receive a 36.6 percent increase under the proposed budget. NSF’s role is to provide a comprehensive

scientific foundation for CCSP through support of a broad and basic research portfolio, which can provide insight into the fundamental processes underlying climate.

**Climate Research.** The FY 2010 request includes \$197.3 million for a Foundation-wide investment that builds upon CCSP and previous NSF efforts. It focuses on multidisciplinary research that deepens our current understanding of complex interactions that influence climate, through expanded observing capabilities, modeling and simulation, and fundamental research on ways to mitigate and adapt to the impacts of a changing climate. Investments will address smart adaptation and mitigation science, regional and decadal-scale climate modeling, ecosystem vulnerability, the carbon and water cycles, ocean acidification, abrupt climate change, and weather extremes.

**Cyber-enabled Discovery and Innovation (CDI).** (44.7 percent increase to \$102.6 million) CDI supports transformative, multidisciplinary science and engineering research outcomes made possible by innovations and advances in computational concepts, methods, models, algorithms, and tools. CDI breakthroughs advance one or more of the three themes: From Data to Knowledge; Understanding Complexity in Natural, Built, and Social Systems; Building Virtual Organizations.

**Cybersecurity.** The FY 2010 request includes \$126.7 million for cybersecurity research and education, with \$40.0 million specifically devoted to research in usability, theoretical foundations, and privacy in support of the Comprehensive National Cybersecurity Initiative.

**Experimental Program to Stimulate Competitive Research (EPSCoR).** NSF remains a leader in efforts to broaden participation in science and engineering in all states and regions. Funding for EPSCoR increases by 10.6 percent to \$147.1 million.

**Homeland Security Activities.** NSF programs apply to homeland security priorities in two areas: protecting critical infrastructure and key assets and defending against catastrophic threats. The proposed budget will increase that funding 2.2 percent to \$385.5 million.

**Networking and Information Technology R&D (NITRD).** NITRD coordinates networking and information technology investments across agencies. Major funding increases for FY 2010 are in such areas as large-scale networking, high-end computing research, human-computer interaction, and research on social, economic, and workforce aspects of advanced computing and communications technologies. The proposed budget will increase funding for the program by a 10.6 percent increase to \$1,110.8 million.

**National Nanotechnology Initiative.** This multi-agency initiative seeks systematic understanding, organization, manipulation, and control of

atomic, molecular, and supramolecular levels of matter in the size range of 1-100 nanometers. The initiative will receive a 6.5 percent increase to \$423.0 million under the proposed budget, which will also provide a \$2.0 million increase for the Environmental, Health, and Safety area to support decision analysis research.

**Major Research Equipment and Facilities Construction.** (\$117.29 million)

- Advanced Laser Interferometer Gravitational Wave Observatory: \$46.30 million.
- Atacama Large Millimeter Array: \$42.76 million.
- IceCube Neutrino Observatory: \$950,000.
- Advanced Technology Solar Telescope: \$10.0 million.
- Ocean Observatories Initiative: \$14.28 million.
- Judgment Fund: \$3.0 million.

**Regaining Our Energy Science and Engineering Edge (RE-ENERGYSE).** This set of investments, part of the president's New Energy for America plan, focuses on preparing students for careers related to research and education on clean energy. NSF, working with the Department of Energy, will leverage existing programs and partnerships to train scientists and technicians, educate K-12 and undergraduate students, and inform the public.

**Science and Engineering Beyond Moore's Law.** In 10 to 20 years, current silicon technology will reach the limits of Moore's Law—the empirical observation that computing power doubles roughly every 18 months. Activities in FY 2010, funded at \$46.7 million, will encourage transformational activities as well as creating partnering opportunities with the private sector and national laboratories to accelerate innovation.

**Science and Technology Centers (STC).** STCs integrate cutting-edge research, excellence in education, targeted knowledge transfer, and development of a diverse workforce across all disciplines of science and engineering. STCs conduct research through partnerships among academic institutions, national laboratories, industrial organizations, and/or other public/private entities, and via international collaborations, as appropriate. With funding set at \$57.8 million, up to five new STCs are expected to be funded in FY 2010, for a total of 17.

**Stewardship.** To manage the growing and increasingly complex workload being experienced throughout the Foundation, the request includes an 8 percent increase for Agency Operations and Award Management.

Bement ended his remarks to the [National Science Board] by stating that the nation needs "research and education in every scientific field to resolve America's greatest challenges. With a steady eye on the frontier, NSF will continue to support basic research across all fields and

education at all levels to ensure that America remains a global leader in science and technology.”

### Budget Request: Mathematical Sciences

The Division of Mathematical Sciences (DMS) supports research at the frontiers of fundamental, applied, and computational mathematics and statistics and enables discovery in other fields of science and engineering. In turn, advances in science and engineering that are driven by powerful computing environments and that routinely generate large datasets require development of ever more sophisticated mathematical tools. DMS plays a key role in training the nation’s scientific and engineering workforce. In general, 53 percent of the DMS portfolio is available for new research grants. The remaining 47 percent is used primarily to fund continuing grants made in previous years.

DMS supports research programs in algebra, number theory, and combinatorics; analysis; applied mathematics; computational mathematics; foundations; geometry and topology; mathematical biology; probability and statistics. In addition, DMS supports national mathematical sciences research institutes; postdoctoral, graduate and undergraduate training opportunities; and infrastructure, such as workshops, conferences, and equipment.

NSF plays a critical role in the mathematical sciences, as it provides more than 60 percent of all federal support for basic research in the nation’s colleges and universities. In certain areas of the mathematical sciences this percentage is even higher, since NSF supports a broader range of fundamental and multidisciplinary research topics than other federal agencies.

In FY 2008, DMS received 2,181 research proposals and made 678 awards for a funding rate of 31 percent.

### Changes by Activity

*Mathematical Sciences Research Institutes* (+\$6.0 million, to a total of \$26.0 million). These institutes are supported in 10-year cycles. The current funding cycle for four of the institutes ends in FY 2009. They are eligible to re-compete in a FY 2010 institutes solicitation with other projects. The FY 2010 budget can accommodate an increase in the number and size of institute awards. Four to six awards are expected.

*Cyber-enabled Discovery and Innovation (CDI)* (+\$5.20 million, to a total of \$10.40 million). CDI uses the mathematical sciences to provide new ways of obtaining insight into the nature of complex phenomena in science and engineering.

*Science and Engineering Beyond Moore’s Law (SEBML)* (+\$2.0 million, to a total of \$2.75 million). In parallel with Moore’s Law for hardware, SEBML continues the algorithmic “Moore’s Law”, i.e., the exponential increase in speed of basic computations due to innovative new algorithms, and develops new mathematical frameworks for computation.

*Solar Energy Research (SOLAR)* (+\$1.70 million, to a total of \$2.40 million). SOLAR will support multidisciplinary teams engaged in potentially transformative research on the efficient harvesting, conversion, and storage of solar energy.

*Climate Research (CR)* will start in FY 2010 at \$1.85 million. CR will support development of mathematical methods and effective computational techniques needed for simulation and analysis of climate models.

## Mathematical Sciences Funding

(Dollars in Millions)

	FY 2008 Actual	FY 2009 Current Plan	FY 2009 ARRA Estimate	FY 2010 Request	Change Over FY 2009 Plan	
					Amount	Percent
<b>Total, DMS</b>	<b>\$211.75</b>	<b>\$226.18</b>	<b>\$98.00</b>	<b>\$246.41</b>	<b>\$20.23</b>	<b>8.9</b>
Major Components:						
Research and Education Grants	211.37	226.08	98.00	246.21	20.13	8.9%
Centers	0.38	0.10	-	0.20	0.10	1.0%
<i>Ctrs. for Analysis &amp; Synthesis</i>	-	0.10	-	0.10	-	-
<i>Nanoscale Science &amp; Engr. Centers</i>	0.38	-	-	0.10	-	N/A