

# EDUCATION AND HUMAN RESOURCES

**\$857,760,000**  
**+\$12,500,000 / 1.5%**

## Education and Human Resources Funding

(Dollars in Millions)

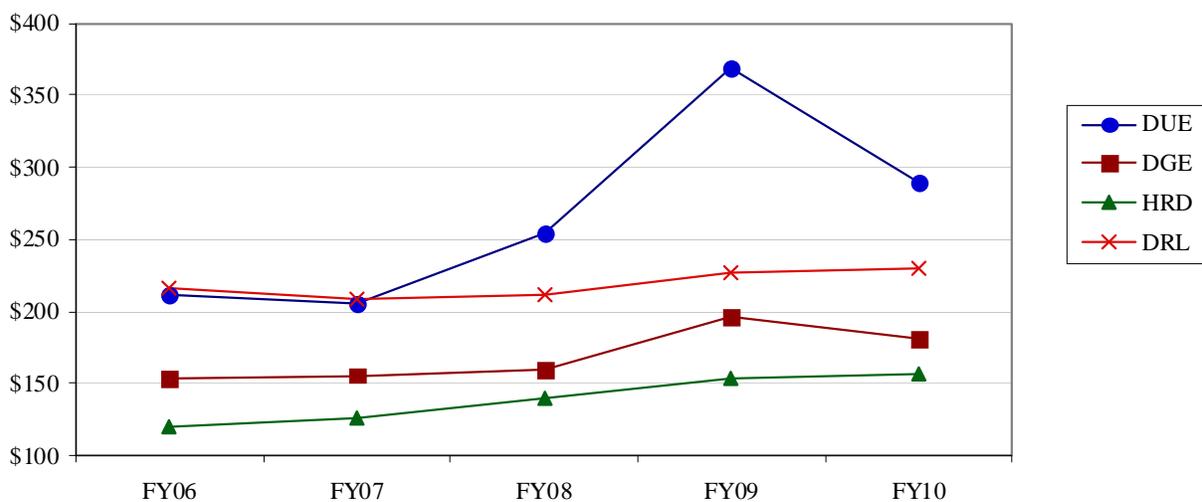
	FY 2008	FY 2009	FY 2009	FY 2010	Change Over	
	Actual	Current Plan	ARRA Estimate	Request	FY 2009 Plan Amount	Percent
Research on Learning in Formal and Informal Settings (DRL)	\$212.30	\$226.50	-	\$229.50	\$3.00	1.3%
Undergraduate Education (DUE)	254.00	283.23	85.00	289.91	6.68	2.4%
Graduate Education (DGE)	159.59	181.50	15.00	181.44	-0.06	-0.0%
Human Resource Development (HRD)	140.37	154.03	-	156.91	2.88	1.9%
<b>Total, EHR</b>	<b>\$766.26</b>	<b>\$845.26</b>	<b>\$100.00</b>	<b>\$857.76</b>	<b>\$12.50</b>	<b>1.5%</b>

Totals may not add due to rounding.

As the principal source of federal funding to promote science and engineering (S&E) education, the NSF Directorate for Education and Human Resources (EHR) promotes excellence in science, technology, engineering, and mathematics (STEM) education. The goal of EHR activities is to strengthen U.S. education at all levels, in both formal and informal learning settings, and to support continued U.S. economic and research preeminence. The EHR Directorate promotes excellence in STEM education through its highest priorities: the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators; a well-informed citizenry; and access to the ideas and tools of science and engineering for all. The investment in education, research, and infrastructure enhances the quality of life of all citizens and the health, prosperity, welfare, and security of the nation while building the STEM workforce of the 21<sup>st</sup> century.

## EHR Subactivity Funding

(Dollars in Millions)



### Appropriation Language

For necessary expenses in carrying out science and engineering education and human resources programs and activities pursuant to the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-1875), including services as authorized by 5 U.S.C. 3109, authorized travel, and rental of conference rooms in the District of Columbia, ~~\$845,260,000~~ \$857,760,000, to remain available until September 30, 2010: *Provided further*, That not less than \$55,000,000 shall be available until expended for activities authorized by section 7030 of Public Law 110-69-2011.

### Education and Human Resources FY 2010 Summary Statement (Dollars in Millions)

	Enacted/ Request	Supplemental	Carryover/ Recoveries	Rescission	Expired	Total Resources	Obligations Incurred/Est.
FY 2008 Appropriation	\$725.60	\$40.00	1.07	-0.10	-0.31	\$766.26	\$766.26
FY 2009 Current Plan (CP)	845.26					845.26	845.26
FY 2009 ARRA	100.00					100.00	100.00
FY 2010 Request	857.76					857.76	857.76
\$ Change from FY 2009 CP							\$12.50
% Change from FY 2009 CP							1.5%

Totals may not add due to rounding.

### Explanation of Carryover

Within the **Education and Human Resources (EHR)** appropriation, a total of \$2,764 was carried forward into FY 2009.

### EHR in Context

The EHR FY 2010 Budget Request is aligned with several national directives: Presidential initiatives, the America COMPETES Act (ACA), and guidance from the National Science Board and the National Academies. It fosters connections among higher education, business and industry, K-12 systems both formal and informal, and professional societies to share in the production and productivity of the next generation of scientists and engineers to ensure national competitiveness in S&E.

To sustain its national leadership in STEM research, policy, and practice, EHR continues to emphasize its thematic priorities in FY 2010: Broadening Participation to Improve Workforce Development; Enriching the Education of STEM Teachers; Furthering Public Understanding of Science and Advancing STEM Literacy; Fostering Cyberlearning to Enhance STEM Education; Promoting Learning through Research and Evaluation; and Advancing Career Development Opportunities. These thematic areas encourage the community to identify commonalities of purpose and characteristics that link across numerous programs. The thematic structure emphasizes synergistic work among programs. The synergy will promote linkages and discussions among various stakeholder groups; advance our knowledge base in terms of breadth, depth, and coverage; ensure a systematic response to national issues in STEM education; and help define NSF's strategic leadership in STEM education.

EHR partners with the scientific and education communities directly to both situate the directorate's work in the broader societal and scientific context, and to advance shared commitments to STEM education research, development, practice, and workforce development. EHR scientific staff involvement with professional disciplinary and education societies' committees, working groups, symposia, and conferences is essential in identifying key needs and issues in STEM education. STEM education challenges and themes, including K-12 student achievement, higher education STEM enrollment trends, STEM teacher workforce preparation, and graduate enrollment patterns of interest to the Administration are tracked through a variety of reports. These include the National Science Board's Science and Engineering Indicators (NSB 08-01; [www.nsf.gov/statistics/seind08/](http://www.nsf.gov/statistics/seind08/)), the National Assessment of Educational Progress (<http://nces.ed.gov/NATIONSREPORTCARD/>), the reports of the Council of Graduate Schools ([www.cgsnet.org/Default.aspx?tabid=177](http://www.cgsnet.org/Default.aspx?tabid=177)), and international comparative studies such as the Trends in International Mathematics and Science Study (TIMSS 2007; <http://timss.bc.edu/TIMSS2007/index.html>) and the Programme for International Student Assessment (PISA, [www.pisa.oecd.org](http://www.pisa.oecd.org)).

### **Directorate-Wide Changes and Priorities**

*Advance Technological Education (ATE) (+\$12.38 million, to a total of \$64.0 million).*

ATE, housed in DUE, focuses on educating technicians who have the understanding, knowledge, and abilities to creatively support science and engineering. Support is also provided for professional development of the faculty who teach the technicians. Projects work closely with a variety of industries to learn about and meet the educational requirements of industry for technicians. For example, wind energy has become a key focus as a renewable energy source over the past decade. Last year alone, 3,200 new wind turbines were installed across the nation adding to the total of more than 25,000. The budget increase will fund approximately 10 additional awards in FY 2010.

*Graduate Research Fellowships (GRF) (-\$4.42 million, to a total of \$102.58 million).*

In FY 2010, approximately 1,654 new Fellows will be supported. In response to the Administration's plan to triple the number of NSF's new Graduate Research Fellows, EHR is contributing to NSF's commitment to encourage more highly talented students to pursue graduate education in science and engineering. Total funding for GRF is estimated to be \$122.00 million, including EHR's contribution of \$102.58 million. Although the EHR FY 2010 budget decreases, NSF-wide contributions will increase for this EHR-managed program. GRF is widely recognized as a unique fellowship award program because it supports the development of world-class scientists and engineers across all S&E fields supported by NSF as well as international research activity.

*Climate Change Education (CCE) (-\$4.50 million, to a total of \$5.50 million).*

EHR, the Directorates of Geosciences (GEO) and Biological Sciences (BIO), and the Office of Polar Programs (OPP) will support this new multi-disciplinary, multi-faceted climate change education program to enable a variety of partnerships, including those among K-12 education, higher education, the private sector, and related non-profit organizations, in formal and informal settings, as well as relevant education and/or climate-related policymakers. It will support individual investigators and multidisciplinary teams of STEM researchers and educators in a range of activities, including those local, regional, and/or global in scope. This includes partnerships to establish model professional development opportunities for climate policy decision makers. Although there is a decrease within EHR, the total FY 2010 request is \$10.0 million including the EHR expected contribution of \$5.50 million.

*Integrative Graduate Education and Research Traineeships Program (IGERT) (+\$4.86 million, to a total of \$29.86 million).*

IGERT is an NSF-wide program administered by DGE. This increase will provide funding for three new IGERT awards in the most critical science and engineering areas of national importance (e.g., activities will include a range from clean renewable energy and water to climate change education).

*Louis Stokes Alliances for Minority Participation (LSAMP) (+\$2.25 million, to a total of \$44.75 million).*

LSAMP's objective is to increase the number and quality of underrepresented minorities completing undergraduate degrees in STEM. With the increase in resources, LSAMP will support an additional LSAMP Bridge to the Doctorate award and enhance international research opportunities for underrepresented students and faculty through five supplemental awards.

*STEM Talent Expansion Program (STEP) (+\$1.83 million, to a total of \$31.53 million).*

STEP seeks to increase the number of students receiving degrees in established or emerging fields within science, technology, engineering, and mathematics. Awards are made both to provide for implementation efforts at academic institutions and to support research degree attainment in STEM. The increase will allow the establishment of two additional centers in FY 2010, in collaboration with the Research and Related Activities (R&RA) Directorates.

*Project and Program Evaluation (PPE) (+\$2.0 million, to a total of \$12.0 million).*

PPE is a strong focus of the EHR Directorate. Funded within the DRL, emphases include planning and oversight of third-party evaluations of EHR programs and thematic STEM evaluation studies; providing evaluation technical assistance throughout EHR and NSF; and providing training opportunities and tools to build capacity in the field. EHR's evaluation team coordinates data collection efforts for performance monitoring and responding to GPRA and other federal reporting requirements; disseminates broader information and evaluation findings to various stakeholders; and addresses directorate-wide knowledge management concerns for improved productivity. Increased funding will allow for continued longitudinal studies in FY 2010.

*Research and Evaluation on Education in Science and Engineering (REESE) (+\$1.0 million, to a total of \$43.0 million).*

REESE supports basic and applied research and evaluation that enhances understanding of STEM learning and teaching. Through its increased investment in FY 2010 the program will encourage proposals to examine the feasibility of studying major STEM education innovations or policies with national implications in such areas as teacher education and K-12 standards and assessment.

## **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, periodic reviews of programs and portfolios of programs by external Committees of Visitors, and directorate Advisory Committees. 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.

All EHR programs require project-level evaluation, and findings from these are aggregated and considered in program-level strategic planning and refinement at the program and division level. In

addition, program evaluations are ongoing to assess program quality and impact, and the results of these formative and summative evaluation activities are essential in the continued shaping of program directions and emphases. Finally, planning for EHR portfolio-wide evaluation is underway, so that the role of EHR investments in improving STEM education and workforce development can be examined in key priority areas.

To ensure the quality of EHR's processes for handling proposals and recommending proposals for awards, EHR convenes Committee of Visitors (COV) comprised of expert external evaluators to review all programs every three years. COV reviews are scheduled for both DUE (S-STEM, SFS, and EASE) and HRD (LSAMP, AGEP, CREST, HBCU-UP and T-CUP) in FY 2010.

**Number of People Involved in EHR Activities**

	FY 2008 Estimate	FY 2009 Estimate	FY 2009	
			ARRA Estimate	FY 2010 Estimate
Senior Researchers	7,643	7,952	280	8,000
Other Professionals	2,434	2,500	350	2,550
Postdoctorates	382	420	4	450
Graduate Students	7,553	7,710	1,650	8,403
Undergraduate Students	5,279	5,335	680	5,335
K-12 Students	12,454	12,454	500	12,470
K-12 Teachers	62,060	62,100	1,075	62,150
<b>Total Number of People</b>	<b>97,805</b>	<b>98,471</b>	<b>4,539</b>	<b>99,358</b>

## Recent Research Highlights

► **Working With K-12 Teachers Improves the Knowledge of Disciplinary Professors:** The main emphasis of NSF's Math and Science Partnership program is on improving K-12 student achievement in mathematics and science. A hallmark method of the program is engaging higher education professors who are experts in their science, mathematics and engineering disciplines to work in a variety of ways with practicing K-12 teachers, as well as with undergraduates who aim to become teachers. Researchers from the Math and Science Partnership of Greater Philadelphia found evidence of an unanticipated second type of impact on professors from their interaction with K-12 teachers – a positive impact on the professors' actual disciplinary knowledge and research. An online survey sent to participating higher education professors confirmed this secondary benefit: fully two-thirds of the respondents indicated a positive impact on their disciplinary knowledge and more than 90 percent of the respondents said the experience made them better teachers.

► **FunWorks: A Digital Library Designed by and for Middle School Students:** FunWorks is an innovative digital library that engages young people in the exploration of career opportunities in science, technology, engineering and mathematics. Developed by the Education Development Center, FunWorks is supported by NSF's National Science, Technology, Engineering and Mathematics Education Digital Library. The center first consulted up to 300 middle-school students from diverse backgrounds in Boston to research student website preferences and interest in science-related careers. Then a middle-school team consisting of four girls and four boys from a Boston community technology center worked with the center for five months to develop FunWorks. The final product is a dynamic digital library that uses "real world" contexts

such as music and sports to present science-related careers to young people. By involving a diverse group of students throughout its development, FunWorks engages under-represented groups such as females, minority populations, students of poverty, and students with disabilities.

► **Balloons Help Scientists Understand Cell Growth:** How cells grow and form have implications on topics ranging from the invasiveness of cancer cells to the capacity of fungi to cause disease. The Integrative Graduate Education and Research Traineeship Program in Biomechanics at Harvard University brings together aspects of mathematical modeling, physics, biology, and genomics to develop simple and tractable frameworks for understanding cell growth. Project trainees demonstrate how types of cell growth may be tackled both experimentally and theoretically. For example, a breakthrough in understanding cell growth was achieved by studying cylindrical rubber balloons against what we already know about mechanical cell function and growth. A comparison of the deformation parameters for the surface revealed a striking similarity between the living cell and the physical analog demonstrated by the balloon. As a part of their training, the students in this program develop interdisciplinary skills to address a variety of biological problems successfully in novel ways. What emerged is a simple mechanical model of cell growth whose predictive power surpasses that of all previous models.



Home page of the FunWorks Web site. Credit: Education Development Center, Inc.

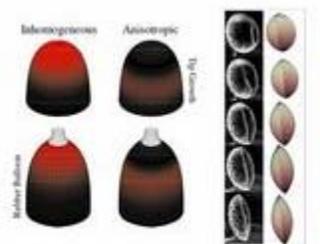
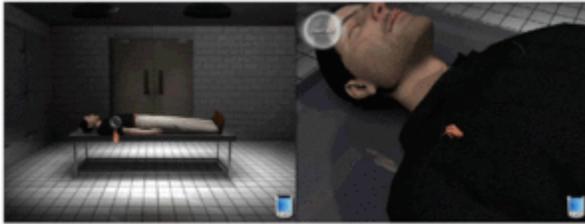


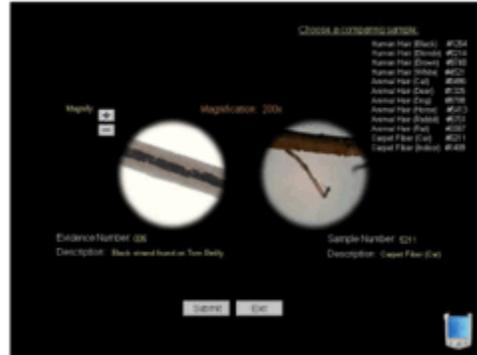
Figure 1: Comparison of surface deformation parameters (inhomogeneity and asymmetry) between a tip-growing root hair and a cylinder of rubber balloons. Figure 2: (Left) Folding of a pollen tube during the germination process. (Right) The breaking solution measured. Tip folding and pollen growth. Credit: Jacques Dumais.

► **Intelligent Software Lets Students Experience Virtual Scientific Investigations:** An NSF-funded virtual curriculum developed by researchers at Temple University is increasing student understanding of forensic science and biological research, and the nature and methods of scientific inquiry. The software's engrossing scenarios bring to life the scientific method and help pique student interest in science.



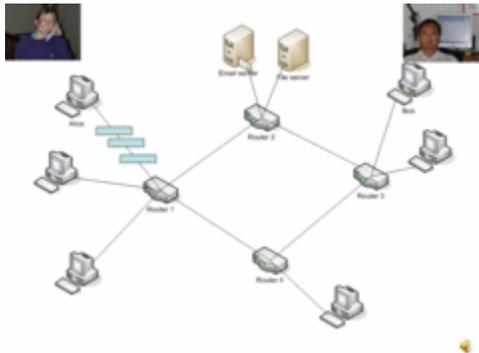
Simulated morgue with a virtual crime victim's body. Credit: Brian Butz, Temple University.

In the first learning scenario, students investigate a murder scene. They decide what evidence to collect – DNA, hair, fibers, blood – and draw conclusions about suspects. The intelligent system operates through a virtual supervisor who oversees students' actions and assures that they exercise due diligence in analyzing the evidence. The scenario introduces students to evidence gathering and analysis procedures used by scientists who study past events. Testing of the software with about 100 students in several high schools in Pennsylvania has yielded high marks from students in evaluation surveys.



Microscopic analysis of hair found on the virtual victim's body. Credit: Brian Butz, Temple University.

► **Graduate Fellows Bring Cyber-Enabled Learning to K-12 Classrooms:** An education project at the New Jersey Institute of Technology supports training for eight doctoral students per year to bring their doctoral research into K-12 classrooms. The project, "C2PRISM," stands for Computation and Communication: Promoting Research Integration in Science and Mathematics.



This is a representation of how packets of information (blue rectangles) must take an efficient route to be reassembled and decoded to be heard. Credit: New Jersey Institute of Technology.

Working one-on-one with eight high school teachers in five different New Jersey schools, the project seeks to improve graduate students' communication skills and enrich classroom instruction and learning. The graduate students come from a wide range of disciplines, and they influence about 1,316 K-12 students per year with simulations and games that engage students in active spatial and computational learning critical to the information technology fields. Interacting with graduate-level scientists prompts students to consider academic careers in science, technology, engineering and math fields, and classroom teachers have the opportunity to expand their use of new technologies within the context of their curriculum.

► **Louis Stokes Alliances for Minority Participation Becomes 39 Strong:** The Louis Stokes

Alliances for Minority Participation in science, technology, engineering and mathematics fields increased to 39 alliances across America in 2008, producing 25,000 graduates, mostly from populations underrepresented in those fields. More than 500 U.S. institutions participate in the program, including Historically Black Colleges and Universities, Hispanic Serving Institutions, Native American Institutions, and community colleges. Since 2002, the Pacific Alliance and the Islands of Opportunity have contributed more than 500 science, technology, engineering, and mathematics baccalaureate degrees to Native American and Native Hawaiian or Pacific Islander students. Successful strategies employed at alliance institutions for recruiting and retaining underrepresented minorities include peer and faculty mentoring, bridge programs, engaged academic learning communities, research experiences for undergraduates, collaborations with professional societies, and private and public sector research organizations. The quality of the academic support and research experiences at participating institutions has resulted in numerous awards and recognition for alliance students and faculty.



Advanced undergraduate students conducting soil sampling experiments in the tropics. *Credit: Islands of Opportunity-LSAMP.*

► **NSF-Funded CYBERCHASE Wins Emmy Award:** The NSF-funded CYBERCHASE program is

accomplishing its mission to improve kids' problem-solving and mathematics skills and inspire confidence and enthusiasm toward math. CYBERCHASE, the groundbreaking multi-platform children's program on PBS KIDS GO! for grades 3-5, has been awarded the first Daytime Emmy Award for Outstanding Broadband Program - Children's. The new Emmy Award category recognizes children's programming distributed via broadband and portable delivery, including the Internet, cell phones, and personal media players. CYBERCHASE won the award for content tied to My Big Idea, a multi-platform activity that introduces viewers to the connection between mathematics and the invention process. Video segments feature both young inventors and the live-action stars of CYBERCHASE. Nearly 5 million viewers watch CYBERCHASE every week and CYBERCHASE Online has had more than 1.7 billion page views. CYBERCHASE's audience is more than one-third African-American or Hispanic; girls and boys watch in equal numbers.



The Emmy-Award winning CYBERCHASE team, featuring Jackie, Inez, Matt, and Digit. *Credit: Sandra Sheppard.*

► **Users Soar with TerraFly:** TerraFly, a new Internet-based technology developed at Florida



A TerraFly web-browsable high-resolution aerial imagery layered with real street, business, and demographic data. *Credit: PI: Yi Deng.*

International University for manipulating geospatial information, makes it possible for users to "fly over" vast land areas using only an ordinary Web browser. By using high-resolution imagery collected by the U.S. Geological Survey and other sources, users can experience an overhead view of almost any location in the U.S. at a one-meter resolution – without the expense of standard GIS application software. Florida International University's Center for Research Excellence in Science and Technology Program contributed major research and development efforts to the project. Spatial data sets come from varied sources and in many different formats, often requiring separate specialized geographic systems to view and extract information. TerraFly enables researchers to perform complex queries of geospatial data and delivers visualizations for users to "fly" through geospatial data using nothing but a typical Internet browser.

Constituencies such as disaster managers are intended users.



**RESEARCH ON LEARNING IN FORMAL  
AND INFORMAL SETTINGS**

**\$229,500,000**  
**+\$3,000,000 / 1.3%**

**Research on Learning in Formal and Informal Settings Funding**

(Dollars in Millions)

	FY 2008	FY 2009	FY 2009	FY 2010	Change Over	
	Actual	Current	ARRA	Request	FY 2009 Plan	Percent
		Plan	Estimate		Amount	
<b>Total, DRL</b>	<b>\$212.30</b>	<b>\$226.50</b>	-	<b>\$229.50</b>	<b>\$3.00</b>	<b>1.3%</b>
Discovery Research K-12	99.25	108.50	-	108.50	-	-
Informal Science Education	64.45	66.00	-	66.00	-	-
Research and Evaluation on						
Education in S&E	41.66	42.00	-	43.00	1.00	2.4%
Project and Program Evaluation	6.94	10.00	-	12.00	2.00	20.0%

Totals may not add due to rounding.

**Summary of FY 2010 Request**

The main goal of the Division of Research on Learning in Formal and Informal Settings (DRL) is to improve in the learning and teaching in the STEM disciplines. The division's programs fund activities in formal education settings ranging from early childhood through graduate school, and informal learning environments from museums to cyberspace. DRL is concerned with STEM learners of all ages and audiences of all types, ranging from STEM teachers to after-school program providers. Projects in DRL include efforts spanning basic research for hypothesis generation and description; design, development, and testing of resources and models for STEM learning; implementation and studies of the efficacy of learning resources; studies of scale-up and effectiveness; and syntheses for building theory and influencing policy and practice. The division is organized in three clusters: Lifelong Learning; Knowledge Building; and Resources, Models, and Tools. These clusters provide intellectual direction and operational coordination for the division's programs and activities.

Funding at the requested level enables DRL to position its entire portfolio of activities to address critical challenges and emerging new opportunities in STEM education. The reformulation and expansion of the research and evaluation focus will enhance the ongoing setting of priorities and emphases in all DRL activities, allowing for a greater impact of STEM education and learning improvements. The proposed FY 2010 budget will provide the collected programs and activities of DRL with the opportunity for dynamic and strategic impact on STEM learning.

*Research and Evaluation on Education in Science and Engineering (REESE) (+\$1.0 million, to a total of \$43.0 million).*

The REESE program supports basic and applied research and evaluation that enhances understanding of STEM learning and teaching. Through REESE investments evidence-based knowledge is accumulating in order to improve practice and policy, and interdisciplinary collaborations are brought to bear on complex educational research issues. With increased resources of \$1.0 million in FY 2010, the program will encourage proposals to examine the feasibility of studying major STEM education innovations or policies with national implications in such areas as teacher education, K-12 standards, and assessment.

*Project and Program Evaluation (PPE) (+\$2.0 million, to a total of \$12.0 million).*

Increased funding will foster theoretical and methodological advances in STEM education program evaluation, and expand a coherent portfolio in program evaluation. Emphases will be in the areas of design, methodology, and measures for program-level evaluations. The program will enlarge its investment in multi-faceted and multiple methods evaluations that include feasibility studies, descriptive evaluations for program improvement, comparative evaluations to gauge program impact, and longitudinal studies. Program and portfolio evaluations and evaluative studies will be undertaken through grant and contract mechanisms with the goals of increased involvement of higher education experts and with greater emphasis on innovative methods.

**UNDERGRADUATE EDUCATION**

**\$289,910,000**  
**+\$6,680,000 / 2.4%**

**Undergraduate Education Funding**

(Dollars in Millions)

	FY 2009	FY 2009	FY 2010 Request	Change Over	
	FY 2008	ARRA		FY 2009 Plan	
	Actual	Estimate		Amount	Percent
Curriculum, Laboratory and Instructional Development	\$82.68	\$85.41	\$86.99	\$1.58	1.8%
Workforce Development	123.45	136.82	144.70	7.88	5.8%
Math and Science Partnership	47.87	61.00	58.22	-2.78	-4.6%
<b>Total, DUE</b>	<b>\$254.00</b>	<b>\$283.23</b>	<b>\$289.91</b>	<b>\$6.68</b>	<b>2.4%</b>
Selected Programs:					
Advance Technological Education	51.46	51.62	64.00	12.38	24.0%
Climate Change Education	-	10.00	5.50	-4.50	-45.0%
Robert Noyce Teacher Scholarship	55.05	55.00	55.00	-	-
STEM Talent Expansion	29.48	29.70	31.53	1.83	6.2%

Totals may not add due to rounding.

**Summary of FY 2010 Request**

The Division of Undergraduate Education (DUE) is the NSF focal point for transforming undergraduate STEM education to meet the needs of the 21st century. DUE's objective is to increase the quality and quantity of the science and engineering workforce, and the extent to which all undergraduate students are well-prepared for an increasingly technological global society. DUE programs emphasize innovation and ongoing improvement in curricula, teaching procedures, and laboratories, so that the next generation is continuously learning by using the tools and methods of inquiry used by working professionals. Collaborations are encouraged among institutions, and among higher education, industry, and K-12 sectors. DUE grants provide for faculty development; support for new instructional materials; offer opportunities to reform courses, laboratories, and curricula; and provide for the assessment of outcomes.

The FY 2010 funding request supports the significant expansion of DUE programs in workforce development, especially the Advanced Technological Education program, and will enable the establishment of larger scale funding within the STEM Talent Expansion program to develop innovative ways to approach building the pipeline of STEM students. Climate Change Education will also continue to be a significant priority.

*Advanced Technological Education (ATE) (+\$12.38 million, to a total of \$64.0 million).*

The ATE program enables educators from two-year colleges to lead programs that improve the skills of technicians and the educators who teach them. Some of its current projects and Centers focus on the delivery and management of energy. The FY 2010 budget request will support the expansion of its critical work with two-year colleges, and increase its capacity to fund clean energy related projects. For example, wind energy has become a key focus as a renewable energy source over the past decade. Last year alone, 3,200 new wind turbines were installed across the Nation adding to the total of more than 25,000. The budget increase will fund approximately 10 additional awards in FY 2010.

*STEM Talent Expansion Program (STEP) (+\$1.83 million, to a total of \$31.53 million).*

The STEP Program seeks to increase the number of students receiving degrees in established or emerging fields within science, technology, engineering, and mathematics. Awards are made both to provide for implementation efforts at academic institutions and to support research degree attainment in STEM. The America Competes Act authorized the establishment of centers within this program, to be jointly funded with one or more disciplinary directorates, to explore fundamental changes in undergraduate practice that promise to significantly improve recruitment and retention of students, and lead to improvement in their learning. The \$1.83 million increase will permit the establishment of two additional centers in FY 2010 in collaboration with the R&RA Directorates.

*Climate Change Education (CCE) (\$4.50 million, to a total of \$5.50 million).*

CCE will build upon the activities funded within DUE in FY 2009 to establish this program on a basis of collaboration with OPP, BIO, and GEO. Although there is a decrease within EHR, the total FY 2010 request is \$10.0 million. This program will enable a variety of partnerships, including those among K-12 education, higher education, the private sector, and related non-profit organizations, in formal and informal settings, as well as relevant education and/or climate-related policymakers. It will support individual investigators and multidisciplinary teams of STEM researchers and educators.

*Math and Science Partnership (MSP) (-\$2.78 million, to a total of \$58.22 million).*

Although there is a decrease in the FY 2010 Budget, DUE plans to meet its MSP goal to build capacity and integrate the work of higher education with that of K-12 to strengthen and reform science and mathematics education. This remains a priority area, anticipating growth in future years.

**GRADUATE EDUCATION**

**\$181,440,000**  
**-\$60,000 / -0.03%**

**Graduate Education Funding**

(Dollars in Millions)

	FY 2008	FY 2009	FY 2009	FY 2010	Change Over	
	Actual	Current Plan	ARRA Estimate	Request	FY 2009 Plan Amount	Percent
<b>Total, DGE</b>	<b>\$159.59</b>	<b>\$181.50</b>	<b>\$15.00</b>	<b>\$181.44</b>	<b>-\$0.06</b>	<b>-0.03%</b>
Graduate Research Fellowships	87.89	107.00	-	102.58	-4.42	-4.1%
Graduate STEM Fellows in in K-12 Education	46.40	49.50	-	49.00	-0.50	-1.0%
Integrative Graduate Education and Research Traineeships	25.29	25.00	-	29.86	4.86	19.4%
Science Masters	-	-	15.00	-	-	N/A

Totals may not add due to rounding.

**Summary of FY 2010 Request**

The Division of Graduate Education (DGE) supports U.S. graduate students and innovative graduate programs that prepare tomorrow’s leaders in science and engineering (S&E). DGE meets its objectives through three graduate education programs that vary in their designs and in the options and opportunities provided to graduate students. The Graduate Research Fellowship program, one of the oldest programs at NSF, provides some of the Nation’s most promising graduate students with great flexibility in selecting the university of their choice and gives them the intellectual independence to follow their research ideas unfettered by the exigencies of mode of support. The Graduate STEM Teaching Fellows in K-12 (GK-12) program supports graduate students in STEM disciplines and associated training that enables them to acquire additional skills that will broadly prepare them for professional and scientific careers. Through interactions with teachers and students in K-12 schools, graduate students improve their communication and teaching skills while enriching STEM education in these schools. The Integrative Graduate Education and Research Traineeships (IGERT) program, based on transformative interdisciplinary research, provides doctoral students with a strong collaborative research foundation, innovative educational programs to help them cross disciplinary boundaries, and development of personal and professional skills to prepare them for the careers of the future.

Each of the three DGE programs recognizes the growing significance of the changing global environment for future scientists and engineers, and each is taking steps to bring more international emphasis and provide more opportunities for students to expand their knowledge of research and education in other nations, as well as to learn about international issues affecting STEM careers. Each of the three DGE programs has a strong commitment to broadening participation and career development.

The FY 2010 Budget will provide support for career preparation of the scientists and engineers of the future with innovative programs and new opportunities. The excitement of cutting-edge research coupled with carefully shaped educational experiences draws young scientists and engineers into graduate study and provides them the foundation to acquire the skills to make contributions in areas critical to our future. Their career successes will be key to the competitiveness of our nation in a world in which innovation in

such areas as energy and climate change will determine both our economic future and the well-being of our society.

*Integrative Graduate Education and Research Traineeships (IGERT) (+\$4.86 million, to a total of \$29.86 million).*

IGERT is a NSF-wide program that prepares U.S. doctoral students to lead the nation in emerging interdisciplinary areas of research by integrating research and education in innovative ways that are tailored to the unique requirements of the new interdisciplinary fields and new career options. The additional funding provided here will support up to three new IGERT awards in the most critical S&E areas of national importance (e.g., activities will include a range from clean renewable energy and water to climate change education). The proposed total NSF FY 2010 IGERT budget level of \$68.88 million will allow further increases in the number of future graduate students supported, thus making a larger investment in the workforce of the future.

*Graduate Research Fellowships (GRF) (-\$4.42 million, to a total of \$102.58 million).*

EHR invests in the preparation, development, and advancement of world-class young investigators through the GRF program. The GRF program strategically invests in intellectual capital, providing support to individuals who are pursuing graduate education. Total funding for GRF increases to \$122.0 million, including EHR's contribution of \$102.58 million. Although the EHR FY 2010 budget decreases, NSF-wide contributions will increase for this EHR-managed program. In FY 2010, approximately 1,654 new Fellows will be awarded in support of the Presidential initiative to triple the number of new graduate research fellowships from 1,000 to 3,000 by FY 2013.

*Graduate STEM Fellows in K-12 Education (GK-12) (-\$0.50 million, to a total of \$49.0 million).*

The GK-12 Education program supports graduate students and training activities that enable the graduate students in NSF-supported STEM disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers. Through interactions with teachers in K-12 schools, graduate students improve their communication and teaching skills while enriching STEM instruction in these schools. The decrease in funding will result in one fewer award in FY 2010.

**HUMAN RESOURCE DEVELOPMENT**

**\$156,910,000**  
**+\$2,880,000 / 1.9%**

**Human Resource Development 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
Undergraduate/Graduate Student Support	\$83.01	\$87.50	-	\$90.10	\$2.60	3.0%
Research and Education Infrastructure	40.81	47.28	-	47.28	-	-
Opportunities for Women and Persons with Disabilities	16.56	19.25	-	19.53	0.28	1.5%
<b>Total, HRD</b>	<b>\$140.37</b>	<b>\$154.03</b>	<b>-</b>	<b>\$156.91</b>	<b>\$2.88</b>	<b>1.9%</b>
Selected Programs:						
Historically Black Colleges and Universities Undergraduate Program	29.74	31.50	-	32.00	0.50	1.6%
Louis Stokes Alliances for Minority Participation	40.47	42.50	-	44.75	2.25	5.3%

Totals may not add due to rounding.

**Summary of FY 2010 Request**

The Division of Human Resource Development (HRD) implements programs and activities that enhance the quantity, quality, and diversity of human capital engaged in U.S. science, technology, engineering, and mathematics (STEM). A principal focus of HRD is to ensure access to and full participation in STEM through increased, improved, and diversified opportunities; enhanced quality in the educational experience; and hands-on research experiences. In particular, HRD plays a central role in increasing opportunities in STEM education for individuals from historically underserved populations - minorities, women and persons with disabilities - and supports the development of the educators, researchers, and institutions dedicated to serving these populations.

HRD programs are funded through three budget lines. Included in the Undergraduate and Graduate Student Support line are the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), the Louis Stokes Alliances for Minority Participation (LSAMP), and the Tribal Colleges and Universities Program (TCUP). The Research and Education Infrastructure line includes the Alliances for Graduate Education and the Professoriate (AGEP) and the Centers of Research Excellence in Science and Technology (CREST) program. The Opportunities for Women and Persons with Disabilities line includes ADVANCE, the Research in Disabilities Education (RDE) program, and the Research on Gender in Science and Engineering (GSE) program.

In FY 2010, with its proposed increase, HRD will increase support for programs that identify, recruit, and train underrepresented scholars in the STEM disciplines. Collectively, support for these programs underscores HRD's mission of broadening participation and workforce development from the undergraduate level to terminal employment.

*Louis Stokes Alliances for Minority Participation (LSAMP) (+\$2.25 million, to a total of \$44.75 million).*

The LSAMP program supports sustained and comprehensive approaches to broadening participation at the baccalaureate level. These approaches facilitate the production of students who are well prepared in

STEM and motivated to pursue graduate education. Projects place emphasis on aggregate baccalaureate production; attention to individual student retention and progression to baccalaureate degrees; and aggregation of student progression to graduate school entry. In addition, expectations are placed on institutionalizing, disseminating, and promoting the replication of strategies and collaborative approaches that have shown success in the transition of undergraduate STEM students to graduate STEM programs. In FY 2010, LSAMP will continue to support institutional alliances that will produce a demonstrable "near-term" increase in the numbers of high quality STEM graduates with the promise of long-term change in the production of new Ph.D.s and their entrance into productive faculty or research careers. The proposed increase will support an additional LSAMP Bridge to the Doctorate award and enhance international research opportunities for underrepresented students and faculty through five supplemental awards.

*Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) (+\$500,000, to a total of \$32.0 million).*

In FY 2010, HBCU-UP will continue to meet its goal of strengthening the quality of undergraduate STEM programs at the nation's HBCUs. Additional HBCU-UP funds will support two to four new HBCU/STEM teacher development projects to increase the numbers and high-quality preparation of teachers.

*ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (+\$280,000, to a total of \$1.53 million).*

The ADVANCE program goal is to develop systemic approaches to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse S&E workforce. The increase will be used to forge relevant instructional linkages through supplements with other broadening participation efforts.

**H-1B NONIMMIGRANT PETITIONER FEES**

**\$100,000,000**

The FY 2010 H-1B Nonimmigrant Petitioner Fees are projected to be \$100.0 million, equivalent to the FY 2009 projection.

**H-1B Nonimmigrant Petitioner Fees Funding**

(Dollars in Millions)

	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Change over	
				FY 2009 Estimate	
				Amount	Percent
H-1B Nonimmigrant Petitioner Fees Funding	\$121.12	\$100.00	\$100.00	-	-

Beginning in FY 1999, Title IV of the American Competitiveness and Workforce Improvement Act of 1998 (P.L. 105-277) established an H-1B Nonimmigrant Petitioner Account in the general fund of the U.S. Treasury for fees collected for each petition for alien nonimmigrant status. That law required that a prescribed percentage of funds in the account be made available to NSF for the following activities:

- **Computer Science, Engineering, and Mathematics Scholarships (CSEMS).** The program supported grants for scholarships to academically-talented, financially needy students pursuing associate, baccalaureate, or graduate degrees in computer science, computer technology, engineering, engineering technology, or mathematics. Grantee institutions awarded scholarships of up to \$2,500 per year for two years to eligible students.
- **Grants for Mathematics, Engineering, or Science Enrichment Courses.** These funds provided opportunities to students for enrollment in year-round academic enrichment courses in mathematics, engineering, or science.
- **Systemic Reform Activities.** These funds supplemented the rural systemic reform efforts administered under the former Division of Educational System Reform (ESR).

In FY 2001, Public Law 106-311 increased the funds available by increasing the petitioner fees. Also, the American Competitiveness in the 21<sup>st</sup> Century Act (P.L. 106-313) amended P.L. 105-277 and changed the way petitioner fees were to be expended.

- The CSEMS activity continued under P.L. 106-313 with a prescribed percentage of H-1B receipts. The maximum scholarship duration was four years and the annual stipend was \$3,125. Funds for this scholarship program totaled 59.5 percent of the total H-1B funding for NSF.
- **Private-Public Partnerships in K-12:** P.L. 106-313 directed the remaining 40.5 percent of receipts toward K-12 activities involving private-public partnerships in a range of areas such as materials development, student externships, and mathematics and science teacher professional development.
- **Information Technology Experiences for Students and Teachers (ITEST)** developed as a partnership activity in K-12 to increase opportunities for students and teachers to learn about, experience, and use information technologies within the context of STEM, including Information Technology (IT) courses.

In FY 2005, Public Law 108-447 reauthorized H-1B funding. NSF was provided with 40 percent of the total H-1B receipts collected. Thirty percent of H-1B receipts (75 percent of the receipts that NSF receives) are to be used for the Low-income Scholarship Program. Ten percent of receipts (25 percent of the receipts that NSF receives) are designated for support of the Grants for Mathematics, Science, or Engineering Enrichment Courses.

**Low-income Scholarship Program.** Eligibility for the scholarships was expanded from the original fields of computer science, engineering, and mathematics to include “other technology and science programs designated by the Director.” The maximum annual scholarship award amount was raised from \$3,125 to \$10,000. NSF may use up to 50 percent of funds “for undergraduate programs for curriculum development, professional and workforce development, and to advance technological education.” Because of the changes, the program was renamed in 2006 from CSEMS to Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM).

Since its inception the low-income scholarship program has received approximately 2,512 proposals from all types of colleges and universities and has made awards for 948 projects. Approximately 49,500 students have received scholarships ranging from one to four years, and many new grants have yet to award all their scholarships. In addition to scholarships, projects include student support activities featuring close involvement of faculty, student mentoring, academic support, and recognition of the students. Such activities are important in recruiting and retaining students in high-technology fields through graduation and into employment. Approximately 100 awards are anticipated in FY 2010.

**ITEST Grants for Mathematics, Science, or Engineering Enrichment Courses.** The ITEST program invests in K-12 activities that address the current concern about shortages of STEM professionals and information technology workers in the U.S. and seeks solutions to help ensure the breadth and depth of the STEM workforce, including education programs for students and teachers that emphasize IT-intensive careers. In FY 2008, the guidelines were revised to address the development, implementation, testing, and scale-up of models, as well as research studies to improve the STEM workforce and build students’ capacity to participate in the STEM workforce, especially the information and communication technology (ICT) areas. The new ITEST solicitation extends the previous solicitation by placing greater emphasis on capturing and establishing a reliable knowledge base about the dispositions toward and knowledge about STEM workforce skills in U.S. students; the name of the program was also changed in this solicitation to Innovative Technology Experiences for Students and Teachers. New categories of awards include: (1) *Strategies projects* for the design, implementation, and evaluation of models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers to encourage students’ readiness for, and their interest and participation in the STEM workforce; (2) *Scale-Up projects* that support the implementation and testing of models that prepare students for information technology or the STEM workforce in a large-scale setting such as a state or at the national level; and (3) *Studies projects* that support research to enrich the understanding of issues related to enlarging the STEM workforce, including efficacy and effectiveness studies of intervention models, longitudinal studies, instruments, and studies to identify predictors of student inclination to pursue STEM career trajectories. The Strategies, Scale-up, and Studies projects replace the previous four components: youth-based projects, comprehensive projects, traditional project renewals, and the ITEST resource center. In 2009, Studies projects were modified and renamed Research projects. Also, conferences and workshops were added as a category to foster a research agenda focused on STEM workforce topics and stronger evaluation strategies to assess the impact of ITEST interventions on student motivation to enter the STEM workforce.

Since its inception, ITEST has received 1,105 proposals and funded over 140 projects that allow students and teachers to work closely with scientists and engineers on extended research projects, ranging from

biotechnology to environmental resource management to programming and problem-solving. Projects draw on a wide mix of local resources, including universities, industry, museums, science and technology centers, and school districts in order to identify the characteristics that engage a wide range of young people in STEM, especially those not successful in traditional school settings. Through a projected \$156 million federal investment, ITEST impacts an estimated 158,000 students (grades K-12), 4,700 teachers, and 1,770 parents/caregivers. In FY 2008, ITEST received 240 full proposals and funded 34 awards, the highest number of awards since the program's inception. The change in categories of awards resulted in smaller grant size, thus allowing for a larger number of awards.

In November 2005, Public Law 109-108 was signed and directed EHR to initiate a K-8 pilot program, which NSF called Academies for Young Scientists, using funds in the FY 2006 EHR appropriation. EHR used approximately \$7 million of funds from its formal K-12 programming and approximately \$7 million of funds from H-1B nonimmigrant petitioner fees for this effort. This effort called for proposals to develop stimulating, intensive STEM learning experiences that engage K-8 students; develop sustainable, district-based partnership demonstration projects; and promote strategies that further develop skills in K-8 STEM teachers. This activity was a demonstration project in FY 2006; no additional funds are requested.

**H-1B Financial Activities from FY 1999 - FY 2008**

(Dollars in Millions)

	<b>FY 1999</b>	<b>FY 2000</b>	<b>FY 2001</b>	<b>FY 2002</b>	<b>FY 2003</b>	<b>FY 2004</b>	<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>
<b>Receipts</b>	<b>\$26.61</b>	<b>\$48.61</b>	<b>\$88.34</b>	<b>\$61.04</b>	<b>\$65.34</b>	<b>\$0.57</b>	<b>\$83.68</b>	<b>\$105.32</b>	<b>\$107.36</b>	<b>\$104.43</b>
Obligations incurred										
Computer Science, Engineering, and Mathematics Scholarships	0.26	23.16	68.37	34.69	25.30	33.91	0.54	80.95	100.04	92.40
Grants for Mathematics, Engineering or Science Enrichment Courses	-	0.20	4.22	5.83	16.27	-	-	-	-	-
Systemic Reform Activities	-	1.70	3.70	3.97	5.00	2.50	2.72	-	-	-
Private-Public Partnership in K-12 <sup>1/</sup>	-	-	2.22	12.82	-	20.87	22.69	18.45	45.90	28.72
<b>Total Obligations</b>	<b>\$0.26</b>	<b>\$25.06</b>	<b>\$78.51</b>	<b>\$57.31</b>	<b>\$46.57</b>	<b>\$57.28</b>	<b>\$25.95</b>	<b>\$99.40</b>	<b>\$145.94</b>	<b>\$121.12</b>
<b>Unobligated Balance end of year</b>	<b>\$26.35</b>	<b>\$49.89</b>	<b>\$59.72</b>	<b>\$63.45</b>	<b>\$83.90</b>	<b>\$29.10</b>	<b>\$89.58</b>	<b>\$98.19</b>	<b>\$63.37</b>	<b>\$50.83</b>

<sup>1/</sup> P.L 106-313 directs that 15 percent of the H-1B Petitioner funds go toward K-12 activities involving private-public partnerships in a range of areas such as materials development, student externships, math and science teacher professional development, etc.

**Explanation of Carryover**

During FY 2009, significant amounts of receipts arrived late in the fiscal year and there was not adequate time to obligate the total amount. In FY 2008, NSF planned earlier solicitation deadlines for the S-STEM and ITEST programs so that awards from H-1B visa funds could be made earlier in the fiscal year. As a result, EHR brought forward fewer resources. Some carryover amount is expected each year since fourth quarter receipts arrive late during the month of September.

