

# Diversity in Action

National Science Foundation  
Directorate for Education  
and Human Resources  
May 2004



The National Science Foundation's Directorate for Education and Human Resources (EHR) administers a multitude of programs that seek to enhance the agency's PEOPLE Goal: *A diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists, and well-prepared citizens* (NSF Strategic Plan 2003-2008). In this capacity, EHR especially seeks to implement programs and activities that significantly enhance the quantity, quality, and diversity of human capital engaged in science, technology, engineering, and mathematics (STEM). Through the remarkable achievements of its awardees and the populations they serve, EHR has facilitated systemic change, inspired excellence in research and pedagogy, and fostered an awareness of diversity and respect for the needs and aspirations of its constituents.

## Recognizing the Need for Diversity

NSF programs devoted to diversity began in the 1970s (Fortenberry, Powlik & Baker 2001). Through that decade, NSF's efforts to improve undergraduate education focused on the development of instructional materials, alternative or interdisciplinary degree development, and the continuing education of science professionals. Early diversity-focused programs included the Minority Science Improvement Program (MSIP), the Research Initiatives in Minority Institutions (RIMI), and the Resource Centers for Science and Engineering (RCSE). The release of *A Nation at Risk* (NCEE 1983) and "The Neal Report" (NSB 1986) stirred the national impetus for improved undergraduate laboratories and teaching faculty. In the late 1980s, the Minority Advancement Award (MAA) and Minority Research Planning Grant (MRPG) programs were popular at NSF, eventually giving way to the Career Advancement Awards (CAA) for young minority faculty. The Committee on Equal Opportunities in Science and Engineering (CEOSE) and the NSF Annual Diversity Conferences also served to better address the needs of minority populations in STEM.

## Supporting Underserved Populations

Today, responding to the needs of its constituents and the guidance of congressional mandates, EHR plays a central role in increasing opportunities in STEM education for individuals from diverse but historically underserved populations—women, minorities, and persons with disabilities—and the institutions dedicated to serving these populations.

*A diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists, and well-prepared citizens.*

PEOPLE Goal  
*NSF Strategic Plan 2003-2008*



A primary focus of EHR's Division of Human Resource Development (HRD) is to ensure access to and full participation in the entire STEM enterprise. This is accomplished through increased and diversified educational opportunities, enhanced quality of the educational experience, the provision of mentoring activities and role models, close collaboration with the surrounding community, and practical research experiences for students, technicians, and paraprofessionals. In overview, HRD's portfolio of programs serves to:

- Build the base of educational research on issues of access and success in formal systems of education;
- Strengthen educational capacity in undergraduate minority-serving institutions;
- Leverage alliances of institutions to produce high-quality graduates at the baccalaureate and graduate levels;
- Strengthen the scientific research capacity of individuals and institutions; and
- Promote broad recognition and dissemination of successful practices and practitioners.

### Historically Black Colleges and Universities

Since 1995, NSF has awarded more than \$300 million to Historically Black Colleges and Universities (HBCUs), including more than \$40 million to 47 institutions in FY 2001 alone. Half of all HBCUs are currently leading or participating in an NSF-supported project. In so doing, they fulfill a key NSF strategy: to help HBCUs move beyond campus boundaries and forge links with other institutions of higher education, K-12 school districts, Federal and private research centers and laboratories, and U.S. business and industry (see Table 1).

NSF's agency-wide support has enabled HBCUs to:

- Make substantial contributions in fundamental research and discovery in established and emerging fields of science and engineering;
- Create high-caliber undergraduate and graduate education activities leading to successful careers in the STEM workforce;

- Integrate research into education at the graduate and undergraduate levels, ensuring distinctive opportunities for learning and discovery; and
- Stimulate capacity building through the development of human intellectual capital and the acquisition of state-of-the-art facilities.

These emphases have helped to provide HBCUs with the fundamental tools and human capital that have allowed them to compete successfully for mainstream NSF support in education and research.

### HBCU Undergraduate Program

The Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) began in FY 1998. It has announced awards totaling \$71 million, including 34 implementation awards with the intent of "promoting diversity and increased participation of underrepresented groups in science, mathematics, engineering and technology" (NSF 1999a). The 31 current HBCU-UP institutions enroll more than 20,000 undergraduate students, 94% of whom are African American. As a result of HBCU-UP support, these students have benefited from enhanced curricula, access to technology and laboratory equipment, improved student services, graduate school preparation, and undergraduate research experiences. In addition, the 2,000 STEM faculty at these HBCUs (50% African American, 25% underrepresented minority, and 25% female) are impacted by HBCU-UP projects that provide faculty training, professional development, and research opportunities. Outcomes include increased research productivity by the faculty and greater numbers of STEM majors graduating with research experience.

Funded at a level of approximately \$20 million annually, the program continues to offer multi-year grants as well as smaller, 1-year planning grants to allow a broader group of institutions to develop STEM program-strengthening projects. In this way, institutional support is made available to HBCUs for the implementation of comprehensive approaches to teaching and learning that improve access to, retention within, and graduation from STEM programs (NSF 2001).



Table 1. NSF Program Support of HBCUs (FY 2001)

	NSF Directorate	Program	Support
Education & Training	Education and Human Resources (EHR)	Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)	27 awards \$14.6 M
	EHR	Louis Stokes Alliances for Minority Participation (LSAMP)	9 awards \$4.23 M
	EHR	Computer Science, Engineering, and Mathematics Scholarship (CSEMS)	19 awards \$5.53 M
	EHR	Course, Curriculum, and Laboratory Improvement (CCLI)	3 awards \$500,000
	EHR	Model Institutions for Excellence (MIE)	1 award \$2.16 M
	EHR	Rural Systemic Initiatives (RSI)	1 award \$2.55 M
	EHR	Teacher Enhancement (TE)	2 awards \$1.8 M
	EHR	Centers of Research Excellence in Science and Technology (CREST)	7 awards \$6.25 M
Research & Development	EHR	Experimental Program to Stimulate Competitive Research (EPSCoR)	2 awards \$600,000
	Computer and Information Sciences Engineering (CISE)	Minority Institutions Infrastructure (MII)	2 awards \$1.1 M
	Foundation-wide	Collaboratives to Integrate Research and Education (CIRE)	1 award \$440,000
	Foundation-wide	Research Experiences for Undergraduates (REU)	7 awards \$360,000
	Foundation-wide	Faculty Early Career Development (CAREER)	12 awards \$500,000
	Interagency	Interagency Education Research Initiative (IERI)	1 increment \$1 M
		TOTAL	94 awards \$40.6 M

Source: National Science Foundation (2001).

## Model Institutions for Excellence

The Model Institutions for Excellence (MIE) program was begun in 1992 at the instigation of Walter Massey, then-Director of NSF. A cross-directorate task force designed the program with the following goals in mind:

- To provide opportunities to define methods for improving STEM education and undergraduate research in selected higher education institutions;
- To target a small number of institutions poised to make a substantial contribution to the goal of increasing the number of underrepresented minority students who earn STEM baccalaureate degrees and then go on to enter graduate-level STEM degree programs or STEM-related careers; and
- To strengthen institutions that will serve as models for the successful recruitment, education, and production of quality, well-prepared STEM baccalaureate degree recipients.

Between academic year 1994-95 and AY 2001-02, STEM enrollment at MIE institutions increased 20.9% and underrepresented minority enrollment increased 25.5%, even while total enrollment decreased 0.2%. STEM Bachelor's degrees conferred to underrepresented minority students was 46.8% compared to 35.7% conferred to majority and other students. In addition, the number of STEM faculty increased 17.8%, compared to 8.8% for faculty overall.

In 1995, NSF and NASA selected six MIE institutions with an established reputation for educating students who have been historically underrepresented in STEM fields. The four NSF sites are: The Oyate Consortium (five Tribal Colleges and Universities in South Dakota), the University of Texas at El Paso, Xavier University (Louisiana), and Universidad Metropolitana (Puerto Rico). The two NASA-supported sites are: Bowie State University (Maryland) and Spelman College (Georgia). Individually, these institutions are as dynamic and diverse as the populations they serve. Collectively, MIE institutions reflect the unique cultural composition of our society.

*MIE students at the University of Texas El Paso. Photo courtesy of David Temple, NSF/EHR.*





## Tribal Colleges and Universities

Overall, campuses in 10 states and more than 100 tribes nationwide are represented by projects in EHR's Tribal Colleges and Universities Program (TCUP). The approximately \$20 million in FY 2001 TCUP awards represented nearly half the total NSF support (\$46.5 million) of TCUs from FY 1995 to FY 1999 (NSF 1999b). TCUP awards are intended to enhance the quality of STEM instructional and outreach programs. A particular emphasis is placed upon the leveraged use of information technologies at Tribal Colleges and Universities, Alaskan Native-serving institutions and Native Hawaiian-serving institutions. Through TCUP, assistance is provided to eligible institutions in their efforts to bridge the disparity in access to research and education technology and prepare students for careers in information technology, science, mathematics, and engineering fields.

Twenty-seven of the nation's 31 Tribal Colleges are 2-year institutions. The few Tribal Colleges that offer baccalaureate degree programs in STEM disciplines, such as Oglala Lakota College in South Dakota and Salish Kootenai College in Montana, produce small number of STEM bachelor's degrees. However, Tribal Colleges serve an important role as feeder schools to several majority institutions that, in turn, produce credible numbers of Native American STEM baccalaureates.

During the 2002-2003 academic year, 10,432 Native American students enrolled in undergraduate STEM programs in 400 partner institutions of EHR's Louis Stokes Alliances for Minority Participation program. Most Native American students enrolled in life sciences (29.4%), engineering (26.5%) and computer science (21.5%) programs. The majority of STEM baccalaureate degrees conferred to undergraduate Native American students during 2002-2003 were in engineering (31.1%), life sciences (29.3%), and computer science (13.1%, see Table 2). The leading producers of Native American STEM baccalaureate degrees are presented in Table 3.

Institution	Native American STEM Baccalaureates
Oklahoma State University	110
University of Oklahoma, Norman	60
Northeastern State University	55
Southeastern Oklahoma State University	40
Washington State University	16
University of Washington	13
University of Montana	10
Montana State University, Bozeman	7
University of Wisconsin	7

*Table 3. Leading producers of Native American STEM baccalaureate graduates in Academic Year 2002-2003.*

Discipline	Enrollment	BS Degrees
Agricultural Sciences	618 (5.9%)	102 (9.5%)
Chemistry	424 (4.0%)	41 (3.8%)
Computer Science	2,240 (21.5%)	141 (13.1%)
Engineering	2,769 (26.5%)	338 (31.1%)
Environmental Science	408 (3.9%)	34 (3.2%)
Geosciences	126 (1.2%)	20 (1.9%)
Life Sciences	3,073 (29.4%)	316 (29.3%)
Mathematics	578 (5.5%)	59 (5.4%)
Physics/Astronomy	196 (1.9%)	25 (2.3%)
<b>Total</b>	<b>10,432</b>	<b>1,076</b>

*Table 2. Native American undergraduate enrollment and bachelor's degrees, by discipline, at Louis Stokes Alliances for Minority Participation (LSAMP) institutions during AY 2002-2003. See <http://www.ehr.nsf.gov/EHR/HRD/amp.asp> for details about LSAMP and a listing of current awardees.*



## Research in Disabilities Education

One in five Americans is identified as having some kind of disability. Half of these individuals—24 million U.S. citizens—possess a significant disability. However, the broad diversity of this population and the disparity of their individual conditions have obscured the magnitude of their numbers and the obstacles they must face in a world poorly equipped to accommodate them. Despite the laudable progress of Federal legislation and the tireless efforts of countless individuals and organizations, persons with disabilities represent just 13 percent of the national workforce and, as of 1997, only about 6 percent of the science and engineering labor force. For students with disabilities, the unintended barriers of the mainstream educational system, the paucity of effective educational tools, misdirection of suitable resources, and the lack of effective role models can drastically compromise the participation of such students in higher education and graduate school. This reduction by attrition is particularly evident in courses of study leading to careers in STEM fields.

From 1992 to 2001, EHR's Program for Persons with Disabilities (PPD) made awards totaling more than \$39 million to 92 projects and 56 sponsors representing 30 states and the District of Columbia. Continued as the Research in Disabilities Education (RDE) program in FY 2004, the program now focuses on the development of human potential, the understanding of cognitive processes in all learners, and pedagogical efforts to increase the participation and achievement of persons with disabilities in STEM education and research.

RDE Alliances serve to inform the public, government, and industry about proven-good practices in the classroom, promote broader awareness of disabilities issues, and define specific areas of accessibility and human learning in need of further attention by educators and the research community. The program now supports three Regional Alliance sites nationwide, including the Regional Alliance in Science, Engineering, and Mathematics (RASEM) project led by New Mexico State University (awarded FY 2001); the Northwest Alliance for Access to STEM led by the University of Washington (FY 2002); and the EAST Alliance led by the University of Southern Maine (FY 2003).

## Gender in Science and Engineering

Over the past decade, NSF has invested in nearly 300 K-16 experimental projects to increase the participation of women and girls in STEM. The Research on Gender in Science and Engineering program (GSE) supports research and the dissemination and integration of proven-good practices in education that will lead to a larger and more diverse science and engineering workforce. Ultimately, research informing educational practice will increase the interest, knowledge, and professional involvement of all students, but particularly girls and women.

Among several recent GSE project highlights—

- Northern Illinois University redesigned one calculus section as an experiment, drawing on research about how female students prefer to learn. The curriculum humanized mathematics by presenting concepts and problems in contexts that connected with students' interest, experiences, and relationships. While a new pedagogy will increase the participation of female students in mathematics and sciences, it will also increase the success and interest of all students.

- San Francisco's Triad Alliance Science Clubs offered activities designed to strengthen students' interest and skills, especially attitudes such as persistence, resilience, confidence, and the ability to defend a position with evidence. The clubs have provided a learning arena for teachers exploring improved learning techniques and new scientific content, which could then be incorporated into their school curriculum.

- Gallaudet University's (DC) FORWARD project focused STEM activities on women with hearing impairments; their teachers and counselors; nontraditional students; and women at women's colleges and traditionally African American universities. A spring workshop for male and female juniors and seniors helped students re-evaluate their personal and career goals, and learn the process of applying for graduate school.

- GSE's award-winning publication, *New Formulas for America's Workforce: Girls in Science and Engineering*, summarizes many of the lessons learned by GSE and highlights several exemplary projects. The publication is available online at: <http://www.nsf.gov/pubs/2003/nsf03207/start.htm>



## Louis Stokes Alliances for Minority Participation

The Louis Stokes Alliances for Minority Participation (LSAMP) program is designed to develop the comprehensive strategies necessary to strengthen the preparation and increase the number of minority students who successfully complete baccalaureates in STEM fields. This objective facilitates the long-term goal of increasing the production of Ph.D.s in STEM fields with an emphasis on entry into faculty positions.

Funded at a level of \$34 million annually, LSAMP has more than 200,000 participants per year and has graduated more than 200,000 students since the program's inception. From 1992 to 1997, over half of LSAMP undergraduates had GPAs of more than 3.25 and 70% had enrolled in a graduate program. LSAMP also requires each alliance awardee to establish meaningful partnerships with other institutions, and encourages the inclusion of government agencies and laboratories, industry and professional organizations.

### LSAMP Bridge to the Doctorate

In FY 2004, the LSAMP program began the "Bridge to the Doctorate" initiative with the intent of lessening the financial burden of promising minority graduate students who wish to continue their studies through to a doctorate in STEM. Each of 13 LSAMP institutions selected 10 graduate students to participate, and each of the 130 students will receive \$77,000 toward their graduate STEM education, for a total level of support of \$10.1 million



*MIE STEM Student at Bowie State University. Photo courtesy of David Temple, NSF/EHR.*

## Alliances for Graduate Education and the Professoriate

The production of quality STEM graduates is a laudable goal, but it is not enough to develop the next generation of STEM educators and researchers. Moreover, the current generation of STEM students can benefit from the expansion and diversification of the mentors and professional role models they look to for guidance. With these considerations in mind, the Alliances for Graduate Education and the Professoriate (AGEP) program seeks to increase significantly the number of African American, Hispanic, and American Indian/Alaskan Native students receiving doctoral degrees in all disciplines funded by NSF. NSF is particularly interested in increasing the number of minorities who will enter the professoriate in these disciplines.

AGEP also supports a research effort to identify major factors that promote successful transition of minority students from undergraduate to graduate study, from entry-level graduate courses through the completion of a dissertation, and from academia to the workplace.

Among AGEP project highlights:

- Begun in 1998, the University of Alabama, Birmingham's Minority Graduate Education Project has seen a doubling of its STEM Ph.D. graduates, from 16 in 2000 to 34 in 2002. There are now more than 50 faculty mentors among five alliance campuses. Sixteen feeder schools involve another 150 faculty from the region. Total STEM minority graduate enrollment has increased 49%, from 87 students in 1997 to 130 students in 2002.

- Howard University (DC) has developed a coordinated, systematic program for mentoring for its AGEP fellows through the Howard Graduate School. After 4 years, the project has experienced only a 10% attrition from its minority doctoral student program. Undergraduate researchers from a number of institutions have also developed professional networks through activities sponsored by the project.

- In 4 years, Arizona State University's Mountain States Alliance (MSA) has increased the number of students participating in its mentored activities from 129 to 250. MSA has also established a network of more than 200 mentor faculty in partner institutions. Minority doctoral STEM enrollment has increased from 111 in 1997 to 368 in 2002 (a 332% increase).



## Centers of Research Excellence in Science and Technology

NSF recognizes that academic institutions with significant minority student enrollments play a vital role in conducting research that contributes to our knowledge base in all disciplines, and in educating minority students who go on to careers in STEM. The Centers of Research Excellence in Science and Technology (CREST) program makes substantial resources available to upgrade the capabilities of the most research-productive minority-serving institutions. CREST develops outstanding centers through the integration of education and research. It serves to promote new knowledge, to increase the research productivity of individual faculty, and to expand a diverse student presence in STEM disciplines. The program also enables CREST centers to increase the effectiveness of related science and engineering activities within their research areas. Among recent CREST project highlights—

■ California State University, Los Angeles, will continue operating the Center for Environmental Analysis of the Centers of Research Excellence in Science and Technology (CEA-CREST). Over the first 4 years of the project, CEA-CREST faculty refereed publications increased 153%, from 17 to 43; presentation of abstracts increased 138%, from 16 to 38; and total grants dollars (not including NSF's CREST) increased 33%, from \$2.07 million to \$2.73 million.

■ The Computational Center for Molecular Structure and Interactions (CMSI) was established at Jackson State University (Mississippi) in 1998. CMSI is recognized as a national and international leader in computational chemistry. Over the past 4 years, CMSI members published 50 to 60 papers per year in leading international peer-reviewed journals, in addition to over 50 to 90 presentations at national and international conferences. Many of these papers and presentations were co-authored by undergraduate and graduate students.

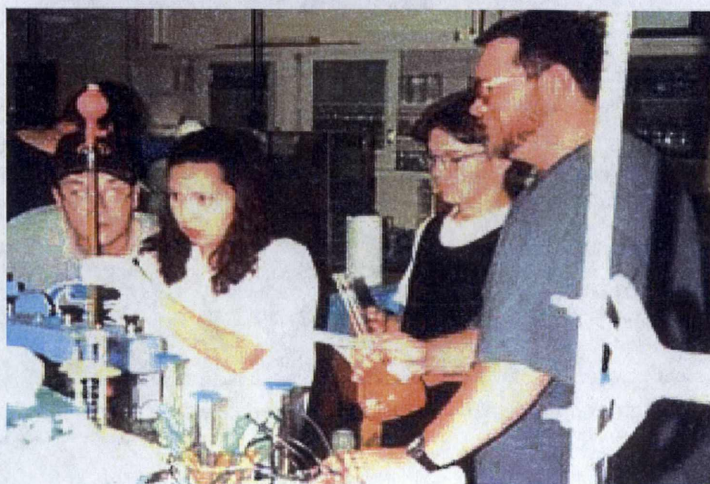
*MIE students at South Dakota's Oyate Consortium.  
Photo courtesy of David Temple, NSF/EHR.*

For FY 2004, the Historically Black Colleges and Universities - Research Infrastructure for Science and Engineering (HBCU-RISE) activity, formerly known as the HBCU Doctoral Capacity Building activity, has been incorporated into the CREST program solicitation. HBCU-RISE supports the development of research capability at HBCUs that offer doctoral degrees in STEM disciplines. Such activities include, but are not limited to: faculty and technical support, faculty professional development, acquisition and/or upgrading of research equipment, and collaborative research efforts with partner universities and national laboratories.

### NSF CREST Centers (2004)

California State University, Los Angeles  
CUNY City College  
Florida International University  
Howard University  
Jackson State University  
Norfolk State University  
North Carolina A&T State University  
North Carolina State University, Raleigh  
Tennessee State University  
Tuskegee University  
Texas A&M University, Kingsville  
University of Puerto Rico, Rio Piedras

*Further details about the CREST program  
and its sponsored centers can be found online at:  
<http://www.ehr.nsf.gov/ehr/hrd/crest.asp>*





## Asian American Participation in STEM

Although Asian students as a group are often thought to be well represented in STEM fields, Southeast Asians, Native Hawaiians, and Pacific Islanders in fact have been underrepresented by Federal programs. With EHR support, the NSF Asian American Pacific Islanders (AAPI) Coordinating Committee hosted a workshop on AAPI issues on November 3 and 4, 2003. The workshop was designed as a means for directly consulting representatives of the AAPI community. The goals of the workshop were two-fold: 1) To identify ways in which NSF can broaden AAPI participation in NSF programs and the STEM workforce, including outreach to potential grantees in the AAPI community; and 2) To acknowledge and celebrate the vast range of successes and contributions of AAPI scientists and engineers.

AAPI workshop participants included a diverse group of over 40 STEM professionals, all sharing a commitment to succeed in balancing the participation of Asian American and Pacific Islanders in NSF research and education programs. The workshop served as a forum for providing valuable insight into AAPI issues, with the goal that all participants benefit from the exchange of information. The structure of the workshop emphasized participant input focusing on common needs in outreach, education, research, and workforce development. When completed, a report from the AAPI workshop will be made available on the NSF website.



AAPI Delegates at NSF, November 2003. Photo courtesy of Win Aung, NSF/ENG.



AAPI Delegates at NSF, November 2003. Photo courtesy of Win Aung, NSF/ENG.

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For more information about these and other EHR programs, visit: <http://www.ehr.nsf.gov/>