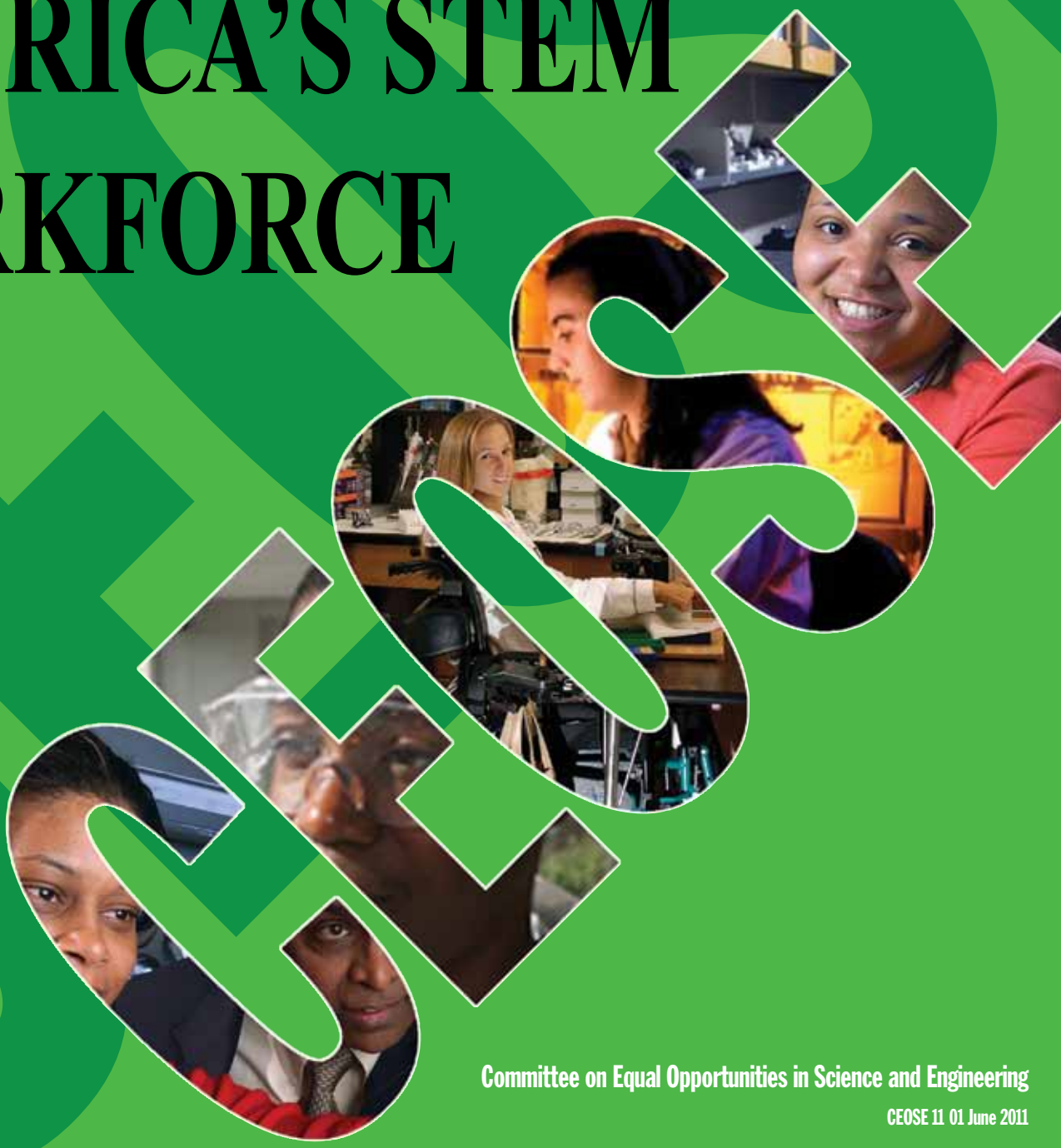
2009-2010 Biennial Report to Congress

BROADENING PARTICIPATION in AMERICA'S STEM W RKFORCE



Committee on Equal Opportunities in Science and Engineering

CEOSE 11 01 June 2011

MISSION

The Committee on Equal Opportunities in Science and Engineering (CEOSE) advises the National Science Foundation (NSF) on policies and programs to encourage full participation by women, underrepresented minorities, and persons with disabilities within all levels of America's science, technology, engineering, and mathematics (STEM) enterprise.

BACKGROUND

The Committee on Equal Opportunities in Science and Engineering was established by the United States Congress through the Science and Engineering Equal Opportunities Act of 1980 to address the problems of growth and diversity in America's STEM workforce. The legislation specifically provides that:

There is established within the National Science Foundation a Committee on Equal Opportunities in Science and Engineering (hereinafter referred to as the "Committee"). The Committee shall provide advice to the Foundation concerning (1) the implementation of the provisions of sections 1885 and 1885d of this title and (2) other policies and activities of the Foundation to encourage full participation of women, minorities, and persons with disabilities in scientific, engineering, and professional fields [42 U.S.C.§1885(c)].

Every two years, the Committee shall prepare and transmit to the Director (of the Foundation) a report on its activities during the previous two years and proposed activities for the next two years. The Director shall transmit to Congress the report, unaltered, together with such comments as the Director deems appropriate [42 U.S.C. §1885(e)].

CEOSE is composed of 15 individuals from diverse STEM disciplines, drawn from diverse institutions in higher education, industry, government, and the non-profit sectors. Its membership also reflects the racial/ethnic and gender diversity of the country's citizenry and includes persons with disabilities. Members of the Committee typically serve a three-year term. A full committee meeting is held three times a year (usually winter, spring, and fall) to review and evaluate NSF policies and program opportunities focused on the state of the participation in, and the advancement of, women, underrepresented minorities, and persons with disabilities in education, training, and science and engineering research. On the basis of its findings, the Committee makes recommendations to the Foundation for improving the levels of participation of underrepresented groups in STEM professions. Committee members also interact with other federal agencies, such as the Department of Defense, National Institutes of Health, Department of Energy, the National Aeronautics and Space Administration, and the National Oceanic and Atmospheric Administration in forging multi-agency collaborations to broaden participation by underrepresented groups in the Nation's STEM workforce.

Broadening Participation in America's STEM Workforce

2009-2010 CEOSE Biennial Report to Congress

Committee on Equal Opportunities in Science and Engineering

CEOSE 11-01
June 2011

ACKNOWLEDGMENTS

Members of the Committee on Equal Opportunities in Science and Engineering are indebted to the following National Science Foundation officials for their technical consultation, collection of critical data, review assistance, comments, and completion of this Biennial Report to Congress: **Dr. Cora B. Marrett**, Deputy Director, National Science Foundation; **Elizabeth M. Velo**, Systems Team Lead, Division of the Budget; **Claudia J. Postell, Esq.**, Director of the Office of Diversity and Inclusion; **Charlene A. Arietti**, Branch Chief, Workforce Planning and Analysis Branch; **Ellen N. Carpenter** and **Charles T. Lee**, Management Analysts, Division of Human Resource Management; and **Shawn L. Murray**, Equal Opportunity Specialist/Disability Program Manager, Office of Diversity and Inclusion; **Dr. Joan S. Burrelli**, Senior Analyst (Retired, May 2011), National Center for Science and Engineering Statistics, and **Dr. Jaquelina C. Falkenheim**, Senior Science Resources Analyst, National Center for Science and Engineering Statistics; and **Amber L. Jones**, Public Affairs Specialist. We are very grateful to **Dr. Walter V. Collier** and **Corinda Davis** of Beyond the Bottom Line, Inc. for their assistance in the analysis of data and preparation of this report, and to **Dr. Kamau Bobb**, **Lori Thurgood**, and **Prudy Brown** of SRI International for the preparation of Chapter 1. Additionally, we are very grateful for the oversight role of **Dr. Margaret E.M. Tolbert**, Senior Advisor, OIA/OD and CEOSE Designated Federal Officer, National Science Foundation, in the planning, preparation, and production of this report.

EXECUTIVE SUMMARY

The underutilization of women and minority demographic groups in building and nurturing new talent pools of scientists and engineers continues to be a problem. A recent report from the National Science Board states "There are students in every demographic and in every school district in the United States with enormous potential to become our future STEM [science, technology, engineering, and mathematics] leaders and to define the leading edge of scientific discovery and technological innovation… Regrettably, far too many of our most able students are neither discovered nor developed, particularly those who have not had adequate access to educational resources, have not been inspired to pursue STEM, or who have faced numerous other barriers to achievement."[1]

In response to this critical situation, the National Science Foundation (NSF), with numerous others inside and outside of the science and engineering community, have heeded the call to strengthen and sustain America's leadership in STEM for nothing less than our future well-being. But, the educational and workforce development paths by which we can achieve this end require even more substantial efforts than currently undertaken, and ones that more aggressively capitalize on the underutilized and untapped talents of all citizens.

The Committee on Equal Opportunities in Science and Engineering (CEOSE) has been authorized by Congress to monitor and report on the status of women, underrepresented minorities, and persons with disabilities in the STEM pipeline and workforce, and to advise the National Science Foundation on what it can do to increase the numbers of these targeted groups within the science and engineering fields. Using its ongoing investigative reviews of the status of broadening participation and the factors that facilitate and impede its progress, CEOSE has persevered in communicating its findings and advising NSF, government policy-makers, and the broader STEM community. Even though CEOSE has amassed evidence that some progress has been achieved in preparing women, minorities, and persons with disabilities for careers in STEM, the Committee finds that more needs to be done in terms of identifying, recruiting, motivating, educating, and retaining underrepresented groups for the next generation of American scientists and engineers.

The primary vehicle by which CEOSE communicates its investigative findings and recommendations to NSF is the biennial reports it prepares for Congress. In this 2009-2010 Biennial Report, CEOSE presents a trend analysis of the numbers of women, minorities, and persons with disabilities involved in STEM education; a trend analysis of NSF's funding of underrepresented principal investigators and broadening participation programs; a profile of the Foundation's workforce of scientists and engineers; a review of CEOSE's focus and activities during 2009-2010; recommendations for improving NSF's broadening participation programs and outcomes to date; and the Committee's plans for 2011-2012.

CEOSE MEETINGS

Six regularly scheduled meetings were convened by CEOSE at the National Science Foundation between February 2009 and October 2010. A total of 434 individuals attended these meetings and included NSF staff members; representatives from the White House, Congress, and federal agencies; and representatives from academia, industry, professional societies, and broadening participation advocacy organizations. The 434 participants represented a 44 percent increase over the total number who participated in the 2007-2008 CEOSE meetings.

THE STATUS OF BROADENING PARTICIPATION IN POSTSECONDARY EDUCATION

Achieving diversity in the U.S. education pipeline is essential to achieving diversity in the domestic STEM workforce. Chapter 1 of the Biennial Report presents statistical profiles of women, men, racial/ethnic minorities, and persons with disabilities in the STEM education pipeline from high school graduation to graduate school from 1998 to 2008. Highlights from the findings reported in the chapter include the following:

High School Completers

- Although participation of both Hispanics and African Americans is increasing at all levels of education, and very rapidly among Hispanics, these two groups remain underrepresented among high school completers and in postsecondary education.
- Fifty-two percent of high school completers in 2008 were men and 48 percent were women – the same distribution as in 1998.
- Sixty-six percent of high school completers were white, 15 percent Hispanic, and 13 percent African American. The remaining 6 percent were Asian/Pacific Islander, American Indian/Alaska Native, or non-Hispanic of more than one race.
- Hispanics' representation among high school completers has increased since 1998 whereas the proportions of both whites and African Americans have decreased.

Undergraduates

- Women constituted a majority of all undergraduate students (57 percent) and of first-time freshmen (54 percent). They outnumbered men in every racial/ethnic group in the total undergraduate population and among first-time freshmen.
- Hispanics and African Americans each constituted about 13 percent of all undergraduate students. Their representation among first-time freshmen was slightly higher – 14 percent for each group.
- Asians/Pacific Islanders were somewhat over 6 percent of all undergraduate students and just under 6 percent of first-time freshmen.
- American Indians/Alaska Natives were 1 percent of all undergraduate students and also of first-time freshmen.
- Including foreign nationals, about 11 percent of all undergraduate students in 2008 had disabilities.

Associate's Degrees in STEM Fields

- In 2008, men were far more prominent than women (60 percent vs. 40 percent) among recipients of associate's degrees in STEM fields.
- Hispanics earned 13 percent and African Americans earned 12 percent of all associate's degrees in STEM fields awarded in 2009. African Americans received the larger percentage of degrees in STEM-related technologies (13 percent vs. 12 percent for Hispanics).
- Asians/Pacific Islanders accounted for 6 percent of associate's degrees in STEM fields and 4 percent of those in STEM-related technologies.
- American Indians/Alaska Natives earned somewhat less than 2 percent of associate's degrees in STEM fields and just over 1 percent of those in STEM-related technologies.

Bachelor's Degrees in STEM Fields

- Women earned just over half (51 percent) of all bachelor's degrees in STEM fields – a small increase from 49 percent in 1998. Their share of bachelor's degrees in STEM-related technologies was 43 percent in 2009, up from 38 percent in 1998.
- Hispanics accounted for almost 9 percent of all bachelor's degrees in STEM fields, and African Americans earned nearly as many degrees. As was the case at the associate's level, African Americans earned the largest minority share of bachelor's degrees in STEM-related technologies (10 percent), and Hispanics earned the second largest minority share (7 percent).
- Asians/Pacific Islanders received nearly 1 in 10 of the STEM bachelor's degrees conferred in 2009.
- American Indians/Alaska Natives received 0.7 percent of bachelor's degrees in STEM fields.

Master's Degrees in STEM Fields

- Women received just under 50 percent of STEM master's degrees.
- Asians/Pacific Islanders and African Americans each accounted for nearly 10 percent of all STEM master's degrees conferred in 2009.
- Hispanics earned almost 7 percent of all STEM master's degrees in 2009.

- American Indians/Alaska Natives accounted for 0.6 percent of STEM master's degrees.

Doctoral Degrees in STEM Fields

- Women approached parity with men, earning 47 percent of all STEM doctorates conferred in 2009 compared to 40 percent in 1998.
- Both Hispanics and African Americans accounted for over 5 percent of STEM doctorates in 2009, an increase from less than 4 percent for both groups in 1998.
- American Indians/Alaska Natives earned 0.6 percent of STEM doctorates in 2009.
- Most racial/ethnic minority groups increased their share of STEM doctorates between 1998 and 2009. The exception is American Indians/ Alaska Natives, whose small percentage of STEM doctorates has remained stable over the years.
- Students with disabilities made up 1.7 percent of STEM doctorate recipients in 2009, an increase from 1.5 percent in 1998. The number of STEM doctorates earned by students with disabilities surpassed the number in non-STEM fields for the first time in 2008 – 334 STEM doctorates (53 percent) vs. 294 non-STEM doctorates. In 2009, students with disabilities earned 349 doctorates in STEM fields (52 percent) and 320 doctorates in non-STEM fields. Physical/orthopedic and learning disabilities were the most common disabilities of STEM doctorate recipients.

Top STEM Fields of Associate's Degrees

- Computer sciences and social sciences were the two largest STEM fields for both male and female associate's degree recipients in 2009. The top three STEM fields of female associate's degree recipients in 2009 were social sciences, psychology, and biological sciences.

Top STEM Fields of Bachelor's Degrees

- The top three STEM fields of female bachelor's degree recipients in 2009 were social sciences, psychology, and biological sciences. The top three fields for male recipients were social sciences, engineering, and biological sciences. Every racial/ethnic group except Asians/Pacific Islanders had the same top three fields as women overall. The top three fields of Asians/Pacific Islanders were the same as for men overall but ranked in a different order: biological sciences, social sciences, and engineering.

Top STEM Fields of Master's Degrees

- Among STEM master's degree recipients in 2009, social sciences, psychology, and engineering ranked as the top three fields for all racial/ethnic groups except Asians/Pacific Islanders, whose top fields were engineering, social sciences, and computer sciences. Overall, men had the same top fields as Asians/Pacific Islanders.
- Women's top fields were the same as at the bachelor's level: social sciences, psychology, and biological sciences.

Top STEM Fields of Doctoral Degrees

- There is more variation in STEM field choice at the doctoral level. In 2009, women's top STEM doctoral field was biological sciences, followed by psychology and social sciences, whereas engineering ranked 1st among men, followed by biological sciences and physical sciences. Biological sciences ranked 1st or 2nd among doctorate recipients in every racial/ethnic group. Psychology was one of the top three STEM doctoral fields for all groups except Asians/ Pacific Islanders, and social sciences ranked in the top three for all groups except Hispanics and whites. Engineering was a top three field only among Asians/Pacific Islanders and Hispanics, and physical sciences ranked in the top three only among whites. It is important to keep in mind when considering fields that each of the underrepresented minority groups continues to receive the majority of its doctorates in non-STEM fields. In 2009, 71 percent of African American doctoral degrees were in non-STEM fields, as were 55 percent of Hispanics' and 57 percent of American Indians/Alaska Natives' degrees.

NSF BROADENING PARTICIPATION ACTIVITIES AND ACHIEVEMENTS

The Foundation continued during the 2009-2010 biennium to place a priority on broadening participation of underrepresented groups in STEM. Following are some highlights from CEOSE's review:

- The number of proposals received from principal investigators (PIs) of underrepresented groups and the award rates increased only marginally from 2004 to 2009. The number of proposals from women PIs went from 20.2 to 23.3 percent; American Indian/Alaska Native PIs remained unchanged at 0.2 percent; African American PIs went from 2.2 to 2.4 percent; Hispanic/Latino PIs increased from 3.4 to 4.1 percent; and Hawaiian/Pacific Islander PIs decreased from 0.1 to 0.05 percent. There was little or no increase in the award rates for these groups. For example, the award rate for African American men was the same in 2004 and 2010 (1.4 percent); the rate for African American women was also the same in 2004 and 2010 (0.8 percent); the award rate for Hispanic/Latino men edged from 2.6 in 2004 to 2.8 percent in 2010, and that for Hispanic/Latina women went from 0.9 in 2004 to 1.2 percent in 2010.

- The American Recovery and Reinvestment Act (ARRA) funding program significantly boosted NSF's overall awards as well as awards made to underrepresented minorities, women, and persons with disabilities in FY 2009. The ARRA funding program made possible a total of 4,318 additional NSF grants, of which 31 percent were awarded to underrepresented PIs. Women PIs received 1,050 awards that they would not have otherwise received under NSF's regular budget; underrepresented minority PIs received an additional 240 grants; and PIs with disabilities received an added 44 grant awards because of the ARRA funding program. The remaining 69 percent, 2,984 grants, were awarded to non-minority men (i.e., white and Asian).

- FY 2009 and FY 2010 financial investments in the Foundation's portfolio of broadening participation research and education programs increased significantly over FY 2007 and FY 2008, i.e., from $1,465.24 billion in 2007 to $2,292.51 billion in FY 2010.

- Growth in the number of underrepresented scientists and engineers (S&Es) among permanent staff at NSF has been marginal since 2003. Women increased their numbers among S&Es from 39.5 percent in 2003 to 41.7 percent in 2010; underrepresented minority S&Es increased from 10.0 to 11.0 percent; and S&Es with disabilities dropped from 9.1 to 8.3 percent.

- However, the Foundation does employ a higher percentage of underrepresented scientists and engineers than in the Nation's overall STEM workforce. For example, based on the latest available (2006) data for the U.S. workforce of scientists and engineers, women made up 28.4 percent, compared with 40.6 percent at NSF in 2006; and African Americans made up 3.0 percent of the country's STEM workforce, compared with 6.7 percent at NSF in 2006.

HIGHLIGHTS OF CEOSE ACTIVITIES

Several areas of concern commanded the attention of CEOSE during the 2009-2010 biennium. Among these were:

- The "invisibility" of women of color in STEM and specific challenges faced by girls and women of color in STEM education and employment — which led to a CEOSE mini-symposium on this critical subject. The symposium, held on October 27-28, 2009, was co-sponsored by NSF, TERC, Inc., the American Chemical Society, and the Association for Women in Science. Several recommendations emanated from the symposium for NSF's consideration, such as that NSF should invest in women of color in STEM; and NSF should fund research, evaluation and development of practices that target key transition points where the greatest loss of women of color from STEM occurs.

- Strengthening ties between CEOSE and the White House Office of Science and Technology Policy, in order to advance an agenda to enhance federal inter-agency collaborations to broaden

participation in STEM.

- Concerns of CEOSE and others that NSF's proposal to combine the Louis Stokes Alliances for Minority Participation (LSAMP), Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), Tribal Colleges and Universities Program (TCUP) and adding a Hispanic Serving Institutions (HSI) program to comprise one comprehensive program would have a negative impact on effectively serving minority undergraduates and institutions. On January 4, 2011, President Obama signed into law reauthorization of the America COMPETES Act, which included a stipulation that NSF is to continue supporting LSAMP, HBCU-UP, TCUP, and HSI as separate programs (H.R. 5116, Title V, Sec. 512).

- The need to foster the development of, and research in, the science of Broadening Participation. CEOSE plans to work closely with the NSF Directorate for Social, Behavioral, and Economic Sciences to develop this science.

CEOSE RECOMMENDATIONS

CEOSE recommends that NSF:

1. Augment support for the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) and the Tribal Colleges and Universities Program (TCUP); and no later than one year from the publication of this report, establish a Hispanic Serving Institutions (HSI) program as separate programs to build the capacity of these minority serving institutions (MSIs) to broaden participation of underrepresented minorities in STEM.

2. Continue concerted efforts, across all NSF directorates and offices, to increase funding for programs that serve the above MSIs, institutions serving persons with disabilities, and students and faculty from underrepresented groups at all institutions; such efforts should include jointly funded programs with HBCU-UP, TCUP, and HSI to support research and research experiences and training for undergraduate and graduate students at these MSIs, and other evidence-based strategies for broadening participation of women, underrepresented minorities, and persons with disabilities.

3. Provide better guidance to members of Committees of Visitors about how to assess broadening participation.

4. Develop within the Social, Behavioral, and Economic Sciences (SBE) Directorate a science of broadening participation program; and CEOSE should join with SBE in addressing questions about this science.

5. Commission the National Academies to conduct a study on the Science of Broadening Participation.

6. Initiate collaboration between NSF's Computer and Information Science and Engineering, and SBE Directorates, and the Office of Cyberinfrastructure on new developments regarding social aspects of computing.

7. Provide additional resources for the National Center for Science and Engineering Statistics, as needed for its increased workload, especially for data and analyses requested by CEOSE.

8. Establish accountability goals and metrics for broadening participation in science and engineering.

9. Facilitate collaborative efforts to broaden participation with other federal agencies through the development of common metrics, formation of interagency programs, and commitment of funding as appropriate. This recommendation was made following a recently completed CEOSE study of current and potential federal interagency collaborations to increase the numbers of underrepresented individuals in the science and engineering professions, and recognizing NSF's leadership in the area of broadening participation in STEM.

RECOMMENDATIONS FROM MINI-SYMPOSIUM ON WOMEN OF COLOR IN STEM

The following recommendations were approved by CEOSE from the Mini-Symposium on Women of Color in STEM:

1. Include a focus on increasing the participation of women of color in existing NSF programs that target women, underrepresented minorities, and persons with disabilities.

2. Invest in developing women of color leaders in STEM, through efforts that include:

   - Providing leadership training to mid-level professionals in academia, industry, and government;
   - Providing funding for senior women of color to visit campuses that would not otherwise have access to these mentors; and
   - Supporting the establishment of a National Society of Women of Color in STEM.

3. Disaggregate data by race/ethnicity, gender, and disability status, so that issues specifically impacting minority girls and women in STEM are brought into high relief. These data should be widely reported.

4. Establish and vigorously support a science of broadening participation program, as an effective means to (a) investigate the experiences of women of color and other underrepresented groups in STEM; and (b) study how their recruitment to, and retention in, STEM education and careers can be improved.

5. Support research and evaluations on understanding causes of drop-off and drop-out rates of women of color in STEM education and careers, and practices that circumvent attrition and improve retention. Potential research and evaluation include re-examining the double-bind findings to determine what progress has been made since the original study.

6. Fund research, evaluation, and development of practices that target key transition points where the greatest loss of women of color from STEM occurs.

7. Fund workshops, conferences, travel awards, and social networks that enable women of color scientists and engineers to network and mentor one another.

8. Fund programs and workshops that teach managers, administrators, and senior staff of colleges, universities, and federal agencies how to mentor women of color in STEM in a culturally competent fashion.

9. Develop and support a centralized digital clearinghouse of information about women of color in STEM.

10. Restructure grant funding, so that a portion is withheld until a follow-up report is submitted by the grantee on how the broadening participation component of the broader impacts criterion will be met.

Endnote

[1] *Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation's Human Capital*. National Science Board, May 5, 2010, pp. 5-6.

ACRONYMS

AAAS	American Association for the Advancement of Science
ACCF	American Competitiveness in Chemistry Fellowship
ACIF	American Competitiveness and Innovation Fellowship
ADVANCE	Increasing the Participation and Advancement of Women in Academic Science and Engineering
AGEP	Alliances for Graduate Education and the Professoriate
AIHEC	American Indian Higher Education Consortium
AISES	American Indian Science and Engineering Society
ARRA	American Recovery and Reinvestment Act
ATE	Advanced Technological Education
BIO	Biological Sciences Directorate
BPC	Broadening Participation in Computing
BRIGE	Broadening Participation Research Initiation Grants in Engineering
C-PATH	CISE Pathways to Revitalize Undergraduate Computing Education
CAA	Career Advancement Awards
B&O	Business and Operations Advisory Committee
CEOSE	Committee on Equal Opportunities in Science and Engineering
CISE	Computer and Information Science and Engineering Directorate
CI-TEAM	Cyberinfrastructure Training, Education, Advancement, and Mentoring
COACh	Committee on the Advancement of Women in Chemistry
COMPETES	(as in America COMPETES Act) Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science
COV	Committee of Visitors
CREST	Centers for Research Excellence in Science and Technology
CRIF	Chemistry Research Instrumentation and Facilities
DGSE	Developing Global Scientists and Engineers
DMR	Division of Materials Research
DMS	Division of Mathematical Sciences
DOD	Department of Defense
DOE	Department of Energy
DOL	Department of Labor
EEC	Engineering Education and Centers
ERC	Engineering Research Center
EHR	Education and Human Resources Directorate

ENG	Engineering Directorate
ERE	Environmental Research and Education Advisory Committee
FASED	Facilitation Awards for Scientists and Engineers with Disabilities
GEO	Geosciences Directorate
GPRA	Government Performance and Results Act
HBCU-UP	Historically Black Colleges and Universities Undergraduate Program
HHE	High Hispanic Enrollment
HSI	Hispanic Serving Institutions
LSAMP	Louis Stokes Alliances for Minority Participation
MPS	Mathematical and Physical Sciences Directorate
MSI	Minority Serving Institution
NSF	National Science Foundation
NSTC	National Science and Technology Council
NTID	National Technical Institute for the Deaf
OISE	Office of International Science and Engineering
OPP	Office of Polar Programs
OSTP	White House Office Of Science and Technology Policy
PI	Principal Investigator
SBE	Social, Behavorial, and Economic Sciences Directorate
S&E	Scientists and Engineers
STEM	Science, Technology, Engineering, and Mathematics
TCUP	Tribal Colleges and Universities Program
URM	Underrepresented Minorities

CONTENTS

TABLES and FIGURES

TABLES and FIGURES CONTINUED

INTRODUCTION

The underutilization of women and minority demographic groups in building and nurturing new talent pools of scientists and engineers continues to be a problem. The National Science Board (NSB) recently reported the following:

> *There are students in every demographic and in every school district in the United States with enormous potential to become our future STEM [science, technology, engineering, and mathematics] leaders and to define the leading edge of scientific discovery and technological innovation… Regrettably, far too many of our most able students are neither discovered nor developed, particularly those who have not had adequate access to educational resources, have not been inspired to pursue STEM, or who have faced numerous other barriers to achievement.*[1]

In response to this critical situation, the National Science Foundation (NSF) and numerous others inside and outside of the science and engineering community, have heeded the call to strengthen and sustain America's leadership in STEM for nothing less than our future well-being. But, the educational and workforce development paths by which we can achieve this end require even more substantial efforts than currently undertaken, and ones that more aggressively capitalize on the under-utilized and untapped talents of all citizens.

President Obama has called on all segments of society to focus on this problem. Two critical pieces of his recent *Educate to Innovate* initiative are to collaborate in innovative partnerships with businesses, schools, philanthropic, and other organizations to improve the math and science skills of our students, and to expand STEM education and career opportunities for underrepresented groups, including women, minorities, and persons with disabilities. As part of this initiative, President Obama announced on September 16, 2010, a new initiative, *Change the Equation*, which is a privately funded program undertaken by businesses to improve the science and math skills of all students, with a special emphasis on girls and underrepresented minorities.[2] Supported by CEOs of some the country's top corporations, including Intel, Xerox, Time Warner, and Eastman Kodak, with contributing funds from the Bill and Melinda Gates Foundation, the goals of the program are to (1) improve the quality of teaching STEM at all grade levels; (2) inspire students to learn about STEM fields; and (3) to sustain inter-organizational commitments to improving STEM education. But even with these recent moves forward, we must increase the tempo of our actions.[3]

In his remarks at the recent 60th anniversary celebration of the National Science Foundation, former NSF Director, Dr. Arden Bement, Jr., stated *"Broadening participation of underrepresented minorities, women, and persons with disabilities in STEM must be accelerated."*[4] The statement acknowledges the work that has been achieved thus far to increase diversity among the Nation's scientists and engineers, but also speaks to the urgency to do more at a faster pace — given the increasing U.S. minority populations and the burgeoning global competitiveness in STEM.

The Committee on Equal Opportunities in Science and Engineering (CEOSE) has been at the vanguard in advocating for increased numbers of women, underrepresented minorities, and persons with disabilities in the STEM fields. Using its ongoing investigative reviews of the status of broadening

INTRODUCTION CONTINUED

participation and the factors that facilitate and impede its progress, CEOSE has persevered in communicating its findings and advising NSF, government policy-makers, and the broader STEM community. Even though CEOSE has amassed evidence that some progress has been achieved in preparing women, minorities, and persons with disabilities for careers in STEM, the Committee finds that more needs to be done in terms of identifying, recruiting, motivating, educating, and retaining underrepresented groups for the next generation of American scientists and engineers.

The primary vehicle by which CEOSE communicates its investigative findings and recommendations to NSF is the biennial reports it prepares for Congress. In the present Biennial Report to Congress, the Committee:

- Looks at past and present trends of underrepresented groups who are earning undergraduate and graduate STEM degrees, by disciplines, and analyzes changes over time;
- Profiles patterns of NSF funding of broadening participation programs and underrepresented principal investigators, and views the changes in demographic diversity of NSF's own workforce of scientists and engineers over the last several years;
- Focuses on women of color in STEM, a particularly neglected group and the challenges these women face in accessing education and career opportunities;
- Continues to emphasize the need for interagency collaborations to broaden participation;
- Highlights major activities of CEOSE during 2009 and 2010;
- Tracks the outcomes of past CEOSE recommendations to NSF;
- Offers new recommendations to NSF based on recent committee findings and considerations; and
- Summarizes the Committee's plans for 2011-2012.

ENDNOTES

[1]*Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation's Human Capital*. National Science Board, May 5, 2010, pp. 5-6.

[2]White House Office of the Press Secretary: President Obama to Announce Major Expansion of "Educate to Innovate" Campaign to Improve Science, Technology, Engineering and Math (STEM) Education.

[3]http://www.whitehouse.gov.

[4]"NSF Celebrates 60 Years of Discovery: The Future of NSF on Its 60th Anniversary," presented at the 2010 Annual Meeting of the American Association for the Advancement of Science, February 20, 2010, www.nsf.gov.

1 THE STATUS OF BROADENING PARTICIPATION IN POSTSECONDARY EDUCATION

"…STEM education will determine whether the United States will remain a leader among nations and whether we will be able to solve immense challenges in such areas as energy, health, environmental protection, and national security." [1]

President's Council of Advisors of Science and Technology

Achieving diversity in the U.S. education pipeline is essential to achieving diversity in the domestic STEM workforce. This chapter focuses on the education pipeline from high school graduation to graduate school. Basic statistics are provided on the distribution of women, men, racial/ethnic minorities, and students with disabilities graduating from high school, enrolled in college, and earning degrees. In addition, the chapter provides detail on women and men within each racial/ethnic group, on students' fields of study, and on the types of institutions from which they obtain associate's, bachelor's, master's, and doctoral degrees.

This chapter also reports on the immediate post-graduation plans of new doctorate recipients in STEM fields[2] – whether they took a postdoc position in the United States following graduation or obtained another job in academe, industry, or another sector such as government, nonprofit organizations, or elementary/secondary schools. The post-graduation plans of new STEM doctorate recipients are the only workforce data presented in this chapter.

Additional data tables and figures can be found at http://www.nsf.gov/od/oia/activities/ceose/index.jsp.

OVERVIEW OF THE EDUCATION PIPELINE COMPARED WITH GENERAL POPULATION

According to the U.S. Census Bureau, 29.8 million U.S. residents were college age (18-24 years old) in 2008.[3] Men constituted a slim majority of this population.More than three in five college-age residents were white. Hispanics were the second largest racial/ethnic group, followed by blacks.

Although men make up more than half of all 18-24 year-olds in the United States, women outnumber men in the undergraduate student population and among recipients of STEM bachelor's degrees. They are also approaching parity with men among STEM graduate students and STEM master's and doctorate recipients. However, while women earn the majority of bachelor's, master's, and doctoral degrees awarded in psychology, biological sciences, and social sciences, they are less well represented in computer sciences and engineering.

The racial/ethnic diversity of the postsecondary school population and of STEM degree recipients has increased over the past decade. For the most part, minority groups increased their shares of STEM bachelor's, master's, and doctoral degrees between 1998 and 2009. However, blacks and Hispanics remain underrepresented at every stage of the education pipeline and among STEM students and degree recipients – the product of leakages throughout the education pipeline, beginning with high school completion. While only a portion of high school completers in any racial/ethnic group enrolls immediately in college, the attrition rate is particularly high for blacks and Hispanics.

There are differences by race/ethnicity in the choice of STEM as a field of study in college. Asians/Pacific Islanders are more inclined than the other racial/ethnic groups to state intentions to major in a STEM field as freshmen and more likely to earn a STEM bachelor's degree. Compared with their proportions in the U.S. population, blacks and Hispanics are underrepresented among recipients of STEM degrees and, for the most part, their representation in the STEM degree population gets smaller as the level of degree rises. They are underrepresented among STEM graduate students relative to their share of STEM bachelor's degrees as well as to their share of the 18-24 year-old population.

The remainder of the Overview section provides more detail on the representation of the different racial/ethnic groups, women and men, and people with disabilities in the education pipeline.

Race/Ethnicity[4]

Figure 1-1 compares high school completion, college enrollment, and degree completion. All data are for U.S. citizens and permanent residents.

Whites constituted 61 percent of all 18-24 year-olds in the U.S. population in 2008.

- Their presence is larger among high school completers, STEM graduate students, and STEM degree recipients at the bachelor's and doctoral levels. Their presence among recipients of STEM master's degrees is about the same as in the general population.
- Whites are underrepresented among first-time freshmen, all undergraduate students, and recipients of STEM associate's degrees.

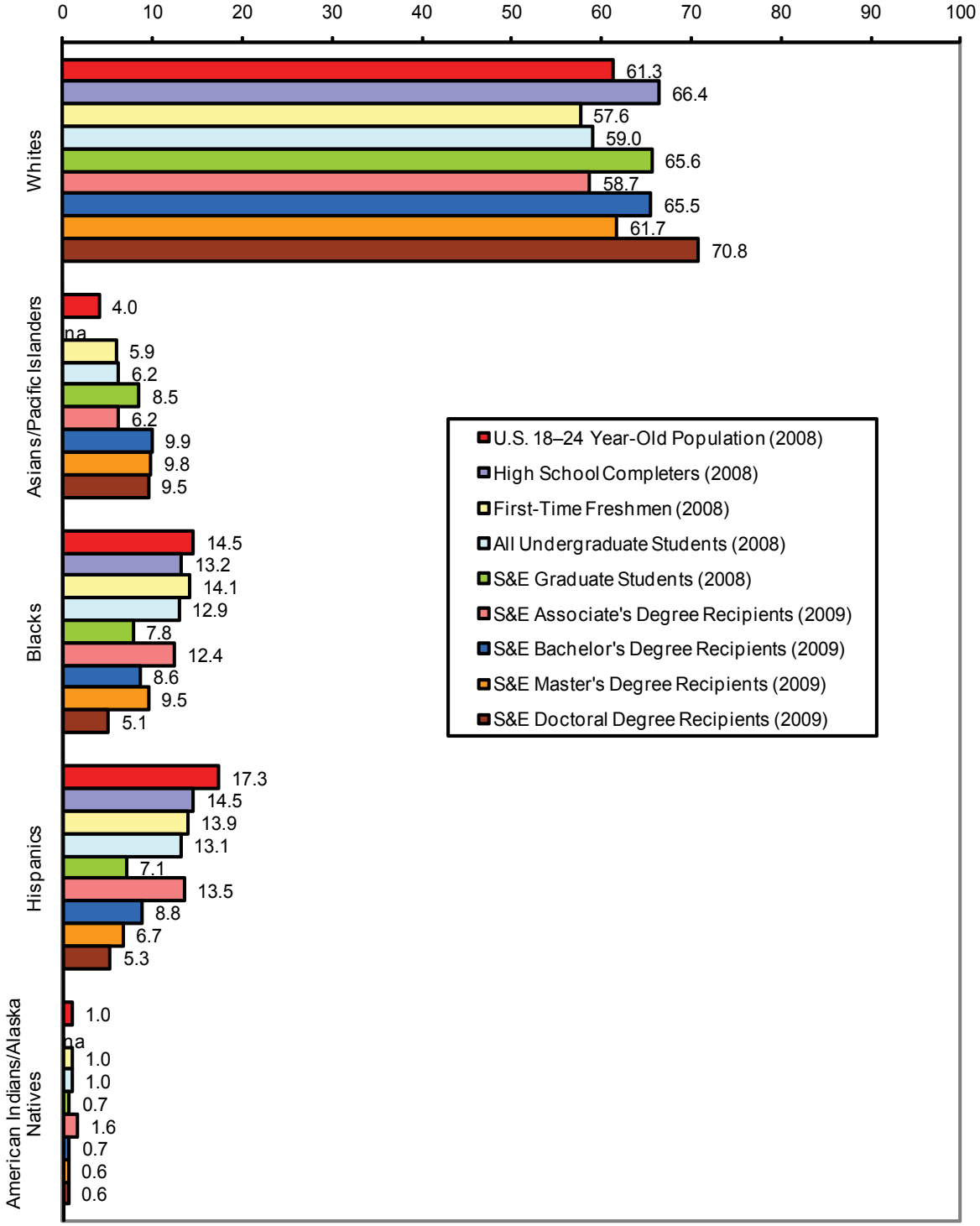
Hispanics and blacks are the largest minority groups in the U.S. resident population. Hispanics made up 17 percent and blacks 15 percent of all 18-24 year-olds in 2008.

- Each group outnumbers Asians/Pacific Islanders and American Indians/Alaska Natives among first-time freshmen, all undergraduate students, and recipients of STEM associate's degrees.
- Although participation of both Hispanics and blacks is increasing at all levels of education, and very rapidly among Hispanics, these two groups remain underrepresented among high school completers and in postsecondary education.

Asians/Pacific Islanders were 4 percent of all 18-24 year-olds in 2008.

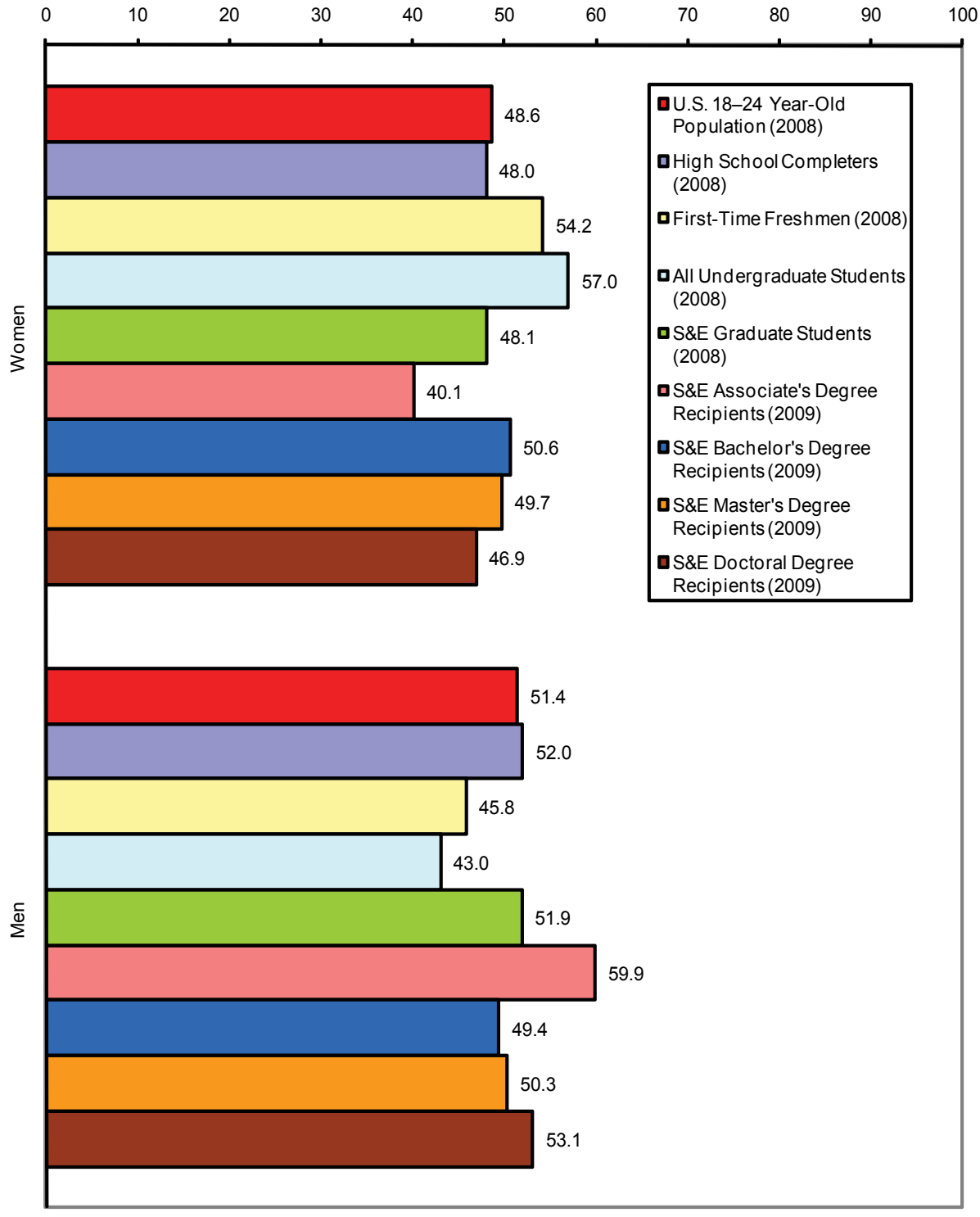
- They continue to enroll in undergraduate and graduate school and to earn STEM degrees at a higher rate than their representation in the general population.
- They receive a higher percentage of bachelor's, master's, and doctoral degrees in STEM fields than any other minority group.

Figure 1-1
Comparison of Racial/Ethnic Distribution of High School Completers, Postsecondary Students, and Degree Recipients to Distribution in U.S. Resident Population of 18–24 Year-Olds (%)



na: not available
Note: High school completions data are not available for Asians/Pacific Islanders and American Indians/Alaska Natives.
Data sources: Varied (see endnotes 3 and 4).

Figure 1-2
Comparison of Gender Distribution of High School Completers, Postsecondary Students, and Degree Recipients to Distribution in U.S. Resident Population of 18–24 Year-Olds (%)



Data sources: Varied (see endnote endnotes 3 and 4).

American Indians/Alaska Natives comprised only 1 percent of the 18-24 year-old population in 2008.

- They have a larger presence among STEM associate's degree recipients but remain underrepresented among STEM graduate students and among STEM bachelor's, master's, and doctoral recipients.

Over the years, the student population has become increasingly more diverse. Although whites continue to be a large majority of enrolled students and degree recipients at all levels, their proportions have decreased, and the proportions for the minority groups have increased. The tremendous growth in the Hispanic population has contributed significantly to this diversity. This growth is reflected in the faster growth among Hispanics in college enrollment and degree attainment than among other groups.

Gender[4]

Figure 1-2 compares the representation of men and women in the U.S. resident population of 18-24 year-olds in 2008 with their representation among high school completers, undergraduate and graduate students, and degree recipients. All data are for U.S. citizens and permanent residents.

- Men were a slim majority (over 51 percent) of all 18-24 year olds in 2008; they outnumbered women in every racial/ethnic group. Men's representation among high school completers in 2008 was about the same (52 percent) as in the U.S. college-age population.

- Women, however, were a majority of all undergraduate students, first-time freshmen, and recipients of STEM bachelor's degrees, and they approached parity with men in enrollment in STEM graduate programs and in attainment of STEM master's and doctoral degrees.

- In terms of numerical growth, women have outpaced men in total undergraduate, first-time freshmen, and STEM graduate enrollment, and also in attainment of STEM bachelor's, master's, and doctoral degrees. Between 1998 and 2009, the number of women earning STEM doctorates increased by 33 percent, whereas the number of men increased by just 0.1 percent. Only at the associate's degree level did men outpace women. Men more than doubled their number of STEM associate's degrees compared to a 45 percent increase for women.

Disability Status[5]

In 2008, fewer than 6 percent of 18-34 year-olds in the U.S. civilian noninstitutionalized population had a disability. Published data, however, are not available for the 18-24 college-age population.

People with disabilities:

- exceeded their representation in the U.S. population among undergraduate students and among STEM graduate students;

- were underrepresented among recipients of doctorates in STEM fields. (Data are not available on the disability status of STEM bachelor's and master's degree recipients.)

HIGH SCHOOL COMPLETIONS AND UNDERGRADUATE ENROLLMENT

Including graduate equivalency diplomas (GEDs), approximately 3.2 million students completed high school in 2008. (Table 1-1)

- Fifty-two percent of high school completers in 2008 were men and 48 percent were women – the same distribution as in 1998.

- Sixty-six percent of high school completers were white, 15 percent Hispanic, and 13 percent black. The remaining 6 percent were Asian/Pacific Islander, American Indian/Alaska Native, or non-Hispanic of more than one race.

- Hispanics' representation among high school completers has increased since 1998 whereas the proportions of both whites and blacks have decreased.

Among those who completed high school in 2008, women (72 percent) were more likely than men (66 percent), and whites (72 percent) were more likely than Hispanics (64 percent) and blacks (56 percent), to have enrolled in college by the October following high school

completion.[6] Although only a portion of high school completers in any racial/ethnic group enrolls immediately in college, attrition is higher for blacks and Hispanics than for the other demographic groups. The percentage has increased since 1998 among women, men, Hispanics, and whites, but has decreased among blacks.

More than 16.2 million students were enrolled in undergraduate school in 2008 (including all fields). Around 3 million (19 percent) were first-time freshmen. The data given below are restricted to U.S. citizens and permanent residents.

Table 1-1

High School Completions, First-Time Freshmen Enrollment, and Total Undergraduate Enrollment of U.S. Citizens and Permanent Residents, by Race/Ethnicity and Gender: 1998, 2003, 2008 (All Fields)

Demographic Group	1998	2003	2008	1998	2003	2008	1998	2003	2008
	High School Completions			First-Time Freshmen			Total Undergraduate Enrollment		
Total Number of Students	2,810,000	2,677,000	3,151,000	2,214,471	2,605,169	3,008,564	12,382,383	14,352,907	16,210,103
	% distribution			% distribution			% distribution		
All Race/ Ethnicities	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Men	51.7	48.8	52.0	46.0	45.2	45.8	43.5	42.8	43.0
Women	48.3	51.3	48.0	54.0	54.8	54.2	56.5	57.2	57.0
Whites	70.5	68.4	66.4	68.3	64.1	57.6	67.7	63.3	59.0
Men	na	na	na	31.9	29.6	27.1	30.0	27.8	26.2
Women	na	na	na	36.4	34.5	30.6	37.7	35.5	32.8
Asians/Pacific Islanders	na	na	na	5.3	5.3	5.9	6.0	6.0	6.2
Men	na	na	na	2.6	2.5	2.8	2.9	2.8	2.9
Women	na	na	na	2.7	2.8	3.1	3.1	3.2	3.3
Blacks	13.7	12.2	13.2	11.9	13.2	14.1	11.1	12.2	12.9
Men	na	na	na	4.9	5.3	5.8	4.1	4.3	4.7
Women	na	na	na	7.0	7.9	8.3	7.0	7.8	8.3
Hispanics	11.2	11.7	14.5	9.8	11.1	13.9	10.1	11.6	13.1
Men	na	na	na	4.3	4.9	6.2	4.3	4.8	5.5
Women	na	na	na	5.4	6.3	7.7	5.8	6.8	7.6
American Indians/Alaska Natives	na	na	na	1.0	1.0	1.0	1.0	1.0	1.0
Men	na	na	na	0.5	0.4	0.4	0.4	0.4	0.4
Women	na	na	na	0.6	0.6	0.6	0.6	0.6	0.6
Other/Unknown Race/Ethnicity	na	na	na	3.7	5.3	7.4	4.0	5.9	7.7
Men	na	na	na	0.5	0.4	0.4	0.4	0.4	0.4
Women	na	na	na	1.9	2.8	4.1	2.2	3.2	4.4

na = not available

Notes: High school completions include individuals ages 16-24 who graduated from high school or completed a GED during the preceding 12 months. These groups accounted for about 98 percent of all high school completions in each year. Data are based on sample surveys of the civilian population. Data for whites and blacks exclude persons identifying themselves as two or more races. Race categories exclude persons of Hispanic ethnicity.

Data sources: (high school completions) National Center for Education Statistics, Digest of Education Statistics (Tables 200 and 201); data collected by U.S. Census Bureau, Current Population Survey, October 1998, 2003, 2008. (first-time freshmen and total undergraduate enrollment) National Science Foundation, special tabulation from WebCASPAR database (October 29, 2010; data collected by the National Center for Education Statistics, IPEDS Fall Enrollment Survey.

- Hispanics and blacks each constituted about 13 percent of all undergraduate students. Their representation among first-time freshmen was slightly higher – 14 percent for each group.
- Asians/Pacific Islanders were somewhat over 6 percent of all undergraduate students and just under 6 percent of first-time freshmen.
- American Indians/Alaska Natives were 1 percent of all undergraduate students and of first-time freshmen.
- Women constituted a majority of all undergraduate students (57 percent) and of first-time freshmen (54 percent). They outnumbered men in every racial/ethnic group in the total undergraduate population and among first-time freshmen.
- Women of color (Asians/Pacific Islanders, American Indians/Alaska Natives, Hispanics, and blacks) accounted for 20 percent of all undergraduate students. Taking into account both gender and race/ethnicity, black women (over 8 percent) were the largest minority group.
- Men of color made up about 13 percent of all undergraduate students. Hispanics had the largest representation among men, constituting about 5 percent of all undergraduate students.
- Overall, the proportions of women and men in the undergraduate population and among first-time freshmen have been static since 1998. However, the proportions of minority women and men have increased as the proportions of white women and men have decreased.

Including foreign nationals, about 11 percent of all undergraduate students in 2008 had disabilities.

DEGREES AND GRADUATE ENROLLMENT: STEM FIELDS[4]

This section discusses the proportions of women, racial/ethnic minorities, and people with disabilities among recipients of associate's, bachelor's, master's, and doctoral degrees in STEM fields; among recipients of associate's and bachelor's degrees in STEM-related technologies (e.g., science, engineering, and health technological processes and equipment); and among graduate students in STEM fields.

At the bachelor's, master's, and doctoral levels, women earned a majority of the STEM degrees awarded to blacks, Hispanics, and American Indians/Alaska Natives in 2009, while men earned a majority of degrees at all three levels among Asians/Pacific Islanders and whites. Since 1998, women have increased their share of associate's degrees in STEM-related technologies, and of STEM bachelor's, master's, and doctoral degrees.

Between 1998 and 2009, every racial/ethnic minority group increased its share of STEM bachelor's and master's degrees and its share of associate's degrees in STEM-related technologies, although some of these increases were well under 1 percentage point. Hispanics and blacks also increased their share of associate's degrees in STEM fields. The share of STEM doctoral degrees earned by minorities increased for every group except American Indians/Alaska Natives, whose small share did not change.

STEM Associate's Degrees

In 2009, U.S. colleges and universities conferred 53,128 associate's degrees in STEM fields and another 110,297 associate's degrees in STEM-related technologies.

- Hispanics earned 13 percent and blacks earned 12 percent of all associate's degrees in STEM fields awarded in 2009. Blacks received the larger percentage of degrees in STEM-related technologies (13 percent vs. 12 percent for Hispanics).
- Asians/Pacific Islanders accounted for 6 percent of associate's degrees in STEM fields and 4 percent of those in STEM-related technologies.
- American Indians/Alaska Natives earned somewhat less than 2 percent of associate's degrees in STEM fields and just over 1 percent of those in STEM-related technologies.
- Men were far more prominent than women (60 percent vs. 40 percent) among recipients of associate's degrees in STEM fields. They outnumbered women in every racial/ethnic group except American Indians/Alaska Natives. Women's share of associate's degrees in STEM fields fell from 49 percent in 1998 to 40 percent in 2009.
- The distribution of men and women was the reverse in STEM-related technologies. Women

earned about 61 percent of associate's degrees in STEM-related technologies, outnumbering men in every racial/ethnic group. Women's share of degrees rose from 51 percent in 1998.

- All racial/ethnic minority groups increased their share of degrees in STEM-related technologies between 1998 and 2009, although some increases were very small. Hispanics and blacks also increased their share of associate's degrees in STEM fields since 1998.

STEM Bachelor's Degrees

In 2009, U.S. colleges and universities awarded 488,380 bachelor's degrees in STEM fields and 30,571 bachelor's degrees in STEM-related technologies.

- Women earned just over half (51 percent) of all bachelor's degrees in STEM fields – a small increase from 49 percent in 1998. Their share of bachelor's degrees in STEM-related technologies was 43 percent in 2009, up from 38 percent in 1998.
- Hispanics accounted for almost 9 percent of all bachelor's degrees in STEM fields, and blacks earned nearly as many degrees. As was the case at the associate's level, blacks earned the largest minority share of bachelor's degrees in STEM-related technologies (10 percent), and Hispanics earned the second largest minority share (7 percent).
- Asians/Pacific Islanders received nearly 10 percent of the STEM bachelor's degrees conferred in 2009.
- American Indians/Alaska Natives received 0.7 percent of bachelor's degrees in STEM fields.
- Every minority group increased its share of STEM bachelor's degrees between 1998 and 2009. However, the increases were very small, ranging from a 2 percentage-point increase for Hispanics to a difference of just 0.1 point for American Indians/Alaska Natives.

STEM Graduate Enrollment

In 2008, there were 369,781 graduate students enrolled in STEM programs. Women made up close to half of those students (48 percent). Nearly one-fourth of STEM graduate students were racial/ethnic minorities. All data except for people with disabilities are restricted to U.S. citizens and permanent residents.

- Nine percent of STEM graduate students in 2008 were Asians/Pacific Islanders, 8 percent black, 7 percent Hispanic, and less than 1 percent American Indians/Alaska Natives.
- About 59 percent of blacks and 64 percent of Hispanics were enrolled full time, compared to two-thirds or more of whites, Asians/Pacific Islanders, and American Indians/Alaska Natives.[7]
- Women who were racial/ethnic minorities made up 13 percent of STEM graduate students in 2008. Black women (5 percent of all STEM graduate students) were the largest subgroup among women and men of color.
- Men of color made up 11 percent of STEM graduate students in 2008. Asian/Pacific Islander men were most prominent (5 percent of all STEM graduate students).
- Women outnumbered men among blacks, Hispanics, and American Indians/Alaska Natives enrolled in STEM graduate programs.
- People with disabilities made up 7 percent of STEM graduate students (including foreign nationals) in 2008. Almost two-thirds (63 percent) of graduate students with disabilities were men. About 40 percent were racial/ethnic minorities: 21 percent Asian/Pacific Islander, 9 percent black, 7 percent Hispanic, 0.2 percent American Indian/Alaska Native, 3 percent more than one race.

STEM Master's Degrees

In 2009, 98,503 master's degrees were conferred in STEM fields.

- Hispanics earned almost 7 percent of all STEM master's degrees in 2009.
- American Indians/Alaska Natives accounted for 0.6 percent of STEM master's degrees.
- Women received just under 50 percent of STEM master's degrees.

- As at the bachelor's level, women and every minority group increased their share of STEM master's degrees between 1998 and 2009, although the increases for Asians/Pacific Islanders and American Indians/Alaska Natives were well under 1 percentage point. The shares for men and whites, on the other hand, decreased over this time period.

STEM Doctoral Degrees

U.S. universities conferred 20,560 doctoral degrees in STEM fields in 2009. All data in this section, including the data on people with disabilities, are restricted to U.S. citizens and permanent residents.

- Women approached parity with men, earning 47 percent of all STEM doctorates conferred in 2009 compared with 40 percent in 1998. Women's share of STEM doctorates increased in every racial/ethnic group except American Indians/Alaska Natives, where women's share decreased from 56 percent in 1998 to 51 percent in 2009.
- As at the bachelor's and master's levels, Asians/Pacific Islanders received nearly one in ten STEM doctorates awarded in 2009.
- Both Hispanics and blacks accounted for more than 5 percent of STEM doctorates in 2009, an increase from less than 4 percent for both groups in 1998.
- American Indians/Alaska Natives earned 0.6 percent of STEM doctorates in 2009.
- Most racial/ethnic minority groups increased their share of STEM doctorates between 1998 and 2009. The exception is American Indians/Alaska Natives, whose small percentage of STEM doctorates has remained stable over the years.
- Students with disabilities made up 1.7 percent of STEM doctorate recipients in 2009, an increase from 1.5 percent in 1998. The number of STEM doctorates earned by students with disabilities surpassed the number in non-STEM fields for the first time in 2008 – 334 STEM doctorates (53 percent) vs. 294 non-STEM doctorates. In 2009, students with disabilities earned 349 doctorates in STEM fields (52 percent) and 320 doctorates in non-STEM fields. Physical/orthopedic and learning disabilities were the most common disabilities of STEM doctorate recipients.

FIELD OF STUDY[8]

More than one-third (35 percent) of first-time freshmen at 4-year institutions in 2008 (including foreign nationals) stated intentions to major in a STEM field. Among U.S. citizens and permanent residents who earned degrees in 2009, 31 percent of bachelor's recipients, 17 percent of master's recipients, and 46 percent of doctorate recipients specialized in STEM fields. Men were more inclined than women, and Asians/Pacific Islanders were more inclined than the other racial/ethnic groups, to state intentions to major in a STEM field as freshmen. Although Asians/Pacific Islanders were also more likely than the other racial/ethnic groups to earn a STEM degree at all three levels, women received a slim majority of STEM bachelor's degrees and neared parity with men in attainment of STEM master's degrees in 2009.

Eight broad fields comprise STEM: agricultural sciences, biological sciences, computer sciences, mathematics and statistics, physical sciences (including earth, atmospheric, and ocean sciences), psychology, social sciences, and engineering. (The STEM definition in this report excludes health/medical sciences.) Among STEM degree recipients, computer sciences is by far the largest field at the associate's level; social sciences is largest at the bachelor's and master's levels (as well as among first-time freshmen and current graduate students); and biological sciences is largest at the doctoral level. Within the STEM-related technologies, more than twice as many associate's degrees are conferred in health technologies as in engineering technologies.

At every degree level there are differences in choice of STEM field by both race/ethnicity and gender. In 2009, women earned a majority of degrees in psychology, biological sciences, and social sciences at the bachelor's, master's, and doctoral levels, and they also earned a majority of agricultural science degrees at the bachelor's and master's levels. Women's smallest shares of degrees at each of these levels were in computer sciences and engineering. Although whites received a majority of bachelor's, master's, and doctoral degrees in every STEM field, individual minority groups (especially Asians/Pacific Islanders) earned double-digit shares of degrees in several fields. There are also differences

among the demographic groups at the associate's degree level.

Field of Associate's Degree

- Although computer sciences and social sciences were the two largest STEM fields for both male and female associate's degree recipients in 2009, men earned more than seven in ten of the computer science degrees (75 percent) whereas women received almost seven in ten of the social science degrees (69 percent). Similarly, men earned 86 percent of engineering technology degrees, whereas women received 83 percent of health technology degrees.

- Computer sciences and social sciences were also the top two fields for every racial/ethnic group at the associate's level. Whites earned a majority of associate's degrees in every STEM field except social sciences. Hispanics received the second highest number of degrees in social sciences and mathematics/statistics (22 percent of the total in each field), biological sciences (18 percent), psychology (17 percent), and engineering (15 percent). Blacks ranked second in computer sciences (15 percent), Asians/Pacific Islanders in physical sciences (14 percent), and American Indians/Alaska Natives in agricultural sciences (4 percent). Blacks and Hispanics earned the second highest number of technology degrees after whites: blacks accounted for 14 percent of associate's degrees in health technologies, and Hispanics accounted for 12 percent of degrees in engineering technologies.

Field of Bachelor's Degree

- The top three STEM fields of female bachelor's degree recipients in 2009 were social sciences, psychology, and biological sciences. The top three fields for male recipients were social sciences, engineering, and biological sciences. Every racial/ethnic group except Asians/Pacific Islanders had the same top three fields as women overall. The top three fields of Asians/Pacific Islanders were the same as for men overall but ranked in a different order: biological sciences, social sciences, and engineering.

Field of Graduate Study

- Among STEM graduate students in 2008, the top three fields for men were engineering (by far their largest field), social sciences, and biological sciences. Engineering ranked among men's top two fields in every racial/ethnic group. Women's top three fields were social sciences, psychology, and biological sciences. Social sciences ranked first or second among women in every racial/ethnic group and among men in every group except Asians/Pacific Islanders.

- Men outnumbered women among engineering graduate students by more than three to one, while women outnumbered men among psychology graduate students by the same ratio. Women were also a majority of graduate students in biological and social sciences.

- Social sciences were the most common STEM fields of graduate study for every racial/ethnic group except Asians/Pacific Islanders, whose largest concentration (31 percent) was in engineering. More than one-third of black and American Indian/Alaska Native students, and more than one-fourth of Hispanic students, specialized in a social science field. Blacks made up 12 percent of all graduate students in social sciences. Political science/public administration was by far the most popular social science subfield in every racial/ethnic group.

- Psychology was the second most common field of graduate study among underrepresented minorities; 10 percent of all psychology students were Hispanic. Engineering ranked second among whites and third among blacks, Hispanics, and American Indians/Alaska Natives. Biological sciences ranked second among Asians/Pacific Islanders and third among whites.

- Graduate students with disabilities were more likely than those without disabilities to specialize in social/behavioral sciences (44 percent vs. 32 percent) and less likely to specialize in mathematics/engineering/computer science fields (32 percent vs. 43 percent). About one-fourth of each group specialized in life/physical sciences.

Field of Master's Degree

- Among STEM master's degree recipients in 2009, social sciences, psychology, and engineering ranked as the top three fields for all racial/ethnic groups except Asians/Pacific Islanders, whose top fields were engineering, social sciences, and computer sciences. Overall, men had the same top fields as Asians/Pacific Islanders. Women's top fields were the same as at the bachelor's level: social sciences, psychology, and biological sciences.

Field of Doctoral Degree

- There is more variation in STEM field choice at the doctoral level. In 2009, women's top STEM doctoral field was biological sciences, followed by psychology and social sciences, whereas engineering ranked first among men, followed by biological sciences and physical sciences. Biological sciences ranked first or second among doctorate recipients in every racial/ethnic group. Psychology was one of the top three STEM doctoral fields for all groups except Asians/Pacific Islanders, and social sciences ranked in the top three for all groups except Hispanics and whites. Engineering was a top three field only among Asians/Pacific Islanders and Hispanics, and physical sciences ranked in the top three only among whites.

- It is important to keep in mind when considering fields that each of the underrepresented minority groups continues to receive the majority of its doctorates in non-STEM fields. In 2009, 71 percent of blacks' doctoral degrees were in non-STEM fields, as were 55 percent of Hispanics' and 57 percent of American Indians/Alaska Natives' doctoral degrees.

INSTITUTION TYPE[9]

Two-Year Colleges

Two-year colleges have accounted for 42-43 percent of total undergraduate enrollment (including all fields) since 1998. They play a larger role in the undergraduate education of racial/ethnic minorities than of whites, and in the education of people with disabilities compared to those without disabilities.

- In 2008, two-year colleges enrolled 53 percent of all Hispanic undergraduate students, 46 percent of American Indians/Alaska Natives, and 44 percent of Asians/Pacific Islanders and blacks, compared with 40 percent of whites.

- The pattern was similar among first-time freshmen in 2008, except that blacks (45 percent) were more likely than Asians/Pacific Islanders (40 percent) to be at a two-year college. Since 1998, the percentage of first-time freshmen at two-year colleges has increased for blacks, Hispanics, and Asians/Pacific Islanders, but decreased somewhat for American Indians/Alaska Natives and whites.

- Half of all undergraduate students with disabilities (51 percent), compared with 45 percent of those without disabilities, were enrolled in a two-year or less-than-two-year institution in 2008.

- Almost the same percentage of women (43 percent) and men (42 percent) were enrolled in a two-year college in 2008; these figures are somewhat lower than in earlier years. Among first-time freshmen, men (43 percent) were somewhat more likely than women (40 percent) to be at a two-year college; men's percentage has been higher than the percentage for women in every racial/ethnic group since 1998.

In 2009, two-year colleges conferred 67 percent of all associate's degrees in STEM fields and 61 percent of all associate's degrees in STEM-related technologies – smaller shares than in earlier years.

- Although Asians/Pacific Islanders received fewer STEM associate's degrees than most of the other racial/ethnic groups, those who did earn this degree were more likely than recipients in the other groups to receive it from a two-year college: 81 percent of Asians/Pacific Islanders vs. 60 percent of blacks (who were the least likely to receive the degree from a two-year college). Among recipients of associate's degrees in STEM-related technologies, whites were the most likely (65 percent) and blacks were again the least likely (52 percent) to receive their degree from a two-year college.

- Women were more likely than men to receive

their STEM associate's degree from a two-year college: 73 percent vs. 63 percent. Asian/Pacific Islander women were the most likely (91 percent) and black men the least likely (55 percent) to receive their STEM associate's degree from a two-year college. Two-year colleges accounted for a smaller percentage of STEM associate's degrees in 2009 than in 1998 for men in every racial/ethnic group and for women in every group except Asians/Pacific Islanders.

- In 2009, men were somewhat more likely than women to earn their associate's degree in STEM-related technologies at a two-year college, although women were the more likely to do so in 1998 and 2003. This was the case in every racial/ethnic group. In 2009, two-year colleges awarded 63 percent of men's degrees vs. 60 percent of women's degrees in STEM-related technologies. The percentage was highest among white men (67 percent) and next highest among white women (64 percent).

Research I Institutions

As defined by the Carnegie Foundation's "A Classification of Institutions of Higher Education," Research I institutions offer a full range of baccalaureate programs, are committed to graduate education through the doctorate, and give high priority to research. They award 50 or more doctoral degrees and receive $40 million or more in federal support annually.

- In 2009, Research I institutions awarded one-third of all STEM bachelor's and master's degrees and almost two-thirds of all STEM doctoral degrees. At all three degree levels, and within every racial/ethnic group, men were more likely than women to receive their STEM degree from a Research I institution.

- At all three degree levels, and also among STEM graduate students, Asians/Pacific Islanders were the most likely racial/ethnic group to be at a Research I institution, followed by whites. In 2009, Research I institutions awarded 57 percent of the bachelor's degrees, 43 percent of the master's degrees, and 73 percent of the doctoral degrees earned by Asians/Pacific Islanders in STEM fields.

- Although a majority of underrepresented minorities earned their STEM doctorates at Research I institutions, their percentages were well below those for Asians/Pacific Islanders and whites. About 54 percent of blacks and 53 percent of Hispanics and American Indians/Alaska Natives with STEM doctorates earned the degree at a Research I institution. Blacks were the least likely of the racial/ethnic groups to earn STEM bachelor's (21 percent) or master's (16 percent) degrees at Research I institutions.

- Since 1998, about 46 percent of graduate students in STEM fields (excluding medical/health) have been enrolled in Research I institutions. The percentages have been stable for both male and female students, but higher for male students. In 2008, 50 percent of men and 41 percent of women were pursuing graduate study at Research I institutions.

- Only among Asians/Pacific Islanders was a majority of STEM graduate students (54 percent) enrolled in Research I institutions in 2008. The next highest percentages were among whites (49 percent) and American Indians/Alaska Natives (45 percent). The figures for Hispanics (35 percent) and blacks (29 percent) are notably lower than for the other groups. Moreover, Hispanics and blacks are the only groups to show a decrease in the Research I percentage since 1998, when over 36 percent of Hispanic and 33 percent of black STEM graduate students were enrolled in Research I institutions. In contrast, Asians/Pacific Islanders increased their presence in Research I institutions by 4.5 percentage points since 1998, and American Indians/Alaska Natives increased their presence by 3.7 percentage points.

Institutions Serving Minorities and Students with Disabilities

Predominantly minority institutions and other institutions with high levels of minority enrollment play a significant role in the education of underrepresented minority students, especially blacks and Hispanics.

- Historically Black Colleges and Universities (HBCUs) awarded 20 percent of the STEM bachelor's degrees blacks earned in 2009,

almost 14 percent of their STEM master's degrees, and 13 percent of their STEM doctoral degrees. The HBCU share of blacks' degrees has decreased since 1998 at the bachelor's and master's levels but increased at the doctoral level. Howard University, an HBCU, has long been the top awarder of doctorates to blacks.

- Black women were more likely than black men to earn their STEM bachelor's and master's degrees at an HBCU. The situation is reversed at the doctoral level – over 14 percent of black men vs. about 12 percent of black women received their STEM doctorate from an HBCU in 2009.

- There are 257 institutions classified as having "high Hispanic enrollment" (HHE). In 2009, HHE institutions conferred 31 percent of Hispanics' STEM degrees at the bachelor's level, 30 percent at the master's level, and 18 percent at the doctoral level. The HHE share of Hispanics' STEM degrees has declined since 1998 at the bachelor's level, increased at the master's level, and stayed about the same at the doctoral level.

- Hispanic women were more likely than Hispanic men to earn their STEM degrees at an HHE institution, especially at the doctoral level (21 percent of women vs. 14 percent of men in 2009). The HHE share of Hispanics' STEM degrees has declined since 1998 for both women and men at the bachelor's and master's levels. At the doctoral level, however, the HHE percentage for men increased from 12 percent in 1998, whereas the HHE percentage for women decreased from 25 percent.

- Tribal colleges play a much smaller role in the education of American Indians/Alaska Natives. In 2009, less than 1.5 percent of this group received their STEM bachelor's degree from a tribal college, with virtually no difference by gender. However, tribal colleges accounted for more than 21 percent of the STEM associate's degrees earned by American Indians/Alaska Natives in 2009 – 25 percent of women's degrees vs. 17 percent of men's degrees. Tribal colleges award very few master's degrees (only 1 in 2009) and no doctoral degrees.

Other institutions serve students with disabilities. Gallaudet University and National Technical Institute for the Deaf (NTID) serve deaf and hard-of-hearing students. Landmark College serves students with learning disabilities and/or attention deficit hyperactivity disorder (AD/HD). The numbers given below include foreign nationals and fields outside of STEM.

- In 2009, Gallaudet University awarded undergraduate degrees to 163 deaf or hard-of-hearing students and 12 hearing students. More than one-fourth of the 175 graduates (26 percent) were students of color. Asians/Pacific Islanders were the largest minority group (10 percent). Women made up almost two-thirds of all undergraduate degree recipients (65 percent).

- Gallaudet conferred graduate degrees to 47 deaf or hard-of-hearing students, 66 hearing students, and 4 students whose hearing status is unknown. About 18 percent of graduate degree recipients were students of color. Blacks earned more graduate degrees (7 percent) than any other minority group at Gallaudet. About 83 percent of all graduate degree recipients were women.

- NTID, which is part of the Rochester Institute of Technology (RIT), supports deaf and hard-of-hearing students. In 2009, its two-year program awarded sub-baccalaureate degrees to 116 students. Another 123 students earned bachelor's degrees and 45 earned master's degrees at NTID. About 24 percent of all degree recipients were racial/ethnic minorities. (The sub-baccalaureate and baccalaureate-level graduates include an unknown number of hearing graduates from the ASL-English Interpretation program; the master's graduates include an unknown number of hearing students from the Master of Science in Secondary Education program.)

- Landmark College is a two-year institution with about 500 students, many of whom go on to four-year institutions and receive bachelor's degrees.

POST-GRADUATION PLANS OF NEW STEM DOCTORATE RECIPIENTS[10]

About 48 percent of U.S. citizens and permanent residents who received STEM doctorates in 2009 and who planned to stay in the United States following graduation took a position as a postdoc, while 22 percent found jobs in academe, 17 percent found jobs in industry, and 13 percent found jobs in "other" sectors (e.g., government, nonprofits, elementary/secondary schools). At this final stage of the education pipeline, there is again variation by gender and race/ethnicity.

- Postdocs have long been most common in the biological and physical sciences. In 2009, 76 percent of new biological science PhDs and 59 percent of new physical science PhDs had U.S. postdocs lined up at graduation. The postdoc figure for new PhDs in other STEM fields ranged from 17 percent in social sciences to 50 percent in psychology.

- U.S. postdocs were more common among women (51 percent) than among men (45 percent) who earned STEM doctorates in 2009. Women were also more likely than men (24 percent vs. 20 percent) to find jobs in academe, whereas men were more likely than women (21 percent vs. 11 percent) to find jobs in industry. Postdoc positions and employment in industry in the United States have increased for both women and men since 2006. U.S. academic employment was about the same in 2009 as in 2006 for women (24 percent) but decreased from 22 percent to 20 percent for men.

- U.S. postdocs were more common among Hispanics than among the other racial/ethnic groups who earned STEM doctorates in 2009: 53 percent of Hispanics compared with 51 percent of American Indians/Alaska Natives, 50 percent of Asians/Pacific Islanders, 48 percent of whites, and 43 percent of blacks. The percentage of postdocs rose between 2006 and 2009 for all groups. The 2009 percentage for each of the underrepresented minority groups was substantially higher than in 2006 – most likely because other U.S. academic employment declined for these groups. Academic employment also declined somewhat among whites but rose among Asians/Pacific Islanders. Employment in industry increased for all groups except Asians/Pacific Islanders and Hispanics.

- In 2009, blacks with new STEM PhDs had the highest percentage with U.S. academic employment (24 percent), followed by whites (23 percent), Hispanics (21 percent), American Indians/Alaska Natives (18 percent), and Asians/Pacific Islanders (16 percent). Employment in industry was far more common among Asians/Pacific Islanders (25 percent) than among the other groups; whites had the next highest percentage (16 percent). Blacks (19 percent) and American Indians/Alaska Natives (18 percent) were the most likely groups to have jobs in a sector other than academe or industry (e.g., government, nonprofits, elementary/secondary schools).

- New STEM doctorate recipients with disabilities have been less likely than those without disabilities to take a postdoc after graduation, although the gap has narrowed. In 2009, 46 percent of new PhDs with disabilities were moving into postdocs – up from 41 percent in 2006. The postdoc percentage for new PhDs without disabilities was 48 percent in 2009 – up from 46 percent in 2006. In 2008, about 46 percent of both groups had postdocs lined up after graduation.

- U.S. academic employment of new STEM PhDs with disabilities declined from 29 percent in 2006 to 23 percent in 2009, while employment in industry rose from 9 percent to 13 percent along with the increase in postdoc positions. In 2009, new STEM PhDs with disabilities were slightly more likely than STEM PhDs without disabilities to have obtained a non-postdoc position in academe (23 percent vs. 22 percent), less likely to be employed in industry (13 percent vs. 17 percent), and more likely to take a job in another sector (19 percent vs. 13 percent).

ENDNOTES

[1]Report to the President *Prepare and Inspire: K-12 Education and Science, Technology, Engineering and Math (STEM) for America's Future*, President's Council of Advisors of Science and Technology, September 2010, page v.

[2]Eight broad fields comprise science and engineering (STEM): agricultural sciences, biological sciences, computer sciences, mathematics and statistics, physical sciences (including earth, atmospheric, and ocean sciences), psychology, social sciences, and engineering. Health and medical science fields are excluded from the STEM definition in this report but may be included in other NSF reports on STEM graduate students and doctorate recipients.

[3]Data on U.S. resident population of 18-24 year-olds in 2008 by race/ethnicity and gender are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Tables 1-1 and 1-2, February 2011), www.nsf.gov/statistics/wmpd; the original source of the data is U.S. Census Bureau, Population Division.

[4]Data on race/ethnicity and gender of high school completers are from National Center for Education Statistics, Digest of Education Statistics (Table 201 for race/ethnicity, Table 200 for gender, 2009); the original source of high school completions data is U.S. Census Bureau, Current Population Survey, October Supplements 1998, 2003, 2008. Data on race/ethnicity and gender of undergraduate students and first-time freshmen are from special tabulations generated from NSF's WebCASPAR system (October to November 2010); the original source of enrollment data is National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall Enrollment Survey. Data on race/ethnicity and gender of S&E graduate students are from Table 1 in NSF InfoBrief 08-302 (December 2007) and NSF InfoBrief 10-320 (June 2010), and from special tabulations generated from NSF's WebCASPAR system (December 2010); the original source of graduate enrollment data is the NSF-NIH Survey of Graduate Students and Postdoctorates in Science and Engineering. Data on race/ethnicity and gender of degree recipients are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (prepublication, June 2011: Tables 4-3 for associate's degrees; Tables 5-3 to 5-5 for bachelor's degrees; Tables 6-3 to 6-5 for master's degrees; Tables 7-4, 7-7, 7-8 for doctorates) and special tabulations generated from NSF's WebCASPAR system (November 2010); the original source of WebCASPAR degree data is National Center for Education Statistics, IPEDS Completions Survey.

[5]Published data on the population of people with disabilities are limited to the U.S. "civilian non-institutionalized" population and includes an 18–34 age category rather than the 18–24 age category included in the population statistics by race/ethnicity and gender; data on U.S. civilian noninstitutionalized population of 18-34 year-olds by disability status are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 1-3, February 2011), www.nsf.gov/statistics/wmpd; the original source of the data is U.S. Census Bureau, 2008 American Community Survey. Data on disability status of undergraduate students are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Tables 2-6 and 2-7, February 2011), www.nsf.gov/statistics/wmpd. Data on disability status of S&E graduate students are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 3-7, February 2011), www.nsf.gov/statistics/wmpd. The original source of data on disability status of undergraduate and graduate students is National Center for Education Statistics, National Postsecondary Student Aid Study. Data on disability status of doctorate recipients are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 7-5, February 2011), www.nsf.gov/statistics/wmpd, and a special tabulation provided by NSF (March 2011); the data were collected in NSF's Survey of Earned Doctorates. To protect the confidentiality of the small number of persons with disabilities who earn doctorates, data on their gender and race/ethnicity are not available to the public.

[6]Data on immediate college enrollment following high school completion are from National Center for Education Statistics, *Digest of Education Statistics* (Tables 200 and 201, 2009); the original source of the data is U.S. Census Bureau, Current Population Survey, October Supplements 1998, 2003, 2008.

[7]Data on full-time enrollment in S&E graduate programs are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 3-5, February 2011), www.nsf.gov/statistics/wmpd. The data were collected in the NSF-NIH Survey of Graduate Students and Postdoctorates in Science and Engineering.

[8]Data on field of study intentions of first-time freshmen are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 2-8, February 2011), www.nsf.gov/statistics/wmpd; the original source of the data is Higher Education Research Institute, University of California at Los Angeles, Survey of the American Freshman (special tabulations, 2009). Data on degree fields are from special tabulations generated from NSF's WebCASPAR system (December 2010); the original source of degree field data is National Center for Education Statistics, IPEDS Completions Survey. Most data on S&E graduate fields are from special tabulations generated from NSF's WebCASPAR system (December 2010); the original source of graduate enrollment data is the NSF-NIH Survey of Graduate Students and Postdoctorates in Science and Engineering. Data on field specializations of persons with and without disabilities are derived from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 3-8, February 2011), www.nsf.gov/statistics/wmpd; the original source of field data by disability status is National Center for Education Statistics, National Postsecondary Student Aid Study.

[9]Most data on institution types are from special tabulations generated from NSF's WebCASPAR system (November to December 2010, April to June 2011). Data on Research I institutions reflect the 2005 edition of the Carnegie Classifications (Carnegie Foundation). The original source of institutions by undergraduate enrollment and degree conferrals is National Center for Education Statistics, IPEDS Fall Enrollment and Completions Surveys. The original source of institutions of S&E graduate students is the NSF-NIH Survey of Graduate Students and Postdoctorates in Science and Engineering. Data on two-year colleges by gender and race/ethnicity are from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Table 2-3, February 2011), www.nsf.gov/statistics/wmpd; data on two-year colleges by disability status are from Table 2-6. Data on institutions serving students with disabilities are from:2009 Gallaudet Annual Report, http://www.gallaudet.edu/Documents/Provost/Gallaudet_University_Annual_Report_FY2009--MAIN.pdf; 2009 NTID Annual Report, http://www.ntid.rit.edu/sites/default/files/annual_report2009.pdf; http://en.wikipedia.org/wiki/Landmark_College.

[10]Data on post-graduation plans of new S&E doctorate recipients in the United States are derived from NSF, *Women, Minorities, and Persons with Disabilities in Science and Engineering* (Tables 8-2, 8-3, and 8-4 for 2009 (February 2011) and Tables G-3 and G-4 for 2006 and 2008 (2008 and 2010), www.nsf.gov/statistics/wmpd; the data were collected in NSF's Survey of Earned Doctorates. To protect the confidentiality of the small number of persons with disabilities who earn doctorates, data on their gender and race/ethnicity are not made available to the public.

2 BROADENING PARTICIPATION AT NSF

"…the goal of broadening participation is not only an issue of fairness and equal opportunity, but is the means of bringing diversity and intellectual breadth to the transformation of science itself."

Dr. David B. Spencer[1]

Major findings of NSF's broadening participation activities during 2009-2010 include:

- Proposals submitted to NSF by underrepresented principal investigators (PIs) increased only marginally from 2004 to 2009. For example, women PIs went from 20.2 to 23.3 percent; and Hispanic/Latino increased from 3.4 to 4.1 percent.
- The American Recovery and Reinvestment Act (ARRA) provided a significant boost to the number of NSF grant awards in FY 2009. With ARRA funding, NSF was able to fund a total of 4,318 additional grants. Underrepresented groups received 31 percent of these additional awards: 1,050 went to women, 240 to underrepresented minorities, and 44 to persons with disabilities.
- FY 2009 and FY 2010 financial investments in the Foundation's portfolio of broadening participation research and education programs increased significantly over FY 2007 and FY 2008, i.e., from $1,465.24 million in 2007 to $2,292.51 million in FY 2010.
- Minorities and persons with disabilities continued to be underrepresented among NSF's permanent staff scientists and engineers (S&Es). Women increased their numbers among S&Es from 39.5 percent in 2003 to 41.7 percent in 2010, whereas underrepresented minority S&Es increased from 10.0 to 11.0 percent, and the number of S&Es with disabilities dropped from 9.1 to 8.3 percent.

MERIT REVIEW RESULTS

All proposals submitted to NSF are subject to the merit review process, in which a proposal is reviewed under two criteria: *the intellectual merit* of the project and the *broader impacts* of the project's primary research or educational goal. Under the first criterion, a proposal is assessed for its scientific importance, qualifications of the proposer, and the potential for transformative research. The second criterion requires that the proposed activities address one or more of the following questions: How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, race, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? And what may be the benefits of the proposed activity to society?

For a host of reasons (e.g., community biases, proposer priorities, or panel reviewer emphasis on diversity in STEM), the question regarding broadening participation is less frequently addressed than the other broader impact areas. Evidence for this has been largely anecdotal from reviews of project reports. But, the consistency of these anecdotes and program officer observations have prompted many of NSF's directorates and program offices to supplement the broader impacts criterion by adding a specific requirement that broadening participation of underrepresented groups in STEM be explicitly addressed in proposals. To better ensure PI and institutional attention to diversity, CEOSE submitted a proposal to the National Science Board that a third merit review criterion be established that will specifically require that broadening participation be addressed in all proposals (see Recommendations in Chapter 3).

Research and education programs in which this additional requirement is being instituted include NSF's *focused* broadening participation programs and those with an *emphasis* on diversity. Data in Table 2-1 present a sample of this policy change. These data are based on a 2008 survey of NSF programs.[2]

With the exception of the Office of International Science and Engineering (OISE) and Office of Polar Programs (OPP), all other NSF directorates have some programs that require broadening participation or diversity activities. The Biological Sciences (BIO) Directorate has the highest proportion of programs that require broadening participation or diversity components, followed by Educational and Human Resources (EHR), Engineering (ENG), Social, Behavioral, and Economic Sciences (SBE), Mathematics and Physical Sciences (MPS), Computer and Information Science and Engineering (CISE), and Geosciences (GEO). It is expected that more of NSF's program solicitations will place added emphasis on broadening participation.

Table 2-1
NSF Programs Requiring Additional Criteria for Broadening Participation

Directorate/ Program Office	Total Sampled Programs	Programs Requiring Diversity/BP Activities
BIO	6	67% *(4)*
CISE	8	37% *(3)*
EHR	20	45% *(9)*
ENG	7	43% *(3)*
GEO	6	17% *(1)*
OISE	6	0
MPS	21	38% *(8)*
OPP	4	0
SBE	5	40% *(2)*

Source: Internal NSF survey conducted in FY 2008.

PROPOSALS

NSF rendered a total of 45,181 proposal decisions in FY 2009 and 55,562 in FY 2010. Between 2004 and 2010, there was an overall upward trend in the total number of proposal decisions made by NSF (see Table 2-2). Paralleling this trend was a slightly rising annual number of proposals from female and Hispanic PIs, and a very slightly rising, albeit fluctuating, change in the number of proposals from African American PIs during this same period. In contrast, the number of proposals received from Native American and Hawaiian Native/ Pacific Islander PIs declined over this 6-year period.

To increase the number and quality of proposals as well as the diversity of the proposers, the Foundation provides outreach initiatives, viz., *NSF Days*, in which

representatives from the directorates and major program offices hold workshops on the campuses of majority and minority serving colleges and universities. These workshops focus on NSF's funding opportunities, the merit review process, and grant writing. Anecdotal feedback indicates that the workshops provide a useful service to the academic community and especially to new PIs or PIs who have not submitted proposals to the Foundation. But, given the above mixed results in proposal submissions from underrepresented minority PIs, it is hard to say whether the *NSF Days* outreach efforts are having any impact on prospective or current minority PIs seeking NSF funding—especially, Hawaiian Native, Pacific Islander, Native American, and African American PIs, as well as PIs with disabilities, whose proposal numbers show negative or no significant growth over time.

Table 2-2
Characteristics of Principal Investigators (PIs) Who Submitted Proposals to NSF: FY 2004 2010

PI Characteristics	2004	2005	2006	2007	2008	2009	2010
Total PIs*	41,727	39,722	39,992	41,847	41,511	41,818	n/a
Male	79.8% *(33,300)*	79.2% *(31,456)*	78.7% *(31,482)*	78.0% *(32,650)*	77.3% *(32,074)*	76.7% *(32,091)*	n/a
Female	20.2% *(8,427)*	20.8% *(8,266)*	21.3% *(8,510)*	22.0% *(9,197)*	22.7% *(9,437)*	23.3% *(9,727)*	n/a
American Indian/ Native Alaskan	0.2% *(93)*	0.2% *(94)*	0.2% *(93)*	0.2% *(80)*	0.2% *(82)*	0.2% *(77)*	n/a
African American	2.2% *(900)*	2.0% *(813)*	2.2% *(881)*	2.4% *(992)*	2.3% *(965)*	2.4% *(1,005)*	n/a
Hispanic/Latino	3.4% *(1,432)*	3.6% *(1,436)*	3.7% *(1,483)*	3.8% *(1,591)*	3.8% *(1,590)*	4.1% *(1,726)*	n/a
Hawaiian Native/ Pacific Islander	0.1% *(47)*	0.05% *(21)*	0.06% *(25)*	0.06% *(24)*	0.07% *(30)*	0.05% *(21)*	n/a
White	72.5% *(30,251)*	73.4% *(28,752)*	71.6% *(28,645)*	70.1% *(29,318)*	69.5% *(28,842)*	68.2% *(28,525)*	n/a
Asian	18.3% *(7,618)*	18.3% *(7,253)*	19.6% *(7,821)*	20.6% *(8,622)*	21.3% *(8,847)*	22.5% *(9,396)*	n/a
Persons with Disabilities	1.3% *(525)*	1.1% *(454)*	1.1% *(434)*	1.1% *(448)*	1.1% *(448)*	1.1% *(470)*	n/a

Source: Competitively Reviewed Proposals, Awards and Funding Rates by PI Characteristics. NSF Enterprise Information System 10/02/09.
**Total figures include persons unidentified by gender and race/ethnicity.*

A recent study commissioned by the Bayer Corporation found that a major disincentive to pursuing STEM education and a career as a scientist or engineer is the lack of encouragement and nurturing received early on in the lives of women and underrepresented minorities, coupled with pervasive gender and racial/ethnic biases encountered in the school (including college) and work settings.[3] While the study was based on interviews with chemists and chemical engineers, the findings were viewed as having, at least, some relevance for other disciplines, especially those with relatively few women and minorities. The absence of early and sustained encouragement and persistent bias may be contributing factors to the low numbers of minorities pursuing a STEM career and even to the low number of minority PIs. This may represent a formidable challenge to NSF's outreach efforts to increase the number of minority PIs who submit proposals to the Foundation. NSF may wish to consider strengthening some relevant programs within the research directorates or in Education and Human Resources, or collaborating with the Department of Education and other agencies, to work toward remedying the situation.

AWARDS AND RATES

Of the 45,181 proposal decisions rendered by the Foundation in FY 2009, 32 percent resulted in awards. The total number of proposals included 6,869 proposals that were financed by the American Recovery and Reinvestment Act funding program. Excluding these ARRA-funded proposals, the Foundation's FY 2009 total award rate would have been 20 percent. Of the 55,562 proposal decisions made in FY 2010, 23 percent resulted in awards; excluding the ARRA-funded proposals, the award rate for FY 2010 would have been 21 percent. Since 2004, the average total annual award rate has been 25.7 percent, ranging from a low of 24 percent in FY 2004 to a high of 32 percent in FY 2009.

Changes in annual award rates varied across the underrepresented groups between FY 2004 and 2009. For female PIs, their annual award rates remained higher than or equal to the annual rates for all PIs. The average annual award rate for female PIs during FY 2004 and 2009 was 27.3, ranging from 25 in FY 2004 to 34 percent in FY 2009. The other two underrepresented groups did not fare as well. Underrepresented minority PIs had an average annual award rate of 24.8 percent, ranging from a rate of 23 in FY 2004 to 30 percent in FY 2009; and PIs with disabilities had an average annual award rate of 24.7 percent, ranging from a rate of 21 in FY 2005 to 32 percent in FY 2009.

DISAGGREGATED ANALYSIS OF PI RACE AND GENDER

As can be seen in Table 2-3, white male PIs, by far, received the largest share of NSF grant awards, followed by white female PIs and Asian American male PIs. American Indian/Alaska Native, Hawaiian Native/Pacific Islander, Hispanic/Latina, and African American female PIs accounted for less than 1.5 percent of all NSF's award recipients. The relative absence of women of color among NSF-supported researchers was underscored by the CEOSE-sponsored mini-symposium in 2009 on the plight of women of color in STEM.

MEDIAN AMOUNT OF PI AWARDS

The median size award for PIs rose from $280,632 in FY 2007 to $300,000 in FY 2010. Almost 75 percent of white male and female PIs have consistently received awards at or above the median, compared with 5 or less than 5 percent of male and female underrepresented minority PIs. African American and Hispanic female PIs tend to receive slightly more awards at or above the median award amount than their male counterparts. By contrast and although they are not an underrepresented minority, Asian American PI males received a higher proportion of awards at or above the median than American Asian female PIs. American Indian/Alaska Native and Hawaiian Native/Pacific Islander PIs received the least number of awards at or above the median. Their numbers between male and female PIs are very small. See Table 2-4 for median award rates for all groups.

IMPACT OF ARRA FUNDING ON PI AWARDS

How much of an impact did the special American Recovery and Reinvestment Act funding have on increasing the number of NSF awards received by the underrepresented groups in 2009? Under the economic stimulus funding, female PIs received an additional 1,050 awards and males, an additional 3,268; and underrepresented minority PIs received 240 awards that they would not have otherwise received. PIs with disabilities received 44 awards as a consequence of the ARRA funding opportunity.[4]

NSF FUNDING OF BROADENING PARTICIPATION PROGRAMS

The National Science Foundation has a portfolio of programs that supports efforts to increase participation of underrepresented groups in STEM education, and career development and advancement. The programs are categorized into four basic groups: (1) *Focused* programs, which have an explicit broadening participation program goal, and for which the majority of each award's budget goes to broadening participation activities (e.g., recruitment, education, training, hands-on research experiences, and mentoring for women, underrepresented minorities, or persons with disabilities).

Next are *Emphasis* programs, which have a component(s) of broadening participation integrated into the overall program activities. Projects in this group address diversity in addition to the intellectual merit and broader impacts criteria. The third group, *Potential* programs, has an eligibility criterion or other design feature that indicates a high likelihood that the project will contribute to broadening participation, e.g., efforts to augment core programs to address identified broadening participation challenges.[5] The last group consists of *Other* programs, which address broadening participation in a variety of ways.

Table 2-3

Principal Investigator (PI) Awards by Gender and Race/Ethnicity Groups: FY 2004 2010

Year (Total PI awards)	African Amer.	Amer. Indian/ Alaska Native	Asian Amer.	Native Hawaiian/ Pacific Isl.	Hispanic/ Latino	White	Multi-racial
2004 (9,430)*	1.4%	0.1%	11.8%	0.01%	2.6%	62.5%	0.6%
Men	*(136)*	*(9)*	*(1,110)*	*(1)*	*(243)*	*(5,895)*	*(55)*
Women	0.8%	0.1%	2.1%	0	0.9%	17.0%	0.1%
	(79)	*(8)*	*(194)*		*(90)*	*(1,597)*	*(13)*
2005 (9,133)*	1.4%	0.1%	11.2%	0.03%	2.5%	61.4%	0.6%
Men	*(125)*	*(11)*	*(1,027)*	*(3)*	*(228)*	*(5,609)*	*(58)*
Women	0.7%	0.1%	2.4%	0.01%	1.1%	18.1%	0.3%
	(60)	*(13)*	*(216)*	*(1)*	*(100)*	*(1,655)*	*(27)*
2006 (9,697)*	1.3%	0.1%	13.0%	0.1%	2.8%	60.0%	0.5%
Men	*(131)*	*(15)*	*(1,254)*	*(8)*	*(276)*	*(5,819)*	*(47)*
Women	0.7%	0.1%	2.6%		1.0%	17.4%	0.2%
	(73)	*(14)*	*(250)*	0	*(99)*	*(1,692)*	*(19)*
2007 (10,574)*	1.4%	0.2%	13.6%	0.03%	2.9%	58.7%	0.4%
Men	*(151)*	*(17)*	*(1,437)*	*(3)*	*(305)*	*(6,207)*	*(48)*
Women	0.7%	0.1%	3.0%	0.01%	1.1%	17.6%	0.2%
	(80)	*(10)*	*(317)*	*(1)*	*(114)*	*(1,859)*	*(25)*
2008 (10,177)*	1.5%	0.1%	14.0%	0.05%	2.6%	57.2%	0.5%
Men	*(151)*	*(8)*	*(1,415)*	*(5)*	*(265)*	*(5,824)*	*(50)*
Women	0.8%	0.1%	3.2%	0.02%	1.1%	18.7%	0.2%
	(84)	*(11)*	*(327)*	*(2)*	*(112)*	*(1,901)*	*(22)*
2009 (14,755)*	1.4%		11.7%	0.05%	3.0%	58.2%	0.6%
Men	*(206)*	0	*(1,729)*	*(7)*	*(449)*	*(8,590)*	*(86)*
Women	0.9%		3.6%	0.02%	1.2%	19.1%	0.2%
	(129)	0	*(525)*	*(3)*	*(175)*	*(2,822)*	*(34)*
2009 ARRA **	1.0%		11.4%	0.02%	2.7%	60.5%	0.5%
(4,499)	*(44)*	0	*(511)*	*(1)*	*(124)*	*(2,723)*	*(22)*
Men							
Women	0.5%		3.7%		0.9%	18.6%	0.2%
	(22)	0	*(166)*	0	*(40)*	*(839)*	*(7)*
2010 (11,578)*	1.4%	0.1%	14.4%	0.06%	2.8%	56.1%	0.5%
Men	*(161)*	*(9)*	*(1,663)*	*(7)*	*(322)*	*(6,491)*	*(65)*
Women	0.8%	0.1%	3.4%	0.01%	1.2%	18.9%	0.3%
	(96)	*(12)*	*(389)*	*(1)*	*(141)*	*(2,185)*	*(36)*

**Total PI awards for FY 2004 = 10,270 (840 PIs with missing data); FY 2005 = 9,742 (609 PIs with missing data); FY 2006 = 10,450 (753 PIs with missing data); FY 2007 = 11,010 (4,360 PIs with missing data); FY 2008 = 10,186 (9 PIs with missing data); FY 2009 = 16,324 (1,569 PIs with missing data); and FY 2010 = 13,015 (1,437 PIs with missing data).*

*** Total PI awards under FY 2009 American Recovery and Reinvestment Act = 4,941 (442 PIs with missing data).*

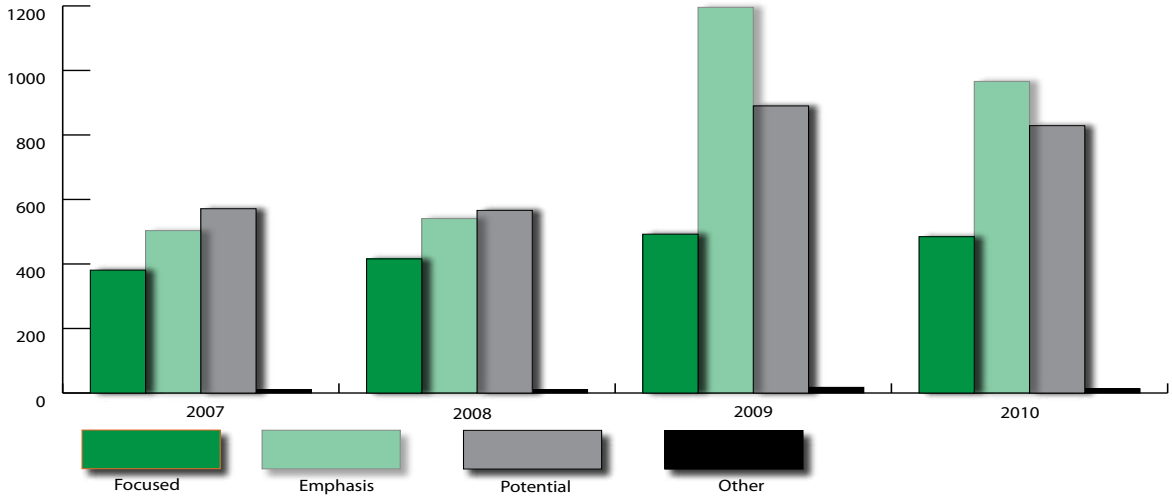
CEOSE is not in full accord with the "Broadening Participation" classification of programs devised by NSF in its *Broadening Participation at the National Science Foundation: A Framework for Action*, because it deviates from the Congressional charge of this committee and what NSF should be focusing on, which is the underrepresentation in STEM of women, minorities, and persons with disabilities. Euphemistic terms like "broadening participation" and "diversity" are sometimes taken at face value and deviate the discussion from the issue. We, therefore, use the current classification scheme in the following analysis for illustrative purposes because incongruities are readily apparent, and the Committee will be taking the matter up with NSF in the coming year.

In keeping with NSF's commitment to facilitate increases in the education and employment of women, underrepresented minorities, and persons with disabilities in STEM, funding for the Foundation's broadening participation program portfolio continued to grow annually from FY 2007 to FY 2010. This held true including or excluding the ARRA funds. Funding for the entire portfolio grew by 56 percent between FY 2007 and FY 2010–from $1,465.24 million to $2,292.51 million. As can be viewed in Table 2-5, the program categories showing the greatest percentage increase in funding between FY 2007 and FY 2010 were *Emphasis* (92 percent), *Potential* (45 percent), and *Other* programs (35 percent). For reasons not clear to the Committee, *Focused* programs, which have the greatest concentration of broadening participation activities, received the smallest increase in their budgets by comparison, i.e., 27 percent.

IMPACT OF ARRA FUNDING ON BROADENING PARTICIPATION PROGRAMS

As a leading funding agency for the sciences and engineering, the National Science Foundation was allocated $3 billion dollars in ARRA funds to invest in critical areas of research and innovation. In a speech to employees, the Director of NSF said that the Foundation's portion of the ARRA was *"...sorely needed to ensure that America remains a leader in science and engineering research and education. That investment of $3 billion will have an immediate impact on investigators, post docs, graduate and undergraduate students, and teachers throughout the nation."*[6]

Figure 2-1
Broadening Participation Program Funding: FY 2007-2010 (in millions)



Data source: NSF Division of the Budget. See narrative above for definitions of Focused, Emphasis, Potential and Other Program categories.

A large proportion of the $3 billion was used to fund highly promising projects that could not be launched in FY 2008 or FY 2009 due to lack of funds.

Programs in the broadening participation portfolio received 22 percent of the total ARRA funds in FY 2009. In the *Focused* portfolio group, a total of $67.49 million in ARRA funding went to the following programs: Experimental Program to Stimulate Competitive Research ($30 million), Partnerships for Research and Education in Materials ($9.60 million), Opportunities for Enhancing Diversity in the Geosciences ($6.96

Table 2-4

Percent of Gender/Race Groups Who Received NSF Principal Investigator (PI) Awards above the Median Amount for FY 2007 to 2010

	2007*		2008*		2009*		2010*	
Median Award	$280,632		$275,000		$300,000		$300,000	
	Male	Female	Male	Female	Male	Female	Male	Female
African Amer.	1.4% *(64)*	0.9% *(39)*	1.4% *(71)*	0.7% *(34)*	1.2% *(93)*	0.8% *(63)*	1.2% *(63)*	0.6% *(33)*
Amer. Indian/ Alaska Native	0.1% *(4)*	0.1% *(5)*	0.06% *(3)*	0.1% *(5)*	0	0	0.1% *(4)*	0.1% *(4)*
Asian Amer.	12.5% *(563)*	2.6% *(118)*	12.0% *(607)*	2.6% *(134)*	12.0 % *(898)*	3.4% *(257)*	15.0% *(787)*	3.1% *(163)*
Hawaiian/ Pacific Isl.	0.04% *(2)*	0.02% (1)	0.02% *(1)*	0.04% *(2)*	0.04% *(3)*	0	0.04% *(2)*	0.02% *(1)*
Hispanic	3.1% *(142)*	1.0% *(44)*	2.5% *(126)*	0.8% *(42)*	3.3% *(248)*	1.3% *(95)*	2.8% *(147)*	1.0% *(53)*
White	59.0% *(2,658)*	17.4% *(785)*	51.0% *(2,595)*	15.5% *(790)*	57.8% *(4,319)*	19.3% *(1,439)*	56.0% *(2,932)*	17.5% *(914)*
Multi-racial	0.4% *(20)*	0.2% *(9)*	0.5% *(24)*	0.1% *(4)*	0.5% *(41)*	0.2% *(16)*	0.5% *(27)*	0.3% *(17)*

**Total PI-awards above median in FY 2007 = 4,502 (missing data = 271); in FY 2008 = 5,099 (missing data = 305); in FY 2009 = 7,472 (missing data = 1,507); and FY 2010 =5,234 (missing data = 419).*

million), Network for Earthquake Engineering Simulation Research ($5.83 million), Centers of Research Excellence in Science and Technology ($5 million), BIO Minority Post-docs ($3 million), Broadening Participation Research Initiation Grants in Engineering ($2 million), Partnerships in Astronomy and Astrophysics Research and Education ($1.89 million), Undergraduate Research and Mentoring in Biological Sciences ($1.68 million), ADVANCE ($1 million), and Geoscience Education Program ($0.53 million).

Programs in the *Emphasis* portfolio group received ARRA funding for the National Nanotechnology Initiative ($101.20 million), Robert Noyce Scholarship ($60 million), Research Experiences for Undergraduates ($26 million), Chemistry Research Instrumentation and Facilities ($14.73 million), Integrative Graduate Education and Research Traineeship ($14.22 million), Enhancing the Mathematical Sciences Workforce in the 21st Century ($12.69 million), American Competitiveness in Chemistry Fellowship ($2.40 million), for a total of $231.24 million.

Programs in the *Potential* broadening participation portfolio group that received ARRA funding included: the MRI Instrumentation ($99.85 million), International Polar Year ($83.50 million), Graduate Research Fellowship ($46.94 million), Math and Science Partnership ($25 million), Research in Undergraduate Institutions ($12.33 million), Developing Global Scientists and Engineers ($2.98 million), and Graduate STEM Fellows in K-12 Education ($2.50 million), for a total of $273.10 million. Finally, the Graduate Research Fellowship for Women in Engineering and Computer Science, included by NSF in the *Other* program category, received $6.89 million in ARRA funding.

DIVERSITY AMONG THE RANKS OF SCIENTISTS AND ENGINEERS AT NSF

During the 2009-2010 biennium, CEOSE studied the extent to which broadening participation is reflected among the ranks of scientists and engineers at all levels of the Foundation's grant-making process: grant policy, proposal review, approval, and post-award assessment. The study looked at the membership composition of: (a) the National Science Board, which sets grant-making policy for the Foundation; (b) permanent staff scientists and engineers who promote and solicit proposals, provide technical assistance to grantees, and monitor grants; (c) program officers, who review grant proposals and recommend funding; (d) grant proposal

Table 2-5
Funding NSF Broadening Participation Program Portfolio: FY 2007 2010 (in millions)

Program Category	FY 2007 Total	FY 2008 Total	FY 2009 Omnibus	FY 2009 ARRA	FY 2009 Total	FY 2010 Estimated
Focused	$380.95	$415.62	$424.97	$67.49	$492.46	$484.50
Emphasis	$503.33	$540.68	$964.54	$231.24	$1,195.78	$966.12
Potential	$571.22	$566.23	$616.84	$273.10	$889.94	$828.74
Other	$9.74	$10.64	$10.77	$6.89	$17.66	$13.15
All	$1,465.24	$1,533.17	$2,017.12	$578.72	$2,595.84	$2,292.51

reviewers; (e) advisory committees, who advise directorates, program offices, and other sectors of NSF on various programmatic and operational matters; and (f) Committees of Visitors, who evaluate funded programs and projects.

NATIONAL SCIENCE BOARD

Since 2007, members of the National Science Board (NSB) have been predominantly white males. With an annual average total of 23 members, of which females have consistently made up 30 percent (or 7), African Americans 4.3 percent (or 1), and Hispanics, 8.7 percent (or 2). During FY 2009 and 2010, there were no African American board members and only 1 Hispanic member. Data on members with disabilities were not available. All National Science Board members are appointed by the President of the United States of America.

PERMANENT STAFF SCIENTISTS AND ENGINEERS AT NSF

Positive and substantial change in the number of underrepresented groups within the science and engineering workforce is a major indicator of successful broadening participation. Unfortunately, substantial increase in the diversity of NSF's permanent staff of scientists and engineers has yet to take place. In FY 2003, CEOSE reported that women made up 39.5 percent of NSF's permanent staff scientists and engineers, underrepresented minorities, 10.0 percent, and persons with disabilities, 9.1 percent.[7] Seven years later, the situation for women and minorities improved only marginally. In FY 2010, women made up 41.7 percent, and underrepresented minorities 11.0 percent of the Foundation's permanent staff scientists and engineers. The proportion of persons with disabilities dropped to 8.3 percent in FY 2010.

Between FY 2004 and FY 2010, the total number of permanent staff scientists and engineers at NSF increased by 29, from 463 to 492. (see Table 2-6). Total annual S&E staff fluctuated significantly during this period. There was a net increase of 18 women scientists and engineers. The total number of underrepresented minorities increased by 5. (African Americans increased by 3, Hispanics by 3, and American Indians decreased by 1).

The number of permanent staff scientists and engineers with disabilities at NSF ranged from 33 in FY 2004 to 41 in FY 2010, with an annual average of 39 across the 7-year period.

The race and gender disaggregation analysis presented in Table 2.6 shows a consistent pattern of white males being the dominant demographic group among the Foundation's permanent staff of scientists and engineers. White males constituted approximately one-half of all S&E staff from FY 2004 to 2010. During this period, there was no significant growth in the numbers of minority male or female scientists or engineers. None of the three underrepresented minority groups reported in Table 2.6, African American, Hispanic/Latino, or American Indian, accounted for more than 5 percent of NSF's total S&E permanent staff at any point between 2004 and 2010.

NSF VERSUS U.S. STEM WORKFORCE

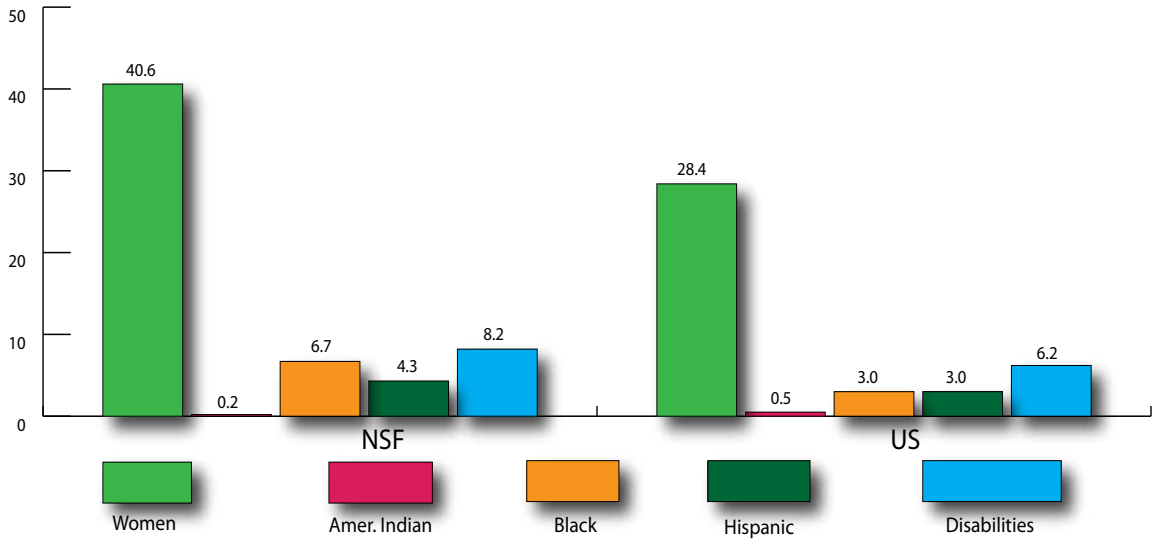
Although growth in the number of underrepresented permanent staff scientists and engineers at the Foundation has been marginal over the last seven years, the NSF's level of gender, racial and disability diversity is much higher than in the country's general STEM workforce.

Table 2-6
Gender and Racial/Ethnicity Diversity of NSF's Scientists and Engineers: FY 2004 2010

Year	Total S&E Staff	African American		American Indian/ Alaskan Native		Asian American		Hispanic / Latino		White	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2004	463	2.6% *(12)*	3.7% *(17)*	0.4% *(2)*	0	5.4% *(25)*	3.0% *(14)*	2.4% *(11)*	1.9% *(9)*	49.0% *(226)*	32.0% *(149)*
2005	448	2.5% *(11)*	4.2% *(19)*	0.2% *(1)*	0	4.0% *(18)*	2.7% *(12)*	2.5% *(11)*	1.8% *(8)*	50.0% *(224)*	32.1% *(144)*
2006	473	2.7% *(13)*	4.2% *(20)*	0.2% *(1)*	*0*	6.1% *(29)*	2.5% *(12)*	1.9% *(9)*	1.9% *(9)*	50.5% *(239)*	29.8% *(141)*
2007	458	2.6% *(12)*	4.6% *(21)*	0.2% *(1)*	*0*	5.2% *(24)*	3.1% *(14)*	1.7% *(8)*	2.2% *(10)*	50.2% *(230)*	30.1% *(138)*
2008	469	1.7% *(8)*	4.9% *(23)*	0.2% *(1)*	0.2% *(1)*	5.3% *(25)*	3.4% *(16)*	2.1% *(10)*	1.9% *(9)*	49.7% *(233)*	30.4 *(143)*
2009	510	2.2% *(11)*	4.5% *(23)*	0.2% *(1)*	*0*	4.7% *(24)*	3.7% *(19)*	2.3% *(12)*	1.9% *(10)*	50.0% *(255)*	30.4% *(155)*
2010	492	2.2% *(11)*	4.3% *(21)*	0.2% *(1)*	0	4.9% *(24)*	3.8% *(19)*	2.0% *(10)*	2.2% *(11)*	49.0% *(241)*	31.3% *(154)*

Source: NSF Division of Human Resource Management. Includes permanent staff only.

Figure 2-2
Percent of Underrepresented Scientists and Engineers within NSF Versus the Total U.S. STEM Workforce



Source: NSF's Division of Human Resource Management; and U.S. data obtained from "Women, Minorities and Persons with Disabilities in Science and Engineering," 2011, Tables 9.5, 9.6, and 9.8.

As shown in Figure 2-2, there are far more women S&Es at NSF than in the national STEM workforce, a higher percentage of African Americans (Blacks), a higher percentage of Hispanics, and a higher percentage of S&Es with disabilities. While there are less than 1 percent of American Indian S&Es at NSF, there is a slightly greater percentage of American Indian S&Es in the general STEM workforce.

DIVERSITY WITHIN NSF'S DIRECTORATES

Women

In FY 2010, the Education and Human Resources (EHR), Social, Behavioral, and Economic Sciences (SBE), Engineering (ENG), and Geosciences (GEO) directorates employed the largest number of women scientists and engineers on permanent staff: 37, 30, 25 and 25, respectively. The smallest number of women (12) was employed in the Office of Polar Programs (OPP). Between FY 2004 and FY 2010, the net change in the number of women scientists and engineers (S&E) in the directorates varied greatly (see Table 2-7). For example, CISE's total S&Es decreased by 1, but the number of women S&Es increased by 2; in EHR, total S&Es increased by 5 but the number of women remained unchanged at 37; in GEO, total S&Es grew by 23 and women, by 10; and in SBE, total S&Es declined by 53 and women declined by 13.

MINORITIES

In comparison to women, there were far fewer underrepresented minority scientists and engineers on permanent staff within NSF's directorates during the FY 2004-2010 period. For each fiscal year, underrepresented minorities constituted 10 percent of all S&E permanent staff. EHR employed by far the largest number of minority S&Es on permanent staff. Minority S&Es and engineers have been particularly underrepresented in the BIO, CISE and GEO directorates, and in OPP (see Table 2-8). The largest numbers of African American, Hispanic, and American Indian S&Es were employed in the EHR and ENG directorates. This pattern was relatively stable over the seven-year period from FY 2004 to FY 2010. When the trend in directorate minority S&Es was compared with the total permanent S&E staff growth between FY 2004 and FY 2010, no direct relationships were found. There was substantial variation in the data. For example, in BIO total S&Es increased by 6 and minority S&Es remained unchanged at 1; EHR's total S&E staff grew by 21 and minority S&Es by 5; OPP's total S&Es declined by 1 and minority S&Es increased by 2; ENG's total S&E staff dropped by 7 and minority S&Es decreased by 1; and SBE's total S&Es decreased by 23 and minority S&Es decreased by 1.

Table 2-7

Gender Diversity of NSF Scientists and Engineers by Directorate and Program Office: FY 2004 2010

FISCAL YEAR	BIO	CISE	EHR	ENG	GEO	MPS	OPP	SBE	Total
2004: Women	18	13	37	15	15	28	23	43	192
Men	26	19	32	43	29	54	22	43	268
2005: Women	20	15	40	11	18	22	23	26	175
Men	21	14	35	41	28	54	21	32	246
2006: Women	16	15	41	13	21	19	21	25	171
Men	27	12	35	43	31	65	23	40	276
2007: Women	19	16	33	13	19	20	23	29	172
Men	27	11	30	38	30	69	21	35	261
2008: Women	21	15	38	14	20	18	23	33	182
Men	28	13	34	35	33	66	21	33	263
2009: Women	17	15	45	21	20	19	25	31	193
Men	37	15	45	39	34	66	20	30	286
2010: Women	24	15	37	18	25	18	12	30	179
Men	26	16	37	33	42	67	11	33	265

Source: NSF's Division of Human Resource Management. Employee counts include only permanent staff.

PERSONS WITH DISABILITIES

In FY 2010, the largest number of scientists and engineers on permanent staff with disabilities were employed in EHR and MPS: 12 and 9, respectively. OPP had none. Across directorates, the total number of scientists

Table 2-8

Number of Underrepresented Minority Scientists and Engineers at NSF by Directorate and Program Office: FY 2004 2010

Directorate/ Program Office	*2004 (Total S&E 463)*	*2005 (Total S&E 448)*	*2006 (Total S&E 473)*	*2007 (Total S&E 458)*	*2008 (Total S&E 469)*	*2009 (Total S&E 510)*	*2010 (Total S&E 492)*
BIO	***1***	***2***	***0***	***2***	***4***	***3***	***1***
CISE	***3***	***1***	***1***	***1***	***1***	***2***	***2***
EHR	***19***	***21***	***20***	***17***	***19***	***22***	***20***
ENG	***8***	***6***	***6***	***8***	***7***	***8***	***7***
GEO	***3***	***4***	***5***	***5***	***4***	***3***	***3***
MPS	***6***	***6***	***6***	***7***	***6***	***7***	***8***
OPP	***0***	***0***	***1***	***1***	***2***	***2***	***2***
SBE	***7***	***6***	***8***	***5***	***4***	***5***	***6***
Total	47 (10.1%)	*46 (10.3%)*	*47 (10.0%)*	*46 (10.0%)*	*47 (10.0%)*	*52 (10.0%)*	*49 (10%)*

Source: NSF Division of Human Resource Management. Employee counts include only permanent staff. Underrepresented groups include African American, American Indian/Alaska Native, Hispanic, and Native Hawaiian/Pacific Islander.

and engineers with disabilities changed by 8, from 33 in FY 2004 to 41 in FY 2010. Although the numbers are small, the greatest increase in permanent staff scientists and engineers with disabilities occurred in the EHR and MPS directorates, each by 4. That there were no S&Es with disabilities in OPP between FY 2004 and FY 2010 may be related to the physical challenges called for by the requisite field research.

The reader is cautioned to view the disability data presented in Table 2-9 as suggestive, at best, due to pervasive underreporting problems. Also, it is not clear whether an individual reported a disability in one and not the other years. Improved data collection is required for this underrepresented group in STEM.

Table 2-9

Number of NSF's Scientists and Engineers with Disabilities by Directorate and Year: FY 2004 2010

Directorate/ Program Office	2004	2005	2006	2007	2008	2009	2010
BIO	2	2	2	3	4	2	2
CISE	3	4	3	4	3	4	5
EHR	5	8	8	6	9	9	9
ENG	4	4	3	5	5	6	5
GEO	4	4	4	4	4	5	5
MPS	8	10	11	10	10	10	12
OPP	0	0	0	0	0	0	0
SBE	7	6	7	6	6	6	3
Total	33	38	38	38	41	42	41

Source: NSF's Division of Human Resource Management. Data include only permanent staff.

NSF PROGRAM OFFICERS

Program officers are themselves scientists and engineers, and are experts in given areas. Within the context of the Foundation's merit review process, program officers are key decision-makers. They receive and review all incoming proposals; assign them to reviewers or a panel of reviewers; synthesize the comments of the reviewers; and make a recommendation as to whether a proposal should be approved for funding or declined, based on external reviews, panel discussions, and other factors such as portfolio balance and amount of available funding. Program officer recommendations are then reviewed and acted upon by the division director or other appropriate NSF official.

In response to the growing volume of proposals received by NSF over the years, the number of program officers has grown. For instance, between October 2001 and October 2009, the total number of program officers increased from 377 to 525. The number of women program officers increased from 136 to 210. Minority program officers increased from 72 to 121 during this same period, while non-Hispanic white program officers also grew from 205 to 404.[8]

NSF PROPOSAL REVIEWERS

Commensurate with the increase in the number of proposals received by the Foundation was an increase in the number of proposal reviewers. Between FY 2007 and FY 2010, the number of reviewers grew by 9 percent.

CEOSE found that the number of women, African Americans, Hispanics, and Native Americans among NSF reviewers increased only marginally between FY 2007 and FY 2010. But as can be seen in Table 2-10, the magnitude of "unknown" data seriously limited any definitive conclusions from this assessment. Approximately two-thirds of the reviewers failed to report their gender; and almost three-quarters did not report their race, ethnicity, or disability status.

ADVISORY COMMITTEES

During FY 2009 and FY 2010, a total of 15 and 14 advisory committees, respectively, met with S&E staff members of the Foundation's directorates and major program offices. The purpose of these meetings was to discuss missions and goals; review impacts of research and education programs; advise on priority research areas, institutional policy, and strategies for improving quality of postsecondary education in the S&E disciplines; and review program evaluation findings. A list of the individual advisory committees, including CEOSE, Government Performance and Results Act (GPRA) and Business and Operations (B&O) committees is included in Appendix A.

Of the three underrepresented groups, women were better represented on advisory committees than minorities and persons with disabilities (Table 2-11). The SBE, EHR and MPS directorates, CEOSE; GPRA and B&O committees; and ERE division had the greatest numbers of women on their advisory committees. ENG and OPP have the fewest numbers of women on their committees. The largest numbers of minorities were represented on advisory committees for EHR, CEOSE, GPRA, and ENG. Those entities with the fewest numbers of minorities on the advisory committees were OPP, CISE, B&O, and SBE. None of the advisory committees had more than 1 person with a disability, and approximately one-half had no persons with disabilities. An overwhelming majority of advisory committee members (71 percent) were on faculty at major research institutions. The remaining members were from minority serving institutions (5 percent); community colleges (3 percent); and other government agencies; academic, research and advocacy organizations; and professional STEM societies (21 percent).

COMMITTEES OF VISITORS

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. A Committee of Visitors (COV) typically reviews funded research and education programs every three years and assesses how a program was implemented given the proposed goals and objectives, specific requirements set by the Foundation for the program, and contributions made by the program to the Foundation's overall strategic goals.

The COVs reviewed 27 different programs in the Foundation's research and education directorates and major program offices during FY 2009 and FY 2010.

Similar to the pattern among the advisory committees, women were better represented among the members of the COVs than minorities and persons with disabilities

Table 2-10
Demographic Diversity of NSF Proposal Reviewers: FY 2007 2010

	2007	2008	2009	2010
Total	41,881	41,427	41,552	45,661
Male	23.0% *(9,653)*	23.0% *(9,538)*	23.1% *(9,613)*	23.3% *(10,630)*
Female	9.6% *(4,016)*	9.7% *(4,032)*	10.0% *(4,169)*	10.5% *(4,813)*
Unknown	67.4% *(28,212)*	67.2% *(27,857)*	66.8% *(27,770)*	66.2% *(30,218)*
African Amer.	0.9% *(364)*	0.9% *(383)*	0.9% *(381)*	0.9% *(428)*
Asian	3.4% *(1,422)*	3.5% *(1,447)*	3.7% *(1,557)*	3.9% *(1,789)*
Hispanic/ Latino	1.9% *(782)*	1.8% *(761)*	1.9% *(801)*	2.0% *(937)*
Native Amer.*	0.1% (36)	0.1% *(32)*	0.1% *(40)*	0.1% *(41)*
Native Hawaiian	0.01% *(6)*	0.01% *(5)*	0.02% *(7)*	0.01% *(3)*
White	20.0% *(8,362)*	20.0% *(8,299)*	20.2% *(8,404)*	20.7% *(9,474)*
Multiracial	0.2% *(68)*	0.2% *(79)*	0.2% *(71)*	0.2% *(92)*
Unknown	73.6% *(30,841)*	73.4% *(30,421)*	73.0% *(30,291)*	72.0% *(32,897)*
Disability: Yes	0.7% *(309)*	0.6% *(267)*	0.6% *(265)*	0.7% *(306)*
Disability: No	24.5% *(10,243)*	25.0% *(10,273)*	25.3% *(10,501)*	25.8% *(11,801)*
Unknown	74.8% *(31,329)*	74.6% *(30,887)*	74.1% *(30,786)*	73.5% *(33,554)*

**Includes American Indian and Alaska Natives.*

(Table 2-12). Appendix A contains more detailed data, by individual directorate and program office.

Persons with disabilities made up less than 2 percent of COV members in FY 2009 and none in FY 2010. One of the recommendations that emerged from the 2007 CEOSE mini-symposium on organizations that serve persons with disabilities was for NSF and other organizations to increase the input of disabled persons in the development of technologies and programs that can affect the success of persons with disabilities in STEM. The virtual "invisibility" of this underrepresented group is clearly reflected in their small numbers among both on NSF advisory committees and Committees of Visitors.

The types of institutions from which members of COVs are recruited are similar to those for the advisory committees. Approximately three-quarters come from major research institutions, 2.5 percent from minority serving institutions, 2 percent from community colleges, and about 17 percent from other organizations, including other government agencies.

IMPLICATIONS OF NSF WORKFORCE DATA

Although the National Science Foundation has done

a better job at demographic diversification in its S&E workforce compared with the country's overall S&E workforce, the Foundation cannot rest on this achievement alone. The present data clearly show that the numbers of underrepresented minorities and persons with disabilities, in particular, have only increased marginally among NSF's permanent staff scientists and engineers since 2003, and that white men continue to far outnumber other demographic groups in the Foundation's staff of S&Es, as well as among key decision-makers in NSF's grant-making process (e.g., National Science Board members, NSF program officers, and advisory committee members).

Along with being a leader in advocating for broadening participation in STEM, the Foundation needs to also lead by example through increased demographic diversity among its own staff of scientists, technologists, engineers, and mathematicians. While it attempts to broaden participation among staff through recruitment of temporary or rotating STEM professionals from other agencies, NSF would exemplify even greater commitment to broadening participation by expanding the number of permanent staff from underrepresented groups−especially underrepresented minorities and persons with disabilities.

Greater and sustained NSF efforts are needed to increase the number of women, African American, Hispanic/Latino, American Indian, Alaska Native, Native Hawaiian, and Pacific Islander scientists and engineers, as well as those with disabilities, within all sectors of the Foundation's immediate community (i.e., S&E staff, reviewers, and advisory committees). With demographic diversity comes diversity in perspectives, experiences unique to underrepresented groups, and an appreciation of the challenges faced by underrepresented individuals in seeking a career in STEM and possibly creative strategies for overcoming these challenges.

Table 2-11
Profiles of NSF Advisory Committee Members: FY 2009 2010

2009	2010
Total Committees = 15	Total Committees = 14
Total Members = 274	Total Members = 253
Males = 59% Females = 41%	Males = 62% Females = 38%
URMs = 25% Non-URMs = 75%	URMs = 27% Non-URMs = 73%
Persons with Disabilities = 1.5%	Persons with Disabilities = 1.7%

Source: NSF Directorates and Program Offices. Data for 2010 covered from January to August. URMs refer to underrepresented minorities.

Table 2-12
Profiles of NSF Committees of Visitors: FY 2009 2010

2009	2010
Total Committees = 14	Total Committees = 13
Total Members = 206	Total Members = 239
Males = 62% Females = 38%	Males = 63% Females = 37%
Minorities = 10% Non-Minorities = 90%	Minorities = 10% Non-Minorities = 90%
Persons with Disabilities = 1.5%	Persons with Disabilites = -0%

Source: NSF Directorates and Program Offices. Data for 2010 covered from January to August. URMs refer to underrepresented minorities.

Endnotes

[1]Spencer, David B. and Dawes, Sharon, *Report of the Advisory Committee for GPRA Performance Assessment FY 2009*, National Science Foundation, p. 5.

[2]Data are based on a 2008 survey of 243 active NSF programs (Report in Response to America COMPETES Act: SEC. 7022, NSF April 2008).

[3] Female and Minority Chemists and Chemical Engineers Speak About Diversity and Underrepresentation in STEM, Bayer Facts of Science Education XIV, Bayer Corporation, March 2010.

[4]*Report to the National Science Board on the National Science Foundation's Merit Review Process Fiscal Year 2009*, p. 9, Figure 3: Competitively Reviewed Proposals, Awards and Funding Rates by PI Characteristics, and Appendix 3: Proposals, Awards and Funding Rates by PI Race and Ethnicity, National Science Foundation, May 2010.

[5]*Broadening Participation at the National Science Foundation: A Framework for Action*, National Science Foundation, August 2008, p. 7.

[6]Dr. Arden L. Bement, Jr., Director of the National Science Foundation, speech to Foundation's employees, March 26, 2009.

[7]*Broadening Participation in America's Science and Engineering Workforce. The 1994-2003 Decennial and 2003-2004 Biennial Report to Congress*, National Science Foundation, December FY 2004, p. 42.

[8]*Report to the National Science Board on the National Science Foundation's Merit Review Process Fiscal Year 2009*, National Science Foundation, May 2010, p. 30 and *Report to the National Science Board on the National Science Foundation's Merit Review Process Fiscal Year 2001*, National Science Foundation, May 2002, p. 17.

3 HIGHLIGHTS OF CEOSE ACTIVITIES: 2009-2010

"There are students in every demographic…in the United States with enormous potential to become our future STEM leaders and to define the leading edge of scientific discovery and technological innovation." [1]

Dr. Arden L. Bement, Jr., former NSF Director

Several areas of concern commanded the attention of CEOSE during the 2009-2010 biennium. Among them were:

- The "invisibility" of women of color in STEM and specific challenges faced by girls and women of color in STEM education and employment. A CEOSE mini-symposium on the subject was co-sponsored by NSF, TERC, Inc., the American Chemical Society, and the Association for Women in Science.
- Strengthening ties between CEOSE and the White House Office of Science and Technology Policy, to enhance federal inter-agency collaborations for broadening participation in STEM.
- Concerns of members of CEOSE and others that NSF's proposal to combine three programs—the Louis Stokes Alliances for Minority Participation (LSAMP), Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), and Tribal Colleges and Universities Program (TCUP) — as well as adding a Hispanic Serving Institutions (HSI) program to create one comprehensive program would have a negative impact on effectively serving minority undergraduates and institutions.
- The need to foster the development of the Science of Broadening Participation.

CEOSE MEETINGS

Six regularly scheduled meetings were convened by CEOSE at the National Science Foundation between February 2009 and October 2010. A total of 434 individuals attended these meetings and included NSF staff members; representatives from the White House, Congress, and federal agencies; and representatives from academia, industry, professional societies, and broadening participation advocacy organizations. The 434 participants represented a 44 percent increase over the total number of participants in 2007-2008 CEOSE meetings.

To inform CEOSE about the national status of broadening participation, emerging issues, and progress towards greater diversity in STEM, 35 presenters were invited by the Committee during 2009-2010 to discuss a variety of topics. Highlights of these discussions included the following:

- A problem encountered in tracking the progress of underrepresented groups in STEM is a result of NSF's suppression of small data cells in the Survey of Earned Doctorates (**Dr. Shirley McBay**, Quality Education for Minorities Network).
- Despite decades of programmatic efforts to broaden participation in STEM, the statistics show that little progress has been made in increasing the number of underrepresented persons among scientists and engineers (**Drs. Kellenia Craig-Henderson and Laurel Smith-Doerr**, NSF's SBE Directorate).
- A Diversity and Innovation Caucus in the House of Representatives is in place to engage House members more in initiatives to broaden participation in STEM (**Dr. Joyce E. Purser**, Office of Congresswoman Eddie Bernice Johnson).
- President Obama places great emphasis on diversity in STEM education. CEOSE and the National Science and Technology Council of the White House's Office of Science and Technology Policy should collaborate (**Christyl C. Johnson**, NSTC).
- NSF proposes to create the Comprehensive Broadening Participation of Undergraduates in STEM program, which combines the extant HBCU-UP, TCUP, and the new HSI program (**Dr. Arden L. Bement, Jr.**, former NSF Director). While some favor this newly proposed merger, others see little or no benefit to it, including members of Congress, CEOSE, the White House Initiative on HBCUs, American Indian Higher Education Consortium, Quality Education for Minorities Network, and the Hispanic Association of Colleges and Universities.
- The long-awaited study by the National Academy of Science confirmed the Nation's need to invest more in educating and employing underrepresented groups in STEM. Drs. Wesley L. Harris, Sandra K. Begay-Campbell and Evelynn Hammonds of CEOSE were members of this research committee. (**Drs. Peter H. Henderson and Ernestine Psalmonds**, National Research Council).
- CEOSE's assessment of the lack of demographic diversity among members of the National Science Board and how that may affect NSB decisions regarding broadening participation (**Dr. Marigold Linton**, CEOSE).
- Plans for the developing Science of Broadening Participation at NSF (**Dr. Kellina Craig-Henderson**, SBE).

A complete listing of the 2009-2010 presentations can be found at the CEOSE website: www.nsf.gov/od/oia/activities/ceose/index.jsp, under "Meeting Minutes."

MINI-SYMPOSIUM ON WOMEN OF COLOR IN STEM

On October 27 and 28, 2009, CEOSE hosted a mini-symposium on women of color in science and engineering. The event was co-sponsored by NSF, TERC, Inc., the American Chemical Society, and the Association for Women in Science and chaired by Drs. Maria Ong and Evelynn Hammonds of CEOSE. A total of 113 individuals from government, industry, academia, and nonprofit organizations attended the symposium.

The small number and marginalization of African American, American Indian/Alaska Native, Asian, Hispanic, and Hawaiian Native/Pacific Islander women among the ranks of scientists and engineers was the driving force behind the symposium. Its specific purposes were to (a) provide opportunities for participants to share experiences, (b) advance the current

state of knowledge about the challenges and supports for women of color in STEM fields, (c) unite disparate knowledge about minority women and the programs and institutions with which they interact, and (d) provide suggestions to CEOSE for subsequent recommendations to NSF. The presentations and discussions about the challenges faced by women of color in the STEM pipeline and workplace were eye-opening and informative.

Symposium Participants

Key-note speakers were **Dr. Joan S. Burrelli**, Senior Analyst (Retired, May 2011), NSF National Center for Science and Engineering Statistics and **Attorney Christina M. Tchen**, Director, White House Office of Public Engagement and Executive Director of the Council on Women and Girls.

Panel Discussion Participants

A report on the symposium's events, findings, and suggestions can be obtained from TERC: www.terc.edu.

OTHER KEY CEOSE ACTIVITIES

Spreading the Word

Dr. Mae C. Jemison, the first African American woman astronaut and former member of CEOSE, recently appeared on CNN to discuss the bias women and minorities face in considering and entering STEM fields. She cited two studies by the Bayer Corporation and University Association of Women that found among other things the lack of portrayals of these two groups in the media and publications as scientists and engineers. She noted that while females out-perform males in math and science from grades 4 to 12, they do not view themselves as scientists — due to the lack of role model images. Dr. Jemison also pointed out that females and minority students in particular are not exposed to science and engineering early in their school years, and are consequently unaware of these career options.[2]

Dr. Mae C. Jemison

MOVING THE INTERAGENCY AGENDA AHEAD

Representatives from the Department of Energy's Office of Science, the U.S. Army, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and the White House Initiative on HBCUs attended the CEOSE meetings, updated the Committee on the broadening participation activities at their agencies, and provided invaluable input to the Committee's discussions. To increase participation by other agencies and to garner more support for inter-agency initiatives to broaden participation in STEM, **Dr. Wesley L. Harris**, former CEOSE Chair, urged the Committee to publish J*oining Forces to Broaden Participation in Science and Engineering*, a study of current federal interagency collaboration and strategic recommendations for future collaborations to increase the number of underrepresented individuals in the science and engineering professions. The report is seen as a jumping-off point to begin formalizing various interagency activities, such as holding and organizing interagency meetings, sharing information, integrating

Table 3-1
CEOSE 2007 2008 Recommendations and Outcomes

No.	2007-2008 Recommendation	Outcome as of December 2010
1	NSF should submit to the National Science Board (NSB) a proposal to require that all proposals, under the broader impacts criterion, must address broadening participation.	The NSF Director submitted the proposal to the NSB at its September 2008 meeting. The proposal is being considered by the Task Force on Merit Review Criteria.*
2	NSF should take the lead in proposing a "CEOSE-like" body in other STEM-related federal agencies with advisory responsibilities for broadening participation.	The Acting NSF Director suggested that the idea be directed to OSTP rather than NSF, since OSTP has oversight for all federal STEM-related agencies.*
3	NSF should enhance interactions with selected federal agencies to enable and promote the sharing of ideas and information, particularly best practices, with the objective of increasing access of underrepresented groups to STEM fields.	CEOSE was encouraged by the NSF Director to forge ahead with its interagency agenda to begin information sharing with the support of OSTP.
4	NSF should continue efforts to rapidly increase the number of graduate fellowship awards to persons from underrepresented groups in STEM.	CEOSE was asked to help by considering approaches to increase the number of minority applicants.*
5	NSF should consider conducting a comprehensive review of impact evaluation findings on its broadening participation programs, and use the review to determine what works.	No update available from NSF.
6	NSF should continue to support programs that address institutional transformation in academia and industry.	NSF has continued to fund the ADVANCE program.
7	Institutions that serve students with specials needs, such as Gallaudet, should have a designation similar to minority serving institutions, such that they can benefit from transition programs and partnerships with majority institutions on large research initiatives.	Some NSF solicitations now designate institutions that serve persons with disabilities as eligible for grants.**
8	NSF-sponsored scholarships, fellowships, and internships should be targeted to support STEM students with disabilities.	No update available.
9	The Facilitation Awards for Scientists and Engineers should be expanded to include all STEM graduate students and faculty who are disabled and want to attend conferences.	No update available.
10	NSF should regularly collect data on disability in STEM.	National Center for Science and Engineering Statistics is improving its collection of data on persons with disabilities in STEM.
11	Funding for programs aimed at increasing the number of successful students and faculty with disabilities should be increased.	No update available.
12	Research in technology for persons with disabilities should be strengthened by making sure projects align with the actual needs of persons with disabilities.	No update available.
13	NSF should better serve Native Americans by expanding and fine-tuning existing NSF programs.	The Acting NSF Director indicated that the recommendation needs clarification. **
14	NSF should work outside of existing NSF programs to better serve Native Americans.	No update available.
15	NSF should perform (or support) research and evaluations to provide a better understanding of Native American education and social issues.	No update available.

**Outcome information obtained from e-mail to Dr. Margaret E.M. Tolbert from Dr. Cora Marrett, Acting NSF Director, June 25, 2010. ** See, for example, NSF Solicitation #08-606, Broadening Participation Research Initiation Grants in Engineering.*

similar programs, and possibly creating a "CEOSE-like" body within each of the agencies. CEOSE agreed with Dr. Harris, and he facilitated a continuation of dialogue among CEOSE, NSF, and other federal agencies.

A REVIEW OF CEOSE RECOMMENDATIONS SINCE 1980

Dr. Harris also analyzed all of the recommendations made by CEOSE for NSF's consideration since the Committee's inception in 1980. A total of 231 recommendations were made. Of these, 22.5 percent related to women, 23.3 percent to underrepresented minorities, 21.2 percent to persons with disabilities, and the remaining 32.0 percent to overall broadening participation topics. Six core themes emerged: (1) request for grantee, STEM education, and workforce data from NSF; (2) diversity of NSF personnel, panels, and committees; (3) affirmative action and broadening participation policies; (4) outreach efforts with other federal STEM-related agencies; (5) K-12 education; and (6) financial aid and funding of broadening participation programs.

Due to resource and time limitations, the analysis did not include a look at NSF responses or other outcomes for all of the recommendations. A more comprehensive follow-up analysis is planned for a future biennial or decennial report to Congress.

NEW CEOSE MEMBERS

Five new members joined the Committee during the 2009-2010 biennium: **Dr. Cecilia A. Conrad**, Vice President for Academic Affairs, Dean of the College, and Professor of Economics, Pomona College (Claremont, Calif.); **Dr. George Middendorf**, Professor of Biology, Howard University (Washington, D.C.); **Ms. Lueny Morell**, Director of Engineering Education and University Relations, Hewlett-Packard Company (Aguadilla, PR); **Dr. Eugenia Paulus**, Professor of Chemistry, North Hennepin Community College (Brooklyn Park, Minn.); and **Dr. Wendy Raymond**, Professor of Biology and Associate Dean for Institutional Diversity, Williams College (Williamstown, Mass.).

TRACKING OUTCOMES OF 2007-2008 CEOSE RECOMMENDATIONS TO NSF

On the basis of information gathered by the Committee from presentations, CEOSE symposia, the literature, and discussions, a number of recommendations were made to NSF during the last biennium (2007-2008). Due to an extensive turn-over in NSF staff, including the Director, CEOSE was unable to procure all of the information needed to follow up on its recommendations. Some outcomes of the 2007-2008 CEOSE recommendations are presented in Table 3-1.

Endnotes

[1]Remarks made at the 60th Anniversary of NSF celebration at the 2010 Annual AAAS Conference, February 20, 2010.

[2]Dr. Jemison was interviewed by T.J. Holmes on CNN on March 29, 2010.

4 RECOMMENDATIONS OF 2009-2010 AND FUTURE PLANS

"The future belongs to the nation that best educates its citizens."[1]

U.S. President Barack Obama

2009-2010 CEOSE RECOMMENDATIONS

CEOSE ended the 2009-2010 biennium with a number of new recommendations for the National Science Foundation to consider for enhancing the Foundation's broadening participation efforts:

1. Augment support for the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), the Louis Stokes Alliances for Minority Participation (LSAMP) Program, and the Tribal Colleges and Universities Program (TCUP). No later than one year from the publication of this report, establish an Hispanic Serving Institutions (HSI) Program. Support these four programs separately to build the capacity of minority serving institutions (MSIs) to broaden the participation of underrepresented groups in STEM.

2. Continue concerted efforts, across all NSF directorates and offices, to increase funding for programs that serve the above MSIs, institutions serving persons with disabilities, and students and faculty from underrepresented groups at all institutions; such efforts should include jointly funded programs with HBCU-UP, TCUP, and the HSI program to support research and research experiences and training for undergraduate and graduate students at these MSIs, and other evidence-based strategies for broadening participation of women, underrepresented minorities, and persons with disabilities.

3. Provide better guidance to people who serve on Committees of Visitors on how to assess broadening participation.

4. Develop a science of broadening participation program in its SBE Directorate that will join with CEOSE in addressing questions about this science.

5. Commission the National Academies to conduct a study on the Science of Broadening Participation.

6. Initiate collaboration between NSF's Directorates of Computer and Information Science and Engineering, and Social, Behavioral, and Economic Sciences, and the Office of Cyberinfrastructure on the new developments regarding social aspects of computing.

7. Provide additional resources for NSF's National Center for Science and Engineering Statistics, as needed for its increased workload, especially for data and analyses requested by CEOSE.

8. Establish accountability goals and metrics for broadening participation in science and engineering.

9. Facilitate collaborative efforts to broaden participation with other federal agencies through the development of common metrics, formation of interagency programs, and commitment of funding as appropriate. This recommendation was made following a recently completed CEOSE study of current and potential federal interagency collaborations to increase the numbers of underrepresented individuals in the science and engineering professions, and recognizing NSF's leadership in the area of broadening participation in STEM.

RECOMMENDATIONS FROM MINI-SYMPOSIUM ON WOMEN OF COLOR IN STEM

The following are recommendations approved by CEOSE from the Mini-Symposium on Women of Color in STEM. NSF should:

1. Initiate a focus on increasing the participation of women of color in existing NSF programs that target women, underrepresented minorities, and persons with disabilities.

2. Invest in developing women of color leaders in STEM through efforts that include:

   - Providing leadership training for mid-level professionals in academia, industry, and government;
   - Providing funding for senior women of color to visit campuses that would not otherwise have access to these mentoring opportunities.
   - Supporting the establishment of a National Society of Women of Color in STEM.

3. Disaggregate data by race/ethnicity, gender, and disability status, so that issues specifically impacting minority girls and women in STEM are brought into high relief. These data should be widely reported.

4. Establish and vigorously support a science of broadening participation program, as an effective means to (a) investigate the experiences of women of color and other underrepresented groups in STEM; and (b) study how their recruitment to, and retention in, STEM education and careers can be improved.

5. Support research and evaluations on understanding causes of drop-off and drop-out rates of women of color in STEM education and careers, and on practices that circumvent attrition and improve retention. Potential research and evaluation include re-examining the double-bind findings to determine what progress has been made since the original study.

6. Fund research, evaluation, and development of practices that target key transition points where the greatest loss of women of color from STEM occurs.

7. Fund workshops, conferences, travel awards, and social networks that enable women of color scientists and engineers to network and mentor one another.

8. Fund programs and workshops that teach managers, administrators, senior staff of colleges, universities, and federal agencies how to mentor women of color in STEM in a culturally competent fashion.

9. Develop and support a centralized digital clearinghouse of information about women of color in STEM.

10. Restructure grant funding, so that a portion is withheld until a follow-up report is submitted by the grantee on how the broadening participation component of the broader impacts criterion will be met.

CEOSE PLANS FOR 2011-2012

For the next two years, CEOSE has planned several activities, some of which are unfinished initiatives from the 2009-2010:

- Finalize the analysis of, and document the Committee's metrics to gauge and track NSF's performance in broadening participation.
- Hold a mini-symposium in the spring of 2012 on the Science of Broadening Participation and evaluation of broadening participation programs.
- Continue conversations with NSF Assistant Directors and Office Directors on their efforts to broaden participation in STEM. The focus will continue to be on NSF staff, principal investigators, committees of visitors, advisory committees, *ad hoc* reviewers, site visitors, and panelists, as well as funding for broadening participation programs, outreach strategies, and plans for corrective actions when strategies are deficient or not effective. Data and other information to be reported by the Assistant Directors and Office Directors are to cover a five -year period so that trends will be evident.
- Continue to address broadening participation issues in STEM that are pertinent to the Congressional mandate of CEOSE.
- Continue to study and discuss minority serving institutions and programs, and make recommendations to NSF to improve these programs.
- Continue to study, discuss, and promote institutional transformation.

Endnote

[1]Prepared Remarks of President Barack Obama. Back to School Event. Arlington, VA, September 8, 2009.

NATIONAL SCIENCE FOUNDATION
COMMITTEE ON EQUAL OPPORTUNITIES IN SCIENCE AND ENGINEERING (CEOSE)

MEMBERSHIP 2009 AND 2010

Dr. Muriel Poston
CEOSE Chair
Dean of the Faculty
Skidmore College
Saratoga Springs, NY
Tenure: 04/01/06-03/31/09; 04/01/09-03/31/12

Ms. Sandra K. Begay-Campbell
1st Vice Chair
Principal Member of the Technical Staff
Sandia National Laboratories
Albuquerque, NM
Tenure: 06/30/05-06/29/08; 06/30/08-06/29/11

Dr. Richard E. Ladner
2nd Vice Chair
Boeing Professor in Computer Science and Engineering
Department of Computer Science and Engineering
University of Washington
Seattle, WA
Tenure: 04/01/06-03/31/09; 04/01/09-03/31/12

Dr. Cecilia A. Conrad
Vice President for Academic Affairs and Dean of the College and Stedman-Sumner Professor of Economics
Pomona College
Claremont, CA
Tenure: 02/01/10-03/31/13

Dr. Joseph S. Francisco
Associate Dean for Research and Graduate Education, William E. Moore Distinguished Professor of Earth and Atmospheric Sciences and Chemistry, Past President of the American Chemical Society
College of Science
Purdue University
West Lafayette, IN
Tenure: 04/01/06-03/31/09; 04/01/09-03/31/12

Dr. Evelynn Hammonds
Dean of Harvard College and Barbara Gutmann Rosenkrantz Professor of the History of Science and of African and African American Studies
Harvard University
Cambridge, MA
Tenure: 02/01/09-01/31/12

Dr. Berverly K. Hartline
Associate Provost for Research and Dean of Graduate Studies
University of the District of Columbia Washington, DC
Tenure: 02/01/03-01/31/05; 02/01/06-01/31/09; Chair 02/01/07-01/31/08, Vice-Chair 08/16/06-08/15/07

Dr. Wesley L. Harris
Associate Provost for Faculty Equity and Charles S. Draper Professor of Aeronautics and Astronautics
Massachusetts Institute of Technology
Cambridge, MA
Tenure: 05/01/04-04/30/07; 05/01/07-04/30/10; Chair 02/01/08-01/31/09

Dr. Mae C. Jemison
President
The Jemison Group, Inc.
Houston, TX
Tenure: 10/01/06-09/30/09

Dr. Robert L. Lichter
Principal
Merrimack Consultants, LLC
Great Barrington, MA
Tenure: 02/01/03-01/01/06; 02/01/06-01/01/09; Chair 02/01/05-01/31/06

Dr. Marigold Linton
Director of American Indian Outreach and Past President of SACNAS
University of Kansas
Lawrence, KS
Tenure: 10/01/06-09/30/09; 10/01/09-09/30/12

Dr. Theresa A. Maldonado
Associate Vice Chancellor for Research
Texas A&M University System
Director, Energy Engineering Institute Texas Engineering Experiment
Station College Station, TX
Tenure: 10/01/06-09/30/09; 10/01/09-09/16/10; Chair 02/01/09-01/31/10

Dr. George Middendorf
Graduate Professor
Department of Biology
Howard University
Washington, DC
Tenure: 02/01/10-03/31/13

Ms. Lueny Morell
Program Director
Strategic Innovation and Research Services Office
Hewlett Packard Laboratories
Aguadilla, PR
Tenure: 02/01/10-03/31/13

Dr. Samuel L. Myers, Jr.
Roy Wilkins Professor of Human Relations and Social Justice
Hubert H. Humphrey Institute of Public Affairs
University of Minnesota
Minneapolis, MN
Tenure: 10/01/03-09/30/06; 10/01/06-09/30/09; Chair 02/01/06-01/31/07

Dr. Maria (Mia) Ong
Principal Investigator
Education Research Collaborative
TERC, Inc.
Cambridge, MA
Tenure: 02/01/08-01/31/11; 02/01/11-01/31/14

Dr. Eugenia Paulus
Professor of Chemistry
Department of Chemistry
North Hennepin Community College
Brooklyn Park, MN
Tenure: 02/01/10-03/31/13

NATIONAL SCIENCE FOUNDATION
COMMITTEE ON EQUAL OPPORTUNITIES IN SCIENCE AND ENGINEERING (CEOSE)

MEMBERSHIP 2009 AND 2010—CONTINUED

Dr. Alexander Ramírez
Executive Director of
Information Technology Initiatives
HACU National Headquarters
San Antonio, TX
Tenure: 02/01/09-01/31/12

Dr. Wendy Raymond
Professor of Biology and
Associate Dean for Institutional
Diversity
Williams College
Williamstown, MA
Tenure: 02/01/10-03/31/13

Executive Liaison
Dr. Margaret E.M. Tolbert
Senior Advisor and CEOSE
Designated Federal Officer
Office of Integrative Activities/
Office of the Director
National Science Foundation
Arlington, VA
Tenure: 09/02 - present

APPENDIX A

Appendix A Table 2-11

Numbers of Underrepresented Members on NSF Advisory Committees (AC)
FY 2009 → 2010

Advisory Committees	Male 2009→2010	Female 2009→2010	Minorities* 2009→2010	Non-Minorities 2009→2010	Persons with Disabilities 2009→2010
AAAC	9 → 10	4 → 3	2 → 2	11 → 11	0 → 0
ACCI	17 → 15	8 → 6	5 → 3	20 → 18	1 → 0
BIO	14 → 15	8 → 8	3 → 5	19 → 18	0 → 0
B&O	8 → 7	9 → 9	4 → 3	13 → 13	1 → 1
CEOSE	4 → 4	6 → 9	9 → 10	1 → 3	0 → 1
CISE	18 → 15	8 → 5	3 → 3	23 → 17	0 → 0
EHR	8 → 8	8 → 9	5 → 7	11 → 10	0 → 0
ENG	12 → 11	3 → 6	9 → 13	6 → 4	0 → 0
ERE	8 → 13	8 → 8	3 → 5	13 → 16	0 → 1
GEO	15 → 14	6 → 7	4 → 4	17 → 17	0 → 0
GPRA**	10 → 0	11 → 0	8 → 0	13 → 0	0 → 0
MPS	14 → 18	9 → 8	5 → 5	18 → 21	1 → 1
OISE	7 → 8	6 → 7	5 → 6	8 → 9	0 → 0
OPP	8 → 6	7 → 4	2 → 2	13 → 8	0 → 0
SBE	10 → 11	11 → 9	2 → 1	19 → 19	1 → 0
TOTAL	154 → 147	104 → 89	64 → 62	194 → 174	4 → 4

** The category of "Minorities" includes Asian Americans.*
*** The GPRA Advisory Committee was discontinued as of FY 2010.*

APPENDIX B

Appendix B Table 2-12

Numbers and Profiles of NSF Committees of Visitors (COV) 2009 2010

Directorate/Program Office (# of COVs)	Total COV Members	Male	Female	Minorities*	Non-Minorities	Persons with Disabilities
BIO (2) 2009	19	10	9	3	16	1
(2) 2010	15	9	6	2	13	0
CISE (3) 2009	71	54	17	5	66	0
2010	n/a	n/a	n/a	n/a	n/a	n/a
EHR (1) 2009	51	27	24	5	11	0
(1) 2010	18	9	8	7	10	0
ENG (2) 2009	27	19	8	2	22	1
(2) 2010	31	19	12	9	22	0
GEO (2) 2009	17	8	9	3	14	0
(3) 2010	27	18	9	6	21	0
MPS 2009	n/a	n/a	n/a	n/a	n/a	n/a
(3) 2010	101	68	33	18	85	0
OISE 2009	n/a	n/a	n/a	n/a	n/a	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a
OPP 2009	n/a	n/a	n/a	n/a	n/a	n/a
(3) 2010	27	17	10	0	18	0
SBE (1) 2009	21	11	11	2	19	1
(1) 2010	20	10	9	1	19	0
TOTAL 2009	206 (100%)	129 (62%)	77 (38%)	20 (10%)	186 (90%)	3 (1.5%)
2010	239 (100%)	150 (63%)	77 (37%)	25 (10%)	214 (90%)	0 (0%)

**The category of "Minorities" includes Asian Americans. Race and ethnicity of 54 members were unknown.*

NOTES

NOTES

PHOTO CREDITS

CHAPTER ONE

Page 5 (left to right):
1. Courtesy of Center for BioModular Multi-Scale Systems, Louisiana State University.

2. Photo by Mark Mortensen , BUGS Program, University of North Texas.

3. Photo by Amy Snyder, Children Playing with Space Filling Blocks.

CHAPTER TWO

Page 21 (left to right)
1. Photo by Laurence Gough, iStock Photos.

2. Photo by Peter Rejeck, NSF, Antarctic Geological Drilling Program, Ohio State University.

3. Photo by Wei Lin, EPSCoR Program, North Dakota State University.

CHAPTER THREE

Page 37 (left to right):

1. Courtesy of North Dakota State University.

2. Courtesy of PREM, University of Puerto Rico, Humacao.

3. Courtesy of Argonne National Laboratory.

Page 39 (column 1, top down):
1. Courtesy of the American Chemical Society, Symposium Participants.

2. Courtesy of the American Chemical Society, Panel Discussion Participants.

(Column 2):

3. Courtesy of Dr. Mae C. Jemison

CHAPTER FOUR

Page 43 (left to right):
1. Photo by Gary Meek, Georgia Institute of Technology.

2. Photo by Chuck Kennedy, White House, President Obama Honors Outstanding Teachers and Mentors in Mathematics and Science.

3. Photo by Wei Lin, North Dakota State University, EPSCoR Program.

National Science Foundation
4201 Wilson Boulevard, Suite 935
Arlington, VA 22230