

EDUCATION AND HUMAN RESOURCES

EDUCATION AND HUMAN RESOURCES

\$771,360,000

The FY 2005 Request for the Education and Human Resources Activity (EHR) is \$771.36 million, a decrease of \$167.62 million, or 17.9 percent, from the FY 2004 Estimate of \$938.98 million.

Education and Human Resources Funding (Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Math and Science Partnership ¹	144.07	139.17	0.00	-139.17	-100.0%
EPSCoR	89.21	94.44	84.00	-10.44	-11.1%
Elementary, Secondary and Informal Education ²	223.30	212.26	172.75	-39.51	-18.6%
Undergraduate Education	172.55	155.50	158.85	3.35	2.2%
Graduate Education	139.50	155.95	173.88	17.93	11.5%
Human Resource Development	99.48	115.85	107.94	-7.91	-6.8%
Research, Evaluation and Communication	66.77	65.81	73.94	8.13	12.4%
Total, EHR	\$934.88	\$938.98	\$771.36	-\$167.62	-17.9%

*Totals may not add due to rounding.

¹ FY 2005 funding for the Math and Science Partnership is in the Integrative Activities line of the Budget.

² The FY 2003 Actual and FY 2004 Estimate for ESIE includes \$40.31 million and \$28.01 million, respectively, from Education System Reform (ESR), which has been phased out. In addition, FY 2003 Actual and FY 2004 Estimate have been restated for the purposes of the FY 2005 Budget Request to reflect all funds for the Teacher Professional Continuum (TPC) on this line, including those previously shown in DUE (FY 2003, \$6.71 million; FY 2004 Estimate, \$6.48 million).

NSF, in accordance with the NSF Act of 1950, is the principal federal agency charged with promoting science and engineering (S&E) education. In support of this mission, the Education and Human Resources Activity promotes the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians and educators and a well-informed citizenry that have access to the ideas and tools of science and engineering. The EHR Activity supports education, research, and infrastructure development in all science, technology, engineering and mathematics (STEM) disciplines. The purpose of these activities is to enhance the quality of life of all citizens and the health, prosperity, welfare and security of the nation.

RELEVANCE

Critical issues face the nation's STEM educational system. 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. S&E degrees each year as a percentage of the population of 24 year olds have remained virtually constant at 5-6 percent for the last several years. Fewer domestic students are pursuing graduate work in S&E fields, and, within this group, women and minorities are seriously underrepresented.

Furthermore, 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 those skills.

EHR activities help strengthen U.S. education at all levels and help ensure continued U.S. economic and research preeminence. They respond to the need expressed in the recent National Science Board report, *The Science and Engineering Workforce Realizing America's Potential*, “to ensure our country’s capacity in S&E in an increasingly competitive and changing global labor market.”

In addressing these issues, the EHR portfolio focuses on three “core” areas:

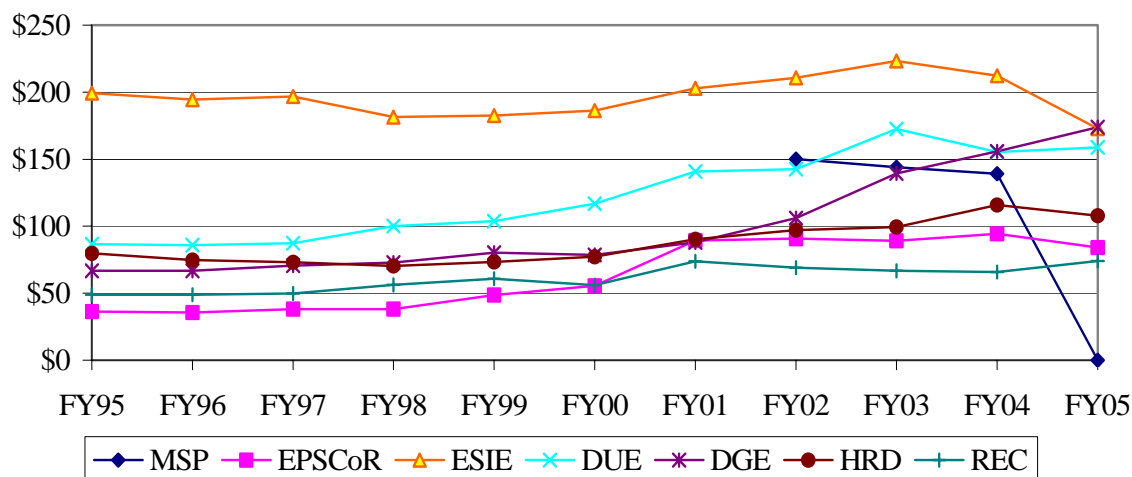
- Attracting and preparing U.S. citizens for STEM careers
- Developing K-12 teachers and STEM faculty
- Increasing institutional capacity to provide STEM education and prepare STEM professionals

For each of these areas, key programmatic strategies have been developed. The FY 2005 Budget Request provides support for a broad range of educational activities:

- K-12 programs develop effective, research-based instructional materials and provide preparation and professional development for teachers. Development of instructional materials that promote scientific and technological literacy and develop life-long skills for learners of all ages enhance these projects.
- Undergraduate programs focus on developing courses, curricula and laboratory experiences for two- and four-year colleges and universities, expanding the nation’s STEM talent, addressing 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.
- Graduate programs provide support to attract and prepare U.S. students for STEM careers. Increasing the number of awards, which in turn will increase the number of supported graduate students, will enhance this support.
- Evaluation and research on education are emphasized throughout the EHR portfolio to inform improvements in educational practice. EHR emphasizes the use of information technology in education and the translation of research results into educational practice.
- EPSCoR’s goal is to maximize the potential inherent in a state’s science and technology resources and use those resources as a foundation for economic growth.
- Informal science activities across the nation help foster the public understanding of science and promote adult learning in STEM.
- The Workforce for the 21st Century priority area focuses on preparing U.S. domestic students for the STEM workforce, promoting diversity of the workforce, and conducting research to inform the preparation of the next generation of the workforce.

Support for STEM education and related research and human resource development programs for the EHR Subactivities since FY 1995 is shown in the chart below.

EHR Subactivity Funding (Dollars in Millions)

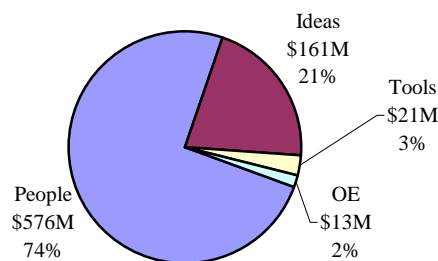


STRATEGIC GOALS

The four NSF strategic outcome goals guide EHR activities:

- PEOPLE:** EHR contributes approximately 54 percent of all NSF funds intended to achieve NSF's People Strategic Goal. EHR's objectives are to improve the quality of STEM education and training at all levels, increase the diversity of the STEM community and instructional workforce, and broaden the participation of all Americans 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 results into improved educational practice. EPSCoR increases the nation's capacity in S&E research.
- TOOLS:** EHR invests in the National STEM Education Digital Library (NSDL), which serves as a national resource to increase the quality, quantity and comprehensiveness of Internet-based STEM educational materials while creating virtual learning communities among students, teachers and faculty.
- ORGANIZATIONAL EXCELLENCE (OE):** Organizational Excellence provides for administrative activities necessary to enable NSF to achieve its mission and goals. These investments include support for Intergovernmental Personnel Act appointments and for contractors performing administrative functions as well as for enhancement of the technological capacity required to manage competitions and to monitor the performance of award portfolios.

FY 2005 EHR Strategic Goals



Faced with difficult choices for competing and meritorious investments, EHR's FY 2005 Budget Request emphasizes the core areas of attracting and preparing U.S. citizens for STEM careers (including increasing support for the Integrative Graduate Education and Research Traineeship, Graduate Research Fellowship and Graduate Fellows in K-12 Education programs), developing K-12 teachers, and increasing institutional capacity to provide STEM education and prepare STEM professionals. The reduction in EHR's budget is primarily due to the phase out of the Math and Science Partnership (MSP). Funding for MSP is discussed in the Integrative Activities chapter. FY 2004 is the last year of the Educational System Reform initiatives (\$28.01 million at the FY 2004 Estimate); in FY 2005 these funds are reallocated to support continuing priorities in EHR.

The most significant decrease from the FY 2004 Estimate is \$139.17 million for the Math and Science Partnership, which is no longer funded in the EHR Activity.

Other decreases include the following programs:

- Informal Science Education (ISE), decreased by \$12.13 million to \$50.0 million;
- Experimental Program to Stimulate Competitive Research (EPSCoR), reduced by \$10.44 million to \$84.0 million;
- STEM Talent Expansion Program (STEP), decreased by \$9.85 million to \$15.0 million;
- Advanced Technological Education (ATE), reduced by \$7.07 million to \$38.16 million;
- Robert Noyce Scholarship program, reduced by \$3.95 million to \$4.0 million; and
- Historically Black Colleges and Universities – Undergraduate Program (HBCU-UP), reduced by \$3.88 million to \$19.98 million.

Details on the impact of these decreases can be found in the Division narratives following this overview section.

Funding by Strategic Goal: Summary
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
People	748.21	741.53	575.79	-165.74	-22.4%
Ideas	152.15	163.59	161.09	-2.50	-1.5%
Tools	22.43	18.49	21.11	2.62	14.2%
OE	12.09	15.37	13.37	-2.00	-13.0%
Total, EHR	\$934.88	\$938.98	\$771.36	-\$167.62	-17.9%

Totals may not add due to rounding.

PEOPLE (-\$165.74 million, for a total of \$575.79 million)**EHR People Investments**
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Individuals	209.21	201.74	209.69	7.95	3.9%
Institutions	137.18	137.05	126.21	-10.84	-7.9%
Collaborations	401.82	402.74	239.89	-162.85	-40.4%
Total, People	\$748.21	\$741.53	\$575.79	-\$165.74	-22.4%

Totals may not add due to rounding.

INDIVIDUALS

- Increase support for the Integrative Graduate Education and Research Traineeships (IGERT) by \$7.15 million from the FY 2004 Estimate of \$24.53 million to \$31.68 million in FY 2005, in order to increase the number of participating institutions and awardees.
- Funding for the Graduate Research Fellowships (GRF) program is increased by \$5.53 million from the FY 2004 Estimate of \$89.21 million to \$94.74 million in FY 2005. This will support additional awards and promote increased diversity in the applicant and awardee pools.
- Other EHR activities in support of the Individuals component of the People goal include the development of K-12 teachers with strong disciplinary and pedagogical content knowledge, and undergraduate students well-prepared to enter the scientific and technological workforce or advance to graduate S&E education.

Individuals Funding by Program
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Graduate Research Fellowships	79.76	89.21	94.74	5.53	6.2%
IGERT	23.39	24.53	31.68	7.15	29.1%
Noyce Scholarships	6.93	7.95	4.00	-3.95	-49.7%
Scholarships for Service	30.14	16.08	16.18	0.10	0.6%
Teacher Professional Continuum	66.65	62.16	62.16	0.00	0.0%
Other	2.34	1.81	0.93	-0.88	-48.6%
Total, Individuals	\$209.21	\$201.74	\$209.69	\$7.95	3.9%

Totals may not add due to rounding.

INSTITUTIONS

- Support for Course, Curriculum, and Laboratory Improvement (CCLI) for undergraduate students in the nation's two- and four-year colleges and universities is \$46.53 million in FY 2005, an increase of \$6.12 million over the FY 2004 Estimate of \$40.41 million.
- The STEM Talent Expansion Program (STEP) is funded in FY 2005 at \$15.0 million, a decrease of \$9.85 million from the FY 2004 Estimate, which allows support for approximately ten awards.

- Instructional and Assessment Materials Development (IMD) is funded at \$29.45 million, an increase of \$630,000 over the FY 2004 Estimate of \$28.82 million. IMD projects develop student materials and assessments for improving preK-12 STM education nationally.
- The Advanced Technological Education (ATE) program, which supports improvement in technician education in science- and engineering-related fields that drive the nation's economy, particularly at two-year colleges and secondary schools, is decreased from the FY 2004 Estimate of \$45.23 million by \$7.07 million to \$38.16 million.

COLLABORATIONS

- Support for NSF Graduate Teaching Fellows in K-12 Education (GK-12) totals \$47.46 million, an increase of \$5.25 million over the FY 2004 Estimate of \$42.21 million. The GK-12 Program promotes collaboration between universities and K-12 schools that benefit K-12 students and teachers, as well as the science and engineering graduate students who serve as resources in the K-12 classrooms.
- Support for the Louis Stokes Alliances for Minority Participation (LSAMP) program will be sustained at the FY 2004 Estimate of \$34.30 million, and the Alliances for Graduate Education and the Professoriate (AGEP) program will also be level-funded at \$14.91 million, to allow for continuing alliances and integration between the programs.
- Other investments in Collaborations foster partnerships with colleges, universities, school districts, and other institutions - public, private, state, local, and federal - to strengthen STEM education at all levels and increase the participation of underrepresented minorities and women in STEM fields.

Collaborations Funding by Program
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Centers for Learning and Teaching Evaluation	24.60	26.84	26.84	0.00	0.0%
GK-12	36.34	42.21	47.46	5.25	12.4%
HBCU-UP	18.71	23.86	19.98	-3.88	-16.3%
Informal Science Education	60.23	62.13	50.00	-12.13	-19.5%
LSAMP	31.81	34.30	34.30	0.00	0.0%
Math and Science Partnership Alliances for Graduate Education and the Professoriate	144.07	139.17	0.00	-139.17	-100.0%
Tribal Colleges	11.48	14.91	14.91	0.00	0.0%
Other	9.84	9.92	9.92	0.00	0.0%
Total, Collaborations	52.24	37.83	24.91	-12.92	-34.2%
Total, Collaborations	\$401.82	\$402.74	\$239.89	-\$162.85	-40.4%

Totals may not add due to rounding.

IDEAS (-\$2.50 million, for a total of \$161.09 million)

FUNDAMENTAL SCIENCE AND ENGINEERING

- Support for Research on Learning and Education (ROLE) increases by \$8.13 million to \$47.46 million in FY 2005. This reflects the need to increase the research base to inform improvements in our nation's educational enterprise.

CAPABILITY ENHANCEMENT

- EPSCoR is funded at \$84.0 million, a decrease of \$10.44 from the FY 2004 Estimate to support Research Infrastructure Improvement, co-funding and outreach for EPSCoR. An additional \$30.0 million is funded in the Research and Related Activities Account, for a total of \$114.0 million in FY 2005.

TOOLS (+\$2.62 million, for a total of \$21.11 million)**INFRASTRUCTURE AND INSTRUMENTATION**

EHR's investment in the National STEM Education Digital Library (NSDL) is increased by \$2.62 million over the FY 2004 Estimate of \$18.49 million to \$21.11 million. NSDL will serve as a national resource to increase development and access of high quality educational materials while creating virtual learning communities among students, teachers, and faculty.

ORGANIZATIONAL EXCELLENCE (-\$2.0 million for a total of \$13.37 million)

Organizational Excellence provides for administrative activities necessary to enable NSF to achieve its strategic goals. Requested funding for FY 2005 is \$13.37 million, compared to \$15.37 million in FY 2004. This includes the cost of the Intergovernmental Personnel Act (IPA) appointments and contractors performing administrative functions.

PRIORITY AREAS

In FY 2005, EHR will support research and education efforts related to broad, Foundation-wide priority areas in Nanoscale Science and Engineering, Workforce for the 21st Century, and Mathematical Sciences.

EHR Investments in NSF Priority Areas
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Nanoscale Science and Engineering	0.22	2.55	4.16	1.61	63.1%
Workforce for the 21 st Century	N/A	0.00	15.38	15.38	N/A
Mathematical Sciences	2.74	2.74	2.74	0.00	0.0%
Human and Social Dynamics	0.00	0.99	0.00	-0.99	-100.0%

Nanoscale Science and Engineering (NSE): The EHR contribution to NSE increases by \$1.61 million to \$4.16 million in FY 2005 to support undergraduate education and the new emphasis on K-12 nanoscience education.

Workforce for the 21st Century: In FY 2005, \$15.38 million is requested for this effort. EHR will focus on preparing scientists, mathematicians, engineers, technologists and educators capable of meeting the challenges of the 21st Century; attracting students, especially those students who have traditionally been underrepresented, to science, technology, engineering and mathematics (STEM) disciplines, thus increasing participation in and diversity of the STEM workforce.

Mathematical Sciences: FY 2005 support totals \$2.74 million, equal to the FY 2004 Estimate, providing continuing support for mathematical sciences education activities.

Human and Social Dynamics: Due to the constraints of overall funding, EHR will not make a formal contribution to the Human and Social Dynamics (HSD) priority area in FY 2005. If appropriate, some HSD proposals will be considered for funding within EHR's Division of Research, Evaluation and Communication (REC).

QUALITY

EHR maximizes the quality of the research and education 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 97 percent in FY 2003, the last year for which complete data exist. Project evaluation is required with projects reporting their progress and impact through annual and final reports to NSF. In addition, external program evaluations are conducted for EHR-managed activities.

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 scientific community; how EHR can promote quality graduate and undergraduate education in science, technology, engineering and mathematics (STEM); and priority investment areas in STEM education research. The EHRAC meets twice a year and members represent a cross section of STEM disciplines; a cross section of institutions including industry; broad geographic representation; and balanced representation of women and underrepresented minorities.

PERFORMANCE

Recent Research Highlights

The National Center for Accessible Media is developing access specifications for the use of the National STEM Education Digital Library (NSDL) by persons with disabilities, and building the NSDL capacity to ensure interoperability and accessibility of their collections and services. This project is also contributing to the national and international effort to ensure that users with disabilities will have access to online learning resources.

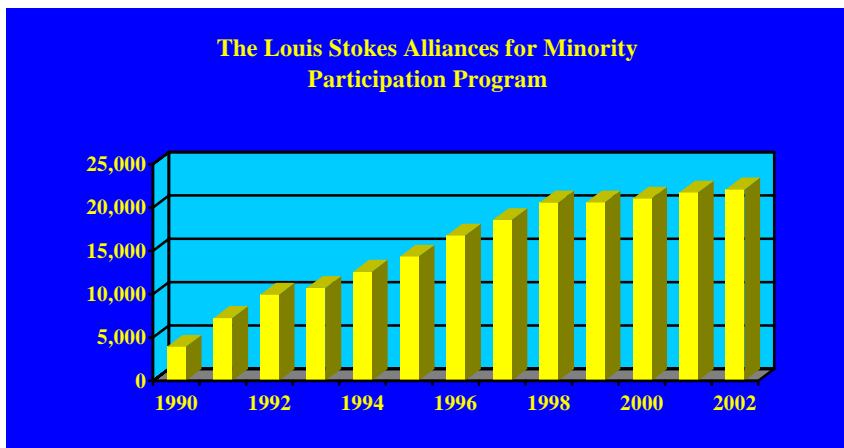


A teacher at an Oklahoma City Community College biotechnology workshop views live cell cultures under a microscope.

Funded by the *Advanced Technological Education Program*, Oklahoma City Community College is working with the local school districts to infuse high quality biotechnology programs into the high schools. Using nationally developed curriculum as well as engaging parents and mentors, the programs are preparing high school students, especially minority students underrepresented in the sciences, for further study and careers in biotechnology.

In 2002, more than 21,429 underrepresented minority students received science and engineering baccalaureate degrees via the *Louis Stokes Alliances for Minority Participation Program (LSAMP)*. Collectively, the reach of the LSAMP program extends north to Alaska, Washington, Montana and New York; south to Texas, Florida and Puerto Rico; east to Massachusetts, Rhode Island,

Pennsylvania and the Carolinas; through Middle America, including Illinois, Missouri, Oklahoma, Tennessee, Colorado and New Mexico; and west to Arizona, California and Hawaii. The program now includes 30 alliances representing over 400 individual institutions. In 2003, the number of STEM students impacted directly by the LSAMP program reached an all-time high of 206,893.



DragonflyTV features children engaged in their own science investigations, and these investigations are crafted and presented—in collaboration between the show producers and the featured children—to model complete inquiry experiences. *DragonflyTV* young investigators explore every kind of science, from the



Victoria and Alejandra from *DragonflyTV* at the Guadalupe-Nipomo Sand Dunes near San Luis Obispo, California.

mysteries of the human body to the power of a tornado. More than 50 percent of young investigators are girls and more than 50 percent are children of color. Program evaluations have demonstrated that children who watch *DragonflyTV* increase their interest in doing science investigations and have a better appreciation of experimental techniques. In 2002, the first season of *DragonflyTV* aired on 250 PBS stations, with the potential for reaching 87 percent of U.S. households. According to Nielsen Research for February 2002, 1,600,000 viewers tuned in each week; total viewers for 2002 exceeded 25,000,000. Nearly 25 percent of the audience was composed of children, ages 6-11; 33 percent were adults, suggesting that many families watch the show together. NSF funding has helped leverage major corporate underwriting from Best Buy, which has recently committed \$1.1 million to the continuation of the series.

Access Science, a project in the NSF Graduate Teaching Fellows in K-12 Education Program, supports graduate students in science and engineering departments at the University of Pennsylvania to work with K-12 students and teachers in the urban public schools in West Philadelphia. With a school population that is 98 percent African American, this project is having a significant impact on populations that are currently underrepresented in the science and engineering fields.

The ***Cancer Detection using 3-D Ultrasonic Imaging*** project at Wayne State University, funded through the Integrative Graduate Education and Research Traineeship Program, is a collaboration between WSU and Karmanos Cancer Research Institute. Engineering, physics, and medicine graduate students as well as medical clinicians are conducting multi-disciplinary research to develop a detection technique with image resolution smaller than 2 mm (typical precursor size of cancer tumors) so that early detection and diagnosis of the tumors could lead to possible therapeutic treatments and higher survival rates.

The Center for Learning and Teaching with a Focus on Research for Developing Instructional Materials in Science represents a collaboration of the American Association for the Advancement of Science, Northwestern University, the University of Michigan, Michigan State University, as well as the Detroit and Chicago Public School Systems. This Center is creating a new generation of leadership for curriculum development, evaluation, and implementation. Efforts focus on (1) developing a national infrastructure at doctoral and postdoctoral levels; (2) providing training to current and prospective science teachers and related professionals; and (3) conducting research on materials development and methods for determining their impact on teacher and student learning.



Members of the West Philadelphia High School Electric Vehicle Team pose with their project.

Number of People Involved in EHR Activities

	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate
Senior Researchers	5,900	5,900	5,500
Other Professionals	3,800	3,800	2,200
Postdoctorates	430	450	290
Graduate Students	4,345	4,800	5,075
Undergraduate Students	21,000	21,000	19,000
K-12 Students	13,000	14,000	10,500
K-12 Teachers	84,500	85,500	82,000
Total Number of People	132,975	135,450	124,565

Change in Teacher Professional Continuum (TPC) Funding by Division

A portion of funds for the Teacher Professional Continuum were expended from the Division of Undergraduate Education in FY 2003 and a portion of funds for this program are reflected in the Congressional report language for FY 2004. In FY 2005, funds have been consolidated in the Elementary, Secondary, and Informal Education (ESIE) Subactivity. In order to compare data across all years in a meaningful manner, FY 2003 Actual and FY 2004 Estimate data have been restated for the purposes of the FY 2005 Budget to reflect all TPC funds in the ESIE Subactivity. Prior to the restatement, funds were distributed as shown below.

TPC Funding (Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request
Undergraduate Education	6.71	6.48	0.00
Elementary, Secondary and Informal Education	59.94	55.68	62.16
Total, TPC	\$66.65	\$62.16	\$62.16

Totals may not add due to rounding.

**EXPERIMENTAL PROGRAM TO STIMULATE
COMPETITIVE RESEARCH****\$84,000,000**

The FY 2005 Request for the Experimental Program to Stimulate Competitive Research (EPSCoR) is \$84.0 million, a decrease of \$10.44 million, or 11.1 percent, below the FY 2004 Estimate of \$94.44 million.

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Experimental Program to Stimulate Competitive Research	89.21	94.44	84.00	-10.44	-11.1%
Total, EPSCoR	\$89.21	\$94.44	\$84.00	-\$10.44	-11.1%

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-four 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, Rhode Island, South Carolina, South Dakota, Tennessee, 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 FY 2005 Budget Request represents a decrease of \$10.44 million from the FY 2004 Estimate, which may require NSF to provide less support for infrastructure awards.

The success of EPSCoR-supported projects is demonstrated in the following examples:

- Researchers at the University of Oklahoma have developed a new method for processing semiconductor laser materials. Use of this procedure will significantly reduce self-heating effects that presently limit the performance of various diode laser technologies. For example, the lifetime of short wavelength lasers designed for next generation high definition DVD players can be increased significantly by using this new packaging technology. Operation temperatures of long wavelength lasers designed for chemical sensing applications can be significantly increased using this new method, helping to reduce the size and cost of sensors used to diagnose diseases such as asthma and monitor air samples for homeland security needs.
- The Montana NSF EPSCoR investment in bio-nanotechnology has resulted in a national effort with both biomedical and electronic applications. The Montana nanotechnology group has successfully synthesized a variety of mono-disperse transition-metal oxide based nanomaterials within various protein cage structures and placed these structures into 2-dimensional arrays. By varying the magnetic alloy content within these cage structures, it is possible to modify the primary (magnetic moment) and secondary magnetic properties of the ion. These monodisperse magnetic particles with controllable magnetic properties and interactions serve as the building blocks for the next generation

of electronic memory and logic and have important potential applications in drug delivery and treatments. Several collaborations have been fostered involving Montana scientists and engineers from MIT, Caltech, Scripps, NASA, and UCLA. It motivated the generation of an NSF-supported Nanotechnology Interdisciplinary Research Team (NIRT) proposal, funded by NSF for 5 years.

- On the island of Kauai, a weather-monitoring network is being established using equipment purchased under Hawaii's EPSCoR Research Infrastructure Improvement grant. This network will provide continuous data feeds on regional climate conditions through a wireless network of weather stations/repeaters into an ecoinformatics database program at the Manoa campus. A rich dataset of weather on regional and microclimate scales will be integrated with ecologic and genetic data to allow researchers to develop more accurate models that will assist in the preservation of endangered species and control of invasive species. Integration of research and education is an important part of this project. Partnering with Kamehameha Schools, university graduate and undergraduate students interact with intermediate and secondary level students who are largely of Native Hawaiian ancestry.
- South Dakota Science on the Move consists of two converted semi-trailers, which come equipped with 12 lab stations and a skilled science instructor. These two mobile science classrooms travel to South Dakota's K-12 schools, bringing high-tech learning opportunities and hands-on experiences that are not always available to students in small rural schools. The project is a cooperative effort between South Dakota EPSCoR, state of South Dakota, NSF, the Governor's Math, Science, and Technology Council (MSTC), the South Dakota Rural Development Council, the Governor's Office of Economic Development, South Dakota Future Funds, and the Howard Hughes Medical Institute.

Funding of \$84.0 million in EHR is supplemented in the FY 2005 Request by approximately \$30.0 million for co-funding activities in the Research and Related Activities Appropriation, bringing total EPSCoR support to approximately \$114.0 million. The FY 2005 Request level will require NSF to provide less than level continuing support for the following activities:

Research Infrastructure Improvement (RII) Awards - 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 fifty percent non-federal state match is required over the term of the award.

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 1998-2003, researchers from EPSCoR states received over 1,100 awards totaling \$392.0 million through this mechanism. EPSCoR provided \$165.40 million and NSF research programs provided \$226.60 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 almost 900 visits to EPSCoR states to foster greater participation by institutions and researchers in other NSF-supported activities.

ELEMENTARY, SECONDARY, AND INFORMAL EDUCATION **\$172,750,000**

The FY 2005 Request for the Elementary, Secondary, and Informal Education (ESIE) Subactivity is \$172.75 million, a decrease of \$39.51 million, or 18.6 percent, from the FY 2004 Estimate of \$212.26 million.

Elementary, Secondary and Informal Education Funding

(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Instructional and Assessment Materials Development	28.78	28.82	29.45	0.63	2.2%
Teacher Development ¹	134.08	121.31	93.30	-28.01	-23.1%
Informal Science Education	60.44	62.13	50.00	-12.13	-19.5%
Total, ESIE	\$223.30	\$212.26	\$172.75	-\$39.51	-18.6%

Totals may not add due to rounding.

¹ FY 2003 Actual and FY 2004 Estimate for ESIE include \$40.31 million and \$28.01 million, respectively, from Education System Reform (ESR), which has been phased out. In addition, FY 2003 Actual and FY 2004 Estimate have been restated for the purposes of the FY 2005 Budget Request to reflect all funds for the Teacher Professional Continuum (TPC) on this line, including those previously shown in DUE (FY 2003, \$6.71 million; FY 2004 Estimate, \$6.48 million).

ESIE's comprehensive programming develops research-based models and high-quality, innovative resources designed to strategically impact learning and teaching in science, technology, and mathematics (STM) education, grades 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 efforts increase scientific and technological literacy and develop life-long skills for 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 innovations that promote high standards in content, pedagogy, and assessment; and through collaborations, capitalize on the strengths of formal and informal education, research and practitioner communities, and major stakeholders (e.g., higher education, school districts, state agencies).

Instructional and Assessment Materials Development (IMD) projects develop student materials and assessments for improving preK-12 STM education nationally. 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, *Everyday Mathematics* (a curriculum for grades K-6) has been adopted citywide in New York, Philadelphia, Chicago, Portland, Seattle, and Denver. A recently proposed, innovative, physics-chemistry-biology sequence promotes understanding of biological processes at the molecular level. San Diego is studying the implementation of this sequence using NSF-funded curricula *Active Physics* and *Living by Chemistry*. *Active Physics* is taught to over one million 9th-grade students and is also being implemented in Prince George's County (MD), Boston (MA), and Little Rock (AR). Emphasis in IMD is placed on developing and researching new approaches to teaching secondary science, technology, and mathematics, and testing the limits of emerging educational technologies.

Teacher Development supports creation of models and resources requisite to large-scale STM education reform. A coherent approach to the teacher education continuum consolidates lessons learned from pre-service, in-service, and systemic programs.

Teacher Development activities include:

- **Centers for Learning and Teaching (CLTs)**, which address national priorities for (a) rebuilding and diversifying the human infrastructure for science, technology, engineering and mathematics (STEM) education; (b) increasing the number of highly qualified K-16 educators; and (c) conducting research on learning, teaching, and education policies. Recently funded CLTs focus on creating a national facility for research on science education, mathematics teaching in urban settings, and studying mathematics curriculum development. A recent adaptation of CLT for the nanoscale priority area will accelerate and study the integration of advances in emerging technologies into our nation's classrooms, grades 7-16. Doctoral-student recruitment at the University of California, Berkeley, a partner in the *Diversity in Mathematics Education Center* (University of Wisconsin), represents a notable CLT impact. Four of the six students recruited for 2003-2004 received university fellowships, a number typically awarded to the entire College of Education. In 2003, a significant international dimension was introduced as the German Research Foundation and NSF identified research themes of mutual interest for joint support. FY 2005 funding for this program is \$26.84 million, unchanged from the FY 2004 Estimate.
- **Teacher Professional Continuum (TPC)**, which provides a coherent continuum of professional experiences that both prepare teachers and enhance their skills. TPC is a jointly-managed activity with DUE and seeks to expand research on effective STM teaching and teacher learning; to disseminate research findings, strategies and resources to national audiences; and to strengthen the infrastructure that supports the STM teaching professional. NSF has had a major impact on secondary physics teaching nationwide. *QuarkNet* Centers at 43 universities are actively engaging teachers in high energy physics research and translation of these experiences into classrooms. Sustained support for the mature *QuarkNet* effort – jointly supported with NSF's Physics Division – will be provided by the Department of Energy. *Modeling Physics* and *Physics by Inquiry* are both education research projects that now serve teachers across the grades 6-16 and K-20 continuum, respectively. Investigators from both projects have been recognized for their seminal work, one receiving the Oersted Medal, the highest award for physics education given by the American Association of Physics Teachers (AAPT) for original work in physics education; the other received the 2002 Medal of the International Commission on Physics Education at Udine, Italy. FY 2005 funding for this program is \$62.16 million, equal to the FY 2004 Estimate.
- **Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST)**, which provide national career recognition for exemplary elementary and secondary teachers of mathematics and science. FY 2005 funding is \$4.30 million, unchanged from the FY 2004 Estimate.

Informal Science Education (ISE) promotes public interest, understanding, and engagement in science and technology through voluntary, self-directed, and life-long learning opportunities for millions of children and adults. ISE-supported activities include development of science museum exhibits, radio and television series, large-format films, youth programs, and Web-based projects. One example, *Citizen Science* developed by the Cornell Lab of Ornithology in partnership with the National Audubon Society, integrates informal learning with scientific research and conservation. The Web portal www.eBird.org allows the public to enter and analyze observations used by Cornell researchers to study the distribution and abundance of North American birds; some 15 million records already have been contributed to this national database. ISE projects often receive national recognition. Recent examples include the Emmy for Outstanding Science, Technology, and Nature Programming for the PBS NOVA program, *The Secret Life of the Brain*, and the Giant Screen Theater Association Lifelong Learning Award for Jane Goodall's *Wild Chimpanzees*. Due to the decreased FY 2005 funding level, new initiatives to further develop the informal science education infrastructure and its connections to formal education will be scaled back.

UNDERGRADUATE EDUCATION**\$158,850,000**

The FY 2005 Request for the Undergraduate Education (DUE) Subactivity is \$158.85 million, an increase of \$3.35 million, or 2.2 percent, over the FY 2004 Estimate of \$155.50 million.

Undergraduate Education Funding

(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Curriculum, Laboratory, and Instructional Development	99.70	93.20	88.14	-5.06	-5.4%
Workforce Development ¹	72.85	62.30	70.71	8.41	13.5%
Total, DUE	\$172.55	\$155.50	\$158.85	\$3.35	2.2%

Totals may not add due to rounding.

¹ FY 2003 Actual and FY 2004 Estimate have been restated for the purposes of the FY 2005 Budget Request to reflect all funds for the Teacher Professional Continuum (TPC) in the ESIE Subactivity, including those previously displayed on this line in DUE (FY 2003, \$6.71 million; FY 2004 Estimate, \$6.48 million).

The Undergraduate Education Subactivity serves as NSF's focal point for the improvement of undergraduate science, technology, engineering, and mathematics (STEM) education and provides leadership and project support for efforts that promote the opportunity for all undergraduate students including disciplinary majors, prospective preK-12 teachers, undergraduate majors in other fields, and prospective technicians to engage in inquiry-based learning. 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.

Curriculum, Laboratory, and Instructional Development includes:

The STEM Talent Expansion Program (STEP), initiated in FY 2002, supports efforts at colleges and universities to increase the number of U.S. citizens and permanent residents pursuing and receiving associate or bachelor's degrees in established or emerging STEM fields. The FY 2005 Request is \$15.0 million, a decrease of \$9.85 million from the FY 2004 Estimate of \$24.85 million. This will decrease the already very low success rate in the program. The restricted size of the awards will require that the scope and number of partners able to engage in any given project be limited.

The **Robert Noyce Scholarship Program** offers 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 high-need K-12 schools. FY 2005 funding for this program is \$4.0 million, a decrease of \$3.95 million from the FY 2004 Estimate of \$7.95 million.

National STEM Education Digital Library (NSDL), opened in 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 and forms a critical part of the cyberinfrastructure for teaching and learning. The FY 2005 Request will support continued development of NSDL by strengthening the core integration of previously-funded collections and services projects; continued incorporation of technological advances and targeted research to improve the functionality and usability of NSDL services; initiation of new collections of high quality educational products and digital library services, and expansion of user services across the breadth of the preK-12 enterprise. The FY 2005 Request for this program is \$21.11 million, an increase of \$2.62 million over the FY 2004 Estimate of \$18.49 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. The recipients share NSF's "highest honor for excellence in both teaching and research." The FY 2005 Request is held at the FY 2004 Estimate of \$1.50 million.

Course, Curriculum, and Laboratory Improvement (CCLI) aims to assure all students access to a high quality STEM education by focusing on the identification, development, adaptation, implementation, dissemination and assessment of exemplary curricular and laboratory educational materials and instructional models. The focus includes introductory and upper level courses, and disciplinary and interdisciplinary efforts in established and emerging fields. This program also 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. The FY 2005 Request for CCLI is \$46.53 million, a \$6.12 million increase from the FY 2004 Estimate of \$40.41 million. This increase will allow an emphasis on assessment and evaluation, modern instrumentation, and educational materials and curricula and program development in emerging areas.

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. FY 2005 funding for SfS is increased by \$100,000 over the FY 2004 Estimate of \$16.08 million to \$16.18 million.

Advanced Technological Education (ATE) supports improvement in technician education in science- and engineering-related fields that drive the nation's economy, 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 2005, funding is decreased from the FY 2004 Estimate of \$45.23 million by \$7.07 million to \$38.16 million. This will preclude the program from supporting additional activities in core mathematics and science in community colleges and from supporting summer and other research opportunities for community college faculty and students at four-year institutions and research laboratories.

Teacher Professional Continuum (TPC), a joint activity between DUE and ESIE, addresses critical issues regarding the recruitment, preparation, enhancement, and retention of K-12 science, technology, and mathematics teachers. All funds for this activity are shown in ESIE.

The **Higher Education Centers for Learning and Teaching (HE CLTs)**, an extension of the CLT program in ESIE, 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. The FY 2005 Request of \$990,000 is unchanged from the FY 2004 Estimate. Support for these centers is also provided by ENG and MPS.

Workforce for the 21st Century priority area funding of \$15.38 million will focus on attracting and preparing U.S. domestic students for the STEM workforce, especially those students who have traditionally been underrepresented in these fields, and conducting research to inform the preparation of the next generation of the workforce.

GRADUATE EDUCATION**\$173,880,000**

The FY 2005 Request for the Graduate Education (DGE) Subactivity is \$173.88 million, an increase of \$17.93 million, or 11.5 percent, over the FY 2004 Estimate of \$155.95 million.

Graduate Education Funding
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Graduate Education Funding	139.50	155.95	173.88	17.93	11.5%
Total, DGE	\$139.50	\$155.95	\$173.88	\$17.93	11.5%

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 graduate research and teaching fellowships and traineeships. The increase of \$17.93 million reflects the Foundation's commitment to increasing the number of awards and graduate students supported to attract high quality students necessary for the nation's future. In academic year 2004-2005, the annual stipend will be \$30,000. An estimated 5,500 GRF, GK-12, and IGERT Fellowships and Traineeships will be supported NSF-wide.

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 2005, priorities include achieving greater diversity in the applicant and awardee pools and increasing the number of awards. Since 1952, nearly 39,000 U.S. students have received GRF awards. Support from EHR is increased from the FY 2004 Estimate of \$89.21 million by \$5.53 million to \$94.74 million. Total NSF support is \$103.30 million.

Although awarded at the early stages of their careers, Fellows have truly remarkable records of accomplishment. Examples of specific activities Fellows have pursued over the past year in addition to their superb academic achievements are:

- Michelle Rich, a student in Archeology at Southern Methodist University, is broadening participation in science through her work with the Waka' (El Peru) Archaeological Project by hiring local Guatemalans to participate in the project. She worked directly with four individuals from different towns to help train them as an archaeological field crew. On a practical level, what they learned can help them not only to secure future gainful employment, but also provides an opportunity for them to understand and teach the public about the history of their region.
- Kathryn DeLaurentis, a Mechanical Engineering Student at Rutgers University (RU), is involved in The Academy at Rutgers for Girls in Engineering and Technology, aimed at encouraging greater involvement of young women (grades 7-10) in engineering and science. She is a mentor for students enrolled in the Ronald E. McNair and the Minority Academic Career (MAC) Programs. In addition, she participated in the RU Graduate Student Advocacy Day on Capitol Hill. She and her fellow graduate students communicated to Congress the importance of and need for federal support for graduate education.

Graduate Teaching Fellowships in K-12 Education (GK-12) supports graduate and advanced undergraduate STEM students working in partnership with K-12 teachers to expand and strengthen the teachers' content knowledge and teaching skills in science and mathematics, and to help the graduate students develop communication and pedagogical skills. Within DGE, support for this program is increased from the FY 2004 Estimate of \$42.21 million by \$5.25 million to \$47.46 million. Total NSF support is \$55.70 million.

GK-12 Fellows at North Carolina State are working with students who do not normally participate in science because of language or other limitations. A bilingual Fellow working with limited English proficient Hispanic students at Combs Elementary in Raleigh, North Carolina was instrumental in enabling them to participate in the district science fair. This led to a permanent partnership between Combs and university students in the Spanish for Engineers class. A Fellow who spoke American Sign Language worked with students in the hearing impaired department of Combs and discovered that many science concepts have no unique signs; for example, chemistry and physics have the same sign. As a result the Fellow and teachers at the school produced a handbook for interpreting science to hearing impaired students, including a suggested standardized list of signs to be used county-wide. Interest in science increased dramatically among the hearing impaired students. The hands-on activities brought to their classroom made it possible for them to understand a subject that had previously been inaccessible. Two hearing impaired students entered the annual science fair, and one won in his category.

Research advisors of the current Cornell University GK-12 Fellows were asked for comments on the GK-12 program and its impacts on their advisee and his/her graduate work (either positive or negative), Based on their responses, the program is a success. A typical response was "I have to say that the program has been great for her and has really inspired her to develop interesting interactive projects for the students. She has balanced the teaching with her research extremely well and I think that everyone concerned is benefiting from her efforts - particularly the students who are being turned on to science by her enthusiasm and excellent projects. I think that this is a great program and appreciate the chance to have my graduate student participate in it."

Integrative Graduate Education and Research Traineeships (IGERT), an NSF-wide program initiated in FY 1998, supports U.S. scientists and engineers pursuing careers in research and/or education with interdisciplinary backgrounds and deep knowledge in chosen disciplines. The program is intended to catalyze a cultural change in graduate education for students, faculty, and institutions by establishing innovative new models for graduate education and training in an environment that transcends traditional disciplinary boundaries; to facilitate diversity in student participation and preparation; and to contribute to the development of a globally-engaged science and engineering workforce. Within DGE, support is increased from the FY 2004 Estimate of \$24.53 million by \$7.15 million to \$31.68 million, to make awards to more institutions and reach more trainees. NSF-wide support is \$81.74 million.

At the University of Kentucky, the presentation of student posters by John Ball and Phillip Douglass illustrated the integration of the chemistry of molecular recognition with the development of magnetoelastic sensors and surface molecular sensors. Students from chemistry and engineering demonstrated their collaborations effectively. Several journal articles resulted from their work.

At Carnegie-Mellon University, simulations are being used to study the structure and dynamics of social processes. These models of human behavior have numerous applications from the military to computer games. Matthew Dombrowski and Keith Hunter published and presented the results of these studies.

HUMAN RESOURCE DEVELOPMENT**\$107,940,000**

The FY 2005 Request for the Human Resource Development (HRD) Subactivity is \$107.94 million, a decrease of \$7.91 million, or 6.8 percent, from the FY 2004 Estimate of \$115.85 million.

Human Resource Development Funding
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Undergraduate/Graduate Student Support	60.76	68.37	64.49	-3.88	-5.7%
Research and Education Infrastructure	22.74	32.33	28.30	-4.03	-12.5%
Opportunities for Women and Persons with Disabilities	15.98	15.15	15.15	0.00	0.0%
Total, HRD	\$99.48	\$115.85	\$107.94	-\$7.91	-6.8%

Totals may not add due to rounding.

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 maintained at the FY 2004 Estimate of \$34.30 million to continue coordination with other programs that aim to increase participation of underrepresented minority students. The North Carolina LSAMP is one successful project. Significant highlights of this effort include:

- 841 BS degrees awarded to minority STEM students in 2002.
- Minority STEM enrollment increased 17.8 percent, from 4,744 in Fall 1997 to 5,588 in Fall 2001.
- Faculty and students throughout the Alliance participated in 50 STEM-related local, state, and national conferences and professional meetings. Many students made both oral and poster presentations at several of these events.

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, upgrade of scientific

instrumentation, and improvement of research infrastructure. The FY 2005 Request of \$19.98 million is \$3.88 million less than the FY 2004 Estimate and provides for continued 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 2005, support for the program within HRD remains constant at the FY 2004 Estimate of \$9.92 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 2005, funding is maintained at the FY 2004 Estimate of \$290,000.

Research and Education Infrastructure includes:

Alliances for Graduate Education and the Professoriate (AGEP) implement 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 2005, program support totals \$14.91 million, unchanged from the FY 2004 Estimate.

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 12 Centers. CREST funding for FY 2005 is \$10.88 million, a decrease of \$4.03 million from the FY 2004 Estimate of \$14.91 million. Within CREST, THRUST, strengthens the research capability of doctoral degree granting Historically Black Colleges and Universities in the STEM disciplines by investing in collaborative research, training, equipment and doctoral student support.

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 \$2.51 million for total NSF support of \$9.78 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 is maintained at the FY 2004 Estimate of \$9.90 million.

The Research in Disabilities Education (RiDE) program, formerly the Program for Persons with Disabilities (PPD), will be funded at \$5.25 million, equal to the FY 2004 Estimate. 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**\$73,940,000**

The FY 2005 Request for the Research, Evaluation and Communication (REC) Subactivity is \$73.94 million, an increase of \$8.13 million, or 12.4 percent, over the FY 2004 Estimate of \$65.81 million.

Research, Evaluation and Communication Funding
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004	
				Amount	Percent
Research	54.27	54.24	62.37	8.13	15.0%
Evaluation	12.50	11.57	11.57	0.00	0.0%
Total, REC	\$66.77	\$65.81	\$73.94	\$8.13	12.4%

Totals may not add due to rounding.

Research Funding. The FY 2005 Request of \$62.37 million for Research will support:

The **Research on Learning and Education (ROLE)** program seeks to build a stronger interdisciplinary approach to research on learning and education. The FY 2005 funding increase is in line with the increased emphasis across NSF, indeed the nation, on funding evidence-based, rigorous STEM education research. In the past two ROLE competitions, NSF has received 40 percent more proposals than previously, many of them rated "highly competitive" by outside reviewers; however, due to budget constraints, many of these strong projects have not been funded. The FY 2005 increase will allow NSF to increase the size and duration of ROLE grants, allowing more longitudinal studies; fund more ROLE grants; expand the reach of ROLE grants to include more 9-12, undergraduate, graduate and workforce projects; develop capacity-building projects; fund more international efforts; and co-fund more education research projects across EHR and NSF. ROLE and related research funding totals \$47.46 million in FY 2005, an increase of \$8.13 million over FY 2004 Estimate of \$39.33 million.

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. IERI is an interagency effort of the NSF, Department of Education and the NICHD of NIH. 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. 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 \$14.91 million in FY 2005 for IERI, unchanged from the FY 2004 Estimate. In addition, the Research and Related Activities Appropriation will provide \$9.63 million for this program. The participating agencies will coordinate efforts, but are holding separate IERI competitions for 2004 and 2005.

Research on learning, teaching, and technology generates important discoveries, advancing our understanding of knowledge acquisition and instructional practice and strengthening the research base for all EHR programs. 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 disturbingly low 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 of 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 educational 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 among 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 appropriate for classrooms today and in the future.

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 addresses its most critical educational challenges.

Evaluation. Evaluation funding in FY 2005 remains level with the FY 2004 Estimate of \$11.57 million. 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. The evaluation program will continue to develop program indicators, produce databases, conduct impact studies, and carry out program evaluations, to document accountability throughout NSF's portfolio of STEM education, training and human resource development programs. The Evaluation Research and Evaluation Capacity Building (EREC) program awarded its first round of grants in FY 2002 and early 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 2005 funding will continue support for evaluations of multiple education programs or projects with similar objectives.