MAKING VISIBLE THE INVISIBLE
BOLD LEADERSHIP ACTIONS

Committee on Equal Opportunities in Science and Engineering
2019-2020 Biennial Report to Congress

CEOSE MISSION & BACKGROUND

The Committee on Equal Opportunities in Science and Engineering (CEOSE) advises the U.S. National Science Foundation (NSF) on policies, programs, practices and activities to encourage full participation of women, underrepresented racial/ethnic populations and persons with disabilities within all levels of the nation's STEM enterprise.

The committee was established by the United States Congress through the "Science and Engineering Equal Opportunities Act" in 1980 to address the problems of growth and diversity in America's STEM workforce. The legislation states the following:

"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)]."

Committee members, comprising of approximately 16 individuals, come from diverse STEM disciplines, drawn from diverse institutions in higher education, industry, government and nonprofit 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 participation and advancement of women, underrepresented racial and ethnic groups, and persons with disabilities in education, training and science and engineering research. Based on the findings, the committee makes recommendations to the Foundation for improving the levels of participation of underrepresented groups in STEM professions.

The committee members also interact with other federal agencies, such as the U.S. Department of Agriculture, National Institutes of Health, the Smithsonian Institution and the White House Initiative on Historically Black Colleges and Universities in forging ongoing collaborative insights about efforts to broaden participation by underrepresented groups in the nation's STEM workforce.

MAKING **VISIBLE** THE **INVISIBLE**
BOLD **LEADERSHIP** ACTIONS

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AI — Artificial Intelligence

ARIS — Center for Advancing Research Impact in Society

ASPIRE Alliance — The National Alliance for Inclusive and Diverse STEM Faculty

ATC — Advanced Technology Center

BI — Broader Impacts

BIIS — Budget Internet Information System

BIO — Directorate for Biological Sciences

BP — Broadening Participation

BPCnet — Broadening Participation in Computing Resource Portal

CEOSE — Committee on Equal Opportunities in Science and Engineering

CISE — Directorate for Computer and Information Science and Engineering

COVID-19 — Coronavirus Disease of 2019

CREST — Centers of Research Excellence in Science and Technology

DCL — Dear Colleague Letter

DIVE — Diversity and Inclusion Video Exhibition

DO-IT — Disabilities, Opportunities, Internetworking, and Technology Center

EAGER — Early-Concept Grant for Exploratory Research

EDSIN — Environmental Data Science Inclusion Network

EHR — Directorate for Education and Human Resources

ENG — Directorate for Engineering

EPSCoR — Established Program to Stimulate Competitive Research

FASED — Facilitation Awards for Scientists and Engineers with Disabilities

GEO — Directorate for Geosciences

GEO GOLD — Geoscience Opportunities for Leadership in Diversity

GPRA — Government Performance and Results Modernization Act

HAAEs — High African American Enrollment

HAIEs — High American Indian Enrollment

HBCU — Historically Black Colleges and Universities

HBCU-EiR — Historically Black Colleges and Universities — Excellence in Research program

HBCU-UP — Historically Black Colleges and Universities — Undergraduate Program

HHE — High Hispanic Enrollment

HSI	Hispanic-Serving Institution
IHE	Institutions of Higher Education
IPA	Intergovernmental Personnel Act
IT	Information Technology
IUSE GEOPaths	Improving Undergraduate STEM Education: Pathways into Geoscience
JCORE	White House National Science and Technology Council's Joint Committee on the Research Environment
LDP	Leadership Development Program
LTER	Long-Term Ecological Research Network
MR	Merit Review
MRI	Major Research Instrumentation
MSI	Minority-Serving Institution
NASA	National Aeronautics and Space Administration
NASEM	National Academies of Sciences, Engineering and Medicine
NCSES	National Center for Science and Engineering Statistics
NEON	National Ecological Observatory Network
NIH	National Institutes of Health
NSB	National Science Board
NSF	National Science Foundation
NSF INCLUDES	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science
OIA	Office of Integrative Activities
OLPA	Office of Legislative and Public Affairs
OSTP	[White House] Office of Science and Technology Policy
PAESMEM	Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring
PIs	Principal Investigators
RAPID	Rapid Response Research Grant
REU	Research Experiences for Undergraduates
RII	Research Infrastructure Improvement
S&E	Science and Engineering
SBE	Directorate for Social, Behavioral and Economic Sciences
SEAPD-STEM	Southeast Alliance for Persons with Disabilities in STEM
STCs	Science and Technology Centers
STEM	Science, Technology, Engineering, and Mathematics
TCUs	Tribal Colleges and Universities
TCUP	Tribal Colleges and Universities Program
URG	Underrepresented Groups
VSEES	Visiting Scientists, Engineers, and Educators
WaYS	Wabanaki Youth Science Program
WHI-HBCU	White House Initiative on Historically Black Colleges and Universities
WMPD Report	Women, Minorities, and Persons with Disabilities in S&E Report

EXECUTIVE
SUMMARY

EXECUTIVE SUMMARY

Diverse perspectives are necessary for solving critical scientific and social challenges such as disease, hunger, poverty, safety and security. Yet, statistics show relatively little diversity in the fields of science, technology, engineering and mathematics necessary to solve those issues. As the nation's population of underrepresented and underserved groups grows, the inclusiveness of people from diverse backgrounds is foundational to the success of the nation's science and engineering enterprise. STEM leaders from underrepresented groups, including Black or African American, Hispanic or Latino American, American Indian or Alaska Native, persons with disabilities and women, provide the different cultural perspectives necessary to solve the broad spectrum of human problems. In its last report to Congress, the Committee on Equal Opportunities in Science and Engineering (CEOSE) suggested the U.S. National Science Foundation (NSF) provide "increased support for place-based implementation research projects that are grounded in and engage local communities." Expanding research knowledge and providing the capabilities needed in underrepresented and underserved communities are absolutely necessary to foster an inclusive and diverse network of research leaders, now and in the future.

INVESTING IN BROADENING PARTICIPATION

NSF champions programs that broaden participation of groups historically underrepresented in STEM. The Foundation works to advance diversity and inclusion through its broadening participation portfolio, a variety of strategic partnerships and investments across NSF that integrate research with education, expand and modernize research infrastructure, and scale successful approaches in broadening participation. For example, the Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES) program expands education pathways into the STEM community through a national network of public and private partnerships designed to scale diversity efforts in STEM. Another example is the Louis Stokes Alliances for Minority Participation program, whose alliance-based initiative is designed to increase the number of STEM graduates from underrepresented communities and help them transition successfully into the STEM workforce. Also, the Established Program to Stimulate Competitive Research (EPSCoR) invests in S&E research and capacity building in U.S. states and territories that receive a disproportionately low share of NSF funding. The Historically Black Colleges and Universities — Excellence in Research (HBCU-EiR) program builds on NSF's continuing efforts to strengthen research capacity at HBCUs and expand opportunities for HBCU researchers. The program supports research projects across all scientific disciplines, including education. In the areas of social, behavioral, and economic science research, the Build and Broaden program encourages research collaborations between scholars at minority-serving institutions (MSIs) and scholars in other institutions or organizations to help build the STEM workforce.

NSF is commended for its demonstrated commitment in working toward the full inclusion of persons from underrepresented racial/ethnic groups, persons with disabilities, and women in STEM education, STEM research and the STEM workforce. As such, the following actions and implemented policies and practices represent substantial progress in NSF's leadership in the inclusion of all Americans in the S&E enterprise: NSF funding of MSIs, publicly available diversity data about NSF funding of individual investigators, and the implementation of relevant NSF broadening participation-related policies, practices and priorities (e.g., sexual harassment terms and conditions, rapid response to COVID-19 and support to individuals and institutions disproportionally impacted by the pandemic, and promoting diversity among scientists and engineers at NSF).

Today's focus on inclusiveness is about the intellectual opportunities to address systemic issues of "ism" and biases and to remove barriers related to being overlooked, undercounted or simply missing. More specifically, CEOSE is calling attention to the need for **more diverse scientific leadership**, more attention to the economic advantage of belongingness in STEM, and increased attention on the removal of social and cultural barriers. Additionally, CEOSE is encouraging the development of innovative strategies and approaches to define, monitor and report success in broadening participation, thereby addressing the challenges related to the limits of analysis due to data quality and sample size.

CEOSE ACTIVITIES

Six CEOSE meetings were convened between February 2019 and October 2020 focusing on areas such as investing in community-based research, intersectionality and STEM diversity, investing in diverse community voices, and understanding the STEM capacity and contributions of MSIs within the context of adverse impacts of COVID-19. Targeted attention was placed on advancing diverse leadership in STEM, and a CEOSE leadership roundtable discussion was held. A panel was also convened that focused on moving the spotlight from leadership development to leadership at the top.

CEOSE held discussions with NSF's Director, Chief Operating Officer, Assistant Directors, Deputy Assistant Directors, liaisons from other federal agencies, and outside experts with expertise in diversity and inclusion. Additionally, CEOSE sets as goals the inclusion of new voices, perspectives and experiences in all its meeting discussions as well as the construction of collaborative partnerships with other organizational units, such as the National Center for Science and Engineering Statistics and the National Science Board (NSB).

CEOSE RECOMMENDATION AND SUGGESTIONS

At a fundamental level, leadership includes behaviors that guide, influence and mobilize others toward a common vision, goal or objective. In this report, we want to emphasize leadership as it takes place in decision-making, relationship-building and networking; the development of individuals as leaders; and the willingness of all people to make the right decisions, serve as models and examples, accept responsibility and be held accountable.

Leadership is demonstrated through decisions, actions and opportunities at the organization and individual levels. Yet, some of these actions may not be recognized as **leadership**. Leadership matters because leaders shape funding decisions, admit students to STEM graduate programs, decide when or if communities are invited to partner in NSF-funded projects, and determine if the microculture of their research teams is inclusive. In demonstrating empowered leadership within the staff, advisors and communities it serves, NSF can do more to increase knowledge and awareness of invisibility issues in STEM communities and acknowledge meaningful leadership actions for transformational change.

Based on these perspectives, CEOSE recommends **NSF demonstrate and promote bold leadership actions to create, integrate and make visible elements within and across its programs to enhance broadening participation of underrepresented and underserved groups in STEM**. In order to make visible the invisible, CEOSE also provides more explicit and visible guidance for NSF to take immediate action to address this 2019-2020 CEOSE recommendation, as depicted in *Table 4 – Opportunities to Make Transformative Leadership Visible* in Section IV of this report. Finally, the call to action at speed and scale must reflect that **broadening participation is not a problem but a strategy to promote and advance scientific research, learning and innovation**.

The **SEAS Islands Alliance** is a National Science Foundation INCLUDES $10 million investment to broaden participation in the geosciences, working with communities in seven U.S. or U.S.-affiliated island jurisdictions (U.S. Virgin Islands, Puerto Rico, Guam, Commonwealth of the Northern Mariana Islands, Republic of Palau, Federated States of Micronesia, and the Republic of the Marshall Islands). The SEAS Islands Alliance builds coastal geoscience pathways for students from pre-college to the workforce and investigates their engagement in the pathway, identity development, and sense of belonging. Over five years, the Alliance will engage 425 pre-college students in enrichment programs, 90 undergraduate students in research and career experiences, 65 graduate students through fellowships and the Bridge to Graduate School Program (an 8-week summer research experience), and 25 post-degree recipients as Workforce Fellows in jobs created in partnership with territorial agencies, non-profits, and industry. These interventions and support programming (e.g., mentoring, professional networking, cohort-building activities, and family events) empower participants, grow island networks, and enhance agency of island communities to address environmental problems by building knowledge, confidence, and leadership skills among island youth.

I. INTRODUCTION: MAKING VISIBILE THE INVISIBLE

Members of CEOSE have identified and defined a set of critical topics to address in a series of three consecutive reports that will focus on the theme Making Visible the Invisible.[1] The 2019-2020 report will serve as the first in the series.

Within the theme *Making Visible the Invisible*, the reports will focus on the following topics: inclusive excellence in leadership (2019-2020 report focus); critical issues in defining and understanding intersectionality; and addressing challenges and opportunities in acknowledging and valuing severely underrepresented groups, such as persons with disabilities, neurodiverse individuals or individuals who are neurodiverse, Native Americans and individuals or representatives of lesbian, gay, bisexual, transgender and queer communities.

The theme *Making Visible the Invisible* is broad and serves to recognize that much of the work and understanding related to broadening participation and diversity, equity, inclusion and belonging remains unacknowledged, misunderstood, undervalued and understudied. Therefore, CEOSE will continue to make recommendations to bring to the forefront the knowledge, experiences and perspectives so critical to realizing measurable systemic change in broadening participation in NSF-supported programs and activities.

Section I of this report provides the contextual background and shows connections and synergy across the CEOSE reports that shaped the 2019-2020 recommendations. Section II highlights recent NSF accomplishments and emerging ideas that are underway at the Foundation. Section III summarizes notable CEOSE activities in 2019 and 2020, as well as the committee's plans for 2021-2022. The last section of this report provides more details about the report theme of "making visible the invisible" and the recommendation for "bold leadership action."

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[1] Key recommendations from previous CEOSE reports include: a single recommendation for a bold new initiative to broaden participation (2011-2012); five proposed specific components of a plan for implementing the new initiative, which became INCLUDES (2013-2014); a recommendation for an accountability framework for assessment of broadening participation activities (2015-2016); and a recommendation for inclusion of diverse community voices across research and education portfolios at NSF (2017-2018).

II. BROADENING PARTICIPATION IN AMERICA'S SCIENTIFIC ENTERPRISE: INSIGHTS, CHALLENGES/OPPORTUNITIES AND IMPLICATIONS

INSIGHTS

CEOSE is a congressionally-mandated advisory committee charged by the United States to advise NSF on polices, programs and practices that will promote the full participation of women, underrepresented racial/ethnic groups, and persons with disabilities within all levels of America's S&E enterprise. Every two years, CEOSE prepares a report of its activities during the previous two years and proposed activities for the next two years. This 2019-2020 CEOSE Report to Congress fulfills the congressional mandate of the "Science and Engineering Equal Opportunities Act of 1980."

Additionally, in meeting this reporting requirement, CEOSE has been responding to challenges posed by former NSF Directors:

- Former Director Subra Suresh asked CEOSE to come up with a big, bold, new effort to broaden participation in S&E. (The 2011-2012 report called for NSF to implement a bold new initiative.)

- Former Acting Director Cora B. Marrett encouraged CEOSE to focus its advice on the catalytic role of NSF to address institutional barriers and promote evidence-based/driven systemic change strategies. (The 2013-2014 report outlined five evidence-based implementation components to broaden participation.)

- Former Director France Córdova relied on CEOSE's input to help the Foundation chart a national movement focused on large-scale change for the diversification of STEM disciplines. (The 2015-2016 report included suggestions and practices to ensure an accountability movement for broadening participation at three levels: grantees, institutions of higher education and NSF.)

- Former Acting Director Kelvin K. Droegemeier underscored the need for more solution-oriented advice about meaningful and impactful partnerships and engagements.

Current NSF Director Sethuraman Panchanathan has identified that one of the three visionary pillars for NSF under his leadership is ensuring accessibility and inclusivity. With this increased attention on broadening participation in STEM, CEOSE is timely in pursing the current (and ongoing) theme to make visible the invisible STEM talent, thereby advancing diversity, equity, accessibility and inclusion in the scientific enterprise.

CHALLENGES AND OPPORTUNITIES

Developing strategies for broadening participation in STEM continues to be an urgent matter for the nation. However, it is equally important to note that NSF's programs in the broadening participation portfolio have had some success moving the needle in this area.

BP PROGRAM FACTS

700,000	Approximate number of minority students the Louis Stokes Alliances for Minority Participation program has helped attain a bachelor's degree in a science or engineering discipline over its 30-year history.
71	Number of awards made in the broadening participation track of the Postdoctoral Fellowships in Biology program in FY 18 – FY 20.
528	Number of awards since 1998 that the HBCU Undergraduate Program made to 86 of 101 accredited HBCUs across the U.S., including seven of the 12 community colleges.
84	Number of HBCU-Excellence in Research awards made in 2018 and 2019 to 26 HBCUs.
106	Number of FY 18 – FY 20 awards made in the HSI program.
1,200	Number of partnering institutions in 49 states that participated in the NSF INCLUDES design and development pilot program.
5	Number of proof-of-concept initiatives supported in part by NSF through Project Overcome to deploy broadband technology to rural and urban underserved communities.
160	Number of institutions supported by NSF's ADVANCE program designed to increase the participation and advancement of women in academic STEM careers.
6	Varieties of STEM learning products — from AI-powered robots to coding apps — developed to serve children with differing abilities by Zyrobotics, an NSF I-Corps participant.

Source: NSF internal OLPA document and internal communications with BP liaisons, 2021.

FIGURE 1

Underrepresentation in the Science and Engineering Enterprise

WHAT DOES 'UNDERREPRESENTATION' MEAN?

Some groups have disproportionately low representation in science and engineering compared to the U.S. population.

S&E OCCUPATIONS		U.S. POPULATION
46.4%	White men	29.8%
17.7%	White women	29.6%
14.1%	Asian men	3.0%
6.5%	Asian women	3.3%
3.3%	Black men	6.3%
1.8%	Black women	6.7%
5.1%	Hispanic men	9.5%
2.4%	Hispanic women	9.1%
2.6%	Other men/women	2.7%

Sources: 2019 National Survey of College Graduates (left), 2019 American Community Survey (right).

We continue to report that, although gains have been made by most demographic groups in most S&E disciplines, overall participation of women, underrepresented racial/ethnic groups and persons with disabilities within STEM fields is still disproportionately low (CEOSE 2013-2014). It is critical not to lose sight of individuals, especially their multiple demographic identities, while concentrating on the big picture of parity in STEM diversity and inclusion (CEOSE 2015-2016 and CEOSE 2017-2018).

It is important to underscore that inclusivity in STEM is not simply a problem to be solved. Today's focus on inclusiveness is about the intellectual opportunities to address systemic issues of "ism" and biases and to remove barriers of exclusion. More specifically, CEOSE is calling attention to the following:

- More Diverse Scientific Leadership: CEOSE applauded the Directorate for Geosciences for its investment in GEO Opportunities for Leadership in Diversity, designed to unleash the potential of geoscientists with interests in broadening participation to become impactful leaders in the community (CEOSE 2017-2018). More of these efforts are needed to create and increase a network of diversity and inclusion champions, advancing a greater sense of inclusion and belonging in each of the STEM disciplinary fields.

The **Emerge: Broadening Participation and Leadership in Freshwater Science** award aims to increase the diversity of the freshwater science workforce through the use of a novel and transformative series of training and mentoring experiences for underrepresented minorities (URM), orchestrated in collaboration with the Society for Freshwater Science (SFS). Over a five-year project, EMERGE – the evolution of the 10-year commitment to diversity at the undergraduate level by SFS named "Instars" for the early life stages of aquatic insects – will deliver over 700 such experiences to individuals across career stages and create a roadmap that institutions and organizations can use to build a more diverse and inclusive STEM workforce. Key aspects of the experiences will include networking opportunities with other URM trainees and professionals, technological training in data analysis, and collaborative research that creates a sense of confidence and accomplishment. Program experiences and lessons will be disseminated though scholarly publications, shared resources with other institutions and scientific societies, and a series of documentary films.

- More Attention about the Economic Advantage of Inclusion in STEM: If we do not make a sufficient investment to broaden participation in S&E and employment, then the economic issues of today will be perpetuated into the future (CEOSE 2011-12). The business case for diversity should expand the engagement of a wide range of stakeholders committed to the goal of a fully inclusive, fully diverse, globally competitive STEM workforce.

- Increased Attention to the Removal of Social and Cultural Barriers: Inequities across a variety of social dimensions such as discrimination, harassment, explicit and implicit biases, differential access issues and historical and systemic racism contribute to outcome disparities (CEOSE 2015-2016). Again, full inclusion of diverse communities "will result in better, more innovative, and transformative S&E, as well as a better, more decent and just society" (CEOSE 2017-2018).

- Measurement Innovations: The nation must confront "over-reliance on imperfect indicators of merit" (CEOSE 2015-2016). Additionally, "no program or initiative can truly succeed without accountability." CEOSE has applauded NSF for a more rigorous accounting of funding for programs to broaden participation; however, for catalytic and/or transformative change, there must be a high level of broadening participation accountability for institutions supported by NSF and within NSF itself (CEOSE 2015-2016). Additionally, CEOSE is encouraging development of innovative strategies and approaches to define, monitor and report success in broadening participation, thereby addressing the challenges related to little or no analyses due to data quality and sample size.

SMALL NUMBERS

"As companies collect more and more data on their workforce, there are going to be groups for whom the available data are more limited than others. Small numbers cannot be a rationale to stall progress. Concluding that little can be said with limited data renders underrepresented groups more invisible and creates a roadblock to meaningful changes. To create lasting and impactful changes, organizations should be willing to analyze small numbers, gather detailed interview data on employee experiences, engage managers as allies for changes, and hold themselves accountable to making small numbers grow."

Source: "The Mistakes Companies Make When They Use Data to Plan Diversity Efforts,"
Harvard Business Review, April 16, 2019.

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

(NSF GRPA Report 2009 and in CEOSE 2011-2012)

In its recent reports, CEOSE has consistently stressed the importance of broadening participation in advancing the S&E enterprise. For example, CEOSE has called for better integration of broadening participation in the merit review process rather than just as a part of broader impacts (CEOSE 2015-2016 and CEOSE 2017-2018). Current and future opportunities need to focus on building inclusive 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 2015-2016).

IMPLICATIONS

It is NSF's responsibility to provide the "intellectual and scientific leadership to develop a truly inclusive STEM enterprise that fully and effectively engages all of our citizens" (CEOSE 2013-2014). The creative advantage of achieving America's promise of equal opportunities is dependent on a cultural shift in perspectives and corresponding actions (CEOSE 2013-2014). The "unspoken system" of inequalities and barriers to full inclusion in STEM must be confronted directly to achieve the overarching broadening participation goal (CEOSE 2015-2016). NSF must redouble its efforts to "move the needle" significantly so that the STEM workforce reflects and represents the U.S. population while maintaining the nation's leadership in scientific discovery and innovation. Therefore, in this report, CEOSE directs its recommendation to NSF leadership on making visible the invisible to achieve sustainable impacts in broadening participation in STEM.

This **Building an Ecosystem for Broadening Participation for Computing: 4-H and the Land-Grant University System** EAGER project explored three partnership models between computer science (CS) academic departments and 4-H to advance effective practices for broadening participation in computing (BPC). Representatives from 4-H programs in four states (Alabama, Pennsylvania, Utah and West Virginia) collaborated with the CS department from at least one university to develop a BPC plan for their state. In 2020, participating states trained 426 adults to lead CS learning experiences for youth from underrepresented groups. The project also developed equity-focused professional development resources for youth development and computer science professionals which can be found at **Click2SciencePD.org**. A total of 989 youths were exposed to computer science through this project, including participants who were trained to lead CS activities with their younger peers. This EAGER program continues to provide resources that promote computational literacy and youth leadership through a professional development toolkit that can be found on a website developed after the project, **Click2ComputerScience.org**.

DIVERSITY IN STEM LEADERSHIP

At no other time in CEOSE's 40-year history has the United States and the world had to respond to life-altering co-occurring crises related to public health, civil rights and social justice, and leadership. Many lessons will be learned from this transformative change. From these crises, excellent leaders have evolved and adapted, rising to address challenges and guiding the development of resilience in others. These crises also afford opportunities for leaders to gain experience in addressing systemic issues and eliminating fundamental barriers.

The topics of leadership, competencies and attributes in leaders, the development of leadership styles, and the impact of leaders are widely studied and translated into assessments, training and a plethora of models for guidance and improvement of leadership. Across many discussions and presentations, CEOSE members continually revisited the notion of how critical leadership is to the impacts most desired in "moving the needle" with respect to broadening participation of underrepresented groups. CEOSE members considered a variety of interesting questions, such as: How can leadership impact diversity? How diverse is the pool of senior leaders in STEM? What role does NSF have as convener, funder and agenda-setter in giving incentive to leaders to value and promote broadening participation in the scientific enterprise? How does NSF leadership provide a window of visibility between the scientific community and the general public? Moreover, in discussions around these questions, CEOSE members recognized the importance of illuminating examples of inclusivity in leadership actions, opportunities to develop the next generation of diverse leaders, and demonstrations of leadership within and outside positions of authority.

In summary, **broadening participation is not a problem but a strategy to promote and advance scientific research and learning**. Charged with addressing structural inequality in the S&E enterprise, CEOSE is attempting to use this report to make visible the invisible and move with urgency toward diversification and inclusivity of STEM education, research and workforce development.

2019-2020 CEOSE
RECOMMENDATION

CEOSE recommends that NSF demonstrate and promote bold leadership actions to create, integrate and make visible elements within and across its programs to enhance broadening participation of underrepresented and underserved groups in STEM.

III. NSF'S BROADENING PARTICIPATION DATA AND ACCOMPLISHMENTS: BP PORTFOLIO, PROGRAMS, PROJECTS, POLICIES AND PRACTICES, AND PRIORITIES

NSF is commended for its demonstrated commitment to work toward the full inclusion of persons from underrepresented racial/ethnic groups, persons with disabilities and women in STEM education, STEM research and the STEM workforce. This section of the report provides the status and/or evidence of substantial progress regarding NSF's leadership in the inclusion of all Americans in the scientific enterprise.

NSF PORTFOLIO FUNDING OF BROADENING PARTICIPATION PROGRAMS

NSF has continued to provide over $1 billion in support for funding opportunities designed to broaden participation of women, underrepresented racial/ethnic groups and persons with disabilities in S&E. This funding is reported annually and divided into three categories: focused, emphasis and geographic diversity. In Fiscal Year 2019, NSF invested $1,178.75 million in programs to broaden participation in STEM:

- $244.48 million for focused programs that have broadening participation as an explicit goal of the program.

- $758.60 million for emphasis programs that have broadening participation as one of several emphases, but BP is not an explicit goal of the program.

- $175.67 million for geographic diversity programs that have geographic diversity as an explicit goal.

In FY 2020, there was a decrease in the overall investment ($1,105.15 million) but a notable increase in the investment for focused programs. However, it is important to point out that the decrease should be interpreted with caution. The prevailing explanation for the decrease is that for FY 2021, NSF's CAREER program was counted as an emphasis program, but was not counted in FY 2020, due to the BP emphasis program methodology and the program's three-year funding average was less than the requirement of 50%. This accounts for a net decrease of $185 million to the BP emphasis program total.

- $363.36 million for focused programs.

- $551.27 million for emphasis programs.

- $190.32 million for geographic diversity programs.

  (See details in *Appendix A – NSF Programs to Broaden Participation FY 2021 Budget Request to Congress* in this report.)

NSF FUNDING OF MINORITY-SERVING INSTITUTIONS

According to data from the *NSF 2019 Minority-Serving Institutions Report*, NSF's total investment to all MSIs in FY 2019 was $798.6 million, representing 12.9% of the $6,196.6 million awarded to all institutions of higher education (IHE). Table 1 (below) has the 10-year trend data; the full report is in *Appendix B – Report on FY 2019 Funding to Minority-Serving Institutions* in this report.

The report stated that from FY 2018 to FY 2019, the investment rose from $771.9 million to $798.6 million. This increase of $26.7 million was largely due to the new HBCU-Excellence in Research and Hispanic-Serving Institutions (HSI) programs.

The **Computing Alliance of Hispanic-Serving Institutions (CAHSI)** was established in 2006 as a CISE Broadening Participation in Computing (BPC) alliance, which later (2018) evolved to become the NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discovers in Engineering and Science) CAHSI Alliance. The vision of this program is for Hispanics to represent at least 20 percent of the population who earn credentials in computing by 2030. In July 2019, CAHSI hosted a convening of over 40 Hispanic Serving Institutions (HSI) to develop a set of recommendations to support equitable distribution of resources to different types of higher education institutions. Findings from this and other convenings were presented to the NSF Committee on Equal Opportunities in Science and Engineering (CEOSE). In addition, these findings informed the development of the CISE-MSI Research expansion program, which aims to expand Minority Serving Institutions (MSI) faculty engagement in CISE Core research and other participating programs.

TABLE 1 | Direct NSF Funding to Minority-Serving Institutions for Fiscal Year 2009-2019

BIIS Univ cut as of NOV 2019 (Millions of Dollars)

Appropriation	FY	All IHEs	HBCUs	HBCU% of IHE	HHEs	HHE % of IHE	TCUs	TCU % of IHE	Total HBCU, HHE & TCU	Total HBCU, HHE & TCU % of IHE
Education and Human Resources	2009	$672.9	$61.2M	9.1%	$38.5	5.7%	$14.0	2.1%	$113.6	16.9%
	2010	$689.5	$56.8	8.2%	$43.7	6.3%	$11.9	1.7%	$112.4	16.3%
	2011	$693.5	$66.6	9.6%	$34.7	5.0%	$11.8	1.7%	$113.1	16.3%
	2012	$685.7	$64.3	9.4%	$36.4	5.3%	$9.6	1.4%	$110.3	16.1%
	2013	$697.2	$66.3	9.5%	$38.2	5.5%	$10.8	1.6%	$115.3	16.5%
	2014	$688.9	$59.5	8.6%	$45.1	6.6%	$11.4	1.7%	$116.1	16.9%
	2015	$728.9	$66.0	9.1%	$44.3	6.1%	$12.7	1.7%	$123.1	16.9%
	2016	$738.0	$58.0	7.9%	$70.5	9.5%	$7.3	1.0%	$135.8	18.4%
	2017	$736.1	$59.7	8.1%	$47.6	6.5%	$13.7	1.9%	$120.9	16.4%
	2018	$762.0	$58.6	7.7%	$107.6	14.1%	$17.0	2 .2%	$183.3	24.1%
	2019	$804.0	$61.9	7.7%	$119.9	14.9%	$13.0	1.6%	$194.8	24.2%
Major Research Equipment and Facilities Construction	2008	$47.6	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2009	$73.1	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2010	$80.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2011	$25.2	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2012	$22.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2013	$15.2	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2014	$14.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2015	$0.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2016	$0.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2017	$121.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2018	$88.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2019	$108.1	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
Research and Related Activities	2008	$3,689.7	$29.7	0.8%	$66.4	1.8%	$1.7	0.0%	$97.7	2.6%
	2009	$3,864.8	$31.0	0.8%	$84.6	2.2%	$4.5	0.1%	$120.1	3.1%
	2010	$4,223.7	$25.8	0.6%	$95.3	2.3%	$1.7	0.0%	$122.8	2.9%
	2011	$4,333.2	$23.1	0.5%	$115.8	2.7%	$1.4	0.0%	$140.4	3.2%
	2012	$4,439.4	$30.2	0.7%	$96.8	2.2%	$0.1	0.0%	$127.1	2.9%
	2013	$4,299.5	$19.2	0.4%	$111.5	2.6%	$1.3	0.0%	$132.0	3.1%
	2014	$4,429.3	$28.5	0.6%	$152.3	3.4%	$0.5	0.0%	$181.3	4.1%
	2015	$4,703.7	$18.7	0.4%	$165.6	3.5%	$0.0	0.0%	$184.3	3.9%
	2016	$4,639.7	$36.6	0.8%	$251.0	5.4%	$0.5	0.0%	$288.0	6.2%
	2017	$4,668.1	$20.8	0.4%	$242.2	5.2%	$0.2	0.0%	$263.2	5.6%
	2018	$4,870.8	$43.9	0.9%	$338.9	7.0%	$1.1	0.0%	$383.9	7.9%
	2019	$5,150.1	$30.8	0.6%	$341.0	6.6%	$0.8	0.0%	$372.5	7.2%
H-1B Visa Receipts	2008	$110.2	$5.0	4.5%	$6.4	5.8%	$0.0	0.0%	$11.4	10.3%
	2009	$74.3	$2.8	3.8%	$4.9	6.5%	$0.0	0.0%	$7.7	10.4%
	2010	$86.3	$4.1	4.8%	$7.6	8.8%	$0.6	0.7%	$12.3	14.2%
	2011	$84.1	$2.2	2.6%	$8.8	10.5%	$0.8	1.0%	$11.8	14.1%
	2012	$83.6	$2.8	3.4%	$12.7	15.2%	$0.5	0.6%	$16.0	19.2%
	2013	$104.4	$6.7	6.4%	$5.9	5.6%	$0.3	0.3%	$12.9	12.3%
	2014	$120.5	$3.2	2.7%	$9.6	7.9%	$0.0	0.0%	$12.8	10.6%
	2015	$128.1	$3.5	2.7%	$16.3	12.7%	$0.0	0.0%	$19.7	15.4%
	2016	$169.9	$8.2	4.8%	$26.9	15.8%	$0.0	0.0%	$35.1	20.7%
	2017	$102.7	$2.3	2.2%	$8.3	8.1%	$1.0	0.9%	$11.6	11.3%
	2018	$177.5	$3.1	1.8%	$35.8	20.2%	$0.0	0.0%	$39.0	21.9%
	2019	$134.4	$8.3	6.2%	$20.5	15.3%	$0.0	0.0%	$28.8	21.4%
FY 2019 Grand Totals		$6,196.6	$101.0	1.6%	$481.4	7.8%	$13.8	0.2%	$596.2	9.6%

Numbers may not add due to rounding.

NSF FUNDING OF INDIVIDUAL INVESTIGATORS

CEOSE has praised the Foundation for providing merit review training that gives attention to unconscious bias and increases awareness of tools for portfolio balance and the need for panel/reviewer diversity. However, the *Merit Review Process: Fiscal Year 2019 Digest* states the following:

> *"The number and percentage of total proposals submitted from women and underrepresented groups has remained approximately the same for 10 years. These underrepresented groups include American Indians or Alaska Natives, Black or African Americans, Hispanic or Latino Americans, Native Hawaiians or Pacific Islanders. NSB will engage NSF and outside experts, including the Committee on Equal Opportunities in Science and Engineering, in discussions about current and prospective strategies to increase participation of underrepresented groups in NSF's programs."*

TABLE 2 | Research Awards by Racial and Ethnic Group, 2019

† = number less than 10; †† = row sum not available because a cell includes a number less than 10.

2019	Hispanic	Non-Hispanic	Unknown	Funding Rate
American Indian or Native Alaskan	†	15	†	33%
Asian	†	1,620	112	21%
Black or African American	†	146	†	23%
Native Hawaiian or Pacific Islander	†	†	†	††
White	214	4,469	243	29%
Multi-racial	14	83	†	27%
Unknown	94	244	1,291	22%
Funding Rate	27%	27%	21%	

Source: *Merit Review Process: Fiscal Year 2019 Digest.*

Funding rates are different for different groups. For example, the table above shows that among those who self-identified as Hispanic or non-Hispanic, the funding rates were the same. It also shows that a large group not considered underrepresented (Asian Americans) had a lower funding rate than groups that are considered underrepresented (Black or African American, Hispanic or Latino American, American Indian or Alaska Native).

In FY 2019, the funding rate for research proposals (a subset of the larger group of competitive proposals) grew for all racial groups, ethnic groups and women compared to FY 2018. The need to increase the representation of underrepresented groups submitting proposals and receiving awards from NSF is complicated by missing data, as shown in Table 2 and pointed out in the 2019 Merit Review Digest:

> *"Demographic information about proposers is based on self-reported data; not all proposers choose to disclose this information. PIs of research proposals acted on in FY 2019 provided information about their gender, race, ethnicity or disability status 78%, 78%, 77% or 71% of the time, respectively."*

The results for demographic diversity for funding rates that are shared below must be interpreted with caution due to the issue of non-responses.

- The proportion of proposals from females was 28.9% and the overall funding rate was 31.6%.

- The proportion of proposals from PIs of underrepresented racial or ethnic groups was 8.5% and the funding rate was 28.2%.

- The proportion of proposals from PIs identifying themselves as having a disability was 1.3% and the funding rate was 28%.

The detailed tables are in *Appendix C – Selected Merit Review Tables from the Merit Review Process: FY 2019 Digest* in this report.

RECENT/REVISED PROGRAMMATIC EFFORTS IN THE NSF BROADENING PARTICIPATION PORTFOLIO

During this reporting period, CEOSE inquired about the exemplary efforts of the following programs with a broadening participation focus or emphasis.

- **NSF INCLUDES** – The NSF INCLUDES National Network has grown and comprises several types of awards: design and development launch pilots, conferences, Early-Concept Grants for Exploratory Research, supplements and co-funded grants, alliances, planning grants, coordination hub cooperative agreements and a third-party evaluation contract. The most recent funding opportunities are: 1) planning grants to build capacity for the development of collaborative infrastructure that would lead to the establishment of a large-scale effort to address a broadening participation strategy (NSF 19-600); and 2) new alliances that employ a collaborative infrastructure approach to promote broadening participation efforts in STEM at scale (NSF 20-569). Program features have covered the NSF STEM DIVE (Diversity and Inclusion Video Exhibition) Challenge (see https://www.nsf.gov/ehr/stemdive.jsp); an invitation to join and contribute to the National Network (see https://www.includesnetwork.org); and the most recent results-oriented report, *NSF INCLUDES Special Report to the Nation II* (NSF 20-099). Project level highlights include brief descriptions of each of the NSF INCLUDES Alliances; the community-centered project Wabanaki Youth Science (WaYS) program that focuses on integrating technology science and traditional culture; and the collaborative NASA and NSF INCLUDES effort Building MSI-Led Coalitions to Strengthen Broadening Participation in Engineering (https://www.nasa.gov/stem/murep/about/index.html).

- **HBCU — Excellence in Research** – The HBCU-EiR investment, which is designed to enable STEM faculty at HBCUs to conduct research and further develop research capacity, is strengthening connections between HBCUs and NSF research programs and communities. The effort has evolved from a Dear Colleague Letter to a track in the HBCU-Undergraduate Program portfolio (NSF 18-522) to its own solicitation (NSF 20-542). Proposals for the new solicitation-based EiR competition were received in October 2020. As of October 2021, there were 154 EiR awards made to 37 unique HBCUs.

- **CISE BPC Pilot** – The Directorate for Computer and Information Science and Engineering is engaging its principal investigators in evidenced-based, meaningful actions in support of broadening participation in computing. The CISE Broadening Participation in Computing Pilot program is requiring a BP plan in large and medium-sized awards, as well as requiring reporting of BP outcomes in these grantees' annual reports. The ideal BPC plan is "well-developed, impactful and cohesive." Understanding that this approach is promoting culture change throughout the CISE community, PIs are being connected to a clearinghouse of resources via the BPCnet Resource Portal (**bpcnet.org**) and workshops and webinars are planned. CEOSE commented that this is a groundbreaking approach that could become another NSF-wide model.

- **MRI** – The Major Research Instrumentation program supports the acquisition or development of a major research instrument that is in general, too costly, or not appropriate for support through other NSF programs. MRI is giving increased attention to reaching MSIs, particularly HBCUs. In 2019, the program received 134 proposals from MSIs and the funding rate for these was 22%. However, only three of the 29 awards to MSIs went to HBCUs. Special outreach efforts for HBCU-Undergraduate Program and Centers of Research Excellence in Science and Technology PIs are underway. Additionally, the latest MRI solicitation emphasizes that the program seeks to broaden representation in its award portfolio, including women, early-career researchers, underrepresented minorities and persons with disabilities. Regarding the latter group, MRI is encouraging PIs to consider Facilitation Awards for Scientists and Engineers with Disabilities (FASED) requests as part of the MRI proposal submission.

This **Building Leadership Capacity and Support for Women of Color Faculty** EAGER project provides and promotes leadership development amongst the most underserved women population of faculty and administrators in higher education—Blacks or African Americans, Hispanics or Latinos, American Indians, and Alaska Natives. Approximately 50 mid- to senior- level women in these populations have been identified to participate in this 2-year EAGER Project. The project was designed to be rolled out in three phases in each of the 2 years. The first phase of this project focuses on assisting underserved women in computing and engineering faculty understand who they are as potential leaders, through leadership development assessments. The second phase brings these women together with senior colleagues and certified facilitators to learn about leadership strategies and tools; assist participants in interpreting the results of their individual assessments; develop a personal, leadership development plan; facilitate discussion on case studies related to leadership and management; and describe the role race and gender play for women in leadership positions and organizational advancement. The third phase builds a strategic alliance across a subset of historically underserved and often overlooked members of the computing and engineering professoriate to encourage and support their advancement into STEM leadership positions.

The **Cultivating Indigenous Research Communities for Leadership in Education and STEM (CIRCLES)** Alliance, an EPSCoR-funded initiative develops Native-based STEM education activities for K-12 and higher education students. The six-state Alliance builds on existing partnerships with tribal communities and tribal colleges in Idaho, Montana, New Mexico, North Dakota, South Dakota, and Wyoming to develop a collective strategy for increasing the engagement, involvement, and success of AI/AN students in STEM. With 10.5 percent of the nation's AI/AN population residing within the project's six states, the CIRCLES Alliance is poised to make a meaningful, collective impact across the region while generating results and approaches that can be scaled nationally. Ultimately, the project aims to support tribal communities in producing a STEM-ready workforce to meet their communities' unique economic development needs.

- **STC** – NSF investments in Science and Technology Centers support large-scale, long-term research focused on creating new scientific paradigms, establishing entirely new scientific disciplines, or developing transformative technologies that have the potential for broad scientific or societal impact. Since 1989, NSF has funded 25 centers and there are currently 12 active awards. At all levels, each center is expected to develop strategies for broadening participation (e.g., outreach to students in grades 8-12, summer research opportunities for underrepresented groups, partnerships with MSIs, networks involving institutions serving students with disabilities, and inclusive mentorship and professional development workshops). In a presentation to CEOSE, examples of broadening participation were highlighted that included the engagement of Howard University in the STC for Brain, Minds and Machines and the inclusion of learning resources to encourage deaf and hard of hearing students to study science in the STC for Integrated Quantum Materials.

- **EPSCoR** – Workshop proposals to the Established Program to Stimulate Competitive Research must demonstrate the team has worked to ensure there's a diversity of individuals, including from groups underrepresented in STEM, at every level — from steering committee and leadership to the speakers and participants. Broadening participation is one of EPSCoR's co-funding priorities in making decisions about joint support of meritorious proposals from EPSCoR institutions. From FY 2014 to FY 2020, close to one-third of the PIs of EPSCoR's Research Infrastructure and Improvement program projects were women (46 of 157). Impactful projects highlighted in a presentation to CEOSE included the production and release of North Dakota's statewide Broadening Participation Plan; Alabama EPSCoR's dedicated Research Experiences for Undergraduates-like track for students from four HBCUs in Alabama; Montana EPSCoR's support and recognition of the contributions of Native American students in STEM; and Louisiana EPSCoR's targeted mentoring and hands-on experiences to help build the next generation of diverse cyber and engineering professionals.

NSF BROADENING PARTICIPATION-RELATED POLICIES, PRACTICES AND PRIORITIES

- **Sexual Harassment** – As noted by former NSF Director France Córdova, the Foundation is committed to ensuring the safety and security of the people that NSF awards support. The new policy regarding sexual harassment was issued to provide "targeted, serious consequences for harassers." NSF is encouraging anyone with a harassment complaint involving an NSF-funded researcher to report the incident to their institution and visit NSF's sexual harassment webpage to submit a harassment complaint directly to the NSF Office of Equity and Civil Rights. The webpage also has effective codes of conduct and standards of behavior that may be applied everywhere NSF-supported research is conducted. Additionally, NSF issued in March 2019 the Dear Colleague Letter "Research on Sexual Harassment and Other Forms of Harassment in Science, Technology, Engineering and Mathematics (STEM) Contexts" (NSF 19-053). The DCL explained to the research community that NSF welcomes and supports competitive research that advances fundamental knowledge about the nature and underlying dynamics of sexual and other forms of harassment and mechanisms for evaluating harassment prevalence, prevention and responses in a range of STEM education, research and workplace settings.

- **COVID-19** – NSF issued Important Notice No. 146 to the S&E community in March 2020, acknowledging the uncertainty and upheaval of the unprecedented disruptions to education, academic and research programs and the struggles in communities and workplaces due to the pandemic. The Foundation also issued guidance for NSF awardees to implement flexibilities authorized by the Office of Management and Budget and accepted proposals for non-medical, non-clinical care Rapid Response Research awards relating to the coronavirus (see more information at https://www.nsf.gov/coronavirus). NSF also extended some proposal deadlines (e.g., ADVANCE, SBE Postdoctoral Research Fellowships and TCUP), aiming to provide maximum flexibility and encouraging PIs in need of an extension to work with their program managers as soon as possible.

- **NCSES WMPD Digest** – The National Center for Science and Engineering Statistics has continued to release the *Women, Minorities, and Persons with Disabilities in Science and Engineering Digest*. This report is valued for providing detailed diversity information about the participation levels of underrepresented groups in four areas of STEM education and the S&E workforce: enrollment, field of degree, employment status and occupation.

- **Diversity Among the Scientists and Engineers at NSF** – The importance of broadening participation is reflected in the employment practices of NSF since the Foundation's scientists and engineers help shape the current and future demographics of practicing scientists and engineers. The scientific staff at NSF receive bias mitigation training and resources to help ensure diversity considerations in portfolio balance and a review process free of bias. NSF had 529 program officers in FY 2019. Program officers can be permanent NSF employees or non-permanent employees. As shown in Table 2, 57% were permanent program officers and 43% were non-permanent (e.g., including visiting scientists, engineers and educators and employees under the Intergovernmental Personnel Act). In FY 2019, the distribution of program officers consisted of 47% female and 29% racial or ethnic minority. (See *Appendix D - NSF Scientists and Engineers, FY 11 to FY 20* in this report for trend data.)

This **Exploring Impacts of Scholarships, Cross-Institutional Networks, and Co-Curricular Activities on Navajo Student and Faculty Leadership Development** EAGER project responds to the COVID-19 pandemic that has disproportionately impacted vulnerable populations such as the Navajo Nation. Navajo students have had difficulty accessing essential as well as educational resources throughout the pandemic. This is impacting student retention in geoscience, environmental science, and other STEM fields where diversity in perspectives and leadership is sorely needed. This project will counteract these impacts with professional development opportunities and funding to directly support Navajo students, recent graduates, and early career professionals, including: 1) Financial support via stipends for students and recent graduates from Navajo Technical University and Dine College, 2) Computing stipends to support laptops and broadband internet access for participation in the network, 3) Opportunities for support through individual meetings with peer and vertical mentors, and community talking circles on COVID, health and wellbeing, and leadership, and 4) Opportunities for participation in virtual workshops and research and outreach projects pertaining to environmental science and other green STEM fields at each of the participating institutions. Network-building activities between the University of New Mexico, Navajo Technical University, Dine College, and the Center for Diverse Leadership in Science (CDLS) will provide opportunities for connection with students, recent graduates, and faculty from multiple institutions and CDLS.

TABLE 3 | **Distribution of NSF Program Officers by Characteristics: FY 2019**

Program Officers	Total	Percent
Total	529	100%
Gender		
Male	281	53%
Female	248	47%
Race and Ethnicity		
Racial or Ethnic Minority	152	29%
Non-Minority	377	71%
Employment		
Permanent	300	57%
Visiting Scientists, Engineers & Educators	36	7%
Temporary	36	7%
Intergovernmental Personnel Act (IPA)	157	30%

NSF Division of Human Resource Management, 09/30/2019.
Data are for the end of FY 2019.

Source: *Merit Review Process: Fiscal Year 2019 Digest.*

- **Agency Priorities** – The FY 2018-2022 strategic plan emphasizes NSF's commitment to ensuring talented individuals from all sectors of society have access to STEM learning and opportunities to compete for research funding. The agency's five-year strategic plan notes that inclusion is a core value, guiding how NSF sets priorities, addresses challenges, and recruits and supports personnel. In addition to NSF INCLUDES, another example of the agency's commitment to broadening participation is its plan of priorities and strategies designed to support STEM capacity building and research competitiveness of HBCUs. The plan, covering FYs 2020-2021 and 2021-2022, was submitted to the White House Initiative on Historically Black Colleges and Universities (WHI-HBCU) and can be found on the NSF Broadening Participation website (also, see *Appendix E – NSF's HBCU Agency Plan* in this report).

During this reporting period, the directorship of the Foundation changed. Sethuraman Panchanathan became NSF's 15th Director, "promising a continued push for inclusiveness in science and engineering."

EXCERPT FROM NSF NEWS RELEASE 20-007, 'NEW DIRECTOR TAKES THE HELM AT NATIONAL SCIENCE FOUNDATION'

Panchanathan identified three pillars of his vision for NSF: advancing research into the future, ensuring inclusivity and continuing global leadership in science and engineering. He has a long history of doing exactly those things. "World-class science requires talented scientists and engineers drawn from every corner of our nation — from remote rural areas to the largest urban centers. The best science is shaped by a wide range of perspectives," Panchanathan said. "I want people to get excited by science and have the opportunity to be part of the scientific enterprise. It is our responsibility to inspire talent and find ways to catalyze innovation across our country."

IV. CEOSE ACTIVITIES IN 2019-2020 AND PLANS FOR 2021-2022

CEOSE activities in 2019-2020 included in-person and virtual committee meetings, dissemination of the 2017-2018 CEOSE report, and the preparation of this report. The ongoing work of the committee to advance broadening participation in STEM was aligned with the plans set forth in the prior report. This section provides a brief overview of the committee's work during the 2019-2020 reporting period.

CEOSE MEETINGS

Six CEOSE meetings were convened between February 2019 and October 2020. Regular sessions at these meetings included the following: NSF INCLUDES briefings, reports by CEOSE liaisons to NSF Directorate/Office advisory committees, and discussions with the NSF Director and Chief Operating Officer. The meeting minutes on the CEOSE webpage provide more information about each of the six meetings. Some of the presentations and discussions with the Director, Chief Operating Officer and other senior leaders that were particularly noteworthy are highlighted below.

INCREASED FOCUS ON PERSONS WITH DISABILITIES IN STEM

SUPPORTING PERSONS WITH DISABILITIES IN STEM DISCIPLINES

A presentation by Sheryl Burgstahler, founder and Director of the DO-IT (Disabilities, Opportunities, Internetworking and Technology) Center and the Access Technology Center at the University of Washington, featured several NSF-funded projects focused on individuals with disabilities. She described the following four theoretical and conceptual frameworks: 1) social justice model of disability instead of the medical/deficit model; 2) disability as a diversity issue; 3) universal design instead of accommodations-only framework; and 4) student-centered community building framework. Burgstahler pointed out the inclusion of more people with disabilities in STEM improves the scientific enterprise because of the unique expertise and perspectives they bring with them. She emphasized the importance of considering ability as a continuum where most disabilities are "invisible." She also provided results from an external evaluation of DO-IT that showed successful education and career transitions, and found that retention in STEM careers for people with disabilities could be achieved when they have a sense of purpose, a sense of belonging, and active involvement in their academic and social lives through internships, workshops, networking and mentoring.

ACCESS TO INNOVATIVE EDUCATION: STEM OPPORTUNITIES FOR STUDENTS WITH LEARNING DISABILITIES

A presentation by outgoing CEOSE Member Peter Eden, president of Landmark College, an IHE that serves only neurodivergent students with learning differences, emphasized neurodivergent and neurodiversity as terms of empowerment. Eden highlighted the Directorate for Education and Human Resources (EHR)-funded project Access to Innovative Education: STEM Opportunities for Students with Learning Disabilities (AIE-STEM), designed to improve STEM education and outcomes for neurodivergent students. The project is funding and mentoring 23 scholars from the life sciences and computer science programs. He discussed the challenges and benefits of increasing internships and research opportunities for neurodivergent students. Initial data suggested that the student scholars are gaining confidence in STEM ambitions with an improved sense of self and with support from multiple areas.

SOUTH EAST ALLIANCE FOR PERSONS WITH DISABILITIES IN STEM

A presentation by CEOSE Member Daniela Marghitu, a Co-PI of the NSF INCLUDES Launch Pilot entitled South East Alliance for Persons with Disabilities in STEM (SEAPD-STEM), highlighted the following successful project interventions, which help to increase the participation of people with disabilities in the scientific enterprise: peer and faculty mentoring, small student cluster groups, monthly group meetings, research internships and presentations, annual conferences, and high school campus visits. Marghitu described the project history, which involves 21 institutions throughout the Southeastern United States and Washington, D.C. The project has provided financial, academic and social support to over 260 students with disabilities in STEM majors. The disability categories of these participating students have included Asperger's Syndrome/autism spectrum, attention deficit disorder/attention deficit hyperactivity disorder, hearing impairment, physical/orthopedic/mobility impairment, systemic health/medical condition, psychological/psychiatric condition, learning disorder, visual impairment, speech impairment and acquired/traumatic brain injury. Marghitu reiterated that students enrolled in postsecondary STEM majors comprise one of the largest untapped pools of future American engineers, mathematicians, scientists, technologists and technicians.

Diversity, equity, and inclusion is often siloed from many aspects of the scientific process and portions of the atmospheric science scientific community. New approaches and entry points at higher levels of engagement are needed to foster a diverse community of researchers, scholars, and practitioners in the geosciences. To this end, researchers from the **CUltivating socially Responsible ATmospheric scientists through Education, Leadership, and Action (CURATE)** GOLD-EN EAGER project plan to bridge DEI gaps by developing a novel hybrid (face-to-face and online components) atmospheric science course designed to break down traditional barriers for entry into diversity, equity and inclusion engagement by graduate students and postdoctoral researchers. Specific project objectives include training on how to 1) identify social identity and how it shapes scientific thought and practice, 2) evaluate and explain the impacts of science and technology on marginalized groups, 3)identify and respond to manifestations of implicit and explicit bias in STEM, 4) recognize social justice issues in the geoscience community and beyond with a focus on designing and implementing interventions and 5) act as advocates and allies for people with different life-experiences. The course will provide the structure and resources to help participants emerge as diversity leaders, better prepared to address issues of participation, representation, and inclusion challenges unique to the geosciences.

In 2020, NSF's Directorate for Social, Behavioral and Economic Sciences launched the **Build and Broaden** program to support transformative research, training opportunities and new research infrastructure at minority-serving institutions throughout the country. "Minority-serving institutions make critical contributions to our nation's STEM enterprise by producing some of our most talented scientists and engineers," says Kellina Craig-Henderson, Deputy Assistant Director of NSF's Directorate for Social, Behavioral and Economic Sciences. "And yet, NSF receives few grant proposals from minority-serving institutions. As a result, innovative and potentially groundbreaking scientific work at those institutions is left unfunded and unpursued." The Build and Broaden program is increasing proposal submissions from minority-serving institutions by fostering research partnerships centered on those institutions, thus growing their scientific infrastructure and capacity. The program is also enriching the topics explored by the social, behavioral and economic sciences by generating wider and more diverse participation in its disciplines. So far, the program has already received more than 100 proposals from minority-serving institutions.

FOCUSED ATTENTION ON ISSUES OF INTERSECTIONALITY

INTERSECTIONALITY AND STEM DIVERSITY

Two NSF-funded research projects provided critical insights about women of color in STEM. The first was "Research Methods and Findings of Multiple Consciousness: Investigating the Identities (Academic, Gender, Race and Disability) of Black Women Undergraduate Students in STEM and Their Impact on Persistence" from Howard University/HBCU-Undergraduate Program (EHR/HRD 1505150) presented by Kalynda C. Smith, the Co-PI at Hampton University. The second presentation, by PI Carmen M. Lilley, focused on a research initiation grant, "A Study on the Intersection of Race and Gender on Leadership Formation of Engineering Students," to the University of Illinois Chicago (ENG/EEC 1738132). Both presentations pointed out that grouping people by demographic identity is a challenge that it is multidimensional. One example would be consideration of the intersection of race and gender with the intersection of academic success and science identity. CEOSE noted that the situation becomes more complicated when another level is considered (e.g., women of color with disabilities). The panelists and CEOSE discussed coping mechanisms and strategies, the influence of group dynamics on risk-taking, and the need to address leadership skills as a cross-cutting theme. In providing context for the discussion, NSF EPSCoR Section Head and former CEOSE Member Loretta Moore highlighted the increased attention that the ADVANCE program has on intersectionality, especially for women of color.

DEEPER APPRECIATION OF THE STEM CAPACITY AND CONTRIBUTIONS OF MSIs

SUPPORTING MSIs TO BROADEN PARTICIPATION IN STEM DISCIPLINES

This panel discussion consisted of two presentations. The first was *MSI: America's Underutilized Resource for Strengthening the STEM Workforce*, a National Academies of Sciences, Engineering and Medicine report, presented by Leigh M. Jackson of NASEM.

The over 700 MSIs, who represent 14% of all degree-granting Title IV-eligible IHEs, enroll about 30% of the nation's undergraduates. MSIs are often under-resourced; nevertheless, they serve as a model of diversity for educating the STEM workforce. CEOSE pointed out the need for meaningful partnerships that are respectful of MSIs' roles and contributions.

The second presentation was an overview of recent and planned activities of the WHI-HBCU, given by initiative Executive Director Johnathan Holifield. This presentation advanced the discussion of supporting MSIs by focusing on the historical overview of HBCUs and their critical role to the STEM enterprise. WHI-HBCU is using the term "competitiveness" as a watchword focused on improving the quality of life for HBCUs and visualizing these institutions as an asset base for opportunity zones in their local communities. CEOSE agreed with Holifield about the urgency of acknowledging HBCUs' local investments as an advantage for workforce development and economic development.

PANEL: BP IMPLICATIONS OF INSTITUTIONAL PRACTICES AND COVID-19

A special feature of the June 2020 meeting was a panel focused on the impact of COVID-19 on MSIs. The panelists were:

- **HSIs** — Anne Gates, professor and chair of the Computer Science Department, University of Texas at El Paso

- **TCUs** — Robert Megginson, CEOSE member

- **HBCUs** — Vernon Morris, CEOSE member

- **EPSCoR** — Loretta Moore, section head of NSF EPSCoR and former CEOSE member

Professor Anne Gates pointed out that COVID-19 exposed several disparities in higher education, especially in the areas of access to laptops, broadband and appropriate study environments. Additionally, the loss of job security greatly impacted student internships. Other challenges included providing quality education while transitioning to a virtual world and using digital tools most effectively to be competitive in a global setting. Gates noted there are new opportunities for colleges and universities to incentivize community engagement, enhance education with on-demand collaborative environments, and extend access for virtual research and professional experiences. She suggested the response of the higher education community needs to include more flexible academic pathways, promote collaborative team building, provide technical skills that are needed in an increasingly automated workplace, and provide social and behavior support services.

CEOSE Member Robert Megginson directed CEOSE's attention to a message from the American Indian Higher Education Consortium that described the pandemic as a "tremendous, disruptive change that is requiring TCUs to move to online learning." Most TCUs have few online teaching capabilities and nearly all lack the needed IT infrastructure. Megginson shared information about the instructional status of 32 of the 40 TCUs. In several cases, he pointed out the culturally responsive role of instruction in serving diverse tribal communities. In addition to helping students deal with remote learning, these institutions had to address student support services such as funding for travel and access to housing and food. He pointed out the important role NSF can have in improving the IT infrastructure needs of TCUs.

CEOSE Member Vernon Morris discussed the multiplying effects of challenges for some HBCUs due to the state of unrest in urban communities. He noted the timing of the campus shutdown at Howard University was during spring break, confounding unexpected costs in a very short period and forcing students to make fast decisions. The situation revealed poor communication, limited readiness and inflexibility in dealing with catastrophes. Other specific challenges included limited access to online connectivity, limited or no access to student support services, issues related to quality of instruction, faculty attrition, and disruption to immersive mentoring and research experiences. He also pointed out that the unstable environments created by COVID-19 require new models for the delivery of STEM research and education.

EPSCoR Section Head Loretta Moore, noting that EPSCoR jurisdictions have varying racial diversity and types of MSIs, discussed how limited access to the internet, the absence of a laptop or home computer, modest income and family responsibilities are contributing to underrepresented racial/ethnic students falling behind during the current period of distance learning. To counter these and other COVID-19 challenges, she noted that EPSCoR resilience strategies have included revising project strategic plans to adapt timelines due to COVID-19 disruptions; conducting outreach initiatives and summer undergraduate research activities using virtual technologies where possible; keeping project personnel, including students, employed on non-laboratory projects while labs are closed or open with limited operations; and supporting rural and MSI internet connectivity via EPSCoR's Inter-Campus and Intra-Campus Cyber Connectivity investment.

INCREASED FOCUS ON BOTH THE SCIENCE AND IMPACT OF BROADENING PARTICIPATION IN STEM RESEARCH

LEVERAGING BROADENING PARTICIPATION TO ADVANCE RESEARCH IMPACTS IN SOCIETY

CEOSE expressed a strong interest in learning about the recently funded NSF-wide center focused on broader impacts, the Center for Advancing Research Impact in Society (ARIS). The ARIS Center has three key components: training, partnerships and scholarship. ARIS aims to: 1) serve as an advocate and resource for the broader impacts community; 2) leverage expertise and partnerships to make research accessible through an integrated approach to scholarships and professional development; and 3) build connections among researchers, practitioners and communities to benefit society. A presentation about the ARIS Center by Executive Director Susan Renoe also highlighted the ARIS 2019 fellows, ARIS 2019 Broader Impacts Champions, links to broader impacts resources, and the work of the Committee on Minority Serving Institutions.

This area is important to both CEOSE and NSF. Former Acting NSF Director Kelvin Droegemeier discussed with CEOSE the importance of broader impacts as an institutional responsibility, particularly the scaling up of broadening participation activities. In October 2020, during a special session of CEOSE with the NSB, it was apparent that there was a common interest in helping the research community articulate and demonstrate the value of broadening participation as an important component of merit review.

The National Center for Science and Engineering Statistics released the latest **Women, Minorities, and Persons with Disabilities in Science and Engineering** report in 2021. The biennial report provides detailed information about participation levels of underrepresented groups in science and engineering education and employment. "Ensuring accessibility and inclusivity in STEM is essential to cultivate a robust U.S. science and engineering enterprise," said NSF Director Sethuraman Panchanathan. "This report provides useful information that helps us understand where we are and where we need to go." "The report serves to inform policymakers and the science and engineering communities on issues impacting underrepresented groups over time," said NCSES Director Emilda B. Rivers. "The report also provides a valuable resource to academic researchers and community leaders to further the discourse on STEM representation."

NSF's Directorate for Mathematical and Physical Sciences supports funding for future STEM leaders from all backgrounds. The **Mathepatics Mathematical and Physical Sciences Ascending Postdoctoral Research Fellowships (MPS-Ascend)** program, aims to support outstanding future scientists with a focus on achieving excellence through diversity and supporting postdoctoral Fellows that will broaden the participation of underrepresented minorities in academia as well as across the Nation's scientific enterprise. The intent is to support and prepare postdoctoral Fellows to transition from a postdoctoral position into the first few years of an academic faculty position or other career choice. The **Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences (LEAPS-MPS)** program supports MPS principal investigators at minority-serving institutions (MSIs), predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities initiating their research programs early in their careers. Both solicitations require applicants to submit a specific and impactful plan to broaden the participation of underrepresented minorities within MPS fields.

TARGETED ATTENTION ON ADVANCING DIVERSE LEADERSHIP IN STEM

CEOSE LEADERSHIP ROUNDTABLE

Two CEOSE members, Charles Isbell of the Georgia Institute of Technology and Lydia Villa-Komaroff of Intersections SBD, shared their journey in becoming STEM leaders and how they are promoting broadening participation in the STEM enterprise. They pointed out leaders should: 1) provide inspiration and incentives; 2) know what resources are available at all levels; 3) have knowledge about their individual STEM school and departments, which is critically important in trying to introduce any kind of change through leadership; and 4) be held accountable for cultural change that results in inclusive environments.

Over this reporting period, CEOSE members shared with NSF leadership that the long-term cultural changes necessary for inclusion and increased representation of underrepresented groups in STEM are difficult without the support and active involvement of leadership. Several questions were raised for continued discussion: How can leadership impact diversity? How diverse is the pool of senior leaders in STEM? What role does NSF have as a convener, funder and agenda setter to incentivize leaders to value and promote broadening participation in the scientific enterprise?

PANEL: FROM LEADERSHIP DEVELOPMENT TO LEADERSHIP AT THE TOP

Bruce DeRuntz, NSF PI and Director of the Leadership Development Program in the College of Engineering at Southern Illinois University Carbondale, presented a student leadership model that is answering the call from industry for work-ready STEM graduates who are future technical leaders. Funded by the EHR Directorate (EHR/DUE 1644166), Pathways to STEM Leadership Careers is a relationship-based, social interdependency approach emphasizing mentoring, tutoring and improvement of both the community and the environment. Over 15 student-led projects per year are developed and implemented in three phases: 1) learning about leadership; 2) learning how to become a high performing team member; and 3) learning how to lead a team.

Robert Kirsch, NSF Co-PI and faculty in Leadership and Interdisciplinary Studies at Arizona State University, and Rebecca Batchelor, NSF Co-PI and education and outreach associate at University of Colorado Boulder, provided a data-informed and evidence-based overview of the GEO Directorate-funded "Sparks for Change" award (GEO/ICER 1645453). The project used a triad model of connecting junior faculty interested in broadening participation ("sparks") with more senior partners in the same or in other departments within the college ("partners") and experienced broadening participation experts ("sponsors") to drive change needed to increase diversity in the geosciences. An important feature of this model is the use of action plans to focus efforts and spark change, providing a clear structure to align diversity, equity and inclusion goals with actions and metrics.

DISSEMINATION OF AND NSF'S RESPONSE TO THE 2017-2018 CEOSE REPORT

The 2017-2018 CEOSE report was submitted to NSF in September 2019, and the Director transmitted it to Congress. In the report, **CEOSE recommended that NSF give increased attention to including diverse community voices across its research and education portfolios through community-driven projects**. The report was well-received by NSF leadership and research communities. CEOSE also prepared a dissemination letter and a report summary that was sent to the leadership of over 100 STEM organizations, NSF program directors, members of various NSF advisory committees, and several other listservs (see *Appendix F – 2017-2018 CEOSE DCL and Report Handout* in this report). The report can be found on the CEOSE website. Additionally, a summary of the NSF response to the 2017-2018 recommendation and suggestions can be found in *Appendix G - Examples of NSF-Supported Programs, Projects, Strategies/Activities, and Events Related to CEOSE's Recommendation of Investing in Diverse Community Voices Across the Research and Education Portfolios through Community-Driven Projects* in this report and some specific efforts and activities are noted below.

During the October 2019 CEOSE meeting, Chief Operating Officer Fleming Crim commended CEOSE for a timely biennial report that is forward-thinking and conveyed that the NSF Director would be referencing the report in an upcoming speech in Iceland. He commented that the recommendation is relevant for what the Foundation is implementing in Navigating the New Arctic, one of the NSF's 10 Big Ideas for Future NSF Investments, and the recommendation is deemed visionary beyond the Foundation's investment in informal science.

During the February 2020 CEOSE meeting, the following Assistant Directors used data to provide an overview of the broadening participation challenges in various disciplines of the STEM enterprises: CISE Assistant Director Margaret Martonosi, GEO Assistant Director William Easterling, EHR Assistant Director Karen Marrongelle and ENG Assistant Director Dawn Tilbury. They also provided information about relevant community-based activities underway in their organizations.

CEOSE also learned about the engagement of a diverse community in two large-scale efforts: the National Ecological Observatory Network (NEON) in a presentation by NEON Program Director Roland Roberts; and the Long-Term Ecological Research Network (LTER) in a presentation by LTER Program Director Douglas Levey. The five-year strategic engagement plan for NEON emphasizes broadening participation with a focus on building an inclusive user community to advance science.
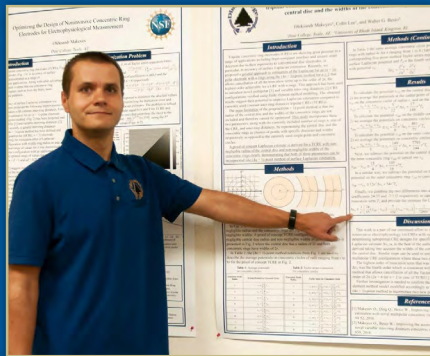
Oleksandr Makeyev, Associate Professor from Diné College, might be the first tribal college faculty member to be awarded a patent in the United States. His design of concentric ring electrodes sensors has boosted the accuracy of the technology in detecting electrical signals from tissue. According to Makeyev, "The patent can be used for various kinds of electrophysiological measurement, such as recording electric signals from brain, heart, muscles, intestines, uterus, etc., for diagnostic purposes." Dr. Makeyev's subsequent work lays the groundwork for further patent applications. "The approval of this scientific patent shows our growth and entrance into academic entrepreneurship field as an institution of higher education and exhibits the highly qualified and esteemed faculty we have educating our students," said Diné College President Charles "Monty" Roessel. The research was funded by the **NSF Tribal Colleges and Universities Program (TCUP)**, which helps to build research and STEM instructional capacity of specific institutions serving Indigenous populations in the United States.

Of the 161 NEON outreach and engagement activities reported since the start of 2021, 14% were for groups underrepresented in STEM and four staff engagement activities were hosted at MSIs. The Environmental Data Science Inclusion Network (EDSIN) was launched in the spring of 2019 following the NEON-led NSF INCLUDES conference that brought together researchers, practitioners, evaluators, employers and others interested in examining diversity, equity and inclusion (DEI) across the environmental and data science fields. Examination of DEI is especially relevant in these fields where analyses of big ecological datasets and policies driven by those analyses may have profound environmental and societal implications. NEON is committed to making progress in these areas through a growing membership, collaborating organizational collaborations and ongoing programs. EDSIN has now grown to 229 members currently, including faculty from 18 MSIs (some of whom have joined the HBCU and TCU working groups), nine community colleges and 17 partner organizations. Additionally, NEON is engaging with Access-INCLUDES, a program that links the knowledge and results of NSF disability-related projects and other projects within the NSF INCLUDES National Network.

The LTER presentation provided an overview about the research of the network, which is supported by NSF's BIO, GEO and SBE directorates. The presentation highlighted two urban sites (Phoenix and Baltimore), mentioning their activities are designed to increase awareness of the importance of urban ecology. Two other examples of community engagement efforts were the Schoolyard Ecology Program, which includes socio-ecological and place-based lessons, and the Schoolyard Ecology Book Series, which features theme-based books on the local ecological system in multiple languages and conveys ecology through the eyes of diverse children. These outreach efforts promote environmental literacy and engagement in underserved communities and bring user perspectives into the LTER community, assuring that society helps to shape LTER research. LTER has a partnership with the Ecological Society of America, engaging small groups of 10-15 underrepresented students with field trips to LTER sites where students meet scientists, learn about ecological research through hands-on field experiences, and hear career panels discuss their work and encourage students to think about becoming a scientist. Other projects highlighted were Bonanza Creek's partnership with rural communities in Alaska and the W.K. Kellogg Biological Station's partnership with agricultural professionals.

In another presentation, given by invited National Institutes of Health (NIH) speakers David Wilson, Director of NIH's Tribal Health Research Office (THRO), and Juliana Blome, THRO Deputy Director, highlighted their engagement with American Indian and Alaska Native communities. Wilson and Blome stressed the importance of tribal engagement in the research approval process and highlighted successful strategies NIH uses to gather meaningful input from tribes on NIH policies, programs and activities.

FUTURE PLANS

During the CEOSE meetings, several presentations and discussions informed future directions for the committee. These driving forces for CEOSE's future workplan are noted below.

- ### REGULAR SESSIONS WITH NCSES

  NCSES provided an update on the forthcoming *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2021* report. This report is submitted to Congress and serves as an enumeration by sex, race and ethnic group and discipline of the people in scientific and engineering positions and of students studying in scientific and engineering fields. The presenters asked CEOSE members to share their concerns and ideas about the report. CEOSE members expressed the need to exclude temporary VISA holders in the race/ethnicity analyses and the need for additional groupings to advance discussions about intersectionality of demographic factors. Members also suggested expanding the report to include visuals of state level or regional level analyses and separate data for women, underrepresented racial/ethnic groups and persons with disabilities by career levels. CEOSE member Gilda Barabino of Olin College of Engineering pointed out that "all data for all groups along the career path needs to be disaggregated, women of color remain invisible without disaggregation, and too little data is available for faculty." A critical issue discussed was the suppression of small cell analysis. New content for the upcoming 2021 report will include a focus on early-career scientists and engineers with disabilities and underrepresentation in the skilled technical workforce. Regular briefings by NCSES will be scheduled for future CEOSE meetings.

- ### REGULAR SESSIONS WITH NSB

  In October 2020, NSB leadership presented an overview of the *Vision 2030* report to CEOSE with an emphasis on STEM talent development and in turn, in December 2020, CEOSE presented to the Board an overview of the committee's work and themes to be covered in the *2019-2020 CEOSE Report to Congress*. CEOSE embraced the elements of leadership the NSB presented (i.e., building meaningful partnerships, infrastructure for linking researchers, the practice of science from lab to service to society, and talent as the greatest resource of the nation for pushing the frontiers of science) and expressed that their outlook on the "missing millions" is that they are not missing per se, but leadership must be held accountable for making them — and their talents — visible. CEOSE was also supportive of NSB's emphasis on expanding the geography of innovation, focusing on precollege years, promoting bold leadership to translate ideas into action, and being accountable with reliable, up-to-date data. CEOSE commended NSB for the recent statement on racism in S&E, pointing to the urgency and opportunity to diversify STEM. CEOSE would like to continue the discussion about infrastructure and new ways to focus on broader impacts. NSB Chair Ellen Ochoa emphasized that an ongoing relationship between NSB and CEOSE would be mutually beneficial to "amplify each other's messages and reach wider audiences."

- **JOINT SESSIONS WITH DIRECTORATE ADVISORY COMMITTEES**

  A powerful outcome of the roundtable with the NSF Assistant Directors and Deputy Assistant Directors and the CEOSE liaisons to NSF directorate advisory committees has been a request to have joint advisory committees. In October 2020, the CEOSE-BIO joint advisory session provided the two communities with the opportunity to frame broadening participation discussions in terms of opportunity or finding a solution for integrating perspectives. The committee stressed this is a mindset change and not just about a set of programs. Other important points were: 1) broaden participation, and address retention in parallel with recruitment; 2) be mindful of the hidden labor performed by underrepresented groups that are not valued, including token representation on committees, and duties not shared equally with other members of the group, department or organization; 3) embrace new and different perspectives at multiple levels (students, faculty, etc.); 4) radical cultural change is needed to address systemic racism; counting individuals is not sufficient; and 5) expand leadership with people who are not like us and people we have not noticed. It is anticipated that at least once a year, CEOSE will have a joint meeting with another advisory committee.

- **DIRECTOR'S INCLUSIVITY PILLAR**

  Broadening participation is front and center in the NSF Director's vision for the Foundation. Specifically, the three pillars of his vision for NSF are advancing research into the future, ensuring inclusivity, and continuing global leadership in S&E. During the Director's visit with CEOSE, he emphasized the importance of accessibility and inclusivity as essential to strategic actions and activities going forward (e.g., curiosity-driven/exploration research, artificial intelligence in every state, a national quantum platform accessible to all, learning everywhere). The Director applauded the committee's report plans and he was supportive of the members' comments concerning: 1) cohort and talent development; 2) partnerships for change; 3) infrastructure needs of MSIs; 4) leveraging the community as framers of research and not just the recipients; and 5) making broadening participation the synergistic link that bridges intellectual merit and broader impacts. CEOSE is excited about ongoing work with NSF leadership to operationalize a vision of STEM inclusivity and to leverage diversity of perspectives to meet the goal of a fully inclusive, fully diverse STEM workforce.

- **UPCOMING MEETINGS AND THE NEXT BIENNIAL REPORT**

  Several areas of invisibility in the STEM enterprise became focus areas for presentations and discussions at CEOSE meetings during the 2019-2020 biennium. They were: 1) the invisibility of underrepresented groups due to the exclusion of data with low cell size; 2) the invisibility of the needs of underrepresented groups with multiple demographic identities and the limited attention to specific challenges of these individuals who face multiple threats to pursing and advancing in STEM education and careers; 3) the invisible presence of MSIs as lead institutions for frontier research and emerging research priorities, as well as overlooking the success of MSIs in STEM workforce development; and 4) the invisibility of efforts to address neurological or cognitive disorders in the discussion of, and support to, persons with disabilities in STEM.

  While this report has strong emphasis on the invisibility of underrepresented groups, particularly racial/ethnic groups and individuals with disabilities, and STEM leadership roles in academic and non-academic STEM institutions, future meetings and reports will address other areas of the conceptual framework of *making visible the invisible* depicted in the figure in Section V, figure 2 of this report.

V. CEOSE RECOMMENDATION: MAKING VISIBLE THE INVISIBLE

The theme *Making Visible the Invisible* enables CEOSE to organize its activities, meetings and recommendations with the goal of taking action and making progress toward "moving the needle" in broadening participation in STEM. CEOSE sets as its goals the inclusion of new voices, perspectives and experiences in its discussions and the construction of collaborative partnerships with other organizational units, such as NCSES and the NSB, to address significant challenges in broadening participation. Figure 2 – *Diversity, Equity and Inclusion: Making Visible the Invisible* below represents the areas of focus within the *Making Visible the Invisible* theme.

FIGURE 2

Diversity, Equity and Inclusion: Making Visible the Invisible

DIVERSITY IN LEADERSHIP/UNDERREPRESENTED LEADERSHIP

- Leadership **actions** and leadership **positions**
- Leadership as mindset AND action, not just position
- Integrative or infused leadership (as opposed to one-off activity or project based)

- Ties to past CEOSE reports with examples of leadership actions: NSF took a risk with NSF INCLUDES and brought along other agencies

- PI community needs to take leadership (without authority) – scientific leadership
- Next generation of leaders
- Increasing opportunities for some groups to become leaders
- Introspecting about leadership

UNDERSTANDING INTERSECTIONALITY

Intersectionality, "One Size Fits All" programming isn't effective

Big Data vs small data vs no data – Beyond the "small -n" problem and quantification vs experimental

Aggregated data and categorization no longer represent diverse identities and experiences

RECOGNITION OF SEVERELY UNDERREPRESENTED GROUPS

Persons with Disabilities

Neuro-diversity

Underserved Communities

Individuals Who Elect Not to be Categorized

Women in Skilled Technical Workforce

Native Americans

*Note: CEOSE's work is in progress, and additional parts of this display will take shape across future discussions.

The topics of leadership, competencies and attributes in leaders; the development of leadership styles; and the impact of leaders are widely studied and translated into assessments, training and a plethora of models for guidance and improvement of leadership. Across many discussions and presentations, CEOSE members continually revisited the notion of how critical leadership is to the impacts most desired in "moving the needle" with respect to broadening participation of severely underrepresented groups. However, this section of the report is not to provide an overarching review of literature about leadership or treat leadership as an academic or research question, rather, this section of the CEOSE report strives to draw together examples of leadership in the context of diversity, equity and inclusion.

At a fundamental level, leadership includes behaviors that guide, influence and mobilize others toward a common vision, goal or objective. In this report, we want to emphasize leadership as it takes place in: 1) decision-making; 2) relationship building and networking; 3) the development of individuals to be leaders; 4) the commitment to serve as role models and change agents; and 5) the responsibility for transparency and accountability to further advance broadening participation and inclusion in STEM.

INSPIRATIONAL LEADERSHIP QUOTES

"When you've worked hard and done well, and walked through that door of opportunity, you do not slam it shut behind you."

Former First Lady Michelle Obama

"Be persistent and be prepared to work through any 'limitation' that is either self-imposed or society-imposed. Remember that perseverance plays an important role in scientific discovery, and never be afraid to challenge conventional wisdom."

Omowunmi A. Sadik

Distinguished Professor and Chair of Chemistry and
Environmental Science, New Jersey Institute of Technology

"This next generation of scientists and engineers will drive discovery and innovation, and the world will be a safer and better place for it. We must never stop innovating in ways to interest a more diverse body of students in STEM activities and lighting that STEM spark across all demographics and backgrounds. Our future depends upon it."

Cheryl Ingstad

Director of the Artificial Intelligence and
Technology Office, U.S. Department of Energy

DIVERSE LEADERSHIP WITHIN NSF'S ORGANIZATIONAL INFRASTRUCTURE

NSF regularly invites the perspectives and guidance from external experts as part of their infrastructure within each directorate and office. External advisory committees, like CEOSE, identify leaders within the STEM community to serve as members, discuss current and critical issues, and provide advice to NSF regarding policies, practices and activities. Business leaders, federal employees from other agencies, academic and research leaders, university presidents, vice presidents, deans and faculty comprise the membership of NSF's 16 external advisory committees. CEOSE members also serve as liaisons to other external advisory committees to ensure that CEOSE perspectives and knowledge about broadening participation are integrated into the work of these committees. Regardless of their position, title or leadership standing at their respective institution or organization, each member of these advisory committees can demonstrate leadership actions in their roles as committee members by sharing their experiences and perspectives. NSF values their recommendations and is accountable to these committees in how it addresses and implements them.

One notable example of an advisory committee recommendation is the formation of the NSF INCLUDES initiative, which is a direct implementation resulting from CEOSE's recommendations from its *2011-2012 Biennial Report to Congress*. NSF's decision to develop an initiative focused on large investments related to broadening participation has now resulted in 180 directly funded NSF INCLUDES projects and a coordination hub that guides and supports the NSF INCLUDES National Network. The NSF INCLUDES initiative is a visible example of commitment and emphasis placed on broadening participation. The National Network strives to bring other perspectives and participants into the NSF INCLUDES community, regardless of whether they have received NSF INCLUDES funding or not. And NSF's leadership further emphasized its commitment to broadening participation by elevating the NSF INCLUDES initiative as one of NSF's 10 Big Ideas. Leadership is visible throughout the actions, commitments and decisions concerning the NSF INCLUDES initiative. For example, the ASPIRE Alliance has developed a leadership training program for diverse mid-career faculty who aspire to leadership positions. NSF INCLUDES may be NSF's most visible example of leadership in the context of broadening participation.

Aspire: The National Alliance for Inclusive and Diverse STEM Faculty aims to help higher educational institutions attract more women, members of underrepresented racial and ethnic groups, people with disabilities and those from low socioeconomic backgrounds into STEM college programs, while assisting them to stay in the programs and help them graduate and succeed in a modern STEM workforce. To do this, the five-year, $10 million NSF program encourages colleges and universities to make institutional change by aligning and reinforcing professional development and hiring practices of STEM faculty. Through the alliance, cohorts of institutions commit to the advancement of more inclusive and diverse campus cultures; develop inclusive practices for STEM faculty; and implement effective recruitment, hiring and retention practices to diversify STEM faculty. Dr. Gina Sanchez Gibau, associate vice chancellor for faculty diversity and inclusion at Indiana University–Purdue University Indianapolis stated the program has enabled their university to develop partnerships with five other regional Midwest institutions in order to increase network mentorship, especially for women of color in STEM.

The **Engineering for US All project (e4USA)** is introducing a diverse new generation of students and educators to engineering by developing and piloting a national high school engineering course. The program empowers teachers to gain the self-efficacy, self-confidence and skills to teach and assess students' engineering-based competencies. Students study engineering in society, practice professional skills, and perform community-focused engineering design to help them envision themselves as engineers. Led by Darryll Pines at the University of Maryland, the e4USA team has enlisted 16 university partners to prepare and support teachers at regional high schools. So far, approximately 2,000 students (42% female students and 37% Black/African American students) have participated in e4USA through 36 high schools across 11 states, Washington, D.C., and the U.S. Virgin Islands. In the future, e4USA plans to continue improving its curriculum and teacher development, grow its partnerships, expand college credit and placement options, and develop a national high school engineering assessment.

In 2020, NSF welcomed its 15th Director, Sethuraman Panchanathan. Continuing NSF's commitment to broadening participation — championed by NSF's 14th Director France Córdova — Director Panchanathan has explicitly addressed issues of broadening participation in articulating his vision:

"*The resources, funding and different initiatives NSF is deploying to support inclusivity and broaden participation are the seeds for building a STEM community that reflects the whole nation. The alliances and networks that we are building to connect programs and share resources and best practices are key to strengthening these efforts and extending their reach. But the final piece is the need for leaders to institutionalize these efforts and make them self-sustaining cultures of inclusivity that are embedded within communities.*"

In addition to the Director's commitment, broadening participation is embedded within NSF's Strategic Plan and incorporated into NSB's *Vision 2030* report in the context of its action to *Develop STEM Talent for America*.

DEVELOPMENT OF LEADERS ACROSS THE STEM COMMUNITY

Informal opportunities to develop leaders are abundant, including effective mentoring and sponsoring activities, experiences learned from leading and participating in NSF-funded projects, and engagement of investigators in NSF-funded and organized workshops and seminars. Individuals introspecting on these experiences often derive new leadership ideas, observe model leadership behaviors, and test opportunities to demonstrate leadership. However, what makes these leadership experiences visible are often more formal leadership training experiences, especially those focused on the next generation of leaders in STEM.

In 2018, NSF launched the Leadership Development Program (LDP) and graduated its first cohort of aspiring supervisors (17) and aspiring executives (12) in December 2019. LDP is a competitive merit-based program designed to enhance leadership capabilities within NSF through robust training opportunities, mentoring, coaching, networking and detail assignments. LDP develops cohorts of rising leaders who understand the context within which NSF operates, who develop strong connections within the Foundation and across the federal government, and who make impactful contributions to NSF's success as a high-performing federal agency. As a highly trained, vetted and engaged group, LDP participants are eager to take on formal and informal leadership roles at NSF.

NSF also sponsors over 170 individuals annually from colleges, universities and other organizations who come to the Foundation as rotational program officers. As described in recruitment materials, "As a rotator, you will be in a prime position to collaborate with others and *increase your visibility* as you survey the entire breadth of U.S. and international science, engineering and education in real time. In addition, as a temporary program director, you can retain your ties to your current institution and return to it with new insights and experience for your team." The insights gained by rotators help to expand knowledge and expertise, broker new relationships that can foster collaborations and the expansion of professional networks, and enable them to return to their home organizations and institutions to demonstrate leadership to their colleagues and students. Their leadership also enriches NSF and ensures its priorities are aligned with those of the community it serves.

Finally, significant national awards provide visibility to individuals and organizations that might otherwise remain invisible despite their transformative impacts on others. For example, in recognition of mentors who work with underrepresented groups to develop fully the nation's human resources in STEM, NSF and the White House Office of Science and Technology Policy (OSTP) sponsor the Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). This program was created to identify and recognize individuals and organizations that have contributed outstanding efforts in mentoring and have enhanced the participation of individuals (including persons with disabilities) who might not otherwise have considered or had access to opportunities in STEM disciplines and professions. Through awards like PAESMEM, mentors are recognized for their leadership models and unique approaches that advance broadening participation.

ADDRESSING SYSTEMIC BARRIERS TO DIVERSITY, EQUITY AND INCLUSION

Integrated practices in the fundamental structure and activities of a system that create or support disadvantageous outcomes for some groups compared to others is a general description of systemic barriers (DeSutter, 2013). NSF has developed several programs and initiatives that ask investigators to address systemic barriers, biases and changes, including NSF ADVANCE, Racial Equity in STEM Education, GEO GOLD, Broadening Participation in Engineering and Alliances for Graduate Education and the Professoriate. NSF is seeking ideas and solutions from the STEM community while promoting leadership among investigators and institutions in addressing the most significant challenges to reducing bias, promoting diversity and seeing sustainable and positive change for broadening participation of underrepresented groups in STEM.

In the "NSB Statement on Racism in Science & Engineering," issued in June 2020, NSB demonstrates leadership in action through its implementation of the Vision 2030 report: "*As the NSB implements our Vision 2030 plan, we will act intentionally to remove barriers and ensure that the U.S. S&E environment is one in which all are respected and valued.*" NSB and CEOSE have increased the frequency of joint discussions to explore additional points of intersection and means by which both groups can raise awareness and visibility of systemic barriers and sustainable solutions.

As an EPSCoR jurisdiction, West Virginia lacks STEM networks, industries, and research laboratories that drive the STEM economies in other states. A large fraction of the state's post-secondary STEM students are first in their families to go to college. And, while West Virginia high school students profess an interest in STEM in higher percentages than the national average, completing a STEM degree is elusive for about 70% of its first-generation rural students. First2 is working to turn this statistic upside down by building a cross-sector state-wide learning network, aimed at improving institutionalized practices that obstruct student success. Student voice is a core value of the **First2 Network**. Making up one-half of our growing membership (N= >400), first generation undergraduate students define the barriers that they face and co-develop change ideas to test. First2 working groups improve knowledge of STEM industry careers, build faculty-student relationships, strengthen college readiness, and create opportunities for student leadership.

The White House National Science and Technology Council's Joint Committee on the Research Environment (JCORE) included a subcommittee on safe and inclusive research environments. This subcommittee served as the primary coordination body for federal government agencies to share promising practices, challenges and activities regarding harassment of all types in the research environment. JCORE solicited community feedback in November 2019 and held a summit to develop policy recommendations and effective practices to improve the research environment. Although a new administration now leads the White House and OSTP, and some members of JCORE have also transitioned, leaders in the research community have an opportunity to continue these efforts and work to ensure that researchers have access to safe and inclusive research environments as many of them reopen following the COVID-19 pandemic.

RECOMMENDATION

In its *2015-2016 Biennial Report to Congress*, CEOSE created "a new, visible approach to accountability" for broadening participation programs, investigators, institutions and NSF. By recommending accountability practices, CEOSE encouraged action at all levels, contexts and experiences. As described throughout every CEOSE report and in this 2019-2020 report in particular, leadership is demonstrated through decisions, actions and opportunities at the organization and individual levels. Yet, some of these actions may not be recognized as leadership. Leadership matters because leaders shape funding decisions, admit students to STEM graduate programs, decide when and if communities are invited to partner in NSF-funded projects, and determine if the microculture of their research teams is inclusive. In demonstrating its leadership and empowerment of leaders in staff, advisors and the communities it serves, NSF can do more to increase knowledge and awareness of invisibility issues in STEM communities, identify the participation and advancement of underrepresented groups in the scientific enterprise, and acknowledge meaningful leadership actions for transformational change.

CEOSE recommends NSF demonstrate and promote bold leadership actions to create, integrate and make visible elements within and across its programs to enhance broadening participation of underrepresented and underserved groups in STEM.

Because this report is framed within the *Making Visible the Invisible* theme, CEOSE members endorsed the notion that *more explicit and visible guidance* could be suggested to NSF regarding specific examples aligned with the report's recommendation. Therefore, examples from NSF broadening participation programs showing how NSF funding is helping to develop a diverse next generation of STEM leaders are featured in sidebars throughout this report.

Table 4 – Opportunities to Make Transformative Leadership Visible below provides numerous examples of opportunities within NSF programs, divisions and directorates in which leaders can be developed, leadership actions can be demonstrated, and examples of transformative leadership, especially in addressing systemic barriers for underrepresented groups in STEM, can be recognized.

TABLE 4 │ Opportunities to Make Transformative Leadership Visible

NSF Opportunities	Suggested Leadership Actions
Develop the next generation of leaders in Broadening Participation (BP)/Diversity, Equity and Inclusion (DEI) in STEM through programmatic investments	Use elements of model programs, such as EPSCoR, Mid-Career Advancement and ADVANCE, but direct program foci toward underrepresented groups and communities and provide support for diverse mid-career faculty who aspire to leadership positions in STEM.
Recognize/reward leadership in BP/DEI in STEM	Create new awards to recognize BP/DEI in STEM to become part of NSF's group of prestigious awards that include Alan T. Waterman, Vannevar Bush and NSB Public Service awards and PAESMEM.
Recast the PI role as a scientific leadership role	Include more content and resources dedicated to leadership development at PI meetings and workshops and financially support leadership development activities emphasizing early-career and student researchers.
Value risk-taking as part of leadership	Train proposal reviewers and program officers to recognize and value leadership and positive risk-taking behaviors (lack of prior funding, assistant professors as PIs on collaborative teams, funding PIs outside of directorate disciplines, etc.).
Encourage leadership in directing BP/DEI mindset change AND action	Capture elements that address this through programs like NSF ADVANCE; require and hold funded projects and programs accountable for sustainability plans, suggesting that long-term mindset change is encouraged for projects and programs to pursue.
Transform BP/DEI across institutions/ organizations as opposed to one-off activity or project based	Fund development of institutional BP infrastructure (infrastructure improvement) to make institutions competitive for programs like Sea Change; establish funding programs that focus on the development of institutional broader impacts; learn from the unique cultures of Minority Serving Institutions (MSIs) and use them as models to create equitable and inclusive spaces at all institutions/organizations.
Implement opportunities related to BP/DEI in leadership actions and leadership positions	Develop more funding programs with institutional transformation tracks; develop additional review criteria that request evidence around leadership actions; showcase projects that both address the 10 Big Ideas and are examples of BP/DEI and label them as leaders in the next generation of STEM research; frame funding programs that arise from the 2026 Idea Accelerator in the context of both science and BP/DEI.
Build awareness around BP/DEI leadership examples	Encourage directorates to highlight effective leadership models and practices; develop more hubs, networks, etc. that allow leaders to be developed and flourish; identify and highlight non-traditional examples of leadership and those who demonstrate leadership without positions of authority.
Recognize both the opportunities and limitations of remote engagement for enhancing the pipeline of diverse STEM leaders	Encourage directorates to allow more remote participation on panels, advisory committees and committees of visitors and as program directors; recognize the continuing existence of the "digital divide" and its impact on grooming and developing the next generation of diverse STEM leaders.

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APPENDICES
A – G

APPENDIX A

NSF PROGRAMS TO BROADEN PARTICIPATION

TABLE │ FY 2021 Budget Request to Congress (Millions of Dollars)

	Amount of Funding Captured	FY 2019 Actual	FY 2020 (TBD)	FY 2021 Request	FY 2021 Request Change Over FY 2019 Actual	
					Amount	Percent
Total, NSF Broadening Participation Programs		$1,178.75	-	$998.42	-$180.32	-15.3%
ADVANCE	100%	$18.00	-	$17.03	-$0.97	-5.4%
Alliances for Graduate Education & the Professoriate (AGEP)	100%	7.99	-	7.13	-0.86	-10.8%
AGEP Graduate Research Supplements (AGEP-GRS)	100%	2.14	-	1.50	-0.64	-30.0%
Broadening Participation in Biology Fellowships	100%	2.50	-	2.50	-	-
Broadening Participation in Engineering (BPE)	100%	2.97	-	6.13	3.16	106.4%
Career-Life Balance (CLB)[1]	100%	0.54	-	-	-0.54	-100.0%
Centers of Research Excellence in Science & Technology (CREST)	100%	24.00	-	21.41	-2.59	-10.8%
Excellence Awards in Science & Engineering (EASE)[2]	100%	5.63	-	3.78	-1.85	-32.8%
Historically Black Colleges & Universities Undergraduate Program (HBCU-UP)	100%	35.01	-	31.22	-3.79	-10.8%
HBCU Excellence in Research (HBCU-EiR)	100%	15.20	-	9.50	-5.70	-37.5%
Improving Undergraduate STEM Education (IUSE): Hispanic Serving Institutions (HSI) Program	100%	40.01	-	14.19	-25.82	-64.5%
Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)	100%	20.20	-	18.92	-1.28	-6.3%
Louis Stokes Alliances for Minority Participation (LSAMP)	100%	46.01	-	43.53	-2.48	-5.4%
Partnerships for Research & Education in Materials (PREM)	100%	6.55	-	7.00	0.45	6.9%
SBE Postdoctoral Research Fellowships-Broadening Participation	100%	1.33	-	1.41	0.08	6.3%
Science of Broadening Participation	100%	1.40	-	1.42	0.02	1.4%
Tribal Colleges & Universities Program (TCUP)	100%	15.01	-	12.49	-2.52	-16.8%
Subtotal, Focused Programs		$244.48	-	$199.16	-$45.32	-18.5%
Advancing Informal STEM Learning (AISL)	50%	$31.37	-	$28.00	-$3.37	-10.7%
Computer Science for All (CSforAll)[3]	58%	[11.60]	-	11.00	-0.60	-5.2%
Disability and Rehabilitation Engineering (DARE)	50%	2.61	-	2.21	-0.40	-15.2%
Discovery Research PreK-12 (DRK-12)	64%	56.28	-	57.35	1.07	1.9%
Faculty Early Career Development Program (CAREER)	51%	185.45	-	129.40	-56.05	-30.2%
Graduate Research Fellowship Program (GRFP)	66%	186.38	-	180.31	-6.07	-3.3%
Improving Undergraduate STEM Education (IUSE)	66%	66.98	-	57.95	-9.02	-13.5%
Innovative Technology Experiences for Students and Teachers (ITEST)[4]	71%	24.17	-	27.71	3.54	14.6%
International Research Experiences for Students (IRES)	58%	6.91	-	7.06	0.14	2.1%
NSF Scholarships in STEM (S-STEM)[4]	53%	60.36	-	61.94	1.57	2.6%
Research Experiences for Undergraduates (REU) – Sites & Supplements	64%	58.55	-	47.32	-11.22	-19.2%
Robert Noyce Teacher Scholarship Program (NOYCE)	57%	42.86	-	25.35	-17.51	-40.9%
STEM + Computing (STEM+C) Partnerships[3]	57%	36.70	-	-	-36.70	-100.0%
Subtotal, Emphasis Programs		$758.60	-	$635.59	-$123.01	-16.2%
EPSCoR	100%	$175.67	-	$163.67	-$12.00	-6.8%
Subtotal, Geographic Diversity Program		$175.67	-	$163.67	-$12.00	-6.8%

[1] NSF continues to support the Career-Life Balance (CLB) Initiative through supplemental funding to active NSF awards. In general, CLB funding will be reported annually as part of NSF's actual obligations.

[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] In FY 2019, CSforAll was supported as a component of STEM+C. The FY 2019 Actual is shown for comparison purposes only. In FY 2020, funding for STEM+C moves to implement CSforAll as a freestanding program and to expand EHR's computer science education portfolio through existing programs.

[4] Innovative Technology Experiences for Students and Teachers (ITEST) and NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) are H1B Visa funded programs.

APPENDIX B

REPORT ON FY 2019 FUNDING
TO MINORITY-SERVING INSTITUTIONS

The National Science Foundation Authorization Act of 2002 (P.L. 107-368, Section 18) requires the National Science Foundation (NSF) to report annually on funds awarded to all identified minority-serving institutions (MSIs).[1] This report tracks NSF funding to MSIs from its FY 2019 appropriation and from its H-1B Nonimmigrant Petitioner Account.[2]

NSF is funded primarily through six congressional appropriations, which totaled $8.1 billion in FY 2019. By comparison, the FY 2019 budget authority was 4.0 percent above the FY 2018 budget authority of $7.8 billion. In FY 2019, NSF programmatic activities—including grants and cooperative agreements—funded through NSF's Research and Related Activities (R&RA), Education and Human Resources (EHR), and Major Research Equipment and Facilities Construction (MRE) appropriations accounted for 95 percent of NSF's total appropriations.

Additionally, in FY 2019 NSF received $157 million in H-1B Nonimmigrant Petitioner fees. This amount reflects $9.7 million that was sequestered in FY 2019 and $ 10.3 million that was sequestered in FY 2018. H-1B funds are used to support two programs, scholarships for low-income students and partnerships in K-12 education, with an emphasis on broadening participation in science and engineering.

NSF's total investment to all MSIs in FY 2019 was $798.6 million. This amount represents 12.9 percent of the $6,196.6 million awarded to all institutions of higher education (IHEs). There has been a 213 percent increase in nominal dollars over the past decade, in NSF's total funding for MSIs. In FY 2019, the investment rose from $771.9 million to $798.6 million. This increase of $26.7 million was due, in part, to the new Historically Black Colleges and Universities- Excellence in Research (HBCU-EiR) and Hispanic Serving Institutions (HSI) programs. Additionally, the following NSF programmatic activities contributed to the overall increase in FY 2019 funding: Established Program to Stimulate

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[1] Identification of MSIs and HHEs is based on the 2006 U.S. Accredited Post-Secondary Minority Institutions, U.S. Department of Education (ED), Office of Civil Rights Data. It is the most recent list available. A minority postsecondary institution is defined as an institution "Whose enrollment of a single minority or a combination of minorities exceeds 50 percent of all enrollment." 20 U.S.C. § 1067k(3). NSF uses ED's list to recognize those IHEs with considerable enrollment of Alaska Natives, Native Hawaiians, a substantial number of historically underrepresented minority populations (i.e. African-Americans, Native Americans and Hispanics). The complete list of MSIs is available online at **https://www2.ed.gov/about/offices/list/ope/idues/eligibility.html**.

[2] Beginning in FY 1999, Title IV of the "American Competitiveness and Workforce Improvement Act of 1998" (P.L. 105-277) established an H-1B Nonimmigrant Petitioner Account in the general fund of the U.S. Treasury for fees collected for each petition for alien nonimmigrant status. That law required that prescribed percentages of funds in the account be made available to NSF for low-income scholarships; grants for mathematics, engineering or science enrichment courses; and systemic reform activities. In FY 2005, Public Law 108-447 reauthorized H-1B funding. NSF was provided with 40 percent of the total H-1B receipts collected.

Competitive Research (EPSCoR) Research Infrastructure Improvement, and EPSCoR Co-Funding; Louis Stokes Alliances for Minority Participation (LSAMP), Discovery Research PreK-12 (DRK-12), Major Research Instrumentation (MRI), Partnerships for Research and Education in Materials (PREM); Student support programs, namely the Graduate Research Fellowship Program (GRFP), Robert Noyce Teacher Scholarship Program (Noyce), NSF Scholarships in Science, Technology, Engineering and Mathematics (S-STEM), and CyberCorps®: Scholarship for Service (SFS).

In FY 2019, awards to HBCUs, Institutions with High Hispanic Enrollment (HHEs), and Tribal Colleges and Universities (TCUs) totaled $596.2 million or 9.6 percent of funding to all IHEs. This is a 1.6 percent decrease from the FY 2018 level ($606.1 million). NSF's funding to Majority Minority-Serving Institutions (MMSIs),[3] Alaska Native and Native Hawaiian Serving Institutions, Pacific Island IHEs, and IHEs with High African American Enrollment (HAAE) or High American Indian Enrollment (HAIE) and those primarily serving students with disabilities (DSIs) was $202.4 million or 3.3 percent of funding to all IHEs. This is a 22 percent increase from the FY 2018 level ($165.8 million). The following table provides a breakout by budget category of the NSF funds awarded.

TABLE | **FY 2019 NSF Direct Funding to Minority-Serving Institutions**

(Millions of Dollars)

	EHR	MRE	R&RA	H-1B	Total*	MSIs as a Percent of IHE Funding
HBCUs, HHEs & TCUs	$194.8	0	$372.5	$28.8	$596.2	9.6%
MMSIs, Alaska-Native and Native Hawaiian Serving, Pacific Island IHEs, HAAEs, HAIEs, and DSIs	$24.2	0	$171.4	$6.8	$202.4	3.3%
Total	$219.0	$0	$544.0	$35.6	$798.6	12.9%

*Numbers may not add due to rounding.

[3] IHEs as identified by ED with total minority enrollment greater than or equal to 50 percent of total student enrollment. To avoid double counting, funds identified in the MMSI category excludes all funding to named categories of minority-serving institutions (e.g., HBCU).

The table below provides data on NSF funding by budget category to all categories of MSIs in FY 2019 and the preceding ten years. The funding as a percentage of total funding to all IHEs is also included.

TABLE | **NSF Direct Funding to All Categories of Minority-Serving Institutions**

(Millions of Dollars)

Year	Funding to All Categories of Minority-Serving Institutions					Funding to All IHEs	MSIs as a Percent of IHE Funding
	EHR	MRE	R&RA	H-1B	Total		
2009	$119.7	$0	$126.5	$8.2	$254.4	$4,685.2	5.4%
2010	$116.2	$0	$127.4	$12.4	$255.9	$5,080.5	5.0%
2011	$121.5	$0	$147.3	$11.9	$280.7	$5,136.0	5.5%
2012	$115.8	$0	$131.8	$17.3	$265.0	$5,230.7	5.1%
2013	$125.6	$0	$138.6	$15.9	$280.1	$5,116.3	5.5%
2014	$124.8	$0	$187.0	$15.2	$327.0	$5,253.6	6.2%
2015	$131.5	$0	$192.3	$22.5	$346.2	$5,560.7	6.2%
2016	$152.1	$0	$314.0	$38.5	$504.6	$5,547.6	9.1%
2017	$124.7	$0	$275.4	$12.7	$412.8	$5,628.8	7.3%
2018	$210.7	$0	$507.0	$54.2	$771.9	$5,898.3	13.1%
2019	$219.0	$0	$544.0	$35.6	$798.6	$6,196.6	12.9%

The next table provides a breakout by appropriations category of funding to HBCUs, HHEs and TCUs for the years 2009-2019. In FY 2019, the funding from EHR, R&RA and H-1B accounts to HBCUs, HHEs and TCUs was $596.2 million, a decrease from the FY 2018 level ($606.1 million). FY 2019 funding to HBCUs, HHEs and TCUs also represented a decrease as a percentage of funding to all IHEs (9.6 percent) compared to FY 2018 (10.3percent).

TABLE | Direct NSF Funding to Minority-Serving Institutions for FY 2009-2019

BllS Univ cut as of NOV 2019 (Millions of Dollars)

Appropriation	FY	All IHEs	HBCUs	HBCU% of IHE	HHEs	HHE % of IHE	TCUs	TCU % of IHE	Total HBCU, HHE & TCU	Total HBCU, HHE & TCU % of IHE
Education and Human Resources	2009	$672.9	$61.2M	9.1%	$38.5	5.7%	$14.0	2.1%	$113.6	16.9%
	2010	$689.5	$56.8	8.2%	$43.7	6.3%	$11.9	1.7%	$112.4	16.3%
	2011	$693.5	$66.6	9.6%	$34.7	5.0%	$11.8	1.7%	$113.1	16.3%
	2012	$685.7	$64.3	9.4%	$36.4	5.3%	$9.6	1.4%	$110.3	16.1%
	2013	$697.2	$66.3	9.5%	$38.2	5.5%	$10.8	1.6%	$115.3	16.5%
	2014	$688.9	$59.5	8.6%	$45.1	6.6%	$11.4	1.7%	$116.1	16.9%
	2015	$728.9	$66.0	9.1%	$44.3	6.1%	$12.7	1.7%	$123.1	16.9%
	2016	$738.0	$58.0	7.9%	$70.5	9.5%	$7.3	1.0%	$135.8	18.4%
	2017	$736.1	$59.7	8.1%	$47.6	6.5%	$13.7	1.9%	$120.9	16.4%
	2018	$762.0	$58.6	7.7%	$107.6	14.1%	$17.0	2 .2%	$183.3	24.1%
	2019	$804.0	$61.9	7.7%	$119.9	14.9%	$13.0	1.6%	$194.8	24.2%
Major Research Equipment and Facilities Construction	2008	$47.6	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2009	$73.1	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2010	$80.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2011	$25.2	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2012	$22.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2013	$15.2	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2014	$14.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2015	$0.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2016	$0.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2017	$121.9	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2018	$88.0	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
	2019	$108.1	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%	$0.0	0.0%
Research and Related Activities	2008	$3,689.7	$29.7	0.8%	$66.4	1.8%	$1.7	0.0%	$97.7	2.6%
	2009	$3,864.8	$31.0	0.8%	$84.6	2.2%	$4.5	0.1%	$120.1	3.1%
	2010	$4,223.7	$25.8	0.6%	$95.3	2.3%	$1.7	0.0%	$122.8	2.9%
	2011	$4,333.2	$23.1	0.5%	$115.8	2.7%	$1.4	0.0%	$140.4	3.2%
	2012	$4,439.4	$30.2	0.7%	$96.8	2.2%	$0.1	0.0%	$127.1	2.9%
	2013	$4,299.5	$19.2	0.4%	$111.5	2.6%	$1.3	0.0%	$132.0	3.1%
	2014	$4,429.3	$28.5	0.6%	$152.3	3.4%	$0.5	0.0%	$181.3	4.1%
	2015	$4,703.7	$18.7	0.4%	$165.6	3.5%	$0.0	0.0%	$184.3	3.9%
	2016	$4,639.7	$36.6	0.8%	$251.0	5.4%	$0.5	0.0%	$288.0	6.2%
	2017	$4,668.1	$20.8	0.4%	$242.2	5.2%	$0.2	0.0%	$263.2	5.6%
	2018	$4,870.8	$43.9	0.9%	$338.9	7.0%	$1.1	0.0%	$383.9	7.9%
	2019	$5,150.1	$30.8	0.6%	$341.0	6.6%	$0.8	0.0%	$372.5	7.2%
H-1B Visa Receipts	2008	$110.2	$5.0	4.5%	$6.4	5.8%	$0.0	0.0%	$11.4	10.3%
	2009	$74.3	$2.8	3.8%	$4.9	6.5%	$0.0	0.0%	$7.7	10.4%
	2010	$86.3	$4.1	4.8%	$7.6	8.8%	$0.6	0.7%	$12.3	14.2%
	2011	$84.1	$2.2	2.6%	$8.8	10.5%	$0.8	1.0%	$11.8	14.1%
	2012	$83.6	$2.8	3.4%	$12.7	15.2%	$0.5	0.6%	$16.0	19.2%
	2013	$104.4	$6.7	6.4%	$5.9	5.6%	$0.3	0.3%	$12.9	12.3%
	2014	$120.5	$3.2	2.7%	$9.6	7.9%	$0.0	0.0%	$12.8	10.6%
	2015	$128.1	$3.5	2.7%	$16.3	12.7%	$0.0	0.0%	$19.7	15.4%
	2016	$169.9	$8.2	4.8%	$26.9	15.8%	$0.0	0.0%	$35.1	20.7%
	2017	$102.7	$2.3	2.2%	$8.3	8.1%	$1.0	0.9%	$11.6	11.3%
	2018	$177.5	$3.1	1.8%	$35.8	20.2%	$0.0	0.0%	$39.0	21.9%
	2019	$134.4	$8.3	6.2%	$20.5	15.3%	$0.0	0.0%	$28.8	21.4%
FY 2019 Grand Totals		$6,196.6	$101.0	1.6%	$481.4	7.8%	$13.8	0.2%	$596.2	9.6%

Numbers may not add due to rounding.

APPENDIX C

SELECTED MERIT REVIEW TABLES FROM THE MERIT REVIEW PROCESS: FISCAL YEAR 2019 DIGEST

TABLE | **Proposals, Awards, and Funding Rates, by PI Type**

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
All PIs	Proposals	45,181	55,542	51,562	48,613	48,999	48,051	49,620	49,285	49,415	48,321	41,024
	Awards	14,595	12,996	11,192	11,524	10,829	10,958	12,007	11,877	11,447	11,702	11,243
	Funding Rate	32%	23%	22%	24%	22%	23%	24%	24%	23%	24%	27%
Female PIs	Proposals	9,727	11,903	11,488	10,795	11,152	11,142	11,444	11,598	11,322	10,858	9,076
	Awards	3,297	2,982	2,602	2,775	2,556	2,669	3,007	3,032	2,962	2,943	2,843
	Funding Rate	34%	25%	23%	26%	23%	24%	26%	26%	26%	27%	31%
Male PIs	Proposals	32,091	38,695	35,211	32,932	32,866	31,625	32,411	31,528	30,046	28,180	22,277
	Awards	10,437	9,080	7,739	7,816	7,316	7,286	7,810	7,512	6,930	6,884	6,157
	Funding Rate	33%	23%	22%	24%	22%	23%	24%	24%	23%	24%	28%
PIs from Under-represented Racial or Ethnic Groups	Proposals	2,945	3,613	3,441	3,291	3,303	3,268	3,383	3,331	3,403	3,498	2,714
	Awards	889	812	735	718	651	681	788	778	806	853	766
	Funding Rate	30%	22%	21%	22%	20%	21%	23%	23%	24%	24%	28%
New PIs	Proposals	16,840	21,545	19,238	17,943	17,635	17,405	18,276	18,348	18,757	18,596	15,654
	Awards	4,174	3,620	2,976	3,063	3,013	3,108	3,320	3,510	3,319	3,257	3,252
	Funding Rate	25%	17%	15%	17%	17%	18%	18%	19%	18%	18%	21%
Prior PIs	Proposals	28,341	33,997	32,324	30,670	31,364	30,646	31,344	30,937	30,658	29,725	25,370
	Awards	10,421	9,376	8,216	8,461	7,816	7,850	8,687	8,367	8,128	8,445	7,991
	Funding Rate	37%	28%	25%	28%	25%	26%	28%	27%	27%	28%	31%
PIs with disabilities	Proposals	470	545	543	483	488	468	562	496	491	453	373
	Awards	149	108	107	134	122	99	120	110	120	114	103
	Funding Rate	32%	20%	20%	28%	25%	21%	21%	22%	24%	25%	28%

Source: NSF Enterprise Information System, 10/01/19.

## TABLE | Proposals, Awards, and Funding Rates, by PI Race and Ethnicity

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
American Indian/ Alaska Native	Proposals	88	118	129	83	113	103	104	99	134	112	90
	Total Awards	29	28	36	18	28	36	25	29	39	29	33
	Funding Rate	33%	24%	28%	22%	25%	35%	24%	29%	29%	26%	37%
Black/ African American	Proposals	1,022	1,280	1,201	1,154	1,124	1,123	1,102	1,134	1,135	1,159	929
	Total Awards	298	270	243	263	203	204	233	264	266	262	246
	Funding Rate	29%	21%	20%	23%	18%	18%	21%	23%	23%	23%	26%
Native Hawaiian/ Pacific Islander	Proposals	23	38	42	40	32	30	30	41	30	30	47
	Total Awards	8	10	11	6	5	5	2	7	5	5	14
	Funding Rate	35%	26%	26%	15%	16%	17%	7%	17%	17%	17%	30%
Asian	Proposals	9,550	11,626	10,829	10,382	10,511	10,538	11,148	11,623	11,552	11,362	9,141
	Total Awards	2,465	2,124	1,907	1,914	1,887	1,925	2,256	2,168	2,166	2,127	2,073
	Funding Rate	26%	18%	18%	18%	18%	18%	20%	19%	19%	19%	23%
White	Proposals	29,975	36,153	33,200	30,596	30,766	29,624	30,099	29,031	27,804	25,744	20,400
	Total Awards	10,499	9,306	7,826	8,020	7,372	7,390	7,902	7,748	7,170	7,138	6,389
	Funding Rate	35%	26%	24%	26%	24%	25%	26%	27%	26%	28%	31%
Multiracial	Proposals	337	512	433	448	439	425	495	508	550	550	467
	Total Awards	112	118	99	113	110	114	151	124	143	154	132
	Funding Rate	33%	23%	23%	25%	25%	27%	31%	24%	26%	28%	28%
Hispanic or Latino	Proposals	1,755	2,092	2,019	1,934	1,956	1,921	2,053	1,950	1,993	2,106	1,549
	Total Awards	533	476	438	412	401	411	495	459	460	534	449
	Funding Rate	30%	23%	22%	21%	21%	21%	24%	24%	23%	25%	29%

Source: NSF Enterprise Information System, 10/01/19 and NSF Report Server, 10/01/2019.

APPENDIX D

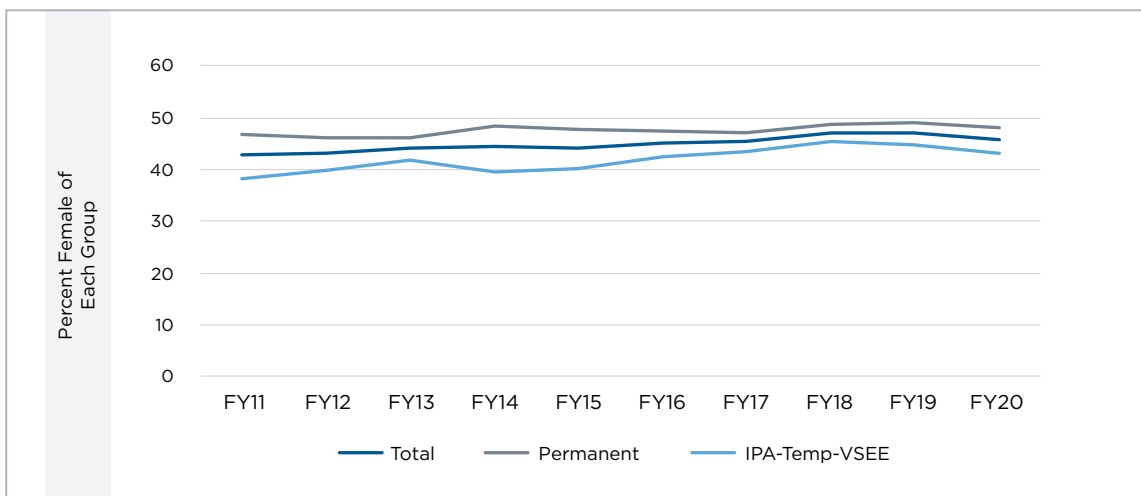**FIGURE | NSF Scientists and Engineers: FY2011–FY2020**

Increase in staff, both permanent and IPA-Temp-VSEE, since FY17.
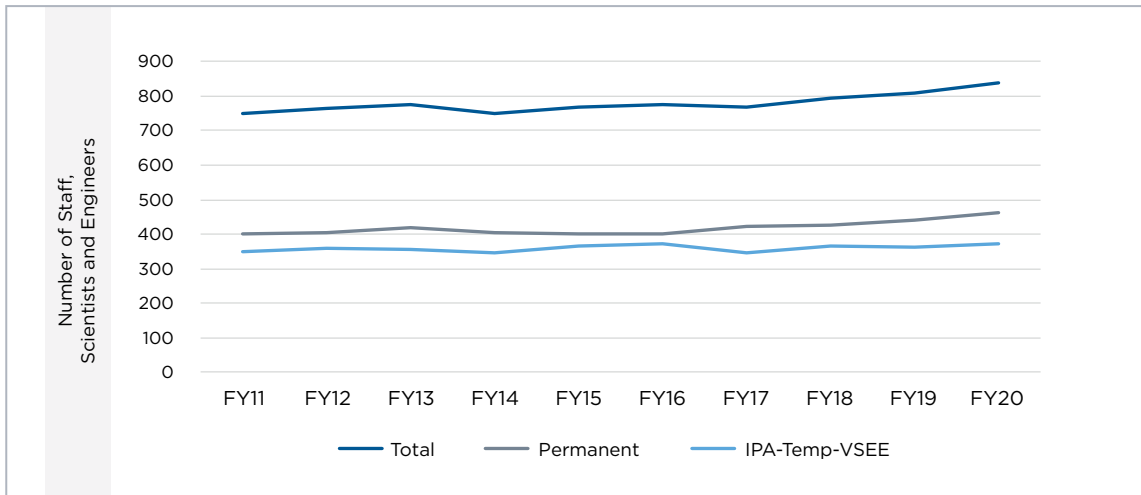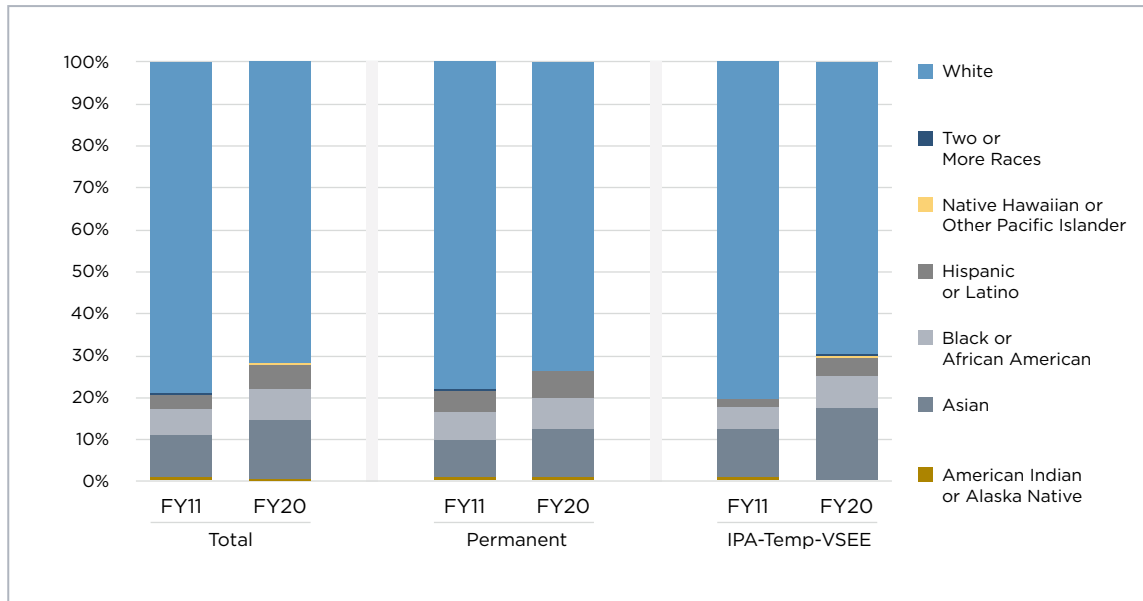

Source: Administrative data from National Science Foundation, Office of Equity and Civil Rights. Data retrieved on January 27, 2021.

FIGURE | NSF Scientists and Engineers, Percent Female of Each Group, Total, Permanent, IPA-Temp-VSEE: FY2011–FY2020

The percentage of women among NSF scientists and engineers is similar to the share of women among all U.S. employed scientists and engineers across all occupations, which was 47.9% in 2019. However, NSF's percentage of women scientists and engineers is greater than that of employed doctorate holders in science, engineering, and health in 2019, which was 36.3% female.

Source: Administrative data from National Science Foundation, Office of Equity and Civil Rights. Data retrieved on January 27, 2021.

| **NSF Scientists and Engineers by Race and Ethnicity, Percent of Each Group, Total, Permanent, IPA-Temp-VSEE: FY2011–FY2020**

Blacks/African Americans, Hispanics/Latinos, and Asians increased their share of Total Scientists and Engineers from FY11 to FY20.

Source: Administrative data from National Science Foundation, Office of Equity and Civil Rights. Data retrieved on January 27, 2021.

FIGURE | **NSF Scientists and Engineers, Underrepresented Minorities as a Percent of Each Group, Total, Permanent, IPA-Temp-VSEE: FY2011–FY2020**

Underrepresented minorities have increased as a share of scientists and engineers. Underrepresente minorities (URM) are Hispanics/Latinos, Blacks/African Americans, and Native Americans/Alaska Natives.
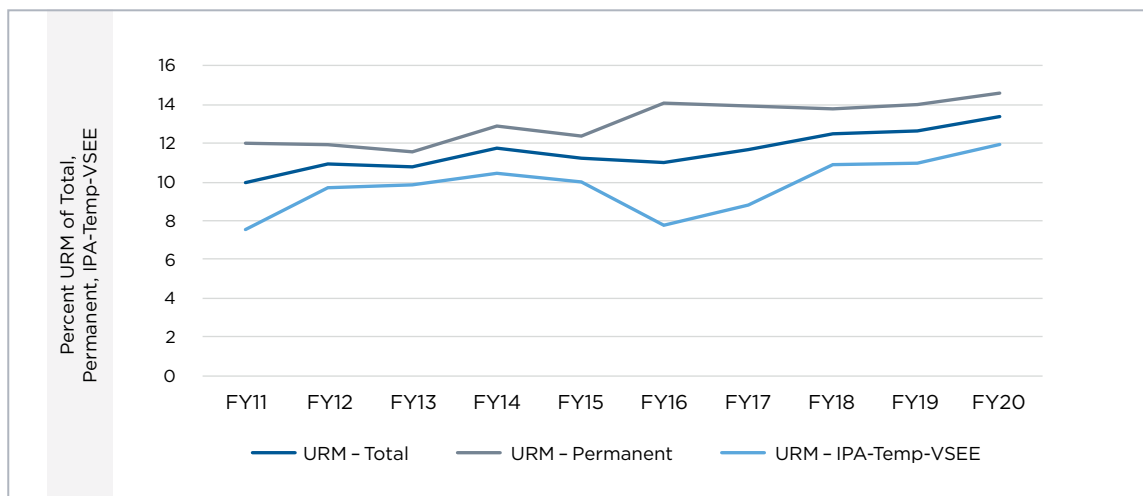
Source: Administrative data from National Science Foundation, Office of Equity and Civil Rights. Data retrieved on January 27, 2021.

APPENDIX E

National Science Foundation

Plan Point of Contact: Dr. Suzanne Iacono
Liaison: Dr. Suzanne Iacono
Representatives: Bernice Anderson

Agency Mission

The National Science Foundation (NSF) was established to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes.

Agency Goals

1 Expand knowledge in science, engineering, and learning.

2 Advance the capability of the nation to meet current and future challenges.

3 Enhance NSF's performance of its mission.

HBCU Goals

1 Leverage the diverse perspectives of HBCUs' researchers, educators, and community partners in pursuit of discovery and innovation.
- Education
- Academic Research Enterprise

2 Provide resources to junior/early career faculty to establish their research agenda.
- 21st Century Infrastructure
- Academic Research Enterprise

3 Improve the knowledge transfer within the HBCU network.
- Education
- 21st Century Infrastructure

4 Enhance the technical support to HBCUs.
- Education
- Academic Research Enterprise
- Economic Development & Competitiveness

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HBCU Metrics

1 Invest from the education and human resources appropriation approximately 8 to 9 percent of all IHE funding for HBCUs by FY 22.

2 Invest from the research and related activities appropriation approximately $32 million for grants and cooperative agreements to HBCUs by FY 22.

3 Increase the visibility of at least three HBCU-led broadening participation research centers by FY 22.

4 Provide technical assistance to enable three to five HBCUs to compete successfully for funding from the Major Research Instrumentation Program by FY 22.

AGENCY ACTIONS: STRATEGIES AND TACTICS

Strategies

1 The Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) will provide awards to strengthen STEM undergraduate education and research at HBCUs.

2 The HBCU Excellence in Research (EiR) program will support awards to stimulate sustainable improvement in HBCUs' research and development capacity and competitiveness within NSF's research programs.

3 HBCU Research Infrastructure for Science and Engineering (RISE), a track within the Centers of Research Excellence in Science and Technology Program will make awards that support the development of research capability at HBCUs that offer doctoral degrees in science and engineering disciplines.

4 The NSF Major Research Instrumentation Program will encourage HBCUs to submit competitive proposals to acquire critical research instrumentation for research and research training and/or develop next-generation research instruments that open new opportunities to advance the frontiers in science and engineering research.

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Tactics

1 Support a portfolio of competitive awards to HBCUs that are investments in ideas, individuals, and infrastructure. (NSF Strategic Objective [SO] 1.1)

2 Promote HBCU-led partnerships to accelerate innovation and make visible diverse talent to meet pressing societal needs. (NSF SO 2.1)

3 Invest in HBCUs' development of a future generation of researchers and a scientifically skilled workforce via NSF's programs to broaden participation in STEM. (NSF SO 2.2)

4 Attract and recruit STEM talent from HBCUs for STEM positions at NSF, as well as support summer internship opportunities for HBCU undergraduate and graduate students (NSF SO 3.1)

5 Support HBCU-related networks and conferences as well as encourage HBCUs to be active participants in the NSF INCLUDES National Network (NSF SO 3.1)

6 Leverage information technology to improve outreach and technical assistance to the HBCU community, including hosting virtual listening sessions. (NSF SO 3.2)

Point of contact: Bernice Anderson · banderso@nsf.gov · 703-292-5151

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APPENDIX F

Committee on Equal Opportunities in Science and Engineering (CEOSE)

www.nsf.gov/od/oia/activities/ceose

Established by Congress to advise the National Science Foundation concerning the implementation of the Science and Engineering Equal Opportunities Act and other policies and activities to encourage the full participation of women, underrepresented minorities, and persons with disabilities in scientific, engineering, and professional fields.

CEOSE Members, 2019

Jose D. Fuentes
(CEOSE Chair)
Pennsylvania State University

Alicia Knoedler
(Vice Chair)
Exaptive, Inc.

Gilda Barabino
The City College of New York

Suzanne Barbour
University of Georgia

Peter Eden
Landmark College

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Georgia Institute of Technology

Daniela Marghitu
Auburn University

Robert Eugene Megginson
University of Michigan

Lydia Villa-Komaroff
Intersections SBD

Nai-Chang Yeh
California Institute of Technology

CEOSE Executive Liaison
Suzi Iacono
National Science Foundation

CEOSE Executive Secretary
Bernice Anderson
National Science Foundation

October 9, 2019

Dear Colleague:

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/Latino Americans 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.

In the recently completed 2017-18 report, CEOSE calls on NSF to increase support for place-based, implementation research projects that are grounded in and engage local communities. To realize this more integrative vision for inclusiveness in the STEM enterprise, **CEOSE recommends that NSF give increased attention to including diverse community voices across its research and education portfolios through community-driven projects.**

In her letter transmitting the report to Congress, NSF's Director, France A. Córdova wrote, "By encouraging research projects in their local environments, NSF can strengthen the diversity of the Nation's STEM workforce and promote the full inclusion of excellence across the country."

The enclosed summary provides and overview of Investing in Diverse Community Voices – CEOSE 2017-2018 Biennial report to Congress. The full report can be found at the CEOSE website at www.nsf.gov/od/oia/activities/ceose.

Best regards,

The CEOSE Advisory Committee

CEOSE
Committee on Equal Opportunities in Science and Engineering

INVESTING IN DIVERSE COMMUNITY VOICES

An inclusive science, technology, engineering and mathematics (STEM) workforce is needed to maintain America's leadership in the scientific enterprise. Increasing the participation of underrepresented groups including African Americans, Hispanic/Latino Americans, American Indians/Alaska Natives, persons with disabilities and women requires national attention to fully engage the nation's citizens in transforming its STEM enterprise.

Involving diverse community voices in research projects, especially community-based, community-engaged, and community-focused research projects, has numerous benefits, including serving as a means for increasing broadening participation of underrepresented groups in STEM and improving science and engineering (S&E). However, it requires performing research differently and rejecting the assumption that applied and theoretical research should be distinct. Understanding that application and theory are interconnected and mutually enhancing in place-based research through problem-solving projects such as NSF's Big Idea Navigating the New Arctic is fundamental.

CEOSE proposes developing and implementing a recursive, iterative approach that is based on the following propositions: (1) significant societal problems cannot be solved without the unfettered full inclusion of underrepresented populations; (2) full inclusion, in turn, will result in better, more innovative and transformative S&E, as well as a better, more decent and just society; and (3) developing community-based research initiatives that are carried out with community members and focus on local scientific problems is a promising strategy to help achieve the interrelated goals of full inclusion, better S&E, and a better society.

Based on these perspectives, activities and propositions, CEOSE calls on NSF to increase support for place-based implementation research projects that are grounded in and engage local communities. To realize this more integrative vision for inclusiveness in the STEM enterprise, CEOSE recommends:

"NSF give increased attention to including diverse community voices across its research and education portfolios through community-driven projects."

2017-2018 Biennial Report to Congress

ADVANCING KNOWLEDGE AND BROADENING PARTICIPATION

An important goal of broadening participation is to be the means of bringing diversity and intellectual breadth to the transformation of science itself. Diversity contributes to better learning, and problem-solving.

The changing landscape of science as expressed within NSF's 10 Big Ideas, especially NSF INCLUDES, Navigating the New Arctic and Future of Work at the Human Technology Frontier, provides invaluable opportunities for emphasizing the need to include community members who are experiencing the very problems of interest to scientists and engineers involved in the research projects. Community members, in effect, have information and resources and possess knowledge essential for developing the methods, approaches, findings and theories necessary for solving the problem at hand.
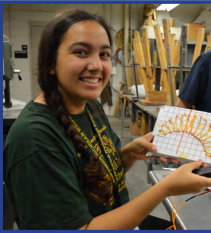
New opportunities must be provided to help the nation increase its use of diverse communities to help solve highly complex, real-world problems. Moreover, the talent of all Americans is needed to improve the health and education of communities; decrease poverty; increase the number and percentage of historically underrepresented groups in STEM; and bring new approaches to the strategic goals of scientific discovery and learning.

NSF's investments address the agency's STEM workforce strategic objective to "foster the growth of a more capable and diverse research workforce and advance the scientific and innovation skills of the Nation." Some of these efforts include:

- **NSF INCLUDES** - catalyzes novel approaches in broadening participation in STEM by incentivizing the building of collaborative infrastructures that proactively seeks and effectively develops STEM talent from all sectors and groups in the nation.

- **GEO Directorate's Opportunities for Leadership in Diversity (GOLD) -** facilitates the design, pilot implementation and evaluation of innovative professional development curricula that can unleash the potential of geoscientists with interests in broadening participation to become impactful leaders in the community.

- **Improving Undergraduate STEM Education: Hispanic-Serving Institutions (HSI) Program** - provides support to HSIs to enhance the quality of undergraduate STEM education and to increase retention and graduation rates of undergraduate students pursuing degrees in STEM fields at HSIs.

- **Historically Black Colleges and Universities Excellence in Research Program** - promotes sustainable improvements to the research and development capacity and competitiveness of HBCUs.

- **Tribal Enterprise Advancement (TEA) Centers** - supports tribal colleges and universities to establish centers that are addressing environmental, social, educational and economic challenges and promoting community-relevant STEM opportunities

- **Louis Stokes Regional Centers of Excellence (LSRCEs)** - supports recruitment and retention of minority undergraduate and graduate students studying STEM disciplines.

- **Pursuing Meaningful Actions in Support of Broadening Participation in Computing (BPC)** - enhances the community's awareness of and barriers to BPC, as well as to provide information and resources to principal investigators (PIs) so that they can develop interest, skills, and activities in support of BPC at all levels (K-12, undergraduate, graduate, and postgraduate).

2017-2018 Biennial Report to Congress
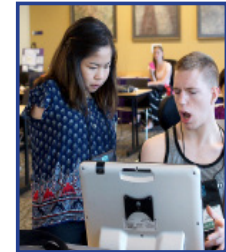
APPENDIX G

RESPONDING TO THE 2017-2018 CEOSE RECOMMENDATION: INVESTING IN DIVERSE COMMUNITY VOICES

EXAMPLES OF NSF ACTIVITIES AND NSF-SUPPORTED PROJECTS

FUNDING OPPORTUNITIES

- **Coastlines and People (20-567)**
- **GEO GOLD-EN DCL (20-058)**
- **Build and Broaden (20-048)**

The funding opportunities (Coastlines and People (CoPe), NSF 20-567; GEO GOLD-EN DCL, NSF 20-058; Build and Broaden (B²), NSF 20-048) seek to foster diversity and inclusion through partnerships, coordination, and collaborations. In using a hub-based environment, **CoPe** seeks to provide a framework where multiple institutions and constituencies can easily work together on scientific questions relevant to all. They also aim to support ground-breaking investigations on Coastlines and People that cross disciplines, involve stakeholders and local communities, and integrate broadening participation into the values of all activities and research the hub undertakes. To expand the reach of current **GOLD-EN** efforts, scientists hope to bring to scale related diversity activities in the geosciences and develop unique approaches for greater inclusion in the geoscience education and research community through collaboration efforts and research coordination networks. The **Build and Broaden (B²)** initiative aims to foster partnerships and build research collaborations among institutions that include at least one Minority-Serving Institution (MSI) in order to promote fundamental research, perspectives, and ideas in the SBE sciences.

SPECIAL EVENTS/ PRESENTATIONS

- The 2019 Fall meeting of the **ERE AC** included a symposium on November 5, 2019 that focused on the co-production of knowledge. A panel of guest speakers discussed the "opportunities and challenges of engaging community members, decision-makers, and other stakeholders in science to co-produce knowledge."

- The **Tribal College and University Program (TCUP)** held a two-day research symposium at NSF in December 2019. Also, TCUP is working with other units in the Foundation to support collaborations that involve multiple institutions of higher education led by TCUP institutions, namely the Partnerships for Geoscience Education (PAGE) and the Partnerships for Documentary Linguistics Education (PADLE).

- **CISE** conducted four MSI convenings that included listening sessions during which participants from HBCUs, HSIs and TCUs made suggestions for increasing their engagement in the CISE portfolio.

- **ENG** has sponsored over two dozen workshops focused on sustainable urban systems.

- Black Lives in Science: An **MPS** Distinguished Panel was held August 18, 2020.

RESOURCES

Below are videos of several NSF-funded projects that showcase diverse community voices.

- **CAB: Breaking Boundaries & Building Community to Boost STEM**
  Kim Pearson/The College of New Jersey

- **#EngineersShowUp to Disrupt Systems of Oppression**
  Donna Riley/Minnesota State University Mankato, Purdue University

- **Community Researchers Lead Science Project Equitably**
  Makeda Cheatom/Minnesota State University Mankato, Purdue University

- **INSITE: Exploring STEM Careers with Incarcerated Learners**
  Heather Griller Clark/Arizona State University, University of Massachusetts Amherst

- **Computer Science for Appalachia (CSA)**
  Lynn Hodge/University of Tennessee – Knoxville

RESOURCE SITES

- The **ARIS** website at https://researchinsociety.org is designed to advance the impacts of research for the betterment of society includes online events and resources focused on broadening participation.

- The **ADVANCE Resource and Coordination (ARC) Network** website, https://www.equityinstem.org, strives to advance STEM equity in academia by convening diverse audiences to collaborate, share, and implement the best practices and tools shown to effect change.

- The **NSF INCLUDES National Network** has podcasts and a library of briefs, webinars, and other resources for expanding the opportunities of underrepresented groups in STEM; join this community at https://www.includesnetwork.org.

PROJECTS

Placed-Based Research Projects (NSF Award Search)

- **EAR 2018059/2018222:** Collaborative Research: A place-based, student-led research project in the Pioneer Mountains, Montana: An investigation of very dry, alpine glaciation proximal to the Laurentide Ice Sheet

- **ICER 1911347:** GP-IMPACT: Improving Geoscience Education for Rural and First-Generation College Students through a Shared-Instruments Collaboration

- **DBI 2019233:** Alaska Undergraduate Research Experience: Partnering for Alaska Students by Growing Recruitment and Retention through Undergraduate Research

- **EEC 1916673:** Research: Looks Like Me: Leveraging Funds of Identity to Enhance Engineering Career Pursuits in Rural/Reservation Communities

- **SES 1941917:** CAREER: A Quantitative Analysis of Spatial Inequality and Place-based Policies

- **RCN-UBE 2018116:** RCN-UBE Incubator: Diversifying and integrating marine education at field stations along a latitudinal gradient

- * **CBET 1943413:** CAREER: Community-Engaged, Sensor Network for Identifying Air Pollution Sources

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