Accountability for Broadening Participation in STEM

CEOSE

2015-2016 Biennial Report to Congress

Committee on Equal Opportunities in Science and Engineering

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 [42U.S.C. §1885(e)].

CEOSE is composed of 16 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 policies and program opportunities focused on the state of the participation and 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.

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Executive Summary

Progress in broadening participation has been insufficient to meet increased challenges despite decades of efforts to improve representation of people from underrepresented groups (women, African Americans, Hispanics/Latinos, American Indians/Alaska Natives and persons with disabilities) in science, technology, engineering, and mathematics (STEM). Therefore, in its previous two reports, CEOSE focused its recommendations to NSF on ways to "move the needle" to achieve demonstrable progress in broadening participation. In its 2011-2012 report, CEOSE focused on a single recommendation calling for a bold new initiative to broaden participation. That recommendation resulted in the establishment of an NSF initiative "Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science" (NSF INCLUDES) launched in FY 2016, which CEOSE members recognized as a promising initial response. CEOSE's 2013-2014 report reiterated the recommendation for a bold new initiative and proposed five specific components of a plan for implementation (i.e., develop and implement an effective preK-20+ system of STEM pathways; provide stable and sufficient direct support for individuals; support the further development of a science of broadening participation grounded in empirical research; conduct field experiments to understand and mitigate the barriers to broadening participation; and recognize the field-specific nature of the broadening participation challenge). In this 2015-2016 report, CEOSE recommends developing an accountability framework for assessing the full development of the bold new initiative advocated in the first two reports as well as the overall broadening participation portfolio. The committee wants to ensure that investigators, higher education institutions, and NSF do what they propose to accomplish regarding broadening participation and that the strategies employed are proven and effective.

Progress and Challenges

As noted in the previous CEOSE reports, people from underrepresented groups have made some progress in STEM but remain underrepresented in STEM as a whole, and are particularly underrepresented in some STEM fields, notably engineering, mathematics, computer science, and some of the physical sciences[1]. Although the number and diversity of scientists and engineers in the United States have increased over the past 20 years, most of the gains have been for White women and Asian men and women.

There are inequalities across a variety of socio-economic dimensions as well as specific barriers such as: high teaching loads in some institutions; low awareness of programs among some groups; over-reliance on imperfect indicators of merit such as standardized test scores with known outcome disparities by groups (Miller and Stassun, 2014); explicit bias; and uneven access to mentors and well-connected professionals and sponsors. Some are more difficult to measure directly: implicit bias; hidden assumptions; and expectations of who can do science. These barriers contribute to an unspoken system that makes it difficult to achieve our overarching broadening participation goal.

[1] Within the physical sciences, participation of these groups is lowest in physics, astronomy, and the geosciences.

NSF Funding of Broadening Participation

The NSF portfolio for broadening participation includes focused programs (those explicitly aimed at broadening participation) and emphasis programs (those not explicitly focused on broadening participation but emphasize efforts in this area). The FY 2017 budget request was $592.53 million for both focused and emphasis programs, up from $589.40 million in FY 2016. In previous years, focused programs accounted for about one-fourth of NSF funding of broadening participation, but with the addition of NSF INCLUDES as part of the focused programs in FY 2016, focused programs accounted for 30% of NSF funding for broadening participation. (See the appendix for the FY 2017 budget requests to Congress.) NSF provides additional support for broadening participation activities through research and education grants in programs not directly affiliated with the NSF Broadening Participation portfolio.

NSF INCLUDES. In response to CEOSE's 2011-2012 recommendation for a bold new initiative, NSF is developing a broadening participation initiative that will learn from and build on existing successes, foster wide-ranging partnerships, develop shared measurements and systematic networked coordination, collaboration and leveraging, set a national agenda with sensitivity to local differences, and connect research and practice of "science of broadening participation." That effort will have an accountability component embedded in it that will help funded programs make measurable progress in broadening participation.

In FY 2015, the NSF Director convened NSF INCLUDES stakeholders from various sectors, disciplines and areas of the country to generate and prioritize ideas and strategies for the NSF INCLUDES initiative. In FY 2016-2017, NSF funded its first cohort of 40 NSF INCLUDES Design and Development Launch Pilots, which are pilot projects for bold, innovative ways for solving a broadening participation (BP) challenge in STEM. In the future, NSF will solicit proposals to form NSF INCLUDES Alliances. Each Alliance proposal (that will be awarded in FY 2018) is expected to build from a Design and Development Launch Pilot that develops and adds new partners, collaborators, or networks and to use collective impact approaches to scale up successful projects.

Broader Participation in Proposals and Awards. Previous NSF efforts to broaden participation have had some positive effects, but much remains to be done. The number of women submitting proposals to NSF and the number receiving awards has steadily increased over the past decade and the success rate for female PIs is slightly higher than that for male PIs. And, although the rate of increase for proposals submitted by PIs from underrepresented groups has been higher than the increase for all proposals submitted to NSF, the number and percentage of proposals submitted to NSF from these groups remains very small and the success rates for Asian (20%), African American (21%), and Hispanic (24%) PIs are lower than those for White (26%) PIs (NSB, 2016). Further, the percentage of proposals from persons with disabilities (roughly 1%) has not increased over the past decade.

Workshop on Accountability. NSF funded a two-day workshop focused on developing an accountability framework for broadening participation. The workshop was held in October 2016 and convened a variety of stakeholders from across the STEM enterprise, including evaluation experts, to determine what lessons could be learned from exemplary programs, what metrics and measurement are needed, and what

considerations are key to developing and implementing an accountability system for broadening participation. Several key aspects of an accountability system were generally agreed upon at the workshop, including the need for a pre-K-20+ pathways approach and the need to take into account institutional differences and resources. Participants emphasized the importance of broadening participation in producing better science and engineering. The workshop report informed the development of the accountability principles and a focus on three basic levels at which accountability must be addressed: the individual project, the institution awarded the grant, and NSF itself, and the recommendation in this 2015-2016 CEOSE report.

CEOSE Activities, Outcomes, and Plans for the Future

In its 2015 and 2016 meetings, the committee focused on NSF INCLUDES, broadening participation in STEM (with a particular emphasis on persons with disabilities and women of color), the need to broaden participation in the NSF review and awards process, and the need for more assessment and evaluation with the aim of developing an accountability framework for broadening participation. In discussions with NSF leadership about NSF INCLUDES, the dialogue centered on defining the scope and focus of the initiative in terms of setting goals, expected outcomes, common directions, and measurements. CEOSE members recognized that NSF INCLUDES is a most promising response, but only an initial response to the 2011-12 and 2013-14 CEOSE reports. CEOSE members were concerned about availability of funding to sustain the effort, the need to not lose sight of individuals while concentrating on the big picture, the need to involve social science in the effort, and the need to broaden the community of voices at the table.

In the next reporting cycle, CEOSE plans to focus on how best to implement the bold new initiative and the issue of accountability in broadening participation through: continuing the discussion of the integration of broadening participation and its accountability across the full range of Big Idea efforts going forward; emphasizing the need to build accountability into NSF's broadening participation portfolio, as well as broadening participation in the NSF facilities portfolio; further examining NSF's science of broadening participation investment; better integrating broadening participation directly as a part of the merit review process (rather than as part of broader impacts alone), and helping NSF leverage its efforts through encouraging increased accountability on higher education for broadening participation. Additionally, future directions will focus on building inclusive community-engaged STEM communities that would promote STEM participation on the ground and at all ages, as well as reap the scientific benefits of the insights of people from diverse settings, neighborhoods, and circumstances in the innovation cycle.

CEOSE's Recommendation for an Accountability Framework

Given that no initiative can truly succeed without accountability, the focus of this report is on accountability and what it means to incorporate a higher level of accountability into broadening participation programs and into NSF itself. For an accountability framework to succeed, it must have: a set of clear assumptions, definitions, goals, and metrics, as well as a strategy for change. The goal is to facilitate excellent science and engineering by utilizing all the talent the nation has to offer. To achieve this goal, we must lower barriers to full participation by all groups and work to ensure that there is

meaningful and sustained participation by all. We need to create a new, visible approach to accountability that adheres to several clear principles:

- The framework should take into account local conditions, context and history;
- The framework must encourage success by requiring accountability from the beginning;
- The framework must require evaluation systems that allow periodic feedback to modify practice;
- The framework must encourage learning from and through implementation of programs and projects; and
- The framework must encourage and document partnerships among organizations within and across sectors to heighten impact.

Accountability, in the context of NSF's broadening participation efforts, must be addressed at three basic levels:

1. The first is at the level of the individual project, where PIs are accountable for using grants to the best of their ability to accomplish the project's goals, as well as reporting and disseminating the outcomes of their projects.

2. The second is at the level of the institution awarded a grant, particularly institutions of higher education. Institutions are jointly accountable with PIs for monitoring grant expenditures and meeting reporting requirements.

3. The third is at the level of NSF itself, where NSF is accountable for using its funding vehicles effectively to further the U.S. scientific endeavor and having the data available to demonstrate that it is doing so.

Suggested Practices for Principal Investigators' Role in Ensuring Accountability

Principal investigators (PIs) funded by NSF or other federal agencies can strive to be accountable for broadening participation in their own research and for being models for their students, their institutions, and for other researchers. In their role in supporting accountability, there are several steps that PIs can consider in responding to and implementing the bold new initiative:

1. **PIs can incorporate best practices to broadening participation into their research, not just as an add-on activity, but also as an integral part of their research practice.** That is, as appropriate, they can seek to facilitate excellent science by utilizing diverse talent.

2. **PIs can ensure that they actually do what they said they were going to do by conducting evaluation of their efforts**. Successful efforts should have a research foundation and evaluation structured into the research from the beginning. Monitoring and evaluation should involve measurement at regular intervals, periodic feedback, engagement of the groups affected, learning from failure, and flexibility.

3. **PIs can ensure that their evaluation efforts are sound through collaboration**. They can involve evaluation experts within their institution, coordinate with institutional research offices and other PIs within their institution, participate in national forums on evaluating broadening participation efforts, and seek training in evaluation of broadening participation.

4. **PIs can disseminate results of their broadening participation efforts within and across institutions to exchange knowledge and to allow others to adopt and adapt successful practices**.

Suggested Practices for Higher Education's Role in Ensuring Accountability

Higher education institutions, as leaders in the community, as models of inclusion for other institutional stakeholders in broadening participation, and as educators of future leaders of the nation, can play an important role in ensuring accountability for broadening participation. Institutions could build and share accountability systems that emphasize the importance of broadening participation as an integral component of funded programs, that evaluate performance and outcomes, and that rely on the assessment of data.

In its role in supporting accountability, there are several steps that higher education institutions can consider for promoting innovation and accountability:

1. **Public and private academic institutions that receive federal funding could lead the way in implementing and documenting an accountability system and demonstrating accountability on the institutional level.**

2. **Higher education grantees could ensure rigorous evaluation**. Details on who participates in each project and why, closing disparities in participation, raising degree completion rates, forming partnerships with local K-12 schools and other community-based organizations, and clarity on the consequences of the project/program/center success for various publics would ensure more rigorous accountability at the institutional level.

3. **Academic institutions could aggregate data from grants that document PIs' broadening participation efforts.** Combining data from distinct NSF-funded projects, as well as those from different agency programs, can increase understanding of the scale and duration of effort as well as the number of students impacted.

4. **Academic institutions could change behavior—their policies, programs, and/or practices—to increase the participation of the students they enroll and educate for careers in STEM.** Identifying significant and persistent problems, such as precollege preparation, campus climate, debt disparities, data recognition and use, graduate student transitions, and faculty diversity, helps to frame and focus the design of any accountability system.

5. **Academic institutions can lead in communities and function as models of inclusion both for and with other stakeholders in broadening participation.**

Suggested Practices for NSF's Role in Ensuring Accountability

NSF has an important role among federal funding agencies and can lead the way in building an accountability system that provides incentives to principal investigators and institutions of higher education to move with urgency toward the goal of broadening participation. NSF-funded programs could emphasize the importance of broadening participation as an integral component of research and education, along with the understanding that the measurement of success depends on being able to evaluate performance and outcomes, which in turn relies on the assessment of data.

In its role in supporting accountability, there are several steps that NSF can consider for promoting innovation and accountability with the new initiative:

1. **Acknowledge grantee institutions for positive past and present contributions to broadening participation**. Based on data from grantee institutions on their contributions to broadening participation, NSF can recognize those who have done exceptionally well, and provide visible benchmarks that allow institutions to calibrate their own efforts. (See box on Higher Education.)

2. **Facilitate changing culture through the power of convening.** NSF can continue to convene its grantees in national forums to discuss diversity as an asset and to advance broadening participation culture as central to the future of science and engineering. It also can provide information and opportunities for its grantees to network and/or cooperate in their broadening participation activities, so that resources for such efforts can be multiplied nationwide and those with less can benefit from those who have more.

3. **Provide multiple levels of learning and networking opportunities.** Success requires multiple levels of learning opportunities for NSF program officers, reviewers, PIs, and evaluators. NSF could consider offering learning opportunities through workshops, conferences, online resources, technical assistance, virtual sponsored research offices, and other mechanisms as appropriate. These learning opportunities provided by NSF can also facilitate networking among NSF-funded PIs and higher-education institutions to multiply the impact of their broadening participation activities.

4. **Further elevate the value of broadening participation and diversity of perspectives as crucial to excellence in the research process**. NSF's merit review system is exemplary and crucial to NSF's role in supporting science. Because broadening participation is central to the act of doing excellent science, broadening participation should be reflected as a value in the evaluation of all merit review criteria; in the development and writing of program announcements; in the construction of review panels and instructions to the reviewer; and throughout the merit review process.

5. **Promote, develop, and implement an effective strategy for long term longitudinal data collection**. Data include long-term tracking of participants targeted by programs from undergraduates to postdocs to faculty in order to determine their long-term success. Data collection should be designed so that we can learn about multiple pathways for STEM careers.

6. **Utilize Committees of Visitors (COV) to evaluate the new broadening participation initiative.** The COVs can ask in what ways the various efforts of the initiative further the participation of underrepresented racial/ethnic groups, women, and persons with disabilities in the U.S. scientific enterprise. COVs would be enhanced by including some members who have extensive knowledge in broadening participation. CEOSE can take as its responsibility to digest and summarize any findings.

Suggested Practices for NSF's Role in Ensuring Accountability continued

7. **Promote and support the further development of a science of broadening participation**. We may be seeing the emergence of a new discipline that can unify efforts across multiple disciplines in STEM. As such, it is important to learn from actual projects, the implementation of those projects—including significant efforts that arise from programs such as NSF INCLUDES. NSF should encourage the publication of NSF-supported empirical research in the science of broadening participation in high-impact science, engineering, and education venues to advance our collective knowledge with: a) a better understanding of the differential participation of students from underrepresented groups in some STEM careers; b) a better understanding of the impact of belonging to multiple underrepresented groups at once on participation in STEM; and c) an enlarged body of research on participation in STEM by individuals with disabilities, including both physical and mental challenges. (See https://www.ada.gov/pubs/adastatute08.htm#12102 for the Americans with Disabilities Act definition of disability, which includes both physical and mental challenges.)

    - Such support includes leveraging NSF-funded projects that may not have been originally designed as broadening participation efforts, but provide serendipitous opportunities to gain understanding about barriers to broadening participation and mitigation of those barriers.
    - Such support could also recognize the field-specific nature of the broadening participation challenge even as we generalize and unify across fields, encouraging publication of discipline specific empirical research in the science of broadening participation in high-impact discipline focused science and education venues.

As noted earlier, NSF has made many good faith efforts across the Foundation to broaden participation, including embracing the challenge of implementing a bold new initiative around broadening participation. NSF plays an important role among federal funding agencies and can lead the way in building an accountability system that provides incentives to principal investigators and institutions of higher education to move with urgency toward the goal of broadening participation.

Therefore, CEOSE recommends that:

NSF should adopt a framework based on the information and principles in this report that ensures true shared accountability for PIs, for institutions, and for NSF itself in promoting participation and excellence in science and engineering by deliberately and fully utilizing all the talent and potential the Nation has to offer.

ACRONYMS

ADVANCE	Increasing the Participation and Advancement of Women in Academic Science and Engineering program
AGEP	Alliances for Graduate Education and the Professoriate program
AIR	American Institute for Research
ARRA	American Recovery and Reinvestment Act
ATE	Advance Technological Education
BIO	Biological Sciences Directorate
BP	Broadening Participation
BPC	Broadening Participation in Computing program
BPC-A	Broadening Participation in Computing Alliance program
CAREER	Faculty Early Career Development program
CEOSE	Committee on Equal Opportunities in Science and Engineering
CE21	Computing Education for the 21st Century program
CISE	Computer and Information Science and Engineering Directorate
CLB	Career-Life Balance Initiative
COMPETES	Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (as in the America COMPETES Act)
CREST	Centers of Research Excellence in Science and Technology program
DHS	Department of Homeland Security
DOC/ESA	Department of Commerce, Economics and Statistics Administration
DOD	Department of Defense
DOE	Department of Energy
DOL	Department of Labor
DOI	Department of Interior
DR K-12	Discovery Research PreK-12 program
EAC	Evaluation and Assessment Capability Section
ED	Department of Education

NSF ACRONYMS (cont'd)

EHR	Education and Human Resources Directorate
ENG	Engineering Directorate
EPA	Environmental Protection Agency
EPSCoR	Experimental Program to Stimulate Competitive Research
EREV	Engineering Research Experiences for Veterans program
GARDE	General and Age-related Disabilities Engineering program
GEO	Geosciences Directorate
GRFP	Graduate Research Fellowship Program
GSE	Research on Gender in Science and Engineering program
HBCU	Historically Black Colleges and Universities
HBCU-UP	Historically Black Colleges and Universities-Undergraduate Program
HHEI	High Hispanic Enrollment Institution
HRD	Division of Human Resource Development
HSI	Hispanic Serving Institution
I-Corps	Innovation Corps Program
INCLUDES	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science
IPEDS	Integrated Postsecondary Education Data System
IUSE	Improving Undergraduate STEM Education
LSAMP	Louis Stokes Alliances for Minority Participation program
MPS	Mathematical and Physical Sciences Directorate
MRI	Major Research Instrumentation program
MSI	Minority-serving Institution
NASA	National Aeronautics and Space Administration
NCES	National Center for Education Statistics
NCSES	National Center for Science and Engineering Statistics
NIH	National Institutes of Health

NSF ACRONYMS (cont'd)

NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOYCE	Robert Noyce Teacher Scholarship Program
NSB	National Science Board
NSF	National Science Foundation
NSTC	National Science and Technology Council
OAC	Office of Advanced Cyberinfrastructure (Existed Name: ACI)
OCI	Office of Cyberinfrastructure
OD	Office of Director (NSF)
OEDG	Opportunities for Enhancing Diversity in the Geosciences program
OIA	Office of Integrative Activities
OIG	Office of the Inspector General
OIRM	Office of Information and Resources Management
OISE	Office of International Science and Engineering (ISE)
OPP	Office of Polar Programs
OSTP	White House Office of Science and Technology Policy
PAARE	Partnership in Astronomy and Astrophysics Research and Education program
PCAST	President's Council of Advisors on Science and Technology
PI	Principal Investigator
PIRE	Partnership for International Research and Education program
PREM	Partnership for Research and Education in Materials program
RDE	Research in Disabilities Education program
REAL	Research on Education and Learning
REESE	Research and Evaluation on Education in Science and Engineering program
REU	Research Experiences for Undergraduates
SBE	Social, Behavioral, and Economic Sciences Directorate

NSF ACRONYMS (cont'd)

SBP	Science of Broadening Participation
SED	Survey of Earned Doctorates
S&E	Science and Engineering
SEH	Science, Engineering, and Health
SESTAT	Scientists and Engineers Statistical Data System
SI	Smithsonian Institution
SOARS	Significant Opportunities in Atmospheric Research and Science program
STEM	Science, Technology, Engineering, and Mathematics
TCUP	Tribal Colleges and Universities Program
URM	Underrepresented Minority
USDA	United States Department of Agriculture

Chapter 1. Introduction and Progress

The Committee on Equal Opportunities in Science and Engineering (CEOSE) is charged by the United States Congress to advise the National Science Foundation (NSF) on policies and programs that encourage full participation by women, underrepresented racial and ethnic groups (African Americans, Hispanics/Latinos, and Native Americans), and persons with disabilities within all levels of the United States' science, technology, engineering, and mathematics (STEM) enterprise and to transmit to the Director of NSF every two years a report on its activities during the previous two years and proposed activities for the next two years.

Despite decades of efforts to improve representation of these individuals traditionally underrepresented in STEM, progress has been insufficient to meet increased needs and challenges. Therefore, in the 2011-2012 report CEOSE focused on a single recommendation calling for a bold new initiative to broaden participation (see sidebar).

That recommendation was well-received by NSF and resulted in the establishment of an NSF initiative "Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science" (NSF INCLUDES) that was launched in FY 2016. (See Appendix A.)

A Bold New Initiative

"NSF should implement a bold new initiative, focused on broadening participation of underrepresented groups in STEM that emphasizes institutional transformation and system change; collects and makes accessible longitudinal data; defines clear benchmarks for success; supports the translation, replication and expansion of successful broadening participation efforts; and provides significant financial support to individuals who represent the very broadened participation that we seek."

The 2013-2014 CEOSE report reiterated, built upon, and advanced the recommendation for a bold new initiative, laying out five specific components of a plan to implement a bold new initiative to broaden participation at NSF:

1. Develop and implement an effective preK-20+ system of STEM pathways;
2. Provide stable and sufficient direct support for individuals;
3. Support the further development of a science of broadening participation grounded in empirical research;
4. Conduct field experiments to understand and mitigate the barriers to broadening participation; and
5. Recognize the field specific nature of the broadening participation challenge.

NSF also funded projects that responded to these components. A table with CEOSE's five recommended implementation components and summaries of examples of NSF investment responses to date to those five recommendations can be found in Appendix B.

NSF continues to respond to CEOSE's prior recommendations regarding establishing a Hispanic Serving Institution (HSI) program. NSF reissued two Dear Colleague Letters (DCLs) in 2015 (NSF 15-063: Effort to Broaden Participation of Students in Two-Year Hispanic Serving Institutions in Science, Technology, Engineering and Mathematics and NSF 15-078: Stimulating Research on Effective Strategies in Undergraduate STEM Education at Two-Year Hispanic Serving Institutions). NSF also released a new DCL, NSF 16-094, Strengthening Transfer of Students from Two-year Hispanic-serving Institutions to Four-year STEM Programs.

In this 2015-2016 report, CEOSE recommends developing an accountability framework for assessing the full development of the bold new initiative advocated in the first two reports as well as the overall broadening participation portfolio. Given that progress in broadening participation has been insufficient to meet increased challenges despite decades of efforts to improve participation of underrepresented groups in STEM, the committee wants to ensure that investigators, higher education institutions, and NSF actually do what they propose to accomplish and that the strategies employed are proven and effective. The 2015-16 recommendation addresses accountability for both NSF grantees and for NSF itself, focusing on the need for institutional change, for making certain that the entities that NSF funds, most notably institutions of higher education, are actually held accountable, and that NSF itself is held accountable for broadening participation efforts, including the bold new initiative. Specifically, NSF should be held accountable for encouraging grantees to broaden participation, to ensure that these grantees evaluate their efforts at broadening participation, and to ensure that successful efforts be scaled up and institutionalized. Therefore, CEOSE proposes an accountability effort based on the following principles for this new initiative:

- The framework should take into account local conditions, context and history;
- The framework must encourage success by requiring accountability from the beginning;
- The framework must require evaluation systems that allow various types of data analyses and periodic feedback to modify practice;
- The framework must encourage learning from and through implementation of programs and projects; and
- The framework must connect organizations within and across sectors to heighten impact.

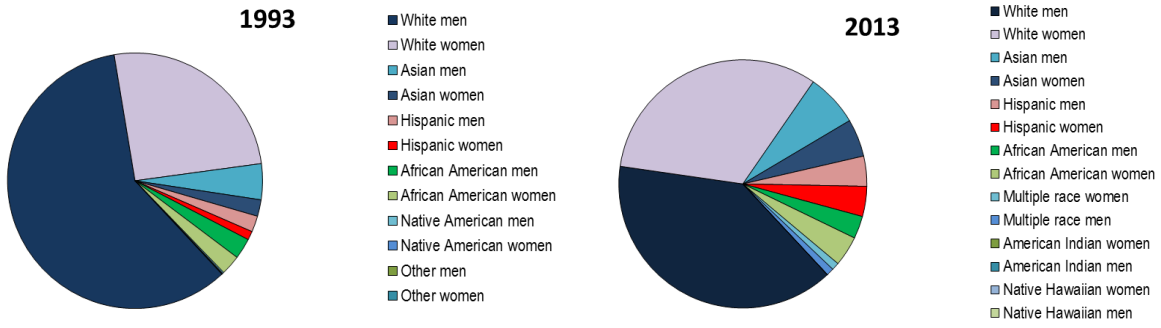
CEOSE calls on NSF to implement the above principles as a means to ensure that the bold new initiative that the committee proposed in its 2011-2012 report results in substantial progress in broadening participation.

Thus, CEOSE recommends that NSF, its constituents, and its partners work toward understanding their progress collectively on their shared goals around broadening participation, to adjust as necessary to achieve those goals; and to, above all, be accountable to those goals.

Chapter 2. Challenges and Opportunities

As noted in the previous CEOSE reports, women, African Americans, Hispanics/Latinos, American Indians/Alaska Natives and persons with disabilities have made some progress in STEM but remain underrepresented in STEM as a whole, and are particularly underrepresented in some STEM fields, notably engineering, mathematics, computer science, and some of the physical sciences.[1] Although the numbers of scientists and engineers in the United States have increased over the past 20 years, and the diversity of those scientists and engineers has increased, most of the gains have been for White women and Asian men and women (Figure 2.1)

Figure 2.1 Employed scientists and engineers, by sex and race/ethnicity: 1993 and 2013



Source: National Science Foundation, National Center for Science and Engineering Statistics.

Numerous reports over the past several decades have identified barriers to full participation for women and underrepresented racial/ethnic groups in STEM. Although gains have been made by women in degree attainment, differences remain by field (with lower participation in engineering, mathematics, physics, and computer science), women remain underrepresented in the higher academic ranks and in research institutions, and they remain underrepresented in tenure-track positions (Long, 2001). Marriage and family are critical influences on men's and women's careers in higher education (Mason, Wolfinger and Goulden, 2013) as are unconscious bias (Moss-Racusin Dovidio, Brescoll, Grahama and Handelsman, 2013) and institutional climate (NAS, 2006).

Women of color face challenges particularly at the transition from high school graduation to college enrollment, in college completion, and in the transition to and completion of doctoral education (NAS, 2013). Women faculty of color are more likely to be in an adjunct job; more likely

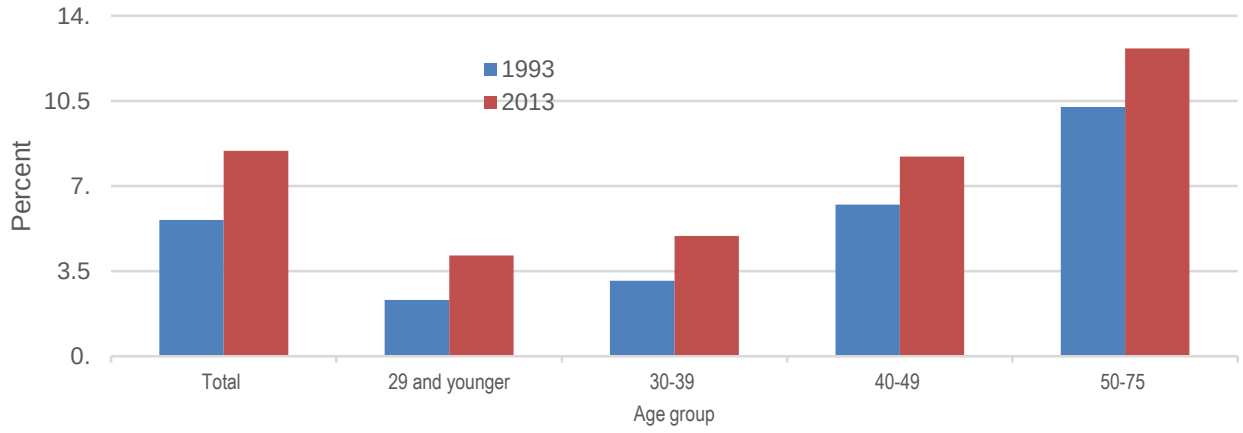
[1] Within the physical sciences, participation of these groups is lowest in physics, astronomy, and the geosciences.

to be employed at a minority-serving institution[2]; less likely to be in a tenure-track job in a predominantly white institution; and less likely to become tenured in a predominantly white institution than White women (Ginther and Kahn, 2012).

For men and women of color, challenges exist all along the pathways to STEM education and employment, but particularly at certain junctures, for example, high school course-taking, undergraduate retention, and the transition to graduate school (NAS, 2011). Challenges/barriers include college affordability and the need for financial assistance, academic and social support, course availability, ease of course transfer, and teacher preparation and retention (Parsons, Bulls, Freeman, Butler and Atwater, 2016).

Over the past twenty years, gains have been made by persons with disabilities in the science and engineering workforce. In 1993, 5.6 percent of scientists and engineers reported disabilities. Twenty years later, that figure was 8.4 percent. Notably, gains were made at all age levels, indicating that gains were not simply due to an aging workforce (Figure 2.2).

Figure 2.2 Persons with disabilities as a percentage of employed scientists and engineers



Source: National Science Foundation, National Center for Science and Engineering Statistics.

[2] Minority-serving institutions (MSIs) are colleges and universities serving a large percentage of minority students. (U.S. Department of Education, National Center for Education Statistics 2008. See https://nces.ed.gov/pubs2008/2008156.pdf

NSF Funding of Broadening Participation

NSF's portfolio for broadening participation includes focused programs (those explicitly aimed at broadening participation) as well as emphasis programs (those that are not explicitly focused on broadening participation but emphasize efforts in this area). Focused programs have broadening participation as an explicit goal, and the majority of each award's budget goes to broadening participation activities. See Appendix C for a listing of programs. Examples of such programs include: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE), Louis Stokes Alliances for Minority Participation (LSAMP), and Tribal Colleges and Universities Program (TCUP). Emphasis programs have broadening participation as one of several emphases, but lack an explicit broadening participation goal. Examples of Emphasis programs include: Advancing Informal STEM Learning (AISL), Graduate Research Fellowship Program (GRFP), Discovery Research PreK-12 (DR K-12), General and Age Related Disabilities Engineering (GARDE), and scholarship programs.

The FY 2017 budget request was $592.53 million for both focused and emphasis programs, up from $589.40 million in FY 2016. In previous years, focused programs accounted for about one-fourth of NSF funding of broadening participation, but with the addition of NSF INCLUDES as part of the focused programs in FY 2016, focused programs accounted for 30% of NSF funding for broadening participation. (See Appendix D for the FY 2017 budget requests to Congress.)

NSF provides additional support for broadening participation activities through research and education grants in programs not directly affiliated with the NSF Broadening Participation portfolio. Broadening participation is one aspect of the broader impacts review criterion that may be addressed in proposals. Examples of these types of effort include award #1531963 "MRI: Acquisition of a 400 MHz NMR Spectrometer for Chemistry and Chemical Forensics" that includes funding for an annual chemistry camp for junior high school girls, and award #1600118 "Bioprinting of Bone Tissue into Defect Sites on Animal Models in Surgery Settings" that includes funding for training, education, and participation of underrepresented populations in summer camps and workshops.

NSF INCLUDES

In response to CEOSE's 2011-2012 recommendation for a bold new initiative (See Appendices E and F), NSF is developing a broadening participation initiative that will learn from and build on existing successes, foster wide ranging partnerships, develop shared measurements and systematic networked coordination, collaboration and leveraging, set a national agenda with sensitivity to local differences, and connect research and practice of the "science of broadening participation." That effort will have an accountability component embedded in it. NSF INCLUDES

strives to make measurable progress in broadening participation by driving multiplicative impacts, building large-scale, multi-institutional communities through alliances, scaling up through a shared platform, common metrics and goals, scaling out through translation, replication of BP strategies, and engaging in large-scale data collection and data analytics.

In FY 2015, the NSF Director kicked off NSF INCLUDES by inviting stakeholders from various sectors, disciplines and areas of the country to generate and prioritize ideas and strategies. The goals of the workshop were "1) to consider potential scalable, high-impact innovations in STEM education to assure success for all people across the nation; and 2) to generate ideas, strategies, and actions that will alter the current landscape and potentially achieve a transformative change for inclusion." Recommendations included augmenting the NSF approach from isolated efforts toward a coordinated, longer-term approach, scaling successful efforts throughout and among academic institutions, and institutional transformation through catalytic innovation.

The long-term goal of NSF INCLUDES is to "fund new research, models, and partnerships that lead to demonstrable progress – moving the needle – in meeting the challenge of broadening participation in science and engineering." An NSF INCLUDES working group has been established and charged. Three components of the initiative have been identified:

- Design and development launch pilots that will be engaged primarily in planning activities and laying the foundations for potential partners to share common goals and purposes through collective impact-style approaches,
- Alliances that will leverage and build on the activities of design and development launch pilots, adding new partners, collaborators, or networks. Each alliance will have its own local communication organization, and
- An organization that will provide increased communications, interoperability, coordination, support, and accountability for the network of NSF INCLUDES alliances.

NSF INCLUDES

The President's FY 2016 budget announced that NSF would launch NSF INCLUDES, a multi-year comprehensive national initiative to catalyze improvement in the preparation, participation, advancement and potential contributions of those who have been traditionally underserved in the science, technology, engineering, and mathematics (STEM) fields. NSF INCLUDES builds on NSF's significant agency-wide portfolio of programs that address broadening participation.

The first cohort of NSF INCLUDES grants included 40 NSF INCLUDES Design and Development Launch Pilots to design social innovation approaches to broaden participation in STEM and 13 conferences to inform the design of the coordinated infrastructure support. The first meeting for NSF INCLUDES principal investigators was held in January 2017. NSF also awarded a technical

assistance contract and a developmental evaluation contract. More information about NSF INCLUDES can be found on the website.[3]

Success stories

Although overall progress of underrepresented groups may be slow, NSF's Assistant Directors reported on numerous instances of successful efforts and success in some disciplines at the June 2016 CEOSE meeting (see stories below).

- **Lighting the Pathway to Faculty Careers for Natives in STEM**

  The goal of this project is to increase the number of American Indian and Alaska Native students who persist in STEM fields, who enter into graduate programs in STEM, and who become STEM faculty. Based on an initial student survey and a survey conducted six months later, an increasing percentage of students intend to pursue a STEM related career and all 4 of the seniors are moving on to graduate degree programs. Assessment of various intervention strategies, including mentoring, role models, research experiences, leadership training, and graduate school preparation, are expected to yield further evidence of success in subsequent years.
  http://www.aises.org/content/lighting-pathway

- **Transfer-to-Excellence Research Experience for Undergraduates (TTE-REU)**

  The aim of this research experience program is to encourage community college students to transfer to a 4-year institution and complete the bachelor's degree in STEM. The program is evaluated through pre/post surveys of program participants, surveys of a comparison group of non-participants enrolled at community colleges, and an annual longitudinal survey of participants. Results show that community college students participating in this program (72% of whom are from underrepresented groups) have a much higher transfer rate to 4-year colleges than non-participants.
  https://www.e3s-center.org/education/edu-tte-reu-appl2.htm

- **East Asia and Pacific Summer Institutes for US Graduate Students (EAPSI): User-driven design of technology for increasing blind people's independence while shopping**

  Through a summer internship at a major industrial research laboratory, a visually impaired Hispanic graduate student designed a prototype system to facilitate independent exploration of environments by blind people and developed collaborations with top international researchers in the field of accessibility. The EAPSI program in general documents that EAPSI PhD fellows were more likely than a comparison group to hold positions at academic institutions and to collaborate with international researchers.
  https://www.nsf.gov/awardsearch/showAward?AWD_ID=1515546andHistoricalAwards=false

[3] https://www.nsf.gov/news/special_reports/nsfincludes/index.jsp?WT.mc_id=USNSF_53

- **California State University Louis Stokes Alliance for Minority Participation Senior Alliance (CSU-LSAMP)**

  CSU-LSAMP is an alliance of the 23 campuses of the California State University system, which aims to increase undergraduate student enrollment in STEM and increase the number of STEM baccalaureate degrees awarded to underrepresented students. From 1994 to 2013, CSU STEM baccalaureate degree production of underrepresented students increased 277% as compared with only 28% for other CSU students over the same period. CSU-LSAMP participants are 1.2-1.8 times more likely than non-participants to remain enrolled in STEM disciplines and CSU-LSAMP participants are two times more likely than non-participants to graduate with STEM degrees.
  http://www.csus.edu/csu-lsamp/

- **Transforming Engineering Culture to Advance Inclusion and Diversity (TECAID)**

  TECAID provided intensive professional development and facilitated virtual learning communities for department leaders and faculty with the aim of creating and sustaining inclusive, learner-centered educational environments in mechanical engineering departments. Through survey methods, TECAID is being evaluated on outcomes, such as acquisition of knowledge by participants, development of workable action plans by participants, trials of specific strategies, improvement of student experiences, and development of materials and a plan to scale up the project. Significant findings thus far include: an increase in awareness of implicit bias and micro-inequities; increased confidence about how to create organizational change, marshal resources to make change, and build alliances with others; an increase in actions to increase diversity of faculty, staff and students; and increased reporting of departmental actions to address student diversity.
  http://www.wskc.org/tecaid

- **Sustainable Diversity in the Computing Research Pipeline**

  Two interventions in this project (DREU (Distributed Research Experiences for Undergraduates) and CREU (Collaborative Research Experiences for Undergraduates)) aim to provide undergraduate research experiences for groups underrepresented in STEM. Data collected document that twice as many students in these two programs attend graduate school as compared to other REU students and that students in these two programs who did go to graduate schools were more likely to enroll in PhD programs than other REU students.
  http://cra.org/cerp/wp-content/uploads/sites/4/2014/05/CRA-W-CDC-Alliance-REU-Evaluation-Report-2011-20131.pdf

Workshop on Accountability

NSF funded a two-day workshop on developing an accountability framework for broadening participation. The October 2016 workshop[4] convened a variety of stakeholders from across the STEM enterprise, including evaluation experts, to determine what lessons could be learned from exemplary programs, what metrics and measurement are needed, and what considerations are key to developing and implementing an accountability system for broadening participation. Key aspects of an accountability system were generally agreed upon at the workshop: the need for a pre-K through 20 + pathways approach and the need to take into account institutional differences and resources. Participants emphasized the importance of broadening participation in producing better science. Results of that workshop informed the development of a number of the principles and practices discussed in the next section of this report.

Diversity within NSF

CEOSE encourages NSF to foster diversity within NSF as well as within the STEM enterprise. That includes fostering diversity of NSF staff and of reviewers to ensure awareness of diversity issues and commitment to broadening the participation of students and practicing scientists and engineers in NSF funding.

Diversity of NSF Staff

Over the ten-year period FY 2007-2016, the diversity of NSF's scientists and engineers changed little. The percentage of NSF's scientists and engineers who are White women increased, the percentage who are Asian, particularly Asian women, increased, and the percentage who are Hispanic/Latino increased slightly, but there were few, if any, gains for American Indians, African Americans, or Native Hawaiians. (See Appendix G.) The percent of NSF's scientists and engineers who report disabilities remained fairly stable over that ten-year period.

Diversity of NSF-funded Principal Investigators[5]

The number of women submitting proposals to NSF and the number receiving awards has steadily increased over the past decade and the success rate for female PIs is slightly higher than that for male PIs (NSB, 2016).

[4] The accountability workshop report can be found at https://upenn.box.com/v/BetterSTEMOutcomesFinal2 and the workshop blog can be found at https://www.higheredtoday.org/2017/05/22/new-accountability-broadening-participation-stem/.

[5] Gender, disability, and ethnic or racial data are based on self-reported information in proposals. About 87% of PIs provided gender information and 89% provided some ethnic or racial information. (88% of proposals were from PIs who provided gender information, 90% were from PIs who provided race or ethnicity information, and 71% were from PIs who provided information about disability status. (NSB, 2016)

Although the number and percentage of proposals submitted to NSF from PIs from underrepresented groups remains very small, the rate of increase for proposals submitted by these groups has been higher than the increase for all proposals submitted to NSF. However, the success rate for PIs from racial or ethnic groups is lower than the average success rate over all PIs; for example, Asian (20%), African American (21%), and Hispanic (24%) PIs have lower success rates than White (26%) PIs (NSB, 2016).

The percentage of proposals from persons with disabilities (roughly 1%) has not increased over the past decade, however their success rate is generally comparable to the overall success rate for all PIs (NSB 2016).

Next Steps

CEOSE hopes that NSF INCLUDES, other NSF broadening participation efforts, and internal institutional transformation to improve diversity at NSF will substantially improve the participation of women, minorities, and persons with disabilities in STEM. To help ensure that such efforts will be successful, CEOSE is advocating a shared, multi-level accountability framework outlined in the next section.

Chapter 3. Accountability

The Accountability Recommendation

NSF should adopt a framework based on the information and principles in this report that ensures true shared accountability for PIs, for institutions, and for NSF itself in promoting participation and excellence in science and engineering by deliberately and fully utilizing all the talent and potential the Nation has to offer.

In its 2011-2012 report, CEOSE recommended that "NSF implement a bold new initiative, focused on broadening participation of underrepresented groups in STEM… that emphasizes institutional transformation and system change; collects and makes accessible longitudinal data; defines clear benchmarks for success; supports the translation, replication and expansion of successful broadening participation efforts; and provides significant financial support to individuals who represent the very broadened participation that we seek."

NSF has embraced this challenge. Building upon its long history in broadening participation across STEM disciplines, it has focused on the process of developing and refining investment strategies that are consistent with this bold initiative. These actions are admirable; however, it is worth noting that no initiative can truly succeed without accountability. In this report, we focus on the core principle of accountability and what it means to integrate accountability into the bold new initiative and into NSF itself.

It is useful to define terms. Accountability is a complex phenomenon. Accountability is best understood as taking ownership of achieving a set of desired results. Further, for any challenge as complicated as broadening participation, accountability should involve a framework that is embedded, embraced, and practiced willingly by the PIs, grantee institutions and NSF.

In order for such an accountability framework to succeed, it must have: a set of clear assumptions, definitions, goals, and metrics, as well as a strategy for change. Our goal is straightforward: to facilitate excellent science and engineering by utilizing all the talent the nation has to offer. In order to achieve this goal, we must lower barriers to full participation by all groups and work to ensure that there is meaningful and sustained participation by all.

Principles for Overcoming Barriers to Success

There are several barriers to full participation in STEM. There are inequalities across a variety of socio-economic dimensions as well as specific barriers such as: high teaching loads in some institutions; low awareness of programs among some groups; over-reliance on imperfect indicators of merit such as standardized test scores with known outcome disparities by groups (Miller and Stassun, 2014); explicit bias; and uneven access to mentors and well-connected

professionals and sponsors. Some are more difficult to measure directly: implicit bias; hidden assumptions; and expectations of who can do science. These barriers contribute to an unspoken system that makes it difficult to achieve our overarching broadening participation goal. In replacing this invisible system and intentionally addressing inequities, we need to create a new, visible approach to accountability that adheres to a number of clear principles:

- The framework should take into account local conditions, context and history. While all higher education institutions should be accountable for broadening participation in the larger ecosystem of institutions, each institution cannot be held to the same expectations in the details; rather, an accountability framework should take into account the sociocultural and historical factors that may influence a particular assessment or measure. These factors cannot become crutches or excuses; however, we should expect those with more resources to make a correspondingly increased effort to broaden participation.

- The framework must encourage success by requiring accountability from the beginning. Qualitative reviews, data analysis, evaluation, and evidence-based reporting must be integrated into projects from the beginning, as deemed appropriate, not added as an afterthought. These assessments should be tailored to programmatic foci and projects rather than assuming that all assessment approaches should be the same or involve the same components.

- The framework must require evaluation systems that allow periodic feedback to modify practice. Evaluation should guide the evolution of programs and projects in the portfolio. Evaluation must use participatory methods that engage the groups affected, that involve learning from failure, and that are flexible. Evaluation should include both quantitative and qualitative multidimensional metrics that take into account contextual factors in order to ensure understanding and meaning.

- The framework must encourage learning from and through implementation of programs and projects. Although the community tends to value new ideas, it is important that the system support the communication, evolution and adaptation of successful approaches to broadening participation. Additionally, self-study must take place to examine empirically how policies and practices aid or deter broadening participation.

- The framework must encourage and document partnerships among organizations within and across sectors to heighten impact. These partnerships must span local, state, and federal organizations. They must span business, government, community-based organizations, and educational institutions. They must span all levels of education. A useful framework will employ multiple methods to incentivize and assess collaboration across all these sectors.

Three Levels of Accountability

There are three basic levels at which accountability must be addressed in the context of NSF's new broadening participation initiative:

1. The first is at the level of the individual project, where PIs and the Co-PIs are accountable for accomplishing the project's goals, as well as reporting and disseminating the outcomes of their projects. PIs can incorporate best practices to broadening participation into their research, not just as an add-on activity, but also as an integral part of their research practice. PIs can ensure that they actually do what they said they were going to do by conducting evaluation of their efforts. PIs can disseminate results of their broadening participation efforts within and across institutions to exchange knowledge and to allow others to adopt and adapt successful practices.

2. The second is at the level of the institution awarded a grant, particularly institutions of higher education. Institutions are jointly accountable with PIs for monitoring grant expenditures and meeting reporting requirements; however, the institutions must also be accountable for clearly demonstrating that they are concretely contributing to the success of these new projects, that they are creating a supportive climate for these projects, that they provide resources and help facilitate broadening participation for their principal investigators, and that they are monitoring their overall portfolio of broadening participation projects. Moreover, institutions could aggregate qualitative and quantitative data from various investments that document their broadening participation efforts. Combining data from distinct NSF-funded projects, as well as those from different agency programs, can increase understanding of the scale and duration of the broadening participating movement as well as the number of students impacted. Public and private academic institutions that receive federal funding could lead the way in implementing and documenting an innovative accountability system and demonstrating accountability on the institutional level**.**

3. The third is at the level of NSF itself, where NSF is accountable for using its funding vehicles effectively to further the U.S. scientific endeavor and having the data available to demonstrate that it is doing so. For example, NSF could promote and support the further development of a *science of broadening participation,* encouraging the publication of NSF-supported empirical research in the science of broadening participation in high-impact science, engineering, and education venues to advance our collective knowledge with: a) a better understanding of the differential participation of students from underrepresented groups in some STEM careers; b) a better understanding of the impact of belonging to multiple underrepresented groups at once on participation

in STEM; and c) an enlarged body of research on participation in STEM by individuals with disabilities, both physical and learning. Additionally, utilize the Committee of Visitors (COV) mechanism to review and assess the new broadening participation initiative. COVs can ask in what ways the various efforts of the initiative further the participation of underrepresented groups, women, and persons with disabilities in the U.S. scientific enterprise. Such committees would be enhanced by including some members who have extensive knowledge in broadening participation. CEOSE can take as its responsibility to digest and summarize any findings.

As such, within the bold new initiative recommendation, NSF is accountable for knowing the extent to which a broadening participation project funded by the Foundation has succeeded, how that project has enabled the success of other projects, and how that project fits into the larger portfolio of broadening participation projects. Note that accountability here does not mean that each and every NSF-funded broadening participation project must succeed at its goals, particularly within the duration of NSF funding; rather, NSF should be able to understand the extent to which they have. The same is true for PIs and institutions. Science is risky, so success is not guaranteed; however, PIs and institutions should understand why efforts have or have not been successful, leveraging accountability for learning and improvement/change.

It should also be emphasized that understanding the extent of success is not the same as simply requiring that there be evaluation plans. Unlike an award with the goal of funding the construction of a scientific instrument, the ultimate extent to which a broadening participation project has been successful may not be known within the grant period, and it is difficult to require the PIs to do additional extended evaluation years after a project's end. However, this challenge may be addressed as a follow-up study that could be a component of a periodic portfolio outcome analysis or a longer-term portfolio evaluation. Further, because of the local context, we should encourage a more formative approach to evaluation and assessment that allows PIs to experiment with what works in their given settings.

Suggested Practices for Principal Investigators' Role in Ensuring Accountability

Principal investigators (PIs) funded by NSF or other federal agencies can strive to be accountable for broadening participation in their own research and for being models for their students, their institutions, and for other researchers. In their role in supporting accountability, there are several steps that PIs can consider in responding to and implementing the bold new initiative:

1. **PIs can incorporate best practices to broadening participation into their research, not just as an add-on activity, but also as an integral part of their research practice.** That is, as appropriate, they can seek to facilitate excellent science by utilizing diverse talent.

2. **PIs can ensure that they actually do what they said they were going to do by conducting evaluation of their efforts**. Successful efforts should have a research foundation and evaluation structured into the research from the beginning. Monitoring and evaluation should involve measurement at regular intervals, periodic feedback, engagement of the groups affected, learning from failure, and flexibility.

3. **PIs can ensure that their evaluation efforts are sound through collaboration**. They can involve evaluation experts within their institution, coordinate with institutional research offices, and other PIs within their institution, participate in national forums on evaluating broadening participation efforts, and seek training in evaluation of broadening participation.

4. **PIs can disseminate results of their broadening participation efforts within and across institutions to exchange knowledge and to allow others to adopt and adapt successful practices.**

Suggested Practices for Higher Education's Role in Ensuring Accountability

Higher education institutions, as leaders in the community, as models of inclusion for other institutional stakeholders in broadening participation, and as educators of future leaders of the nation, can play an important role in ensuring accountability for broadening participation. Institutions could build and share accountability systems that emphasize the importance of broadening participation as an integral component of funded programs, that evaluate performance and outcomes, and that rely on the assessment of data.

In its role in supporting accountability, there are several steps that higher education institutions can consider for promoting innovation and accountability:

1. **Public and private academic institutions that receive federal funding could lead the way in implementing and documenting an accountability system and demonstrating accountability on the institutional level.**

2. **Higher education grantees could ensure rigorous evaluation.** Details on who participates in each project and why, closing disparities in participation, raising degree completion rates, forming partnerships with local K-12 schools and other community-based organizations, and clarity on the consequences of the project/program/center success for various publics would ensure more rigorous accountability at the institutional level.

3. **Academic institutions could aggregate data from grants that document PIs' broadening participation efforts.** Combining data from distinct NSF-funded projects, as well as those from different agency programs, can increase understanding of the scale and duration of effort as well as the number of students impacted.

4. **Academic institutions could change behavior—their policies, programs, and/or practices—to increase the participation of the students they enroll and educate for careers in STEM.** Identifying significant and persistent problems, such as precollege preparation, campus climate, debt disparities, data recognition and use, graduate student transitions, and faculty diversity, helps to frame and focus the design of any accountability system.

5. **Academic institutions of higher education can lead in communities and function as models of inclusion both for and with other stakeholders in broadening participation.**

Suggested Practices for NSF's Role in Ensuring Accountability

NSF has an important role among federal funding agencies and can lead the way in building an accountability system that provides incentives to principal investigators and institutions of higher education to move with urgency toward the goal of broadening participation. NSF-funded programs could emphasize the importance of broadening participation as an integral component of research and education, along with the understanding that the measurement of success depends on being able to evaluate performance and outcomes, which in turn relies on the assessment of data.

In its role in supporting accountability, there are several steps that NSF can consider for promoting innovation and accountability with the new initiative:

1. **Acknowledge grantee institutions for positive past and present contributions to broadening participation**. Based on data from grantee institutions on their contributions to broadening participation, NSF can recognize those who have done exceptionally well, and provide visible benchmarks that allow institutions to calibrate their own efforts. (See box on Higher Education.)

2. **Facilitate changing culture through the power of convening.** NSF can continue to convene its grantees in national forums to discuss diversity as an asset and to advance broadening participation culture as central to the future of science and engineering. It also can provide information and opportunities for its grantees to network and/or cooperate in their broadening participation activities, so that resources for such efforts can be multiplied nationwide and those with less can benefit from those who have more.

3. **Provide multiple levels of learning and networking opportunities.** Success requires multiple levels of learning opportunities for NSF program officers, reviewers, PIs, and evaluators. NSF could consider offering learning opportunities through workshops, conferences, online resources, technical assistance, virtual sponsored research offices, and other mechanisms as appropriate. These learning opportunities provided by NSF can also facilitate networking among NSF-funded PIs and higher-education institutions to multiply the impact of their broadening participation activities.

4. **Further elevate the value of broadening participation and diversity of perspectives as crucial to excellence in the research process.** NSF's merit review system is exemplary and crucial to NSF's role in supporting science. Because broadening participation is central to the act of doing excellent science, broadening participation should be reflected as a value in the evaluation of all merit review criteria; in the development and writing of program announcements; in the construction of review panels and instructions to the reviewer; and throughout the merit review process.

5. **Promote, develop, and implement an effective strategy for long term longitudinal data collection**. Data include long-term tracking of participants targeted by programs from undergraduates to postdocs to faculty in order to determine their long-term success. Data collection should be designed so that we can learn about multiple pathways for STEM careers.

6. **Utilize Committees of Visitors (COV) to evaluate the new broadening participation initiative.** The COVs can ask in what ways the various efforts of the initiative further the participation of underrepresented racial/ethnic groups, women, and persons with disabilities in the U.S. scientific enterprise. COVs would be enhanced by including some members who have extensive knowledge in broadening participation. CEOSE can take as its responsibility to digest and summarize any findings.

Suggested Practices for NSF's Role in Ensuring Accountability (cont'd)

7. **Promote and support the further development of a science of broadening participation.** We may be seeing the emergence of a new discipline that can unify efforts across multiple disciplines in STEM. As such, it is important to learn from research projects and the implementation of those projects—including significant efforts that arise from programs such as NSF INCLUDES. NSF should encourage the publication of NSF-supported empirical research in the science of broadening participation in high-impact science, engineering, and education venues to advance our collective knowledge with: a) a better understanding of the differential participation of students from underrepresented groups in some STEM careers; b) a better understanding of the impact of belonging to multiple underrepresented groups at once on participation in STEM; and c) an enlarged body of research on participation in STEM by individuals with disabilities. (See https://www.ada.gov/pubs/adastatute08.htm#12102 for the Americans with Disabilities Act definition of disability, which includes both physical and mental challenges.)

   - Such support includes leveraging NSF-funded projects that may not have been originally designed as broadening participation efforts, but provide serendipitous opportunities to gain understanding about barriers to broadening participation and mitigation of those barriers.

   - Such support could also recognize the field-specific nature of the broadening participation challenge even as we generalize and unify across fields, encouraging publication of discipline specific empirical research in the science of broadening participation in high-impact discipline focused science and education venues.

Accountability is Ongoing

NSF has made many good faith efforts across the Foundation to broaden participation. Indeed, NSF has embraced the challenge of implementing a bold new initiative around broadening participation. The recommendation and suggested practices noted above are meant to strengthen these efforts and to provide mechanisms that allow NSF, its constituents, and its partners: to understand their progress collectively on their shared goals around broadening participation, to adjust as necessary to achieve those goals; and to, above all, be accountable to those goals.

Chapter 4. CEOSE Activities, Outcomes, and Plans for the Future

CEOSE Activities for 2015-2016

CEOSE met six times between February 2015 and October 2016. Key topics included: NSF INCLUDES, the lack of progress for persons with disabilities, emphasis on broadening participation in the NSF review and awards process, need for more assessment and evaluation, dissemination of best practices, women of color in STEM leadership positions, women in STEM grants, availability of data, developing an accountability framework, the science of broadening participation, and evaluating collective impact.

Highlights of presentations and discussions include the following:

- **NSF INCLUDES**

In FY 2015, NSF, in response to CEOSE's recommendation for a bold new initiative, launched NSF's Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES). NSF held a workshop on June 3, 2015 that brought together a group of thought leaders from across the nation to brainstorm and prioritize ideas, strategies, and actions that could be pursued in NSF INCLUDES. NSF also constituted an NSF INCLUDES Working Group tasked to develop the initial solicitation of the NSF INCLUDES pilots and to plan the ideas labs and workshops. In discussions with the Director, Chief Operating Officer, and Assistant Directors, CEOSE members suggested examining the lessons than can be transferred from EPSCoR's track 3 awards,[6] understanding how to manage the resisters, and conducting implementation research in the promotion of systemic approaches and linkages.

Efforts in FY 2016 by NSF and CEOSE centered around defining the scope and focus of the initiative in terms of setting goals, expected outcomes, common directions, and measurements. CEOSE members were concerned about the availability of funding to sustain the effort, the need to not lose sight of individuals while concentrating on the big picture, the need to involve social science in the effort, and the need to broaden the community of voices at the table. In particular, CEOSE was concerned with how to involve persons with disabilities in the effort. CEOSE also took the position that race requires a special focus (due to the barriers previously discussed in chapter 3 as well as structural inequality) and that focus on economic status alone is insufficient to bring about a change in participation for members of underrepresented groups.

[6] In FY 2013, EPSCoR funded projects to produce novel methods to broaden the participation of women, underrepresented racial/ethnic groups, people with disabilities, and individuals from rural communities in STEM fields.

- **The science of broadening participation**

CEOSE heard a presentation on NSF's Science of Broadening Participation activity which can provide information on how best to broaden participation and which can inform and be informed by NSF INCLUDES in areas such as measurement/metrics, data analytics, and evaluation. One of the key issues arising from the discussion of these topics was on the relationship between social and non-social scientists in terms of the need for greater access to recent literature and the importance of expert outside evaluation of projects.

- **Dissemination of best practices**

CEOSE heard from the Coalition of Hispanic, African, and Native Americans for the Next Generation of Engineers and Scientists (CHANGES), a coalition of professional organizations serving underrepresented groups that leverages and strengthens members' programs and disseminates information on STEM research, policy and educational programs and best practices. CEOSE members thought CHANGES could be helpful for data on existing broadening participation efforts and information on how to move forward in fostering broadened participation.

- **Women of color in STEM leadership positions**

The presentations from the Opportunities for Underrepresented Scholars (OURS) program focused on increasing the pool of women, especially women of color, in STEM leadership positions. In the first year of the program, approximately 30% of OURS graduates were promoted to leadership positions. CEOSE members expressed interest in the program and dissemination of the model, and discussed with the presenters their connections with search committees and the issue of leadership versus power.

The Committee also heard about the National Academies' report on women of color in academia which found that women of color are less likely to graduate from college, to get a PhD in science and engineering, to get a tenure track job in a majority-white academic institution; are more likely to be in a non-tenure track position and in an institution serving primarily members of groups underrepresented in STEM; and are disproportionately likely to face implicit bias. CEOSE members emphasized that there are many explicit barriers in addition to implicit bias that limit full participation in STEM, including the Graduate Record Examination and the current state of K-12 education in regards to members of groups underrepresented in STEM.

- **Women in federal STEM grants**

The committee discussed the Government Accountability Office's (GAO) report[7] on Federal agencies' data on women grant applicants. CEOSE expressed concern that social sciences and

[7] http://www.gao.gov/products/GAO-16-14

psychology are excluded from STEM in the GAO study, not only because women are underrepresented in some social science fields, e.g., economics, but also because some NSF grants are cross-cutting, e.g., climate science and social sciences, and although women may be well represented in some social and behavioral science fields, they may not be receiving grants at a proportional rate. CEOSE recommended including psychology and the social sciences in the study, and recommended that GAO take into account the problems with missing demographic data in agencies' data on grants.

- **Emphasis on broadening participation in the NSF review and awards process**

In discussions with the NSF Broadening Participation Working Group, CEOSE expressed the need for increasing faculty IPAs from underrepresented groups through better awareness of opportunities. They also stressed the need to gather more information on broadening participation activities that are part of awards from programs that are not in the broadening participation portfolio. NSF made recent changes to requirements for annual and final progress reports that ask for certification of organizational support for broader impacts. CEOSE emphasized the need to hold institutions accountable for implementing proposed broader impacts or broadening participation activities. The BP Working Group is interested in CEOSE's ideas on how to track broadening participation metrics at the institution level. CEOSE members discussed how to get researchers to adopt best practices in broadening participation and how to increase reporting of demographic information in Fastlane. In addition, CEOSE suggested that there be increased assessment of activities for broadening participation in large research facilities supported by NSF.

- **Lack of progress for persons with disabilities**

In discussion with the Director and Chief Operating Officer, CEOSE members pointed out the lack of progress for persons with disabilities in STEM education and the few focused NSF programs that target people with disability. Following a presentation on the Women, Minorities, and Persons with Disabilities in Science and Engineering report, CEOSE expressed concern about the lack of focus on persons with disabilities in the Digest report and changes in the disability question in the Survey of Earned Doctorates. CEOSE also heard from the Office of Disability Employment Policy at the US Department of Labor on a new disability initiative (ePolicyWorks) that national experts can use to shape policy and address barriers to employment of persons with disabilities.

- **Availability of data**

In December 2014, the Census Bureau, in a Federal Register Notice, proposed eliminating the field of bachelor's degree question on the American Community Survey. CEOSE sent a letter in

response which strongly recommended keeping question 12 (Field of Bachelor's Degree) in the survey because that question is used by NSF to ensure that NSF's workforce surveys have a sufficient sample of women, underrepresented racial/ethnic groups, and persons with disabilities in STEM fields. That letter, in conjunction with those by other interested parties, was influential in the Census Bureau's decision to keep the question, thus ensuring that NSF will continue to have quality data on participation by members of underrepresented groups in the STEM workforce.

- **Need for more assessment and evaluation**

In discussions with NSF leadership and the head of NSF's Evaluation and Assessment Capability section (EAC), CEOSE stressed that accountability should be held at three levels—NSF, individuals (mainly PIs) and institutions receiving awards. CEOSE will work with the EAC unit in outlining an assessment and accountability system for broadening participation. CEOSE discussed with NSF what constitutes evidence of broadening participation and what broad concepts and constructs should be used to explore texts for evidence of broadening participation. CEOSE suggested using key words like inclusion, diversity, equity, equality, and parity in text mining, and also that NSF should examine the totality of investments in broadening participation at a given institution to assess diversity goals in terms of institutional transformation.

In order to make substantial improvements in broadening participation, cultural and organizational changes are needed. The committee focused on the need for metrics in this area and the need to determine what needs to happen to achieve success. As part of this effort, CEOSE heard from NSF Assistant Directors about successful data-driven exemplars of broadening participation in their directorates and from the EAC unit about issues and considerations in developing an accountability framework for broadening participation.

The committee heard a presentation on evaluating collective impact of social change which emphasized using an adaptive approach to social problems and using emergent solutions that arise out of continuous learning and adaptation. Rather than just program evaluation, which measures the impact of specific interventions, an evolving continuous assessment of multiple parts at several levels is needed.

Outcomes

In 2016, CEOSE sent a flyer[8] and letter summarizing the focus of the 2013-14 report to approximately 120 Executive Directors of STEM organizations. CEOSE Liaisons gave presentations on the 2011-12 and 2013-14 reports, on NSF INCLUDES, and on broadening participation to NSF

[8] https://www.nsf.gov/od/oia/activities/ceose/documents/CEOSE%202013-2014%20Biennial%20Report%20To%20Congresss%20Flyer-Final_08-27-2015.pdf

Advisory Committee meetings. The CEOSE Chair gave a presentation entitled "Broadening Participation in STEM From the Federal Perspective" [https://broaderimpacts.net/wp-content/uploads/2016/05/0420_0915_Harkavy.pdf] at the 2016 National Alliance for Broader Impacts summit. The committee continued to receive information from NSF about support for the components of the bold initiative as evidenced by the table in the appendices.

Future Directions

In the next reporting cycle, CEOSE plans to focus on how best to implement the bold new initiative and the issue of accountability in broadening participation through: continuing the discussion of the integration of broadening participation and its accountability across the full range of Big Idea[9] efforts going forward; emphasizing the need to build accountability into NSF's broadening participation portfolio, as well as, building assessment for broadening participation activities in the NSF-funded large research facilities; further examining NSF's science of broadening participation investment; better integrating broadening participation directly as a part of the merit review process (rather than as part of broader impacts alone); and helping NSF leverage its efforts through encouraging increased accountability on higher education for broadening participation. Additionally, future directions will focus on building inclusive community-engaged STEM communities that would promote STEM participation on the ground and at all ages, as well as reap the scientific benefits of the insights of people from diverse settings, neighborhoods, and circumstances in the innovation cycle.

Conclusion

NSF has made many good faith efforts across the Foundation to broaden participation, including embracing the challenge of implementing a bold new initiative around broadening participation. NSF has an important role among federal funding agencies and can lead the way in building an accountability system that provides incentives to principal investigators and institutions of higher education to move with urgency toward the goal of broadening participation

Therefore, CEOSE recommends that:

NSF should adopt a framework based on the information and principles in this report that ensures true shared accountability for PIs, for institutions, and for NSF itself in promoting participation and excellence in science and engineering by deliberately and fully utilizing all the talent and potential the Nation has to offer.

[9] NSF's "10 Big Ideas" are drivers of NSF's long-term research agenda. More information can be found at https://www.nsf.gov/about/congress/reports/nsf_big_ideas.pdf

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Appendix A

INCLUSION ACROSS THE NATION OF COMMUNITIES OF LEARNERS OF UNDERREPRESENTED DISCOVERERS IN ENGINEERING AND SCIENCE (NSF INCLUDES)

$16,000,000
+$500,000 / 3.2%)

Overview

NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science) is a comprehensive national initiative to enhance U.S. leadership in science and engineering discovery and innovation by proactively seeking and effectively developing science, technology, engineering, and mathematics (STEM) talent from all sectors and groups in our society. The NSF INCLUDES initiative will improve the preparation, increase the participation, and ensure the contributions of individuals from groups that traditionally have been underserved and/or underrepresented in the STEM enterprise. In particular, the specific goal of NSF INCLUDES is to develop the STEM talent of women, members of racial and ethnic groups that have been underrepresented in STEM, persons with low socio-economic status, and people with disabilities.

Diversity – of thought, perspective, and experience – is essential for excellence in research and innovation in 21st century science and engineering. Full participation of all of America's STEM talent is critical to the advancement of science and engineering for national security, health, and economic competitiveness. African Americans, Hispanics, Native Americans, women, persons with disabilities, and persons with low socio-economic status are underrepresented in various fields of science and engineering across all levels – from K-12 to undergraduate and graduate levels to long-term workforce participation. Inclusion of talent from all these sectors of American society is necessary for the health and vitality of the science and engineering community and its societal relevance. Some of the key challenges to this broad participation are: *under-preparation* and lack of opportunity for members of all demographic groups to become "STEMcapable"; *under-resourcing* as seen in growing disparities of access to quality learning and technology; and *under-production* of STEM graduates from abovementioned sectors. Significant investments, including those by NSF and the larger STEM community, have been made to address these long-standing problems. However, further investment is critical so that these challenges can be overcome and the U.S. science and engineering enterprise can benefit from the creative contributions by talented people from all sectors of society, yielding a competitive advantage in a globalized world for national security, health, and economy.

The NSF INCLUDES initiative will support two of NSF's Strategic Goals and associated objectives:
Goal 1: Transform the Frontiers of Science and Engineering – Objective 2: Integrate education and research to support the development of a diverse STEM workforce with cutting-edge capabilities; and
Goal 2: Stimulate Innovation and Address Societal Needs through Research and Education – Objective 1: Strengthen the links between fundamental research and societal needs through investments and partnerships.

Total Funding for NSF INCLUDES
(Dollars in Millions)

FY 2015 Actual	FY 2016 Estimate	FY 2017 Request
-	**$15.50**	**$16.00**

Goals

The long-term goals of NSF INCLUDES are to fund new research, models, networks, and partnerships that lead to measureable progress at the national level, and the ability to scale the concepts of diversity and inclusion in STEM. This will be achieved, in part, by increasing coherence and leveraging synergies across the NSF broadening participation (BP) portfolio (see the Summary Table chapter for funding details), including both BP "focus" and BP "emphasis" programs, through alignment with the NSF INCLUDES framework.

Appendix B

NSF-Supported Strategies/Projects Related to CEOSE Specific Components of a Plan to Implement a Bold New Initiative to Broaden Participation at NSF

CEOSE-recommended Implementation Components	NSF Investment Examples
Develop and implement an effective preK-20+ system of STEM pathways	NSF supported several relevant research projects e.g., "Ignite Inspiration and Innovation" (Award #1458187); "SFAz+98: Building Capacity for STEM Pathways in Rural Arizona" (Award #1400687);"AGEP-BPR: A Study of the Cultural Factors Affecting Underrepresented Minority STEM Doctoral Students and Academic Pathway and Transition Programs" (Award #1433835);"Understanding PhD Career Pathways in STEM: Proposal for a Workshop to Develop an Instrument" (Award #1534620).
Provide stable and sufficient direct support for individuals	NSF funds students directly through a number of fellowship programs, e.g., The Graduate Research Fellowship program (GRFP) and postdoctoral fellowship programs in specific disciplines, e.g., mathematics, biology, earth sciences, etc. NSF also supports projects that provide direct support, e.g., the LSAMP Bridge to the Doctorate as well as through individual grants, e.g., "2+1 STEM Scholarship Program" (Award #1457942); Supporting Community College Transfer Students to Earn STEM Baccalaureate Degrees (Award #1458430).
Support the further development of a science of broadening participation grounded in empirical research	A "Dear Colleague Letter: Stimulating Research Related to the Science of Broadening Participation" was issued in April 2015.
Conduct field experiments to understand and mitigate the barriers to broadening participation	NSF funded several relevant research projects, including "CAREER SBP Creating Equitable STEM Environments: A Multi-Method Contextual Approach to Mitigating Social Identity Threat Among Women in STEM" (Award #1450755); "Understanding the Role of Cultural and Career Purpose Orientations in Underrepresented Minority Science Student Success" (Award #1420271).
Recognize the field specific nature of the broadening participation challenge	NSF Directorates have field specific broadening participation efforts, e.g., Broadening Participation in Engineering (BPE), Partnerships for Research and Education in Materials (PREM); Partnerships in Astronomy and Astrophysics Research and Education (PAARE).

Appendix C.
NSF's Broadening Participation Portfolio

Focused Programs *Programs with an explicit program goal of broadening participation. The majority of each award's budget goes to broadening participation activities, and could involve research on the topic.*			
PROGRAM NAME	**Publication No.**	**Directorate**	**Division**
Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)	17-522	All	All
ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers	16-594	All	All
Broadening Participation in Engineering	16-7680	ENG	EEC
Centers of Research Excellence in Science and Technology (CREST) and HBCU Research Infrastructure for Science and Engineering (RISE)	16-525	EHR, ENG	HRD
Disability and Rehabilitation Engineering	17-5342	ENG	CBET
EPSCoR Research Infrastructure Improvement Program Track-3: Building Diverse Communities	13-553	OIA	
Experimental Program to Stimulate Competitive Research: Workshop Opportunities (EPS-WO)	12-588	All	All
Historically Black Colleges and Universities Undergraduate Program	16-538	EHR	HRD
Louis Stokes Alliances for Minority Participation	15-594	EHR	HRD
NSF Scholarships in Science, Technology, Engineering, and Mathematics	17-527	EHR	DUE

Partnerships for Research and Education in Materials	14-606	MPS	DMR
Partnerships in Astronomy and Astrophysics Research and Education	13-566	MPS	AST
Postdoctoral Research Fellowships in Biology	15-501	BIO	
Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM)	16-534	EHR	HRD
SBE Postdoctoral Research Fellowships	16-590	SBE	SMA
Tribal Colleges and Universities Program	16-531	EHR, ENG, GEO, SBE	HRD, EEC, BCS

Emphasis Programs

Programs with an additional review criterion on broadening participation. All awards have broadening participation components (e.g., a project diversity plan) along with components not necessarily related to broadening participation.

PROGRAM NAME	Publication No.	Directorate	Division
Advancing Informal STEM Learning	15-593	EHR	DRL
Computer Science for All	17-525	CISE, EHR	CCF, CNS, IIS, DRL
EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2017	16-612	CISE, ENG, MPS	CCF, EFMA, DMR, DMS, PHY
Gen-3 Engineering Research Centers	15-589	ENG	EEC
Graduate Research Fellowship Program	16-588	All	All
Innovative Technology Experiences for Students and Teachers	15-599	EHR	DRL
International Research Experiences for Students	12-551	All	All

Major Research Instrumentation Program:	15-504	All	All
Materials Research Science and Engineering Centers	16-545	MPS	DMR
Research Experiences for Undergraduates	13-542	All	All
Science and Technology Centers: Integrative Partnerships	14-600	All	All

Dear Colleague Letters			
PROGRAM NAME	**Publication No.**	**Directorate**	**Division**
Life STEM	DCL 16-143	EHR	All
Strengthening Transfer of Students from Two-year Hispanic-serving Institutions to Four-year STEM Programs	DCL 16-094	EHR	DUE, HRD
Strengthening Research Capacity at Historically Black Colleges and Universities	DCL 16-080	All	All
Fundamental Research to Improve STEM Teaching and Learning, and Workforce Development for Persons with Disabilities within the EHR Core Research Program	DCL 16-064	EHR	HRD, DRL
Stimulating Research on Effective Strategies in Undergraduate STEM Education at Two-Year Hispanic Serving Institutions	DCL 15-078	All	All
Stimulating Research Related to the Science of Broadening Participation	DCL 15-066	SBE, EHR	All
Effort to Broaden the Participation of Students in Two-Year Hispanic Serving Institutions in Science, Technology, Education, and Mathematics (STEM)	DCL 15-063	All	All

Veterans Research Supplement Program (VRS)	DCL 14-124	ENG	EEC, IIP
Research Assistantships for High School Students (RAHSS): Supplemental Funding to Current SBIR/STTR Phase II Awards to Broaden Participation in Science and Engineering	DCL 14-073	ENG	IIP
Career-Life Balance (CLB) Supplemental Funding Opportunities in Support of Postdoctoral Investigators Funded by NSF Awards	DCL 13-109	All	All
Career-Life Balance (CLB) - Graduate Research Fellowship Program (GRFP) Supplemental Funding Requests	DCL 13-099	All	All
Balancing the Scale: NSF's Career-Life Balance (CLB) Initiative	N/A	All	All
Career-Life Balance (CLB) Initiative	DCL 13-075	All	All
MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements	DCL 13-071	MPS	AST, CHE, DMR, DMS, PHY
Announcement of Efforts to Increase Hispanic Participation in STEM Fields	DCL 12-081	BIO, CISE, EHR, ENG	All
Research Assistantships for High School Students RAHSS) - BIO supplements	DCL 12-078	BIO	All
Research Experience for Teachers (RET): Funding Opportunity in the Biological Sciences	DCL 12-075	BIO	All
Engineering Research Experiences for Veterans	DCL 12-074	ENG	CMMI, CBET, ECCS
Research Experiences for Veterans/Teachers	DCL 12-073	ENG	All

Supplemental Opportunity for Small Business Innovation Research and Small Business Innovation Research/Small Business Technology Transfer for CREST/HBCU-RISE Collaborations	DCL 12-069	ENG, EHR	IIP, HRD
SBIR/STTR Supplemental Funding for Community College Research Teams	DCL 08-029	ENG, EHR	IIP, HRD, DUE
Research Assistantships for High School Students (RAHSS) - SBIR/STTR Phase II Supplements	DCL 06-003	ENG	IIP

Appendix D

National Science Foundation
Programs to Broaden Participation
FY 2017 Request to Congress
(Dollars in Millions)

Group/Program	Amount of Funding Captured	FY 2015 Actual	FY 2016 Estimate	FY 2017 Request (Discretionary)	FY 2017 Request (Mandatory)[1]	FY 2017 Request	FY 2017 Request Change Over FY 2016 Estimate	
							Amount	Percent
Total, NSF Broadening Participation Programs		**$765.18**	**$751.40**	**$733.46**	**$29.76**	**$763.22**	**$11.82**	**1.6%**
ADVANCE	100%	$14.89	$14.90	$14.10	-	$14.10	-$0.80	-5.4%
Alliances for Graduate Education and the Professoriate (AGEP)	100%	8.00	8.00	8.00	-	8.00	-	-
AGEP Graduate Research Supplements (AGEP-GRS)	100%	2.47	0.45	2.60	-	2.60	2.15	477.8%
Broadening Participation in Biology Fellowships	100%	3.80	2.50	2.50	-	2.50	-	-
Broadening Participation in Engineering (BPE)	100%	8.86	7.00	7.00	-	7.00	-	-
Career-Life Balance (CLB)	100%	0.49	1.00	1.00	-	1.00	-	-
Centers of Research Excellence in Science and Technology (CREST)	100%	24.01	24.00	24.00	-	24.00	-	-
Excellence Awards in Science and Engineering (EASE)[2]	100%	5.92	5.82	5.82	-	5.82	-	-
Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)	100%	32.04	35.00	35.00	-	35.00	-	-
Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)	100%	-	15.50	16.00	-	16.00	0.50	3.2%
Louis Stokes Alliances for Minority Participation (LSAMP)	100%	45.91	46.00	46.00	-	46.00	-	-
Partnerships for Research and Education in Materials (PREM)	100%	7.00	6.80	6.43	-	6.43	-0.37	-5.4%
Partnerships in Astronomy and Astrophysics Research Education (PAARE)	100%	1.00	2.00	1.50	-	1.50	-0.50	-25.0%
SBE Postdoctoral Research Fellowships-Broadening Participation	100%	1.11	1.50	1.50	-	1.50	-	-

SBE Science of Broadening Participation	100%	2.14	1.50	1.50	-	1.50	-	-
Tribal Colleges and Universities Program (TCUP)	100%	13.58	14.00	14.00	-	14.00	-	-
Subtotal, Focused Programs		**$171.21**	**$185.97**	**$186.95**	**-**	**$186.95**	**$0.98**	**0.5%**
Advancing Informal STEM Learning (AISL)	58%	$31.91	$36.25	$31.90	$4.35	$36.25	-	-
Discovery Research PreK-12 (DR K-12)	59%	49.60	48.82	48.82	-	48.82	-	-
General and Age Related Disabilities Engineering (GARDE)	50%	1.70	1.70	1.70	-	1.70	-	-
Graduate Research Fellowship (GRF)	61%	203.28	202.47	202.62	-	202.62	0.15	0.1%
Robert Noyce Teacher Scholarship Program (NOYCE)	60%	36.64	36.53	36.53	-	36.53	-	-
NSF Scholarships in STEM (S-STEM)[3]	59%	64.51	44.25	44.25	-	44.25	-	-
STEM + Computing Partnerships (STEM+C Partnerships)	55%	40.89	35.41	18.56	16.85	35.41	-	-
Subtotal, Emphasis Programs		**$428.51**	**$405.43**	**$384.38**	**$21.20**	**$405.58**	**$0.15**	**0.0%**
EPSCoR	100%	$165.46	$160.00	$162.13	$8.56	$170.69	$10.69	6.7%
Subtotal, Geographic Diversity Program		**$165.46**	**$160.00**	**$162.13**	**$8.56**	**$170.69**	**$10.69**	**6.7%**

Totals may not add due to rounding.

[1] Includes only new mandatory funding. Excludes H1B Non-Immigrant Petitioner mandatory funds.

[2] The Excellence Awards in Science and Engineering (EASE) program is comprised of both Presidential Awards for Excellence in Science, Math and Engineering Mentoring (PAESMEM) and Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST).

[3] Amounts for NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) are H1B Non-Immigrant Petitioner mandatory funds.

Appendix E

Summary of the Broadening Participation Working Group Report on the NSF Response to the CEOSE 2011-2012 Recommendation

The CEOSE Recommendation

The 2011-2012 CEOSE (Committee on Equal Opportunities in Science and Engineering) report requested that NSF launch a **bold new initiative** for broadening participation (BP) with the goal of eventually having the participation of scientists and engineers in Science, Technology, Engineering, and Math (STEM) fields mirror the population of the Nation. This initiative would recognize, adapt, and expand successful "best practices" in broadening participation and promote transformative research on the science of broadening participation; careful analysis and widespread dissemination of results would subsequently inform future research and investments to achieve the goals of diversity, inclusion, and parity.

This bold new initiative would have specific goals and components, including: **institutional and systemic change** to address recruitment, progression, and advancement in the federal and academic STEM workforce; focus on interventions that are **scalable** nation-wide; **integration** of current research results on BP and education into interventions, especially interventions aimed at training**;** use of **innovative, longitudinal analysis** to quantify the success of broadening participation efforts, including innovation in monitoring, assessment, and evaluation; **adoption of defined benchmarks** for all aspects of broadening participation (e.g., by disciplines, education levels, type of research, and type/phase of implementation activities, etc.); support for **translation, replication, and expansion of what works** to broaden participation, such that innovation and scaling are not competing activities for funding; **coordination of research centers and projects across levels of schooling**, from pre-K to 20+, and including formal and informal learning experiences and environments; provision of **direct financial support** to individuals (students, postdoctoral fellows, faculty, and practitioners) as investigators in broadening participation; promotion of **interagency and private sector partnerships** for shared vision, financial resources, implementation and dissemination; and, **long-term commitment** to impact STEM employment, education, and research.

Broadening Participation Working Group Recommendations

The NSF BP Working Group developed a matrix representing an array of options for NSF to augment its ongoing activities in broadening participation in STEM and respond to the 2011-2012 CEOSE recommendation. The matrix outlines a range of NSF activities beginning with the end of FY14 (i.e. August and September) through FY16. These ideas can also help inform NSF-wide activities envisioned for new BP efforts in FY2015 and beyond. These activities range from those very easy to implement quickly, such as an IdeaShare site to gather ideas on BP from NSF staff, to large-scale high investment activities such as Centers devoted to the science of broadening participation, or to broadening participation itself. Here we outline examples from three levels of activities that NSF could pursue:

Near-term, low cost activities

IdeaShare activities: NSF employees, those serving NSF on Intergovernmental Personnel Act assignments (IPAs) and Visiting Scientists are an excellent resource of ideas about NSF priorities and mechanisms for broadening participation. We should tap into this wealth of experience and hold one or several IdeaShare activities designed to

generate ideas about investments of varying size in the broadening participation initiative. IdeaShare challenges for broadening participation ideas could be undertaken during Fiscal Year (FY) 2015.

Use of community blogs: Blogs could serve as a reciprocal resource for NSF and the scientific communities. Blogs could generate conversations with scientists and/or educators about cutting-edge findings related to the science of broadening participation, and how to best implement and scale up these best practices. This would also be low cost, but could have a high impact in terms of providing forums for dialogue and information-sharing between different stakeholders.

Supplemental funding: Supplemental funding is a major, low-risk mechanism by which NSF could augment its activities in broadening participation. Through Dear Colleagues Letters (DCLs) and other means, NSF programs and Divisions could notify the principal investigator (PI) community that increased emphasis on supplements will take place, and could outline a variety of supplement types that could be made. The particular demographic targets of supplements may vary by Directorate or Division, depending on the needs of the discipline. These could start as early as FY15.

Mid-scale activities

Community Design Projects: Community Design Projects are considered higher-risk and low to medium investment and would essentially include awards that address local or regional broadening participation efforts, including course and curriculum improvement, inclusion of culturally relevant pedagogies, faculty development, and institutional capacity building efforts. As a lower-risk strategy, replication of proven strategies that have been shown to enhance recruitment, retention, engagement, and persistence in STEM (e.g., bridge programs, cohort models, mentoring, and research experiences through internships and other mechanisms) should also be explored. Research has also highlighted the importance of addressing campus climate and culture as a contributor to successful broadening participation efforts. Examples of community design programs that can be translated into a broadening participation framework are the Partnership Undergraduate Life Science Education (PULSE) activities spearheaded by the Directorate of Biological Sciences (BIO) and the NSF-wide Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE) program. Additionally, scientific societies could play a major role in deploying best practices to the community and pursuing broadening participation.

Large-scale initiatives

Broadening Participation Institutes/Partnerships/Centers: High risk and medium to high investment options include Broadening Participation Centers that focus on the science and practice of broadening participation. While some of NSF's existing research centers may already include broadening participation as a goal, this and other new initiatives would call for new centers to be created with broadening participation as the central mission and the foundation for all other activities. These centers would focus on building the knowledge base for broadening participation, as well as on translating research to practice in scalable programs for widespread dissemination. The NSF Science of Learning Centers provide a good model and set of goals that might be used to inform these proposed centers which are intended to focus exclusively on broadening participation.

Large-scale national initiatives: The need for a robust STEM workforce has been reiterated in recent reports by the National Research Council (NRC), President's Council of Advisors on Science and Technology (PCAST) and the National Science Board (NSB). These reports offer extensive recommendations for strategies for addressing persistent disparities in racial, ethnic, and gender representation in STEM specifically by strengthening K-12 education, increasing student interest and motivation in STEM, and by increasing the number of underrepresented students successfully completing undergraduate STEM degree programs and who wish to pursue STEM careers. Large scale, national initiatives that address the full spectrum of the educational trajectory, from pre-kindergarten

to graduate school and beyond are considered bold activities requiring large investment. Such initiatives might perform, collect, vet and disseminate research on best practices, provide a locus for the development of national communities of researchers and practitioners, and build public/private partnerships that can implement best practices at scale and create systemic changes. By taking a systems approach, NSF can help remove some of the barriers embedded in academic, social, and occupational systems that currently impede progress for underrepresented groups at all levels.

NSF Leadership in Broadening Participation Coordination and Communication

On the whole, NSF has a strong commitment to broadening participation activities. However, NSF's impact in broadening participation could be greater if we identify strategic goals for broadening participation that involve all Directorates, as well as increase the number of budgeted emphasis programs that directly target broadening participation. Additionally, effective communication throughout NSF is paramount. Although broadening participation must be an activity encompassing all of NSF and to which all NSF feels responsible, effective communication and coordination of activities could be enhanced via a NSF-wide committee responsible for the charge. Working with the Director, this committee would have representation from all NSF Directorates and could make clear the importance that the agency places on broadening the participation of underrepresented groups in science.

The Committee could help coordinate broadening participation activities across NSF by helping to share best practices throughout the Foundation and providing recommendations for diverse activities. These could include new funding activities, increasing the prominence of broadening participation language in the NSF merit criteria and in NSF solicitations, and enhancing the NSF broadening participation website, thereby providing a central clearinghouse for best practices at NSF and elsewhere. The website would also list NSF funding programs as well as demographic information by subfield and links to discipline-specific resources which provide guidance on ways to educate the scientific community, reviewers and panelists about the importance of broadening participation in NSF projects as well as best practices that make such efforts effective. These scientists and their communities could then be more effective ambassadors for NSF's broadening participation mission as a whole.

Concluding Thoughts

NSF must continue its leading role in broadening participation, which is a core value of the agency, a key component of broader impacts, and a recommendation advocated by NSF advisory committees to help address complex scientific and societal challenges. The NSF BP Working Group consensus is that NSF should develop a multidimensional strategy that is responsive to the 2011-2012 CEOSE recommendation:

The NSF response to the call for a "bold new initiative" must be a focused effort resulting in new knowledge about participation in science and engineering, effective diversity practices for dissemination (including scaling up), and partnerships for greater inclusive investments in STEM. This will take a great investment in time and resources as well as tailored activities for the underrepresented groups because the challenges are not the same across STEM disciplines or across and within the groups:. The specific needs of the groups must be met while understanding that systemic approaches for diversity must occur at all levels to ensure significant gains in representation and advancement of all groups in STEM disciplines and careers. Thus, the call to action is a catalytic moment for NSF to enable its research communities to help accomplish both, CEOSE's 2011-2012 recommendation and NSF's FY 2014-2018 strategic goals for diversity.

Appendix F

NSF BROADENING PARTICIPATION OPTIONS

Level of Investment by Level of Boldness (Size and Novelty of Effort) versus Potential Impact

	POTENTIAL IMPACT / INVESTMENT POTENTIAL IMPACT		
BOLDNESS	**LOW**	**MEDIUM**	**HIGH**
	• Call for Community Design Projects in response to the 2011-2012 CEOSE recommendation • Provide funding for BP infrastructure that PIs could "plug in" to for meaningful BP Broader Impacts	• Call for BP Institutes/Centers conducting BP research and increasing the number of UR scientists and engineers • Call for Partnerships/Centers that can translate BP research into scalable programs for widespread dissemination	• Call for large-scale BP partnerships that cover research, implementation and scaling across preK-20+, focusing on institutional and systemic outcomes

	POTENTIAL IMPACT / INVESTMENT POTENTIAL IMPACT		
BOLDNESS	**LOW**	**MEDIUM**	**HIGH**
	• Increase the availability of BP Supplements via DCLs from directorates • Make available BP data by subfields • Encourage PIs/faculty to participate in diversity meetings • Form a Rotator Corps for BP • Expand Science: Becoming the Messenger Workshop to have a BP focus	• Support additional replication of successful implementations or additional partnering with model BP programs • Leverage efforts like REU, I-Cubed (I3), PULSE, etc. • Make supplemental funding available to all NSF research centers for BP goals(contingent on strong existing efforts) • Engage STEM Diversity Organizations and have an NSF BP presence at their national meetings	• Increase in number of Emphasis and other programs reaching the 50% threshold • Offer support for mid- and large-scale BP theoretical studies with potential for large scale implementation • Identify strategic goals for BP for NSF that address all directorates • Increase the prominence of BP language in the merit review criteria and in Annual and Final reporting

	POTENTIAL IMPACT / INVESTMENT POTENTIAL IMPACT		
BOLDNESS	**LOW**	**MEDIUM**	**HIGH**
	• Provide BP Memo to NSF Staff from the Director • Enhance BP website with best/promising practices • More systematically inform NSF staff about best practices in BP • Form an agency-wide BP advocacy group to increase communication and identify cross-agency BP goals	• Provide Important Notice to Community about BP • Establish BP Policies for Workshops Agency-wide (see BIO) • More systematically inform panelists and reviewers about best practices in BP • Support NSF-wide workshops on BP from experts in the BP field	• Increase the prominence of BP language in solicitations, on NSF website and via social media used by OLPA • Use community blogs to promote BP discussions • Create BP IdeaShare for gathering ideas/input, etc.

Appendix G

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
Total, NSF Scientists and Engineers	574	648	705	692	684	694	696	674	683	679
American Indian/Alaska Native	5	2	2	3	4	2	4	5	4	5
Asian	64	70	73	71	74	87	87	80	80	91
Black or African American	41	44	46	43	41	41	35	40	43	43
Hispanic or Latino	15	18	24	24	23	30	33	34	29	28
Native Hawaiian/Other Pacific Islander	3	2	1	0	0	0	1	2	1	1
White	446	512	559	551	542	534	536	513	526	511
Men	340	378	413	400	390	396	390	380	388	376
American Indian/Alaska Native	2	1	2	2	2	1	1	3	3	3
Asian	46	47	47	46	43	47	49	51	47	54
Black or African American	13	11	15	15	14	15	11	10	14	16
Hispanic or Latino	7	9	13	11	12	17	19	18	15	15
Native Hawaiian/Other Pacific Islander	3	2	1	0	0	0	1	2	1	1
White	269	308	335	326	319	316	309	296	308	287
Women	234	270	292	292	294	298	306	294	295	303
American Indian/Alaska Native	3	1	0	1	2	1	3	2	1	2
Asian	18	23	26	25	31	40	38	29	33	37
Black or African American	28	33	31	28	27	26	24	30	29	27
Hispanic or Latino	8	9	11	13	11	13	14	16	14	13
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	177	204	224	225	223	218	227	217	218	224

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
BIO	71	80	78	73	71	83	76	75	90	84
Women	38	40	31	36	35	42	41	34	38	34
American Indian/Alaska Native	1	0	0	1	1	0	0	0	0	0
Asian	5	5	5	4	3	4	4	2	2	4
Black or African American	2	2	1	0	0	3	2	2	2	3
Hispanic	0	0	1	0	0	0	0	1	2	1
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	30	33	24	31	31	35	35	29	32	26
Men	33	40	47	37	36	41	35	41	52	50
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	6	3	3	4	3	4	2	4	5	4
Black or African American	1	2	2	2	1	2	2	1	1	1
Hispanic	0	1	3	0	0	0	0	1	1	2
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	26	34	39	31	32	35	31	35	45	42
CISE	46	47	51	51	51	58	68	63	66	68
Women	18	19	19	21	18	17	21	20	23	22
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	1	2	2	2	3	3	3	3	4	5
Black or African American	0	0	1	1	0	0	0	0	0	0
Hispanic	1	1	1	1	1	1	2	2	2	2
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	16	16	15	17	14	13	16	15	17	15
Men	28	28	32	30	33	41	47	43	43	46
American Indian/Alaska Native										
Asian	8	9	10	7	8	12	13	14	12	19
Black or African American	1	1	0	0	1	1	1	1	2	3
Hispanic	0	0	0	0	1	2	2	1	1	0
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	19	18	22	23	23	26	31	27	28	23

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
EHR	83	99	123	109	105	96	95	96	100	94
Women	47	55	63	55	54	50	54	52	56	59
American Indian/Alaska Native	1	1	0	0	0	0	0	0	0	0
Asian	1	2	3	2	1	3	4	2	1	3
Black or African American	13	17	17	13	13	10	10	14	16	15
Hispanic	3	3	2	3	3	4	3	2	2	4
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	29	32	41	37	37	33	37	34	37	37
Men	36	44	60	54	51	46	41	44	44	35
American Indian/Alaska Native	1	1	2	2	2	1	1	1	1	1
Asian	3	3	4	6	3	2	2	1	1	2
Black or African American	5	5	7	7	5	4	3	2	5	4
Hispanic	1	2	2	2	3	3	3	4	4	2
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	1	1	1	1
White	26	33	45	37	38	36	31	35	32	25
ENG	71	77	90	79	79	79	89	83	78	83
Women	17	19	27	24	27	27	30	28	23	29
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	1	3	3	6	6	5	3	3	4
Black or African American	3	3	3	3	3	3	4	5	2	2
Hispanic	0	0	0	0	0	1	3	3	0	0
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	14	15	21	18	18	17	18	17	18	23
Men	54	58	63	55	52	52	59	55	55	54
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	15	16	15	12	15	13	12	14	14	16
Black or African American	2	1	1	1	0	1	0	0	1	1
Hispanic	2	2	3	2	2	4	4	2	1	1
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	1	0	0
White	35	39	44	39	34	33	42	38	38	34

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
GEO	68	78	76	85	81	81	111	110	111	115
Women	25	30	29	34	32	36	51	47	49	56
American Indian/Alaska Native	1	0	0	0	0	0	3	2	1	2
Asian	1	1	1	2	3	5	4	2	5	7
Black or African American	0	0	0	0	1	1	0	1	1	0
Hispanic	3	3	3	3	3	3	4	3	4	4
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	20	26	25	29	25	27	40	39	38	43
Men	43	48	47	51	49	45	60	63	62	59
American Indian/Alaska Native	0	0	0	0	0	0	0	2	2	2
Asian	4	5	4	4	2	3	6	4	2	2
Black or African American	0	0	0	0	1	1	0	0	0	1
Hispanic	0	0	0	0	0	0	2	2	2	1
Native Hawaiian/Other Pacific Islander	1	0	0	0	0	0	0	0	0	0
White	38	43	43	47	46	41	52	55	56	53
MPS	91	101	105	102	107	107	110	113	106	110
Women	22	25	28	23	28	29	27	33	28	29
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	5	4	3	3	5	6	2	5	6	4
Black or African American	1	1	0	0	0	1	1	0	0	0
Hispanic	1	1	2	3	1	1	1	2	1	1
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	15	19	23	17	22	21	23	26	21	24
Men	69	76	77	79	79	78	83	80	78	81
American Indian/Alaska Native										
Asian	8	9	8	10	9	10	12	10	9	8
Black or African American	3	2	3	4	4	5	5	5	4	3
Hispanic	2	2	2	3	3	5	5	5	3	6
Native Hawaiian/Other Pacific Islander	1	1	0	0	0	0	0	0	0	0
White	55	62	64	62	63	58	61	60	62	64

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
O/D	68	70	84	80	83	77	45	37	37	37
Women	33	35	42	45	46	38	25	23	20	21
American Indian/Alaska Native	0	0	0	0	1	1	0	0	0	0
Asian	1	1	3	2	2	2	3	1	2	3
Black or African American	4	5	4	6	5	3	3	3	4	4
Hispanic	0	1	2	2	2	2	0	2	1	0
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	28	28	33	35	36	30	19	17	13	14
Men	35	35	42	35	37	39	20	14	17	16
American Indian/Alaska Native	1	0	0	0	0	0	0	0	0	0
Asian	0	0	2	2	2	2	2	2	1	1
Black or African American	0	0	1	0	1	1	0	0	0	0
Hispanic	1	1	1	1	1	1	1	1	1	1
Native Hawaiian/Other Pacific Islander	1	1	1	0	0	0	0	0	0	0
White	32	33	37	32	33	35	17	11	15	14
SBE	64	78	75	80	81	86	83	78	82	77
Women	30	40	40	40	44	46	45	46	49	43
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	3	6	6	7	8	11	13	11	10	7
Black or African American	4	4	4	4	4	4	2	3	3	2
Hispanic	0	0	0	1	1	1	1	1	2	1
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	23	30	30	28	31	30	29	31	34	33
Men	34	38	35	40	37	40	38	32	33	34
American Indian/Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	2	2	1	1	1	1	0	2	3	2
Black or African American	1	0	1	1	0	0	0	1	1	3
Hispanic	1	1	2	2	2	2	2	2	2	2
Native Hawaiian/Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
White	30	35	31	36	34	37	36	27	27	27
Total, NSF's Scientists and Engineers	574	648	705	693	685	695	697	674	684	683
With disability	50	54	56	49	55	57	58	53	51	56
No Disability	512	577	627	621	609	616	622	605	615	606
Not identified	12	17	22	23	21	22	17	16	18	21

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Number									
BIO										
With disability	5	6	4	4	5	6	7	2	5	7
No Disability	66	73	71	68	66	76	69	71	82	74
Not identified	0	1	3	1	0	1	0	2	3	3
CISE										
With disability	5	4	5	4	4	6	11	8	8	7
No Disability	39	40	43	43	45	50	53	54	57	59
Not identified	2	3	3	4	2	2	4	1	1	2
EHR										
With disability	5	8	8	5	10	8	7	9	8	8
No Disability	76	86	109	95	86	82	85	82	88	82
Not identified	2	5	6	9	9	6	3	5	4	4
ENG										
With disability	7	6	8	8	6	6	6	6	6	7
No Disability	62	70	82	71	73	72	81	76	71	76
Not identified	2	1	0	0	0	1	2	1	1	0
GEO										
With disability	7	4	5	5	6	6	10	11	10	10
No Disability	61	72	69	79	74	74	100	98	98	102
Not identified	0	2	2	1	1	1	1	1	3	3
MPS										
With disability	8	12	10	11	10	9	10	13	9	11
No Disability	82	88	93	88	92	93	95	96	93	95
Not identified	1	1	2	3	5	5	5	4	4	4
O/D										
With disability	10	11	11	8	9	8	2	1	3	2
No Disability	57	58	72	71	71	66	42	35	32	32
Not identified	1	1	1	1	3	3	1	1	2	3
SBE										
With disability	2	2	3	2	2	4	3	2	1	3
No Disability	58	73	67	75	79	81	80	76	81	73
Not identified	4	3	5	3	0	1	0	0	0	1

Gender, Race/ethnicity, and Disability Status of Scientists and Engineers Employed at NSF, by Directorate: FY 2007-2016 continued

Directorate and demographic characteristics	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
	Percent									
Total, NSF Scientists and Engineers	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
American Indian/Alaska Native	0.9	0.3	0.3	0.4	0.6	0.3	0.6	0.7	0.6	0.7
Asian	11.1	10.8	10.4	10.3	10.8	12.5	12.5	11.9	11.7	13.4
Black or African American	7.1	6.8	6.5	6.2	6.0	5.9	5.0	5.9	6.3	6.3
Hispanic or Latino	2.6	2.8	3.4	3.5	3.4	4.3	4.7	5.0	4.2	4.1
Native Hawaiian/Other Pacific Islander	0.5	0.3	0.1	0.0	0.0	0.0	0.1	0.3	0.1	0.1
White	77.7	79.0	79.3	79.6	79.2	76.9	77.0	76.1	77.0	75.3
Men	59.2	58.3	58.6	57.8	57.0	57.1	56.0	56.4	56.8	55.4
American Indian/Alaska Native	0.3	0.2	0.3	0.3	0.3	0.1	0.1	0.4	0.4	0.4
Asian	8.0	7.3	6.7	6.6	6.3	6.8	7.0	7.6	6.9	8.0
Black or African American	2.3	1.7	2.1	2.2	2.0	2.2	1.6	1.5	2.0	2.4
Hispanic or Latino	1.2	1.4	1.8	1.6	1.8	2.4	2.7	2.7	2.2	2.2
Native Hawaiian/Other Pacific Islander	0.5	0.3	0.1	0.0	0.0	0.0	0.1	0.3	0.1	0.1
White	46.9	47.5	47.5	47.1	46.6	45.5	44.4	43.9	45.1	42.3
Women	40.8	41.7	41.4	42.2	43.0	42.9	44.0	43.6	43.2	44.6
American Indian/Alaska Native	0.5	0.2	0.0	0.1	0.3	0.1	0.4	0.3	0.1	0.3
Asian	3.1	3.5	3.7	3.6	4.5	5.8	5.5	4.3	4.8	5.4
Black or African American	4.9	5.1	4.4	4.0	3.9	3.7	3.4	4.5	4.2	4.0
Hispanic or Latino	1.4	1.4	1.6	1.9	1.6	1.9	2.0	2.4	2.0	1.9
Native Hawaiian/Other Pacific Islander	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
White	30.8	31.5	31.8	32.5	32.6	31.4	32.6	32.2	31.9	33.0
Total, NSF's Scientists and Engineers	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With disability	8.7	8.3	7.9	7.1	8.0	8.2	8.3	7.9	7.5	8.2
No Disability	89.2	89.0	88.9	89.6	88.9	88.6	89.2	89.8	89.9	88.7
Not identified	2.1	2.6	3.1	3.3	3.1	3.2	2.4	2.4	2.6	3.1

In FY16, four employees did not identify has having a race.

Total includes employees in BFA, OIRM, NSB, and OIG not shown separately.

Source: NSF Division of Human Resources Management

NATIONAL SCIENCE FOUNDATION
COMMITTEE ON EQUAL OPPORTUNITIES IN SCIENCE AND ENGINEERING (CEOSE)
MEMBERSHIP 2015 - 2016

Dr. Ira Harkavy * (Chair)
Associate Vice President
University of Pennsylvania
Philadelphia, PA
Terms: 06/01/2012-05/31/2015;
06/01/2015-05/31/2018
Vice Chair Term: 10/01/2014-01/31/2016
Chair Term: 02/01/2016-05/31/2018

Dr. Louis Martin-Vega * (Vice-Chair)
Professor and Dean
College of Engineering
North Carolina State University
113-B Page Hall
Campus Box 7901
Raleigh, NC 27695-7901
Terms: 06/01/2014-05/31/2017;
06/01/2017-05/31/2020
Co-Chair: 02/01/2016-05/31/2020

Dr. Mary Monroe Atwater *
Professor of Science Education
Department of Mathematics of Science Education and
Affiliate Faculty Member in African American Studies
College of Arts and Sciences
The University of Georgia
Athens, GA 30602-7124
Term: 02/01/2015-01/31/2018

Dr. Karl Booksh
Professor of Chemistry
Department of Chemistry
Newark, DE 19716
Terms: 09/09/2011-09/08/2014;
09/09/2014-09/08/2015

Dr. Nancy Cantor *
Chancellor
Rutgers University- Newark
249 University Ave.,
Newark, New Jersey 07102-1811
Terms: 10/01/2014-09/30/2017;
10/01/2017 – 09/30/2018

Dr. Garikai Campbell *
Provost and Senior Vice President
Office of the Provost
Morehouse College
Atlanta, GA 30314
Term: 02/01/2015-01/31/2019

Dr. Peter Eden *
President
Landmark College
Putney, Vermont 05346
Term: 02/01/2016-01/31/2019

Dr. Jose Fuentes *
Professor of Meteorology
Department of Meteorology
Pennsylvania State University
State College, PA 16801
Term: 02/01/2016-01/31/2019

Mr. Michael Gooden *
Chief Executive Officer
Integrated Systems Analysis, Inc.
Alexandria, VA 22311
Term: 02/01/2016-01/31/2018

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 02138
Terms: 02/01/2009 - 01/31/2012;
02/01/2012 - 01/31/2015

Dr. Charles Isbell *
Professor and Senior Associate Dean
School of Interactive Computing
Georgia Institute of Technology
Atlanta, GA 30332
Terms: 06/01/2012-05/31/2015;
06/01/2015-05/31/2018

Dr. Robert Jones *
President
University at Albany
Albany, NY 12222
Terms: 06/01/2012-05/31/2015;
06/01/2015-05/31/2018

* Current Members

NATIONAL SCIENCE FOUNDATION
COMMITTEE ON EQUAL OPPORTUNITIES IN SCIENCE AND ENGINEERING (CEOSE)
MEMBERSHIP 2015 - 2016 (cont'd)

Dr. Alicia Knoedler *
Associate Vice President for Research
Director, Center for Research Program Development & Enrichment
The University of Oklahoma
301 David L. Boren Boulevard, Unit 1120
Norman, OK 73072
Terms: 02/01/2014-01/31/2017;
02/01/2017-01/31/2020

Dr. Daniela Marghitu *
Professor of the Computer Science and Software Engineering
Department of Computer Science and Software Engineering
Auburn University
Auburn, AL 36849
Term: 01/01/2015-01/31/2018

Dr. Robert Eugene Megginson *
Arthur F. Thurman Professor
University of Michigan Department of Mathematics Ann Arbor, MI 48109-1043
Terms: 06/01/2014-05/31/2017;
06/01/2017-05/31/2020

Dr. George Middendorf
Graduate Professor
Department of Biology
Howard University
Washington, DC
Terms: 02/01/2010-01/31/2013;
02/01/2013-01/31/2016

Dr. Loretta Moore *
Department of Computer Science
Jackson State University
Jackson, MS 39217
Term: 01/01/2016-01/31/2019

Dr. Lydia Villa-Komaroff *
Consultant
Chestnut Hill, MA 02467
Term: 02/01/2015-01/31/2018

Dr. Wendy Raymond (Former Chair)
Vice President for Academic Affairs and Dean of Faculty Professor of Biology
Davidson College
Davidson, NC 28035
Terms: 02/01/2010-01/31/2013;
02/01/2013 – 01/31/2016
Chair Term: 02/01/2014-01/31/2016

Dr. Keivan Gaudalupe Stassun
Professor of Physics and Astronomy
Vanderbilt University
Department of Physics & Astronomy
Nashville, TN
Terms: 09/09/2011-09/08/2014;
09/09/2014-09/08/2015

Dr. Joseph Whittaker
Dean and Professor of School of Computer, Mathematical & Natural Sciences
Morgan State University
Baltimore, MD 21251
Terms: 09/09/2011-09/08/2014;
09/09/2014-09/08/2015

Dr. Nai-Chang Yeh *
Professor
California Institute of Technology
Pasadena, CA 91125
Term: 02/01/2016-01/31/2019

NSF Contacts

Dr. Suzanne Iacono
Office Head and CEOSE Executive Liaison
Office of Integrative Activities (OIA)
Office of Director, NSF

Dr. Bernice T. Anderson
Senior Advisor and CEOSE Executive Secretary
Office of Integrative Activities (OIA)
Office of Director, NSF

* Current Members

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