

## INTEGRATIVE ACTIVITIES

**\$271,120,000**  
**+\$29,780,000 / 12.3%**

### Integrative Activities Funding

(Dollars in Millions)

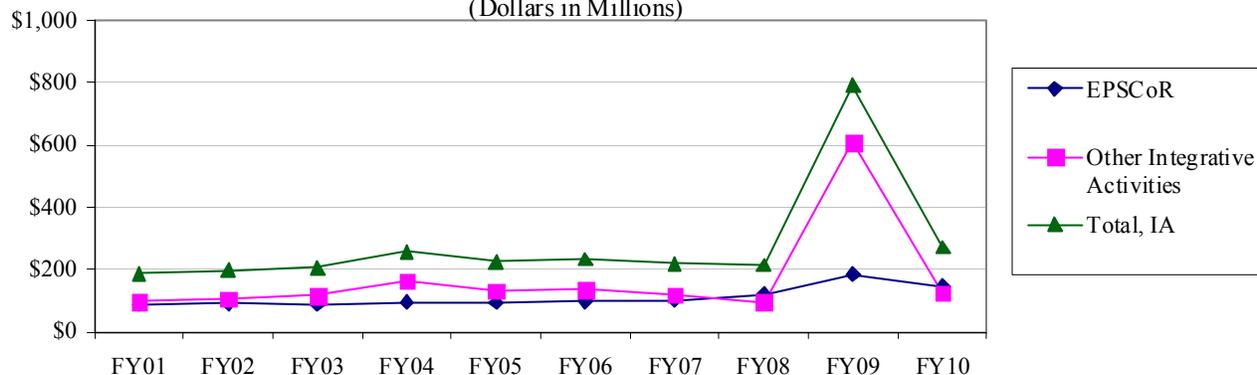
	FY 2008 Actual	FY 2009 Current Plan	FY 2009 ARRA Estimate	FY 2010 Request	Change Over FY 2009 Plan	
					Amount	Percent
<b>Total, IA<sup>1</sup></b>	<b>\$214.48</b>	<b>\$241.34</b>	<b>\$550.00</b>	<b>\$271.12</b>	<b>29.78</b>	<b>12.3%</b>
<i>EPSCoR</i>	<i>120.00</i>	<i>133.00</i>	<i>50.00</i>	<i>147.12</i>	<i>14.12</i>	<i>10.6%</i>

<sup>1</sup> In FY 2010, management responsibilities for Partnerships for Innovation (PFI) and Science of Learning Centers (SLC) are transferred to the Directorate for Engineering and the Directorate for Social, Behavioral and Economic Sciences, respectively. Funding for the PFI and SLC is removed for all years for comparability.

Integrative Activities (IA) supports emerging, cross-disciplinary research and education, recognizing the importance of integrative efforts to the future of science and engineering. IA is a source of federal funding for the acquisition and development of research instrumentation at U.S. academic institutions and for strengthening the research and educational infrastructure throughout the Nation. Additionally, IA invests in a number of integrative research and education centers and programs that enhance NSF research investments in discovery and workforce development.

### Integrative Activities Funding

(Dollars in Millions)



### IA in Context

IA programs are managed by a variety of organizations within NSF, which provides the flexibility to broaden support for emerging, cross-disciplinary research programs and activities. For example, the Science and Technology Centers: Integrative Partnerships (STC) program, which currently funds 17 centers that are managed cooperatively by six NSF directorates/offices and the Office of Integrative Activities, supports innovative, potentially transformative, complex research and education projects that require large-scale, long-term awards. STCs engage the Nation's intellectual talent through partnerships among academia, industry, national laboratories, and government. These collaborations create synergies that enhance: innovation and the timely transfer of knowledge and technology from the laboratory to appropriate industries; the launching of spin-off companies; the training of the next generation of

scientists and engineers as well as educators; and the creation of job opportunities. STCs have impressive records of research achievement as well as strong partnerships with K-12/informal education communities and industry.

The Major Research Instrumentation (MRI) program is a Foundation-wide, crosscutting program that supports the acquisition and development of instrumentation to enable research in all areas of interest to NSF. MRI funding provides state-of-the-art instrumentation that is too costly to be supported through other NSF programs. Scientific advances in many fields are critically dependent on sophisticated instrumentation, and the MRI empowers the Nation's scientists and engineers to undertake leading-edge disciplinary and cross-disciplinary research. The MRI program enables the establishment of research-intensive learning environments that promote the development of a diverse workforce and the next generation of instrumentation, as well the creation of academic/private sector partnerships to create new products with wide scientific and commercial impact. Approximately \$20.0 million supports teaching-intensive and minority-serving institutions, including Historically Black Colleges and Universities, Hispanic-Serving Institutions, Tribal Colleges and Universities, and community colleges, with proposal success rates that are comparable to those for research-intensive universities.

A leading-edge, 21<sup>st</sup> century communications effort is essential for public acceptance and support of science and engineering. "Traditional media" – television networks, newspapers, and magazines – are giving way to internet news sites, web logs, personal-device downloads, wireless transmissions, and the like, competing among a population that have become highly pluralized not only in its requirements for information, but also in its cultural demographics. In today's technological culture, opportunities for learning abound in both community and personal settings. The Office of Legislative and Public Affairs' effort, "Communicating Science Broadly Through Multi-media Platforms", creates products and processes that make learning and understanding science, technology, engineering, and mathematics part of everyday life.

The Experimental Program for Stimulation of Competitive Research (EPSCoR) maximizes cross-directorate interaction and ensures the integration of its efforts with the research and education directorates. Detailed information about EPSCoR is provided later in this chapter.

**Integrative Activities Funding by Program**

(Dollars in Millions)

	FY 2008 Actual	FY 2009		FY 2010 Request	Change Over FY 2009 Plan	
		Current Plan	ARRA Estimate		Amount	Percent
Communicating Science Broadly <sup>1</sup>	[\$4.44]	\$4.00	-	\$4.00	-	-
EPSCoR	120.00	133.00	50.00	147.12	14.12	10.6%
Major Research Instrumentation	93.87	100.00	300.00	100.00	-	-
Partnerships for Innovation <sup>2</sup>	[9.19]	[9.19]	-	-	-	N/A
Science and Technology Centers	0.59	1.30	-	13.40	12.10	930.8%
Science and Technology Policy Institute <sup>3</sup>	[2.24]	3.04	-	3.04	-	-
Science of Learning Centers <sup>2</sup>	[14.89]	[12.5]	-	-	-	N/A
Graduate Research Fellowship	-	-	-	3.56	3.56	N/A
Academic Research Infrastructure	-	-	200.00	-	-	N/A
<b>Total, Integrative Activities</b>	<b>\$214.48</b>	<b>\$241.34</b>	<b>\$550.00</b>	<b>\$271.12</b>	<b>\$29.78</b>	<b>12.3%</b>

Totals may not add due to rounding.

<sup>1</sup> Communicating Science Broadly is presented in FY 2008 for information purposes only and is not included in the total for this year. This effort was funded through Research and Related Activities Program funding prior to being transferred to IA in FY 2009.

<sup>2</sup> In FY 2010, funding for the Partnerships for Innovation and the Science of Learning Centers programs is transferred to the Directorate for Engineering and the Directorate for Social, Behavioral and Economic Sciences, respectively, which have primary responsibility for funding and program management.

<sup>3</sup> In FY 2008, \$2.24 million was transferred to the Office of Science and Technology Policy for the Science and Technology Policy Institute.

**Office-wide Changes and Priorities**

*EPSCoR (+\$14.12 million, to a total of \$147.12 million).*

With an increase of \$14.12 million over the FY 2009 Current Plan, FY 2010 funding for EPSCoR will total \$147.12 million, an increase of 10.6 percent above the FY 2009 level. This is in keeping with previous Congressional direction that EPSCoR funding levels should mirror overall changes in the Research and Related Activities (R&RA) budget. This increase, combined with the redirection of \$8.82 million from Co-Funding, will raise the level for Research Infrastructure Improvement (RII) to a total of \$114.44 million, or 22.94 percent over the FY 2009 Current Plan level. In FY 2010, EPSCoR investment priorities are: 1) improved competitiveness of EPSCoR jurisdictions in disciplinary and multidisciplinary research programs across NSF, including large scale and cross-cutting competitions; 2) strengthened cyberinfrastructure critical to advances in research and education in all EPSCoR jurisdictions; and 3) increased diversity that is essential to greater use of the human and institutional resources in EPSCoR jurisdictions.

*Science and Technology Centers: Integrative Partnerships (+\$12.10 million, to a total of \$13.40 million).*

FY 2010 funding of \$13.40 million will support the start up of five new centers. In FY 2009, after ten years of funding, support for five centers from the Class of 2000 program ended. The STC research portfolio reflects the disciplines of science and engineering supported by the NSF. Some examples of continuing investment include cyber-security, advanced sensors and embedded networked sensing, revolutionary materials for information technology, and modeling and simulation of complex earth environments for improving their sustainability, and weather/climate prediction.

*Graduate Research Fellowships (+\$3.56 million, to a total of \$3.56 million).*

In support of the Presidential initiative to triple the number of new fellows, IA will invest new funding totaling \$3.56 million for graduate research fellowships in FY 2010.

*Major Research Instrumentation (No change for a total of \$100.0 million).*

Funding for MRI will be unchanged from the FY 2009 allocation. The MRI FY 2010 competition will be the third such competition within 12 months (preceded by FY 2009 competition in January 2009 and the ARRA-funded competition in mid-2009). During FY 2010, the MRI funding cap will be \$4.0 million for single instrument acquisition requests submitted by eligible institutions.

In the FY 2008 MRI competition, NSF reviewed 810 proposals, requesting \$515.80 million. MRI funds were used to make 225 awards totaling \$93.90 million. Of those awards, minority-serving institutions received 24 awards totaling \$9.30 million, and non-Ph.D.-granting institutions received 84 awards totaling \$21.20 million. All institution types had comparable success rates, based on the number of proposals submitted. Approximately 225 competitive awards are anticipated in FY 2010.

*Communicating Science Broadly (No change for a total of \$4.0 million).*

The requested \$4.0 million supports a range of program activities encompassing internet technology, visualization, cable TV, radio, the entertainment industry, public awareness campaigns, and new outreach efforts, including new partnerships with research institutions, state and local governments, and businesses.

*Science and Technology Policy Institute (No change for a total of \$3.04 million).*

In support of the Office of Science and Technology Policy request for the Science and Technology Policy Institute, and consistent with the STPI authorizing statute, NSF sponsors the STPI contract at \$3.04 million.

*Science of Learning Centers and Partnerships for Innovation*

Two programs previously funded through the IA budget have been transferred to those directorates which have the primary responsibility for managing the programs. The Directorate for Social, Behavioral and Economic Sciences and the Directorate for Engineering now have the lead for funding and management oversight of the Science of Learning Centers and Partnerships for Innovation programs, respectively.

**EXPERIMENTAL PROGRAM TO STIMULATE  
COMPETITIVE RESEARCH**

**\$147,120,000  
+\$14,120,000 / 10.6%**

**Experimental Program to Stimulate Competitive Research Funding**

(Dollars in Millions)

	FY 2009		FY 2009	FY 2010 Request	Change Over FY 2009 Plan	
	FY 2008 Actual	Current Plan	ARRA Estimate		Amount	Percent
Co-Funding	\$46.98	\$40.00	-	\$31.18	-\$8.82	-22.1%
Outreach and Workshops	0.23	1.50	-	1.50	-	-
Research Infrastructure Improvement	72.79	91.50	50.00	114.44	22.94	25.1%
<b>Total, EPSCoR</b>	<b>\$120.00</b>	<b>\$133.00</b>	<b>\$50.00</b>	<b>\$147.12</b>	<b>\$14.12</b>	<b>10.6%</b>

*Experimental Program to Stimulate Competitive Research (EPSCoR) (+\$14.12 million to a total of \$147.12 million).* This request is in keeping with previous Congressional direction that EPSCoR funding levels should mirror overall changes in the Research and Related Activities (R&RA) budget. EPSCoR is explicitly focused on assisting NSF in its statutory function “to strengthen research and education throughout the United States.” The primary goals of EPSCoR are to (1) provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness, and (2) advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation, and overall knowledge-based prosperity. Its objectives are to: (1) catalyze key research themes that empower knowledge generation, dissemination, and application; (2) activate effective jurisdictional and regional collaborations that advance scientific research, promote innovation, and benefit society; (3) broaden participation in science and engineering (S&E) by institutions, organizations, and people within EPSCoR jurisdictions; and (4) use EPSCoR for development, implementation, and evaluation of future programmatic experiments that motivate positive change and progression.

EPSCoR employs a portfolio of three complementary strategies, Research Infrastructure Improvement (RII), Co-Funding of Disciplinary and Multidisciplinary Research, and Outreach and Workshops.

- RII Track-1 awards provide up to \$4.0 million per year for up to five years. They are intended to improve the research competitiveness of jurisdictions by improving academic research infrastructure in areas of science and engineering supported by the National Science Foundation and critical to the particular jurisdiction’s science and technology initiative or plan. These areas must be identified by the jurisdiction’s EPSCoR governing committee as having the best potential to improve future R&D competitiveness.

RII Track-2 awards provide up to \$2.0 million per year for up to three years as collaborative awards to consortia of EPSCoR jurisdictions to support innovation-enabling cyberinfrastructure of regional, thematic, or technological importance. These awards facilitate the enhancement of discovery, learning, and economic development of EPSCoR jurisdictions through the use of cyberinfrastructure and other technologies, and are a vital complement to RII Track-1 awards.

- Through Co-Funding of Disciplinary and Multidisciplinary Research, EPSCoR co-invests with NSF directorates and offices in the support of meritorious proposals from individual investigators, groups, and centers in EPSCoR jurisdictions that are submitted to the Foundation’s research and education

programs, and crosscutting initiatives. These proposals have been merit reviewed and recommended for award, but could not be funded without the combined, leveraged support of EPSCoR and the research and education directorates.

- In its Outreach and Workshops activities, NSF EPSCoR invites requests for support of workshops, conferences, and other community-based activities designed to explore opportunities in emerging areas of science and engineering, and to share best practices in design and implementation in strategic planning, diversity, communication, cyberinfrastructure, evaluation, and other topics of importance to EPSCoR jurisdictions. The EPSCoR Office also supports outreach travel that enables NSF staff from all directorates and offices to work with the EPSCoR research community regarding NSF opportunities, priorities, programs, and policies. Such visits also serve to more fully acquaint NSF staff with the science and engineering accomplishments, ongoing activities, and new directions and opportunities in research and education in the EPSCoR jurisdictions.

In general, 50 percent of EPSCoR’s portfolio is available for new research grants. The remaining 50 percent is used primarily to fund continuing grants made in previous years.

### **Program Evaluation and Performance Improvement**

The Performance Information chapter describes the Foundation’s performance evaluation framework, which is built upon the four strategic outcome goals in NSF’s Strategic Plan: *Discovery, Learning, Research Infrastructure, and Stewardship*. Performance evaluation is conducted at all levels within the Foundation, using both qualitative and quantitative measures – including an agency-wide annual review of research and education outcomes by an external expert committee and periodic reviews of programs and portfolios of programs by external Committees of Visitors and directorate Advisory Committees. In FY 2009, EPSCoR will hold a Committee of Visitors as well as reserve site visits to review the progress of the program and its RII projects. Other performance indicators, such as funding rates, award size and duration, and numbers of people supported on research and education grants, are also factored into the performance assessment process.

**Number of People Involved in EPSCoR Activities**

	FY 2008 Estimate	FY 2009 Estimate	FY 2009	
			ARRA Estimate	FY 2010 Estimate
Senior Researchers	540	555	81	597
Other Professionals	234	155	23	167
Postdoctorates	86	95	7	102
Graduate Students	557	405	60	437
Undergraduate Students	452	411	60	444
<b>Total Number of People</b>	<b>1,869</b>	<b>1,621</b>	<b>231</b>	<b>1,747</b>

## Recent Research Highlights

► **Mobile Robots: City-Climbers with Artificial Intelligence:** Moving up and down the side of a building is no longer the sole purview of cartoon heroes such as Spiderman. Researchers and students from the City College of the City University of New York are developing a new generation of miniature wall-climbing robots and artificial intelligence techniques. Unlike earlier wall-climbing robots, the City-Climber robots use aerodynamic attraction, which achieves good balance between strong adhesion force and high mobility and does not require perfect sealing. As a result, they can operate on both smooth and rough surfaces with reasonably large payloads. Equipped with a camera, motion sensor, rotary laser range sensor and computing board, the robot is capable of constructing a complete 3D-laser map of indoor environments in collaboration with three ground robots. Using artificial intelligence techniques, inspired from genetic improvements of living creatures, City Climbers will be equipped with software modules to allow them to spread uniformly over given areas. City-climber robot technology has wide applications in various defense, security, and inspection missions. Variant prototypes may be eventually used for tasks such as building inspections and window cleaning.



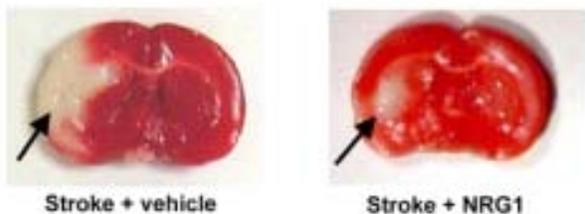
CityClimber prototype-IV on a brick wall. *Credit: Umit Uyar and Jizhong Xiao, CUNY City College of New York.*

► **Bioinformatics Workshop for Teachers:** Secondary and postsecondary teachers of science, mathematics, and technology are armed with the tools needed to better prepare and excite students about the computational sciences and biotechnology after attending a professional development workshop on bioinformatics. Participants were exposed to research, development, and application of computational tools and approaches for expanding their use in biological, medical, behavioral, and health related areas. The hands-on experiences in computational sciences and biotechnologies increased participants' awareness of and knowledge in the field while better preparing them to implement activities in the classroom and share the excitement of computational science with their students. They received research-based curriculum materials developed through Mississippi-EPSCoR (NSF) and the Human Genome Project (NIH). Contributors to the workshop included experts from BioRad Laboratories in California and research/education faculty from Jackson State University, Mississippi State University, the University of Mississippi and the University of Southern Mississippi.



Participants incorporating a green fluorescent protein into bacteria. *Credit: Mississippi EPSCoR*

► **Growth Factor Found to Extend Therapeutic Window for Stroke Victims:** A naturally occurring growth factor called neuregulin-1 could possibly extend the window for therapeutic treatments for stroke victims. With pilot funding from NSF, a research team led by the Center for Behavioral Neuroscience Science at Emory University examined the effects of administering neuregulin-1, a protective compound which neurons produce naturally in rats after they suffered strokes. Researchers discovered neuregulin-1 reduced cell death by 90 percent when compared to rats that did not receive it. The compound also protected neurons from damage even when administered as long as 13



A simplified rat brain slice after stroke given either a placebo or neuregulin. Credit: Byron Ford, Ph.D., Morehouse School of Medicine.

hours after the stroke's onset. In further analysis of the affected brain tissue, researchers determined neuregulin-1 produces its protective effects by turning on or off nearly 1,000 genes that regulate cell death and inflammation. Neuregulin-1 also blocks the production of free radicals, compounds that have been implicated in cell injury and aging.

► **Record Neutron Beam Intensity:** An NSF-funded instrument at the Center for High Resolution Neutron Scattering now holds the record for producing the world's most intense neutron beam. The instrument, called MACS, produces a beam that exceeds the competition by more than an order of magnitude. Neutrons are an ideal probe of materials at the nanoscale level. However, because neutrons interact weakly with materials, researchers need a very intense beam to study small samples. The instrument, which was funded by a MRI grant, was built at Johns Hopkins University with the involvement of graduate and undergraduate students. It comprises 357 graphite platelets that can be oriented to direct neutrons at the same sample. With 40 times more neutrons and 20 times better detection capability, MACS will be 100 to 1,000 times more efficient than a conventional spectrometer.



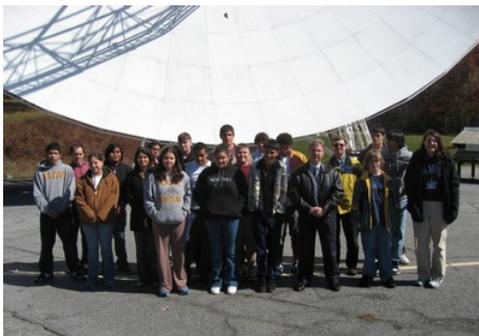
The MACS focusing device built with involvement of graduate and undergraduate students. Credit: Hopkins.

► **NSF Science and Technology Center Wins United Nations Prize:** NSF's Science and Technology Center for Sustainability of Semi-Arid Hydrology and Riparian Areas is one of two institutions to win the 2007 International Great Man-made River Prize. The prize is awarded by the United Nations Education, Science, and Culture Organization for remarkable scientific research work on water usage in arid areas, as well as areas subject to drought, and also for the development of agriculture to benefit humanity and the environment. The purpose of the technology center, headquartered at the University of Arizona, is to inform and support water professionals by conducting stakeholder-relevant research, education, and knowledge transfer activities. The goal is to create new or improved understanding of the complexities in, and impacts of, the interactions between physical, biological, economic and human factors in semi-arid hydrology.



Students measure evaporation rates in Patagonia, Arizona. Credit: Jonathan Petti, SAHRA, University of Arizona, Tucson.

► **Vast Facility in Appalachia Brings Students, Researchers Together:** NSF funds a major project to



Cherokee High School principal, teachers, and students with Pisgah Astronomical Research Institute director Don Cline in front of one of PARI's 26-ft radio telescopes. *Credit: PARI.*

study rapid variability in distant cosmic radio sources. The scientific outcome may provide possible new leads on the nature of dark matter and the structure of the galaxy. What makes this project different from many others is the location of the research facility deep in the heart of Appalachia, a traditionally under-represented area for advanced scientific research. Two 26-meter radio dishes at the Pisgah Astronomical Research Institute in the Pisgah National Forest of western North Carolina provide an excellent platform for the research project. Each summer, the institute hosts dozens of high school students and teachers for a residential science program, giving the participants a better understanding of science, and spurring some of the students to later careers in the sciences. The program is run by the University of North Carolina at Asheville.

