

# **EDUCATION AND HUMAN RESOURCES**

## EDUCATION AND HUMAN RESOURCES

**\$938,040,000**

The FY 2004 Request for the Education and Human Resources Activity (EHR) is \$938.04 million, an increase of \$29.96 million, or 3.3 percent, over the FY 2003 Request of \$908.08 million.

EHR Funding  
(Dollars in Millions)

	FY 2002 Actual	FY 2003 Request	FY 2004 Request	Change	
				Amount	Percent
Math and Science Partnership	150.08	200.00	200.00	0.00	0.0%
EPSCoR <sup>1</sup>	90.65	75.00	75.00	0.00	0.0%
Elementary, Secondary & Informal Education <sup>2</sup>	210.76	211.69	194.45	-17.24	-8.1%
Undergraduate Education	142.70	135.60	142.10	6.50	4.8%
Graduate Education	105.97	128.38	156.88	28.50	22.2%
Human Resource Development	97.01	90.21	103.41	13.20	14.6%
Research, Evaluation & Communication	68.95	67.20	66.20	-1.00	-1.5%
<b>Total, EHR<sup>3</sup></b>	<b>\$866.11</b>	<b>\$908.08</b>	<b>\$938.04</b>	<b>\$29.96</b>	<b>3.3%</b>

<sup>1</sup>FY 2002 Actual includes \$10.97 million for the Partnerships for Innovation program, which is funded in Integrative Activities in the Research and Related Activities Appropriation in the FY 2003 and FY 2004 Requests.

<sup>2</sup>FY 2002 Actual and FY 2003 Request for Elementary, Secondary and Informal Education (ESIE) includes \$45.06 million and \$40.25 million, respectively, from Education System Reform (ESR). In FY 2004, all remaining ESR projects are moved to ESIE in order to consolidate K-12 programs.

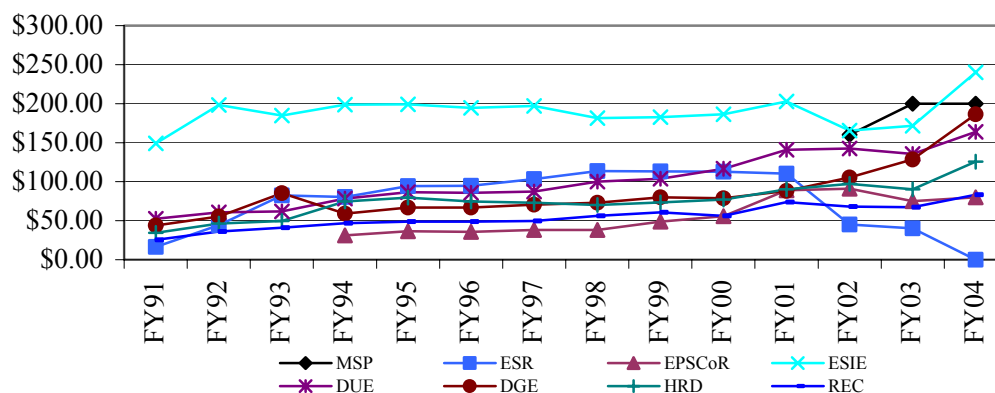
<sup>3</sup>Totals may not add due to rounding. Excludes \$57.31 million in FY 2002 and an estimated \$65.68 million in FY 2003 from H-1B Nonimmigrant Petitioner Fees. Legislation for this activity expires in FY 2003.

## RELEVANCE

The Education and Human Resources (EHR) Activity supports education, research, and infrastructure development in all science, technology, engineering and mathematics (STEM) disciplines. In accordance with the NSF Act of 1950, NSF is the principal federal agency charged with promoting science and engineering (S&E) education at all levels and in all settings. Support for STEM education and related research and human resource development programs for the EHR Subactivities from FY 1991 is shown in the chart below.

EHR Subactivity Funding

Dollars in Millions



Because of its comprehensive research and education portfolio in S&E education, EHR is in a unique position to address the critical problems facing America's STEM educational system and the workforce implications of those problems. Too few K-12 teachers are knowledgeable in science or mathematics. By high school, unacceptably low numbers of students are motivated to enroll in physics or chemistry, and only 20-25 percent of graduating high school seniors have completed enough mathematics to be ready to study science or engineering. Each year, S&E degrees as a percentage of the population of 24 year olds have remained virtually constant at 5-6 percent. Within this group, women and minorities are seriously underrepresented. The U.S. Department of Labor estimates that 60 percent of the new jobs being created in our economy today will require technological literacy while only 22 percent of the young people entering the job market now actually possess the necessary skills.

EHR's portfolio is comprehensive, addresses critical national issues in science and math education, and includes a research and evaluation track in each activity to ensure that EHR-sponsored programs add to our knowledge base about STEM education, that recommended educational improvements are evidence-based and that high standards of accountability are sustained. EHR's education and research programs are aligned with Administration priorities as outlined in the *No Child Left Behind Act* and the Administration's interagency priorities for R&D. These priorities include strengthening science, mathematics, and engineering education by promoting excellent educational programs and best practices; and emphasizing research that enables the successful development and implementation of science-based programs and practices. Research goals include strengthening mathematics and science education and advancing the use of educational technology for improving both student achievement and teacher training. Examples of EHR programs that address national concerns include:

- The President's education initiative, the Math and Science Partnership (MSP), which seeks to improve K-12 education for all by preparing teachers in STEM disciplines, enhancing STEM faculty participation in K-12 schools, offering advanced courses to students, and ensuring that schools offer a challenging curriculum.
- Informal science activities across the nation that help foster the public understanding of science and promote adult learning in STEM.
- Research on education includes a focus on the use of information technology in education and the translation of research results into educational practice.
- Undergraduate programs focus on meeting the needs of two-year colleges, expanding the nation's STEM talent, meeting federal workforce needs for cybersecurity specialists, fostering STEM research and education capacity at Historically Black Colleges and Universities (HBCUs) and other minority-serving institutions, and promoting the advancement of women and racial/ethnic minority students to increase their participation in the STEM enterprise.
- EPSCoR activities develop State-NSF partnerships designed to stimulate sustainable improvement in R&D competitiveness in the 22 states eligible for the EPSCoR program.

## STRATEGIC GOALS

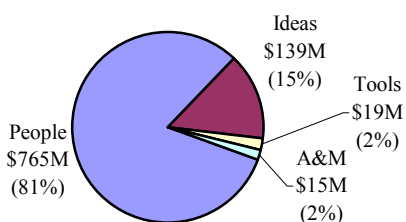
For FY 2004, EHR program activities will be directed at achieving four broad goals:

1. Preparing the **next generation of STEM professionals** and attracting more U.S. citizens to STEM careers.
2. Increasing the **technological and scientific literacy** of the general public so that they can exercise responsible citizenship in an increasingly technological society and acquire knowledge of science, mathematics and technology that is appropriate to the development of workforce skills and life-long career opportunities.

3. Creating the capacity to promote participation (**diversity**) and achievement in STEM consistently and effectively.
4. Attending to **critical workforce needs** requiring significant math and science skills and knowledge, both by attracting new people to these STEM careers and by support for the development and retooling of the current STEM workforce. Current and anticipated workforce needs include: a) STEM talent in the professional and instructional workforces; b) STEM professionals for the growing fields of homeland defense and cybersecurity and for emerging fields (e.g., nanotechnology); and c) replacements for the substantial numbers of STEM workers, teachers and faculty who are expected to retire over the next 10 years.

Three strategic focus areas guide EHR's activities:

**FY 2004 EHR Strategic Goals**



**PEOPLE:** EHR contributes two-thirds of all NSF funds intended to achieve the PEOPLE Strategic Goal. EHR's objectives are to improve the quality of STEM education and training at all levels, support promising students, increase the diversity of the STEM community and instructional workforce, and broaden the participation of all U.S. citizens in the STEM enterprise.

**IDEAS:** EHR promotes research on learning, STEM education and the use of learning technologies for students, teachers and adult learners, and fosters the translation of research successes into educational practice. EHR provides leadership through the Interagency Education Research Initiative (IERI) and other broad research programs to advance knowledge about how individuals learn, explore learning innovations that can serve society, expand participation in cutting-edge research, and build a strong community of education researchers.

**TOOLS:** EHR invests in the National STEM Education Digital Library (NSDL), which builds a national resource to increase the quality, quantity and comprehensiveness of Internet-based STEM educational materials while creating virtual learning communities that link students, teachers and faculty with each other and with a rich array of learning tools.

EHR's support for ongoing core and new activities contributes to NSF's efforts to achieve its strategic goals, and to the administration and management activities necessary to achieve these goals.

Summary of EHR Funding by Strategic Goal  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Estimate	Estimate	Amount	Percent
People	679.91	732.69	764.85	32.16	4.4%
Ideas	146.32	137.22	139.22	2.00	1.5%
Tools	24.16	23.60	18.60	-5.00	-21.2%
Administration & Management	15.72	14.57	15.37	0.80	5.5%
<b>Total, EHR</b>	<b>\$866.11</b>	<b>\$908.08</b>	<b>\$938.04</b>	<b>\$29.96</b>	<b>3.3%</b>

**Budget Highlights**

**People** (+\$32.16 million, for a total of \$764.85 million)

The EHR portfolio includes programs affecting all STEM fields, every educational level, and both formal and informal educational settings. EHR’s past efforts have demonstrated the value of systemic approaches to educational improvement. People activities managed by EHR are informed by research, and based on evidence of successful practices and on recognized educational standards. EHR’s activities develop effective curricula and courses, and provide professional development for teachers and faculty.

EHR People Investments  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Estimate	Estimate	Amount	Percent
PreK-12 Education	308.70	359.58	346.89	-12.69	-3.5%
Undergraduate Education	166.08	157.35	180.70	23.35	14.8%
Graduate & Professional	114.33	136.87	164.92	28.05	20.5%
Other People Support	90.80	78.89	72.34	-6.55	-8.3%
<b>Total, People</b>	<b>\$679.91</b>	<b>\$732.69</b>	<b>\$764.85</b>	<b>\$32.16</b>	<b>4.4%</b>

**PreK-12 Education**

- Within the \$200.0 million total for the Math and Science Partnership (MSP), EHR will fund the *MSP Teacher Institutes for the 21<sup>st</sup> Century* that will produce teachers at all grade levels, K-12, who are knowledgeable and proficient in mathematics, science, and related technologies and who have the disciplinary expertise and stature needed to motivate students towards continued study of mathematics/science in advanced courses.

**Undergraduate Education**

- The STEM Talent Expansion Program (STEP) increases by \$5.0 million to \$7.0 million to build this program as a way to reinvigorate undergraduate experience.
- The Louis Stokes Alliances for Minority Participation (LSAMP) program increases by \$6.20 million to \$32.73 million to increase award size and improve collaboration through partnerships with the Alliances for Graduate Education and the Professoriate (AGEP) program.
- The Historically Black Colleges and Universities – Undergraduate Program (HBCU-UP) increases by \$6.0 million to \$19.97 million to increase award size and improve coordination with other institutions that serve minority students.
- The Federal Cyber Service: Scholarship for Service (SfS) program increases by \$5.0 million to \$16.18 million to increase the numbers of associate and baccalaureate degree recipients in STEM fields in areas of critical national need.

**Graduate & Professional**

- Increasing the stipend level and the number of students in the three NSF-supported graduate education programs continues to be a high priority of the Foundation. The FY 2004 Request provides an increase of \$28.50 million to a total of \$156.88 million to increase the number of graduate students

and raise the annual stipend level to \$30,000 in the Integrative Graduate Education Research Traineeships (IGERT) program, the Graduate Teaching Fellowships in K-12 Education (GK-12) program and the Graduate Research Fellowships (GRF) program. With additional funding from the R&RA Activities, nearly 5,000 U.S. graduate students in the STEM disciplines will be supported.

### **Workforce for the 21<sup>st</sup> Century**

In FY 2004, EHR will provide \$8.50 million in funding to launch NSF's Workforce for the 21<sup>st</sup> Century priority area. For FY 2004, NSF's Workforce efforts will focus on attracting students, especially those students who have traditionally been underrepresented, to science, technology, engineering and mathematics (STEM) disciplines, and on research activities focused on workforce issues. Examples of possible activities include integrating research and education through hands-on research experiences for high school students and/or undergraduates across disciplines, providing for partnerships with non-academic S&E employers to offer internships and in-service learning, and conducting research on factors determining students' career choices.

**Ideas** (+\$2.0 million, for a total of \$139.22 million)

EHR promotes the Foundation's Ideas goal through research tracks in its programs. EHR pursues research questions addressing cognitive science, educational practice, learning technologies, effective methods of instruction, ways to adapt successful practices to a larger scale, etc. EHR seeks to develop a more effective program of research on education and the effective use of learning technologies.

Programs specific to the Ideas goal include: Experimental Program to Stimulate Competitive Research (EPSCoR) which remains level with the FY 2003 Request of \$75.0 million; the Research on Learning and Education (ROLE) program, which is funded at the FY 2003 Request level of \$39.56 million; and the Interagency Education Research Initiative (IERI), funded at \$15.0 million in EHR, with an additional \$10.0 million contributed by the R&RA Activity. The \$25.0 million total for IERI is the same as in the FY 2003 Request.

EHR's support for the Centers of Research Excellence in Science and Technology totals \$10.88 million, an increase of \$2.0 million over the FY 2003 Request, primarily to increase award size. These Centers are designed to stimulate the capacity for conducting competitive research at minority institutions. The Centers help to produce well-trained doctoral students and assist faculty to become more competitive in obtaining research funding.

### **Priority Areas**

In FY 2004, EHR will support research and education efforts related to broad, Foundation-wide priority areas in Information Technology Research, Nanoscale Science and Engineering, Mathematical Sciences, and Human and Social Dynamics.

EHR Investments in Priority Areas  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Request	Request	Amount	Percent
Information Technology Research	2.00	2.48	9.53	7.05	284.3%
Nanoscale Science and Engineering	0.00	0.22	2.22	2.00	909.1%
Mathematical Sciences	n/a	2.74	2.74	0.00	0.0%
Human and Social Dynamics	n/a	n/a	1.00	1.00	n/a

- **Information Technology Research (ITR):** EHR's total support for the ITR priority area is \$9.53 million in FY 2004, an increase of \$7.05 million over the FY 2003 Request of \$2.48 million. The increase will allow for study on the impact of IT on educational practice, new approaches to using technology in education, application and adaptation of technologies to promote learning in a variety of fields and settings, and the effects of technology on learning.
- **Nanoscale Science and Engineering (NSE):** The EHR contribution to NSE increases by \$2.0 million to \$2.22 million in FY 2004 to support undergraduate education and the new emphasis on K-12 nanoscience education.
- **Mathematical Sciences:** FY 2004 support totals \$2.74 million, unchanged from the FY 2003 Request. EHR participation supports mathematical sciences education activities.
- **Human and Social Dynamics:** EHR contributes \$1.0 million in FY 2004 to support research in the Enhancing Human Performance research area.

**Tools** (-\$5.0 million, for a total of \$18.60 million)

The National STEM Education Digital Library (NSDL) promotes Internet-based STEM educational resources and allows the formation of virtual learning communities linking students and teachers/faculty with a wide array of resources. EHR funding for NSDL decreases by \$5.0 million in FY 2004 to \$18.60 million. Additional support in the GEO and MPS activities brings the NSDL total to \$23.80 million in FY 2004. NSF recently awarded support for the NSDL Core Integration Portal project, which will serve as the central management point for the Library and for collections and services. As a result of this award, funding requirements for NSDL decline in FY 2004.

**Administration and Management**

Administration and Management provides for administrative activities necessary to make it possible for NSF to achieve its strategic goals. Requested funding for FY 2004 is \$15.37 million, an increase of \$800,000 over the FY 2003 Request. This includes the cost of Intergovernmental Personnel Act appointments and contractors performing administrative functions.

**QUALITY**

EHR maximizes the quality of the education awards and R&D it supports through the use of a competitive, merit-based review process. The percent of basic and applied research funds that were

allocated to projects that undergo merit review was 95 percent in FY 2002, the last year for which complete data exist.

To ensure the highest quality in processing and recommending proposals for awards, EHR convenes Committees of Visitors, composed of qualified external evaluators, to review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of NSF's investments.

The Directorate also receives advice from the Advisory Committee for Education and Human Resources (EHRAC) on such issues as: the mission, programs, and goals that can best serve the science education community; how the EHR portfolio can be improved; how EHR can promote quality STEM education at all levels; and priority investment areas in education research. The EHRAC meets twice a year. Members are educators and researchers representing a wide cross-section of STEM fields and a cross-section of institutions including industry. The Committee has broad geographic representation and balanced representation of women and underrepresented minorities.

## PERFORMANCE

Examples of significant discoveries or advances resulting from EHR-supported research and education awards include:

- For the three-year-old Historically Black Colleges and Universities–Undergraduate Program (HBCU-UP) project at Clark Atlanta University, the number of minority STEM majors involved in faculty-supervised research has increased from 25 in 1999 to 45 in 2001. The university has developed and implemented the Center of Excellence in Teaching and Learning and the Distance Learning Instructional Technology Education Center to provide faculty development opportunities that engage faculty in the institutional reform effort. There are now 145 STEM faculty who are prepared to use innovative pedagogical techniques, and this number is expected to continue to grow. The project's combined pre-calculus course, developed through an HBCU-UP program initiative, emphasizes problem-solving, provides more contact hours between students and instructors, and teaches students relatively new to STEM disciplines how to read and understand scientific and technical materials.
- As part of NSF's Experimental Program to Stimulate Competitive Research (EPSCoR) program, researchers in Kansas are considering critical questions in Homeland Security and attempting to mitigate future bioterrorism and biological hazards through the *Kansas Program for Complex Fluid Flow*. A dozen scientists at Kansas State University, the University of Kansas, and Wichita State University are gaining a better understanding of how air moves through a confined space occupied by people, such as a room or an aircraft cabin, and how particles or contaminants may be transported through the area and around objects. <http://www.mne.ksu.edu/cff/>.
- In work funded under the Interagency Education Research Initiative (IERI), Robert J. Sternberg at Yale University suggests that classroom instruction can be more effective if it promotes all three aspects of intelligence – analytic, creative, and practical – as all are critical to learning. For classes in grades 3 to 5, Sternberg found that when all three aspects were emphasized, students had higher levels of mathematical achievement, the learning rate for minority students was higher than the rate for non-minority students, and achievement gains were higher in poorer schools than in affluent schools.



- An Integrative Graduate Education Research Traineeships (IGERT) project at Carnegie Mellon University responded rapidly to the events of 9/11 by studying how terrorist networks are likely to evolve, using models to develop strategies for terrorist network destabilization, demonstrating that destabilization strategies that work in hierarchical companies will not work on networks, and addressing various intelligence and planning issues. Currently four counterterrorism projects are underway. [http://www.casos.ece.cmu.edu/home\\_frame.html](http://www.casos.ece.cmu.edu/home_frame.html).
- In the past decade, science has deciphered more secrets of the human brain than in the previous 90 years combined. In 2002, the Public Broadcasting System (PBS) aired the five-part series, *The Secret Life of the Brain*, exploring the startling new map of the brain, contradicting much of what was previously believed, and holding out hope for dramatic advances in the areas of addiction, depression, learning disorders, Alzheimer's Disease, and schizophrenia. With support from the Informal Science Education (*ISE*) program, *The Brain* called on neuroscience's leading researchers to increase public understanding of how research is practiced; the connection between pure and applied research; and how these methods impact their lives. Over 15 million people viewed all or part of the series. Educational outreach products included an award-winning book; a Web site, [www.pbs.org/wnet/brain](http://www.pbs.org/wnet/brain), which has been accessed by more than 600,000 users; and grants to PBS stations nationally for educational outreach.
- The NSF Graduate Research Fellowships program has a well-deserved reputation for supporting some of the most promising researchers and educators in America. Four of the Nobel Laureates for 2001 were former NSF Fellows: Eric Allen Cornell (Physics), Karl B. Sharpless (Chemistry), Leland H. Hartwell (Physiology or Medicine) and Joseph E. Stiglitz (Economics). Two of the 15 National Medal of Science winners for 2002, Mario R. Capecchi and Ernest R. Davids, were former NSF Graduate Fellows.
- Research in detector technology development initially supported under EHR's Centers of Research Excellence in Science and Technology (CREST) program by the Hampton University Nuclear and High Energy Physics Research Center has been expanded this year into the Center for Advanced Medical Instrumentation. This Center has developed patented diagnostic and surgical devices now used clinically and houses a new academic program in Medical Physics (the first such program in Virginia and the first nationally at an HBCU). Hampton University physics doctoral students represented half of the total African Americans graduating in this discipline this year.
- The Louis Stokes Alliances for Minority Participation (LSAMP) program has played a seminal role in increasing the number of minority bachelor's degree recipients in the United States since its inception in 1991. In 2002, student participants in the LSAMP Program reached an all time high of 201,615 enrollees, with 21,707 underrepresented minority graduates at the bachelor's degree level in STEM disciplines. Graduates are being accepted into America's top schools. For example, enrollment of undergraduate students at the Florida/Georgia LSAMP has increased from 454 in 1993 to 1,268 in 2001 while the number of STEM bachelor's graduates at participating institutions more than quadrupled from 416 in 1991 to 2,145 in 2001. Another highly successful LSAMP project is in Houston. The Houston LSAMP has graduated 1,206 STEM minority students during its first two years of operation and currently has 6,414 minority students enrolled in STEM areas. The number of direct participants in the Houston Alliance has increased from 155 students during the first year of the program to 337 students during the second year – an increase of 117 percent.
- The *Pennsylvania State ATE Center in Nanofabrication* builds upon two significant strengths in Pennsylvania: the Nanofabrication Manufacturing Technology Partnership with industry and the NSF-sponsored Penn State Nanofabrication Facility, a research facility that is part of NSF's National

Nanotechnology Users Network. The Center's goal is to develop a workforce with broad skills in micro- and nanofabrication applications through a resource-sharing approach. The Center shares the Penn State Nanofabrication Facility to support educational programs at more than 30 institutions of higher education; relies on private industry to guide every phase of educational program development; has created programs in micro- and nanofabrication at community colleges and other institutions across Pennsylvania; operates a unique capstone semester program at Penn State for college students; conducts workshops and courses for faculty; and develops educator and student awareness of micro- and nanofabrication education and career opportunities. The Center has partnerships with all 14 community colleges and several state universities in Pennsylvania to offer programs in nanofabrication. Students work together in class, labs, or the nanofabrication facility about 8 hours a day during the capstone semester, and graduates are eagerly sought by industry. <http://www.nanofab.psu.edu/>

- This year, the *Summer Undergraduate Research in Science/Engineering (SURE)* program at the Georgia Tech Alliance for Graduate Education and the Professoriate (AGEP) continued its strong record of success as it entered its eleventh year, with an enrollment of students from 17 different universities in the U.S., Puerto Rico, and the U.S. Virgin Islands. This year's group provides a very promising cohort of potential Georgia Tech graduate students. Nearly 90 percent of SURE's 166 total participants have gone to graduate school (nearly half have enrolled at Georgia Tech). A CyberNetwork that will provide unprecedented connectivity between undergraduate minority development programs (e.g., LSAMP) and graduate development programs (e.g., AGEP) is near completion, and is being co-funded by NSF's Office of Integrative Activities.
- Supported by the National STEM Education Digital Library (NSDL), the Scripps Institute of Oceanography is collaborating with the San Diego Supercomputer Center and the University of California-San Diego Library to develop a prototype digital library collection that includes extensive data, images, and documents from a recent oceanographic cruise in the Pacific. A Floating Digital Library Workshop was held aboard the R/V Melville in March 2002 while researchers were collecting geophysical data off the coast of New Zealand. This activity represents an important step in providing real-time data to scientists and educators. On May 8, a "Live on the Web" talk gave an overview of the accomplishments of the expedition. This project represents the potential for expanding the audience able to benefit from oceanographic expeditions.

**Other Performance Indicators**

The following table shows the growth in the number of people benefiting from EHR’s funding.

Number of People Supported in EHR Activities			
	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate
Senior Researchers	5,798	5,900	5,900
Other Professionals	3,768	3,800	3,800
Postdoctorates	417	430	450
Graduate Students	4,317	4,600	4,800
Undergraduate Students	20,000	21,000	21,000
K-12 Students	11,000	13,000	14,000
K-12 Teachers	83,500	84,500	85,500
<b>Total Number of People</b>	<b>128,800</b>	<b>133,230</b>	<b>135,450</b>

**Change in EHR Budget Structure**

The Education and Human Resources Activity is restructured in FY 2004 to promote a coherent approach to the teacher education continuum in which NSF’s state, urban, and rural systemic initiatives are integrated from the Education Systemic Reform (ESR) Subactivity into the Elementary, Secondary, and Informal Education (ESIE) Subactivity. This restructuring will consolidate preK-12 programs and capture lessons learned from the urban and rural systemic efforts. Support for existing awardees will continue in FY 2004. A crosswalk for the FY 2003 Request is shown below.

EHR Change in Budget Structure  
(Dollars in Millions)

Current Structure	New Structure			Total, Current Structure	
	ESR	ESIE			
		IMD	TSD		ISE
<b>Education System Reform (ESR)</b>		<b>40.25</b>		<b>40.25</b>	
<b>Elementary, Secondary, and Informal Education (ESIE)</b>				<b>171.44</b>	
<i>Instructional &amp; Assessment Materials Development (IMD)</i>		28.99			28.99
<i>Teacher and Student Development (TSD)</i>			87.45		87.45
<i>Informal Science Education (ISE)</i>				55.00	55.00
<b>Total, New Structure</b>	<b>\$0.00</b>	<b>\$28.99</b>	<b>\$127.70</b>	<b>\$55.00</b>	<b>\$211.69</b>

**MATH AND SCIENCE PARTNERSHIP**

**\$200,000,000**

The FY 2004 Request for the Math and Science Partnership Subactivity is \$200.0 million, unchanged from the FY 2003 Request.

Math and Science Partnership Funding  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Request	Request	Amount	Percent
Total, MSP	\$150.08	\$200.00	\$200.00	\$0.00	0.0%

The Math and Science Partnership (MSP) program responds to a growing national concern – the lackluster performance of U.S. children in mathematics and science. *No Child Left Behind*, which enunciates the President’s vision for K-12 education, articulates this concern and identifies the main underlying factors for the poor performance of U.S. students: too many teachers teaching out of field, too few students taking advanced coursework, and too few schools offering challenging curricula and textbooks.

MSP builds on the nation’s dedication to improve mathematics and science education through support of partnerships that unite the efforts of local school districts with faculties of colleges and universities – especially disciplinary faculties in mathematics, science, and engineering – and with other stakeholders. MSP seeks to improve student outcomes in mathematics and science for all students, at all K-12 levels. As the achievement of students rises, MSP expects to significantly reduce achievement gaps in mathematics and science education among diverse student populations.

To achieve these long-term outcomes, the MSP program supports the development, implementation and sustainability of promising partnerships among: mathematics, science, engineering and education faculty and their institutions of higher education; administrators, teachers and guidance counselors in K-12 schools and school systems; and other important stakeholders to:

- Ensure that all K-12 students have access to, are prepared for and are encouraged to participate and succeed in challenging curricula and advanced mathematics and science courses;
- Enhance the quality, quantity and diversity of the K-12 mathematics and science teacher workforce; and
- Develop evidence-based outcomes that contribute to our understanding of how students effectively learn mathematics and science.

The first competitions for (a) MSP Comprehensive and Targeted projects and (b) MSP Research, Evaluation and Technical Assistance (RETA) projects were held in FY 2002 and resulted in seven Comprehensive awards, seventeen Targeted awards and twelve RETA awards. Collectively, the funded Comprehensive and Targeted projects and RETA projects constitute the MSP Learning Network, a network of researchers and practitioners studying and evaluating promising strategies to improve K-12 student achievement and other student outcomes in mathematics and science. The MSP Learning Network activities are expected to deepen our understanding of how students effectively learn mathematics and science such that successful approaches can be broadly disseminated and emulated in educational practice.

MSP Comprehensive projects implement change in mathematics and science educational practices in both higher education institutions and in schools and school districts to result in improved student achievement

across the K-12 continuum. Projects are distinguished by the range and variety of lead institutions and partners involved. The Washington University MSP, for example, partners the University with five school districts, the St. Louis Science Center and the St. Louis Zoo. The El Paso MSP involves not only the University of Texas at El Paso and twelve independent school districts, but also the Office of the Mayor of El Paso and the Hispanic and Black Chambers of Commerce.

Targeted projects focus on improved K-12 student achievement in a narrower grade range or have a disciplinary focus in mathematics and/or science. The partnership housed at the University System of Maryland, for example, targets science in grades 9-12, while the California State University-Fullerton partnership targets mathematics in grades 6-12.

In New York, another targeted project at SUNY-Brockport teams with the Rochester City School District and the Brighton Central School District, with the Shodor Foundation and the Krell Institute as additional partners. A Computational Mathematics, Science and Technology (CMST) approach to learning science will be employed in which students and teachers engage in fieldwork, laboratory experiments, mathematical modeling, computer simulation and visualization. CMST employs mathematical models to describe physical phenomena, therefore bringing a new perspective to the usefulness of mathematics as a tool in real life. A Challenge program incorporating CMST will provide tools and motivation for 200<sup>7th</sup> to 12<sup>th</sup>-grade students under the supervision of participating teachers. In addition to the collaboration and new strategies for problem solving, an important component of the professional development program for mathematics and science teachers is a four-week summer institute each year, serving a total of 240 teachers. In addition, there is a master's degree program for 30 teachers. Preservice education programs at SUNY-Brockport are being revised and new courses are to be introduced with a focus towards improving the quality, quantity and diversity of the new teacher workforce.

Research, Evaluation and Technical Assistance (RETA) projects provide large-scale research and evaluation capacity for the MSP Learning Network, and provide Comprehensive and Targeted awardees with assistance in the implementation and evaluation of their work.

- The Council of Chief State School Officers has established a collaborative research team involving the Wisconsin Center for Education Research and the American Institutes for Research to address the following research questions: (1) To what extent is the quality of the professional development supported by MSP consistent with a research-based definition of quality? (2) What effects do teachers' professional development experiences have on instructional practices and content taught in math and science classes? (3) Are high-quality professional development activities more likely than lower-quality activities to increase the alignment of content with state standards and assessments? (4) How can MSP projects use study findings to improve professional development and the content and instruction of mathematics and science classes?

In FY 2003, MSP continues support for new Comprehensive and Targeted awards and a combination of research, evaluation and technical assistance grants and contracts, informed by assessments of lessons learned from the FY 2002 efforts. In FY 2004, MSP adds a new activity for Teacher Institutes for the 21st Century, with a focus on developing master teachers who have deep content expertise in mathematics, science, and related technologies, who are excited about newer developments in these fields, and who have the disciplinary depth and stature to motivate students towards continued study of mathematics and science in advanced courses.

NSF and the U.S. Department of Education (ED) will continue to collaborate on appropriate program linkages to manage the federal investment in science and mathematics education for the greatest effectiveness. In FY 2002, NSF and ED co-funded one MSP Comprehensive award and one Targeted award.

**EXPERIMENTAL PROGRAM TO STIMULATE  
COMPETITIVE RESEARCH**

**\$75,000,000**

The FY 2004 Request for the Experimental Program to Stimulate Competitive Research (EPSCoR) is \$75.0 million, unchanged from the FY 2003 Request.

Experimental Program to Stimulate Competitive Research Funding  
(Dollars in Millions)

	FY 2002 Actual	FY 2003 Request	FY 2004 Request	Change Amount	Change Percent
Innovation Partnership Activities <sup>1</sup>	10.97	0.00	0.00	n/a	n/a
Experimental Program to Stimulate Competitive Research	79.68	75.00	75.00	0.00	0.0%
<b>Total, EPSCoR</b>	<b>\$90.65</b>	<b>\$75.00</b>	<b>\$75.00</b>	<b>\$0.00</b>	<b>0.0%</b>

<sup>1</sup> The Partnership for Innovation Program is transferred to Integrative Activities in the Research and Related Activities Appropriation in FY 2003 and FY 2004.

EPSCoR is a State-NSF partnership designed to stimulate sustainable improvements in R&D competitiveness through the development and utilization of science and technology (S&T) resources that reside in a state's major research universities. EPSCoR emphasizes local direction and administration by broad-based statewide governing committees; program accountability at all levels; and non-federal cost-sharing investments. EPSCoR currently operates in twenty-two states, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands. The states are: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming. EPSCoR attempts to develop nationally competitive R&D infrastructures within participating states by promoting partnerships among state government, universities, and the private sector in strategic research areas with high growth potential. The success of EPSCoR supported projects is demonstrated in the following examples:

- An Idaho research team is building on their own and others' previous EPSCoR-supported research to develop novel nanowire structures in the 10- to 100-nanometer range. The research aims to synthesize nanowires of a variety of semiconducting materials and to selectively grow nanowires in predetermined, ordered arrays. Though the current stage of research has just been started, it has been discovered that nanowires can be formed into nanosprings of about 60 nanometers (400 atoms) in diameter. A subsequent process for forming nanosprings from silicon and carbon has verified a theoretical model predicting that nanosprings could be formed from any amorphous ceramic material. Nanosprings have potential application in nano-electro-mechanical devices such as nanomotors.
- In West Virginia, faculty hires and important equipment purchases made possible by EPSCoR hold the promise for scientific advances in several areas related to the use of biomolecules as diagnostic and therapeutic agents, including the development of human "signatures" for security purposes. The purchase of state-of-the-art research equipment such as a 600MHz Magnetic Resonance Spectrometer and a Quadrupole Time of Flight Mass Spectrometer was vital in recruiting distinguished senior faculty to West Virginia University to develop a broad research program in biomolecular structure and biomarkers.

- In Kentucky, EPSCoR is attempting to close the digital gap in underdeveloped regions. This project involves collaboration among many EPSCoR states and with the National Computational Science Alliance and the National Partnership for Advanced Computational Infrastructure (NPACI). The project has provided a vehicle through which scientists and researchers in EPSCoR states will be able to utilize the Access Grid technology developed by the National Center for Supercomputing Applications (NCSA). To date, Access Grid nodes have been established in 16 of the 22 EPSCoR states. The Access Grid can support large-scale distributed meetings and collaborative work sessions as well as seminars, lectures, tutorials, and training.
- A New Mexico EPSCoR project will catalogue a significant collection of arthropods. Once the cataloguing of this collection has been accomplished, national information links will greatly increase the utility of the collection to researchers and educators across the United States. Follow-up funding already committed from the University of New Mexico, New Mexico State University and Western New Mexico University will allow scientists to integrate biota data across various taxa available from many institutions and to connect to national databases.
- In Alaska, EPSCoR is supporting a project in the Fairbanks North Star Borough School District to implement consistent, standards-based K-6 mathematics curriculum and instruction. *Project PRIME* is a local pilot project that will provide over 200 hours of training in math content and teaching methods to teachers and administrators with the aim of increasing student performance as measured on state-mandated tests in grades 2-9. The project will increase the mathematical content knowledge of K-6 teachers and create a cadre of math teacher leaders. Project PRIME will form active, substantive partnerships with the University of Alaska-Fairbanks Department of Mathematical Sciences and School of Education, the NSF-sponsored Alternative to Rebuilding Curriculum Center, the Alaska Department of Education and Early Development, and businesses in Fairbanks.

The FY 2004 Request of \$75.0 million represents no change from FY 2003. Funding in EHR is supplemented in the Request by approximately \$30.0 million in the Research and Related Activities Appropriation, bringing total EPSCoR support to approximately \$105.0 million. The FY 2004 Request will enable NSF to provide continuing support for the following activities:

Research Infrastructure Improvement (RII) - RII are 36-month awards of up to \$9.0 million total for research infrastructure improvements in S&T areas identified as critical to a state's future R&D competitiveness. A 50 percent non-federal state match is required over the term of the award. RII awards were recommended for the states of Hawaii, Kansas, and Vermont during FY 2003.

Co-funding - Co-funding efforts at NSF involve joint support of research and education proposals submitted by researchers from EPSCoR states to the Foundation's ongoing grant programs as a means of accelerating the movement of EPSCoR researchers and institutions into the mainstream of federal and private sector R&D support. During the period FY 1998-2002, researchers from EPSCoR states received over 900 awards totaling \$312.8 million through this mechanism. NSF research programs provided \$187.90 million of this total.

Outreach - NSF program officers and staff coordinate a comprehensive outreach program to universities, industry, and state government in EPSCoR states to inform researchers and S&T administrators of NSF policies and programs. Since the program's inception in FY 1998, NSF staff have made 724 visits to EPSCoR states to foster greater participation by institutions and researchers in other NSF-supported activities.

**ELEMENTARY, SECONDARY, AND INFORMAL EDUCATION \$194,450,000**

The FY 2004 Request for the Elementary, Secondary, and Informal Education (ESIE) Subactivity is \$194.45 million, a decrease of \$17.24 million, or 8.1 percent, from the FY 2003 Request of \$211.69 million.

Elementary, Secondary and Informal Education Funding  
(Dollars in Millions)

	FY 2002 Actual	FY 2003 Request	FY 2004 Request	Change	
				Amount	Percent
Instructional & Assessment Materials Development	28.86	28.99	28.99	0.00	0.0%
Teacher Development*	126.21	127.70	115.46	-12.24	-9.6%
Informal Science Education	55.68	55.00	50.00	-5.00	-9.1%
<b>Total, ESIE</b>	<b>\$210.76</b>	<b>\$211.69</b>	<b>\$194.45</b>	<b>-\$17.24</b>	<b>-8.1%</b>

Totals may not add due to rounding

\*FY 2002 Actual and FY 2003 Request for Elementary, Secondary and Informal Education (ESIE) includes \$45.06 million and \$40.25 million, respectively, from Education System Reform (ESR). For the FY 2004 Request, ESR projects are moved to ESIE in order to consolidate K-12 programs.

ESIE’s comprehensive programming develops research-based models and high-quality, innovative resources that strengthen the teaching and learning of science, technology, and mathematics (STM) education, pre-Kindergarten through grade 12 (preK-12). Instructional materials and student assessments that promote active investigation, together with new models for teacher education, contribute to STM classroom environments that serve all students well. Moreover, ESIE media, exhibit, and community-based programs increase scientific and technological literacy and develop life-long skills benefiting learners of all ages. ESIE programs create a solid educational foundation for the future research, instructional, and technological workforce, as well as for students pursuing post-secondary education in other disciplines. All ESIE efforts incorporate high standards in content, pedagogy, and assessment; capitalize on the strengths of formal and informal education communities; and forge partnerships among major stakeholders (e.g., higher education, school districts, state education agencies).

**Instructional and Assessment Materials Development (IMD)** activities develop instructional materials and assessment tools for improving preK-12 STM education. These materials influence traditional textbooks and are gaining wider national acceptance as a growing body of research demonstrates their impact on student performance. For example, *Contemporary Mathematics in Context (Core-Plus)* — a secondary curriculum emphasizing real-life investigations and modeling — is a four-year research and development effort that has led to gains in achievement, as well as effective transition to university-level study. At the University of Michigan, entering *Core-Plus* students out-scored a control-group of their peers in their first-year mathematics course. In FY 2004, IMD funding is maintained at the FY 2003 Request of \$28.99 million.

**Teacher Development** supports creation of models and resources requisite to large-scale STM education reform. Newly restructured programming promotes a coherent approach to the teacher education continuum in which NSF’s state, urban, and rural systemic initiatives are integrated from the Education Systemic Reform (ESR) Subactivity into ESIE’s Teacher Development activities. This restructure will consolidate preK-12 programs and capture lessons learned from the urban and rural systemic efforts. Support for existing awardees will continue in the FY 2004 Request. In the FY 2004 Request, funding for Teacher Development activities decreases by \$12.24 million from the FY 2003 Request due mainly to



the transfer of and reduced funding commitment to the ESR programs. Teacher Development activities include:

- **Centers for Learning and Teaching (CLTs)** address national priorities for (a) rebuilding and diversifying the human infrastructure for STEM education; (b) increasing the number of K-16 educators with deep knowledge of discipline, pedagogy, and student assessment; and (c) conducting substantive research on learning, teaching, and education policies. Recently funded CLTs are researching the nature of mathematical knowledge required for teaching proficiency; testing models of collaboration in professional development to strengthen qualifications of teachers newly entering the workforce; and studying ways to improve development of science curricula. A notable impact of CLT efforts is the partner alliances forged to strengthen development of STM K-12 specialists. For example, the *Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM)* catalyzed an unprecedented agreement among graduate deans at the University of Tennessee, Ohio University, Marshall University, the University of Kentucky, and the University of Louisville. *ACCLAIM* partner institutions now accept each other's graduate credit courses. Each university thus capitalizes on its strengths and graduate fellows are given maximum flexibility in designing programs of study. A summary of the award information may be found at: <https://www.fastlane.nsf.gov/servlet/showaward?award=0119679>.
- **Teacher Professional Continuum (TPC)** brings together EHR's teacher education efforts, creating a coherent continuum of professional experiences that both prepare teachers and enhance their skills. TPC goals are to produce innovative resources for preparing and supporting STM teachers and administrators; to research and develop models and systems that support the professional continuum; to research teacher learning and its impact on teaching practice; and to disseminate research findings, strategies, and resources to a national audience. The quality of NSF's professional development materials is evidenced by three evaluations conducted by the National Staff Development Council. Evaluation criteria included: a well-defined staff development program; demonstration of improved student achievement; content-specific strategies for improving teachers' content knowledge and pedagogical skills; and use in multiple schools or across a district, state, or region. Fourteen of the 22 projects found to impact student achievement were developed with NSF support. In FY 2004, TPC funding in ESIE is \$55.12 million, a decrease of \$1.0 million from the FY 2003 Request.
- **Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST)** provide national career recognition for exemplary elementary and secondary teachers of mathematics and science. In FY 2004, funding is maintained at the FY 2003 Request of \$4.33 million.

**Informal Science Education (ISE)** promotes public interest, understanding, and engagement in science and technology through voluntary, self-directed, and lifelong learning opportunities for both children and adults. ISE-supported activities include development of radio and television series, large-format films, exhibits, Web-based projects, youth programs, and a variety of educational materials and programs. In addition to reaching large audiences, ISE projects often receive national and/or international recognition. For example, the Children's Museum of Indianapolis' traveling exhibit, *Bones*, teaches visitors about the science of bones. Among the rich suite of print, video, and digital educational materials is *Break a Bone* (winner of a 2002 Telly Award for non-broadcast communications) and *Bones Website* (winner of the international Crystal Award of Excellence which recognizes high-quality web production) <http://tcm.childrensmuseum.org/bones/entrance.htm>. FY 2004 funding decreases to \$50.0 million, a reduction of \$5.0 million or 9 percent below the FY 2003 Request of \$55 million. Efforts to reach audiences in smaller communities are maintained, while those to promote public understanding of research and develop STM instructional materials for after-school programs are scaled back.

**UNDERGRADUATE EDUCATION**

**\$142,100,000**

The FY 2004 Request for the Undergraduate Education (DUE) Subactivity is \$142.10 million, an increase of \$6.50 million, or 4.8 percent, over the FY 2003 Request of \$135.60 million.

Undergraduate Education Funding  
(Dollars in Millions)

	FY 2002 Actual	FY 2003 Request	FY 2004 Request	Change Amount	Change Percent
Curriculum, Laboratory, & Instructional Development	85.59	79.74	71.74	-8.00	-10.0%
Workforce Development	57.11	55.86	70.36	14.50	26.0%
<b>Total, DUE</b>	<b>\$142.70</b>	<b>\$135.60</b>	<b>\$142.10</b>	<b>\$6.50</b>	<b>4.8%</b>

The Undergraduate Education Subactivity serves as NSF’s focal point for the improvement of undergraduate science, technology, engineering, and mathematics (STEM) education. This Subactivity provides leadership and leveraged project support for efforts that promote the engagement in inquiry-based learning by all undergraduate students including disciplinary majors, prospective preK-12 teachers, prospective technicians, and non-majors/citizens in an increasingly technological society. Supported projects are in 2- and 4-year colleges, and universities. The objectives are to improve STEM learning across the undergraduate spectrum through the reform of courses, laboratories, curricula, and instructional materials, and to increase the quality and quantity of the science and engineering workforce. Emphases include integration of learning technologies, faculty development, and preparation of teachers.

**Curriculum, Laboratory, and Instructional Development** includes:

The STEM Talent Expansion Program (STEP), initiated in FY 2002, to support initial planning and pilot efforts at colleges and universities to increase the number of U.S. citizens and permanent residents pursuing and receiving associates or bachelor’s degrees in established or emerging STEM fields. Support for this program is increased in FY 2004 by \$5.0 million to \$7.0 million.

The Robert Noyce Scholarship Program, offering scholarships for juniors and seniors majoring in mathematics, science or engineering, and stipends for science, mathematics, or engineering professionals seeking to become teachers. Projects help recipients obtain certification and become successful math and science teachers in K-12 schools. FY 2004 funding for this program is \$4.0 million, unchanged from the FY 2003 Request.

National STEM Education Digital Library (NSDL), formally opened in summer 2002, establishes a national resource of high quality Internet-based STEM educational content and services to support learners at all levels, in formal and informal settings. In FY 2003, the Core Integration project will be funded, which provides centralized management of the Library and the Library’s collections and services. The FY 2004 Request will support: (1) continued development of NSDL by strengthening the core integration of the interoperation of previously-funded collections and services projects; (2) continued incorporation of technological advances and targeted research to improve the functionality and usability of NSDL services; and (3) initiation of new collections of high quality educational products and digital library services that increase the comprehensiveness and usability of the NSDL. The FY 2004 Request decreases from the FY 2003 Request by \$5.0 million to a level of \$18.60 million, reflecting the fact that funding requirements decline with the award of the Core Integration project. Additional funding of \$5.20 million in the R&RA appropriation from the GEO and MPS Activities brings the total funding to \$23.80 million.

The NSF Director's Awards for Distinguished Teaching Scholars program seeks to engage faculty who bring the excitement and richness of discovery in STEM fields to all students, whether they currently plan STEM careers or not. The recipients share NSF's "highest honor for excellence in both teaching and research" and receive \$300,000 over four years to continue and expand their work beyond their institutions. The FY 2004 Request is held constant at the FY 2003 Request of \$1.51 million.

Course, Curriculum, and Laboratory Improvement (CCLI) strengthens NSF's efforts to assure access to a high quality STEM education for all students by focusing on the identification, development, adaptation and implementation of exemplary curricular and laboratory educational materials and instructional models. The FY 2004 Request for CCLI is \$40.63 million, an \$8.0 million reduction from the FY 2003 Request of \$48.63 million. Within CCLI, Assessment of Student Achievement in Undergraduate Education (ASA) is supported at \$3.0 million, the same as the FY 2003 Request. ASA promotes the development and dissemination of assessment practices, materials, and tools to improve courses and curricula as a basis for improving undergraduate STEM education. ASA supports assessments of undergraduate student performance, and provides measures for student academic learning outcomes and the quality of educational environments in support of student learning.

**Workforce Development** includes:

Federal Cyber Service: Scholarship for Service (SfS) seeks to build a cadre of individuals in the Federal sector with the skills needed to protect the nation's critical information infrastructure. Scholarships provide full tuition, academic fees, and student stipends in exchange for service in Federal agencies after graduation. Capacity building grants improve the quality and increase the production of information assurance and computer security professionals. In FY 2002, the U.S. Congress provided an additional \$19.30 million in funding to increase the number of students in the program. In response, EHR has funded new scholarship programs at four schools, as well as nine supplements to the existing eleven scholarship-providing institutions, resulting in 130 new scholarships that otherwise would not have been available under this program. FY 2004 funding for SfS is increased by \$5.0 million to \$16.18 million.

Advanced Technological Education (ATE) supports improvement in technician education, particularly at two-year colleges and secondary schools, by supporting the design and implementation of new curricula, courses, laboratories, educational materials, opportunities for faculty and student development, and collaboration among educational institutions and partners from business, industry, and government. In FY 2004, funding is sustained at the FY 2003 Request of \$38.16 million.

Teacher Professional Continuum (TPC) is the Foundation's effort to address critical issues and needs regarding the recruitment, preparation, enhancement, and retention of K-12 science, technology, and mathematics teachers and is a joint activity with ESIE. This effort is supportive of EHR's highest priorities, including the Math and Science Partnership and Centers for Learning and Teaching. The FY 2004 Request is \$6.52 million in the DUE Subactivity and will be used to support efforts within TPC that focus on the preparation of future teachers.

The Higher Education Centers for Learning and Teaching (HE CLTs) are an extension of the CLT program in ESIE and support coordinated efforts to reform teaching and learning at the nation's colleges and universities through a blend of research, faculty professional development, and education practice. Requested funding of \$1.0 million will create a new Center, co-funded by MPS and ENG in the Research and Related Activities Appropriation.

Workforce for the 21<sup>st</sup> Century priority area funding of \$8.50 million is included in the DUE Subactivity. For FY 2004, NSF's Workforce efforts will focus on attracting students, especially those students who have traditionally been underrepresented, to science, technology, engineering and mathematics (STEM) disciplines.

**GRADUATE EDUCATION**

**\$156,880,000**

The FY 2004 Request for the Graduate Education (DGE) Subactivity \$156.88 million, an increase of \$28.5 million, or 22.2 percent, over the FY 2003 Request of \$128.38 million.

Graduate Education Funding  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Request	Request	Amount	Percent
Total, DGE	\$105.97	\$128.38	\$156.88	\$28.50	22.2%

The Graduate Education Subactivity aims to recognize and support a diverse pool of outstanding individuals in their pursuit of advanced science, technology, engineering, and mathematics (STEM) education; to reform graduate education; and to build stronger links between higher education and K-12 education. These efforts help strengthen U.S. education at all levels and help ensure continued U.S. economic and research preeminence. Individuals are supported through research and teaching fellowships and traineeships at the graduate level. The increase of \$28.50 million reflects the Foundation’s commitment to increasing graduate stipends to a level that will attract the high quality students necessary for the nation’s future and to increasing the number of supported graduate students. In academic year (AY) 2004-2005, the annual stipend will be increased to \$30,000, an increase of \$5,000 over the FY 2003 Request.

Graduate Research Fellowships (GRF) support the most promising science, mathematics, and engineering students in the U.S. to develop their knowledge and skills so that they perform at the forefront of education and research. In FY 2004, priorities include achieving greater diversity in the applicant and awardee pools, and continuing to increase support levels to strengthen the competitiveness and prestige of the program. Since 1952, nearly 38,000 U.S. students have received GRF awards. In FY 2004, funding for this program increases within DGE by \$16.29 million (22.2 percent) over the FY 2003 Request, to a total of \$89.74 million. About 2,200 Fellows will be supported in FY 2004 with DGE funds; an estimated 2,550 Fellows are supported throughout the Foundation.

Graduate Research Fellows study a wide variety of fields in many different settings. Fellows have many noteworthy accomplishments while graduate students; for example, Fellows reported work towards 32 patents during the 2001-2002 academic year. The patent ideas come from a wide range of disciplines: engineering (agricultural, biomedical, chemical, electrical, mechanical), materials science, chemistry, and the life sciences. The following examples illustrate accomplishments of Fellows:

- Catherine Linnen, a Ph.D. candidate in Evolutionary Biology at Harvard University, studies the biology and systematics of a sawfly genus found in the northern United States and Canada. In AY 2001-2002, she co-authored two publications, received the Derek Bok Award for Excellence in Teaching, and received three research grants.
- Kathryn Jeanne De Laurentis is a Ph.D. student in mechanical engineering at Rutgers. She is investigating novel design methodologies for lightweight robotic manipulators. In particular, she is developing the design of a ‘shape memory’ robotic hand with applications in biomedical engineering, prosthetics and situations where a dextrous robotic hand is needed to perform fine tasks. In AY 2001-2002, she was a co-author of one journal publication and four conference presentations and was a recipient of a U.S. patent awarded in April 2002. She also has been involved in two programs at Rutgers that encourage participation of middle and high school girls in engineering and technology,

participates in a mentoring program at the County College of Morris, and is mentor for a student enrolled in the Ronald McNair program.

Graduate Teaching Fellowships in K-12 Education (GK-12) supports graduate and advanced undergraduate STEM students as content resources for K-12 teachers. This NSF-wide program links the acknowledged excellence of U.S. graduate education with the critical needs of the K-12 sector. Graduate Teaching Fellows assist K-12 teachers with the science and mathematics content of their teaching, demonstrate key science and mathematics concepts, and gain pedagogical skills necessary at all education levels. Professional development opportunities are provided for the K-12 teachers. The FY 2004 Request for GK-12 in EHR is \$42.46 million, an increase of \$7.71 million (22.2 percent) over the FY 2003 Request. Including funding from the R&RA Account, the total number of graduate students supported through GK-12 is about 900.

The GK-12 program is building partnerships to improve graduate education and the K-12 learning environment. For example, the GK-12 project at Northeastern University partners with the Hewlett Packard Foundation, the Boston Museum of Science, the Philanthropic Initiative Foundation, the New England Aquarium and the Boston Public Schools to cross-fertilize the experience of Fellows to the urban educational environment. Both the Museum and Aquarium provide professional development activities for Fellows and teachers, pairing scientists with teachers. Retired scientist and engineer volunteers also serve as resources.

A grant to the University of Pennsylvania illustrates the excitement for science and mathematics that can result from connections between graduate and K-12 education. Thurgood Marshall elementary school is an inner city elementary school with a high population of African American students and a broad mix of students from other nations. Few (or sometimes none) of the students score average or above on the state math exam. Fellows are helping implement an innovative and challenging math program. The principal reports: “The Fellows offer a new perspective. Teachers feel less risk when working with the Fellows than working with expert mentor teachers. The Fellows helped by giving the teachers an opportunity to discuss things with people who knew and loved math.”

Integrative Graduate Education and Research Traineeships (IGERT), an NSF-wide program initiated in FY 1998, promotes new paradigms in graduate education. Graduate students engage in a broad array of coursework and research opportunities that transcend disciplinary boundaries, explore career options through internships, develop skills such as communication, computation, and teamwork, and engage in international activities. Support for IGERT within the Graduate Education Subactivity increases by \$4.48 million (22.3 percent) to \$24.68 million in FY 2004. Approximately 1,500 trainees are supported throughout the Foundation.

Adnan Derti, an IGERT trainee at Boston University, is working on the development of a microarray fabrication facility, involving biology, chemistry, genetics, and manufacturing engineering. Derti produced a working prototype DNA microarray fabricator that will generate arrays expected to have greater specificity and cost less than those commercially available. The next step is to adapt this to proteomics, one of the great challenges of the post-genomic era.

Pedro Irazoqui-Pastor, an IGERT trainee at the University of California – Los Angeles, has combined neuroscience with bioengineering and state-of-the-art circuit design. This education provided skills necessary to develop an inductively powered, wireless neural recording device. This implanted device, which can record both single-unit activity and field potentials, has been successfully designed, fabricated, and tested. This device makes possible a variety of previously impossible-to-perform neuroscientific experiments.

**HUMAN RESOURCE DEVELOPMENT**

**\$103,410,000**

The FY 2004 Request for the Human Resource Development (HRD) Subactivity is \$103.41 million, an increase of \$13.20 million, or 14.6 percent, above the FY 2003 Request of \$90.21 million.

Human Resource Development Funding  
(Dollars in Millions)

	FY 2002 Actual	FY 2003 Request	FY 2004 Request	Change Amount	Change Percent
Undergraduate/Graduate Student Support	55.07	50.77	62.97	12.20	24.0%
Research and Education Infrastructure	25.30	23.20	25.20	2.00	8.6%
Opportunities for Women and Persons with Disabilities	16.64	16.24	15.24	-1.00	-6.2%
<b>Total, HRD</b>	<b>\$97.01</b>	<b>\$90.21</b>	<b>\$103.41</b>	<b>\$13.20</b>	<b>14.6%</b>

The Human Resource Development Subactivity aims to increase the participation and advancement of underrepresented groups and institutions at every level of science, technology, engineering, and mathematics (STEM) education through the promotion of racial and ethnic diversity, gender equity, and access for persons with disabilities. Programs focus on success factors such as increasing interest and academic performance, degree attainment, and workforce participation. These efforts engage the full range of academic institutions and — through the development, assessment and documentation of model efforts to improve teaching, learning, and research participation — serve to benefit all students.

Within this Subactivity, programs address three priorities: (1) increasing substantially the diversity of the STEM professoriate; (2) strengthening the synergy among key minority-focused programs and the interactions among grantees within these programs and with other NSF programs in research and education; and (3) expanding upon a strong educational research base to develop and foster broad implementation of innovative strategies for increasing participation and achievement of girls, women, and persons with disabilities in STEM education and research activities.

**Undergraduate/Graduate Student Support** includes:

- Louis Stokes Alliances for Minority Participation (LSAMP) strengthen and encourage STEM baccalaureate degree production of students from underrepresented populations by utilizing the knowledge, resources, and capabilities of a broad range of organizations from the academic, federal, and commercial sectors. The effectiveness of LSAMP is demonstrated by significant increases in the number of minority students in STEM fields earning baccalaureate degrees. Funding is increased by \$6.20 million to a level of \$32.73 million to increase award size and improve coordination with other programs that aim to increase participation of underrepresented minority students.
- Historically Black Colleges and Universities — Undergraduate Program (HBCU-UP) provides awards to enhance the quality of undergraduate STEM programs through curricular reform and enhancement, faculty development, research experiences for undergraduates, upgrading of scientific instrumentation, and improvement of research infrastructure. FY 2004 funding is increased by \$6.0 million to \$19.97 million to increase award size and improve coordination with LSAMP and the Alliances for Graduate Education and the Professoriate.
- Tribal Colleges and Universities Program (TCUP) provides awards to these institutions to enhance the quality of STEM instructional and community outreach programs through curricular reform and enhancement, faculty development, research and other out-of-classroom educational experiences for

students, upgrading of scientific instrumentation, and improvement of research infrastructure. In FY 2004, support for the program remains constant at the FY 2003 Request of \$9.98 million.

- Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM), administered by NSF on behalf of the White House, identify outstanding mentoring efforts/programs designed to enhance the participation of groups underrepresented in science, mathematics, and engineering. In FY 2004, funding is maintained at the FY 2003 Request of \$290,000.

**Research and Education Infrastructure** includes:

- Alliances for Graduate Education and the Professoriate (AGEP) continue implementing strategies for increasing STEM Ph.D. attainment among students drawn from underrepresented minority populations and encouraging those students to enter the professoriate. AGEP activities are projected to double their STEM doctoral degree production within a five-year period. In FY 2004, program support totals \$11.80 million, unchanged from the FY 2003 Request.
- Centers of Research Excellence in Science and Technology (CREST) serve as hubs for conducting competitive research at minority institutions, including those that produce well-trained doctoral students in STEM fields. A goal of the program is to assist Center faculty to participate more fully in other NSF research programs. Currently, HRD supports 11 Centers. CREST funding is increased by \$2.0 million in FY 2004 to \$10.88 million to increase award size.
- Model Institutions for Excellence (MIE) support minority institutions with a strong track record for graduating underrepresented minority students at the baccalaureate level, and encouraging those students to pursue graduate degrees. Jointly funded with the Research and Related Activities Appropriation, EHR funding for this program is sustained at \$2.52 million for total NSF support of \$9.81 million.

**Opportunities for Women and Persons with Disabilities** includes:

- Program for Gender Equity (PGE) supports education and research activities that foster the increased participation of women and girls in STEM. PGE funding of \$9.96 million is requested in FY 2004, a reduction of \$550,000 from the FY 2003 Request of \$10.51 million.
- The Research in Disabilities Education (RiDE) program, formerly the Program for Persons with Disabilities (PPD), will be funded at \$5.28 million, the same as the FY 2003 Request. RiDE supports efforts to increase the participation and achievement of individuals with disabilities in STEM education and careers. Methods and products of focused research awards are incorporated in program-sponsored regional alliances. The alliances serve to inform educators, government and industry about proven-good practices in the classroom, promote broader awareness and inclusion of disabilities issues, and define specific areas of human learning in need of further attention by the research community.

**RESEARCH, EVALUATION AND COMMUNICATION**

**\$66,200,000**

The FY 2004 Request for the Research, Evaluation and Communication (REC) Subactivity is \$66.20 million, a decrease of \$1.00 million, or 1.5%, from the FY 2003 Request.

Research, Evaluation and Communication Funding  
(Dollars in Millions)

	FY 2002	FY 2003	FY 2004	Change	
	Actual	Request	Request	Amount	Percent
Research	55.91	54.56	54.56	0.00	0.0%
Evaluation	13.04	12.64	11.64	-1.00	-7.9%
Total, REC	\$68.95	\$67.20	\$66.20	-\$1.00	-1.5%

Research funding remains unchanged at \$54.56 million in FY 2004 and includes:

- The Research on Learning and Education (ROLE) program organizes a variety of efforts and seeks to build a stronger interdisciplinary approach to research on learning and education. ROLE helps EHR build the research base for all of EHR’s programs. A major focus of ROLE research is to discover how we learn. Cooperatively with other NSF activities in the biological, social, and behavioral science fields, ROLE will continue exploratory efforts in brain research and cognitive neuroscience in order to inform the design of classrooms and other formal and informal learning environments of the future. Additionally, ROLE seeks to advance the nation's ability to change educational systems to improve STEM learning. ROLE and related research funding totals \$39.56 million in FY 2004, the same level as in the FY 2003 Request.
- The Interagency Education Research Initiative (IERI) is unique among EHR programs in that its primary purpose is to support research on implementation and scalability of educational methods. The goal of IERI is to improve preK-12 student learning in reading, mathematics, and science by supporting interdisciplinary research on large-scale implementations of educational practices and technologies that have already secured significant and credible evidence of success that can generalize to larger and more varied settings. Research in IERI thus provides a knowledge base of sustainable improvements in education for diverse student populations in a wide range of learning environments. IERI supports research that reflects the context in which educators do their work, to ensure adaptability to classrooms in an array of settings. Research conducted on a scale that allows for a careful examination of how characteristics within a variety of education systems interact to facilitate learning helps accelerate their successful adoption in a wide range of schools. IERI generates knowledge to address directly the challenge of how to bridge the gap between research and practice, to translate knowledge into tangible tools and practical procedures for education, and to improve educational practices and technologies. REC requests \$15.0 million in FY 2004 for IERI, unchanged from the FY 2003 Request. This investment is leveraged with annual contributions from the NSF Research and Related Activities Appropriation (\$10.0 million) and participation by the Department of Education and the National Institutes of Health.

Research on learning, teaching, and technology generates important discoveries, advancing our understanding of knowledge acquisition, and instructional practice, and strengthening the research base for programs across EHR. It establishes proofs-of-concept for developing and applying learning technologies to STEM learning and teaching at all education levels. A primary goal is to increase the level of science and mathematics knowledge of all students, as well as to develop mechanisms for ensuring effective implementation of learning strategies and tools in classrooms, schools, and large-scale systems. National and international studies, and analyses, such as the Third International Mathematics and Science Study (TIMSS) and the TIMSS-Repeat (TIMSS-R), provide invaluable descriptions of the status and progress made by U.S.



education, as well as insights for meeting its challenges. For example, REC-supported international comparative research highlights the disturbing level of content preparation of U.S. middle school teachers compared to other countries, and suggests that high school teacher induction practices of other countries enable more productive and effective instruction in early teaching careers. This blend of results on research on learning, effective learning technology development, and insights from international comparisons can contribute to policy discourse and decision-making in improving U.S. mathematics and science education practice.

The unique span of REC investment, ranging from the cognitive neuroscientific to the scale of large educational systems, is generating insights into the learning process than can only be approached from a multidisciplinary perspective. A portfolio of nearly 200 projects that covers the span from early childhood through adult learning, including preK-16 education, is helping build a productive and forward-moving research community that is characterized by its multidisciplinary expertise in cognition, learning theory, technology, pedagogy, instructional workforce development, policy, and education system reform.

The research on learning portfolio continues to yield converging results that suggest that different approaches to instruction can produce strong learning gains, especially in disadvantaged settings, such as limited-English urban areas characterized by significant achievement gaps. These studies include a series of separate research projects in different parts of the country. One, for example, has tested an approach based on teaching scientific model-building for fourth and fifth grade students, finding that a sustained program of model-based instruction produced more sophisticated and accurate understanding of scientific concepts and the relationships between them. Another program of instruction, in which presentation of scientific concepts was carefully mediated through the language and cultural symbols of the students, produced significant effect sizes in subsequent standardized science assessments. Projects in REC's educational technology portfolio have continued to build a body of evidence on improving STEM learning. REC supported tools are designed to amplify, highlight, and reveal mathematical or scientific ideas, principles, and processes, and enable the modeling, representation, manipulation and transformation of scientific or mathematical objects and processes. These tools will support significant pedagogical shifts that are appropriate for classrooms today and in the future.

Evaluation funding declines by \$1.0 million to \$11.64 million in FY 2004. Evaluation efforts that systematically assess the impact and results of all major EHR programs are supported in REC, contributing to improved program performance and accountability. Evaluation will continue to use a continuum of activities such as developing program indicators, producing databases, conducting impact studies, and carrying out program evaluations, to document accountability throughout NSF's portfolio of STEM education, training and human resource development programs. A special emphasis of Evaluation activities is measurement and data collection necessary to meet the reporting requirements of the Government Performance and Results Act. Support for evaluation is also included in the Math and Science Partnership program. The Evaluation Research and Evaluation Capacity Building (EREC) program awarded its first round of grants in FY 2002 and early in FY 2003. It was combined in a single program announcement with ROLE to stress the effort within EHR to build a more integrated research and evaluation effort in support of all of EHR's programs. EREC seeks unique approaches to evaluation practice to generate new knowledge for the education community and to support broad policymaking within the research and education enterprise. FY 2004 funding will continue support for evaluations of multiple education programs or projects with similar objectives.

REC also pursues an active program of Communication to disseminate the results of EHR-sponsored research and evaluations. These efforts broadly inform the STEM research and education community, provide vital information for policy-makers, and advance NSF's efforts to integrate research and practice. The interpretation and dissemination of research results to promote research-based approaches to education practice will be essential as the nation address its most critical educational challenges.

**H-1B NONIMMIGRANT PETITIONER FEES**

**\$0**

The FY 2004 H-1B Nonimmigrant Petitioner Fees are projected to be \$0, based on the expiration of current H-1B legislation in FY 2003.

H-1B Nonimmigrant Petitioner Fees Funding  
(Dollars in Millions)

FY 2002	FY 2003	FY 2004	Change	
Actual	Request <sup>1</sup>	Estimate	Amount	Percent
57.31	92.50	0.00	-92.50	-100.0%
\$57.31	\$92.50	\$0.00	-92.50	-100.0%

<sup>1</sup> Estimates of the FY 2003 H-1B funds available to NSF have decreased to \$65.68 million since the FY 2003 Request.

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). Merit-based scholarships of up to \$2,500 for up to two years were provided for new or continued enrollment at institutions of higher education by eligible low-income individuals pursuing associate, undergraduate, or graduate degrees in computer science, computer technology, engineering, engineering technology, or mathematics.
- Grants for Mathematics, Engineering, or Science Enrichment Courses. These funds were intended to provide 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 Educational System Reform (ESR) Subactivity.

All funds resulting from P.L. 105-277 have been obligated.

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 are to be expended.

Computer Science, Engineering, and Mathematics Scholarships (CSEMS). This activity continues under P.L. 106-313 with a prescribed percentage of H-1B receipts. The maximum scholarship duration is four years and the annual stipend is \$3,125. It is estimated that funds for the scholarship program, which total 59.5 percent of the total H-1B funding for NSF, will be about \$39.41 million in FY 2003. Estimated funds in FY 2003 would provide approximately 9,500 scholarships for students at 80 colleges and universities. Exemplary CSEMS activities include:

- The CSEMS project implemented under the auspices of the New Jersey Center for Advanced Technological Education by Middlesex County College focuses on increasing the enrollment, retention, and graduation rates in associate degree programs in the CSEMS disciplines. It includes

significant support for students in the academic programs and targets talented students in underrepresented populations. New initiatives include expanded partnerships with area schools, business and industries; the creation of a student ambassador corps to assist in the recruitment of students; targeted peer tutoring for students in barrier courses; and peer mentoring by senior CSEMS students.

- The CSEMS project implemented at the University of South Carolina at Columbia uses the educational and research infrastructures of eight partner institutions as support systems for financially disadvantaged, underrepresented minorities in the areas of computer science, engineering, and mathematics. The program provides a mentor support system through problem-solving workshops, Drop-in Centers, Computer/Learning Centers and peer mentoring programs. Industrial and government partners provide outstanding cutting-edge research opportunities. Directed research and internships permit students to take part in a variety of research projects, and establish mentoring relations with research faculty and professionals.
- The “CSEMS at Cal III” by a committee of Berkeley faculty and staff from academic support programs project at the University of California, Berkeley, is following a single cohort of freshman and sophomore students over a four-year period, and it awards scholarships to twenty-nine economically disadvantaged students, with a special emphasis on students from underrepresented groups in engineering and science. All students targeted for the scholarships demonstrate financial need. Students are chosen utilizing a comprehensive approach in evaluating each student's academic merit and professionalism. Scholars participate in a variety of retention-related activities tied to the existing student support infrastructure. This includes faculty advising, academic excellence workshops, tutoring, mentoring, internships in industry and/or research experience, and assistance with graduate school applications or job placement. A unifying theme of the "CSEMS at Cal III" program is to increase student retention by helping each student develop into a committed member of the engineering and academic community.

Private-Public Partnerships in K-12. P.L. 106-313 directs the remaining 40.5 percent of receipts from 2001 and out-years toward K-12 activities involving private-public partnerships in a range of areas such as materials development, student externships, and math and science teacher professional development. Funds for this activity are expected to be \$26.27 million in FY 2003.

Information Technology Experiences for Students and Teachers (ITEST) has been added as a partnership activity in K-12 that seeks to increase the opportunities for students and teachers to learn about, experience, and use information technologies within the context of STEM, including Information Technology (IT) courses. Supported projects are intended to provide opportunities for both school-age children and teachers to build the skills and knowledge needed to advance their study, and to function and contribute in a technologically rich society. ITEST includes three major components: (a) youth-based projects with strong emphases on career and educational paths; (b) comprehensive projects for students and teachers; and (c) Resource Centers that engage in research related to funded projects, provide technical support and have responsibilities for national dissemination of project models, instructional materials, and best practices.