
# Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia: Summary of a Conference

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# SEEKING SOLUTIONS

## Maximizing American Talent by Advancing Women of Color in Academia

SUMMARY OF A CONFERENCE

**Karin Matchett, Rapporteur**

**Committee on Advancing Institutional Transformation for Minority Women in Academia**

**Committee on Women in Science, Engineering, and Medicine**

**Policy and Global Affairs**

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# Preface and Acknowledgments

Over the past two centuries, advances in science and technology have transformed human existence. For example, advances in energy, transportation, information and communications technology, and the biological sciences have extended human life span, greatly improved the standard of living, and raised the educational level in much of the world. The tools and knowledge that have emerged promise to bring even more benefits. Yet many of the most urgent challenges faced by human society are caused by the misapplication of science and technology—and their potential misapplication in the future.

Fully realizing the potential of science and technology to improve human life, and reducing any threats to life that accompany those advances, will require a greater push to increase science literacy and engagement and the wisdom to place limits on technologies when necessary. All of this requires the nation and the world to heed the "all hands on deck" call that led to this conference—a strategy for involving every person of talent, regardless of ethnicity, race, or gender, in the effort to maximize the promise and confront the threats of contemporary science and technology. We must eliminate barriers that prevent the full mobilization of our nation's talent in addressing the challenges before us.

Over the last decade there has been increasing worldwide recognition that discrimination based on race or gender in any endeavor limits the pool of talent for that endeavor. This recognition has led to a corresponding increase in attention throughout the globe of the need to more fully incorporate women and people of color into all endeavors. For instance, on March 9, 2013, the Queen of England signed a new charter for the 54 members of the British Commonwealth that asserts," We are implacably opposed to all forms of discrimination, whether rooted in gender, race, colour, creed, political belief or other grounds," and "We recognize that gender equality and women's empowerment are essential components of human development and basic human rights." The March 7, 2013, issue of Nature featured a special section on the gender imbalance in science. There is general agreement that while much progress has been made, there is a long way to go: Equality has not been reached for women or for people of color. Since the publication in 1976 of "The Double-Bind: The Price of Being a Minority Woman in Science," one of the most cited reports that first addressed issues of women of color in science—and co-authored by Shirley Malcom, the closing speaker at the conference—it has been clear that women from racial minorities face even more pronounced barriers.

Under the auspices of the standing Committee on Women in Science, Engineering and Medicine (CWSEM), we were privileged to chair an ad hoc committee to plan a conference "to discuss the current status of women of color in academia and explore the challenges and successful initiatives for creating the institutional changes required to increase representation of women of color at all levels of the academic workforce." The Committee on Advancing Institutional Transformation for Minority Women in Academia was constituted in recognition of the fact that while the number of women, including women of color, pursuing higher education in science, engineering, and medicine has grown, the number of women of color faculty in all institutions of higher education has remained small and has grown less rapidly than the numbers of white women or men of color.

The charge to the National Academies' ad hoc Committee on Advancing Institutional Transformation for Minority Women in Academia was to "organize and conduct a two-day public conference to review the existing research on education and academic career patterns for minority women in science, engineering, and medicine." Specifically, the conference was to focus on:

- A systematic review of relevant research literatures to enhance understanding of the barriers and challenges to the full participation of all women of color in STEM disciplines (science, technology, engineering, and mathematics) and academic careers
- Model practices and programs that recruit, retain, and advance women of color
- The identification of reliable and credible data sources and data gaps
- The identification of the key aspects of exemplary policies and programs that are effective in enhancing the participation of women of color in faculty ranks

The committee, composed of accomplished scientists and engineers with a shared passion for expanding participation in STEM fields, held bi-monthly conference calls and convened meetings at the Beckman Center in California and at the NAS building in Washington, D.C., to consult experts and discuss the existing data and important gaps. Two papers were commissioned to examine and summarize the available data, and those papers are included as appendices in this report. On June 7 and 8, 2012, the committee hosted a public conference in the newly renovated NAS building in Washington, D.C. Over 150 people from academic institutions, funding agencies, and professional societies came together to explore relevant data and discuss possible solutions. Discussion varied from dispassionate dissection to impassioned argument. Participants discussed the available data, the limitations of the data, and the gaps in the data. Individual stories brought data to life. Legal avenues and options, and institutional best practices were summarized, and avenues for the dissemination of these findings were discussed and debated. The tools and factual information from professional organizations and societies, government agencies, academic institutions can be found in Appendix E.

Among the many important insights voiced during conference sessions were the following:

- An important factor in the slow integration of women of color into academia is the structural impediments built into current institutions, particularly in the United States. There cannot be full participation by women of color in academia until policies and expectations for work-family balance are addressed (see Stephanie Coontz, Why gender equality stalled, *New York Times*, Feb. 16, 2013).
- One of the most striking realizations was the recognition that a major issue is the innate biases that all humans carry (see, for example, Thinking, Fast and Slow by Daniel Kahneman). This innate bias leads us all—men, women, people of color—to make snap judgments that, unrecognized and unchecked, will contribute to perpetuating the status quo. In many ways, this recognition frees institutions and individuals from blame and may make it easier for all to join forces in an attempt to fully marshal the talent of the nation in STEM endeavors.

This report has been prepared by the conference rapporteur as a factual summary of what occurred at the conference. The planning committee's role was limited to planning and convening the conference. The views contained in the report are those of individual conference

participants and do not necessarily represent the views of all conference participants, the planning committee, or the National Research Council.

The ad hoc committee decided to keep the "Seeking Solutions" website up as long as possible to act as a catalyst for continued discussion. The committee is also dedicated to finding ways, in addition to publishing this report, to disseminate the suggestions and useful practices identified by conference participants as widely as possible. The difficulties faced by the nation are urgent and require all the talent we can muster.

We are grateful to our colleagues who served as members of the committee, to Karin Matchett, who ably captured and summarized the conference sessions, and to all of the speakers and participants in the conference. We also thank Victoria Gunderson and Mahlet Mesfin, Mirzayan Fellows who assisted the ad hoc committee. The conference could not have occurred without the professional and tireless efforts of Catherine Didion and Wei Jing.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for quality and objectivity. The review comments and draft manuscript remain confidential to protect the integrity of the process.

We wish to thank the following individuals for their review of this report: Christine Grant, North Carolina State University; Peter Kozel, National Institutes of Health; Cheryl Leggon, Georgia Institute of Technology; Ernest Steele, Morgan State University; and Abigail Stewart, University of Michigan.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the content of the report, nor did they see the final draft before its release. Responsibility for the final content of this report rests entirely with the rapporteur and the institution.

This material is based upon work supported by the National Science Foundation under Grant No. 1049637. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Lydia Villa-Komaroff, Cochair
Florence Bonner, Cochair

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# Introduction

The scientific and technological strength of the United States on the global stage is at a critical juncture. As other nations expand their scientific and technological capacity, U.S. research and educational institutions and industries encounter difficulties in attracting and retaining individuals in science, technology, engineering, and mathematics—the STEM disciplines. The United States needs "all hands on deck" and must attract and retain its top talent in science and engineering. Demographic shifts underway mean that the pool of talent from which the nation draws is becoming more and more diverse, with present-day "minorities" projected to not be in the minority by 2050.[1]

Universities, however, are often ill-equipped to train and support people of color, especially women. Instead of having all hands on deck, US institutions watch large numbers of students, teachers, and researchers leave the STEM pathway at several key transition points. One major reason for the mass departures is the fact that academic culture tends to be easily supportive of only a narrow swath of the American population, frequently failing to fully support the entire range of the creative, bright, and ambitious individuals who come to academic institutions with intense interest in science and technology. This conference focused on a key segment of the pool of talented people who often do not find sufficient support in academia: women of color.[2]

Given that success in academia is predicated on many factors and is not solely a function of talent, "Seeking Solutions: Maximizing American Talent by Advancing Women of Color" aimed to elucidate those other factors and to highlight ways that institutions and the individuals working in them can take action to create institutional cultures hospitable to people of every gender, race, and ethnicity. Participants at the conference focused specifically on women of color—people who experience both gender and racial biases—and identified the points in educational and career pathways at which talent and creativity are lost as women of color leave academia for positions in industry and elsewhere, or leave STEM disciplines for other fields. Conference participants discussed the self-efficacy of women of color and promising and/or proven initiatives that academic institutions may wish to adopt in order to provide an environment in which *all* ambitious and talented STEM faculty are welcome and thrive.[3]

Academia was long populated by people who were—through a variety of mechanisms and choices—free from time- and resource-consuming responsibilities outside of the academy. In

[1] According to data released by U.S. Census Bureau in 2008, the minority population – everyone except for non-Hispanic, single-race whites – is projected to be 54 percent of the nation's population by 2050. See more at www.census.gov/newsroom/releases/archives/population/cb08-123.html

[2] Women of color include Asian, Black, Hispanic, and American Indian/Alaska Native women. We acknowledge that not everywhere in the summary are the same categories used. (www.nsf.gov/od/iia/activities/ceose/mini-symp-pres/Women_of_color_stem_Oct2009/Oct27/JoanBurrelliv2.pdf)

[3] Given that the conference was organized by the Committee on Women in Science, Engineering, and Medicine, the discussion embraced a broad swath of disciplines that have different levels and types of issues with regard to their support for American talent across the board—including women of color. While the committee was well aware of the limitations implicit in including such a diversity of disciplines, it considered it necessary to discuss the issues both in the aggregate as well as specific to different disciplines.

the last few decades, academia has gone from being dominated by white men to being increasingly populated by people—mainly but not exclusively women—who maintain broader responsibilities—to children, extended family, and the wider community. Yet support systems in academia (both explicit and implicit) have been slow to broaden and embrace the growing diversity among its graduate students, post docs, and faculty. The consequences of support that is spotty at best are severe, particularly in the face of the U.S. shortage of STEM professionals. The academy, if it is to attract and retain the brightest and most innovative researchers and teachers, must accommodate scholars whose values and lives embrace a set of needs not only inside, but outside of the academy as well.

Participants in this conference brought recommendations and examples of successful practices that strategically minded institutions are employing to capture, nurture, and maximize American talent in science, technology, engineering, and mathematics in academia. Some examples of strategies and some research discussed pertained to women in general, due to an absence of strategies or research on women of color specifically; however, the experiences of women of color were addressed directly whenever possible. Forward-thinking programs in some universities have found success and are moving university programs and "climates" toward ones that support talented faculty who are women of color. Many climate or cultural shifts are conceptually simple and inexpensive to implement. The questions raised and needs identified at this conference show the way toward more hospitable academic environments in which every talented, driven, and creative American in STEM disciplines thrives, finds community and collaborations, and makes his or her maximum contribution to this nation's scientific and technological strength.

Recommendations and insights offered by conference participants clustered in two areas. The first had to do with the need to deliberately expand access for women of color to many modes of support that have tended to accrue virtually automatically to the more "traditional" students and scholars in the history of institutions of higher education—white men and, to a lesser degree, white women and men of color. The second area related to unconscious gender and racial bias. Women of color (and, to differing degrees, women overall) are often on the receiving end of "cognitively automatic" assumptions about their abilities and ambition. But studies have shown and specific institutions can attest to the fact that it is quite possible to diminish systematic bias through well-designed, simple awareness-raising activities and programs (see Chapter 3, Multiple Marginality: Gender, Race, and Equity in Science Education and Research). Pertinent to both areas is the need for better metrics (and mechanisms for obtaining data) for understanding the representation of women of color in STEM fields in academia, their routes through the educational and professional stages of their careers, and the climates and cultures of institutions of higher education in terms of diversity inclusion throughout the United States.

Participants suggested valuable resources and offered examples of programs and activities that are known to help reduce unconscious bias and lead to institutional climates that more evenly support faculty and students of all genders, races, and ethnicities, as well as other important divides. As one participant remarked, the need, broadly conceived, is for an end to *differentism* and a recognition of how an embrace of differences brings strength to academia.

## STATEMENT OF TASK AND CONFERENCE OBJECTIVES

The National Academies' ad hoc Committee on Advancing Institutional Transformation for Minority Women in Academia convened a two-day public conference to review the existing research on education and academic career patterns for women of color in science, engineering, and medicine. The conference focused on model practices and programs that recruit, retain, and advance women of color with a recognition that not all programs may work effectively for different ethnic and racial groups. This topic is important as while the numbers of women pursuing higher education in science, engineering, and medicine has grown (including the number of women of color), there is still a relatively small number of women of color faculty in all institutions of higher education. The conference agenda (Appendix B) was based on (1) a systematic review of relevant research literatures to enhance understanding of the barriers and challenges to the full participation of all women of color in STEM disciplines and academic careers; (2) identification of reliable and credible data sources and data gaps in order to better understand the critical transitions where women of color are lost; and (3) identification of the key aspects of exemplary policies and programs that are effective in enhancing the participation of women of color in faculty ranks.

## ORGANIZATION OF THE SUMMARY

The organization of this summary follows that of the conference's plenary sessions. The conference provoked not one but a number of different conversations among the participants, conversations that tracked more and less closely to the conference's primary goal. This summary focuses on the discussions clearly aligned with the conference's goal of maximizing American talent. The report starts with presenting statistics on the career pathways of women of color faculty in academia (Chapter 1), followed by a panel discussion from four women of color faculty who help articulate a subset of core issues and challenges for women of color in STEM disciplines (Chapter 2). It then summarizes the multiple marginality that women of color often experience in STEM research and education in Chapter 3. To seek solutions together with various stakeholders, the report includes a discussion on the roles of professional societies and federal agencies in Chapter 4 and 5, respectively. It proceeds with highlighting exemplary strategies and programs from minority serving institutions as well as non-minority serving institutions in Chapter 6. The public discussion following each plenary session generated a rich variety of exemplary practices and successful strategies, as did the breakout sessions. Where recommendations and suggested strategies were closely related to a plenary session, they have been summarized with that session. The remaining strategies and exemplary practices pertinent to the conference goals are grouped thematically in Chapter 7.

Two research papers were commissioned for the conference and are included in Appendix A. As part of the conference planning process, written testimonials were solicited from a wide range of professional societies and federal agencies, which were asked to comment on their own efforts to maximize American talent by supporting talented women of color in the relevant fields and to describe broader needs that they see for supporting outstanding women of color in STEM fields overall. The testimonials are included in Appendix E, and they are preceded by tables indicating the topics addressed by each.

# Chapter 1

## Statistics on the Career Pathways of Women of Color Faculty in Academia[4]

### RESEARCH ON EDUCATIONAL AND CAREER PATHWAYS FOR WOMEN OF COLOR IN ACADEMIA

The conference began with a presentation by Donna Ginther, professor of economics at the University of Kansas, and Shulamit Kahn, associate professor at Boston University's School of Management, outlining the results of their data analysis—commissioned by the ad hoc committee—on the representation of women of color at various key points along their educational and career pathways in science, technology, engineering, and mathematics. See full paper in Appendix A-1.

#### Definitions of Data and Caveats

Ginther and Kahn explained that their research was supported by the National Institutes of Health (NIH) and their presentation by the National Science Foundation (NSF), and that while their analysis utilized a great deal of data from the NSF, the NSF does not endorse their methods or conclusions. They also emphasized that their research provided descriptions of situations and did not elucidate the reasons or causes. They did not examine institutional climate, mentoring across the length of a career, or the effect of unconscious bias in promotion and tenure processes, but rather focused on the *numbers* of women of color at each stage of the academic pathway relative to the numbers of men of color, white women, and white men in academia, and the representation of each group in the general population.

Ginther and Kahn used the 1993-2008 version of the NSF's Survey of Doctorate Recipients, a biennial longitudinal survey of individuals who received doctorates in science and engineering. They noted that the Survey of Doctorate Recipients oversamples underrepresented minorities—meaning that their representation in the data set is greater than their representation in the population of academics—and that even then the sample sizes of women of color are very small. Given these small sample sizes, the NSF dictated that the data be aggregated to ensure confidentiality.[5] Ginther and Kahn also used data from the Current Population Survey to examine high school and college graduation rates, the Integrated Postsecondary Education Data System to examine the number of graduates in science and engineering fields, the NSF's Survey of Earned

[4] This session was moderated by Lydia Villa-Komaroff, chief scientific officer, Cytonome/ST, LLC, and cochair, Committee on Advancing Institutional Transformation for Minority Women in Academia.

[5] The issue of aggregated versus disaggregated data came up several times in the conference. (See also Hurtado's discussion of her research below.) There is an important tension between 1) the need to aggregate data in order to protect survey respondents' confidentiality (anonymity), and 2) the need to disaggregate the data in order to see more clearly into the specific experiences of different groups of women.

Doctorates to examine the number of Ph.D.'s in science and engineering, and the Association of American Medical Colleges to examine the number of medical school graduates.

Ginther and Kahn's definition of "women of color" excluded residents of countries other than the United States, and included U.S. residents who are African American, Hispanic, and Native American, and Pacific Islanders.

## Outcomes Evaluated

Ginther and Kahn examined each stage of the academic pathway, from high school to full professor. They gave a snapshot of the most recent Survey of Doctorate Recipients data processed by the NSF, data from 2008 that were released in 2011.

Education pathways included:


Career pathways included:


Types of institutions included:

- Minority-serving institutions (historically black colleges, tribal colleges, and institutions that grant more than 50 percent of degrees to a specific minority group)
- Non-minority-serving institutions
- Research I institutions, as defined by the 1994 Carnegie Classification of Institutions of Higher Education. Research I institutions produce the majority of Ph.D. students.

## Challenge of Small Sample Sizes

Ginther and Kahn reported that among the people in academic occupations related to science and engineering in 2008, there were approximately 2700 women of color, 4000 men of color, 26,000 white women, and 58,000 white men. They explained that the data on women of color had to be aggregated because the number of women of color in academia is so small compared to other groups. They noted that the statistics tend to express measurements in terms of percentages, and they cautioned conference participants about the misperceptions that can result from this. When the starting points are dramatically different—in this case, 2700 in one group and 58,000 in another—then all *percentages* represent numbers that are also dramatically different, but that can look deceptively similar. For example, if the number of white women in a given situation is 1000 and the number of women of color in that same situation is 100, then a result that occurs to the same percentage of women in each group occurs to dramatically different numbers of people. A situation affecting 15 percent of all women would affect 150

white women and 15 women of color. In general, any given percentage for women of color was about 1/10 that of the same percentage for white women and 1/20 that for white men.

## Findings

Ginther and Kahn reported that women of color are less likely than white women to:

- Graduate from college
- Obtain a Ph.D. in science and engineering
- Obtain a tenure-track job in a non-minority-serving institution


**Figure 1.** Percentage of U.S. citizens ages 24-25 who are women of color (WOC) out of (a) the total population of 24-25 year-old citizens, (b) the high school graduates among the 24-25 year-old citizens, and (c) the college graduates among the 24-25 year-old citizens.
Source: 1994 – 2010 Outgoing Rotations of the Current Population Survey. Developed by Ginther and Kahn in the commissioned paper *Education and Academic Career Outcomes for Women of Color in Science and Engineering* (see Appendix A-1)

Women of color are more likely than white women to:

- Be employed in a non-tenure-track position
- Be employed at a minority-serving institution

As shown in Table 1, although women of color make up 12.5 percent of the U.S. population, they make up only 2.3 percent of faculty who are on the tenure track and who are tenured. As we move forward along the academic pathway, the percentage of women of color drops; their numbers are low, even in minority-serving institutions.

*STATISTICS ON THE CAREER PATHWAYS*

**Table1.** Percentage of each academic rank in each race/sex category.

| | % of non-Tenure Track Faculty | % of Tenure-Track/ Tenured Faculty | % of Tenured Faculty | % of Full Professors | % of US Population |
|---|---|---|---|---|---|
| **Women of color** | 5.1% | 2.3% | 1.7% | 1.2% | 12.5% |
| **Black** | 2.3% | 1.1% | 0.7% | 0.4% | 6.2% |
| **Hispanic** | 1.2% | 1.0% | 0.8% | 0.7% | 5.3% |
| **Men of color** | 3.0% | 4.1% | 3.9% | 3.8% | 11.9% |
| **Black** | 1.6% | 1.8% | 1.5% | 1.2% | 5.3% |
| **Hispanic** | 1.1% | 2.2% | 2.2% | 2.4% | 5.6% |
| **Other women** | 42.2% | 26.1% | 23.6% | 20.1% | 38.3% |
| **White** | 38.5% | 23.4% | 21.9% | 18.9% | 36.2% |
| **Asian** | 3.8% | 2.6% | 1.7% | 1.2% | 2.1% |
| **Other men** | 49.6% | 67.5% | 70.8% | 75.0% | 37.3% |
| **White** | 43.2% | 60.1% | 63.9% | 67.4% | 35.5% |
| **Asian** | 6.5% | 7.5% | 6.9% | 7.6% | 1.9% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** |
| **Total 2008 Number** | **15,473** | **85,164** | **62,469** | **36,365** | |

Source: 2008 NSF Survey of Doctorate Recipients. Developed by Ginther and Kahn in the commissioned paper *Education and Academic Career Outcomes for Women of Color in Science and Engineering* (see Appendix A-1).

**Table 2**. Percentage of each academic rank grouping within each university type—non-underrepresented minority (Non-URM) and underrepresented minority (URM)—in each sex/racial major and sub-grouping.

| | NON-URM UNIVERSITIES | | | | URM UNIVERSITIES | | | |
|---|---|---|---|---|---|---|---|---|
| | % of non-Tenure-Track Faculty | % of Tenure-Track faculty (includes tenured) | % of Tenured Faculty | % of Full Professors | % of non-Tenure-Track Faculty | % of Tenure-Track faculty (includes tenured) | % of Tenured Faculty | % of Full Professors |
| **Women of color** | 3.6% | 1.6% | 1.1% | 0.7% | 19.5% | 9.6% | 7.5% | 6.1% |
| **Black** | 28.9% | 0.7% | 0.5% | 0.2% | 8.7% | 5.4% | 3.1% | 1.8% |
| **Hispanic** | 29.6% | 0.7% | 0.5% | 0.4% | 10.2% | 4.1% | 4.4% | 4.3% |
| **Men of color** | 2.5% | 3.0% | 2.7% | 2.5% | 7.5% | 16.2% | 17.3% | 16.9% |
| **Black** | 13.7% | 1.2% | 0.9% | 0.7% | 7.0% | 7.9% | 7.6% | 6.7% |
| **Hispanic** | 11.5% | 1.6% | 1.5% | 1.6% | 0.5% | 8.3% | 9.8% | 10.1% |
| **Other women** | 43.0% | 26.7% | 24.2% | 20.4% | 35.6% | 19.2% | 17.6% | 16.4% |
| **Other men** | 50.9% | 68.7% | 72.1% | 76.4% | 37.4% | 55.0% | 57.6% | 60.7% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |
| **Total 2008 Number** | **13,960** | **78,070** | **57,030** | **33,050** | **1,510** | **7,090** | **5,440** | **3,320** |

Source: 2008 NSF Survey of Doctorate Recipients. Developed by Ginther and Kahn in the commissioned paper *Education and Academic Career Outcomes for Women of Color in Science and Engineering* (see Appendix A-1).

## Educational Pathways and Transitions

### High school and college graduation

Ginther and Kahn explained that the proportion of high school graduates who are women of color is 12 to14 percent, the same percentage as their representation in the U.S. population overall. The graduation rate of women of color is similar to the average of the graduation rates of all groups.[6]

[6] Ginther and Kahn's analysis of education outcomes begins by using data from 1994-2010 waves of the Outgoing Rotations data from the Current Population Survey (CPS). They compare the percentage of U.S. citizens ages 24-25 who were women of color to the percentage of high school graduates among the 24-25 year-old citizens who were

The first dramatic differentiation was seen in college graduation rates. The college graduation rate for women of color (for all college majors combined) is much lower than for high school graduation—40 percent of women of color leave this education pathway between high school and a bachelor's degree. Of women of color who are high school graduates, 17.8 percent go on to graduate from college, a statistic that stands in contrast to college graduation rates of 29.9 percent for white women. As individuals move along the pathway, white women constitute a growing proportion of the people obtaining degrees, resulting in white women becoming overrepresented in academia relative to their representation in the general population and relative to their graduation rates for high school, and leading to women of color becoming underrepresented relative to both of these.

Looking more closely, Ginther and Kahn determined that women of color are starting college at rates approximately proportional to their high school graduation rates but are not graduating at the same rate (data were for all college majors). For STEM majors, in particular, women and men of color graduate at rates similar to one another (3.4 percent/3.0 percent), and white women and men graduate at rates similar to one another (6.5 percent/6.8 percent). Ginther and Kahn postulated that the lower numbers of women of color in STEM may be a function not of their high school preparation in STEM disciplines, but rather of their relative numbers when entering college.[7]

Ginther and Kahn looked specifically at the percentage of women who graduate from college who majored in science and engineering fields. In this measure, the results for women of color and white women were not as disparate. Among women of color, 19.0 percent majored in science or engineering versus 21.9 percent of white women. (Among the men, 24.8 percent of men of color and 28.1 percent of white men majored in these fields.)

**Ph.D. attainment**

The second discrepancy between women of color and people in other groups occurred in the space between college graduation and the completion of a Ph.D. Ginther and Kahn examined the percentage of college graduates with science and engineering degrees who went on to complete a doctorate in science and engineering. The percentage of white women following that career pathway was the highest, at 18.6 percent. Then followed white men (14.8 percent), men of color (8.7 percent), and women of color (6.8 percent). Ginther and Kahn also looked at the medical school pathway, where they found that the percentage of college graduates with science and engineering degrees who went on to medical school was roughly the same for all groups, hovering around 5 percent. Here appeared the difficulty in comparing percentages: By this point in academic careers, the actual numbers of women of color have dropped precipitously; therefore, a rate of 5 percent of women of color completing medical school represents many fewer people than does 5 percent of white women or white men.

Overall, in the student phase of the academic pathway for STEM disciplines, Ginther and Kahn identified two critical transition points exist, points at which interventions are needed. The relative representation of women of color of color drops between high school graduation and college graduation, and between college graduation and completion of a Ph.D.

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women of color, and to the percentage of college graduates among the 24-25 year-old citizens who were women of color.

[7] Appendix A-1: *Education and Academic Career Outcomes for Women of Color in Science and Engineering.*

**Tenure-track positions**

Ginther and Kahn looked at the percentage of Ph.D. recipients who were in a tenure-track position within six years of obtaining the Ph.D.[8] The sample sizes for holders of Ph.D.'s were: 3943 women of color, 5437 men of color, 35,380 white women, and 68,560 white men. (They noted that given the sample sizes, some apparent differences were not statistically significant.)

The presenters divided the results according to institution type: non-minority-serving institutions, minority-serving institutions, and research I universities. In non-minority-serving institutions, women of color were significantly less represented on the faculty than white women or white men, and were represented in approximately the same proportion as men of color. At minority-serving institutions, women and men of color were much more likely than white women and white men to have tenure-track positions. And at research I institutions, women of color were represented on the faculty in an equal percentage as white women. The presenters called attention to what these equivalent percentages meant in terms of actual numbers—for every 100 white women in a tenure-track job in a research I institution, there were 10 women of color in that position.

Ginther and Kahn made clear that these data did not reveal the *reasons* why women and men of color are overrepresented in minority-serving institutions—whether the individuals actively sought out positions in minority-serving institutions or whether these were the institutions that tended to promote men and women of color. Longitudinal data are needed to compare promotion rates in both types of institutions.[9]

**Tenure within 11 years of obtaining the Ph.D.**

Ginther and Kahn analyzed the relative percentages of people holding a Ph.D. who received tenure within 11 years of completing that degree.[10] The sample sizes were: 602 women of color, 796 men of color, 5399 white women, and 10,260 white men. At non-minority-serving institutions, a statistically equivalent percentage of women of color and of white women received tenure. At minority-serving institutions, women of color were slightly more likely than white women to receive tenure. And at research I universities, women of color were significantly more likely to receive tenure than all other groups.

**Full professor**

Ginther and Kahn discussed the percentage of Ph.D.s who attained full professor status within seven years of being granted tenure. The sample sizes were: 408 women of color, 1080 men of color, 4196 white women, and 14,520 white men. At non-minority-serving institutions, women of color and white women were promoted to full professor at statistically equivalent rates (46 to 49 percent). At minority-serving institutions, women of color were promoted to full professor at a slightly lower rate than white women (66.7 percent and 79.7 percent, respectively).

## Taken Together

According to Ginther and Kahn's research, compared to white women, women of color are: 1) more likely to be in an adjunct job; 2) more likely to be employed at a minority-serving institution; 3) less likely to be in a tenure-track job in a non-minority-serving institution; and 4)

[8] SDR/NSF data. 1993-2007. Survey data.
[9] Appendix A-1: *Education and Academic Career Outcomes for Women of Color in Science and Engineering*.
[10] SDR/NSF data, Ph.D.'s from 1992 to 2007.

less likely to become tenured in a non-minority-serving institution. The stages at which women of color continue along an academic path in science and engineering at a rate similar to other groups are:

- Graduation from high school
- Receiving tenure at research I institutions

The stages at which women of color continue on an academic path in science and engineering at a rate slower than that of other groups are:

- Percentage of high school graduates who enter college and complete college degrees
- Percentage of college graduates who complete Ph.D. degrees
- Percentage of Ph.D.'s who secure tenure-track positions at non-minority-serving institutions (this encompasses the postdoctoral stage)
- Percentage of tenure-track faculty who receive tenure at non-minority-serving institutions that are not research I institutions

Once women of color obtain a tenure-track job, they progress through the ranks at similar rates as white women.[11] The largest difference in academic promotion between women of color and white women occurs at the beginning of a faculty career, with the obtaining of a tenure-track job at a non-minority-serving, non-research-I institution. Therefore, although from that point forward women of color and white women are promoted at similar rates, their relative numbers have been distanced by the nonequivalent starting conditions, and the representation of women of color in faculty positions persists at low levels.[12]

## In Closing

Ginther and Kahn went beyond their descriptive data to discussed ways in which the underrepresentation of women of color in academia is self-reinforcing. They emphasized the importance of building a stronger base of college graduates in science and engineering to increase the representation of women of color on the nation's faculty in STEM disciplines. They noted that multiple studies have shown that women of color are more likely to choose particular career tracks if their teachers in those areas included women of color ([a specific example of the general phenomenon whereby any student is more likely to choose a college major if he/she has a professor who shares his/her demographic characteristics[13]). And they re-emphasized the proportion problem—when there are discrepancies in the proportion of people from different gender and ethnic/racial groups who move from one educational or career stage to the next, the consequences are cumulative, and, over time, lead to stark differences in the representation of people from different gender, ethnic and racial groups among the more senior members of the discipline and community.

Ginther and Kahn stated that they believe that to increase the diversity of the faculty at U.S. institutions of higher education, a top priority should be policies designed to increase college graduation rates among women of color.[14] A second important node for intervention,

[11] Appendix A-1: *Education and Academic Career Outcomes for Women of Color in Science and Engineering.*
[12] Ibid.
[13] Please see Appendix A-1 *Education and Academic Career Outcomes for Women of Color in Science and Engineering* section "Discussion" for details and references.
[14] Appendix A-1: *Education and Academic Career Outcomes for Women of Color in Science and Engineering*.

suggested by Ginther and Kahn, is the span of time between receiving the Ph.D. degree and obtaining a tenure-track position, the starting point for most faculty careers and a stage where the representation of women of color significantly drops a second time.

## DATA ON WORK/LIFE BALANCE AND RELATIVE STRESSORS FOR WOMEN OF COLOR IN ACADEMIA

Sylvia Hurtado, a professor at the University of California, Los Angeles, director of the Higher Education Research Institute (HERI), and a member of the Committee on Advancing Institutional Transformation for Minority Women in Academia, presented data from HERI's national faculty survey, which is done every three years. She noted that since participation is voluntary, if the need arises to increase the sampling of specific groups of people, the researchers add supplemental surveys. For example, in an effort to match faculty and student experiences, they applied for funding from the National Science Foundation for a supplement to match faculty and students in STEM fields at the same institution. The data were unweighted, and they represented 673 four-year colleges and universities, 10,438 STEM faculty, and 260 women of color in STEM.

Hurtado's data placed people into the following groups: underrepresented minority women, Asian women, white women, underrepresented minority men, Asian men, and white men. Hurtado discussed the relationships among academic rank, race, and gender in STEM fields. Her data showed that women of color (in this case, not including Asian women) were more likely to be in non-tenure-track positions and less likely to be in full professorships, meaning that women of color are disproportionately occupying positions that have the least power and authority in the academic context.[15]

Across the groups, the percentages showed opposing trends for full professors and lecturers/instructors. The percentage of full professors in a given group went from low to high in the following order: underrepresented minority women, Asian women, white women, underrepresented minority men, Asian men, white men. The percentages of lecturers/instructors ran in the reverse order. (See Table 3)

As a result of these wide discrepancies between numbers of faculty from different demographic groups, faculty who are women of color often have few or no senior colleagues who are women of color in their departments or institutions—and a major reason given by women for leaving STEM fields in academia is a lack of mentorship or guidance.[16] (For people

[15] Appendix A-2: *Women of Color among STEM Faculty: Experiences in Academia*

[16] The term "mentoring" has a variety of definitions and connotations. "Mentoring" is a means of developing human resources. It is about guiding others in their personal quests for growth through learning. It usually focuses on long term personal career development. The benefits of mentoring generally include personal support, role modeling, and friendship. (See: Coaching and Mentoring: How to Develop Top Talent and Achieve Stronger Performance. 2004. Boston, MA: Harvard Business School Press; Catalyst. 2011. *Sponsoring Women to Success*. New York, NY: Catalyst, and Herminia Ibarra, Nancy M. Carter, and Christine Silva. September 2010. "Why Men Still Get More Promotions than Women." *Harvard Business Review*: pp. 80-85.Although the conference participants' usage of the term and concept was their own, mentoring is distinct from sponsorship and championing. Sponsorship is an active support by someone appropriately placed in the organization who has significant influence on decision-making processes or structures and who is advocating for, protecting, and fighting for the career advancement of an individual. While a mentor may be a sponsor, sponsors go beyond the traditional social, emotional, and personal growth development provided by many mentors. (See: Catalyst. 2011. *Sponsoring Women to Success*. New York,

in every demographic group, men and women of all races and ethnicities, professional isolation is a major factor prompting them to leave an institution.) Early-career women of color who lack senior colleagues who can serve as role models and sources of information (both written and unwritten) risk the following: not understanding their role within the faculty community, not having a sense of belonging, having unrealistically low assumptions about their competence, and misunderstanding the rules and unstated practices for promotion and tenure. A dearth of senior colleagues who are women of color reduces the access of early-career faculty to key social networks, wisdom for navigating the department and institution, and discipline-specific professional opportunities. Where relationships do exist, women of color are less satisfied than people in other groups with their relationships with senior leadership as well as their career-stage peers.[17]

**Table 3.** Proportion of STEM faculty in sample by rank, race, and gender.

| Sample | Professor | Associate | Assistant | Lecturer/Instructor |
|---|---|---|---|---|
| **URM Women 260 (2.5%)** | 16.9% | 25.8% | 32.7% | 24.6% |
| **Asian Women 241 (2.2%)** | 19.9% | 31.5% | 32.4% | 16.2% |
| **White Women 3,674 (34.2%)** | 23.6% | 30.3% | 31.1% | 15.1% |
| **URM Men 354 (3.3%)** | 30.2% | 29.4% | 23.2% | 17.2% |
| **Asian Men 510 (4.8%)** | 34.1% | 26.7% | 32.0% | 7.3% |
| **White Men 5,399 (50.3%)** | 44.2% | 27.8% | 18.9% | 9.1% |

Source: HERI Faculty Survey. Presented by S. Hurtado at the Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia Conference, June 2012, Washington, DC.

### Top 10 Sources of Stress

Hurtado's research found the following ten items to be those most frequently reported by women of color as sources of stress:

- Lack of personal time (86.4 percent)
- Self-imposed high expectations (82.4 percent)
- Managing household duties (79.0 percent)
- Working with underprepared students (69.9 percent)
- Institutional budget cuts (66.0 percent)
- Personal finances (65.8 percent)
- Research or publishing demands (61.8 percent)

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NY: Catalyst, and Herminia Ibarra, Nancy M. Carter, and Christine Silva. September 2010. "Why Men Still Get More Promotions than Women." *Harvard Business Review*: pp. 80-85.).

[17] Appendix A-2: *Women of Color among STEM Faculty: Experiences in Academia.*

- Institutional "red tape" (61.0 percent)
- Teaching load (61.0 percent)
- Students (58.5 percent)

Hurtado discussed areas in which people in other groups reported significantly more or less stress on these ten measures. Neither white men nor white women reported as a stressor personal finances, whereas women and men of color did. White men reported less stress from lack of personal time, self-imposed high expectations, and managing household duties, and they reported less stress from institutional red tape. Overall, the stressors reported by white women were statistically similar to those reported by women of color; however, white women reported less stress than women of color in lack of personal time and managing household duties. Men of color also reported less stress than women of color from lack of personal time and managing household duties.

### Subtle Discrimination

Hurtado's research showed significant differences along gender and racial lines with regard to stress that people experienced from discrimination. Women experienced more stress than men, and Asian people and other underrepresented minorities experienced more stress than white individuals.

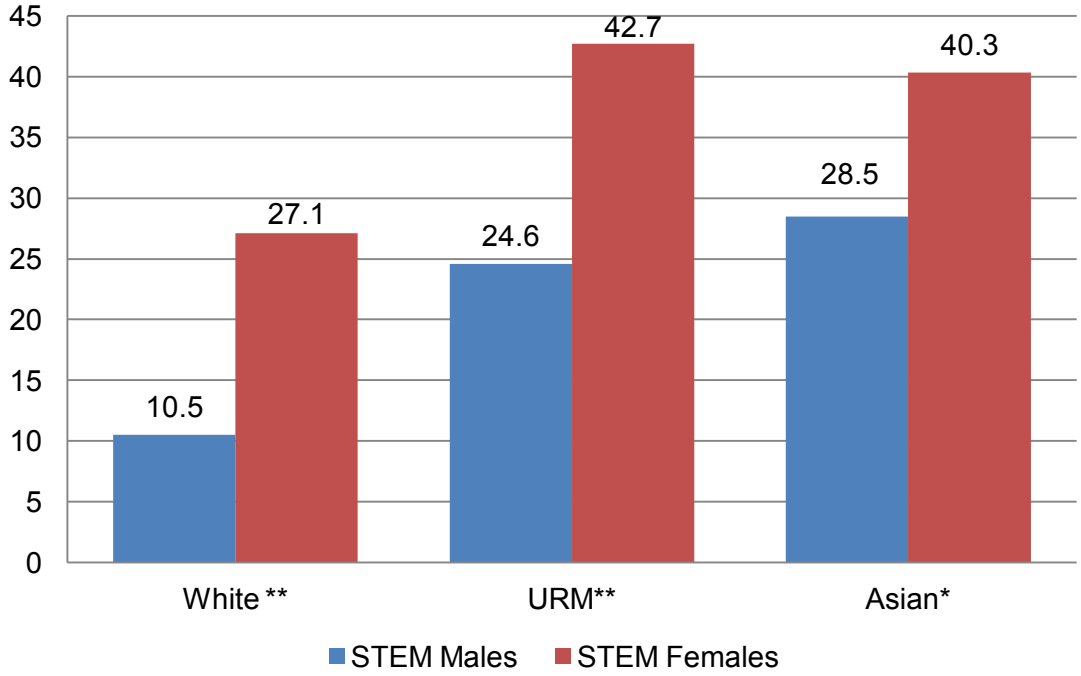


**Figure 2**. Source of Stress in the Last Two Years: Subtle Discrimination (e.g., prejudice, racism, sexism) % Responding "Somewhat" or "Extensive".
Note: Significant male/female differences within group ** p=< .01; * <.05.
Source: HERI Faculty Survey. Presented by S. Hurtado at the Seeking Solutions: Maximizing American Talent by Advancing Women of color in Academia Conference, June 2012, Washington, DC.

### Career-related Stress

Hurtado found that people in all groups experienced relatively less stress at the lower academic ranks, but there were significant differences among groups (Figure 3). Women overall, and women of color specifically, experienced significantly more stress than their male counterparts over the course of their academic careers. Women of color reported the greatest amount of stress of all people at the associate professor level, were lower only than white women at the full professor and assistant professor levels, and were lower than white women and Asian men at the lecturer/instructor level.

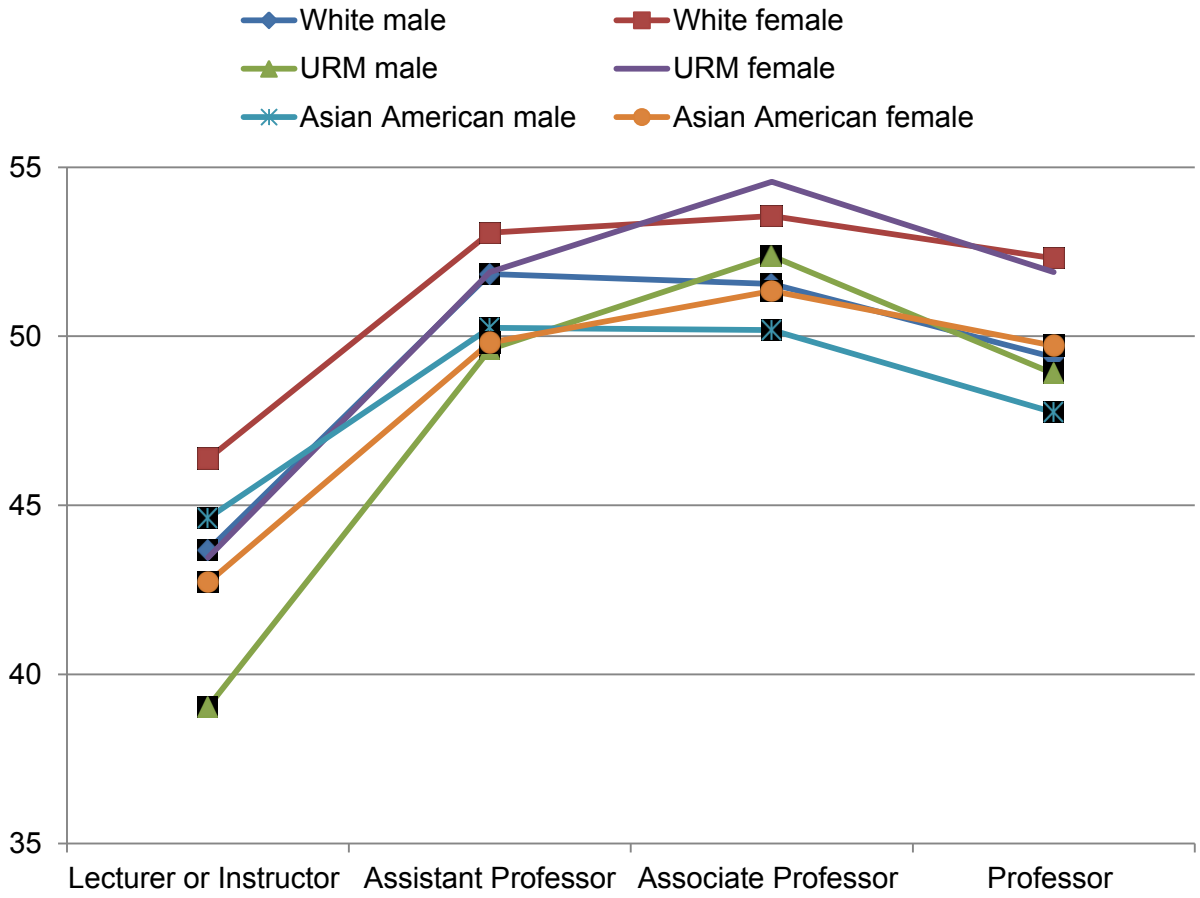


**Figure 3**. Average Career-related Stress
Source: HERI Faculty Survey. Presented by S. Hurtado at the Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia Conference, June 2012, Washington, D.C.

### Workload

Reported workloads were similar across groups, with a few exceptions. Women of color did more student advising than white men, did more committee work than white men and Asian men, and were able to spend less time per week on research and scholarly writing—the basis for promotion—than men in all groups.

## Work Environment

When posed the statement "my research is valued by faculty in my department," women of color (69.7 percent) were less likely to agree than white men (79.3 percent) and Asian men (83.3 percent). To the statement "I have to work harder to be perceived as a legitimate scholar," women of color (79.1 percent) were more likely to agree than white women (66.6 percent), white men (52.4 percent), and men of color (60.1 percent). Regarding satisfaction with compensation and work (a measure that includes salary, benefits, work load, and teaching load), women of color reported the lowest satisfaction of people in all groups at the full professor level and lowest (together with men of color) at the associate professor level, and were in the middle of the pack at the assistant professor and lecturer levels.

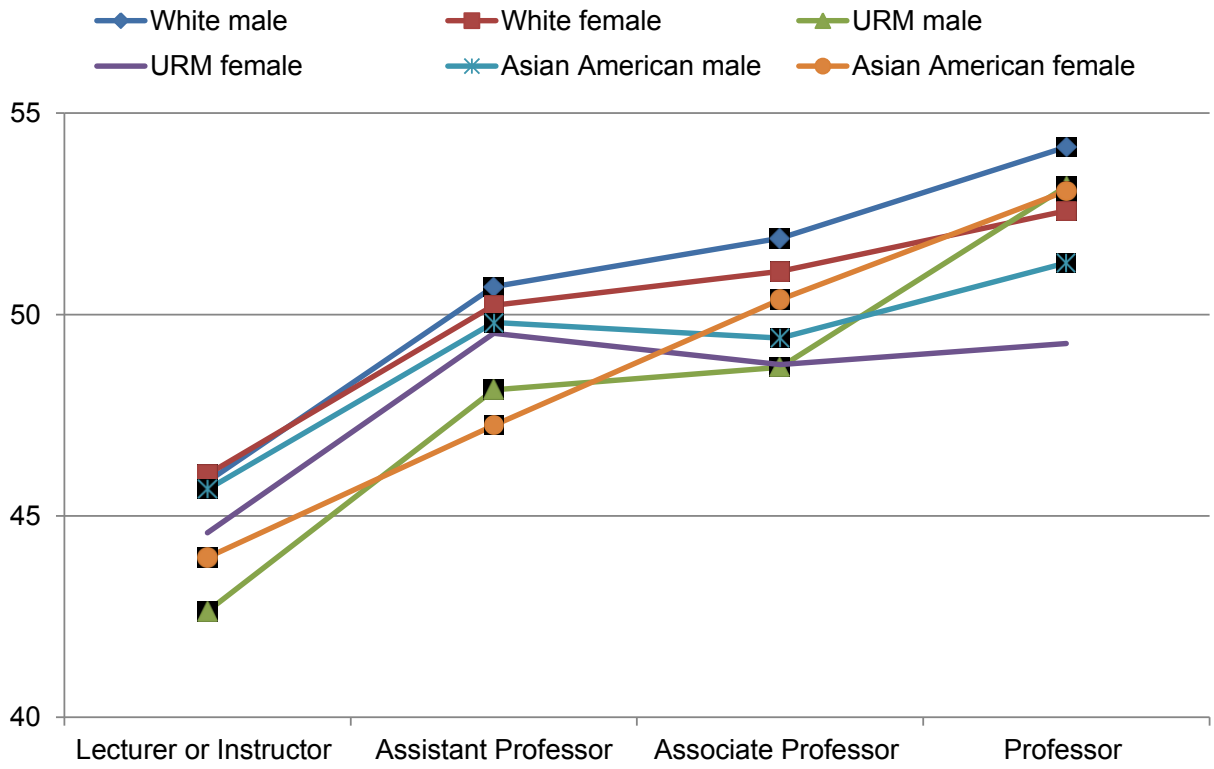


**Figure 4.** Mean Faculty Satisfaction with Compensation and Work.
Source: HERI Faculty Survey. Presented by S. Hurtado at the Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia Conference, June 2012, Washington, D.C.

## Faculty in STEM fields

STEM fields exhibit significant gender differences as well. Women of color share many experiences with all other women; however, women of color report lower work satisfaction, less respect, and some discrimination. Hurtado suggested that possible solutions include salary equity studies, professional development support, and departmental support for advancement.

## The Need for Data

Because women of color are present in such low numbers in academia, data are difficult to collect because confidentiality is difficult to ensure—many women of color are the only woman of color in their department or in their sub-discipline at the national level. In Hurtado's quantitative study of work/life issues, of the 260 women of color in the pool, 43 did not identify their department or their discipline because doing so would have revealed their identity. (Hurtado noted that this phenomenon exists to some extent for white women as well.) In qualitative research, Hurtado's group commonly encounters individuals who refuse to be interviewed or later ask for the record to be deleted. Hurtado emphasized the need for departmental climates to change in order to make unnecessary these women's concerns.

# Chapter 2

# People Behind the Statistics[18]

The conference included a panel of four women of color who are currently at different stages along the academic pathway. These women articulated a subset of the core issues for women of color in STEM disciplines, from postdoc to dean. They embodied the unique challenges and opportunities experienced by women of color and the resilience of women of color in the face of often unspoken positive and negative experiences.

## POSTDOCTORAL RESEARCH FELLOW

Tamisha Vaughn, postdoctoral research fellow from the School of Medicine at Emory University, discussed her experiences in and leading up to the postdoctoral stage in her career path. Vaughn received a bachelor of science degree from Johnson C. Smith University in Charlotte, North Carolina; participated in a post-bachelor program and received her Ph.D. from Virginia Tech; and is currently in a postdoctoral position at the University of North Carolina at Chapel Hill. Early in her college career she planned a path to medical school, but turned toward a research career in immunology after a successful internship with her mentor, a postdoctoral researcher in microbiology at University of North Carolina at Chapel Hill. Vaughn expressed strong agreement about the value of young women observing more advanced women scientists and the positive influence that this has in encouraging students to pursue scientific careers.

Vaughn described the dramatic drop in levels of support for scholars who are women of color between the Ph.D. training period and the postdoctoral phase. Vaughn had been active in programs for minority support in high school, college, and graduate school; however, at the postdoctoral level such organized support ceased to exist. She and her postdoctoral colleagues realized that they would need to take action to obtain the mentoring they needed to successfully navigate the postdoctoral phase and the transition to a faculty position, prompting Vaughn to lead the formation of a Minority Postdoctoral Council. The members of the council hail from a wide range of departments across the university, around the city of Atlanta, and beyond. This network provides mutual assistance for a variety of professional activities, including preparing for job interviews and writing a research plan for major universities.

Vaughn gave her perspective on the reasons for low numbers of women of color in faculty positions, describing the daunting prospects seen by her and other postdocs. In the postdoctoral phase, where researchers are typically faced with five to six years of heavy workloads accompanied by low pay and a very difficult, uncertain path to a tenure-track job, this path must compete with science and engineering jobs in industry that are well paying and offer a more reasonably balanced workload. Vaughn called for stronger mentorship among women of

[18] This session was moderated by Joan Bennett, professor of plant biology and pathology, Rutgers University, and member, Committee on Advancing Institutional Transformation for Minority Women in Academia.

color—passing the torch. She emphasized that it is critical that women's successes in the sciences be made visible to postdoctoral fellows, who critically need role models who have successfully arrived in advanced positions in academia in order to remain committed to that path themselves.

## ASSISTANT PROFESSOR

Patricia Taboada-Serrano, assistant professor in chemical and biomedical engineering at the Rochester Institute of Technology, received her bachelor's degree in Bolivia and master's degree in Venezuela, completed her Ph.D. at the Georgia Institute of Technology, and did postdoctoral work at the Oak Ridge National Laboratory. Taboada-Serrano's remarks focused on the importance of mentorship and institutional climate and culture.

She described the importance to women of color and other women of having strong mentors during the period when they are pursuing job interviews and selecting the institution where they will spend, at the very least, the early years of their career. She noted the importance of having mentors who provide guidance to talented women scientists on what questions to ask at institutions whose faculty they are considering joining, how to identify the characteristics of institutional climates in which they will thrive, and how to determine whether a potential institution has those characteristics.

Regarding university culture and climate, Taboada-Serrano stressed the importance of a woman of color understanding the culture and climate of the institution overall and her prospective department in particular. Job candidates must ask what their rights and resources are and must negotiate for what they need in terms, for example, of the tenure clock and family care policies. Job candidates need also to examine prospective institutions' research cultures. As research becomes increasingly collaborative, junior women scientists need to ensure that their institution's research climate is collaborative and that they will find outstanding collaborators in research areas allied with their own.

Taboada-Serrano called for senior women of color to actively offer their experience to the next generation of scholars and researchers. She envisioned a network—most likely online—where experienced women contribute their experience and offer guidance to the new talent rising through the ranks.

## PROFESSOR

Gilda Barabino, professor of biomedical engineering and associate chair for graduate studies at the Georgia Institute of Technology spoke on her experience over the course of her career thus far. Barabino received her bachelor's degree from Xavier University in chemistry and her Ph.D. in chemical engineering from Rice University. Upon receiving her doctorate in 1986, Barabino was the fifth female African-American Ph.D. chemical engineer in the U.S. She joined the faculty of Northeastern University in 1989 and was the only African-American woman in a tenure-track position in chemical engineering in the country at that time.

Barabino emphasized the importance of context, notably the specific contexts that exist along the entire career pathway that includes the individual, the institution, and the interactions between them. She related common experiences of women of color in academia, approaching them from several directions. Her own research on sickle cell anemia was a subject chosen because she aimed to contribute to the African-American community, and she described

knowing many other women of color who have made similar research choices in an effort to give back to society. She also acknowledged the invisibility felt by many women of color in academia, relating their experiences to Ralph Ellison's Invisible Man[19].

Barabino put her remarks in the context of the academy and its origins, and emphasized the usefulness for women of color of understanding this history. She noted that the academy was founded by people who were not women of color and did not share the experiences, knowledge, or responsibilities of women of color, and that the academy therefore did not evolve as a system designed for their survival or success.

Barabino discussed the fruitfulness of cross-disciplinary research. She co-leads an NSF-sponsored program. Cross-Disciplinary Initiative for Minority Women Faculty, which engages social scientists who study women of color in the sciences and engineering, and helps educate women of color about the unspoken assumptions and norms of academia. Their ultimate goal is to shift the conversation from one of survival to one of thriving. Barabino concluded with a quote from Audre Lorde, calling on women of color to be forces for change: "As women we have been taught either to ignore our differences, or to view them as causes for separation and suspicion rather than as forces for change."

## DEAN

Evelynn Hammonds, dean of Harvard College at Harvard University, spoke on the retention of outstanding faculty and the importance of institutional culture as well as resources provided to individual faculty. She began with an example of an outstanding woman scientist of color who left her tenure-track position at Harvard in favor of an institution whose climate and culture would provide the support she needed. Hammonds raised this as a case of the failure of mentoring programs that are not consistent or comprehensive, and she called for analysis of how, when, and why mentoring works and how, when, and why mentoring fails.

Hammonds remarked on the career trajectories of Nobel Prize winners, noting that for every individual, the presence of a mentor—often more than one—at every point on the pathway was critical to their success. She noted that she herself has benefited greatly from mentors along her own career path but that many women of color lack this critical support.

Hammonds expressed the view that we have failed in our measurement and analysis. She expressed great appreciation for the data presented in the first session of the conference, and she spoke to the problem of small sample sizes and the need to collect nuanced information about the experiences of women of color in academia. She pointed out that the problem is not a fear among women of color of being identified, but rather a fear of retribution. Hammonds urged the development of better metrics to describe the experiences of women of color, highlighting the need for deeper analyses of climate, causes, and context. She specified that the relevant contexts are both of individuals in their local contexts and of departments and institutions.

Universities have an economic imperative to provide an environment in which their faculty, in whom they have invested heavily, will thrive. Hammonds called on provosts and deans to provide leadership, keeping faculty on track with the goals and values of the institution. This imperative is not only one of values but is also economic. Investment in a new tenure-track faculty member is great, and for an institution not to support that individual's success within the institution is economically foolhardy. To support the outstanding researchers who have been brought onto the faculty is to maximize the department's and university's research dollars.

[19] Ellison, Ralph. 1952. Invisible Man. New York, NY: Random House.

Hammonds also addressed the climate in academia for students of color, saying that it is well known that these students receive, on average, less attention and support from faculty, with the result that many talented students in science, engineering, technology, and medicine do not see a place for themselves in the academic world where their contributions will be fully embraced. Consequently, many of them choose alternative paths, and their creativity is lost to the nation's STEM workforce in academia. She urged deans to hold faculty accountable for making sure that all talented STEM students succeed. She urged decision makers in academia not to delay taking action simply because the numbers in our existing data sets are small, stressing that institutions have the information they need to take action now.

# Chapter 3

## Multiple Marginality: Gender, Race, and Equity in Science Education and Research[20]

Joan Williams, distinguished professor of law and director of the center for Work-Life Law at the College of the Law, University of California, Hastings, discussed her work to bring together the academic literature on gender bias, including unconscious bias, and make it widely accessible. She outlined her research groups' efforts to expand the literature to include the experiences of people affected by gender and racial biases simultaneously—the double jeopardy. Her aim has been to elucidate organizational and interpersonal patterns and to give individuals the tools to change these patterns and create more equitable and productive workplaces for women overall and for women of color specifically. Williams described the four main types of gender bias and discussed how they apply to different groups of women of color, noting the many areas where research is lacking. In the breakout session, points from which are also summarized here, she expanded on the known, effective tools available to organizations to diminish or eliminate gender- and race-based bias.

Williams described how the literature on gender bias has traditionally divided the world into two segments—women and men. This dichotomy has resulted in analyses not of women overall but of white women. In response, Williams has turned her work toward investigating how gender bias differs by race. Some research indicates that the bias experienced by people who belong to more than one "subordinated" group is additive while other research indicates that it is multiplicative. Research also indicates that the question of which bias becomes salient (race or gender) is very situation-specific.

Williams' current work examines how gender bias differs by race, with the goal of creating a literature that supports true coalitions around gender. She noted that it means something very different for white women and black women to identify by gender and that when black women identify by gender, it is politically fraught. Her work on multiple marginalities is still underway, and her remarks at the conference pertaining to "double jeopardy" reflected preliminary findings or her hypotheses. For publications based on this work, and additional information and tools, she directed conference participants to online resources of the Center for Work-Life Law (see Chapter 7).

### GLASS CEILING: PROVE IT AGAIN

**Attribution bias.** The "attribution bias" is a discrepancy in explanations for why a person achieves success according to whether the person is female or male. Studies show that women's successes tended to be attributed to transient or external causes (e.g., luck), whereas

[20]This session was moderated by Florence Bonner, senior vice president for research and compliance at Howard University, and cochair, Committee on Advancing Institutional Transformation for Minority Women in Academia.

men's successes are attributed to skill.[21] Conversely, the attribution bias means that women's mistakes are seen as having permanent, internal causes, whereas men's mistakes are accidental. Thus, the literature shows that women are required to prove themselves not once, but repeatedly.[22]

The attribution bias also means that the qualifications of a man are weighted more heavily than those of a woman. Research shows that when the qualifications of two people were compared, if the male candidate had more education than experience, study subjects cited education as the more important factor, and when the male candidate had more experience than education, study subjects cited experience as the more important factor.[23] Finally, Williams discussed how the attribution bias means that women are judged on their achievement while men are judged on their potential. Women must provide relatively more evidence of accomplishment to be seen as equally competent.[24]

**Recall and leniency biases.** Williams discussed how, under the "recall bias," women's mistakes are taken more seriously and remembered longer than the mistakes made by men, and under the leniency bias, objective rules are applied rigorously to women and leniently to men.[25]

**Polarized evaluations**. Exceptionally high achieving women receive higher evaluations than exceptionally high achieving men, while women whose performance is described as "excellent" receive much lower evaluations than men performing similarly.[26]

Williams discussed how these biases affect different women differently, drawing on preliminary (but as yet unpublished) results from her focus groups.[27] She discussed how African-American women are the recipients of two sets of negative competency assumptions simultaneously.[28] Therefore, their mistakes tend to be judged more harshly than those of white women or of African-American men. Another example of what Williams described as the "prove it again" bias regards success and failure. African-American women are expected to fail; but when they do not fail, the reason assumed is charity rather than their own merit. Her preliminary research also seems to show that Latinas are subject to assumptions of even lower competence than African American women and, in addition, are subject to the "immigration shadow," which carries the assumption that a person is a new immigrant together, with the accompanying negative class and competence biases. Asian-American women, in contrast, appear to experience a more complex stereotype. If an Asian-American woman is seen as a "model minority," her

[21] Swim, J., and L. Sana. 1996. He's skilled, she's lucky: A meta-analysis of observer's attributions for women's and men's successes and failures. *Personality And Social Psychology Bulletin,* 22(5):507-519.
[22] Foschi, M. 2000. Double standards for competence: Theory and research. *Annual Review of Sociology* 26:21-42.
[23] Norton, M., J. Vandello and J. Darley. 2004. Casuistry and social category bias. *Journal of Personality and Social Psychology* 87(6):817-831.
[24] Biernat, M., and D. Kobrynowicz. 1997. Gender- and race-based standards of competence: Lower minimum standards but higher ability standards for devalued groups. *Journal of Personality and Social Psychology* 72(3):544-557.
[25] Brewer, M. B. 1996. In Group Favoritism: The Subtle Side of Intergroup Discrimination. In D.M. Messick & A.E. Tenbrunsel (Eds.), *Codes of Conduct: Behavioral Research Into Business Ethics* (pp. 160-170). New York: Sage Foundation.
[26] Linville, P. and E. Jones. 1980. Polarized appraisals of out-group members, *Journal of Personality and Social Psychology* 38(5):689-703.
[27] Results will be published in J.C. Williams, and R. Dempsey. 2014 What Works for Women at Work: Four Patterns Every Working Woman Needs to Know (forthcoming NYU Press, 2014).
[28] Biernat, M. and D. Kobrynowicz. 1997. Gender- and race-based standards of competence: Lower minimum standards but higher ability standards for devalued Groups. *Journal of Personality and Social Psychology* 72(3): 544-557.

competence may be seen as greater than that of a white woman, although the assumption may be that she is suited only for technical work and lacks leadership skills. Alternatively, an Asian-American woman may be seen as a "lotus blossom" (a highly biased term denoting a person who is passive and sexualized). Williams hypothesized that a woman in this situation would be faced with proving her competence considerably more than a white woman would.

## GLASS CEILING: THE TIGHTROPE

Williams discussed the "tightrope bias," which pertains to women's behaviors that bring respect, bring rejection, or bring invisibility, and the contradictions underlying how women's actual behaviors intersect with assumptions about their behavior. One aspect of the tightrope can be seen in a situation in which a behavior is interpreted differently depending on whether a woman or a man exhibited it. Common examples are behaviors that when displayed by a woman are interpreted as aggressive and when displayed by a man are interpreted as assertive.

**Too feminine**. Williams discussed the common expectation that women will behave in traditionally feminine ways—being nice, modest, and attuned to others' needs. Expectations of femininity often emanate not only from other faculty but also from students, who expect women faculty to be warmer, more understanding, and more lenient than men faculty.[29] However, if women do exhibit these so-called feminine behaviors this often causes them not to mesh well with the academic climate, where the expectation is of behaviors more traditionally masculine. When women do not behave in traditionally feminine ways, they may be "policed" into femininity.[30]

**Too masculine**. Williams continued on this theme and discussed how academic culture generally expects and rewards traits considered to be masculine—people who are aggressive, outspoken, competitive, and unemotional—and how women experience contradicting pressures in this respect as well. In a culture where aggressiveness in men is expected, women are easily seen as either too aggressive (and are ostracized) or not aggressive enough (in which case they wind up doing a larger proportion of the collective work). When anger is expressed by a man, it increases his perceived status, and when it is expressed by a woman, it decreases hers. Women are thus commonly faced with the choice to be respected but not liked, or liked (i.e., showing traditionally feminine traits) but not respected.[31]

Williams noted that research has shown that competent, assertive women are often seen as angry or bitter, and effective female managers are seen as lacking in social skills.[32] Women expressing the assumed-masculine traits of negotiation and self-promotion experience backlash, often more so from other women than from men.

**Multiple marginalities.** Williams discussed how there has been little to no research done on how the tightrope bias plays out for women of color. Her institute has research underway to explore these dynamics, and she discussed her hypotheses for what the research may show.

[29] Bettis B.J. and N. Adams. 2011. Nice Work in the Academy. Unpublished manuscript, Washington State University College of Education; University of Alabama, Department of Educational Leadership, Policy, and Technology Studies.

[30] Fiske, S.T., A.J.C. Cuddy, P. Glick, and J. Xu. 1999. (Dis)respecting versus (dis)liking: Status and interdependence predict ambivalent stereotypes of competence and warmth. *Journal of Social Issues* 82(6):878-902.

[31] Fiske, S.T., A.J.C. Cuddy, P. Glick, and J. Xu. 1999. (Dis)respecting versus (dis)liking: Status and interdependence predict ambivalent stereotypes of competence and warmth. *Journal of Social Issues* 82(6):878-902.

[32] Heilman, M. et al (1995). Sex Stereotypes and Their Effects in the Workplace: What We Know and What We Don't Know. Journal of Social Behavior and Personality10(6), 3-26.

Given the complex stereotype for Asian-American women, Williams hypothesizes that either the "too feminine" or "too masculine" bias may play out in any given situation according to parameters yet to be identified. Regarding the application of the "too feminine" stereotype to African-American women and Latinas, Williams had no firm hypothesis and has research underway. Regarding the application of the "too masculine" stereotype, Williams noted that African Americans are seen as more masculine in general than whites,[33] and that dominant African-American women may thus be more likely to be liked and hired than dominant white women.

## THE MATERNAL WALL

The "maternal wall" is gender bias that is triggered by motherhood, and Williams explained that it is an order of magnitude stronger than any other form of bias. Motherhood provokes very strong negative assumptions about an individual's competence and commitment. In a matched resume study, people applying for management consulting jobs submitted resumes that were identical except for four words—"membership in the PTA." The results showed that people who were mothers were 79 percent less likely to be hired, offered $11,000 less in salary, significantly less promotable and held to higher standards of performance and punctuality.[34]

Williams discussed how mothers are seen as an even poorer fit with the "go-getter" ideal worker standard—triggering the prove-it-again bias. In research on situations in which the tightrope bias was combined with the maternal wall, mothers were instructed that they should be home rather than at work, and pregnant managers were expected to be non-authoritarian, easy to negotiate with, gentle, and nice. Conversely, highly successful women with children who did not talk about their children at work were seen as unpromotable and having personality problems.[35]

**Multiple marginalities.** There has also been little data collection regarding the maternal wall as it affects women of different races and ethnicities, and Williams' research group is in the process of gathering and analyzing such data. She sees a divide emerging between "responsible" reproduction (by white women) and "irresponsible" reproduction (by women of color). Williams has preliminary evidence that women of color experience push-back for taking the same family leave that is taken by white women without outsider comment. Williams cited two studies pertaining to African-American women and the maternal wall bias. One study found that African Americans and white women were similarly affected by this bias.[36] The second study asked study subjects how much they would spend on a Mother's Day gift for African American and white women who did or did not stay home with their children. More money was reported to be spent on gifts for white women who did stay home and African American women who did not.[37]

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[33] Eberhardt, J. L., Dasgupta, N., & Banaszynski, T. (2003). Believing is Seeing: The Effects of Racial Labels and Implicit Beliefs on Face Perception, Personality and Social Psychology Bulletin, 29(3), 360-370.

[34] Correll, S.J., S. Benard, and I. Paik. 2007. Getting a job: Is there a motherhood penalty? *American Journal of Sociology* 112(5):1297–1338.

[35] Benard, S., I. Paik and S.J. Correll, 2008. Cognitive bias and the motherhood penalty. *Hastings Law Journal* 59(6):1359-1387.

[36] Benard, S., I. Paik and S.J. Correll, 2008. Cognitive bias and the motherhood penalty. *Hastings Law Journal* 59(6):1359-1387.

[37] Cuddy, A.J.C. 2013. Prescriptions and punishments for working moms: How race and work status affect judgments of mothers. Unpublished paper presented at the Harvard Business School Gender and Work Conference.

## THE GENDER WARS AND CONFLICT AMONG WOMEN

When gender bias is active in an organizational environment, it can result—perhaps paradoxically—in conflict among women. Williams discussed how if women receive the message that there is room at the top of an organizational structure for only one or a few women, this can cause conflict between them. Anecdotal information suggests that women in science sometimes disassociate from the disadvantaged group (gender or ethnicity): "I'm not a woman, I'm a scientist."

Williams addressed the shape that the "mommy wars" can take in academia. Academia includes women who 1) chose not to have children and gave priority to their academic career; 2) chose to have children but did not take family leave or otherwise perceptibly disrupt their academic careers; and 3) chose to have children and take family leave or request part-time appointments. Because of the different choices and assumptions made by those in the three groups, tension often erupts among the groups.

## TRAINING TO SYSTEMATICALLY CHANGE UNCONSCIOUS BIAS

In the breakout session on multiple marginalities, Williams discussed in greater detail how biases can be changed systematically. She urged that scholars and institutions committed to making university culture hospitable to all women and men bring in experts on organizational change, given that universities are complex and can be difficult to change given their relative lack of hierarchy. University faculty have a relatively high degree of autonomy in contrast to employees in many other sectors, including industry, where corporations often have more rigid reporting requirements.

The organization that Williams directs, the Center for Work-Life Law (http://worklifelaw.org), has developed several sets of best practices for monitoring and modifying practices that may carry implicit bias against women and people of color, including:

- work-load negotiations
- start-up agreements
- performance reviews
- the design of policies for maternity leave, paternity leave, spousal assisted hiring, and childcare

The Center for Work-Life Law is also funding studies to evaluate specific factors that contribute to successful motherhood-work balance.

# Chapter 4

# The Key Role of Professional Societies[38]

A large number of professional societies provided written testimonies on their programs and policies regarding women of color to the conference. Please see Appendix E for those testimonies and Chapter 7, where many of their successful strategies and their suggestions for action are discussed.

## SOCIETY FOR ADVANCEMENT OF HISPANICS, CHICANOS, AND NATIVE AMERICANS IN SCIENCE

Judit Camacho, executive director of the Society for Advancement of Hispanics, Chicanos, and Native Americans in Science (SACNAS) represented the society and spoke at the conference. SACNAS focuses on the sciences, mentoring, and culture, emphasizing that students' cultures add value to the scientific community and to their paths through it. SACNAS was originally based in the Southwest, but now has a national reach and includes Puerto Rico. Its network includes more than 30,000 people, with 70 colleges and university chapters, and it supports undergraduate and graduate students as well as postdoctoral fellows and faculty at all stages in their careers. The participation of women in SACNAS is continually rising, and they currently constitute 56 percent of SACNAS' membership. Camacho affirmed SACNAS's commitment to men of color as well.

SACNAS hosts an annual conference of 4000 attendees. The conference includes a session on "Coaching Strong Skills," which addresses the need for women to become assertive while not overbearing, and it has had great success. Camacho highlighted a course developed by faculty at the University of Oregon that trains individuals to do coaching of strong negotiation skills for women, noting that the outcomes in terms of women's new skills were outstanding.

## AMERICAN PSYCHOLOGICAL ASSOCIATION

Suzanne Bennett Johnson, president of the American Psychological Association (APA) and distinguished research professor at Florida State University's College of Medicine, introduced APA, the largest publisher of psychological research in the world and an organization with a membership of more than 130,000 people. She noted two ways in which the goals of the conference intersected with the focus and efforts of the APA: Bias, prejudice, and discrimination are major topics in psychology, and inclusion and diversity are core values.

Bennett Johnson listed several offices and units within the APA focused on women of color:

[38] This session was moderated by Patrick Valdez, director of College Access and Success Initiatives, Office for Access and the Advancement of Public Black Universities, Association of Public and Land-Grant Universities.

- Women's Programs Office
- Office of Ethnic Minority Affairs
- Minority Fellowship Program Office
- Division 35: Society for the Psychology of Women
    - Psychology of Black Women
    - Concerns of Hispanic Women/Latinas
    - Psychology of Asian Pacific American Women
    - Alaskan Native/American Indian/Indigenous Women

The APA has a number of policy statements and publications (see APA's written testimony E-11), and it sponsors a women's leadership conference.

The APA has a Center for Workforce Studies that collects data on psychology researchers by gender, race, employment setting, and activity, and the center monitors employment status and academic rank of women of color. The APA has a diversity implementation plan and has formal relationships with the Association of Black Psychologists, the Asian-American Psychological Association, the National Latina/Latino Psychological Association, and the Society of Indian Psychologists.

The APA is a member of the Collaborative for Enhancing Diversity in Science, a coalition created to increase collaboration among associations, societies, federal agencies, and private foundations to create a more diverse scientific workforce. The collaborative recently hosted a conference on "Enhancing Diversity in Science: Working Together to Develop Common Data, Measures, and Standards," where the APA made the following recommendations:

- Improve the collection and evaluation of empirical data on women of color in academia with a focus on career transition points.
- Identify, highlight, and reward model programs and best practices for maximizing talent of women of color in academia.
- Encourage mentoring of women of color by including protected time for mentoring in grants and contracts.
- Recognize psychology as a STEM discipline.
- Offer financial support for the development of training materials for departments of psychology that provide explicit and proactive guidance on how to promote a supportive and welcoming climate for women of color in academia.
- Offer financial incentives to institutions and departments of psychology to develop comprehensive programs to support women of color, which include:
    - curriculum development
    - enhanced access to role models and mentors
    - scholarship and fellowship funding
    - changes to institutional climate
- Highlight innovative models that support women of color in academia as they navigate multiple roles and identities.

## AMERICAN SOCIETY FOR MICROBIOLOGY

Marian Johnson-Thompson, chair of the Committee on Microbiological Issues Impacting Minorities at ASM, and professor emerita of biology and environmental sciences at the

University of the District of Columbia, introduced the American Society for Microbiology (ASM), an organization serving 26 disciplines in microbiology and having 38,000 members, of which 2.7 percent are women of color. Of its 28 presidents, 12 have been women, although it has not yet had a president who was a woman of color. The ASM's mission is to advance the microbiological sciences as a vehicle for understanding life processes, and it has an honorific arm, the American Academy of Microbiology. In 1979, the ASM established the Committee on the Status of Women in Microbiology, and, in 1984, the Committee on the Status of Minority Microbiologists.

In the 1990s, participation of minorities was not at the level the ASM had aimed for; therefore, it established a task force and engaged focus groups to plot a course toward increasing the participation of underrepresented groups. One outcome of the task force was the creation of a new committee within the Public and Scientific Affairs Board, the Committee on Microbiological Issues Impacting Minorities.

ASM manages the NIH-sponsored conference for minority students who receive NIH funding, Annual Biomedical Research Conference for Minority Students (ABRCMS). The ASM makes efforts to have representation of women of color at its annual meeting. A minority travel award is available, funded by the National Institute for Allergy and Infectious Diseases, and Johnson-Thompson noted that the majority of applicants for that award are women.

The ASM tracks the demographics of its membership, but it (like other societies) sees a significant number of people opting not to identify their ethnicities. For the Annual Biomedical Research Conference for Minority Students, they see slightly more women than men. Members of the Committee on Microbiological Issues Impacting Minorities make an effort to nominate outstanding microbiologists who are women of color for academy fellowship and academy awards. The Alice Evans Award (Evans was president of ASM in 1928) is given to a person who has made outstanding contributions to the advancement of women in microbiology, and at least one woman of color has received that award.

Outstanding minority microbiologists are listed on ASM's website. The Committee on Microbiological Issues Impacting Minorities also produces a monthly electronic newsletter that spotlights an outstanding minority microbiologist in order to increase their visibility.

## AMERICAN CHEMICAL SOCIETY

Linette Watkins, former chair of the Committee of Minority Affairs, current member of the Steering Committee of the Women Chemists of Color Initiative at ACS, and a professor in the Department of Chemistry and Biochemistry at Texas State University, San Marcos, discussed the activities of the American Chemical Society (ACS), formed in 1876 and currently having more than 164,000 members. Many of its members have not identified their race, gender, and/or ethnicity to the ACS, but of those who do, 25 percent are women, and of those women, 11 percent are women of color. The ACS Department of Diversity Programs includes several committees focused on women and/or diversity, including:

- Women Chemists Committee (formed 85 years ago)
    - Travel awards
- Committee on Minority Affairs (formed 20 years ago)
    - ACS Scholars Program
- Joint Sub-Committee on Diversity (formed in the early 2000s)
- Women Chemists of Color Initiative (formed in 2012)

In 2010, a summit was held at the ACS annual meeting that brought together women in the early and mid/late stages of their careers to discuss how to advance a group focused on women chemists of color. In 2012, the ACS established the Women Chemists of Color Initiative with the goals to build community, enhance communication, advocate for women chemists of color, and identify resources to support women of color through their career pathways. Currently, the initiative's main programming activities are at major annual meetings, including that of the ACS itself and those of its sister societies—the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) and the Society for Advancement of Hispanics, Chicanos, and Native Americans in Science (SACNAS).

## PANEL DISCUSSION

**Outcomes measurement.** The moderator asked the panel about the types of outcomes measurement each professional society uses.

Bennett Johnson discussed the APA's strong interest in attracting new members who are in the early stages of their careers, although she noted that many early-career psychology researchers do not identify their ethnicity for data collection. The APA monitors the proportion of their fellows who are women of color, and it collects data from psychology departments around the nation, tracking the occupants of tenure-track positions and the employment status and location of recent Ph.D.s. For the minority fellowship, they track the career trajectory of former fellows.

Watkins described how the ACS evaluates all programs regularly, debating what the measures of success should be and collecting and analyzing data. Concerning the newly formed Women Chemists of Color Initiative, at all events—the summit, networking events, and activities at national meetings—they poll attendees about their satisfaction with the event and solicit feedback for enhancing future activities. The success of the initiative's first two years prompted the ACS to adopt the program as part of its Department of Diversity Programs.

Camacho spoke to two different ways of understanding success: first, as a measure of the outcomes of a specific program, and, second, the long-term success of an organization or a collaboration. She emphasized how an individual's success in her career cannot be attributed to any single cause, and noted that SACNAS considers its efforts to be complementary to the programs in individual college and university campuses. Regarding specific programs, Camacho said that SACNAS has very good data on outcomes. And regarding their long-term success, Camacho noted two challenges: the difficulty of keeping track of people as they move along their career paths, and the difficulty of knowing specifically how SACNAS' efforts figured into their success.

Camacho also discussed how one key component of programmatic success is helping students to see themselves as scientists: engaging students in the practice of science. SACNAS is collaborating with a faculty member at the University of California, Santa Cruz, to examine self-efficacy models and further determine what students need in order to believe they can become a scientist. One of the things that their collaborative research has shown is that students must be actively involved in research, including the communication of the research to wider audiences.

A participant reminded the presenters that professional societies need to survey their *non*-members in order to get a clear picture of the discipline and its levels of inclusion, and she urged

professional societies to take advantage of their vast connections that allow them to survey a wide range of individuals in a given discipline.

**Collaborations.** The moderator and conference participants asked the panel what collaborations exist across societies and whether and how societies exchange information about what efforts are the most successful. The presenters described the following examples of collaborations:

- SACNAS has established a partnership with the American Association for the Advancement of Science to develop leaders among postdocs, early-career scientists, and mid-career scientists. The selected scholars participate in a week-long seminar in Washington, D.C., meeting with leaders in numerous areas of the sciences and biomedicine.
- The ASM has some collaborations, though they are still small. They sponsor a session on microbiology at the SACNAS annual meeting and at the Beta-Kappa-Chi annual meeting.
- ACS also collaborates with some allied societies, mainly through annual meetings as well.

The presenters expressed a shared desire that more information exchange take place regarding best practices, and they agreed that it would be very beneficial to have targeted funding to support such exchanges.

# Chapter 5

## Impact of Federal Agencies: Leading by Example[39]

Lauren Van Wazer, representing the Office of Science and Technology Policy (OSTP) at the White House, spoke to the importance to our nation's engines of discovery, economy, and stability of understanding the issues and proven solutions concerning the inclusion of talented women of color in academia and in the scientific and technological workforce. OSTP advises on a broad array of policy issues ranging from energy and manufacturing to space policy, engages the federal government and the wider technical community in discussions of research and development budgets, and promotes interagency collaboration on science and technology policy issues. She emphasized that the U.S. must cultivate a workforce that corresponds to the diversity, creativity, and talent of the U.S. population as a whole.

Van Wazer described the Obama administration's emphasis on increasing the participation of women, girls, and underrepresented minorities in science, technology, engineering, and mathematics. President Obama has called for "all hands on deck," and First Lady Michelle Obama has urged universities, federal agencies, and corporations to help clear the barriers for women navigating careers in the STEM disciplines. Van Wazer noted that the President and Michelle Obama understand that the government cannot single-handedly develop a comprehensive solution and remove all barriers in science and engineering, but they are committed to leading by example. President Obama has elevated the visibility of accomplished female scientists of color, by appointing Lisa Jackson, an engineer, as head of the Environmental Protection Agency; Regina Benjamin as Surgeon General; Peggy Hamburg as commissioner of the Food and Drug Administration; and Cora Marrett as deputy director of the National Science Foundation.

Federal agencies are actively promoting women of color in the sciences and engineering through investments that bolster institutional reform and pave the way for advancing outstanding women of color in U.S. universities. Examples include the National Science Foundation's distribution of more than 1,000 new awards to women under the American Recovery and Reinvestment Act of 2009, and the NIH's Working Group on Women in Biomedical Careers' formation of a Women of Color Research Network to provide networking, mentoring, and career development activities.

Van Wazer discussed the role of Title IX in universities' efforts to create more hospitable climates for female students and faculty. Science- and technology-related federal agencies are assisting universities in preparing for their Title IX compliance reviews, helping the leadership at these institutions to understand best practices for creating institutional cultures that promote equal access for female students in STEM disciplines and provide supportive climates for women faculty. She noted that the National Aeronautics and Space Administration's (NASA) compliance review process revealed a number of best practices in US universities, and NASA

[39] This session was moderated by Bernadette Gray-Little, chancellor, University of Kansas.

has released a compendium, *Title IX & STEM: Promising Practices for Science, Technology, Engineering & Mathematics,*[40] which presents best practices for universities in improving outreach, admissions, and retention of women in tenure-track positions.

Van Wazer called on the academic community to commit to working with federal agencies and the private sector to identify and deploy the most effective solutions, ensuring that women scientists and engineers have the flexibility and support to enter and remain in the highest levels of research careers. She called on senior women, and senior women of color in particular, to step forward and mentor the next generation of girls who will be those who advance future U.S. scientific and technological innovation. Van Wazer emphasized the need to recognize accomplished women of color in science and technology. She asked the audience to submit nominations for Presidential awards of outstanding scientists who are women of color, noting that Presidential awards are given for accomplishments at many points along STEM career pathways and for a variety of types of achievement.

After Van Wazer's opening talk, Bernadette Gray-Little introduced the session noting that in the United States, diversity in the general population is increasing and will continue. By 2050, ethnic/racial minorities will make up 54 percent of the population. Universities are seeing the trend reflected in their enrollment; however, scientific and academic communities do not show corresponding levels of diversity. Thus, students see too few role models and have difficulty envisioning success. In large numbers they are choosing not to pursue science and technology or to leave those paths early.

Gray-Little expressed her concern that the nation is not taking full advantage of all citizens, and she reiterated the comment offered earlier that the country needs "all hands on deck." Given that the country is currently missing out on the knowledge, experience, and contributions of many of our citizens, she posed the question of how we maximize the talents of a wider range of citizens for the benefit of the nation and the world.

She noted that the salient question is not about diversity for diversity's sake, but rather about utilizing the unique experiences and perspectives that women of color bring, and making sure that opportunities are available for their full participation and contribution to science and society.

## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Jeri Buchholz, NASA's chief human capital officer, introduced NASA's mission as being to ask and answer the most difficult scientific and technical questions ever asked by humankind, find solutions to those problems, make it possible for the resulting technologies to be turned over to the commercial sector, and promote new industries in the private sector. She described how diversity and inclusion permeate every management and program decision at NASA and noted that NASA plays a leadership role within the federal government regarding the employment of people in STEM fields.

At NASA, 89 percent of the workforce is in the fields of aerospace technology and engineering. Women of color make up 5.6 percent of NASA's workforce, a percentage that NASA is working to increase and which Buchholz noted is more than twice that of the relevant civilian labor force, at 2.3 percent. To "move the needle" and substantially increase the

[40] NASA. 2009. Title IX & STEM: Promising Practices for Science, Technology, Engineering & Mathematics. National Aeronautics and Space Administration. Accessed October 21, 2013 online: http://odeo.hq.nasa.gov/documents/71900_HI-RES.8-4-09.pdf

representation of women of color among its workforce, NASA sponsors programs focused on strengthening the educational pathways in STEM disciplines through education and outreach programs for science and math teachers and middle-school girls, and through grants programs that include internships and scholarships.

Buchholz emphasized the importance of first-line supervisors in increasing the numbers of talented women of color at NASA, given these supervisors' key roles in hiring, promoting, mentoring, and distributing work assignments. One strategy employed by NASA that has been successful is to increase division leaders' awareness of the diversity (or lack thereof) in NASA's workforce and to create a structure whereby they are accountable for their specific efforts to increase it. To this end, NASA launched its "State of the People" report, a short, visual report documenting the diversity of the NASA workforce throughout the organization, and division leaders are regularly convened to discuss the state of their divisions and their plans for improvement.

## NATIONAL SCIENCE FOUNDATION

Muriel Poston, director of the Human Resource Development Division of the Education Directorate at NSF, discussed initiatives at the agency, which is devoted to research and innovation through funding basic science. Regarding NSF's workforce, Poston described the Committee on Equal Opportunity in Science and Engineering and NSF's biennial report with data on the participation of people from underrepresented minorities in its proposal pool and workforce. In NSF's temporary and permanent scientific and professional staff, women of color made up 8.6 percent in 2007 and 10.3 percent in 2010 (30 and 50 individuals, respectively). Regarding principal investigators on NSF awards, women of color constituted less than 5 percent in 2004 and 2010, compared to white women, who constituted 17.5 percent.

NSF's premier program supporting all women is the ADVANCE program (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers), the discussion of which she deferred to the next panel on successful practices.

Poston discussed NSF's Career-Life Balance Initiative, which grew out of the ADVANCE program. This initiative offers an opportunity for all women to look at how their funding can support dependent care or personal concerns that require them to step away from their research for a short period of time. The Career-Life Balance Initiative is also linked to NSF's Faculty Early Career Development award (CAREER program) for pre-tenured faculty, as it provides additional funding for technical research support for women who choose to take dependent care leave.

Poston described NSF's Research on Gender in Science and Engineering program, which sponsors formal and informal educational initiatives supporting women and girls from diverse populations. This program also invests in fundamental research on the types of barriers that arise for women in STEM careers and the theoretical frameworks for addressing those barriers.

## NATIONAL INSTITUTES OF HEALTH

Janine Clayton, director of Office of Research on Women's Health at NIH, introduced the agency and its mission to seek fundamental knowledge about the nature of the behavior of living systems and to apply that knowledge to improve human health. Among NIH employees at the GS13-15 levels in science and engineering fields, women of color make up 5.83 percent, of

which 4.61 percent are African American, 1.41 percent are Hispanic, and 0.21 percent are American Indian/Alaskan Native. Among NIH trainees, 6 to 7 percent are women of color (a percentage that does not include Asian women). While women constitute one-fourth to one-third of NIH grantees, women of color constitute just 1.4 percent.

Clayton described the activities of the NIH Working Group on Women in Biomedical Careers, which was formed after the release of *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* in 2006. The current NIH director, Elias Zerhouni, and Vivian Pinn, the first full-time director of the NIH Office of Research on Women's Health, sought to develop innovative strategies and identify tangible actions to address the concerns of women in NIH's intramural and extramural communities.

The Working Group on Women in Biomedical Careers includes several committees, each of which was charged with considering the impact on women of color in its area of focus. The Working Group includes the Women of Color Committee and the Women of Color Research Network (www.wocrn.nih.gov). The Women of Color Research Network's website is a clearinghouse and a forum where scholars share information about role models, resources, and research on women of color in science and technology. The Research Network is open to all people concerned about diversity in academia.

Clayton outlined activities of the Working Group on Women in Biomedical Careers, which include:

- Increasing the family leave period for the NIH National Research Service Award
- Being a founding member of the mid-Atlantic Higher Education Recruitment Consortium, which helps dual-academic-career couples (www.midatlanticherc.org )
- Developing frequently asked questions that outline ways that child care can be achieved through NIH policies
- Developing a modification to the NIH biosketch that provides a place for a researcher to justify and explain gaps in his or her publication record
- Creating a "leave bank," where intramural NIH researchers can donate unused leave time to others
- Co-sponsoring mentoring and career development conferences
- Expanding the eligibility for NIH re-entry supplements to include postdoctoral fellows
- Creating the three-year Back-Up Care program, which provides short-term care for children, elders, and adult dependents
- Establishing the "Keep the Thread" program, a re-entry program for intramural postdoctoral fellows that includes flexible scheduling options, part-time work options, and position-holding during extended leaves
- Planning the construction of additional onsite child care

Clayton described NIH's commitment to informing future initiatives by funding research that identifies the factors behind the success of talented women in academic research programs—aspects of mentoring, aspects of interventions, and elements of barriers and obstacles. NIH released a request for proposals titled "Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering," with one of the grants focused on women of color. Also, the director of the NIH has two advisory committees on the biomedical workforce and on diversity.

## ENVIRONMENTAL PROTECTION AGENCY

Jim Johnson, director of the Environmental Protection Agency's (EPA) National Center for Environmental Research, indicated that there is about a 50-50 split between female and male program officers at the center. However, minority composition at the program officer level is only 10 percent. The center is working to create a comfortable environment that is similar to academic institutions but with less pressure. Johnson noted that there are various outreach programs at the EPA to encourage more minority students to study STEM; however, within the agency there are no differentiating programs for underrepresented minorities. Regarding its grants programs, Johnson noted that the EPA tracks the output such as publications and conference papers from principal investigators, trainees, and students funded by the grants. He concurred with other panel members that finding a way to increase principal investigators' accountability and responsibility to better mentor young researchers is critical. Mentoring has been a key component of various EPA programs that target different groups, including undergraduate students, graduate students, and early-career researchers within the agency.

Responding to Joseph DeSimone's question regarding challenges for universities to be in compliance with Title IX, Johnson noted that the impact of Title IX has been overlooked by academic institutions; however, it is a key component for success, and changes will be made, perhaps at a slower pace, in academic institutions.

# Chapter 6

## Successful Practices and Strategies for Institutional Transformation[41]

In this panel, representatives of minority-serving institutions as well as non-minority-serving institutions shared their secrets of success, including strategies and practices that have been implemented and challenges that must be overcome in order to move their institutional transformation forward.

### UNIVERSITY OF MICHIGAN

James Wayne Jones, Arthur F. Thurnau Professor of Materials Science and Engineering at University of Michigan and the Associate Director of the NSF-funded ADVANCE program (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) at the University of Michigan, described their focus, their efforts, and the outcomes. The University of Michigan was part of the initial cohort of universities that received ADVANCE grants, having been awarded a five-year grant in 2002. They focused on increasing the effectiveness of recruiting and retaining women faculty, on improving the institutional climate, and on increasing the visibility and leadership of women. The director of the program was instrumental in helping departmental leaders to understand issues of institutional climate and helping them to communicate with their faculty and develop strategies to effect change.

Jones described the change in faculty hiring outcomes before and over the course of the ADVANCE grant period, during which trainings on unconscious gender bias took place. Between 2001 and 2007, the percentage of faculty searches that selected women rose from 15 percent to 32 percent in the STEM disciplines.

Since the grant period ended, the University of Michigan has institutionalized the ADVANCE program, supporting it with an annual budget of $800,000 from the provost's office. Staffing includes a 50 percent appointment for the director and a 25 percent appointment for the associate director, as well as several research and program staff.

[41] This session was moderated by Kelly Mack, the program director of NSF's ADVANCE Program at time of the conference. Mack is currently the executive director of Project Kaleidoscope at the Association of American Colleges and Universities.

**Table 4.** University of Michigan hiring outcomes in science, technology, and medicine during the period of 2001 to 2012.

| Department | Year | Women faculty hired | | Men faculty hired | |
|---|---|---|---|---|---|
| | | Number | Percent* | Number | Percent |
| **College of Literature, Science, and the Arts (Natural Sciences departments)** | AY2001-2002 | 5 | 15% | 28 | 85% |
| | AY2003-2012 | 43 | 31% | 94 | 69% |
| **College of Engineering** | AY2001-2002 | 2 | 6% | 32 | 94% |
| | AY2003-2012 | 47 | 29% | 117 | 71% |
| **Medical School (Basic Sciences departments)** | AY2001-2002 | 2 | 50% | 2 | 50% |
| | AY2003-2012 | 15 | 28% | 39 | 72% |
| **Total** | AY2001-2002 | 9 | 13% | 62 | 87% |
| | AY2003-2012 | 105 | 30% | 250 | 70% |

*Denotes percentage of all new hires during the reporting period.
Source: University of Michigan.

Jones described two activities that have been particularly successful. First, the ADVANCE program engages senior faculty in the Strategies and Tactics to Increase Diversity and Excellence (STRIDE) program. Full professors undertake in-depth study of issues concerning institutional climate and unconscious gender bias, attending five workshops in the fall at the peak of faculty recruitment season. The Dean of Engineering and the Dean of the College of Literature, Science, and the Arts require all search committee members to participate in a workshop on recognizing unconscious bias and developing strategies to avoid or mitigate it. Jones noted that faculty appreciate this program and recognize its importance.

Second, the University of Michigan has begun investing immediately in the talented individuals that they have chosen to hire. Launch committees[42] are a new mentoring initiative for new faculty during their first year at the institution. Every newly hired faculty member is provided with a committee of mentors that includes the department chair, a senior faculty member from the department, an ADVANCE faculty member, and a senior faculty member from another department. Launch committees give new faculty a place to confer on a regular basis with a collection of senior people in the institution and a mechanism through which to learn how to access the myriad resources available to them that will help ensure their ongoing success.

## HARVARD MEDICAL SCHOOL

Joan Reede, dean for diversity and community partnership at Harvard Medical School, discussed her office's activities, which are organized around six themes:

1. **Continuity** in programming across academic levels where there exist multiple points of entry, exit, and re-entry. In 1990, the Harvard Medical School Exchange Clerkship Program was begun to bring medical students from other schools to Harvard to encourage them to consider academic residency programs. Each year, 11 to 25 percent match to their residency programs, and over time, more than 40 have joined the faculty.

[42] http://sitemaker.umich.edu/advance/launch_committees

2. **Consistency** in programs over time: long-term effort. For more than 20 years, in every medical school class more than 20 percent of students have been under-represented minorities.
3. **Collaboration** across institutions. The office works in partnership with the Biomedical Bioscience Career Program (www.bscp.org/), which collaborates with the biotechnology, pharmaceutical, and device industries, as well as colleges and universities, and has served more than 9000 students across the country. The Biomedical Bioscience Career Program offers scholarships and mentoring to students about a wide range of career opportunities.
4. **Creativity:** doing things differently.
5. **Communication** customized for different audiences.
6. **Commitment** of the institutional leadership:
    - Diversity inclusion is now in the mission statement of the medical school.
    - Diversity inclusion has been incorporated by the leadership as a cornerstone for excellence in teaching, research, and service.
    - Diversity inclusion is in their promotion guidelines.

The Office for Diversity Inclusion and Community Partnership is working to embed diversity and inclusion into the institution's operations. Reede noted how, too often, an institution's goals of excellence in teaching, research, and service take center stage while diversity programs stand to one side. In addition, success for diversity programs is often spoken of through numbers (specifically, percentages), when in fact an increase in diversity of 100 percent may mean the addition of two people. The office is working to change both practices, creating a new paradigm in which diversity inclusion is part of what the institution *does*—increasing its capacity to capture all human capital and make maximum use of the contributions of all community members to the teaching, research, and service missions of the institution, and its intellectual, social, and financial capital. They are currently examining metrics for productivity, advancement, and retention.

In terms of representation of minorities on the faculty of the Medical School, as a result of the efforts of the Office for Diversity Inclusion and Community Partnership and the Minority Faculty Development Program, and their collaborations with the Harvard Medical Teaching Hospitals, she noted that the number of underrepresented minority faculty has risen from 185 in 1990, when the office was established, to 630 today.

**Data and research.** The office is now looking at the productivity of faculty, assessing their advancement with regard to academic progression and leadership/awards, and looking at retention. (See Chapter 7 for more discussion of needs for data.) Reede emphasized the importance of considering the individual in the context of the institution, the department, and the discipline. She described two major studies that are currently in process. As part of the NIH's Causal Factors program (Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering), they are carrying out a study on women and inclusion that looks at individual, institution, and socio-cultural factors that influence the entry, progression, and retention of women in academic medicine. She noted that diversity goes beyond gender and race to include disability, sexual orientation, and socioeconomic factors. Second, she discussed their American Recovery and Reinvestment Act Pathfinder Award, with which they are creating a repository of analytic tools for use by research community as it asks different questions and develops new analytical tools to

identify theory-driven, evidence-based interventions for maximizing talent by increasing diversity.

Reede noted a number of challenges for data acquisition and analysis. Do we have the data and can we access it? Regarding confidentiality, in addition to the difficulty of ensuring confidentiality for individuals, she described how institutions also are concerned about their reputations, as pressure builds for greater transparency. Are the data accurate? What are the agreed-upon metrics? Do we have the requisite methodologies and tools in place? And can we go beyond the numbers to understand the context? Reede urged the use of more complex models and mixed methods, and emphasized the need to bring complexity to this discussion and broaden its scope—in essence, career epidemiology.

## JACKSON STATE UNIVERSITY

Loretta Moore, professor of computer science and interim associate dean of the College of Science, Engineering, and Technology at Jackson State University, and the principal investigator for the NSF-funded ADVANCE program at the university, spoke about Jackson State's experiences and successes with the ADVANCE program, begun in 2010 and focused specifically on women of color at a minority-serving institution.

The ADVANCE program's objectives are to advance the careers of all women faculty in STEM disciplines and in the social and behavioral sciences at Jackson State University; to foster and sustain a climate and culture of inclusion in the university overall and at the departmental level for all faculty, regardless of gender, race, and other target characteristics; and to communicate with the larger academic community about the challenges of women in general and women of color at historically black colleges and universities in particular. They are addressing the needs of women of color by adopting and adapting interventions that have been used successfully to support white women and by developing new strategies according to input received from their faculty.

Jackson State University's ADVANCE program has several components:

- Summer writing retreats
- Visibility through international group travel to educational institutions
- Mentoring
- Leadership sabbaticals (e.g., senior women faculty in STEM disciplines spend a semester in the office of the president or provost)
- A bias education initiative
- Social science studies including a "Culture and Climate" study
- Policy review, adoption, and modification

To communicate with the larger academic community about their work, they also have rigorous evaluation and dissemination components.

Moore described three of their initiatives in detail. The Summer Writing Retreat was modeled after a program at the University of Nebraska at Lincoln. The goal is to allow faculty to focus on their roles as scholars as a way of supporting their advancement through the academic ranks. The Jackson State Summer Writing Retreat hosts the faculty participants at an off-campus retreat center for two week-long sessions. The curriculum involves long days of writing, sharing of writing, and discussions about scholarship and the writing process. Participants are required to complete and submit a scholarly article by the end of the summer.

Jackson State's program of visibility through International Group Travel leverages its international faculty's connections to give its U.S.-born faculty rich international experiences. Each year, a group of faculty travels to several institutions with which Jackson State has established connections but where faculty in STEM disciplines have not yet been engaged. In 2011, a group traveled to India and visited four cities and seven institutions. Faculty gave research presentations, and a number of research collaborations were begun. In 2012, a group traveled to South Africa, visiting three cities and four institutions. In addition to research presentations given and research collaborations begun, a new international mentoring program was initiated as well.

Moore described the university's Bias Education Initiative, an effort to help women of color address the challenges of balancing multiple responsibilities and expectations, all in the context of unconscious bias. In December 2011 they held a workshop designed to build community, raise questions, and identify solutions among women faculty of color and their spouses and partners. The workshop was divided into three tracks: single women faculty, married or partnered women faculty, and spouses and partners of women faculty. The various groups began creating community, including the spouses and partners, who formed a group designed to explore how best to support their female partners in their work in academia. Future workshops will be held to address questions that emerged at the first, including the impact and experience of having or not having children and the experiences of single women in the academy.

## PANEL DISCUSSION

James Wayne Jones of the University of Michigan spoke to the need for policy changes to be accompanied by education and information to those who will be implementing the changes. For example, a decade ago the University Regents voted to allow schools and colleges to extend the tenure clock to up to 10 years (the College of Engineering, for example, has an eight-year tenure clock, allowing for up to two one-year family-care leaves).The administration had seen that simply putting a policy in place did not ensure the desired outcome, as it was not unusual, when longer tenure clocks were an exception, for tenure committees to have higher expectations for people who had utilized them. However, the attitudinal discrepancy has now virtually disappeared. Leaders at the University of Michigan have learned how to prepare for policy changes that also involve cultural change and behavioral change, and to make clear to faculty both the reasons for the new policies and their importance.

Joan Reede of Harvard Medical School's Office for Diversity Inclusion and Community Partnership noted that she is part of a continuum of change. Since the need for change will outlast her, part of her task is to prepare and train the individuals who come after her. She stated the importance of understanding the culture of one's institution and of using resources and influences both internal and external to the institution. And she noted that an individual does not have to take on every issue at once, nor does she or he have to work alone.

# Chapter 7

## Successful Strategies and Resources for Moving Ahead

This chapter summarizes the suggestions of conference presenters and participants on successful strategies and resources for increasing the representation of women of color in academia in order to maximize the talent in STEM disciplines. Opinions and suggested actions are those of the individual participants and do not necessarily represent the views of all conference participants, the planning committee, or the National Research Council.

U.S. scientific and technological competitiveness relies more than ever on capturing the talent distributed throughout the U.S. population; however, a large percentage of the creative, bright, and ambitious individuals needed by the nation's academic institutions opt—for a variety of reasons—for careers outside of STEM, outside of academia, and outside of both. Likewise, institutions of higher education often fail to support outstanding women of color as they proceed through graduate school and postdocs and into tenure-track positions. Academia's failure to capture American talent pertains to every demographic, but the failure is most profound for women, people of color, and—most notably—women of color.

Presenters, conference participants, and professional societies' written testimonials offered up a wealth of promising and proven strategies for capturing the full breadth of American talent—strategies for solving a problem that is structural as well as personal and that must be addressed by members of society together. They articulated the needs visible from their vantage points in academic institutions, research institutes, federal agencies, professional societies, and beyond, and offered their ideas for how institutional structures can evolve to keep pace with the diminishing of bias elsewhere in society. Conference participants spoke of resources available to people in a wide range of positions who have the power to create change, and they cited research done as well as research needed on multiple angles relevant to the challenge of maximizing American talent.

This chapter compiles the various programs, initiatives, and ideas with which conference participants have had success or that they suggested as promising activities that many organizations may find useful as they work to make their institutions more inclusive.

Additional suggestions for action as well as examples of successful strategies can be found in Appendix E-1, where the diverse and rich testimonials from the professional societies and federal agencies are summarized according to topic area. The complete written testimonies submitted from professional societies and federal agencies can be found in Appendix E.

### RESEARCH, DATA COLLECTION, AND ANALYSIS

Two contrasting perspectives on the need for more data were expressed often by conference participants:

- The key data points have been known for quite some time, but the primary need now is to act on what is known.

- Even though we have good data and should act on them, we nonetheless lack important data points and types of data that are needed to inform and guide future efforts.

Regarding the second point, most existing data pertain to individuals, and data on institutional context are much weaker. Running parallel to the individual/institutional problem is that of quantitative versus qualitative data. A good deal of quantitative data are available (although they are not complete), but several participants cited a lack of certain types of qualitative data that would elucidate key information about individuals' choices and career patterns, and institutions' climate, practices, and policies. For example, when the data show a drop in the number of women of color between high school graduation and college graduation, and between college graduation and completing a Ph.D., it is not known whether the "missing" individuals began graduate programs and dropped out or whether they did not enroll in the first place. Moreover, qualitative data gathering is necessary to reveal the nuances of individuals' perceptions, choices, and experiences. The need for longitudinal data, in particular, was highlighted by numerous participants, as was the importance of periodic reassessment of metrics for productivity, advancement, and retention. These nuances could greatly enrich and inform institutions' and organizations' efforts to capture and retain top American talent. Some of the data needs identified by conference participants included:

- **Disaggregated data.** Comments from the conference participants and written testimonies submitted by professional societies underscore the need for data disaggregated by race/ethnicity and gender.
- **Longitudinal data.** There is a need for longitudinal data that are tied to multiple factors simultaneously: individuals in the training period (e.g., students, graduate students, and postdocs) as well as academic institutions (e.g., programs and policies; and rates of recruiting, enrolling, and supporting women of color).[43]
- **Qualitative data.** Several presenters pointed to a need for more qualitative data that add nuance to the quantitative data currently existing or in the process of being gathered.
- **Better response rates from women of color and people in other potentially disadvantaged groups.** In the breakout session "What Data Can and Cannot Tell Us," the discussion pointed to the difficulties of gathering critical information from members (in the case of professional societies) or study populations (in the case of researchers). Women of color, for example, often may not respond to surveys or may choose not to provide identifying information—rank, race/ethnicity, or department—because they are concerned that they may be identified by doing so and their responses may become public. Trust, therefore, is a key component of obtaining higher response rates from women of color.[44]
- **The ability to determine the exact number of faculty working in STEM fields and their corresponding demographic information using data from the Integrated Postsecondary Education Data System (IPEDS).**[45] The commissioned paper from Hurtado underscored the challenge that the Higher Education Research Institute faces in

[43] Appendix A-1: *Education and Academic Career Outcomes for Women of Color in Science and Engineering.*
[44] See footnote 5 on the tension between acquiring more specific, actionable information and the need for confidentiality.
[45] http://nces.ed.gov/ipeds/

weighing the responses from faculty in STEM disciplines due to data limitations; therefore, their research is less explicit.[46]

In addition to the broad discussion on data, attendees of the conference also discussed data needs on specific topics:

**a) Needed data on faculty, departments and institutions:**

- **Diversity index.** A diversity index would contain institutions' and departments' track records in training and supporting doctoral students as well as notes on students' progress as they move forward in their careers. Many participants believed that a diversity index would be valuable to inform the choices of prospective students—particularly women of color—in terms of research programs and careers in STEM.
- **Collaboration among professional societies to identify successful strategies for engaging and supporting women of color.** Emphasized and noted by many professional societies (e.g., Society of Neuroscience, American Society of Civil Engineers)[47], there is a need for research funding for collaborations across disciplines and across professional societies to support the collection of data about what strategies work to engage women of color in professional societies and support them in their career pathways.
- **Components of successful mentoring programs**. There is a great need for data on how, when, and why mentoring works and how, when, and why mentoring fails.
- **Strategies in context.** There is a great need to capture institutional and departmental contexts and climates, quantitatively and—the more acute need—qualitatively. It would be beneficial to put institutions' successful strategies in context so that institutions and departments can judge which interventions are most likely to be successful in their particular contexts.
- **Attrition within the faculty ranks.** It would be valuable to study attrition to determine faculty's reasons for leaving academia.

**b) Needed data on students:**

- **Undergraduate students trained or mentored by women faculty of color at minority-serving institutions.** There was an interest in knowing the numbers of women of color in STEM who were mentored and trained by women of color in minority-serving institutions (versus those mentored and trained by non-minority faculty members at non-minority-serving institutions). Ginther noted that in quantitative research it is very difficult to match faculty with their students, with the closest possible option being to match Ph.D. students and their faculty advisers.
- **Enrollment rates/activity of students.** Some participants noted a need to analyze enrollment rates/activity of undergraduate and graduate students (to complement existing data on graduation rates). These data are needed in order to see what choices are being made by women of color at various critical points during their education.

[46] Appendix A-2: *Women of Color among STEM Faculty: Experiences in Academia*. See footnote 5 regarding the important tension between need for individuals' confidentiality and the need for disaggregated data.

[47] The professional societies listed in the parentheses in this chapter are examples of some of the relevant practices that professional societies are engaging in. These examples were gathered from the public discussions following the plenary and breakout sessions as well as the written testimonies submitted by the professional societies. Please see Appendix E for all of the written testimonies.

- **Entrance into and completion of doctoral programs.** As noted above, the representation of women of color among college graduates versus recipients of the Ph.D. declines. In contrast, the representation of white women in the two situations rises. There is a need for data that clarify whether women of color are failing to complete Ph.D.'s, are choosing not to complete Ph.D.'s, or are choosing not to enter Ph.D. programs at all and are opting for alternative career pathways.

Suggestions offered by members of various professional societies provided a rich variety of calls for action, some aimed at specific types of organizations and some as invitations to all. Several participants with experience in professional societies mentioned having difficulty learning the race or ethnicity of the societies' members and stressed the need for disaggregated data. Representatives from professional societies also called into question the effectiveness of diversity programs and emphasized the need to evaluate them. Many participants urged improved data collection on women of color along the academic pathway, particularly at career transition stages. Additionally, some participants encouraged junior members of societies to identify their ethnicities in surveys. A participant urged professional societies to collect data on the profession as a whole—data not only on their members but also, and perhaps more importantly, on their nonmembers. Many attendees agreed that data from all members would greatly assist professional societies' leaders in better recognizing and meeting their memberships' needs.

## CAREER PATHWAYS AND TRANSITIONS

Two research papers were presented at the conference. The data used for analysis were collected on all stages of the academic career for women of color and on how they compared to other groups.[48] The key transition points along the academic pathway identified in the research included:

- The stages at which women of color continue along an academic path in science and engineering at a rate similar to that of other groups, including:
  - Graduating from high school
  - Receiving tenure at research I institutions
- The stages at which women of color continue on an academic path in science and engineering at a rate lower than that of other groups, including:
  - Entering college and completing college degrees
  - Completing Ph.D. degrees
  - Securing tenure-track positions at non-minority-serving institutions (this encompasses the postdoctoral stage)
  - Receiving tenure at non-minority-serving, non-research I institutions

Therefore, according to the two researchers, important points for intervention for women of color and for academic institutions, are:

- The period between high school graduation and college graduation.

[48] For more complete information about their methods and findings, please refer to the summaries of their presentations in Chapter 1 and the complete papers and references in Appendix A. See also the Higher Education Research Institute's faculty survey 2013 (http://heri.ucla.edu/facoverview.php).

- During the college years, since women of color begin college at the same rate as other groups but graduate at a lower rate. (These data pertain to all majors, not just STEM.) Interventions could be designed to prevent attrition of women of color from four-year colleges and assist them in the transition from two-year to four-year colleges. Data on STEM majors specifically show women and men of color graduating at similar rates (women of color: 3.4 percent/men of color: 3.0 percent), and white women and men graduating at similar rates (white women: 6.5 percent/ white men: 6.7 percent); hence, the lower numbers of women of color here may be a function of their rates of entering college to begin with.
- Between graduating from college and completing a Ph.D.:
    - The time between college and a graduate program
    - During the graduate program
- Between completing the Ph.D. and obtaining a tenure-track job:
    - The decision point after completing the Ph.D.
    - During a postdoctoral fellowship
    - The hiring process for tenure-track positions (especially at non-minority-serving non-research-I institutions)

The professional isolation in departmental and university-wide climate experienced by women faculty in STEM disciplines is another factor contributing to job dissatisfaction, the research papers find. Women faculty report a lower level of job satisfaction than do men, with professional isolation being a common reason for leaving their departments or institutions. Women of color faculty in STEM disciplines experience even greater professional isolation, as they often lack senior colleagues who are women or women of color who can mentor and guide them. Examples of stressors created in this isolating environment that affect women of color faculty in STEM were raised by the commissioned research papers and echoed by some conference participants (See Table 5).

**Table 5.** Percentage of faculty by race responding having experience "somewhat" or an "extensive" amount of stress in the last two years due to the following stressors.[49]

| Top Ten Stressors for URM Female Faculty in STEM | URM Women | URM Men | White Women | White Men |
|---|---|---|---|---|
| Lack of personal time | 86.4 | 69.7** | 88.5 | 76.8** |
| Self-imposed high expectations | 82.4 | 79.4 | 88.0* | 79.5 |
| Managing household responsibilities | 79.0 | 66.8* | 80.5 | 68.5** |
| Working with underprepared students | 69.9 | 63.3 | 74.5 | 69.6 |
| Institutional budget cuts | 66.0 | 64.2 | 66.5 | 64.0 |
| Personal finances | 65.8 | 65.7 | 59.6 | 57.9* |
| Research or publishing demands | 61.8 | 61.9 | 65.0 | 63.8 |
| Institutional procedures and red tape | 61.0 | 62.6 | 67.2 | 68.9* |
| Teaching load | 61.0 | 56.3 | 68.3* | 60.0 |
| Students | 58.5 | 51.7 | 69.6** | 60.1 |

Note: Significantly different from URM women faculty, *p<.05, **p<.01.
Source: Hurtado, S. and T. Figueroa, Women of Color among STEM Faculty: Experiences in Academia. Paper presented at the Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia Conference, June 2012, Washington, D.C.

Interventions along the educational and career pathways in STEM disciplines could address the needs of students as well as institutions. The needs of undergraduate students identified by presenters and participants throughout the conference included:

- **Customized academic training**. Some talented and driven students lack specific skills or knowledge that their high schools were unable to provide. Colleges and universities need to offer (and receive the funds to offer) customized mentoring, tutoring, and/or coursework to fill specific gaps in these students' backgrounds and set them on solid footing to succeed in high-powered graduate programs.
- **Faculty support and attention**. Some participants mentioned that students of color are given less time and attention by faculty than are non-URM students. Evelynn Hammonds, dean of Harvard College, urged that students of color receive attention by faculty that is on par with that received by non-URM students.
- **Identity: A vision of a viable career in science and technology.** Studies have shown that students need to be actively engaged in doing science and communicating their results from an early point in their education.[50] A key component of students' forming

[49] See commissioned paper from HERI on Appendix B-2.
[50] Tytler, R., J.F. Osborne, G. Williams, K. Tytler, and J. Cripps Clark. 2008. Opening up pathways: Engagement in STEM across the primary–secondary school transition. A review of the literature concerning supports and barriers to science, technology, engineering and mathematics engagement at primary–secondary transition. Canberra: Commissioned by the Australian Department of Education, Employment and Workplace Relations. See also Herrera, F. A. S. Hurtado, G. A. Garcia, J. Gasiewski (2012). A model for redefining STEM identity for talented

identities in a field or discipline is seeing people that they can relate to in teaching and research positions. Female students are particularly disadvantaged in this area because of the small number of women of color in research and teaching positions, particularly in non-minority-serving institutions.

- **Learning by doing.** Programs are needed in which students who are women of color learn by doing. Several participants described how STEM teaching needs to be restructured, ensuring that students are learning by doing. Some opportunities exist, and more are needed, for bright students to be integrated into teams of professionals. Where this partnership is one between minority-serving institutions and research laboratories it needs to be, in part, a financial one, in order to prevent a situation in which minority-serving institutions feel that their students are being "poached" by large research institutions.

**LEARNING BY DOING**

**Box 1: Opportunities for Undergraduate Students**

Several participants highlighted examples of opportunities for undergraduates to become involved in STEM research, urging women of color to apply to these programs.

- At the Olin College of Engineering, undergraduate students work full time for six to twelve months with experienced researchers.
- SACNAS's collaboration with University of California, Santa Cruz, involved an overnight field trip to UC Davis during the 2011 SACNAS National Conference, where students of color visited the campus as well as different research labs and had a conversation with faculty and graduate students.
- Harvard Medical School's Biomedical Science Careers Program collaborates with the biotechnology, pharmaceutical, and device industries, as well as colleges and universities, offering scholarships and mentoring to students about a wide range of career opportunities. The program is supported in part by the Office for Diversity Inclusion and Community Partnership.[a]
- The NSF has a Scholarship for Service program in cybersecurity. The awards provide funding for two years to undergraduates and graduate students, including full tuition plus a stipend, and provide internships at federal agencies. Students do three years of government service after the completion of the award.

[a] *www.bscp.org and www.hms.harvard.edu/dcp*

- **Awareness of the breadth of career paths in STEM.** Faculty, specifically graduate advisers, should maximize the types of projects and career paths that undergraduates and graduate students are exposed to, so that they can make optimal choices about where to invest their creativity with full information about where the opportunities are in the world of STEM careers.
- **Information about universities' track records in recruiting, retaining, and promoting women of color.**

STEM graduate students. Higher Education Research Institute. Available online at www.heri.ucla.edu/nih/downloads /AERA2012HerreraGraduateSTEMIdentity.pdf

- **Information about institutional commitment.** In order for undergraduate students to make informed decisions about where to pursue graduate degrees, they need information about an institution's commitment to creating and maintaining a culture of inclusion. Information needs to be available for all levels: faculty, department, college/school, and university overall.
- **Proposed faculty consumer report.** A participant described the value of having a faculty consumer report, a document that would be a resource with which prospective undergraduates and graduate students could track the performance of institutions regarding the success of their students (time to Ph.D., number of women and underrepresented minorities, career trajectory after leaving the institution).

Conference participants also discussed the needs of institutions that train undergraduate students of color. Minority-serving institutions invest a great deal of time and resources in training talented undergraduates and preparing them to pursue higher education and careers in science, technology, engineering, and mathematics. There is a need for stronger and fairer partnerships between minority-serving institutions and institutions that train Ph.D.'s, with, in the view of some conference participants, the doctoral programs contributing funds for the crucial aspects of outstanding training for high-achieving undergraduates.

Conference participants also discussed the needs of the graduate and postdoctoral students themselves. Several participants emphasized the importance of nominating outstanding scientists who are women of color for awards in their disciplines.

**Box 2: Useful Resources on Nominations**

- The American Association of Medical Colleges has instructions for nominees and nominators.[a]
- The American Association of Medical Colleges has compiled a list of 10 tips for people nominating their colleagues and includes the list in its calls for nominations. This action has dramatically increased the representation of women of color among the candidates for awards.[b]
- The Raise Project has tips for making successful nominations of women in STEM disciplines.[c]

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[a] *www.aamc.org/members/gfa/faculty_vitae/148590/successful_nominations.html*
[b] *www.aamc.org/download/310694/data/10tipsforgwimsreps.pdf*
[c] *www.raiseproject.org/index.php?page=Tips*

## AWARENESS RAISING OF UNCONSCIOUS BIAS

Unconscious gender and racial bias is pervasive in our society and affects, implicitly, the perceptions and decisions of a wide range of people in a wide range of organizations. Raising individuals' awareness of unconscious bias can cause the biases to diminish or dissipate entirely, and several conference participants described how this has taken place at their own institutions. This conference summary includes an overview of research on unconscious bias (Chapter 3) as

well as presentations by leaders in academic institutions and federal agencies who have seen firsthand the positive effects of bias awareness training (Chapter 6).

Since unconscious bias is cognitively automatic, as discussed by Joan Williams and summarized in Chapter 3, biases will persist unless people are made aware of them, for example, through bias awareness training. Such training has an excellent track record, as research has shown and to which Williams and some conference participants attested. Just as faculty and staff are often required to attend training on sexual harassment, several conference participants advised additional training activities that identify how racial and gender bias occurs in academic settings and offer guidance to faculty and university leadership on how to diminish and eliminate bias. Among the actions at the institution level suggested by participants were:

- **Including bias awareness training at key points in university processes.** Important points at which to provide bias awareness training include:
    - Searches for new faculty and postdocs (for search committees)
    - Regular occasions for faculty evaluation—annual reviews, third year reviews, tenure and promotion reviews (for all faculty)
    - Reviews of research grants (for reviewers)
    - The hiring of a "solo" —the department's only [anything], a woman, woman of color, etc. (for departmental chairs, faculty members, staff)
- **Incorporating bias awareness training in universities into training programs that already exist.** See the initiatives described above.
- **Aligning university policies with exemplary practices.** Universities policies and programs can be compared against these practices to determine whether any are inadvertently biased against women or minorities.
- **Applying the exemplary practices at every decision-making step pertaining to a faculty career.** Faculty and university administrators can use these practices for activities such as negotiating workload, determining start-up packages, carrying out performance reviews.
- **Soliciting the help of experts in organizational change.** Universities are complex organizations, and their practices are difficult to change because of their relative lack of hierarchy; members of a college or university community often have more autonomy than do employees in the commercial sector, for example. A participant reminded the conference attendees that there are people whose major focus is on organizational change, and she encouraged institutions to make use of these individuals' expertise.

In addition, several professional societies advocated:

- **Awareness-raising for issues related to the hiring and advancement of women of color in STEM fields** (e.g., American Association for the Advancement of Science, American Astronomical Society, American Physical Society, American Society of Civil Engineers, Biomedical Engineering Society, National Institutes of Health, National Postdoctoral Association, Rutgers Women of Color Scholars).
- **Offering training to people whose actions have an impact on the careers of talented women of color in STEM**, including people in leadership positions in federal agencies, academia, and the scientific community overall (e.g., Biomedical Engineering Society, National Institutes of Health, American Astronomical Society, National Organization for the Professional Advancement of Black Chemists and Chemical Engineers).

**RISING AWARENESS**

**Box 3: Successful Strategies on Addressing Bias**

- The Strategies and Tactics for Recruiting to Improve Diversity and Excellence (STRIDE) program at the University of Michigan aims to maximize the likelihood that faculty search committees will identify diverse, well-qualified candidates, and, when diverse candidates are offered positions, provides information about helping to ensure that they are retained and promoted. The STRIDE committee leads workshops for faculty and administrators involved in hiring and works at the departmental level to assist department chairs and faculty with recruitment and retention. STRIDE offers handbooks on hiring and retention and other resources for deans and department chairs, disseminates research on policies and practices at the university, and provides other resources for faculty and administration.[a]
- Jackson State University offers a bias awareness training program.[b]
- Since 2009, NSF has offered an online implicit bias training as one of its applied learning activities. The module describes the problem of unconscious bias and references the social psychological literature that demonstrates the effects of unconscious bias.
- The Gender Bias Learning Project provides animated scenarios to illustrate the four patterns of gender bias.[c]
- The Harvard Implicit Association Test is a set of online tests that help people to understand the divergence between what they think they think or believe about others, and what they *actually* think or believe about others.[d]
- Research on the subject has been conducted by the Center for Work-Life Law at University of California, Hastings, including these examples:
    - "Effective Policies and Practices for Retention and Advancement of Women in Academia"[e]
    - "The Economics of Retaining Women"[f]
    - "Gender Bias in Academia: Findings from Focus Groups"[g]

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[a] *http://sitemaker.umich.edu/advance/stride_committee*
[b] *http://sites.jsums.edu/jsuadvance/programs/bias-prevention-training*
[c] *www.genderbiaslearning.com/stereotypes.html*
[d] *https://implicit.harvard.edu/implicit/demo/*
[e] *http://worklifelaw.org/wp-content/uploads/2013/01/Effective-Policies-and-Programs-for-Retention-and Advancement-of-Women-in-Academia.pdf*
[f] *http://worklifelaw.org/womens-leadership/gender-bias-academia/retaining-women*
[g] *http://worklifelaw.org/pubs/gender-bias-academia.pdf*

## MENTORING AND SPONSORSHIP[51]

The sentiment was frequently expressed by conference participants that mentoring and sponsorship are crucial for supporting the success of outstanding women of color along the STEM academic pathway. Several participants emphasized the differences between mentorship and sponsorship, and urged that the importance of sponsorship not be forgotten. Whereas mentorship pertains to an individual's development and growth (in teaching, research, and service), sponsorship has to do with promotion and advancement—the active support for a high-achieving individual's movement up through the ranks by a more senior person. Participants

[51] Also see footnote 5.

noted that most if not all leaders in science and technology, as well in academia, have relied on multiple mentors along their paths, and sponsorship at key transitions.

Mentorship and sponsorship are two key areas where people who are not women or not of color are often almost imperceptibly woven into the networks of their more senior colleagues. Women of color, in contrast, and their senior colleagues often must be much more proactive and deliberate in forging those essential professional bonds.

Individual participants offered the following suggestions and views:

- **Data on mentoring.** As mentioned in the data section above, there is a need for data on how, when, and why mentoring works and how, when, and why it fails.
- **Cross-generational mentoring.** While cross-generational mentoring already takes place informally, it would be very valuable for universities and departments to scale up such efforts by actively providing senior faculty with an opportunity to contribute to the success of early-career faculty and giving early-career faculty an opportunity to mentor postdocs and graduate students. Graduate students and postdocs can also serve as valuable mentors to undergraduates.
- **Sponsorship of accomplished junior faculty by senior women of color.** Since sponsorship does not lend itself to encouragement through policies, individuals must take the lead. Some participants encouraged senior women of color to continue to be or to become more aware of opportunities to sponsor talented junior faculty who are women of color as these faculty advance their careers.
- **Mentoring in specific areas.** Several participants urged universities to provide structures for mentoring in these areas and encouraged postdocs to seek out mentoring programs and to initiate them if they do not yet exist:
    - Publishing
    - Grant writing, including budget formulation and coaching on how to ensure that sufficient funds are requested
    - Promotion and tenure processes

**Box 4: Useful Resources on Negotiating**

- The annual conference of the Society for Advancement of Hispanics, Chicanos, and Native Americans in Science (SACNAS) includes a session on "Coaching Strong Skills," which addresses the need for women to increase their assertiveness in an academia-friendly manner.
- The University of Oregon's COACH program trains women to be more effective negotiators.[a]

[a] *http://coach.uoregon.edu/coach/index.php?id=7*

Professional societies are advocating for and supporting mentoring by:

- Providing mentoring to women and people from underrepresented groups to encourage talented individuals to pursue STEM coursework (in both high school and college) and careers (e.g., American Political Science Association, American Society of Biochemistry and Molecular Biology, American Society of Mechanical Engineers, American Society for Microbiology, American Sociological Association, Association for Women in Mathematics).

- Providing training to potential mentors, evaluating mentors, and recognizing outstanding mentors in order to ensure quality mentoring that supports scholars' career development and mitigates professional isolation (e.g., American Meteorological Society, National Institutes of Health).
- Providing funding for senior women of color to visit campuses that would not otherwise have access to senior scholars as mentors (e.g., National Society of Black Physicists, National Society of Hispanic Physicists).
- Ensuring that the academic reward structure gives due credit to faculty who serve as mentors (e.g., American Psychological Association, Biomedical Engineering Society).
- Encouraging mentoring through federal funding agencies' funding of protected mentoring time in grants (e.g., American Institute of Physics, American Psychological Association).

Several participants also spoke to the need for graduate students, postdocs, and senior scholars who are women of color to participate in active networks of their peers. By strengthening these networks with increased participation of women of color, these women can help establish more mentoring relationships for women at all stages of the STEM career pathway. Examples were offered of national online networks and of university-specific initiatives (see Box 5).

**MENTORING AND SPONSORSHIP**

**Box 5: Exemplary Programs from Universities and National Online Networks**

Conference participants discussed many programs initiated at universities with the goal of building and strengthening networks of women of color. Exemplary programs that were highlighted at the conference included:

- The Emory Minority Postdoc Council, founded in 2011 by postdocs at Emory University (including Tamisha Vaughn, whose presentation is summarized in Chapter 2) and housed in Emory's Office of Postdoctoral Education. A major activity of the council is assisting minority postdocs in identifying faculty mentors and building mentoring relationships; the council also facilitates mutual support among the minority postdocs themselves, many of whom are a "solo" in their departments.
- MentorNet, a nonprofit organization seeking to support the success of women of color and other people from underrepresented groups in scientific and technical careers. The University of Michigan partners with MentorNet to develop email-based mentoring relationships by connecting university participants with STEM professionals in academia, industry, and government. [a]
- Purdue University's African-American Latina Native American (AALANA) group, a group of assistant professors who are women of color who meet regularly to build community and share resources. Organized by Purdue's ADVANCE program, the group communicates with the ADVANCE staff about their needs for professional development and other issues, and ADVANCE staff helps to meet their needs and communicates their needs more broadly when called for. AALANA helps to diminish the isolation felt by women of color across departments throughout the university.
- Rutgers University's Women of Color Scholars Initiative, which aims to cultivate supportive environments for women of color in the academy. The initiative employs a multi-pronged approach comprised of workshops, meetings, a virtual community, and networking opportunities.

In addition, a few national online networks for women of color were also highlighted:

- The Women of Color Research Network by the National Institutes of Health, which promotes networking, facilitates mentoring relationships, disseminates information, and raises the profiles of outstanding women of color in the sciences and biomedicine. As of June 2012, it was 650 members.[c]
- DiverseScholar's web portal, which focuses on minority postdoctoral experiences.[d]
- The STEM Women of Color Conclave, an annual conference that provides a national forum where women of color from institutions of higher education build a national network and harness a centralized body of knowledge and exemplary practices. It serves as a central hub of networking and resources for women of color in STEM.

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[a] *http://sitemaker.umich.edu/advance/mentornet*
[b] *http://wocrutgers.wix.com/wocsi*
[c] *www.wocrn.nih.gov*
[d] *www.minoritypostdoc.org*

Additionally, several professional societies encouraged the development of networks of women of color, both within disciplines and across disciplines (e.g., American Astronomical Society, American Meteorological Society, American Mathematical Society, American Physical Society, American Political Science Association, Computer Research Association, National

Organization for the Professional Advancement of Black Chemists and Chemical Engineers, Rutgers Women of Color Scholars, Society for Neuroscience).

**Box 6: Funding and Training Opportunities for Researchers**

Training opportunities:

- Harvard Medical School carried out a proof-of-concept study for a faculty fellowship program in which they bought out early-career researchers' time for scholarship. The fellows were required to have a letter from their department chairs discussing the chairs' plans for embedding the fellow in the department, describing what their role would be. The review committee for applications included senior faculty and the hospital president, and the program included meetings with the fellows and a variety of high-level individuals. The level of accountability was therefore very high. They tracked the performance of the fellows (n=9) as well as the applicants who were not selected (n=29). Fellows had higher retention rates and more grants and publications submitted than those not in the program.
- Jackson State's Summer Writing Workshop (discussed in Chapter 6) provides time, space, and community for faculty writing projects over the three summer months.[a]
- The University of Michigan College of Engineering has a Faculty Fellows Program in which newly hired faculty are required (and funded) to participate. The program includes university leadership and hosts an offsite meeting for several days during August in the year faculty were hired.

Funding opportunities:

- National Science Foundation Scholarship for Service program in cybersecurity offers two years of funding for graduate students, including full tuition plus a stipend, and provides internships at federal agencies.
- MinorityPostdoc.org's funding list.[b]
- Alfred P. Sloan Foundation: Education for Underrepresented Groups. [c]
- Alfred P. Sloan Foundation Minority Ph.D. Program.[d]
- Howard Hughes Foundation's Gilliam Fellowships for Advanced Study.[e]
- Ford Foundation Fellowship Program.[f]

[a] *http://sites.jsums.edu/jsuadvance/programs/summer-writing-retreats*
[bc] *www.minoritypostdoc.org/view/resources.html#DivPD*
[c] *www.sloan.org/major-program-areas/science-education/education-for-underrepresented-groups/*
[d] *www.nacme.org/sloan/Sloan.aspx?pageid=31*
[e] *www.hhmi.org/grants/individuals/gilliam.html*
[f] *http://sites.nationalacademies.org/PGA/FordFellowships/index.htm*

## INSTITUTIONAL TRANSFORMATION

Several participants described a need for universities to have transparent, clear, and well-defined institutional policies around hiring and promotion of faculty, as well as full disclosure of these policies to postdoctoral candidates. Such policies would help to create an environment where women of color—and people in other demographic groups—can freely utilize the policies and exemplary practices without stigma, and also would help to ensure their success by helping them make better-informed career decisions. Individual conference participants encouraged institutions to:

- **Make public and clear the institution's policies on promotion and tenure.**
- **Increase the number of women and underrepresented minorities in candidate pools**—an approach that has been demonstrated to increase the numbers of talented women of color in the faculty ranks.
- **Increase awareness of unconscious bias.** Given that unconscious bias is cognitively automatic, the failure to increase awareness will result in the biases being repeated.

The need to capture top American talent is clearly important for the United States to maintain its scientific and technological competitive edge. But in addition, universities have an economic imperative to reap the full benefits of the scholarship and innovation of the top-flight researchers that they successfully recruit. To serve both imperatives, presenters and conference participants in multiple conference sessions discussed the importance of university leadership creating and enforcing well-crafted policies that support people who have a greater involvement in family and community responsibilities than the "historically ideal worker" typically has had. The perception of diversity not as a side branch of an institution but as an integral part of an institution's identity is an important step for the empowerment of faculty who are women, and especially women of color. For many leaders in academia this is new territory, and conference participants offered a variety of models, strategies, and suggestions to help guide university leaders' efforts. The departmental level is key for ensuring that the tenure process is equitable and flexible and for improving the retention of women of color.

Individual participants made the following suggestions regarding research needs:

- **Research on work-life balance.** The Alfred P. Sloan Foundation has sponsored surveys on work/life balance in academia and medical schools, which gets at the local context. The research shows that the department level is key as the place where individuals are brought onto faculties and where career milestones are judged.
- **Salary equity studies.** Institution by institution, there is a need for centrally conducted salary equity studies that will create an institution-wide check on disparities within departments. University leadership may request that deans and department chairs review the gaps associated with specific salary differences and consider corrective action.
- **Studies of women faculty considering leaving or who have left an institution.** Studies can be conducted of women faculty who are considering leaving an institution or who have left it for another university or a career outside of academia. These would shine light on departmental and university climates that are not inclusive and may point to policy actions that would lead to a welcoming, supportive environment for all faculty.
- **Evidence-based interventions.** The Harvard Medical School's Office for Diversity Inclusion and Community Partnerships is using an American Recovery and Reinvestment Act Pathfinder Award to create a repository of analytical tools that the research community can use as it asks different questions and develops new tools to identify theory-driven, evidence-based interventions for maximizing talent by increasing diversity.

In addition, individual participants and presenters suggested actions that could be implemented at the department level:

- **Department-level proof-of-concept programs.** Proof-of-concept or pilot programs in just a single department can be very useful. The small scale is useful for experimentation,

and if the program works well, other departments are likely to adopt it. Not all departments need to be involved at the outset.

- **Ownership and champions.** It is important that department chairs have ownership of any modifications made to retention and tenure activities and policies. Within departments, it is important that there be faculty champions: individuals who are already recognized leaders in the department. It is extremely beneficial when at least some of the faculty champions are white women and men.
- **Accountability and commitment.** Mutual accountability between departments and central university administration is important. Departments need to be accountable to the university leadership, and, conversely, they need commitment from the university leadership. At the Massachusetts General Hospital, for example, the president cochairs a multicultural affairs committee where department chairs report on their departments' accomplishments in supporting and retaining people of color as well as future initiatives being planned.
- **Recognition of the different student needs served at minority-serving institutions versus non-minority-serving institutions, and the accompanying differences in the obligations and contributions of faculty.** A participant discussed the significant differences in obligations and time commitments between faculty at minority-serving institutions and those at nonminority-serving institutions, relating these differences to institutions' reward structures. Often, faculty at minority-serving institutions must address the needs of students whose high school educations left them with gaps in knowledge and skills. In these cases, mentoring and tutoring occupies a great deal of the faculty's time at these institutions, leaving them with proportionately less time to commit to research activities.[52] The participant encouraged institutional yardsticks to reflect the realities of an institution's student body and faculty, giving respect and support for the hard work done by faculty to prepare students of color to excel in their subsequent graduate studies and careers in the STEM workforce.[53]
- **Dissemination of information about zero-tolerance policies for harassment and discrimination.** Universities should widely disseminate information about zero-tolerance policies and procedures for dealing with harassment and incidents of discrimination.
- **Visibility.** It is very valuable for positive changes in university culture and climate to be made visible and transparent. For example, the NSF ADVANCE program at Jackson State University generated a great deal of interest among department chairs wanting to take advantage of the program's trainings on unconscious bias for search committees, interest that was widely expressed even before the first training had been offered because of the program's visibility from the outset.
- **Guidance when hiring a "solo."** When a department hires a "solo" (and thus comes to include a sole individual of any group), it must deliberately work to ensure that its climate and policies do not inadvertently discriminate against the new faculty member or hinder her or his ability to thrive in that community. It is beneficial if university leadership is available to provide this guidance.

[52] It should be noted that this problem is not always present at minority-serving institutions, and it is also present for many faculty at non-minority-serving institutions.

[53] It is important when comparing teaching responsibilities among institutions to look beyond credit hours taught and to incorporate a broader understanding of each institution's expectations of its faculty, its admission requirements, and the competencies of its students when they arrive.

- **Funding for initiatives that support networks and collaboration for faculty from underrepresented groups.** Funding is needed for activities that reduce faculty isolation and address key problems associated with underrepresentation. Funding could support activities such as workshops and research collaborations.
- **Importance of the voices of white women and white men.** Several participants discussed the great value of having non-minority and non-female faculty involved in leading efforts to make departmental climate and policies welcoming to all.

Individual conference participants also offered suggestions for actions that could be taken by search committees during recruitment:

- **Greater numbers of underrepresented minorities in the candidate pool.** Numerous participants urged institutions to increase the number of women and underrepresented minorities in the candidate pool—the demonstrated most-effective way of bringing the representation of women and minorities on the institution's faculty more in line with the representation of these groups in the general population.
- **Active recruitment of top talent.** Search committees may want to operate in a manner similar to sports coaches, who, rather than wait and see which candidates appear, actively recruit top talent.
- **Inclusion of women and minorities on the search committee.** Several participants felt that search committees, particularly for leadership positions, should include women and underrepresented minorities.

Some participants commented that it would be beneficial if tenure clocks longer than seven years were universities' default. Institutions where this is the case have found it to be valuable for leveling the playing field. Other participants expressed concern regarding the extension of uncertainty that would result from longer tenure clocks and how that can impact personal and professional ambitions.

**Box 7: Exemplary Practices on Tenure Clocks**

The University of Michigan has program called Strategies Toward Excellent Practices (STEP), which was developed with support from an NSF PAID grant that followed the ADVANCE Institutional Transformation program. In STEP, teams of faculty from departments attend a two-day workshop to learn how to effect local change. Climate and inclusion are often the focus of team projects, in a range of contexts including curriculum, faculty evaluation, recruitment, and department life. The university was able to create a flexible context for different schools and colleges to set tenure clocks and to provide flexibility to individuals within those clocks. The University framework indicates that as long as an individual is reviewed for tenure within a ten-year overall framework, it is acceptable. Within this framework, different schools and colleges are free to set different internal schedules for tenure review, and to provide for individuals the freedom to have an early review or delay the review easily.

At Indiana University, a faculty member is not required to request permission to extend the tenure clock; the faculty member simply notifies the department head that s/he wishes to extend the clock.

In addition, several participants suggested that universities improve their family-care policies, including relevant leave policies (see below) and childcare offerings. It was noted that access to childcare is very important for academic women of color who have children, since women of color who are parents are disproportionately single parents or heads of households.

Postdoctoral candidates may make better-informed decisions about joining a given institution by comparing the "Work-Life Law Best Practices" checklist against the policies of the institutions they are considering. The checklist includes exemplary practices for leave policies and is available in document and video form at http://worklifelaw.org/womens-leadership/gender-bias-academia. Some participants expressed the opinion that the utilization of family leave policies needs to be encouraged for all junior faculty, including men. Other participants believed that family leave should be paid leave and that family leave should be under the purview of the university's human resources division and not at the discretion of department chairs.

Many conference participants suggested that universities provide public reports on their student and faculty demographics and on rates of promotion for the benefit of the public as well as members of the university community. One example of this is the University of Michigan's publication of their "Indicator Report" for the university president and provosts. The report details changes in the composition of faculty, the rates of success in getting tenure, rates of attrition, and exit interviews with faculty who leave the university before the tenure decision.[54] Also, every five years for the past 15 years, the university has performed an institution-wide climate survey examining the institution's inclusiveness.

Finally, some participants suggested that university deans and provosts take responsibility for the actions of faculty and department heads who act in ways that undermine the institution's goals or values, specifically related to the institution's goal of inclusion.

**Box 8: Exemplary Practice from Industry**

IBM successfully changed institutional culture by using an individual/institutional hybrid approach. IBM employees were encouraged to form "affinity groups" and to make specific suggestions about ways that the company could improve their experiences as IBM employees. For example, a gay-lesbian-transgender group requested spousal benefits. A group composed of women requested job-sharing options at the executive level and requested access to more weighty projects. IBM management responded to these requests, and the result was a marked improvement in the organization's culture and morale.

**Box 9: Exemplary Practices as Models**

Various models of exemplary practices were explored and recommended to encourage their dissemination:

- Video presentations and scripts on exemplary practices are available from the Center for Work-Life Law at University of California, Hastings.[a]
- NASA offers the report "Title IX and STEM: A Guide for Conducting Self-Evaluations in Science, Technology, Engineering, and Mathematics Programs." [b]
- A participant noted that the American Association of University Women has a STEM initiative for which the association is seeking a demonstration campus where all the exemplary practices for supporting women in STEM are put into place. She alluded to interest by some foundations in this type of activity as well, indicating that this is a potential funding source that can give institutions the money needed to fine-tune and scale up these practices.

[a] *www.genderbiaslearning.com/teachingandtraining.html*
[b] *http://odeo.hq.nasa.gov/documents/TITLE_IX_STEM_Self-Evaluation.pdf*

[54] Clearly, the need for detailed data needs to be tempered by the need for individuals' confidentiality, as noted in footnote 5. The report is available at http://sitemaker.umich.edu/advance/institutional_indicator_reports

## PROFESSIONAL SOCIETIES AND FEDERAL AGENCIES: ACTIVITIES AND SUGGESTIONS FOR ACTION

Many representatives of professional societies offered suggestions, comments, and guidance at the conference, and 28 professional societies submitted informative written testimonials. These testimonials describe their efforts to maximize STEM talent in their own disciplines through inclusion of women (and men) of color and offer their recommendations for initiatives that, in their view, would help to maximize the participation of talented women of color in academia.

Below is a summary of activities and recommendations offered by the professional societies as well as by individual participants at the conference. Please see the testimonials in their entirety in Appendix E.

- **Diversity audits and exemplary practices.** Professional societies could carry out diversity audits with the relevant academic departments and publicize the practices that they find among the departments most successful at recruiting and retaining top talent among women of color.
- **Legislation and advocacy.** Professional societies encouraged other societies to actively support federal policies and legislation designed to support the success of women and people of color at all levels of education and career development (e.g., American Society of Civil Engineers, Biomedical Engineering Society).
- **Professional development funds.** There is a need for professional societies to offer professional development funds for tenure-track faculty at resources-constrained universities or departments for expenses such as publication costs for research that is not supported by grants.
- **Using social media to build networks.** Professional societies may want to utilize social media to create and maintain connections among their members, in particular women of color, making sure to devote sufficient resources to this substantial task and to have a "champion" who pushes the social media strategy forward.

- **Annual meetings and symposia**
    - The suggestion was offered that professional societies host a symposium to discuss the suggestions and tools offered at the *Seeking Solutions* conference.
    - A participant noted that some high-level research conferences have diversity requirements for the presenters.
    - Some professional societies aim to maintain an inclusive climate at annual meetings and other society initiatives (e.g., American Mathematical Society, American Society of Biochemistry and Molecular Biology).

**Box 10: Inclusive Climate at Meetings**

- The Office of Naval Research requires that symposia that it funds include a diverse array of speakers, including gender and racial diversity as well as a range of career stages and employment types (e.g., researchers working outside of academia).
- The annual meeting of the American Society of Biochemistry and Molecular Biology aims to be a fertile intellectual environment for all scientists and attempts to specifically support the professional development women of color. At its annual meeting, the society requires at least 33 percent female or minority representation among the presentations given in the theme-based scientific programs.
- The NIH Research Conference Grants (R13) request for proposals requires that applicants facilitate the attendance of people with family-care responsibilities by identifying resources for family care (including child care) at the conference site.

- **Governance of professional societies.** A participant suggested that professional societies invite a speaker to present at the society's governance meeting about the suggestions and tools offered at this conference.
- **Leadership skills**. Several professional societies advocated providing leadership training to mid-level professionals in academia, industry, and government (e.g., National Society of Black Physicists, National Society of Hispanic Physicists).
- **Faculty development programs.** Several professional societies advocated faculty development training for women and people of color (e.g., American Indian Science and Engineering Society, American Sociological Association, Biomedical Engineering Society).
- **STEM Education (K-12).** Several professional societies noted the importance of the following, with an emphasis on women of color:
    - Increasing public awareness of STEM careers, including supporting efforts to foster outreach to all students, teachers, parents, and K-12 guidance counselors (e.g., American Chemical Society, American Society of Mechanical Engineers, American Society for Microbiology, Society for Neuroscience).
    - Engaging professional societies as well as academic leadership to conduct research to identify and promote strategies that help students transition into STEM professions (e.g., American Political Science Association, American Society of Civil Engineers, National Institutes of Health).
    - Providing all K-16 students with rigorous STEM curricula and hands-on laboratory experiences (e.g., American Physical Society, American Society of Mechanical Engineers, National Aeronautics and Space Administration, National Institutes of Health, Society for Neuroscience).
    - Improving the retention of students in introductory STEM courses (e.g., American Chemical Society, American Institute of Physics, American Physical Society, National Institutes of Health, Society for Neuroscience).
    - Strengthening support for students during the transition from undergraduate to graduate studies (e.g., American Institute of Physics, American Meteorological Society, American Physical Society, American Political Science Association, National Institutes of Health, Society for Neuroscience).

  - Providing internship programs and other educational partnerships to expand the pool of candidates who are people of color and/or are women (e.g., National Aeronautics and Space Administration).
- **Highlighting and rewarding (including financial incentives) model programs** that support women of color, carry out research on model programs, and compile lists of exemplary practices across academia, government, and industry (e.g., American Psychological Association, American Society of Engineering Education, Association for Women in Mathematics, National Aeronautics and Space Administration, National Institutes of Health).

Given the proven effectiveness of funding agencies' initiatives in shifting academic culture, professional societies encouraged the following actions and activities on the part of federal agencies:

**a) Compliance**

- Restructuring grant funding such that a portion is withheld until the grantee has reported on its achievements in the "broadening participation" component (e.g., National Society of Black Physicists, National Society of Hispanic Physicists).
- Establishing vigorous civil rights compliance programs, including conducting full compliance reviews of grantees under the combined statutory mandates of Title VI and Title IX (e.g., National Aeronautics and Space Administration, Society for Neuroscience).

**b) Dialogue within academic institutions**

- Requiring that federally funded initiatives (such as the NSF ADVANCE program) engage in a direct dialogue with faculty and administrators who are women of color (e.g., American Society of Engineering Education).

**c) Mentoring and career development**

- Encouraging mentoring by funding protected mentoring time in grants (e.g., American Institute of Physics, American Psychological Association).
- Requiring evaluations of career progress for women of color (e.g., Biomedical Engineering Society).

**d) Family and work life issues**

- Offering grant supplements to support maternity-related absences among grantees (e.g., American Society of Biochemistry and Molecular Biology, National Postdoctoral Association).
- Ensuring that policies support postdocs by being family-friendly and emphasizing mentoring; and by providing funding and requiring accountability for these efforts (e.g., National Postdoctoral Association).
- Funding the development of training materials that offer academic departments proactive guidance on how to promote a supportive, welcoming climate for women of color in academia (e.g., American Psychological Association).

*SUCCESSFUL STRATEGIES AND RESOURCES FOR MOVING AHEAD*

A series of successful strategies undertaken by federal agencies were highlighted to shed light on various issues including the review process, research funding mechanisms, mentoring, and others (see Boxes 11 - 14).

**Box 11: Addressing Challenges to U.S. STEM Workforce**

- National Aeronautics and Space Administration (NASA).
  - Diversity and Inclusion Policy[a]
  - Diversity Leadership Guide[b]
  - Diversity and Inclusion Strategic Implementation Plan for FY 2012 – 2015
  - State of the People Report, an internal report on the demographics of NASA's workforce, for use by division leaders
- NSF Committee on Equal Opportunity in Science and Engineering.
- "Building and Maintaining a Diverse, High-Quality Workforce: A Guide for Federal Agencies"[c] by the US Office of Personnel Management.
- "Diversity in the Federal Science and Engineering Workforce" by the National Center for Science and Engineering Statistics.[d]
- NSF's science of broadening participation. NSF's Division of Human Resources and Development is partnering with its Directorate for Social, Behavioral, and Economic Sciences to develop "the science of broadening participation." Social science and education researchers will be funded to analyze how minority and majority institutions differentiate around the same interventions (e.g., mentoring), with the intent of helping the individuals who support women of color all along the educational and career pathways.
- The Working Group on Diversity in the Biomedical Research Workforce, an advisory committee to the NIH director, focuses on critical transition points in biomedical education and careers, as individuals proceed from graduate school through obtaining independent research funding, to being awarded tenure at academic institution or achieving similar status in industry.
- The NIH Working Group on Women in Biomedical Careers develops strategies to support the careers of women of color in biomedical and research careers, including the recruitment, retention, and advancement of accomplished scientists and practitioners in the NIH intramural community as well as in academia and industry (www.womeninscience.nih.gov). The NIH Women of Color Committee forms part of the Working Group on Women in Biomedical Careers.

[a] *http://odeo.hq.nasa.gov/documents/Diversity_Inclusion_Policy_Statement.pdf*
[b] *www.grc.nasa.gov/WWW/NLS/LeadershipGuideSepOct06.pdf*
[c] *www.opm.gov/Diversity/guide.htm*
[d] *www.nsf.gov/statistics/infbrief/nsf11303/*

**Box 12: Strategies on Review Process**

- NSF has a training module on implicit bias, and some NSF program officers include a discussion of the subject in their training presentation to review panels. The discussion includes three slides and references for research on unconscious bias.
- NSF study of effects of proposal types on the success of researchers with less typical work histories. NSF designed an experiment that compared the successful pool of two groups of proposals, one involving typical research proposals and the other involving shorter proposals that focused on the scientific rationale and the concept to be studied. When the two groups went through the peer review, there was little overlap between the two lists. In the group of shorter proposals, there were more small institutions and researchers with less typical work histories (i.e., gaps in publications).
- Research has shown that research grant applicants (specifically of NIH R01 grants) have greater success if they have served on a review panel. In response to this research, NIH developed the NIH Early Career Reviewer Program[a] to train new reviewers and do outreach to broad range of institutions. The program is designed to help early-career researchers become reviewers and to diversify the pool of reviewers by bringing in scientists from less research-intensive institutions.
- NASA carries out Title IX compliance reviews of its grantees, designed to ensure that educational programs funded by NASA give equal opportunities to all potential participants and are free of gender discrimination and harassment.[b] The Title IX Compliance Program also unearthed many successful family leave policies among their grantees.

[a] *http://public.csr.nih.gov/ReviewerResources/BecomeAReviewer/Pages/Overview-of-ECR-program.aspx*
[b] *http://odeo.hq.nasa.gov/compliance_program.html*

**Box 13: Federal Agencies' Efforts on Broadening Effective Mentoring**

- NIH Guide to Mentoring and Training in the Intramural Research Program sets forth guidelines for effective mentoring of research trainees in its intramural research programs. The guidelines cover communication skills, negotiation skills, legal and ethical aspects of scientific responsibility, planning of career pathways, and ways of balancing individual goals with the goals of the research group.[a]
- NSF requires a mentoring component for every proposal that includes a postdoctoral fellow, and mentoring is an important component of its Faculty Early Career Development award (CAREER program).
- The Environmental Protection Agency's funding mechanisms require mentoring components for undergraduates, graduate students, and early-career faculty.

[a] *http://sourcebook.od.nih.gov/ethic-conduct/Mentoring percent20Goals-final.pdf and http://sourcebook.od.nih.gov/ethic-conduct/Training-Mentoring-10-08.pdf*

**Box 14: Research Funding Programs**

- NSF's ADVANCE program (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) helps to foster the development of a more diverse STEM workforce by funding programs that aim to increase the representation and advancement of women in academia. ADVANCE programs support the efforts of academic institutions and professional societies to improve institutional structures and make institutional climates welcoming and inclusive.
- NSF's Career-Life Balance Initiative provides funding to support dependent care or personal concerns that require researchers to step away from their research for a short period of time.
- NSF's Directorate for Mathematics and Physical Sciences is partnering with a program in the Division of Human Resource Development, Alliances for Graduate Education and the Professoriate (AGEP) to prepare minorities for faculty positions. The directorate also offers a supplement to support an additional graduate student.
- NIH grant supplements are available to women researchers during the first year after the birth of a baby, available to fund technician support for NIH-supported research.
- NIH's Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering, a grant program, includes one grant focused on women of color.

In addition, individual conference participants made the following suggestions for actions by federal agencies:

- Federal funding agencies should consider conducting a robust Title IX compliance review of their grantees to ensure equal representation of women and of minorities, provide that information to university leadership, make a requirement for grant awards that the applicant explain how it will incorporate the principles of Title IX into the program once the grant is received, and consider withdrawing funding if diversity goals are not met.
- If possible within current regulations, federal funding agencies should consider including diversity goals in requests for proposals.
- All federal funding agencies should consider requiring grant reviewers to receive training on unconscious bias.
- Several participants suggested that division directors be held accountable for the diversity in their review panels and urged that if the reviewer pool that presents has low levels of diversity, then division directors actively recruit a more diverse panel.[55]
- Federal funding agencies could investigate ways to ensure that graduate students receive the requisite mentoring in manuscript preparation and publication.
- Federal funding agencies could evaluate which programs and practices are successful and which have only limited effectiveness. Specifically, several participants asked for randomized pilot programs at different institutions to see what practices improve inclusion under what conditions.
- Federal funding agencies could offer more student support in workforce development and coordinate more closely. A participant from an organization doing workforce

[55] This suggestion has different impacts depending on how it is implemented and in which disciplines. For disciplines with very few women of color, for example, the same people may be called on again and again to serve as reviewers, which, while it may have benefits for the review process, may also (because of the time commitment required) hinder the researchers' own research productivity.

development in cybersecurity with the support of the intelligence agencies spoke of the need for more student support and greater coordination among agencies, specifically, among NSF, the information technology agencies and the intelligence agencies.

- Federal funding agencies could create programs that allow departments to fund a bridge year for entering doctoral students who are very bright but whose educational background has one or more gaps.
- Federal funding agencies could allow training grants to fund tutoring of new graduate students by more senior graduate students, an activity that some departments have found to be very successful and that frees faculty time from tasks that can be done by others.
- Federal funding agencies could survey doctorate-granting departments for successful strategies and modify their grant programs accordingly.

In addition, various professional societies called for national organizations to take the following initiatives:

- Establish a working group focused on faculty success, identifying synergistic goals that support women of color faculty and faculty overall (e.g., American Society of Engineering Education).
- Develop a career development program focused on the challenges faced by women of color faculty, which can be presented to professional and student groups around the country (e.g., American Institute of Physics, National Organization for the Professional Advancement of Black Chemists and Chemical Engineers).
- Create a distinguished lecture series aimed at highlighting the achievements of accomplished women of color in STEM fields (e.g., Association for Women in Mathematics).
- Hold mini-summits of faculty who are women of color at core meetings at the National Academies that include opportunities for these scholars to interact in a focused manner with the key constituencies in the Academies (e.g., American Society of Engineering Education).
- Establish conferences and workshops aimed at women of color (and women overall) in STEM disciplines, including both research and mentoring components (e.g., Association for Women in Mathematics).

# Chapter 8

# Moving Forward

Shirley Malcom, head of the Directorate for Education and Human Resource Programs at the American Association for the Advancement of Science and co-author of *The Double Bind: The Price of Being a Minority Woman in Science*, offered remarks to close the conference, beginning with an illustration of the power of context. She related a comment by a scientist working at the International Centre for Theoretical Physics in Trieste, Italy, who remarked that Trieste is the only place where, when a black man walks down the street, people assume he is a scientist.

Malcom described her view of how individuals and institutions may move from addressing barriers faced by talented women of color in a piecemeal fashion to a strategy that is holistic. Calling forth a football metaphor, she urged her audience to gain a nuanced understanding of the game they are in. She described how football players employ both play books and game plans. In academia, play books are being used, increasingly and to some benefit. But accumulating successes will happen only when individuals and institutions pull together a game plan. Interventions to maximize American talent by advancing talented women of color must be selectively and wisely employed according to the context and climate of each institution.

Play books contain options for how to address a specific situation. In academia this may mean that, for example, if an institution's postdoctoral fellows who are people of color have fewer publications than fellows who are white, mentoring and writing programs are established to address this. More important than a play book, however, is a game plan. A game plan guides choices of which plays are used given a specific context. What is the game being played and how is it played in different corners of the institution? What strategies may be effective given the relative strengths and weaknesses of the different individuals and organizational structures involved?

Malcom also stressed the importance of professional societies. Just as football players are members of the National Football League, academics have their professional societies, and she urged women of color to be visible in their professional, disciplinary contexts. The American Association for the Advancement of Science has attempted to make its meetings (functionally) smaller in order to create communities within the larger professional community. It does so by hosting networking events for specific groups of people, including for women of color.

Malcom noted ways in which football games and the academic life are similar. In both, the game has rules. In football, if you break a rule, you are subjected to a well-defined penalty levied by a referee. But in many academic institutions, breaking a rule brings unevenly distributed penalties or none at all. Likewise, both arenas have risks. Fortunately for ambitious, talented women of color, a Ph.D. in the sciences or technology is portable and can be well employed outside of academia. But Malcom noted that another path is to choose to stay in the game and improve the conditions for the rookies coming in.

Football and academia also have their differences, to which Malcom recommends that we pay attention. Football coaches exert great effort looking for talent. In addition, in football a player's or coach's reputation only carries him so far. If players or coaches arrive with great reputations but do not perform, they're out. Conversely, they may come from places unheard of but when they perform they're in—embraced, supported, and helped to thrive.

As game plans go, Malcom held a high view of the NSF-funded ADVANCE program, as it requires taking a holistic view of the institution. Malcom had a series of comments for multiple audiences about the plays contained in the academic playbook of interventions for maximizing American talent:

- **There is a need for data disaggregated** by race, sex, discipline, citizenship, and other traits, because we cannot change what we do not understand.
- **Mentors, sponsors, and coaches are critical**. Today, young women of color do not have to become something they have never seen. Senior women have a responsibility to make the path visible and easier for junior scholars.
- **We encourage publications by encouraging publishing with others** as well as building broader partnerships.
- **Scholars must make and nurture professional connections.** Women of color must regularly attend the major conferences in their fields and expand their professional networks.
- **Women of color in tenure-track positions must make sure that they understand the policies and procedures that will guide their advancement** in the academic, institutional community. They must ask senior faculty and department chairs about the requirements for moving to the next level and taking a leadership role within the department.
- **Institutions need to ensure that the selection of faculty is more equitable** throughout the recruitment and advancement processes.

In addition, Malcom listed the following points as needing immediate attention in order to increase the nation's ability to capture the intelligence and creativity of its top talent, upon which America's scientific and technological strength depends:

- **The importance of career transition points**—and their weaknesses—in the education and careers of talented women of color.
- **The need for transparent institutional policies**—for example, in hiring and promotion.
- **The need to raise awareness of unconscious biases.**
- The twin needs to 1) **obtain focused, additional data** (qualitative as well as quantitative), and 2) **move ahead to solutions knowing what we know**.
- **The need for federal agencies to fund more research on gender and/or race** targeting select populations.
- Overall, **the need for a "toolkit" that can be customized** to each institutional and personal context.

Malcom concluded by framing the issues at hand in terms of *differentism*, citing research that found that some prejudices or reactions are not conscious but are the result of the brain and gut operating independently. She noted that the "universal tendency [is] to form coalitions and favor our own side."

A key issue, then, is how the academic community moves from differentism to seeing one another as familiar. There are many steps along that path. Malcom described how women of color need to be visible and to participate. They must insist on certain kinds of behaviors—that the institutions that fund research, honor researchers, and maintain disciplines' status behave in such a way that outstanding women of color are included and are a part of creating and sharing knowledge.

Malcom called on talented women of color to remain present and continue contributing, to bring forth a world of science and technology where differentism dissolves, members of academia see one another as familiar, and familiar and talented are one and the same.

# Appendix A-1

## Education and Academic Career Outcomes for Women of Color in Science and Engineering

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**Abstract:** Using a variety of data sources including longitudinal NSF data, this report finds that Women of Color (WOC) are less likely than white women to graduate from college, to obtain a PhD in science and engineering (S&E) fields, and to obtain a tenure-track job at non-minority serving institutions other than top universities. In addition, WOC are more likely to be employed in non-tenure track positions in academia and be employed at under-represented minority-serving institutions (URM). Neither high school graduation nor academic tenure and promotion are the primary reasons that WOC are under-represented. Instead, the transition from high school graduation to college graduation, from college S&E major to S&E PhD, and finally the transition from an S&E PhD to a tenure-track job in a non-URM university are the key points where WOC are dropping out.

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## Education and Academic Career Outcomes for Women of Color in Science and Engineering

This report uses national statistics to quantify the under-representation of women of color (WOC) in science and engineering (S&E) academic careers. It then identifies the stages of WOC's educational and career development that are key to this under- representation of WOC in S&E academia. Armed with this knowledge, those concerned about this under-representation can target interventions and policies that will be the most effective at increasing diversity in academic careers.

Using a variety of data sources including longitudinal NSF data, we find that WOC are less likely than white women to graduate from college, to obtain a PhD in S&E fields, and to obtain a tenure-track job at non-minority serving institutions other than top universities. In addition, WOC are more likely to be employed in non-tenure track positions in academia and be employed at minority-serving institutions. Neither high school graduation nor academic tenure and promotion are the primary reasons that WOC are under-represented. Instead, the transition from high school graduation to college graduation, from college S&E major to S&E PhD, and finally the transition from an S&E PhD to a tenure-track job in a non-URM university are the key points where WOC are dropping out.

The remainder of the paper is organized as follows. After summarizing the literature on academic WOC, we describe the most recent data on the racial and gender distribution of academics in S&E fields. We then evaluate race/ethnicity and gender differences in education pathways including high school graduation, undergraduate major in S&E fields, college graduation, and PhD in S&E fields. Turning to academic career outcomes, we measure the likelihood of obtaining a tenure track job within six years of the PhD, of being awarded tenure within 11 years of the PhD, and of being promoted to full professor within seven years of receiving tenure. The final section discusses the implications of our results.

### 1. Background

Many science organizations and researchers have documented the under-representation of women and minorities in academic S&E (NCSES 2011, NSB 2012, NSF 2011, Nelson & Brammer 2007). Together these studies find that women and under-represented minorities make up smaller and smaller percentages of total academic S&E faculty as one proceeds up the academic ranks. However, few studies have examined the 'double-bind' – the representation of women of color (WOC) in S&E academic careers (Leggon 2006, Towns 2010). Leggon (2006) argues that data need to be disaggregated by race/ethnicity and gender in order to study WOC. Further, she conjectures that the tenure process may disadvantage WOC in academic careers but does not test this hypothesis with data. Towns (2010) uses data from Nelson & Brammer (2007) to show that there are few WOC in the top 100 S&E departments funded by the NSF. However, Towns does not explore the underlying causes of under-representation.

Much of the research on WOC in S&E academe has focused on their qualitative experiences as S&E faculty members (Malcolm & Malcolm 2011, Turner *et al.* 2011, Turner *et al.* 2008, MacLachlan 2000). Turner *et al.* (2008) reviews the mostly qualitative literature on faculty of color in academe and reports that the literature shows that faculty of color cite under-valuation of their research interests, isolation, and lack of department and institutional efforts to recruit and retain a diverse faculty as issues confronting them in academic careers. Ong *et al*.

(2011) provides a synthesis of empirical research on WOC in Science, Technology, Engineering and Mathematics (STEM) disciplines. This literature review finds very few studies of WOC in STEM fields in academe, many which focus on their experiences in undergraduate and graduate school. Ong *et al.* makes extensive recommendations for the future research agenda for WOC in STEM disciplines, including conducting studies that use longitudinal data on WOC in STEM disciplines, "as well as work that addresses transitions and points of loss between the secondary, postsecondary (2-year, 4-year, and graduate institutions), and career stages of the STEM pipeline." (p. 42).

Two studies partially address Ong *et al.*'s recommendation for studying transitions in STEM education and careers. Ginther and Kahn (2009) examine gender differences in academic career outcomes in S&E fields. They find that married women with children are less likely to take tenure track jobs compared to men. However, they find no significant gender differences in promotion to tenure and full professor after controlling for demographic, family, employer, and productivity characteristics. Ginther *et al.* (2009) examines gender and race/ethnicity differences in academic biomedical careers. They find that women and under-represented minorities leave biomedical studies and biomedical research careers at different milestones. Under-represented minorities are lost between high school and college and between college and graduate school. However, Ginther *et al.* does not examine all S&E fields nor does it separate out women and men of color.

This paper addresses Ong *et al.*'s recommendation by examining each stage of education and career progression, from high school to full professor, in order to show the transition points where women of color leave the S&E academic career trajectory. Note that the analysis here is limited to S&E – life science, physical science, and engineering – because our previous research (Ginther and Kahn 2004, Ginther and Kahn 2006, and Ginther and Kahn 2009) shows that combining all STEM disciplines together including social sciences masks important trends in academic careers, and particularly that social science disciplines have very different career outcomes for women compared to the S&E disciplines only.

## 2. The Representation of Women of Color in S&E Academia

We base our analysis of the representation of WOC in S&E academia[1] on the National Science Foundation's (NSF) Survey of Doctorate Recipients (SDR). The SDR is a biennial, longitudinal survey of US trained PhDs in S&E and social science fields. Respondents to the SDR are drawn from the NSF's annual Survey of Earned Doctorates (SED) and followed throughout their careers as long as they remain in the US, are less than 75 years old, or are eliminated from the sample to make way for new PhDs. The SDR over-samples women and under-represented groups, however there are still small numbers of WOC in the data.

Throughout the analysis, we define women of color as US-born[2] women who are African-American, Hispanic, or Native American/Pacific Islander. As we examine higher levels of education, the representation of women of color becomes much lower. In order to preserve the confidentiality of the data, we often must combine these race/ethnicity categories into the single group, women of color (WOC).

[1] Academia includes universities, 4-year colleges, and medical and other professional schools that award post-BA degrees.

[2] The exact definition depends on the data source. In some cases we include all US-born, in other cases we include all citizens or add permanent residents to the citizens.

Tables A-1-1 through A-1-3, based on the 2008 SDR (the most-recent wave of the data), examine the current representation of WOC in S&E academic careers. Although the SDR provides the ideal data set for this analysis because it follows individuals over time and over-samples WOC, we are still dealing with very small numbers of WOC employed in academic jobs.

Estimates from the SDR (shown in the last column of Table A-1-2) show that there were only 2,724 WOC and 3,992 men of color (MOC)[3] with S&E PhDs working in academic jobs compared with 25,900 white women and 57,837 white men. In other words, there are almost 10 times the number of white women and almost 20 times the number of white men as there are WOC working in S&E academia.

Table A-1-1 shows the percentage of WOC compared to all other demographic groups in different academic rank groupings, as estimated from the SDR. For comparison, the last column of Table A-1-1 shows each demographic group's percentage of the U.S population aged 25 to 69 years-old (from the 2000 Census).[4] Although WOC make up 12.5% of the US population, they are only 2.3% of the tenured or tenure track faculty and 5.1% of non-tenure-track faculty (first 2 columns of Table A-1-1). Non-tenure track faculty are the least prestigious and the lowest-paid of all faculty, and therefore this report concentrates on tenure-track and tenured faculty only. MOC as a percentage of tenured/tenure-track academia are almost twice the percentage of WOC (4.1%) but are still grossly under-represented relative to the population (11.9%). Instead, the majority of tenured/tenure-track faculty are white men (60.1%), a percentage two-thirds greater than their percentage of the population. Asians, while a small part of the population, are over-represented within tenured/tenure-track academic ranks, particularly Asian men whose percentage within academia is more than threefold their percentage in the population.

The next columns of Table A-1-1 isolate those higher in the academic hierarchy: first, only academics who are tenured and second, the subset of these who have further been promoted to full professorships. As we move up the academic ranks, the proportion of WOC falls while the proportion of white men rises. At the most senior rank, 67% of full professors are white men compared to only 1.2% who are WOC and 3.8% who are MOC.

[3] As with women, MOC includes men who are African-American, Hispanic, or Native American/Pacific Islander.

[4] For the Census data, there are far more racial categories, including many people with two or more races. For these data, we define people of color as anyone who is *not* a non-Hispanic white or an Asian. The black category here includes those who give their single race as "Black" or "African-American." Hispanics in these Census figures can be of any race. As can be seen in the tables, these categories of Black and Hispanic do not add up to the total URM, although they do double-count those who have Hispanic ethnicity but Black as their single race.

*APPENDIX A-1 EDUCATION AND ACADEMIC CAREER OUTCOMES FOR WOMEN OF COLOR IN SCIENCE AND ENGINEERING*

**Table A-1-1** Percentage of each academic rank in each race/sex category.

| | % of non-Tenure Track Faculty | % of Tenure-Track/ Tenured Faculty | % of Tenured Faculty | % of Full Professors | % of US Population |
|---|---|---|---|---|---|
| **Women of color** | 5.1% | 2.3% | 1.7% | 1.2% | 12.5% |
| **Black** | 2.3% | 1.1% | 0.7% | 0.4% | 6.2% |
| **Hispanic** | 1.2% | 1.0% | 0.8% | 0.7% | 5.3% |
| **Men of color** | 3.0% | 4.1% | 3.9% | 3.8% | 11.9% |
| **Black** | 1.6% | 1.8% | 1.5% | 1.2% | 5.3% |
| **Hispanic** | 1.1% | 2.2% | 2.2% | 2.4% | 5.6% |
| **Other women** | 42.2% | 26.1% | 23.6% | 20.1% | 38.3% |
| **White** | 38.5% | 23.4% | 21.9% | 18.9% | 36.2% |
| **Asian** | 3.8% | 2.6% | 1.7% | 1.2% | 2.1% |
| **Other men** | 49.6% | 67.5% | 70.8% | 75.0% | 37.3% |
| **White** | 43.2% | 60.1% | 63.9% | 67.4% | 35.5% |
| **Asian** | 6.5% | 7.5% | 6.9% | 7.6% | 1.9% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** |
| **Total 2008 Number** | **15,473** | **85,164** | **62,469** | **36,365** | |

Notes: Percentages for people of color are also broken down for two largest racial subgroups; percentages for other races are broken down into their two components. Note that the different academic rank groupings are not mutually exclusive, and particularly that Tenure-Track/Tenured Faculty includes Tenured Faculty (as well as untenured tenure-track faculty) and Tenured Faculty includes Full Professors (as well as Tenured Associate Professors).
Source: 2008 NSF Survey of Doctorate Recipients (SDR). Finer racial distinctions have been suppressed to ensure the SDR's confidentiality as required by the NSF and as a result, Blacks and Hispanics do not add up to the total URM numbers. Calculations are based on weighted 2008 SDR data. See text for more details.

Table A-1-2 shows the distribution of each demographic group across the *mutually exclusive* faculty ranks. Almost 30% of WOC work in non-tenure track positions compared to 12% of MOC, 23% of white women, and 11.5% of white men. Only 19% of WOC working in academic jobs are tenured associate professors and 16% are full professors, compared to 25% and 27% of white women and to 25% and 42% of white men. The corresponding percentages for MOC are more similar to white men than to WOC: MOC's percentage in non-tenure-track positions and in tenured associate positions resemble white men's, but their percentage in tenure-track untenured positions and in full professorships lie between white women's and white men's percentages.

The shrinking proportions of WOC between the tenure-track untenured rank and the tenured full professor rank may be due to the fact that women in general, and WOC in particular, only began getting S&E PhDs in large numbers in recent decades. Therefore, the most senior

academics who would be eligible for full professorships received PhDs when men were the dominant gender. To identify whether there were indeed racial and gender hiring and promotion differences within academia, we need to analyze careers of individuals using longitudinal data. This is exactly what we do in Section 4 below.

**Table A-1-2** Percentage of academics in each sex/racial category (and subcategory) at each *mutually-exclusive* academic rank.

| | % non-Tenure-Track Faculty | % Tenure-Track Untenured | % Tenured, not Full | % Full Professors | | Total # |
|---|---|---|---|---|---|---|
| **Women of color** | 29.2% | 35.6% | 19.0% | 16.2% | 100% | 2,724 |
| **Black** | 27.5% | 39.4% | 22.8% | 10.4% | 100% | 1,294 |
| **Hispanic** | 31.5% | 30.3% | 16.0% | 22.2% | 100% | 1,190 |
| **Men of color** | 11.7% | 29.8% | 23.8% | 34.8% | 100% | 3,992 |
| **Black** | 14.5% | 32.4% | 27.8% | 25.3% | 100% | 1,755 |
| **Hispanic** | 8.4% | 26.5% | 21.4% | 43.7% | 100% | 2,001 |
| **Other women** | 22.8% | 27.2% | 24.7% | 25.3% | 100% | 28,723 |
| **White women** | 23.0% | 25.6% | 24.9% | 26.5% | 100% | 25,900 |
| **Asian women** | 20.8% | 42.2% | 22.6% | 14.5% | 100% | 2,823 |
| **Other men** | 11.8% | 22.1% | 24.4% | 41.8% | 100% | 65,197 |
| **White men** | 11.5% | 21.2% | 24.9% | 42.4% | 100% | 57,837 |
| **Asian men** | 13.6% | 28.8% | 20.2% | 37.4% | 100% | 7,360 |

Notes: Finer racial distinctions have been suppressed to ensure the SDR's confidentiality as required by the NSF and as a result, Blacks and Hispanics do not add up to the total URM numbers. Calculations are based on weighted 2008 SDR data. See text for more details.
Source: 2008 NSF Survey of Doctorate Recipients (SDR).

Table A-1-3 repeats the analysis of Table A-1-1, but divides the sample by academic employer type — Under-represented Minority Universities or colleges (URM-universities) or non-URM-universities. URM-universities are defined as Historically Black Colleges or Universities (HBCU), minority-serving institutions (where more than 25 percent of the student body comes from under-represented groups including African-Americans, Hispanics, and Native Americans), or Tribal Colleges or Universities (TCU). Note that the SDR data includes the *Integrated Postsecondary Education Data System* (IPEDS) institution code for all respondents employed at a higher education institutions, allowing us identify whether each academic worked for a URM-university, be it an HBCU, a TCU, or a minority serving university, or for a non-URM-University.

*APPENDIX A-1 EDUCATION AND ACADEMIC CAREER OUTCOMES FOR WOMEN OF COLOR IN SCIENCE AND ENGINEERING*

**Table A-1-3** Percentage of each academic rank grouping within each university type (URM, Non-URM) in each sex/racial major and sub-grouping.

| | NON-URM UNIVERSITIES | | | | URM UNIVERSITIES | | | |
|---|---|---|---|---|---|---|---|---|
| | % of non-Tenure-Track Faculty | % of Tenure-Track faculty (includes tenured) | % of Tenured Faculty | % of Full Professors | % of non-Tenure-Track Faculty | % of Tenure-Track faculty (includes tenured) | % of Tenured Faculty | % of Full Professors |
| **Women of color** | 3.6% | 1.6% | 1.1% | 0.7% | 19.5% | 9.6% | 7.5% | 6.1% |
| **Black** | 28.9% | 0.7% | 0.5% | 0.2% | 8.7% | 5.4% | 3.1% | 1.8% |
| **Hispanic** | 29.6% | 0.7% | 0.5% | 0.4% | 10.2% | 4.1% | 4.4% | 4.3% |
| **Men of color** | 2.5% | 3.0% | 2.7% | 2.5% | 7.5% | 16.2% | 17.3% | 16.9% |
| **Black** | 13.7% | 1.2% | 0.9% | 0.7% | 7.0% | 7.9% | 7.6% | 6.7% |
| **Hispanic** | 11.5% | 1.6% | 1.5% | 1.6% | 0.5% | 8.3% | 9.8% | 10.1% |
| **Other women** | 43.0% | 26.7% | 24.2% | 20.4% | 35.6% | 19.2% | 17.6% | 16.4% |
| **Other men** | 50.9% | 68.7% | 72.1% | 76.4% | 37.4% | 55.0% | 57.6% | 60.7% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |
| **Total 2008 Number** | **13,960** | **78,070** | **57,030** | **33,050** | **1,510** | **7,090** | **5,440** | **3,320** |

Notes: The different academic rank groupings are not mutually exclusive. URM-Universities include HBCUs, TCUs, and minority serving universities. Also see notes for Table A-1-1.

Although there are more URM faculty in non-URM universities than in URM-universities, WOC are disproportionately employed by URM universities. Only 1.1% of tenure-track or tenured faculty at non-URM institutions are WOC. Thus, of the estimated 57,030 tenure-track or tenured faculty at non-URM institutions, there are only 625 WOC. In contrast, 9.6% or 681 of the 7,090 tenured or tenure-track faculty at URM are WOC. In other words, more WOC are employed at URM-universities even though these universities employed only 11% of all tenure-track/tenured academics. MOC are also over-represented in URM-universities but not to the same extent specifically, a third of URM men are at URM-universities.

We cannot know from this evidence whether WOC and MOC are concentrated in URM-universities because they have chosen these positions or because these are the universities that will hire them and that will promote them. With longitudinal data, we will be able to compare promotion rates in URM and non-URM universities. Without application data, however, we cannot know whether the placement of WOC and MOC into URM universities was by choice or by necessity.

In the sections that follow, we use a variety of data sources to examine each education and academic career step in order to identify the transition points where women of color leave the S&E academic career trajectory.

## 3. Gender and Race/Ethnicity Differences in Education Outcomes

Our analysis of education outcomes begins by using data from the 1994-2010 waves of the Outgoing Rotations data from the Current Population Survey (CPS). In Figure A-1-1, we compare the percentage of US citizens ages 24-25 who were WOC to the percentage of high-school graduates among the 24-25 year-old citizens who were WOC, and to the percentage of college graduates among the 24-25 year-old citizens who were WOC.

Since the 1990s, the percentage of WOC among the general population of 24-25 year-old citizens has been increasing from approximately 12 percent to over 14 percent. The percentage of WOC among the 24-25 year-old citizens who were high-school graduates is practically identical to the percentage of WOC among the total population this age, indicating that WOC are graduating high school at exactly the same rates as the national average. If anything, the high-school graduation rates for WOC seem slightly higher than the national average in some years (including the most recent ones). Thus, interventions are not needed to increase WOC's high-school graduation rates, although these statistics cannot speak to the quality or emphasis of the high-school education received by WOC compared to other demographic groups.

However, WOC are *not* graduating from college at a similar rate as the population as a whole. Figure A-1-1 illustrates this by showing that WOC are a much smaller percentage of 24-25 year-old (citizen) college graduates than they are of high school graduates or of the whole population. Thus, in 2010, nearly 14% of (24-25 year-old) high school graduates were WOC but WOC made up less than 10 percent of college graduates among that age group. Nevertheless, this represents an increase in the percent of WOC among the total population of college graduates (24-25 years old), from 6.6% in 1994. The rate of increase over time in WOC's percentage of college graduates is somewhat greater than the rate of increase in WOC's percentage of high-school graduates, which means that WOC are making some progress in completing college. However, the gap remains large.

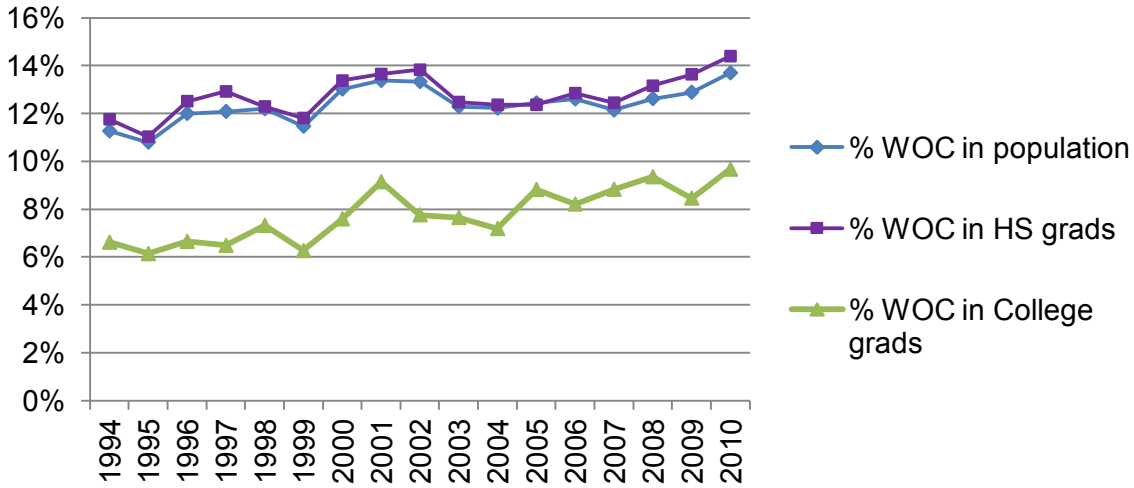


**Figure A-1-1** Percentage of US citizens ages 24-25 who are WOC out of (a) the total population of 24-25 year-old citizens, (b) the high school graduates among the 24-25 year-old citizens, and (c) the college graduates among the 24-25 year-old citizens.
Source: 1994 – 2010 Outgoing Rotations of the Current Population Survey.

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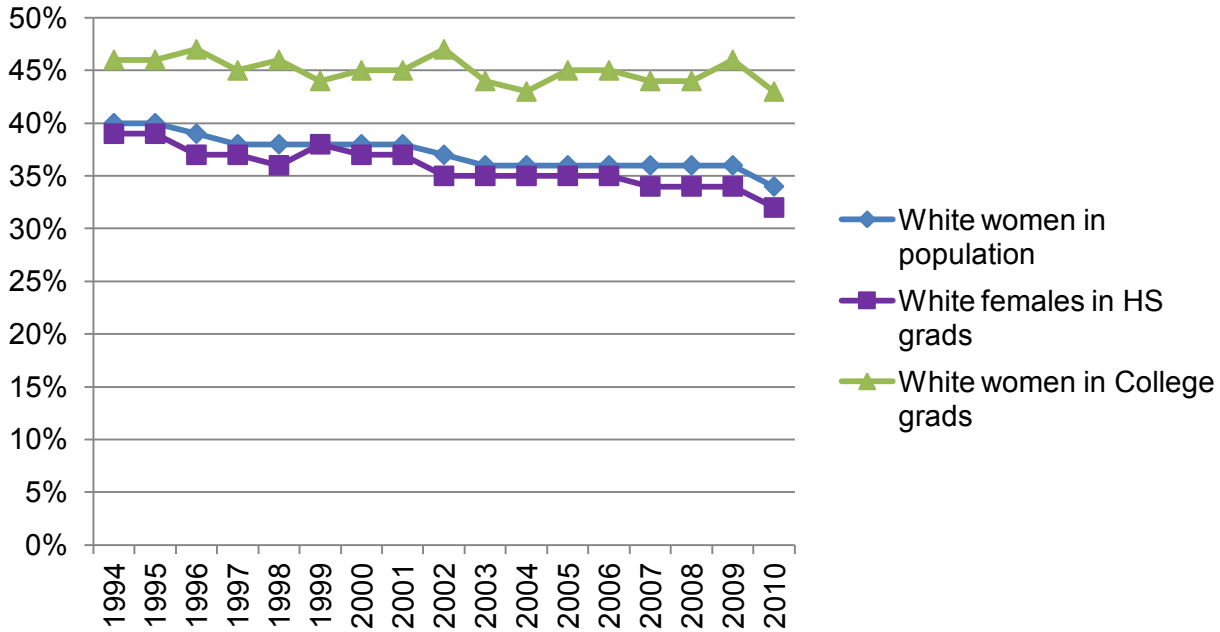


**Figure A-1-2** Percentage of US citizens ages 24-25 who are white women out of (a) the total population of 24-25 year-old citizens, (b) the high school graduates among the 24-25 year-old citizens, and (c) the college graduates among the 24-25 year-old citizens.
Source: 1994 – 2010 Outgoing Rotations of the Current Population Survey.

Figure A-1-2 puts this into perspective by making the same comparison for white women who make up a decreasing share of the total and high-school graduate population of 24-25 year-olds due to the fact that the proportion of non-whites in the US population is growing faster than whites. Thus, white women have gone from 39% of the total US 24-25 (citizen) population in 1996 to 32% in 2010, with quite similar proportions of high school graduates. However, white women's percentages of 24-25 year-olds college graduates are much higher overall than their percentage of the overall population or of high schools graduates, averaging 45%. Moreover, white women are *increasing* the gap between their percentage among college graduates and their percentage among high-school graduates, as higher proportions of white women graduate college. The more recent (2006-2010) college graduation rates are shown directly in Figure A-1-3 as percentages of high school graduates among the 24-25 year-old natives who graduated from college.

In Figure A-1-3 and later graphs, to facilitate our understanding of the representation of WOC, we compare them to white women, white men, and MOC (all native-born). We thus exclude Asians, who have the highest rates of representation among academics as indicated in Table A-1-1. We see that WOC high-school graduates are significantly less likely to graduate from college than white women. Note that these graduation rates are expressed as a percentage of high school graduates, not of the entire 24-25 year-old population.[5]

[5] However, if we had instead expressed them as a percentage of the total population of 24-25 year-olds in each racial group, we would find little change in this graph for WOC and white women, since for each of these race-sex groups the high school proportions and population proportions were similar (as shown in the previous figures.) The same is true for white men and MOC as well, although it would not be for MOC if GED's had not been counted as equivalent to high school graduation, since a sizable proportion of MOC are getting GEDs instead of regular high school diplomas.

Figure A-1-3 also shows that MOC high school graduates have even lower likelihoods of graduating college than do WOC, and that white men have lower likelihoods of graduating college than do white women. In fact, since 1990, men aged 25 to 29 have been less likely than women to graduate college, and this gender gap is growing.[6]

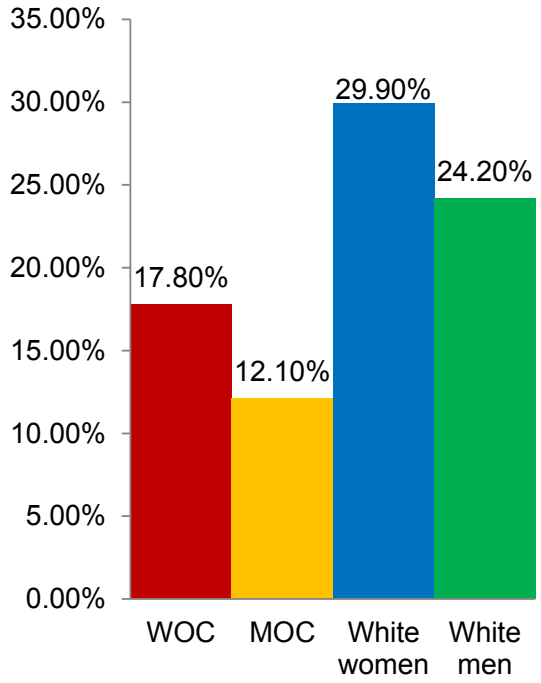


**Figure A-1-3** Percentage of 24-25 year-old high-school graduates who graduated from college for WOC, MOC, white women and white men, averaged over 2006-2010.
Source: Outgoing Rotations of the Current Population Survey.

These data indicate that a particularly necessary point of intervention to increase diversity, both in terms of WOC and in terms of MOC, is the period between high school and college graduation. To isolate where WOC are dropping out, we investigated undergraduate enrollment rates using data from the *Digest of Education Statistics*. In 2008, nearly 17% of undergraduate students at either 2 or 4 year colleges were WOC (Snyder and Dillow 2011). This number is even larger than the percentage WOC among high school graduates shown in Figure A-1-1, probably because the 2008 undergraduate students represent a later cohort than 24-25 year-olds in 2008 and later cohorts have increasingly higher percentages of persons of color. Thus, it appears that WOC are starting college at rates approximately proportional to their high school graduation rates. Our evidence here has shown, however, that they are not graduating from 4-year colleges at similar rates. This suggests that research and intervention should concentrate on preventing attrition of WOC from 4 year colleges and assisting WOC to transition from 2-year to 4-year colleges.

[6] There is a racial difference in the growth of this gap: for under-represented minorities (URMs), the female-male gap between college graduation rates of 24-25 year olds was 3.3 percentage points in 1994 and for the last 5 years of data averaged 5.7 percentage points. For whites, the gap started smaller in 1994 – at 1.1 percentage points. In the last 5 years, however, it is exactly the same as for URMs (5.7 percentage points), suggesting that white males are falling behind white females at a faster rate than MOC are following behind WOC.

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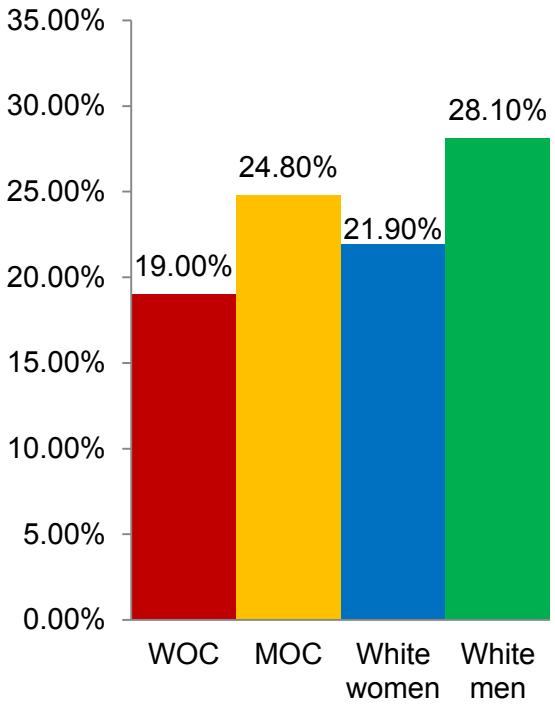


**Figure A-1-4** Percentage of WOC, MOC, white women and white men college graduates who graduated with S&E majors, averaged over 2005-2009 waves of the IPEDS data.

The education facts presented to this point do not isolate those who studied S&E. To examine college major, we used data from the *Integrated Postsecondary Education Data System* (*IPEDS*) over the last five available years of data (2005-2009) to determine the average percentage of all college graduates who majored in S&E majors, by race and sex. This percentage is given in Figure A-1-4 for WOC, MOC, white women and white men. Figure A-1-4 shows that WOC college graduates are only slightly less likely to graduate with S&E majors than white women (19% compared to 22%),[7] but that women of each of these racial groups are less likely than the corresponding men to graduate in these fields. It is interesting to note, however, that the greater tendency of women high school graduates to finish college than men balances out the greater tendency of men to major in S&E. A rough estimate, calculated by multiplying the likelihood of high school grads to graduate from college (by race and sex, from the CPS and Figure A-1-3) times the likelihood of college grads to major in S&E (by race and sex, from the IPEDS and Figure A-1-4) shows that close to the same percentage of WOC and MOC high school grads graduate college with an S&E major (3.4% v. 3.0% respectively) and that close to the same percentage of white female and white male high school grads graduate college with an S&E major (6.5% v. 6.8%).[8] While previous research has shown that the under-representation of WOC and MOC in S&E majors may result from the lack of tracking of students of color into Advanced Placement courses in high school which limits their options to pursue S&E majors in college (Oakes *et al.* 1990), our analysis indicates that lower rates of college graduation contribute more to their under-representation.

[7] The corresponding numbers are 25% for MOC and 28% for white men.
[8] Combining data from two sources can give only approximations because data methods and definitions may not be identical.

How many of these S&E graduates go on to complete a PhD in S&E? To calculate this, we needed to combine data from different sources and to make "synthetic cohorts" that compare S&E college graduates with S&E PhD recipients 7 years later. We calculated 7 years as the approximate length of time between BA and PhD using the NSF's Survey of Earned Doctorates (SED), the annual census of PhDs awarded in the US (during the relevant PhD years). Specifically, we used IPEDS data on the number of college graduates majoring in S&E in our four race/sex categories (WOC, MOC, white men, and white women) averaged over the 2000-2002 waves of IPEDS and compared this to the numbers of S&E PhDs awarded 7 years later in the 2007-2009 waves of the SED.[9]

The probabilities estimated from these calculations (i.e. number of PhDs divided by number of BAs in the same synthetic cohort) are given in Figure A-1-5. Among S&E majors, both WOC and MOC were only about 60% as likely as white women (6.9%/6.7% compared to 11.5%) to get an S&E PhD. White women were also more likely than white men (11.5% compared to 9.6%) to get an S&E PhD, an interesting reversal from earlier decades where women in science were rarities. The increasing numbers of women S&E PhDs are concentrated in biomedical sciences.

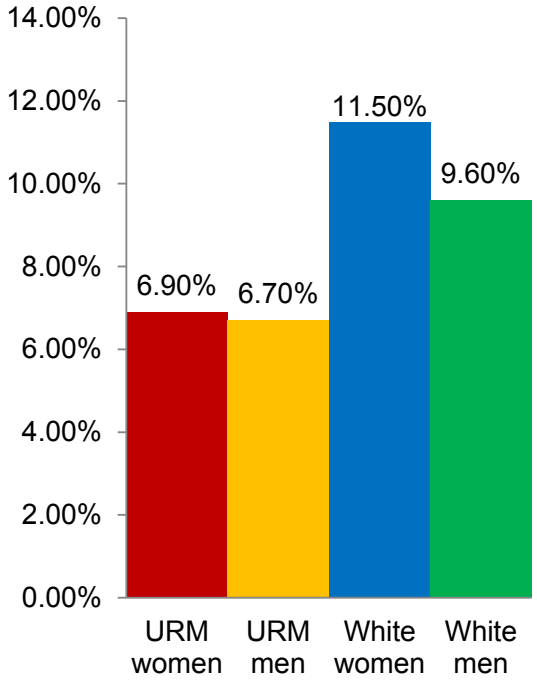


**Figure A-1-5** The likelihood that someone who received an S&E bachelor's degree 2000-2002 graduated with an S&E PhD between 2007-2009 inclusive.
Source: College graduates from IPEDS data and PhD recipients based on Survey of Earned Doctorates (SED).

We made a similar calculation to obtain the probability that S&E majors graduated with a medical degree. As in our PhD calculation, we used the number of S&E college graduates from the 2000-2002 waves IPEDS and compared this to the corresponding numbers of MDs awarded

[9] We used a shorter 3-year period rather than the 5-year period used for college estimates for two reasons. First, IPEDS did not publish 1999 data, and second, during this period PhD numbers changed rapidly and we wanted numbers most closely representing the present situation.

7 years later, as measured by the 2006-2009 waves of the Association of American Medical Colleges (AAMC) student data. The probabilities (i.e. number of MDs divided by number of BAs in the same synthetic cohort) are given in Figure A-1-6. A smaller percentage of S&E majors obtained MDs than PhDs for each sex/race group shown. The percentages getting MDs and PhDs were relatively close for people of color (6.9%/6.7% PhDs and 5.3%/5.1% MDs for WOC/MOC). In contrast, both white men and women were significantly more likely to graduate with a PhD than an MD. In fact, as a percent of S&E majors, more people of color got MDs during this period than whites.

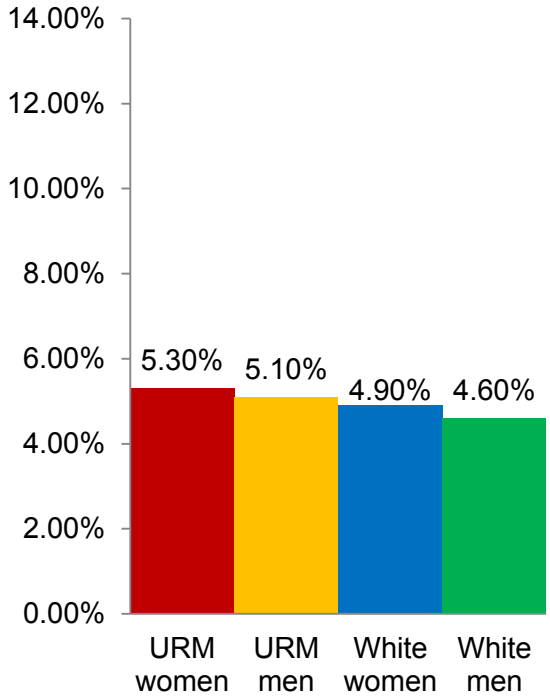


**Figure A-1-6** The likelihood that someone who received an S&E bachelor's degree 2000-2002 graduated with an MD between 2007-2009 inclusive.
Source: College graduates from IPEDS data and MD recipients based on AAMC student data.

After examining each education transition, it is clear that greatest barriers to the increased participation of WOC in S&E academic careers occurs in the transition between high school graduation and college graduation, with a second barrier between college graduation and obtaining an S&E PhD. Programs and policies that seek to increase the diversity of academia should be targeted at these two key points. The next section examines the transition from S&E PhD to tenure track jobs and academic tenure and promotion.

## 4. Gender and Race/Ethnicity Outcomes in Academic Careers

In what follows, we examine whether key career transitions—obtaining a tenure track job, being awarded tenure, and becoming full professor—create barriers for the representation of WOC in academic careers. We do this by comparing WOC to the three comparison groups, MOC, white women, and white men. We also measure whether the race/sex patterns of transitions differ in URM-universities (as defined earlier, including HBCUs, TCUs, or a minority serving universities) compared to other universities. This analysis is based on the NSF's Survey

of Doctorate Recipients (SDR) described earlier. We use the SDR because it is the only longitudinal survey of S&E PhDs. The longitudinal nature of the SDR is key; cross-sectional snapshots cannot distinguish between race/sex differences in the size of the pool of S&E PhDs compared to race/sex differences in hiring and promotion rates. Only longitudinal data that follows individual S&E PhDs as their careers develop, like that available from the SDR, allows us to accurately pinpoint differential hiring and promotion.

The SDR contains detailed information on the respondent's demographic characteristics (race/ethnicity and gender), education background (field of study and PhD year), employer characteristics (employer type) and academic rank/tenure-status as well as the IPEDS number that allows us to categorize workplaces as URM-universities. It also includes the *Carnegie Classification of Institutions of Higher Education,* which allows us to separately study scientists' academic progression at top (Carnegie R1) universities.[10] Note that we use samples of the SDR for this analysis that vary in size because of the timing of academic careers.

In Figure A-1-7, we examine gender and race/ethnicity differences in the likelihood of getting a tenure-track job within approximately six years of the PhD (for S&E PhDs from 1993-2003).[11] Likelihoods are very different depending on whether the tenure track job is in URM and non-URM universities and we therefore separate these out in this figure. Panel A shows the percentage of S&E PhDs who got tenure-track jobs at non-URM universities for WOC, MOC, white women, and white men. Compared to whites, WOC – and MOC– are significantly less likely to obtain tenure-track jobs in non-URM universities. Specifically, WOC are only 72% as likely as white women to obtain tenure-track jobs in these universities. Panel B makes the same comparison for URM universities, where WOC are much *more* likely than white women (7 times as likely) to obtain tenure-track jobs. One-third of WOC who obtain tenure-track jobs work at URM universities. To get a sense of the disproportionate nature of this, note than over the time period that the Figure A-1-7 probabilities were computed, non-URM-universities hired more than 10 times as many new tenure-track faculty than did URM-universities. Thus, WOC do obtain tenure-track jobs, but they are concentrated in URM-serving institutions.

Panel C shows that roughly the same percentage of WOC and white women receive tenure-track jobs at Research I institutions. Note that R1 Universities hired 24% of all new tenure-track academics during this period and a similar proportion (27%) of WOC.

[10] We use the older Carnegie Rankings (pre-2005) because our data cover many years before the newer rankings were available. In addition, we focus on Research I institutions because they produce the largest numbers of S&E PhDs.

[11] Since the last SDR with microdata available was from 2008, we excluded those who got PhDs after 2003.

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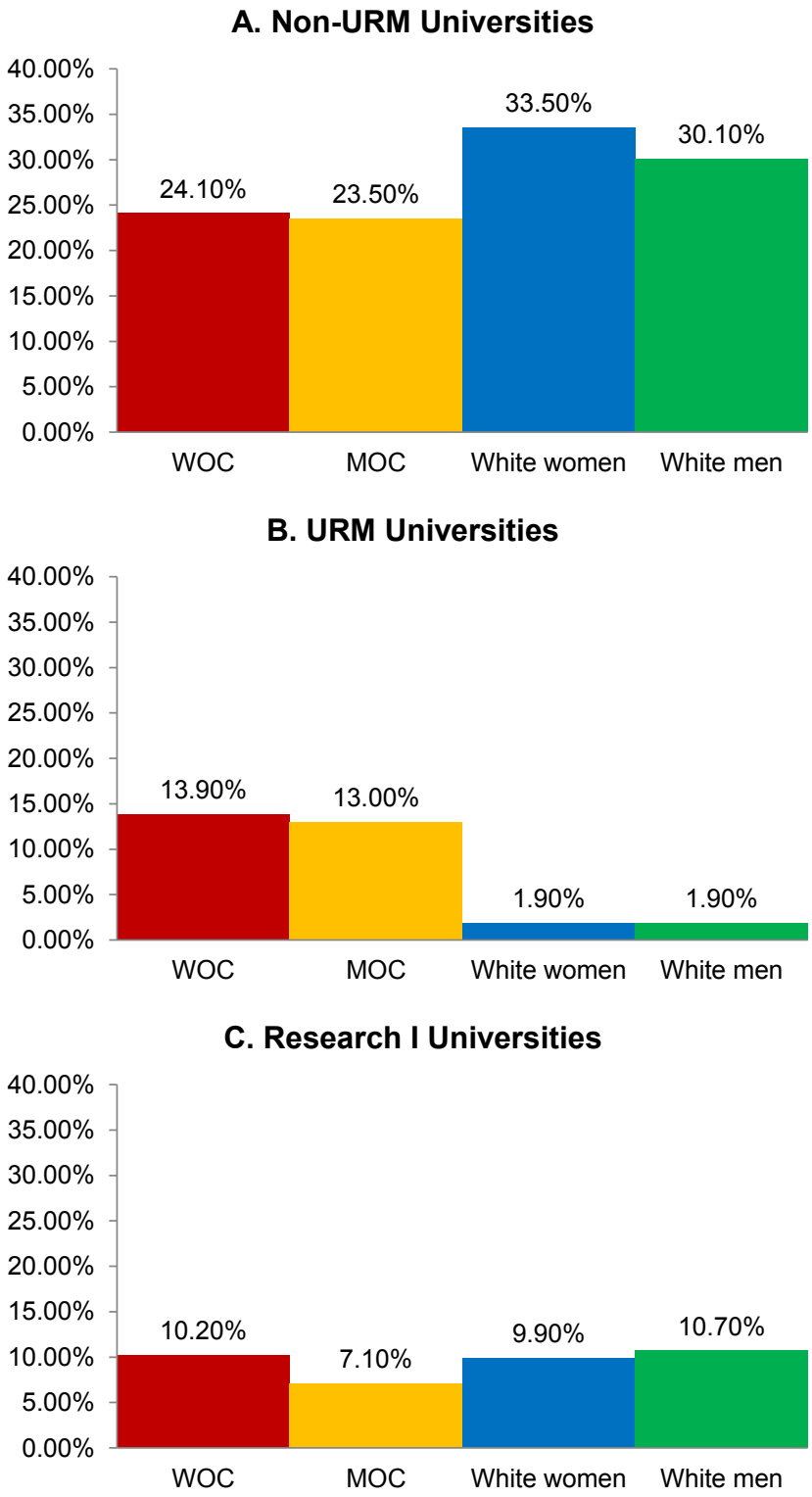


**Figure A-1-7** Probability of obtaining an S&E tenure track job within 6 years of PhD in non-URM, URM, and Research I universities using 1993-2008 waves of the SDR. See text for more details.

Having obtained a tenure-track job, the next hurdle for an academic is the tenure decision. Again, we have analyzed the probability of being awarded tenure at a non-URM university for those who had a tenure track job in a non-URM university (within 6 years of PhD) separately from tenure in an URM-university for those who started in a URM-university. Figure A-1-8 shows the likelihood of receiving tenure 11 years past the PhD for S&E PhDs who graduated from 1993-1998.[12] As Figure A-1-8 indicates, the majority of each of the four race/sex groups who started with a tenure-track job do receive tenure, although there are some differences across the kind of university and across race/sex groupings.

Panel A of Figure A-1-8 shows that WOC who started in a non-URM university are somewhat less likely to receive tenure than white women at a non-URM university, although the difference (71% v. 76%) is not statistically significant. Panel B shows that for the much smaller sample of those who started at a URM-university, WOC are more likely to receive tenure at URM universities than other race/sex groups, although the difference is not statistically significant. Interestingly, white men are the least likely to receive tenure in these universities. Finally, Panel C looks at those who started in a tenure track position at a Research-1 university and shows that WOC are significantly *more* likely than white women (81% v. 67%) to get tenure. Thus, once WOC are on the tenure-track, they do not appear to be disadvantaged in getting tenure, and in fact, are more likely to be tenured at R1 universities. The tenure system does not appear to be an insurmountable hurdle for WOC.

[12] See previous footnote.

*APPENDIX A-1 EDUCATION AND ACADEMIC CAREER OUTCOMES FOR WOMEN OF COLOR IN SCIENCE AND ENGINEERING*

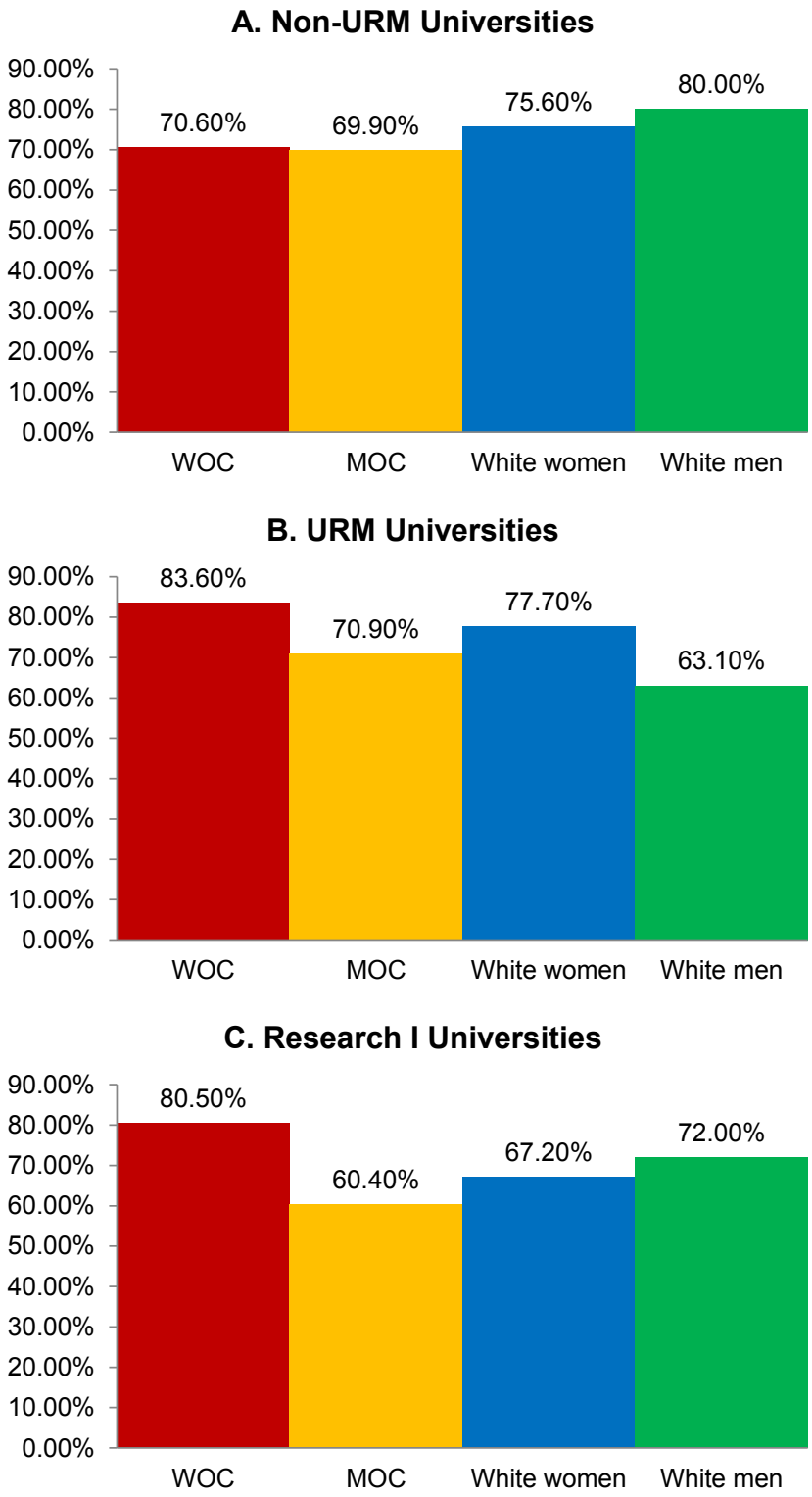


**Figure A-1-8** Probability of obtaining tenure in S&E job within 11 years of PhD in non-URM, URM, and Research I universities using 1993-2008 waves of the SDR.
Source: SDR. See text for more details.

Finally, we consider the likelihood of obtaining the highest academic rank, tenured full professorship, within 7 years of receiving tenure (for those who received tenure within 11 years of PhD.) Since we are talking about career progression across a total of 18 years, we include earlier PhDs (starting in the 1983 PhD cohort) but must cut off more recent PhDs (ending with the 1995 PhD cohort). Because women, both WOC and others, have been rapidly increasing their numbers in S&E fields, limiting ourselves to these earlier cohorts means there are few numbers of women, too few to separate out WOC at Research 1 universities. Thus we only divide universities by their URM-status.

Figure A-1-9 examines the percentage of WOC, MOC, white women and white men who are tenured full professors within 7 years of receiving tenure. Panel A shows the percentage becoming full professor at non-URM universities and Panel B shows the same for URM-universities. The difference between WOC and white women in non-URM universities is tiny. In URM-universities, the difference is greater in percentage points. However, neither of these differences is statistically significant because of the small samples. On the other hand, men at non-URM universities – whether MOC or white men – have higher measured rates of being promoted to full professor than either white women or WOC.

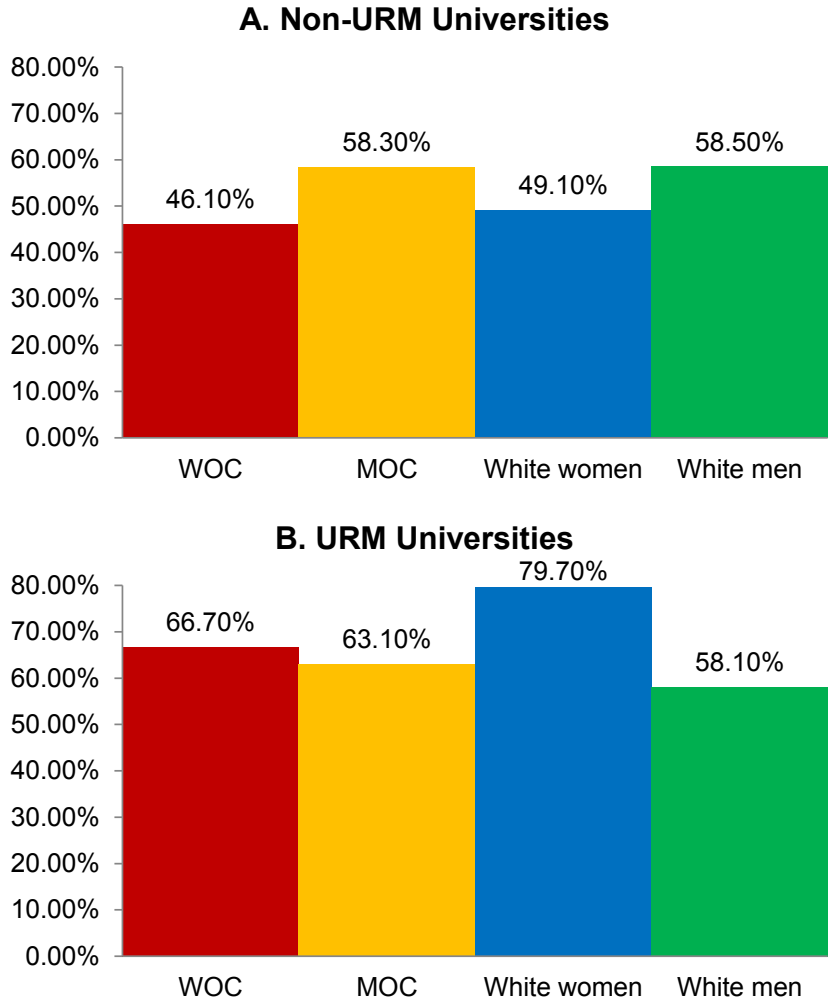


**Figure A-1-9** Probability of obtaining S&E full professor within 7 years of tenure in non-URM and URM universities. Source: SDR. See text for more details.

*APPENDIX A-1 EDUCATION AND ACADEMIC CAREER OUTCOMES FOR WOMEN OF COLOR IN SCIENCE AND ENGINEERING*

In summary, this academic promotion evidence indicates that once WOC obtain tenure track jobs, they progress through the academic ranks at similar rates to white women. However, they are less likely to have obtained tenure-track jobs at non-URM universities other than Research I universities.

Overall, the lower probabilities for women of color in non-URM universities compound in their effect. The largest difference in academic advancement between WOC and white women occurs right at the beginning, in the lower likelihood of starting in a tenure-track job in a non-URM university. This is compounded with the smaller (and statistically insignificant) lower probabilities of getting tenure and of being promoted to full professor. Figure A-1-10 was created by multiplying these three probabilities together to get the probability of proceeding from an S&E PhD to a tenured full professor. Because the cohorts included are not identical in all of these three analyses, Figure A-1-10 can only be considered suggestive. However, the differences across race/sex groups for non-URM universities is somewhat surprising. WOC end up with the lowest likelihood of proceeding from an S&E PhD to full professor in non-URM universities (only 8%), and the likelihoods increase as we move to MOC, white women and ending with white men (14%). WOC suffer along with MOC in getting hired on tenure-track jobs in these universities compared to whites, but fall behind MOC at the promotion to full transition.

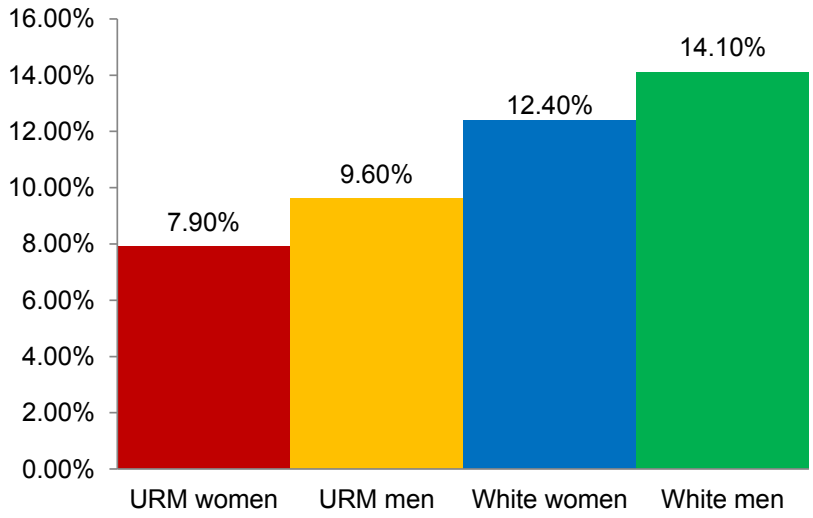


**Figure A-1-10** Probability of an S&E PhD progressing to tenured full professor in Non-URM Universities. Data sources SED and SDR. See text for more details.

## 5. Discussion

We have shown that there are very few WOC S&E PhDs working in academic jobs. More than a third of these few WOC are employed at URM-serving institutions that hire less than 9% of all academics while very few are tenured faculty at non-URM universities (625 or 1% of faculty at these universities). What is responsible for this lack of diversity in academe? It starts with the fact that women of color who graduated from high school are 40 percent less likely to complete a Bachelor's of Science compared to white women. For those WOC who received bachelor's degrees majoring in S&E, they are also 40 percent less likely than white women to receive a PhD in S&E, although equally likely to become medical doctors. Thus, many

of the barriers to increased diversity in academia start at the beginning of the science career—graduating from college and getting an S&E PhD.

Once WOC have the S&E PhD, they do get tenure-track jobs, although they are less likely to get tenure-track jobs in non-URM universities outside top (Research 1) universities. Overall, WOC are about as likely as white women to be awarded tenure, with only small and insignificant differences between URM and non-URM universities. Finally, women of all races are less likely than men to be promoted from tenured associate to tenured full professors within 7 years of being awarded tenure at non-URM universities. Combining all of these factors, the probability of WOC progressing from S&E PhD receipt to tenured full professor in a non-URM university is lower than for the other three race/sex comparison groups. The shortfall of successful WOC academics is *not* concentrated at the top universities. Instead, it occurs at non-R1 non-URM universities.

This lack of diversity in higher education affects the next generation. Several papers have shown the importance of having a professor or instructor who shares the student's demographic characteristics. A series of papers have found that female students are more likely to pursue a major if they have female faculty (Bettinger and Long 2005, Canes and Rosen 1995, and Rask and Bailey 2002) and have better performance in courses (Hoffman and Oreopolous 2007). Carrell, Page, and West (2010) use the random assignment of students to courses at the Air Force Academy to identify the causal effect of having women instructors in STEM courses. They show that female students who were randomly assigned a female professor in introductory STEM courses were more likely to pursue a STEM major than those assigned to a male professor in a STEM course. Hoffman and Oreopoulos (2011) examine community college instructors and find that having an African-American instructor increases African-American students' academic performance. Price (2010) finds that black students are more likely to major in STEM disciplines if they have a STEM course taught by a black instructor; however, he finds that female students are less likely to major in STEM when they have female STEM instructors. Taken together, this evidence indicates that WOC working as faculty in S&E fields will increase the likelihood that WOC pursue S&E degrees. However, only 7,090 of 64,120 of S&E academics in 2008 were WOC.

In summary, this research has painted a statistical portrait of the representation of WOC in the S&E education and career paths. We have shown that the greatest barriers to WOC in the academy occur at the transitions from high school to college graduate, from college graduate to S&E PhD, and to a lesser extent from S&E PhD to a tenure-track job in a non-URM university. These key transition points should be the focus of policies designed to diversify S&E academia. In particular, increasing WOC S&E academics will require first increasing the number of WOC graduating from college (Stephan 2011). Policies designed to increase WOC college graduation should be a top priority for increasing the diversity of the academy.

As WOC progress to academic careers, we found that they are less likely to be employed in S&E tenure-track jobs at non-URM institutions. However, our analysis does not examine the causal factors behind the under-representation of WOC in these institutions. It could be that WOC are more likely to choose URM institutions. Alternatively, the climate at non-URM institutions may discourage WOC from applying or working there. The myriad data sets we have used in this study do not include information on job offers or the climate at these institutions. These topics would provide good avenues for future research on the under-representation of WOC in S&E academic careers.

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# Appendix A-2

## Women of Color among STEM Faculty: Experiences in Academia

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Higher Education Research Institute, UCLA

### Introduction

It is necessary to examine the experiences of talented women of color in postsecondary learning and work environments in order to inform actionable solutions to improve their rate of success in the academy. While the phenomenon of underrepresentation for women of color in STEM may start during the early school years, it accumulates over time within colleges and universities. For example, although women among African American, Latina/o, and American Indian undergraduates are more likely than men to complete college degrees within six years, those aspiring to major in STEM fields at college entry were significantly less likely than their underrepresented minority (URM) male counterparts to be retained in STEM (Hurtado et al., 2012a). For those women who persist to graduate school and complete a degree, the outlook for a career in academia is replete with challenges. In a paper commissioned for these proceedings, using data from the National Science Foundation, Ginther and Kahn (2012) found that women of color represent only 2.3 percent of the tenured or tenure track faculty and 5.1 percent of non-tenure-track faculty, despite the fact that they make up 12.5 percent of the US population. Moreover, among PhD recipients, women of color have a lower likelihood of reaching the rank of full professor with tenure than their male and white counterparts. This structural underrepresentation affects the climate for diversity on two levels in an institution: It directly affects the behaviors and interactions with others in a campus context, and on a psychological level, it shapes the perceptions that others hold of women of color, as well as their own perceptions of the learning and work environment (Hurtado et al., 2008).

Macro issues that involve the pipeline do not fully explain why there are so few women of color in the STEM professoriate. A telling example is in academic medicine, where women comprise a small proportion of the faculty despite near parity in the number of female and male students graduating from medical school (AAMC, 2005). Trower (2008) partly attributes the severe underrepresentation of women and ethnic minorities in STEM academia to an unwelcoming institutional and departmental culture. In a survey of over 1,800 STEM faculty members at 56 universities, an individual's "sense of fit" or sense of belonging to their department was the single most important climate factor predicting job satisfaction (Trower, 2008). Another study, using interviews of established women of color in the physical sciences, demonstrated that belonging to a community allowed them to stay abreast of issues within their field and provided important opportunities to network and collaborate with others (Liefshitz et al., 2011). Having supportive and collegial relationships with colleagues and mentors is especially important for women of color in STEM because it helps them build the confidence "needed to succeed and persist, counteracts negative experiences, and sustains endurance in

challenging circumstances" (Liefshitz et al., 2011, 14). Focused and comparative difference research may provide information about individual and collective strategies that may be used to overcome challenges and increase the odds of success for greater numbers of women of color.

Previous research suggests that women of color face a "double bind" for having two identities that are especially undervalued in STEM contexts: that of being female *and* a racial minority (Ginther and Kahn, 2012; Liefshitz et al., 2011). Instead of a double disadvantage, some researchers have found that the intersection of both gender and race is reflected in women of color's unique perceptions of the workplace in academia (Aguirre et al., 1993) and that their professional experiences in STEM are qualitatively different than that of men and of white women (Liefshitz et al., 2011). Reay (2007, 607) offers yet another potential hypothesis: "Different aspects of self become more prominent in some contexts than in others." In some situations, one identity is foregrounded and the other muted, whereas in other contexts the reverse may be true. The theoretical and empirical challenge for researchers is to consider both conceptions of difference and structural inequalities.

Research has shown that women and individuals from ethnic minority groups are less satisfied with the academic workplace and have a higher probability of leaving the academy early in their careers more compared to their male and white colleagues (Trower and Chait, 2002). However, it is uncertain whether women of color are even more likely than ethnic minority men or white women to leave the academy early in their STEM careers and whether their reasons for leaving coincide with or differ from those reported by the other groups. With the few exceptions noted in this paper, most studies have not disaggregated faculty data to focus specifically on the experiences of women of color.

The purpose of this paper is to explore the experiences of underrepresented women of color in academia. We compare URM women with STEM colleagues in terms of sources of stress, workload demands, and satisfaction. Although there are few sources of quantitative data that have a large enough sample size to make definitive statements about STEM women of color as a group, the national faculty surveys administered triennially by the Cooperative Institutional Research Program (CIRP) at the Higher Education Research Institute (HERI), represent an excellent repository of information that begins to shed light on how URM women are unique from or share similarities with white and Asian women in STEM and their URM male counterparts. Because hundreds of colleges and universities have taken the HERI faculty survey over the years and because raw data and reports are given to all participating institutions to use in their institutional planning and reporting, these data could be useful in gaining a better understanding of URM women's work–life experiences and improving the environments for all underrepresented groups in STEM.

## Method

### Data Source

HERI employs a stratified institutional sampling scheme for all of its surveys to ensure representation that reflects all nonprofit, postsecondary institutions. Four-year colleges and universities identified as part of the national population are divided into 20 stratification groups based on type (four-year college, university), control (public, private nonsectarian, Roman Catholic, other religious), and selectivity in admissions defined as the median SAT Verbal and Math scores (or ACT composite score) of the first-time first-year students. The methodology for the surveys are described in two reports on nationally normed data by institution type, gender,

and rank (Hurtado et al., 2012b; DeAngelo et al., 2009). CIRP invites campuses to participate and provides them with guidelines for survey administration; the survey instrument is administered via the Internet.

For the analysis of this paper, we utilized data collected from the 2007 and 2010 HERI faculty surveys. In cases in which institutional stratification cells were insufficient for drawing conclusions, we supplemented the sample by identifying additional faculty at those institutions for inclusion and sent them surveys to augment the sample.

Academic department or field of study is typically not considered when soliciting participation in the HERI faculty survey from institutions or in the development of supplemental samples targeted to complete all areas of the sample stratification scheme. However, in 2007 and 2010, HERI sought supplemental STEM faculty samples, targeting institutions that had participated in CIRP administered student surveys as part of a longitudinal study of URM undergraduate student experiences in STEM sponsored by the National Science Foundation and the National Institutes of Health (see Web site http://heri.ucla.edu/nih/). To match student and faculty data from the same institutions, STEM faculty were identified via campus Web sites across all STEM departments that taught undergraduates. Augmentation occurred based on the institutional stratification scheme and also specifically included minority-serving, four-year institutions.

*Sample*. STEM faculty members were selected from all CIRP participating institutions and included the supplemental sample of STEM respondents in 2010-11. This sample was augmented with STEM respondents to the 2007-08 survey from an additional 98 institutions (non-duplicative) in order to maximize the population of underrepresented women respondents included in the data. This resulted in a total sample of 673 institutions and 11,039 STEM faculty members, 272 of whom were underrepresented women of color. 601 individuals chose not to provide information on rank and therefore are not included in any of the rank analyses. Approximately 7 percent of survey participants indicated their principal activity was administration, 76.9 percent indicated teaching, 13.9 percent indicated research, 1 percent indicated services to clients and patients, and another 1 percent indicated other or did not provide an answer. An additional 2.8 percent of respondents did not indicate their race or gender on the survey and were excluded from all analyses in the tables that follow.

*Limitations.* While we cast a large net to increase the probability of capturing STEM faculty, supplemental sampling procedures did not specifically select and identify all underrepresented faculty in STEM. Although administration of the survey is traditionally focused on undergraduate teaching faculty, campuses were encouraged to administer widely to all faculty. Results may be less representative of STEM faculty who are employed primarily in research positions. Despite new survey questions targeting part-time faculty and encouragement to survey part-time faculty in both 2007 and 2010, many institutions did not survey part-time faculty due to the additional cost. Consequently, only 7.2 percent of the sample are part-time faculty.

One specific limitation we have observed over the years is that the most vulnerable populations may not respond to surveys or may neglect to provide identifying information (rank, race/ethnicity, or department). Although the survey addresses issues of climate and work demands, we may be underestimating these issues for individuals who do not want to risk being identified by their own institutions. We typically use weights to represent the national population of men and women faculty for all HERI reports; however, we did not weight the responses in this sample because the exact number of faculty working in STEM fields and their corresponding

demographic information were not available in the Integrated Postsecondary Education Data System (IPEDS). In the future, NSF data could be instrumental in helping to weight responses obtained using HERI surveys. Finally, small sample sizes prevent further disaggregation by underrepresented groups (Latina/os, African Americans, and Native Americans). Even when collapsed together, the number of individuals in the URM categories is rather small, making it less likely that statistical comparisons will be significant between the URM groups and others. We have only emphasized those results that are statistically significant between URM women and other groups.

**Lack of Power and Authority in Academia**

Table A-2-1 shows the respondents' academic rank by race and gender in the sample. Women of color represent only 2.5 percent of the sample of respondents. They are least likely to be represented among full professors in the sample, and more likely to be represented at the lowest ranks, which have the least power and authority in academic decision-making.

**Table A-2-1** Proportion of STEM Faculty in Sample by Race/Ethnicity, Gender, and Academic Rank (n=11,039)

| | | | Academic Rank | | | | |
|---|---|---|---|---|---|---|---|
| **Population** | N | % of sample | Professor | Associate | Assistant | Lecturer /Instructor | No Rank Data |
| **URM women** | 272 | 2.5 | 16.2 | 24.6 | 31.3 | 23.5 | 4.4 |
| **Asian women** | 258 | 2.3 | 18.6 | 29.5 | 30.2 | 15.1 | 6.6 |
| **White women** | 3857 | 34.9 | 22.5 | 28.8 | 29.6 | 14.4 | 4.7 |
| **URM men** | 374 | 3.4 | 28.6 | 27.8 | 21.9 | 16.3 | 5.3 |
| **Asian men** | 565 | 5.1 | 30.8 | 24.1 | 28.8 | 6.5 | 9.7 |
| **White men** | 5713 | 51.8 | 41.8 | 26.3 | 17.8 | 8.6 | 5.5 |

Note: The categories for Latino, Native American, and African American have been collapsed into the category "underrepresented minority" (URM).

Asian women are also similarly positioned in terms of small numbers, except that they are more likely to be associate professors than URM women in this sample. White women constitute slightly more than one third of the sample (34.9 percent) but are also concentrated at the lower ranks compared to white men. URM men are more likely to be represented at the full professor level compared to underrepresented women of color. In contrast, white men are predominant among the full professor ranks and are least likely to be represented among assistant professors or in lecturer/instructor tracks. There is no question that inequalities associated with power and authority shape the experiences of women of color in the academy (CMPWSE, 2007; Conley, 1998; Valian, 2006; Trower & Chait, 2002) and while not all analyses in this report control for rank and tenure, acknowledging these differences is important when reviewing comparative differences between groups.

**Relationships with Colleagues**

The departmental social climate is a critical factor affecting the experiences of women of color in STEM (Liefshitz et al., 2011). Specifically, the small number of female ethnic minority women in STEM creates unique challenges for those trying to climb the professoriate ladder.

## *APPENDIX A-2 WOMEN OF COLOR AMONG STEM FACULTY: EXPERIENCE IN ACADEMIA*

Given the few women in their departments, female professors typically have few or no senior female colleagues to serve as role models or mentors (Rosser, 2004), putting these individuals at risk of failing to understand their role within their department, having lowered beliefs about their competency, and feeling a reduced sense of belonging (Ponjuan et al., 2011). A lack of senior female and/or underrepresented minority mentors also limits awareness of unstated rules for promotion and tenure (Williams and Williams, 2006) and limits access to advice on navigating the workplace, important social networks, and professional opportunities within the STEM field (Rosser, 2004; Williams and Williams, 2006). Women cite a lack of mentorship and or guidance as a major influence on their decision to leave the sciences (Preston, 2004).

Relationships with colleagues are critical for women of color in STEM because they aid in their advancement and retention. In a study of over 6,800 tenure-track faculty — a third of whom were in STEM disciplines — Ponjuan and colleagues (2011) found that female and African American faculty were significantly less satisfied, compared to their white male colleagues, with their relationships to senior colleagues. Junior female STEM faculty also reported concerns with the relationships they had with similarly ranked colleagues in their departments, in particular reporting that they felt left out of the camaraderie that developed among young colleagues (Fox, 1996). Cross and Madsen's (1997) review of gender research demonstrates that women are more likely than men to desire relationships and connectedness with others. It may be that women faculty are more aware of the quality of interactions that take place in the STEM work environment and may place a higher value on those relationships (Callister, 2006).

In interviews with female faculty in STEM disciplines, Rosser (2004) found that the lack of camaraderie and inclusion in the department community does not necessarily improve as one moves up the professoriate rank ladder and into the role of full professor. In fact, for some women it worsens (Rosser, 2004) and may include "a lack of support from colleagues and rude or unsympathetic students" (CMPWASE, 2007, 98). In a survey of female faculty in tenured senior positions in science and engineering, women faculty reported feeling invisible and marginalized within their departments and excluded from participating in important decisions affecting the departments (MIT, 1999).

Data from the HERI survey probe several of these issues. Table A-2-2 shows that 69.7 percent of URM women feel their research is valued by faculty in their departments. Although it is a positive sign that over two-thirds of URM women feel their research is valued, it remains alarming that URM women are the least likely of any groups to share this sentiment, especially compared to Asian men (83.3 percent) and white men (79.3 percent). Within every racial group, women are less likely than men to feel that their research is valued by faculty in their departments. A second survey item reflects how much faculty feel they have to work to gain respect. Both URM (79.1 percent) and Asian women (80.9 percent) feel as though they have to work harder than colleagues to be perceived as a legitimate scholar. Interestingly, Asian men (74 percent) are also more likely to feel this is the case. This is indicative of how intersections of race and gender manifest differently and may be driven by STEM disciplinary contexts.

**Table A-2-2** Work Environment: Percent of STEM Faculty Answering "To some extent" or "To a great extent" to the Respective Statement

| | White | URM | Asian |
|---|---|---|---|
| **My research is valued by faculty in my department** | | | |
| Male | 79.3** | 77.0 | 83.3** |
| Female | 72.7 | 69.7 | 77.6 |
| **I have to work harder than my colleagues to be perceived as a legitimate scholar** | | | |
| Male | 52.4** | 60.1** | 74.0 |
| Female | 66.6* | 79.1 | 80.9 |

Note: Significant comparisons with URM females; *p <.05, **p<.01.

STEM disciplines dominated by males are perceived as more prestigious than those with more women (Hill et al., 2010; Rosser, 2004). Working in a male-dominated field, female STEM professionals are typically judged as being less competent than their male peers (Heilman et al., 2004). Unfortunately, research demonstrates that racial and gender bias influences the judgments of those evaluating the work and competency of female and underrepresented faculty throughout their STEM career, making it more likely that their abilities, leadership, research contributions, accomplishments, and roles will be undervalued (CMPWASE, 2007; Valian, 2006). Not surprisingly, white women and individuals from ethnic minority groups report that they must work harder than their white male peers to gain similar levels of recognition or status (Conley, 1998). The data presented in this paper confirm that such is the case among current STEM faculty.

**Bias and Sources of Stress**

Severe underrepresentation or "solo status" activates stereotyping in work and learning environments (Kanter, 1977; Thompson and Sekaquaptewa, 2002). Stereotyping also contributes to limited opportunities for those from stereotyped groups (Brown et al., 2003). Because incidents of biases—however small they may be—accumulate, they often translate to large differences in opportunities and advancement over the course of one's career (CMPWASE, 2007). Figure A-2-1 shows how STEM faculty compare regarding subtle discrimination as a source of stress. The data show that URM women of color (42.7 percent) and Asian women (40.3 percent) are more likely than other groups to report experiences of subtle discrimination. This is a clear illustration of the intersectional role race and gender play in the workplace experiences of those in the academy. Men from every racial/ethnic group are less likely than females to report subtle discrimination as a source of stress, and women of color (including Asians) are uniquely affected.

*APPENDIX A-2 WOMEN OF COLOR AMONG STEM FACULTY: EXPERIENCE IN ACADEMIA*

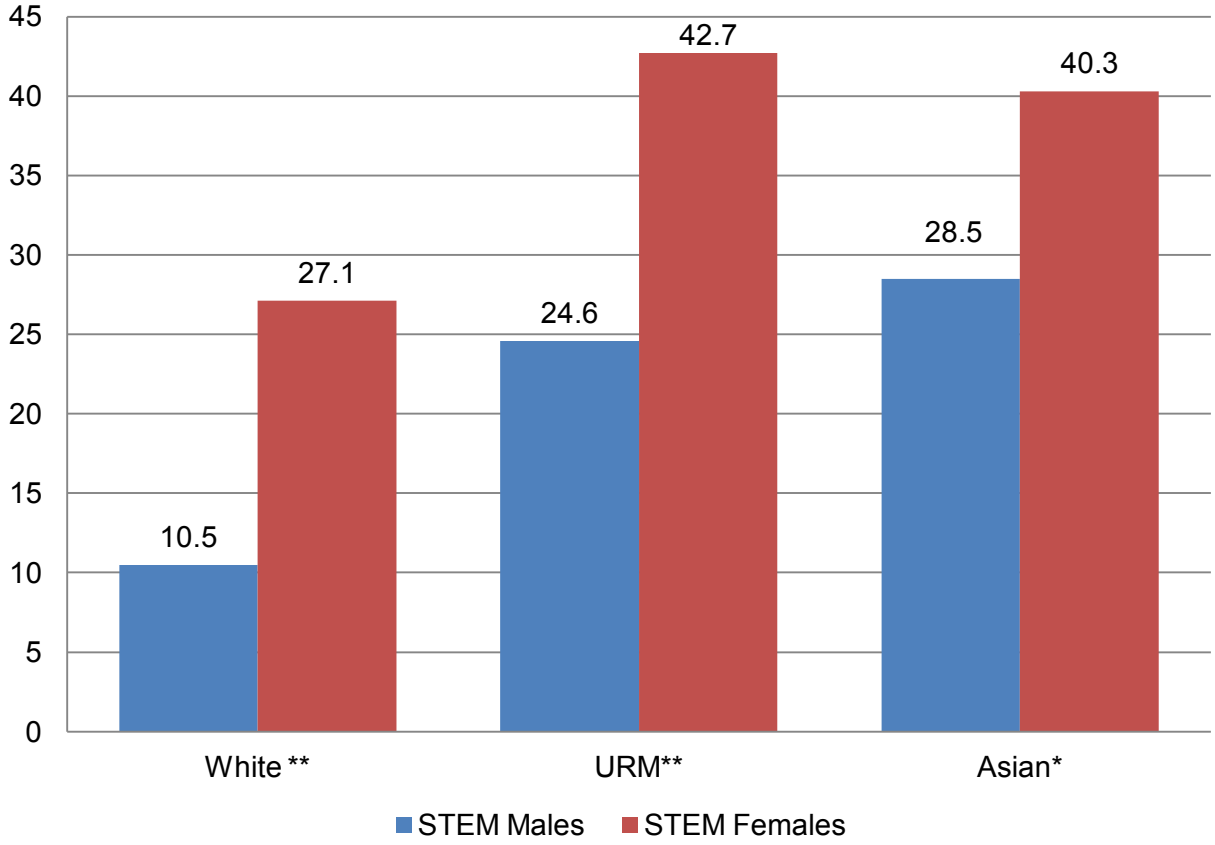


**Figure A-2-1.** Source of Stress in the Last Two Years: Subtle Discrimination (e.g., prejudice, racism, sexism) % Responding "Somewhat" or "Extensive".
Note: Significant male/female differences within group ** p=< .01; * <.05.
Source: HERI Faculty Survey.

It should be noted, however, that subtle discrimination is not the only or primary source of stress among underrepresented minority women faculty in STEM. National data have typically shown gender differences in sources of stress among faculty, and more recent research indicates that this is still largely the case (Hurtado et al., 2012b). Table A-2-3 shows the top sources of stress disaggregated for the first time by URM/white designation and gender among STEM faculty. The top sources of stress are ranked in descending order according to the proportion of individuals from the respective groups that marked having experienced "somewhat" or an "extensive" amount of stress in the last two years due to the stressor. Comparisons are drawn across the STEM faculty.

The top stressors for all faculty in the country, regardless of discipline, are *lack of personal time* and *self-imposed high expectations* (Hurtado et al., 2012b). The patterns indicate clear gender differences within URM faculty and white faculty on specific issues. Underrepresented minority women are significantly more likely than URM and white men to indicate *lack of personal time* as a key area of stress. Although there are many similarities in sources of stress between URM women and white women, a significantly greater proportion of white women identify *self-imposed expectations* as a source of stress compared to URM women;

URM women and men as well as white men are equally as likely to indicate self-imposed expectations as being a primary source of stress.

URM women are also significantly more likely than URM men (p=<.05) and white men (p=<.01) to report *managing household responsibilities* as a source of stress. Similarly, white women are more likely than men from both groups to report this as a source of stress. Over two-thirds of URM women report working with underprepared students and institutional budget cuts as a top source of stress; there are no significant differences across groups on these two issues, however. URM women are more likely (65.8 percent) than white men (57.9 percent) to report *personal finances* as a source of stress. They appear to share similar levels of stress from finances with URM men and white women. *Research and publishing demands* rank as a top stressor for URM women (61.8 percent) as it does for the other groups. White men are significantly more likely than URM women to cite *institutional procedures and red tape* as a source of stress.

Surprisingly, white women (68.3 percent) are more likely than URM women (61 percent) to report *teaching load* and *students* (69.6 percent vs. 58.5 percent) as sources of stress. Although this data demonstrates that students can be a source of work stress for women of color, other studies have shown how working with students can also be a rewarding part of faculty life. For example, women of color in STEM attributed mentoring younger generations of scientists, especially other women and people of color, as an important contributor to their persistence and sense of purpose (Liefshitz et al., 2011). Women of color who worked in STEM fields in which women were severely underrepresented (e.g., astrophysics) considered mentoring students as a personally rewarding experience because it provided them with a much needed sense of connection and strength (Liefshitz et al., 2011).

**Table A-2-3** Percentage of Faculty by Race Responding Having Experienced "Somewhat" or an "Extensive" Amount of Stress in the Last Two Years Due to the Following Stressors:

| Top ten stressor for URM female faculty in STEM | URM women | URM men | White women | White men |
|---|---|---|---|---|
| Lack of personal time | 86.4 | 69.7** | 88.5 | 76.8 |
| Self-imposed high expectations | 82.4 | 79.4 | 88.0* | 79.5 |
| Managing household responsibilities | 79.0 | 66.8* | 80.5 | 68.5** |
| Working with underprepared students | 69.9 | 63.3 | 74.5 | 69.6 |
| Institutional budget cuts | 66.0 | 64.2 | 66.5 | 64.0 |
| Personal finances | 65.8 | 65.7 | 59.6 | 57.9* |
| Research or publishing demands | 61.8 | 61.9 | 65.0 | 63.8 |
| Institutional procedures and red tape | 61.0 | 62.6 | 67.2 | 68.8* |
| Teaching load | 61.0 | 56.3 | 68.3* | 60.0 |
| Students | 58.5 | 51.7 | 69.6** | 60.1 |

Note: Significantly different from URM women faculty. *p<.05, **p<.01.

**Responsibilities and Research**

Because of their small numbers, women of color are typically overburdened with an expectation to be on more committees or to advise more students than their white or male counterparts, although these service activities are not particularly rewarded during promotion and tenure considerations (Edmondson Bell and Nkomo, 2001; Rosser, 2004; Thompson, 2000).

*APPENDIX A-2 WOMEN OF COLOR AMONG STEM FACULTY: EXPERIENCE IN ACADEMIA*

More time engaging in service activities may translate to less time for research. Table A-2-4 shows the percent of STEM tenure-track faculty spending five or more hours a week on specific tasks related to the faculty role. The data appear to confirm previous research that URM women spend more time in *committee work or meetings* and *advising/counseling students* than white men. URM women are similar to minority males and white and Asian females, however, in the amount of time they spend on these activities. One particularly troubling finding is that women of color appear to spend less time on research and writing than their male colleagues from all groups. Further analyses revealed significant differences in the amount of time spent on research and writing between women of color and men (URM, white, and Asian) at the full professor and assistant professor ranks, but no significant differences at the associate professor level. White and Asian women are similar to URM women on time spent on advising, committee work, and research, but differ on reported time spent on teaching. Specifically, a higher percentage of white women report spending five or more hours per week on scheduled teaching and preparing for teaching than other STEM faculty.

**Table A-2-4** Percent of STEM Tenure-Track Faculty Working 5+ Hours/Week on Respective Task.

| | White | | URM | | Asian | |
|---|---|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **Advising counseling students** | 38.5* | 43.6 | 42.7 | 48.5 | 43.2 | 44.3 |
| **Committee work or meetings** | 36.1** | 43.8 | 38.6 | 48.5 | 32.3** | 40.8 |
| **Research and scholarly writing** | 59.8* | 44.9 | 66.2** | 49.5 | 73.3* | 60.2 |
| **Scheduled teaching** | 74.7 | 77.4* | 74.1 | 67.3 | 66.5 | 74.6 |
| **Preparing for teaching** | 79.8 | 84.1* | 78.5 | 76.4 | 76.7 | 82.1 |

Notes: Significant differences with URM females. *p<.05, **p<.01.

Opportunities to engage in valued departmental and workplace assignments are a critical factor in the professional advancement of women of color in STEM, because it gives them exposure to the experiences they need to be considered a competitive applicant to other positions (Liefshitz et al., 2011). Differential access to opportunities and resources is a barrier to research and publication productivity and may be the root of the productivity gap between men and women faculty (Xie and Shauman, 1998). Specifically, when institution type, teaching load, funding, and research assistance are controlled for, the gender productivity gap disappears (Xie and Shauman, 1998). Sex disparities in funding, physical space, and staff support have an important influence on the career satisfaction and advancement of female faculty working in STEM disciplines (Brown et al., 2003).

**Satisfaction with Compensation**

Scales are often used with faculty data to compare groups on average levels of satisfaction across several correlated items, which are constructed using Item Response Theory. The compensation scale (mean set at 50) is a unified measure of faculty responses to satisfaction on six survey items that address salary, retirement benefits, teaching load, job security, opportunities for scholarly pursuits, and prospects for career advancement. Figure A-2-2 shows the responses by rank, race, and gender. Underrepresented minority women at the full professor level (red line) are least satisfied with their compensation compared with any other group. They

are similar to URM males in below-average satisfaction at the associate professor level. In contrast, white males are most satisfied with compensation at every rank. For every group, lecturers and instructors are the least satisfied with compensation, with URM males being especially dissatisfied. These findings are cause for concern, considering that job dissatisfaction is often a precursor to leaving academia.

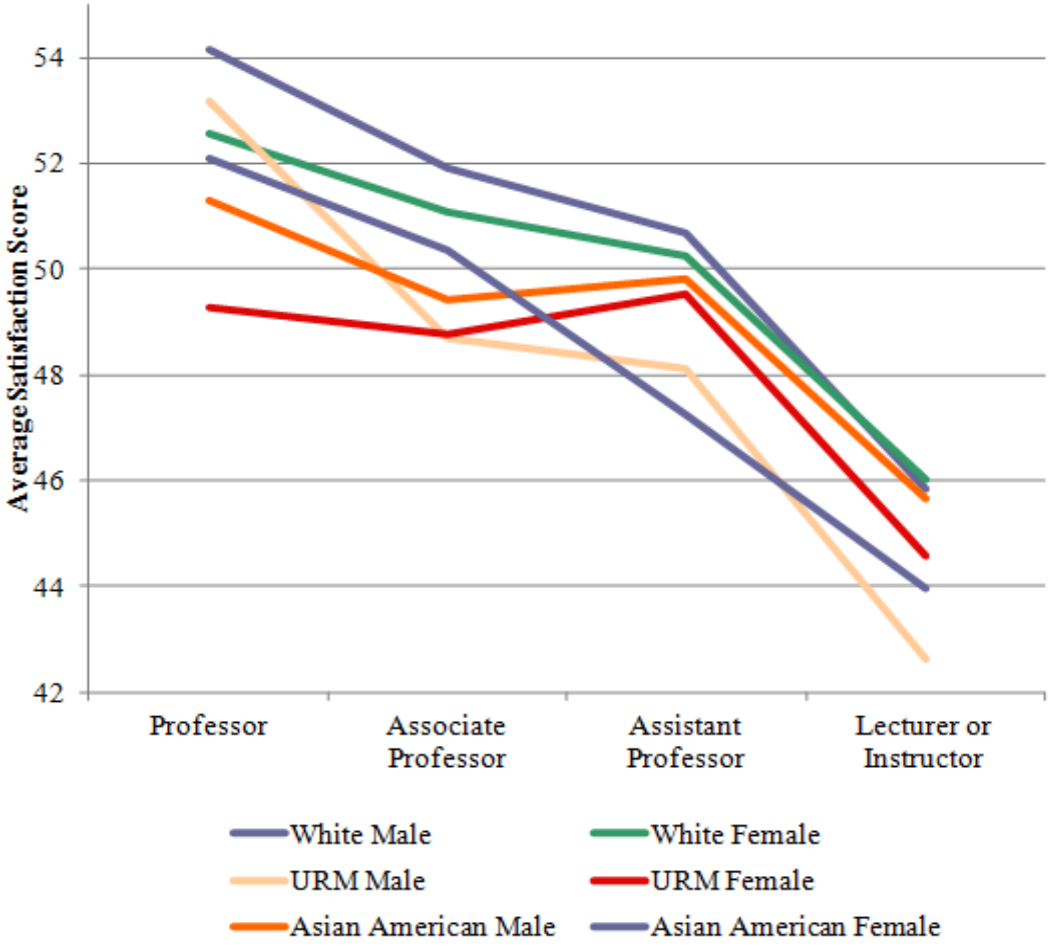


**Figure A-2-2** Faculty Satisfaction with Compensation by Academic Rank.

A severe lack of women of color in senior faculty positions partly reflects the fact that men are more likely to be tenured in STEM disciplines than women, even after controlling for factors such as year since degree was attained, discipline, parental status, and other important variables (Long, 2001). Women faculty in STEM are also promoted at a slower pace than men and have a smaller probability of reaching the highest academic rank, especially at Research 1 institutions (CMPWASE, 2007). These realities may partially explain why female faculty holding professorial rank in various fields across the academy express a lack of confidence in the equity of the tenure process, in which they acknowledge that their male colleagues do not understand the sacrifices they make to remain devoted to their career (Wasburn, 2004). The data we present in this paper adds to this narrative, in that they reveal considerably less satisfaction with compensation among tenured URM women in STEM disciplines.

**Work–Life Balance**

Another complication for women faculty is the significant tension that exists between a woman's personal life and a STEM academic career model that rewards those who demonstrate an unlimited availability to work, even if this comes at the expense of a balanced personal life or one's family (Brown et al., 2003; Trower, 2008). Falling short of this expectation by taking time off for personal or family reasons or placing a great amount of attention on another responsibility—like children or elderly relatives — puts one at risk of appearing less serious about her career (Rosser, 2004). Not surprisingly, few women on the tenure track take advantage of the benefits to which they are entitled —like those that can slow the tenure clock —out of fear that it will hamper their career progression (Wasburn, 2004). The HERI STEM faculty data show that 21.2 percent of URM women reported that they interrupted their professional career for one year or more due to family reasons. This is not significantly different than white women (18.8 percent) or Asian women (13.3 percent). We do not know, however, if they stopped the tenure clock during this interruption or if the interruption took place at a key transition point, like after having successfully reached tenure. Career interruption for family reasons was significantly less prevalent among men: Only 6.8 percent of URM, 4.1 percent of white, and 3.1 percent of Asian men reported that they did so.

Indeed, women are more concerned than their male colleagues about a lack of institutional support for having a family while on the tenure track (Trower and Chait, 2002). In a questionnaire distributed to female scientists and engineers, almost three quarters of participants reported that one of the most significant challenges facing women scientists today as they plan their careers is balancing work with family responsibilities (Rosser, 2004). Work–life balance issues also have a great influence on the family planning decisions of female professors (Rosser, 2004) and eventually take a toll on career satisfaction (Trower, 2008), especially for women of color who are likely to have more responsibilities to extended family and to their communities (Edmondson Bell and Nkomo, 2002). Women who left the sciences cite difficulty managing both work and family responsibilities as one of the main factors influencing their decision to leave (Preston, 2004). Alternatively, having a balanced life by engaging in intellectual, creative, and enjoyable activities out of the realm of science helped women of color in STEM disciplines cope with the pressures they faced in the workplace and promoted their achievement in science (Liefshitz et al., 2011).

## Conclusion

Understanding the factors that reinforce the cycle of inequality in career mobility, satisfaction, and work–life opportunity is the first step in creating solutions that will advance women of color in STEM. Professional isolation, irrespective of field and sex, is a common factor influencing faculty decisions to leave an institution (Hill et al., 2010; UCB, 2001). Among female faculty members in science and engineering fields, in particular, lower levels of job satisfaction and higher intentions to quit is a reality with which post-secondary institutions must contend (Callister, 2006). Fortunately these outcomes are mediated by department climate (Callister, 2006), suggesting that a supportive work environment can go a long way toward improving the career satisfaction of women of color in academia (Wasburn, 2004). Attrition of women of color can be prevented and addressed through activities that overcome the solo status associated with severe underrepresentation in a field. Further, the contexts in which women of color work and learn can be key moderators of success, particularly those that build social and

academic networks within the department and across the institution. These networks are essential to providing information about how to navigate an academic career and create pathways to resources (e.g., funding, knowledge, technology).

From an institutional standpoint, the tenure and reward system and processes must be transparent and must accommodate more woman-centered policies regarding family and work–life issues. National data show that women are not only more likely than male faculty to experience more stress related to household and family responsibilities, but also more likely to experience stress from providing care for an elderly parent (Hurtado et al., 2012b). These demands are a fact of life for women, and flexible campus policies remain necessary.

Institutions must undertake specific initiatives to improve the work–life conditions for women of color and women in the academy. First, centrally conducted salary equity studies create an institution-wide check on disparities within departments. Provosts can request that deans and department chairs review the gaps associated with specific salary differences to consider corrective action. Second, studies can be conducted of women faculty who are considering leaving the institution and/or have left in order to identify patterns in a local context and potential institutional policy solutions. Third, funding for activities should be provided to assist in workshops and intellectual collaborations that reduce isolation and address key problems associated with underrepresentation. Finally, information about zero tolerance policies and appropriate procedures for dealing with harassment and incidents of discrimination should be widely disseminated on a campus. Faculty are now required to participate in sexual harassment training at many public institutions, but additional training models should be constructed to identify how racial bias operates in academic settings. These policies and procedures should be sensitive to the safety and career concerns of women of color in the academic workplace.

By taking these first steps and others, institutions demonstrate a serious commitment to retaining women of color in STEM throughout the different stages of their career trajectory. This should be a high priority at the institutional and national level. The women of color in academia today are the survivors of many encounters with difference and experiences shaped by underrepresentation. We need to do all we can to retain them so that they are available for the next generation of women and minorities entering science.

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# Appendix B

# Agenda and List of Participants

## Conference Agenda

| Thursday, June 7, 2012 | |
|---|---|
| **8:30 AM**<br>**Great Hall** | **Breakfast and Registration** |
| **9:00 AM**<br>**Auditorium** | **Welcome**<br>*Lance A. Davis*, Executive Officer, National Academy of Engineering |
| **9:10 – 10:10 AM**<br>**Auditorium** | **Session I: Statistics on the Career Pathways of Women of Color Faculty in Academia**<br>**Moderator:** *Lydia Villa-Komaroff*, Chief Scientific Officer, Cytonome/ST, LLC and Co-Chair, Committee on Advancing Institutional Transformation for Minority Women in Academia |
| | **Where We Stand: Commissioned Research**<br>• *Donna Ginther*, Professor of Economics, University of Kansas and *Shulamit Kahn*, Associate Professor, School of Management, Boston University<br>• *Sylvia Hurtado*, Professor, University of California Los Angeles and Director, Higher Education Research Institute and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia |
| **10:10 – 10:30 AM**<br>**Auditorium** | **Public Discussion** |
| **10:30 – 10:45 AM** | **Break** |
| **10:45 – 11:45 AM**<br>**Auditorium** | **Session II: Putting a Face to a Statistic: A Panel of Women of Color in Academia**<br>**Moderator:** *Joan Bennett*, Professor of Plant Biology and Pathology, Rutgers University and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia |
| | • *Evelynn Hammonds*, Dean of Harvard College, Harvard University<br>• *Gilda Barabino*, Professor of Biomedical Engineering and Associate Chair for Graduate Studies, Georgia Institute of Technology<br>• *Patricia Taboada-Serrano*, Assistant Professor, Chemical and Biomedical Engineering, Rochester Institute of Technology<br>• *Tamisha Y. Vaughan*, Postdoctoral Research Fellow, School of Medicine, Emory University |

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|---|---|
| **11:45 – 12:15 PM**<br>**Auditorium** | **Session III: Minority Women and Multiple Marginality: Gender, Race and Equity in Science Education and Research**<br>**Moderator:** *Florence Bonner*, Senior Vice President, Research and Compliance, Howard University and Co-Chair, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speaker:** *Joan Williams*, Distinguished Professor of Law & Director of the Center for WorkLife Law, College of the Law, University of California, Hastings |
| **12:15 – 12:30 PM**<br>**Auditorium** | **Public Discussion** |
| **12:30 – 1:30 PM**<br>**Great Hall** | **Lunch** |
| **1:30 -3:00 PM** | **Session IV: Concurrent Sessions** |
| **Member's Room** | **Concurrent Session 1: What Data Can & Cannot Tell Us?**<br>**Moderator:** *Alicia Carriquiry*, Professor of Statistics, Iowa State University and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speakers:**<br>• *Donna Ginther,* Professor of Economics, University of Kansas<br>• *Shulamit Kahn*, Associate Professor, School of Management, Boston University<br>• *Stephen Cohen,* Chief Statistician, National Center for Science and Engineering Statistics, National Science Foundation<br>**Rapporteur:** *Trisha Vickrey,* doctoral student in chemistry, University of Virginia |
| **Board Room** | **Concurrent Session 2: Using a Legal Framework Successfully**<br>**Moderator:** *Joseph DeSimone*, Distinguished Professor of Chemistry and Chemical Engineering, University of North Carolina, Chapel Hill and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speaker:** *Debra Rolison*, Head, Advanced Electrochemical Materials Section, Naval Research Laboratory<br>**Rapporteur:** *Victoria Gunderson*, former Christine Mirzayan Fellow, The National Academies |
| **Lecture Room** | **Concurrent Session 3: How Does Gender Bias Differ by Race and Ethnicity?**<br>**Moderator:** *Vivian Pinn,* Director Emerita, Office of Research on Women's Health, National Institutes of Health and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speaker:** *Joan Williams*, Distinguished Professor of Law & Director of the Center for WorkLife Law, College of the Law, University of California, Hastings<br>**Rapporteur:** *Gretchen Stanton*, doctoral student in chemistry, University of Pennsylvania |

| | |
|---|---|
| **Room 120** | **Concurrent Session 4: Where Are Women of Color: Contingent & Administrative Positions in Academia?**<br>**Moderator:** *Anthony DePass*, Assistant Vice President, Research Development and Director, MBRS Program, Long Island University and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speaker:** *Cherilynn Shadding*, Director of Outreach and Community, School of Medicine, Washington University<br>**Rapporteur:** *Danielle Haney*, Postdoctoral Researcher, School of Medicine, University of Pennsylvania |
| **Room 250** | **Concurrent Session 5: Work-life and Career Issues for Women of Color.**<br>**Moderator:** *Florence Bonner*, Senior Vice President, Research and Compliance, Howard University and Co-Chair, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Speaker:** *Sylvia Hurtado*, Professor, University of California Los Angeles and Director, Higher Education Research Institute and Member, Committee on Advancing Institutional Transformation for Minority Women in Academia<br>**Rapporteur:** *Tanya Figueroa*, doctoral student, Higher Education Research Institute, University of California, Los Angeles |
| **3:00 – 3:30 PM**<br>**Auditorium** | **Plenary: Concurrent Sessions Report Out & Public Discussion** |
| **3:30 – 4:30 PM**<br>**Auditorium** | **Session V: Supporting Women of Color through Professional Societies**<br>**Moderator:** *Patrick L. Valdez*, Director, College Access and Success Initiatives, Association of Public and Land-Grant Universities |
| | Panel discussion with representatives from professional societies<br>• *Judit Camacho*, Executive Director, Society for Advancement of Chicanos and Native Americans in Science (SACNAS)<br>• *Marian Johnson-Thompson*, Chair, Committee on Microbiological Issues Impacting Minorities, American Society for Microbiology and Professor Emerita of Biology and Environmental Sciences, University of the District of Columbia<br>• *Suzanne Bennett Johnson,* President, American Psychological Association and Distinguished Research Professor, College of Medicine, Florida State University<br>• *Linette Watkins*, Former Chair, Committee of Minority Affairs, American Chemical Society and Professor, Department of Chemistry and Biochemistry, Texas State University – San Marcos |
| **4:30 – 5:00 PM**<br>**Auditorium** | **Public Discussion** |
| **5:00 – 6:00 PM** | **Informal Networking Session** |

*APPENDIX B AGENDA AND LIST OF PARTICIPANTS*

| Friday, June 8, 2012 | |
|---|---|
| **9:00 – 9:15 AM**<br>**Auditorium** | **Welcome**<br>• *Joseph DeSimone*, Member, Committee on Advancing Institutional Transformation for Minority Women in Academia and Distinguished Professor of Chemistry and Chemical Engineering, University of North Carolina, Chapel Hill<br>• *Lauren Van Wazer*, Assistant Director for Cyber Security, Office of Science and Technology Policy**,** The White House |
| **9:15 -10:15 AM**<br>**Auditorium** | **Session VI: Impact of Federal Agencies**<br>**Moderator:** *Bernadette Gray-Little*, Chancellor, University of Kansas |
| | **Leading by Example**<br>• *Jeri L. Buchholz*, Chief Human Capital Officer, NASA<br>• *Muriel Poston*, Director, Human Resource Division, Education Directorate, National Science Foundation<br>• *Janine Clayton*, Director, Office of Research on Women's Health, National Institutes of Health<br>• *Jim Johnson,* Director, National Center for Environmental Research, Office of Research and Development, Environmental Protection Agency |
| **10:15 – 11:15 AM**<br>**Auditorium** | **Session VII: Successful Practices and Strategies for Institutional Transformation**<br>**Moderator:** *Kelly Mack*, Program Director, ADVANCE Program, National Science Foundation |
| | Federal initiatives: ADVANCE and other programs<br>• *Loretta Moore*, Professor, Computer Science Department & Interim Dean, School of Science & Technology, Jackson State University<br>• *J. Wayne Jones*, Arthur F. Thurnau Professor, Materials Science and Engineering, University of Michigan<br>• *Joan Y. Reede*, Dean, School of Medicine, Harvard University |
| **11:15 – 11:30 AM**<br>**Auditorium** | **Public Discussion** |
| **11:30 – 11:45 AM** | **Break** |
| **11:45 – 12:30 PM**<br>**Auditorium** | **Closing Session: Next Steps**<br>• *Shirley Malcom*, Head, Directorate for Education and Human Resources Programs, American Association for the Advancement of Science (AAAS) |
| **12:30 – 1: 30 PM**<br>**Great Hall** | **Networking Lunch & Adjournment** |

## List of Participants

| Name | Organization |
|---|---|
| Diane Adger-Johnson | National Institutes of Health |
| Safoah Agyemang | The National Academies |
| Rashada Alexander | National Institutes of Health |
| Todd Allen | Georgia Pacific |
| Yolanda Anderson | North Carolina Central University |
| Jeanne Arnold | Grand Valley State University |
| TaShara Bailey | University of Michigan National Center for Institutional Diversity |
| Tiffani Bailey Lash | National Institutes of Health |
| Gilda Barabino | Georgia Tech and Emory University |
| Natalie Batmanian | Rutgers University |
| Crystal Bedley | Rutgers University |
| Bettina Beech | Wake Forest School of Medicine |
| Anthony Belvin | US Department of Energy |
| Jabbar R. Bennett | Brown University |
| Joan Bennett | Rutgers University |
| Juliana Blome | National Institute of General Medical Sciences |
| Michelle Boissiere | Xavier University of Louisiana |
| Stephanie Bonnes | American Political Science Association |
| Florence Bonner | Howard University |
| Gillian Bowser | Colorado State University |
| Cheryl Anne Boyce | National Institutes of Health |
| Rosalina Bray | National Institutes of Health |
| Madeleine Brehaut | National Academies of Science |
| Alfiee Breland-Noble | Georgetown university medical center |
| Tiffani Bright | Self-employed |
| Robin Broughton | National Institutes of Health |
| Angela Brown | Washington University School of Medicine |
| Marino Bruce | Gramercy Research Group |
| Amanda Bryant-Friedrich | Association for Women in Science |
| Jeri Buchholz | National Aeronautics and Space Administration |
| Jamika Burge | The Defense Advanced Research Projects Agency |
| Reeshemah Burrell | National Science Foundation |
| Erin Cadwalader | Association for Women in Science |
| Judit Camacho | SACNAS |
| Maria Teresa Canto | National Institutes of Health |
| Melissa Carl | American Society of Mechanical Engineers |
| Nikoosh Carlo | National Science Foundation |
| Alicia Carriquiry | Iowa State University |
| Eun-Joo Chang | Society for Neuroscience |
| Sara Cho Kim | George Washington University |
| Vivienne Chin | The National Academies |
| Shari Clarke | Marshall University |
| Taffye Clayton | University of North Carolina- Chapel Hill |
| Janine Clayton | National Institutes of Health |
| Steven Cohen | National Science Foundation |
| Brooke Coley | National Science Foundation |

*APPENDIX B AGENDA AND LIST OF PARTICIPANTS*

| | |
|---|---|
| Johanna Contreras | Mount Sinai Hospital |
| Deanna Crouse | Howard University |
| Lance Davis | National Academy of Engineering |
| Paula Davis | University of Pittsburgh |
| Lisa De las Fuentes | Washington University |
| Nzola De Magalhaes | Rochester Institute of Technology |
| Saundra DeLauder | North Carolina Central University |
| Myra Derbyshire | National Institutes of Health |
| Anthony DePass | Long Island University |
| Joseph DeSimone | University of North Carolina, Chapel Hill |
| Jennifer Diascro | American Political Science Association |
| Catherine Didion | The National Academies |
| Earnestine Easter | National Science Foundation |
| Uchenna Egenti | East Tennessee State University |
| Ekele Enyinnaya | University of Virginia |
| Abby Estabillo | The National Academies |
| Geriel Ettienne-Modeste | Army Research Laboratory, Altus Engineering |
| Wanda Eugene | Vole Lib Research Institute |
| Deneen Evans | Radford University |
| Brendlyn Faison | US Environmental Protection Agency |
| Raenita Fenner | Loyola University Maryland |
| Tanya Figueroa | UCLA Higher Education Research Institute |
| Carolyn Fisher | Henry M. Jackson Foundation for the Advancement of Military Medicine |
| Tamako Garcia | Henry M. Jackson Foundation |
| Heather Garvey | American Society for Microbiology |
| Kristine Garza | Society for Advancement of Chicanos and Native Americans in Science |
| Kristen Gates | Buck Institute for Research on Aging |
| Rosario Gerhardt | Georgia Institute of Technology |
| Donna Ginther | University of Kansas |
| Paula Goodwin | National Institutes of Health |
| Christine Grant | North Carolina State University: College of Engineering |
| Faren Grant | University of Maryland Baltimore County |
| Bernadette Gray-Little | University of Kansas |
| Cobren Greer | National Institutes of Health |
| Vickie Gunderson | National Nanotechnology Coordination Office |
| Jessica Harris | Space Telescope Science Institute |
| Evelynn Hammonds | Harvard University |
| Monique Head | Morgan State University |
| Deneen Hendrick | Camden County College |
| Apriel Hodari | Council for Opportunity in Education |
| Katherine Hoffman | American Chemical Society |
| Jarita Holbrook | National Society of Black Physicists |
| Ann Hornschemeier | NASA Goddard Space Flight Center |
| Avril Houston | Health Resources and Services Administration |
| Elizabeth Howell | Mount Sinai School of Medicine |
| Yvette Huet | University of North Carolina- Charlotte |
| Sylvia Hurtado | University of California, Los Angeles |
| Jedidah Isler | Yale University |
| Rachel Ivie | American Institute of Physics |

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|---|---|
| Sharon Jackson | National Institutes of Health |
| Wei Jing | The National Academies |
| Kay Johnson | National Institutes of Health |
| Suzanne Johnson | American Psychological Association |
| Cathee Johnson Phillips | National Postdoctoral Association |
| Marian Johnson-Thompson | University of the District of Columbia |
| Tamecia Jones | Purdue University, Engineering Education |
| Elva Jones | Winston-Salem State University |
| James Wayne Jones | University of Michigan |
| Michelle Jones-London | National Institutes of Health |
| Mary Juhas | The Ohio State University |
| Anna Kaatz | UW-Madison Center for Women's Health Research |
| Webe Kadima | State University of Ney York at Oswego |
| Shulamit Kahn | Boston University |
| Hideko Kaji | Thomas Jefferson University |
| Margaret Kanipes | North Carolina A&T State University |
| Electron Kebebew | National Institutes of Health |
| Dean Kern | NASA Goddard Space Flight Center |
| Peter Kozel | National Institutes of Health |
| Cheryl Leggon | Georgia Institute of Technology |
| Nicole Lewis | University of Kentucky |
| Tene Lewis | Yale School of Medicine |
| Tamara Lewis Johnson | National Institutes of Health |
| Li Ma | University of Maryland, College Park |
| Kelly Mack | National Science Foundation |
| Arlene Maclin | Bennett College |
| Lynnette Madsen | National Science Foundation |
| Dionne Makila | Association of Universities for Research in Astronomy |
| Shirley Malcom | American Association for the Advancement of Science |
| Ernest Marquez | SACNAS |
| Karin Matchett | K.E. Matchett, LLC |
| Maya Matheny | University of Maryland School of Medicine |
| Aisha Mays | Mount Sinai Medical Center - Division of Adolescent Medicine |
| Tawanna Meadows | National Institutes of Health |
| Shari Miles-Cohen | American Psychological Association |
| Khadijah Mitchell | Johns Hopkins School of Medicine |
| Loretta Moore | Jackson State University |
| Larniece McKoy Moore | Montgomery County Commission for Women |
| Lynn Morin | National Institutes of Health |
| Patrice Moss | Trinity Washington University |
| Carmen Moten | National Institutes of Health |
| Diana Nemergat | National Science Foundation |
| Christine O'Brien | Fellowships Office, National Academies |
| Camellia Okpodu | Norfolk State University |
| Tiffany Omokanwaye | Catholic University of America |
| Mayowa Omokanwaye | Massachusetts Institute of Technology |
| Mahasin Osman | Brown |
| Roland Owens | National Institutes of Health |
| Rosaura Padilla | University of Pennsylvania |
| Dina Paltoo | National Institutes of Health |
| Bonita Parker | JBS International |

*APPENDIX B AGENDA AND LIST OF PARTICIPANTS*

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|---|---|
| Robin Parsel | Institute of Medicine |
| Rehana Patel | Wesleyan University |
| Vivian Pinn | National Institutes of Health |
| Muriel Poston | National Science Foundation |
| Autumn Reed | University of Maryland, Baltimore County |
| Joan Reede | Harvard University |
| Debra Rolison | US Naval Research Laboratory |
| Forough Saadatmand | Howard University |
| Christie Sahley | Purdue University |
| Darlene Saporu | The Ohio State University-ADVANCE Program |
| Marcia Scott | National Institutes of Health |
| Cherilynn Shadding | Washington University School of Medicine |
| Juanita Sharpe | Chicago State University |
| Vanessa Sheppard | Georgetown University |
| Mariela Shirley | National Institutes of Health |
| Bette Siegel | National Aeronautics and Space Administration |
| Rhonda L. Smith | Howard University |
| Sonya Smith | Howard University Department of Mechanical Engineering |
| Patricia Sokolove | National Institutes of Health |
| Melissa Soto | Michigan State University |
| Ingrid St Omer | University of Kentucky |
| Gretchen Stanton | University of Pennsylvania, Chemistry Department |
| Adrienne Starks | National Institutes of Health |
| Ernest C. Steele, Jr. | Morgan State University |
| Krystnell Storr | AAAS Science Magazine |
| Deborah Stroman | University of North Carolina |
| Karen Stubaus | Rutgers, The State University of New Jersey |
| Marilyn Suiter | National Science Foundation |
| Sandra Talley | Nuclear Regulatory Commission |
| Valerie Taylor | Department of Computer Science and Engineering |
| Constance Thompson | The American Society of Civil Engineers |
| Patricia Toboada-Serrano | Rochester Institute of Technology |
| Tiffany Townsend | American Psychological Association |
| Reiko Toyama | National Institutes of Health |
| Elizabeth Travis | MD Anderson Cancer Center, Women Faculty Programs |
| Renetta Tull | The Graduate School at University of Maryland Baltimore County |
| Patrick L. Valdez | Association of Public and Land-Grant Universities |
| Arti Varanasi | Advancing Synergy |
| Noelle Vargas | Meyerhoff Alumnus Graduate |
| Tamisha Vaughn | Emory University |
| Tonia Venters | NASA Goddard Space Flight Center |
| Idalis Villanueva | University of Maryland-College Park |
| Lydia Villa-Komaroff | Cytonome/ST. LLC |
| Wanda Ward | National Science Foundation |
| Linette Watkins | American Chemical Society |
| Elizabeth Wayne | Cornell University |
| Sheldon Weinbaum | The City College of New York |
| Consuelo Wilkins | Meharry Vanderbilt Alliance |
| ClarLynda Williams-DeVane | North Carolina Central University |
| Karen Patricia Williams | Michigan State University - ADVANCE |
| Joan Williams | UC Hastings College of the Law |

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|---|---|
| Keren Witkin | National Institutes of Health |
| Cecelia Wright Brown | University of Baltimore |
| Lilian Wu | International Business Machines (IBM) |
| Fuliang Xie | East Carolina University |
| Ruth Zambrana | University of Maryland |

# Appendix C

## Biographies of Speakers

*(Affiliations and titles listed at the time of the conference)*

### June 7, 2012

### Welcome

***Lance A. Davis*** (NAE member) is the executive officer of the National Academy of Engineering. Under a Congressional charter, the Academy provides advice to the federal government, when requested, on matters of science and technology. As executive officer, Davis is the chief operating officer of the Academy, responsible for the program, financial and membership operations of the Academy, reporting to the president.

Prior to joining the Academy, Davis served as deputy director for defense research and engineering (laboratory management and technology transition) at the Pentagon from 1994 to 1999. In this capacity, he exercised oversight responsibility for the $11B DOD laboratory system and the dual use and technology transfer activities of the DOD. He chaired the Lab Consolidation Working Group charged with restructuring the DOD lab system and the Affordability Task Force charged with balancing the cost/performance equation in Defense Science and Technology. Other major activities included the Quadrennial Defense Review, Lab Quality Improvement Program, Lab Diversification Program, Small Business Innovation Research, Industry IR&D, Manufacturing Science and Technology, and the Defense Technical Information Center. Davis spent the majority of his career in industry at Allied-Signal Inc. He joined the then-Allied Chemical as a research scientist in 1968 and moved through a succession of R&D management positions leading to appointment as vice president of corporate research and development in 1984. He continued in this capacity until joining the Defense Department in 1994. As vice president of R&D, he was responsible for a corporate staff of up to 450 with an annual expense budget in current dollars of about $100 million and a capital budget of $15 million, engaged in research and new product development related to metals, ceramics, crystal growth, electro-optics, device fabrication, thin film deposition, polymer chemistry, engineered plastics, fibers and films, composites, and biotechnology.

Davis is an experienced leader in execution and management of complex research, engineering, process, and product development for materials, components, and systems; in technology policy development and execution on the national level; and in team building, total quality management/business process reengineering, and technology transition. Davis graduated Summa cum Laude from Lafayette College in 1961 with a B.S. in metallurgical engineering. He received a master of engineering degree in 1963 and a Ph.D. in engineering and applied science from Yale University in 1966. He spent two years as a postdoctoral fellow at Yale before joining Allied. Davis is a member of Phi Beta Kappa and Tau Beta Pi. He was elected to the National Academy

of Engineering in 1992 and received the Defense Manufacturing Excellence Award from the Multi-Association Industry Affordability Task Force in December 1999.

**Session I: Statistics on the Career Pathways of Women of Color Faculty in Academia: Where We Stand: Commissioned Research**

**MODERATOR:**
***Lydia Villa-Komaroff*** is a member of the board of directors and chief scientific officer at Cytonome/ST, LLC and a member of the board of directors of the Massachusetts Life Sciences Center. During her 20-year research career, she held positions at the Massachusetts Institute of Technology (MIT), Harvard University, University of Massachusetts Medical School, and Harvard Medical School. Her research was focused on molecular biology of protein synthesis, protein processing, and developmental neuroscience. As a science administrator, she served as vice president for research at Northwestern University in Illinois and vice president for research and chief operating officer of Whitehead Institute for Biomedical Research in Cambridge, MA. Villa-Komaroff has served on several NRC committees. She is a member of the Committee on Women in Science, Engineering, and Medicine (CWSEM) and was a member of the Committee on U.S. Competitiveness: Underrepresented Groups and Expansion of the Science and Engineering Workforce Pipeline. She was elected to a 4-year term on the board of directors of AAAS and was non-executive chair of the board of directors of Transkaryotic Therapies, Inc. Villa-Komaroff received her A.B. from Goucher College and her Ph.D. from MIT.

**SPEAKERS:**
***Donna K. Ginther*** is a professor of economics and the director of the Center for Science Technology & Economic Policy at the Institute for Policy & Social Research at the University of Kansas. Prior to joining the University of Kansas faculty, she was a research economist and associate policy adviser in the regional group of the research department of the Federal Reserve Bank of Atlanta from 2000 to 2002, and she taught at Washington University from 1997 to 2000 and at Southern Methodist University from 1995 to 1997. Her major fields of study are scientific labor markets, gender differences in employment outcomes, wage inequality, scientific entrepreneurship, and children's educational attainments. Ginther has been published in several journals, including the *Journal of the American Statistical Association, Journal of Economic Perspectives, Demography,* and the *Papers and Proceedings of the American Economic Association.* She has also received research funding from the National Science Foundation, the National Institutes of Health, and the Kauffman Foundation. She is currently a member of the board of the Committee on the Status of Women in the Economics Profession of the American Economic Association, and a member of the board of trustees of the Southern Economic Association. A native of Wisconsin, Ginther received her doctorate in economics in 1995, master's degree in economics in 1991, and bachelor's degree in economics in 1987, all from the University of Wisconsin-Madison.

***Shulamit Kahn*** has been at Boston University (BU)'s School of Management since 1987. She received her Ph.D. from the Massachusetts Institute of Technology (MIT) in economics in 1983 and taught at the University of California, Irvine, in the intervening years. Her specialty is labor economics and human resources. Her recent and ongoing research revolves around two major topics. The first is the careers of male and female academics in science. Her present work in this

area (joint with Donna Ginther) concentrates on academic careers in biomedicine and is being funded by the National Institute on Aging of the NIH. In another stream of current research joint with Megan MacGarvie, Professor Kahn is studying the contributions of foreign Ph.D. students to global knowledge creation and diffusion, entrepreneurship and innovation; the work on innovation is also joint with Donna Ginther. This work, funded by the National Science Foundation, has been presented at universities and conferences around the world. As part of her recent service to the university, she served on the BU College of Arts and Sciences Dean Search Committee and the BU Law School Dean Search Committee. In service related to women in academia, she sat on the American Economic Association's Committee on the Status of Women in the Economics Profession, was chair of the Boston University Faculty Council's Committee on Diversity, and was a co-author of "Major Findings of the 2006 Survey on Equity and Diversity at Boston University." She is currently teaching primarily undergraduates and is coordinator for a core SMG course on statistics and economics.

***Sylvia Hurtado*** is professor and director of the Higher Education Research Institute at University of California, Los Angeles (UCLA), in the Graduate School of Education and Information Sciences. Just prior to coming to UCLA, she served as director of the Center for the Study of Higher and Postsecondary Education at the University of Michigan. Hurtado has published numerous articles and books related to her primary interest in student educational outcomes, campus climates, college impact on student development, and diversity in higher education. She has served on numerous editorial boards for journals in education and on the boards for the American Association of Higher Education (AAHE) and the Higher Learning Commission, and she is past-president of the Association for the Study of Higher Education (ASHE). Black Issues in Higher Education named her among the top 15 influential faculty whose work has had an impact on the academy. She obtained her Ph.D. in education from UCLA, Ed.M. from Harvard Graduate School of Education, and A.B. from Princeton University in sociology. Hurtado has coordinated several national research projects, including a U.S. Department of Education-sponsored project on how colleges are preparing students to achieve the cognitive, social, and democratic skills to participate in a diverse democracy. She is launching an NIH project on the preparation of underrepresented students for biomedical and behavioral science research careers. She has also studied assessment, reform, and innovation in undergraduate education on a project through the National Center for Postsecondary Improvement.

**Session II: Putting a Face to a Statistic: A Panel of Women of Color in Academia**

**MODERATOR:**

***Joan W. Bennett*** (NAS member) is a professor in the Department of Plant Biology and Pathology and the associate vice president for the Office for Promotion of Women in Science, Engineering and Mathematics at Rutgers University. She is a past president of the American Society for Microbiology and a member of the National Academy of Sciences. Bennett has done work in fungal genetics as well as in women's studies. She taught a popular course, "Biology of Women," beginning in 1976 while she was at Tulane University (1971-2006). She is currently a leader of her institution's NSF ADVANCE project on women faculty. Bennett earned a bachelor's degree in biology and history from Upsala College and a master's and doctorate degree in botany from the University of Chicago.

**SPEAKERS:**

***Evelynn M. Hammonds***, dean of Harvard College and Barbara Gutmann Rosenkrantz Professor of the History of Science and of African and African American Studies, began her tenure as dean of Harvard College on June 1, 2008. Prior to this appointment, she served as Harvard University's first senior vice provost for faculty development and diversity beginning in July 2005. Hammonds joined the Faculty of Arts and Sciences in 2002 after teaching at the Massachusetts Institute of Technology (MIT), where she was the founding director of the Center for the Study of Diversity in Science, Technology and Medicine. Her scholarly interests include the history of scientific, medical, and sociopolitical concepts of race, the history of disease and public health, gender in science and medicine, and African-American history. She is most recently the author of *The Nature of Difference: Sciences of Race in the United States from Jefferson to Genomics* and several other books and scholarly articles. Hammonds received her B.S. in physics from Spelman College. She earned a bachelor's degree in electrical engineering from Georgia Institute of Technology, a master's degree in physics from MIT, and a Ph.D. in the history of science from Harvard. She holds honorary doctoral degrees from Spelman and Bates Colleges.

***Gilda Barabino*** is a professor and associate chair for graduate studies in the Department of Biomedical Engineering at Georgia Institute of Technology and at Emory University. She recently served as the inaugural vice provost for academic diversity and is credited with establishing a legacy to strengthen diversity and inclusion at Georgia Tech. Barabino received her B.S. degree in chemistry from Xavier University of Louisiana and her Ph.D. in chemical engineering from Rice University. After earning her doctorate, she served as a research process engineer at Rohm and Haas Company. Barabino then joined the chemical engineering faculty at Northeastern University where she rose to the rank of professor and served as vice provost for undergraduate education. Her research focuses on cell and tissue responses to mechanical forces in the context of sickle cell disease and orthopedic tissue engineering. She also investigates race and gender in research settings and science identity formation. Barabino has an extensive record of leadership and service in the chemical and biomedical engineering communities. She is a former member of the National Institutes of Health (NIH) National Advisory Dental and Craniofacial Research Council, the NIH Bioengineering, Technology and Surgical Sciences Study Section and the congressionally appointed NIH Sickle Cell Disease Advisory Committee. She has served on the board of directors and as treasurer of the Biomedical Engineering Society and began a two-year term as president in 2012. She serves on the advisory board of the Committee on the Advancement of Women Chemists and the Harvard Medical School Women of Color in Academic Medicine Advisory Committee. She is a fellow of the American Association for the Advancement of Science, the American Institute for Medical and Biological Engineering and the Biomedical Engineering Society (BMES). She was selected as a Sigma Xi Distinguished Lecturer 2012-2014 and is the recipient of numerous awards, including the BMES Diversity Award, the American Society for Engineering Education/Dow Outstanding Faculty Award, the American Institute of Chemical Engineers (AIChE) Minority Affairs Committee (MAC) Distinguished Service Award, and the AIChE MAC Eminent Chemical Engineers Award. Barabino is a recognized innovator, researcher, and consultant on faculty development and diversity in science and engineering. She currently directs the National Science Foundation (NSF) Minority Faculty Development Workshop and serves as principal investigator on the NSF ADVANCE Leadership Award, "Cross-Disciplinary Initiative for Minority Women Faculty," an

initiative designed to enhance the socialization of tenure-track minority women into academic careers in engineering.

***Patricia Taboada-Serrano*** is assistant professor of chemical and biological engineering at Rochester Institute of Technology. She was born in Brazil and raised in Bolivia. She is a chemical engineer and has an M.Sc. in chemical engineering and a Ph.D. in environmental engineering. She has worked as a research and development engineer at the Center for Applied Research in Bolivia, a postdoctoral research associate at Oak Ridge National Laboratory, and an instructor at Simon Bolivar University (Venezuela) and the Catholic University (Bolivia). She has over twenty scientific publications in peer-reviewed journals and conference proceedings, numerous conference presentations, and two patents pending. Her research interests include nanothermodynamics and the application of nanotechnology in alternative energy systems. She is a member of the American Chemical Society, the American Institute of Chemical Engineers, the Bolivian Institute of Engineers, and the InterAmerican Network of Academies of Sciences (IANAS) Women for Science Working Group.

***Tamisha Vaughan*** is a native of Harrisburg, Pennsylvania. She is a graduate of Johnson C. Smith University of Charlotte, North Carolina, where she majored in biology. While participating in several scientific organizations, including two NIH- funded programs, she gained substantial research experience, which changed her career goal from medical school to study neurosurgery to graduate school to study immunology. Following graduation, Tamisha took a nontraditional route to graduate school by joining a NIH- funded post-baccalaureate program at Virginia Polytechnic Institute and State University (VT-PREP). During her post-baccalaureate experience, Tamisha completed all of the required coursework for a doctorate degree prior to acceptance into the university as a degree-seeking student. This allowed her the freedom to focus on her research in the Innate Immunity and Inflammation Laboratory. Tamisha is now a postdoctoral scientist at Emory University School of Medicine. She now applies her immunology background in a hematology/oncology setting, where she studies the involvement of Grb2-associated binding proteins in hematopoiesis and immune deficiencies.

**Session III: Minority Women and Multiple Marginality: Gender, Race and Equity in Science Education and Research**

**MODERATOR:**

***Florence B. Bonner*** was the former associate vice president for research compliance before being appointed as the senior vice president for research and compliance as of July 2008 at Howard University. She is a professor of behavioral sciences and served as the chair of the Department of Sociology and Anthropology from 1992-2007; founder and director of the African American Women's Institute and the Women's Studies Program at Howard. She is a member of CWSEM. She also served as a senior fellow at the NSF. Before coming to Howard, she was the executive director of the Center for Women in Government at the State University of New York at Albany for four years. She also served as cochair on the development of the Strategic Framework I (SFI) and co-coordinator for the social, behavioral, and economic sciences in the development of SFII. She has been an active researcher at Howard and has been awarded ten grants from various agencies including the National Science Foundation (NSF), National Institutes of Health (NIH), and National Cancer Institute.

**SPEAKER:**
***Joan C. Williams***, a prizewinning author and leading expert on work/family issues, is the author of *Unbending Gender: Why Family and Work Conflict and What To Do About It* (Oxford University Press, 2000), which won the 2000 Gustavus Myers Outstanding Book Award, and *Reshaping the Work-Family Debate: Why Men and Class Matter* (Harvard University Press, 2010). Called "something of a rock star" in her field by *New York Times Magazine*, Williams has been successful in reaching extraordinarily diverse audiences and has been quoted in sources as diverse as the *Washington Post, Redbook,* the *Wall Street Journal, Human Resource Executive, Oprah Magazine* and the *Yale Law Review.* A frequent guest on radio and television, she has taught at Harvard and University of Virginia law schools and is currently distinguished professor, Hastings Foundation Chair, and founding director of the Center for WorkLife Law at the University of California, Hastings College of the Law. The author or co-author of six books and over seventy academic articles, she received the American Bar Foundation's Outstanding Scholar of the Year Prize in 2012, the American Bar Association's Margaret Brent Award for Women Lawyers of Achievement in 2006, and gave the 2008 Massey Lectures in American Civilization at Harvard University. She has given hundreds of speeches and presentations in North and Latin America to groups as diverse as the Society for Human Resource Management, the Denver Rotary Club, the American Philosophical Society, and the Modern Language Association, and has lectured at virtually every leading U.S. university. She is the recipient of two National Science Foundation ADVANCE grants, a Leadership grant in 2005, and a PAID grant in 2011 (with co-PIs Mary Ann Mason and Janet Bandows Koster). Williams' influential reports on work-family conflict among hourly workers include "One Sick Child Away from Being Fired: When Opting Out is not an Option" (2006), "The Three Faces of Work-Family Conflict: The Poor, the Professionals and the Missing Middle" (with Heather Boushey) (2010), and "Improving Work-Life Fit in Hourly Jobs: An Underused Cost-Cutting Strategy in a Globalizing World" (2011). Her work on second-generation gender bias includes the Gender Bias Learning Project (www.genderbiaslearningproject.com). In addition, Williams has a Huffington Post blog.

**Concurrent Session 1: What Data Can & Cannot Tell Us?**

**MODERATOR:**
***Alicia Carriquiry*** is distinguished professor of statistics at Iowa State University. Between January of 2000 and July of 2004 she was associate provost at Iowa State. Her research interests are in Bayesian statistics and general methods. Carriquiry is an elected member of the International Statistical Institute, a fellow of the American Statistical Association and a fellow of the Institute of Mathematical Statistics. She has served on the executive committees of the Institute of Mathematical Statistics and of the American Statistical Association and was a member of the board of trustees of the National Institute of Statistical Sciences. She is also a past president of the International Society for Bayesian Analysis (ISBA) and a past member of the board of the Plant Sciences Institute at Iowa State University. Carriquiry is editor of *The Annals of Applied Statistics* and past editor of *Bayesian Analysis,* and she serves on the editorial boards of several Latin American journals of statistics and mathematics. She has served on several National Academy of Sciences committees. She was a member of the Committee on Gender Differences in the Careers in Science, Mathematics and Engineering Faculty of the National Research Council and is currently a member of the standing Committee on National Statistics

and of the standing Committee on Evidence for Use in Social Science Policy. Carriquiry received an M.Sc. in animal science from the University of Illinois, and an M.Sc. in statistics and a Ph.D. in statistics and animal genetics from Iowa State University.

**SPEAKERS:**
***Donna K. Ginther***: See biography under Session I: Statistics on the Career Pathways of Women of Color Faculty in Academia: Where We Stand: Commissioned Research.

***Shulamit Kahn***: See biography under Session I: Statistics on the Career Pathways of Women of Color Faculty in Academia: Where We Stand: Commissioned Research.

***Stephen H. Cohen*** is currently the chief statistician at the National Science Foundation's National Center for Science and Engineering Statistics. Cohen's field of study includes design of sample surveys, statistical inference from complex sample surveys, disclosure avoidance techniques, privacy, and informed consent. He received his B.A. in mathematics from Boston University in 1968, his M.S. in mathematics from Rensselaer Polytechnic Institute in 1970, and finally his Ph.D. in mathematics from Rensselaer Polytechnic Institute in 1974. Cohen is a member of the Federal Committee on Statistical Methodology (FCSM), the FCSM Confidentiality and Data Access Committee, and the FCSM Privacy Committee. Cohen was past chair of the American Statistical Association's Section of Survey Research Methods.

**RAPPORTEUR:** ***Trisha Vickrey***

**Concurrent Session 2: Using a Legal Framework Successfully**

**MODERATOR:**
***Joseph M. DeSimone*** (NAE and NAS member) is Chancellor's Eminent Professor of Chemistry at the University of North Carolina at Chapel Hill and William R. Kenan Jr. Distinguished Professor of Chemical Engineering at North Carolina State University. DeSimone has received numerous awards and citations honoring his dedication to advancing diversity in the chemistry Ph.D. workforce, such as the 2010 AAAS Mentor Award, the 2009 NIH Director's Pioneer Award, and the 2009 North Carolina Award, which is the highest honor the State of North Carolina can bestow to recognize notable achievements of North Carolinians in the fields of literature, science, the fine arts, and public service. DeSimone is very much engaged on the topic of future faculty and how institutions support them. DeSimone is a member of the National Academy of Engineering and the American Academy of Arts and Sciences.

**SPEAKER:**
***Debra Rolison*** heads the Advanced Electrochemical Materials section at the NRL, where her research focuses on multifunctional nanoarchitectures for such rate-critical applications as catalysis, energy storage and conversion, and sensors. She is also an adjunct professor of chemistry at the University of Utah (2000–present). She was a faculty scholar at Florida Atlantic University (1972–1975) and received a Ph.D. in chemistry from the University of North Carolina at Chapel Hill (1980). Rolison is a fellow of the American Association for the Advancement of Science, the Association for Women in Science, the Materials Research Society, and the American Chemical Society. She received the 2011 ACS Award in the Chemistry of Materials,

the 2011 Hillebrand Prize of the Chemical Society of Washington, and the 2012 Charles N. Reilley Award of the Society for Electroanalytical Chemistry. Her editorial advisory board service includes *Analytical Chemistry, Langmuir, Journal of Electroanalytical Chemistry, Advanced Energy Materials, Nano Letters,* the *Encyclopedia of Nanoscience and Nanotechnology,* and *Annual Review in Analytical Chemistry.* When not otherwise bringing the importance of nothing and disorder to materials chemistry, Rolison writes and lectures widely on issues affecting women (and men!) in science, including proposing Title IX assessments of science and engineering departments. She is the author of over 200 articles and holds 24 patents.

**RAPPORTEUR:** ***Victoria Gunderson***

**Concurrent Session 3: How Does Gender Bias Differ by Race and Ethnicity?**

**MODERATOR:**
***Vivian W. Pinn*** (IOM member) recently retired as the first full-time director of the Office of Research on Women's Health (ORWH) in the Office of the Director of NIH, an appointment she held since 1991. She is also the former NIH Associate Director for Research on Women's Health. She came to NIH from Howard University's College of Medicine in Washington, DC, where she had been professor and chair of the department of pathology, and she has previously held appointments at Tufts University School of Medicine and Harvard Medical School. She has been invited to present the ORWH's mandate, programs, and initiatives to many national and international organizations with an interest in improving women's health, the health of minorities, and careers in bioscience for women and minorities. She has received numerous honors, awards, and recognitions and has been granted eleven honorary degrees of laws and science since 1992. She is a past president of the National Medical Association, a fellow of the American Academy of Arts and Sciences, and a member of the Institute of Medicine (IOM). She serves as a member of CWSEM and has extensive knowledge of underrepresented minority women in medicine and of federal programs that are relevant to women of color.

**SPEAKER:**
***Joan C. Williams***: See biography under Session III: Minority Women and Multiple Marginality: Gender, Race and Equity in Science Education and Research

**RAPPORTEUR:** ***Gretchen Stanton***

**Concurrent Session 4: Where Are Women of Color: Contingent & Administrative Positions in Academia?**

**MODERATOR:**
***Anthony DePass*** is the assistant vice president for research development at Long Island University and an associate professor of biology at its Brooklyn campus. With over 15 years experience in the administration and evaluation of programs aimed at faculty and student development, he is currently principal investigator and director of the Long Island University Minority Biomedical Research Support-Research Initiative for Scientific Enhancement (MBRS/RISE) program that prepares students from underrepresented populations for doctoral study in the biomedical sciences, co-PI of an NSF-funded NOYCE program for science teacher

training, and institutional coordinator for an National Institute of General Medical Sciences (NIGMS) Institutional Research and Academic Career Development Award (IRACDA) program that prepares future faculty as teacher/scholars. He cochaired the National Research Council (NRC) Committee on Interventions that Encourage Minorities to Pursue Research Careers, and has since been chair or cochair for the four annual conferences on Interventions that Broaden Participation in Research Careers. These conferences serve as venues for the dissemination of scholarship related to interventions research and evaluation, as well as related training activities. DePass is also the lead author on assessment for the recently published "Vision and Change in Undergraduate Education- A Call to Action." This work was supported by HHMI, NSF, NIH and AAAS and represents the culmination of a multiyear project involving over 200 faculty administrators and stakeholders nationwide, that addresses the needed improvement of biology education to address 21st century challenges. DePass has served on several review panels and advisory committees that focus on the issues related to the underrepresentation of minorities in the scientific workforce.

**SPEAKER:**
***Cherilynn Reynolds Shadding*** serves as the outreach director for the Genome Institute, a position she has held since 2006. In this position, she is responsible for designing, implementing, and maintaining genomics education programs for the community at large and for K-12 and undergraduate students that stimulate their interest in careers in genomics-related fields. Through her leadership, Opportunities in Genomics Research (OGR) was launched in 2007. This program seeks to increase the number of underrepresented minorities who obtain Ph.D.'s in the field of genomics/genetics. To date, two programs have been implemented under OGR, Undergraduate Scholars and Extensive Study. Shadding is currently involved in research that seeks to identify the interventions that encourage minority students to pursue careers in STEM (science, technology, engineering, mathematics). Shadding received her B.A. (1995) and M.A. (1998) in biology at Fisk University in Nashville. She attended graduate school at Meharry Medical College, where she earned her Ph.D. (2002) in physiology. Her research focus was cell signaling mechanisms in vascular smooth muscle cells and how such events may lead to vascular disease. After receiving her Ph.D., she completed a postdoctoral fellowship at the National Institute on Aging–National Institutes of Health in Baltimore, M.D., under Rui-Ping Xiao. She conducted research that examined the effects of referfusion/injury; hypoxia and acidosis-induced signaling pathways in cardiomyoctyes. She did a second postdoctoral fellowship under Daniel Link at Washington University in St. Louis in the Department of Internal Medicine/Division of Oncology. She studied angiogenesis and hematopoietic stem cell recruitment to sites of injury in a mouse model of hindlimb ischemia.

**RAPPORTEUR:** ***Danielle Haney***

**Concurrent Session 5: Experiences of Women of Color Faculty in STEM**

**MODERATOR:**
***Florence B. Bonner***: See biography under Session III: Minority Women and Multiple Marginality: Gender, Race and Equity in Science Education and Research.

**SPEAKER:**
***Sylvia Hurtado***: See biography under Session I: Statistics on the Career Pathways of Women of Color Faculty in Academia: Where We Stand: Commissioned Research.

**RAPPORTEUR:** ***Tanya Figueroa***

**Session V: Supporting Women of Color through Professional Societies**

**MODERATOR:**
***Patrick Valdez*** serves as the director of college access and success initiatives in the Office for Access and the Advancement of Public Black Universities at the Association of Public and Land Grant Universities, where he is responsible for the development of key initiatives toward improving college access and success for underrepresented minority populations. He is also the staff lead for the rollout of Phase II of the Minority Male STEM Initiative, which will include the publication of several policy briefs and competitively awarded funding to APLU-member institutions to enhance access for minorities in STEM. Valdez has held executive-level positions at St. Edward's University, the University of Texas at San Antonio (UTSA), and the Hispanic Association of Colleges and Universities (HACU). He has extensive experience in student leadership and career development as well as research focused on the challenges and obstacles facing first-generation parents and college students. His current research focuses on the policy formation of Hispanic-Serving Institution (HSI) legislation in 1992. Valdez earned a master's degree in student personnel administration from Teachers College at Columbia University and a bachelor's degree in international studies from St. Edward's University. He is a recipient of a Rackham Merit Fellowship from the Center for the Study of Higher and Postsecondary Education (CSHPE) at the University of Michigan, Ann Arbor, and is currently a doctoral candidate in the higher education administration program at the University of Texas at Austin.

**SPEAKERS:**
***Judit Camacho*** has been engaged with SACNAS (Society for Advancement of Hispanics/Chicanos & Native Americans in Science) for the last 17 years and has served two terms as executive director. SACNAS is dedicated to fostering the success of Hispanic/Chicano and Native American scientists—from college students to professionals—to attain advanced degrees, careers, and positions of leadership. A passionate advocate for social change and full involvement of diverse communities in the sciences, Ms. Camacho is proud to lead an organization that was founded nearly 40 years ago by women and men who were the first Chicanas/os or Native Americans in their fields to obtain a doctoral degree. Ms. Camacho first became involved with SACNAS as a student, while pursuing her mathematics degree from the University of California, Santa Cruz. She has also completed graduate coursework in public health from Johns Hopkins University. In between her terms at SACNAS, Camacho served for five years with the National Institutes of Health (NIH) in the Division for Minority Opportunities in Research at the National Institute of General Medical Sciences and subsequently in the Office of Workforce Development at the National Cancer Institute. Among the projects that she helped craft at NIH were the Summit on Latino Research, Outreach, and Employment at the NIH and the Introduction to Cancer Research Careers Program. As the executive director of SACNAS, Camacho has worked with the SACNAS board of directors to increase and sustain the organization's partnerships and alliances, strengthen the society's national profile, promote a

greater understanding of the necessity for a diverse scientific community within the U.S., and increase underrepresented minority access to the resources and policies that transform the country. Throughout her terms of service at SACNAS, the organization has grown significantly: from a staff of two to a staff of 20; from a budget of $350K to a budget of over $5 million; from a national conference with attendance of over 500 to close to 4,000; and from a conference-driven organization to a society with rich year-round programming including 70 chapters nationwide, regional meetings, leadership development institutes & initiatives, and a significant national science policy/advocacy presence. In December 2011, Camacho was honored by the White House as a "Champion for Change" in recognition of her contributions to advancing women in science, technology, engineering, and mathematics. In July 2012, Camacho and her family will move to Guadalajara, Mexico. Her goal is to build educational bridges between Mexico and the United States through scholarship and community development.

***Marian Johnson-Thompson*** is professor emerita of biology and environmental sciences at the University of the District of Columbia (UDC) in Washington, DC and adjunct professor in the School of Public Health at the University of NC-Chapel Hill. A cancer researcher, microbiologist and educator, she is also a leader in several professional and civic organizations. Her career began in 1971 at the University of the District of Columbia where she was initially appointed instructor and moved up the academic ranks to professor. She joined the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health in 1992 and retired as director of education and biomedical research development in 2008. Prior to that, she also held temporary and sabbatical positions at Goddard Space Flight Center, Lawrence Livermore, General Electric Space Science Center, the National Cancer Institute, NIH and Georgetown University Pharmacology Department (adjunct professor) and Howard University. As a member of several local, national, and international committees and advisory boards that address her professional interests, Johnson-Thompson is frequently invited to address issues related to science equity, health disparities, environmental justice, and human subjects protection. She has served as a reviewer/consultant for the NIH, NSF, EPA, Homeland Security, the Burroughs Welcome Fund, DOD, and NASA; and she serves on the board of the NC Triangle Affiliate of Susan G. Komen for the Cure, the NC Environmental Defense Fund and the African Organization for Research and Training in Cancer. She is a founding member of the National Network of Minority Women in Science. Previously, she served on the Durham, NC, Environmental Affairs Board and she is a Golden Life Member of Delta Sigma Theta, Inc. Her active memberships include the American Society for Microbiology (ASM), where she chairs the Committee on Microbiological Issues Impacting Minorities and serves on ASM's Public and Scientific Affairs Board, the American Association for Cancer Research, the American Society for Cell Biology, the American Association for the Advancement of Science, the Society of Sigma Xi and she is a member of Susan G. Komen for the Cure Advocates in Science. Her awards and honors are many and include the 1999 ONI Award from the International Congress of Black Women, the ASM's Alice Evans Award for her major contributions toward the full participation and advancement of women in microbiology, several NIEHS and NIH Director's Awards, and the 2003 Thurgood Marshall Alumni Award. She was named Meyerhoff Mentor of the Year at the University of Maryland, Baltimore County. She is an elected fellow of the American Academy of Microbiology and an elected fellow of the American Association for the Advancement of Science. Johnson-Thompson received B.S. and M.S. degrees in microbiology from Howard University and a Ph.D. in molecular virology from Georgetown University

Medical School. In 2009, she was honored by her alma mater and awarded the Outstanding Alumni Achievement Award from Howard University.

***Suzanne Bennett Johnson*** is a distinguished research professor at Florida State University (FSU) College of Medicine and 2012 president of the American Psychological Association. She received her B.A. in psychology from Cornell University and her Ph.D. in clinical psychology from SUNY at Stony Brook. She is licensed to practice in Florida and is board certified in Clinical Health Psychology by the American Board of Professional Psychology. From 2002-2010, she served as the first chair of the Department of Medical Humanities and Social Sciences at FSU College of Medicine in Tallahassee. Prior to that time, she was a distinguished professor and director of the Center for Pediatric Psychology and Family Studies at the University of Florida Health Science Center in Gainesville. From 2001-2002, she was a Robert Wood Johnson Health Policy Fellow working in the office of Senator Hillary Rodham Clinton. Johnson has numerous publications in the areas of pediatric psychology and clinical health psychology and has received many research, teaching, and service awards. She is considered an expert in the areas of medical regimen adherence, behavioral aspects of childhood diabetes, pediatric obesity, and the psychological impact of genetic screening on children and families. She has over 30 years of continuous research funding from the National Institutes of Health, including a Research Career Development Award.

***Linette M. Watkins*** is an associate professor in the Department of Chemistry and Biochemistry at Texas State University–San Marcos. She received her B.S. degree in biochemistry from Trinity University (1989) and her Ph.D. in biochemistry from University of Notre Dame (1996). After completing a postdoctoral appointment at Texas A&M University, she joined the faculty at Texas State in 1997. Her research focuses on understanding the mechanism of enzymes involved in the novel degradation pathways. She is actively involved in promoting early involvement of students in undergraduate research and using undergraduate research as a tool for the recruitment and retention of underrepresented students in the chemical sciences. Over the last fifteen years at Texas State, she has mentored over 90 students. She is an active member of the American Chemical Society (ACS) and has served in leadership roles in ACS local sections, divisions, and national committees. She was the chair of the ACS Committee on Minority Affairs from 2006-2008 and has served on the steering committee for the ACS Women Chemists of Color Program since its inception in 2010.

**June 8, 2012**

**Welcome**

***Lauren Maxim Van Wazer*** is assistant director for cyber security in the Office of Science and Technology Policy at the White House. Van Wazer was associate chief and special counsel for the Office of Engineering and Technology of the Federal Communications Commission (FCC) since 2001. In that role, she helped develop and implement wireless broadband, spectrum, homeland security, and telecommunications technology policy and was the principal FCC liaison to the wireless Internet service provider community. Also, she has held positions within the FCC as codirector of the Wireless Broadband Access Task Force, FCC negotiator for Wi-Fi issues as part of the US delegation to the 2003 World Radiocommunications Conference, and press officer

on telecommunications technology policy. Prior to joining the FCC, Van Wazer was an associate with the law firm of Arnold & Porter in Washington, D.C. and a law clerk to Judge Ralph B. Guy, Jr., of the United States Court of Appeals for the Sixth Circuit. She also worked as an engineer for several years in various management positions in the Network Services Department of AT&T in Oakton, Va. Van Wazer received her Juris Doctor, magna cum laude, from Georgetown University Law Center in Washington, D.C., where she was an editor of *The Georgetown Law Journal* and a member of the Order of the Coif. She is also a graduate of the University of Pennsylvania's Moore School of Electrical Engineering in Philadelphia, where she received a B.S.E. in systems science engineering.

**Session VI: Impact of Federal Agencies**

**MODERATOR:**
***Bernadette Gray-Little*** has been the chancellor of the University of Kansas since August 15, 2009. Gray-Little previously was executive vice chancellor and provost from 2006 to 2009 at the University of North Carolina (UNC) at Chapel Hill. A professor of psychology, she rose to the post of UNC's chief academic officer after successive administrative appointments, including dean of the College of Arts and Sciences. While at UNC, she earned a reputation as a champion for the highest quality educational experience for students and a strong advocate for faculty and for research. A native of eastern North Carolina, Gray-Little received her bachelor's degree from Marywood College in Scranton, Pa., and her master's and doctoral degrees in psychology from Saint Louis University. She earned a Fulbright Fellowship to study in Denmark. She also served as a Social Science Research Council Fellow and received a Ford Foundation Senior Scholar Fellowship through the National Research Council.

**SPEAKERS:**
***Jeri L. Buchholz*** became NASA's chief human capital officer and assistant administrator for human capital management on Aug. 1, 2011. In these positions, Buchholz has stewardship responsibility for NASA's workforce. She advises and assists the administrator by carrying out responsibilities in accordance with the Chief Human Capital Officers Act of 2002. Her responsibilities include setting the agency's workforce development strategy; assessing workforce characteristics and future needs based on the agency's mission and strategic plan; aligning the agency's human resources policies and programs with organizational mission, strategic goals, and performance outcomes; and serving as a member of the Office of Personnel Management-led Chief Human Capital Officers Council. Buchholz served as the associate director for human resources operations and policy at the U.S. Nuclear Regulatory Commission. She began her public service career in 1981 as a Peace Corps Volunteer in Zaire, now the Democratic Republic of the Congo. She also has served as the chief human capital officer at the Department of Health and Human Services' Office of Inspector General, as well as the U.S. International Trade Commission. In addition, she has held positions at the Office of Federal Housing Enterprise Oversight, the National Imagery and Mapping Agency, the Defense Intelligence Agency, the U.S. Information Agency, and the U.S. Office of Personnel Management.

***Muriel Poston*** is currently serving as the division director for the Human Resource Division in the Education Directorate at the National Science Foundation and is a professor in the biology

department at Skidmore College. She joined the Skidmore College administration in 2005 as dean of the faculty and until her recent appointment at NSF. At Skidmore she worked with colleagues to re-envision the science program, supported efforts to broaden the participation of underrepresented students and faculty in science, technology, engineering and mathematics (STEM) disciplines, and sought to enhance the capacity and infrastructure of the STEM facilities. Her primary research interests are in plant systematics, especially the evolutionary relationships of the neotropical family Loasaceae. Prior to her appointment at Skidmore, Poston spent over twenty years as a professor in the department of biology/botany at Howard, where she focused on undergraduate education, served as curator of the university herbarium, and worked to develop the environmental science program. Poston previously served as a program director and deputy division director in the Biological Sciences Directorate at the National Science Foundation (NSF), where she was responsible for programs to enhance infrastructure for biological research collections, research instrumentation, and field station facilities. She recently stepped down as the chair of the congressionally mandated Committee on Equal Opportunities in Science and Engineering and as a member of the NSF Advisory Committee for the Biological Sciences Directorate. She also served as a member of the National Research Council's Board of Life Sciences. Poston currently sits on the board of directors of the American Institute of Biological Sciences and the advisory committee of Project Kaleidoscope. Poston earned a B.A. degree from Stanford University, M.A. and Ph.D. degrees from the University of California at Los Angeles, and a J.D. degree from the University of Maryland.

***Janine A. Clayton*** is the acting director of the Office of Research on Women's Health in the Office of the Director at the National Institutes of Health in Bethesda, Maryland, USA. She is the author of over 70 scientific publications, journal articles, and book chapters. Prior to joining the Office of Research on Women's Health, she was the deputy clinical director of the National Eye Institute (NEI) at NIH. A board-certified ophthalmologist, Clayton's research interests include autoimmune ocular diseases and the role of sex and gender in health and disease. Clayton has a particular interest in ocular surface disease and discovered a novel form of disease associated with premature ovarian insufficiency which affects young women. Clayton is a native Washingtonian and received her undergraduate degree with honors from the Johns Hopkins University and her M.D. from Howard University College of Medicine. She completed a residency in ophthalmology at the Medical College of Virginia and fellowship training in cornea and external disease at the Wilmer Eye Institute at Johns Hopkins Hospital and in uveitis and ocular immunology at the NEI. Clayton has been an attending physician and clinical investigator in cornea and uveitis at the NEI since 1996, conducting research on inflammatory diseases of the anterior segment and providing medical and surgical uveitis fellowship training. Her clinical research has ranged from randomized controlled trials of novel therapies for immune-mediated ocular diseases to studies on the development of digital imaging techniques for the anterior segment. Clayton has received several awards from NIH and has been recognized as a leader by her peers. She received the Senior Achievement Award in from the board of trustees of the American Academy of Ophthalmology (AAO) in 2008, and was selected as a 2010 Silver Fellow by the Association for Research in Vision and Ophthalmology (ARVO) in recognition of "accomplishments, leadership and contributions to the Association to help further ARVO's mission to facilitate the advancement of vision research and the prevention and cure of disorders of the visual system worldwide." Clayton has served on critical committees at the NIH Clinical Center and currently serves on the Federal Drug Administration (FDA) Advisory Panel for

Ophthalmic Devices, the executive committee of the Women's Eye Health.Org, the medical and scientific advisory board of Tissue Banks International, and the editorial boards of *The Ocular Surface* and *Oral Diseases*. Clayton was named deputy director of the Office of Research on Women's Health and the Office of the Director at the National Institutes of Health in June 2008. In September 2011, Clayton was appointed acting director of the Office on Research on Women's Health and serves, along with the NIH Director, as cochair of the NIH Working Group on Women in Biomedical Careers.

***James H. Johnson, Jr.*** is the director of the National Center for Environmental Research (NCER) in the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD). In this role, Johnson continues a life-long career dedicated to sustaining and advancing scientific research and education initiatives supporting environmental protection, quality of life programs and policies, and environmental workforce development. Johnson has served on numerous committees and boards for the National Academies, EPA, and academic institutions. He is a member of the Anne Arundel Community College (MD) board of trustees and is the professor emeritus of civil engineering and dean emeritus of the College of Engineering, Architecture and Computer Sciences at Howard University. Johnson earned his Bachelor of Science in Civil Engineering from Howard University, Master of Science from the University of Illinois, and a Ph.D. in applied sciences from the University of Delaware. He is the 2005 recipient of the National Society of Black Engineers' Lifetime Achievement Award in Academia and the 2008 Water Environment Federation Gordon Maskew Fair Award. His research interests include the treatment and disposal of hazardous substances, the use of nanomaterials for environmental restoration, the evaluation of environmental policy issues in relation to minorities, and the development of environmental curricula and strategies to increase the pool of underrepresented groups in STEM disciplines.

**Session VII: Successful Practices and Strategies for Institutional Transformation**

**MODERATOR:**

***Kelly Mack*** is a professor of biology at the University of Maryland Eastern Shore, where she has taught courses in physiology and endocrinology for 15 years, and she is on loan from her home institution (since fall 2008) serving as a program director for the National Science Foundation ADVANCE Program. At her home institution, Mack served in many capacities, including biology program director, where she was responsible for providing leadership and strategic vision for the intellectual, educational, and professional development of biology majors and for the coordination of faculty in providing quality instruction, research, and development activities. During her tenure at UMES, Mack served as principal investigator, director, or co-director for externally funded projects that totaled over $12 million dollars, including the UMES ADVANCE Program, which focused on issues related to African American women faculty in the STEM disciplines and led to the initiation of several institution wide practices to promote the professional development of all faculty. Kelly Mack received her Bachelor of Science degree from the University of Maryland, Eastern Shore, in biology and later her Ph.D. from Howard University in physiology. Mack has had extensive training and experience in the area of cancer research, with her research efforts focusing primarily on the use of novel antitumor agents in human estrogen receptor negative breast tumor cells. Specifically, these efforts have included the role of the cellular accumulation of cisplatin in breast tumor cells, and the use of

demethyltransferase inhibitors and histone deacetylase agents in inducing the re-expression of the estrogen receptor in human breast tumor cells. More recently, her research focus has involved the use of bioflavonoids in the regulation of estrogen receptor positive (ER+) and estrogen receptor negative (ER-) breast tumor cell proliferation. Mack has served as a member of the board of governors for the National Council on Undergraduate Research and is a current member of the National Institutes of Health Review Subcommittee for the Minority Opportunities in Research (MORE) Division.

**SPEAKERS:**

***Loretta A. Moore*** currently serves as interim associate dean for the College of Science, Engineering and Technology at Jackson State University in Jackson, Mississippi. She is a professor and previously served as chair of the Department of Computer Science. She has held positions at Auburn University, AT&T Bell Laboratories, Lawrence Livermore National Laboratory, Army Research Laboratory, NASA Kennedy Space Center, and NASA Marshall Space Flight Center. Moore has worked in a variety of computer science areas with an emphasis on the design of intelligent systems. Her current research is in the area of computational thinking and in the application of intelligent techniques to visual analytics, cybersecurity, and visualization. She has received funding from agencies including the National Science Foundation, Department of Homeland Security, Department of Justice, Department of Energy – Lawrence Livermore National Laboratory, Army Research Laboratory, NASA Kennedy Space Center, NASA Marshall Space Flight Center, NASA Headquarters, and Jacobs Technology. Moore is the principal investigator on a recent grant from the National Science Foundation's ADVANCE program, which is aimed at advancing the careers of female faculty in the STEM and SBS disciplines and transforming the institution's climate to promote opportunities for the advancement of all faculty. She serves as a commissioner for the Computing Accreditation Commission of ABET. Moore is a member of the board of the Association of Departments of Computing at Minority Institutions (ADMI); the US Army Science Board; and ACM, IEEE, and AAUW organizations. She is active in the recruitment, retention, and promotion of African-American Computer Scientists. Moore received her B.S. degree in computer science from Jackson State University and her M.S. and Ph.D. degrees in computer science from the Illinois Institute of Technology.

***J. Wayne Jones*** is an Arthur F. Thurnau Professor of Materials Science and Engineering. He is the associate director for the University of Michigan's ADVANCE program. He holds a Ph.D. in materials science from Vanderbilt University. His research interests focus on developing an understanding of structure-property relationships in advanced structural materials for automotive and aerospace applications. His work has centered on the fatigue and creep behavior of aluminum alloys, particulate strengthened aluminum matrix composites, titanium and titanium aluminides, and more recently on new magnesium alloys. His research group is currently focusing on development of new instrumentation and techniques for studying the fatigue behavior of structural materials in the very high cycle fatigue regime using ultrasonic fatigue. He served as associate dean for undergraduate education in the College of Engineering from 1996 to 2001 and he served as interim chair of MSE in 1992. He served as president of TMS (a 12,000 member materials society) in 1999 and has served on the boards of directors of TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers. He was elected a fellow of ASM International (a 50,000-member materials society) in 2000. In 2007 he received the

Harold H. Johnson Diversity Award from the University of Michigan. In 2010 he received ASM International's Alfred Easton White Distinguished Teacher Award, the society's highest honor for materials science teaching excellence. In 2011 he and his co-authors were awarded the Champion H. Mathewson Medal for "Microstructural Influences on Very-High-Cycle Fatigue-Crack Initiation in Ti-6246," published in Metallurgical and Materials Transactions A, in 2008.

***Joan Y. Reede*** was appointed as the first dean for diversity and community partnership at Harvard Medical School (HMS) in January 2002. She is responsible for the development and management of a comprehensive program that provides leadership, guidance, and support to promote the increased recruitment, retention, and advancement of underrepresented minority faculty at HMS. In 1990, Reede founded the HMS Minority Faculty Development Program and currently also serves as faculty director of its Community Outreach Programs. In 2008, she became the director of the Harvard Catalyst Program for Faculty Development and Diversity. In addition, Reede holds the appointments of associate professor of medicine at HMS, associate professor of society, human development, and health at the Harvard School of Public Health, and assistant in health policy at Massachusetts General Hospital. Over the past 20 years, Reede created and developed more than 20 programs at HMS that aim to address pipeline and leadership issues for minorities and women who are interested in careers in medicine, academic and scientific research, and the healthcare professions. Prior to coming to HMS in 1989, Reede served as the medical director for a Boston community health center and for the Commonwealth of Massachusetts' Department of Youth Services. She has also worked as a pediatrician in community and academic health centers, juvenile prisons, and public schools. Reede has received many awards. The diversity of these honors is a reflection of her far-reaching and varied accomplishments. At the national level, Reede was appointed to the Health and Human Services Advisory Committee on Minority Health by Donna E. Shalala, former Secretary of Health and Human Services, and she served on the board of governors for the Warren Grant Magnuson Clinical Center; the National Advisory Dental and Craniofacial Council; the Secretary's Advisory Committee on Genetics, Health, and Society at the National Institutes of Health (NIH); and as a commissioner of the Sullivan Commission on Diversity in the Healthcare Workforce. Reede formerly served on the Secretary's Advisory Committee to the Director of NIH and is currently on the Sullivan Alliance to Transform America's Health Professions. Reede is a member of the Education Board of the American Public Health Association, serves on the National Advisory Board of the Satcher Health Leadership Institute at Morehouse School of Medicine and the board of directors of the National Hispanic Medical Association, and in 2009 was appointed to the Health Research & Trust board of directors of the American Hospital Association. In 2007, Reede was voted to membership in the Medical Administrators Conference. She presently serves on the National Children's Study Advisory Committee of the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Reede was elected a member of the Institute of Medicine in 2009, and she is the recipient of the 2011 Diversity Award from the Association of Professors of Medicine. Reede graduated from Brown University and Mount Sinai School of Medicine. She completed her pediatric residency at Johns Hopkins Hospital in Baltimore, Maryland, and a fellowship in child psychiatry at Children's Hospital Boston. She holds an M.P.H. and a M.S. in Health Policy and Management from Harvard School of Public Health, and an M.B.A. from Boston University.

**Closing Session: Next Steps**

**SPEAKER:**
***Shirley Malcom*** (NAS member) is head of the Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science (AAAS). The directorate includes AAAS programs in education, activities for underrepresented groups, and public understanding of science and technology. Malcom serves on several boards—including the Heinz Endowments and the H. John Heinz III Center for Science, Economics and the Environment—and is an honorary trustee of the American Museum of Natural History. In 2006 she was named as cochair of the National Science Board Commission on 21st Century Education in STEM. She serves as a regent of Morgan State University and as a trustee of Caltech. In addition, she has chaired a number of national committees addressing education reform and access to scientific and technical education, careers and literacy. Malcom is a former trustee of the Carnegie Corporation of New York. She is a fellow of the AAAS and the American Academy of Arts and Sciences. She served on the National Science Board, the policymaking body of the National Science Foundation, from 1994 to 1998, and from 1994 to 2001 served on the President's Committee of Advisors on Science and Technology. Malcom received her doctorate in ecology from Pennsylvania State University; master's degree in zoology from the University of California, Los Angeles; and bachelor's degree with distinction in zoology from the University of Washington. She also holds 15 honorary degrees. In 2003 Malcom received the Public Welfare Medal of the National Academy of Sciences, the highest award given by the Academy.

# Appendix D

# Annotated Bibliographies[1]

These references were compiled from a literature review of journal articles, published reports, and conference proceedings on the following topics related to the representation of women, underrepresented minorities, and/or women of color in academic science, engineering, and medicine disciplines:

- An Overview of the Pipeline
- The Academic Experience for Women of Color
- Legal Efforts and Benefits of Broadening Participation
- Exploring Bias
- Barriers and Challenges
- Recommendations and Policy Implications

## An Overview of the Pipeline

In 1976, a seminal report "The Double Bind: The Price of Being a Minority Woman in Science" was published, which examined the lack of representation of women of color in STEM fields. While progress has been made in increasing their representation, the number of underrepresented minority (URM) women in tenure-track positions at the top 100 research universities in 2007 was still abysmally low and not growing at the same rate as the doctoral degrees awarded to this subset of women. The references in this section describe some recent data trends for women and/or URM at various stages of the academic pipeline in science, engineering, and medicine fields, in addition to reviewing potential reasons for their lack of growth in representation in the academy.

### Annotated Bibliography

**Cleary, R., et al. 2010. 2009 annual survey of the mathematical sciences (third report). *Notices of the American Mathematics Society,* 57(10):1306-1317.**
This report examines trends in mathematics faculty members at different types of universities and breaks down the numbers by gender and type of faculty appointment. The data show that growth of women faculty members in mathematics departments was minimal from 2002-2009, with tenured/tenure-track female faculty members only making up 13 percent of the total faculty at doctoral granting universities, but 27 percent of the faculty at master's granting universities in 2009. Female faculty are employed at higher percentages in non-tenure track (37 percent) and part-time (39 percent) faculty positions at doctoral granting universities compared to male faculty members.

[1] The annotated bibliographies were compiled by Mahlet Mesfin, Ph.D., Christine Mirzayan Science & Technology Policy Fellow at the National Academies in Spring 2012.

**Ginther, D.K., and S. Kahn. 2006. Does science promote women? Evidence from academia 1973-2001. *Science and Engineering Careers in the United States.* Chicago, IL: University of Chicago Press for NBER Science Engineering Workforce Project, W129691.**
This study evaluates whether gender differences exist in the likelihood of obtaining a tenure track job, promotion to tenure, and promotion to full professor using the 1973- 2001 Survey of Doctorate Recipients. Women were less likely to take tenure track positions in science, but this gender gap is entirely explained by fertility decisions. In science, there is no gender difference in promotion to tenure or full professor after controlling for demographic, family, employer, and productivity covariates. Single women do better at each stage than single men. Women with children are less likely to advance up the academic job ladder beyond their early postdoctorate years, while both marriage and children increase men's likelihood of advancing.

**Ginther, D.K., et al. 2009. *Diversity in Academic Biomedicine: An Evaluation of Education and Career Outcomes with Implications for Policy*. New York, NY: Social Science Network.**
This study examines the educational transition rates from high school to academic careers in in the biomedical sciences by gender, race, and ethnicity using a number of educational databases. This was followed by a multivariate regression to examine faculty career outcomes using the National Science Foundation's Survey of Doctorate Recipients. While transitions between milestones are distinctive by gender and race/ethnicity, the transitions between high school and college and between college and graduate school are critical points at which underrepresented minorities are lost from the biomedical pipeline, suggesting some specific targets for policy intervention.

**Leggon, C. 2006. Women in science: Racial and ethnic differences and the differences they make. *Journal of Technology Transfer,* 31:325-333.**
This review examines the underrepresentation of women of color and non-Hispanic white women in the scientific workforce by race and ethnicity. Aggregated data obscures significant differences that can result in ineffective policies. Female scientists are more likely to earn a bachelor's degree at a research university and are only represented at 43 of the top 50 universities. Men are four times more likely to have full-time faculty positions in S&E positions, even as women's representation in doctoral degree programs is increasing. There is an inverse proportion of institutional prestige and proportion of female faculty members, and URM women were less likely to be in tenured positions. Female faculty members have lower salaries than their male counterparts and are less likely to negotiate other factors of employment. Implementing institutional change requires cohesive and integral efforts of understanding the issues/problems, reviewing the most effective practices, reexamining tenure and hiring processes, and strong leadership within the institutions.

**National Center for Science and Engineering Statistics. 2011. *Academic Institutions of Minority Faculty with Science, Engineering, and Health Doctorates.* Arlington, VA: National Science Foundation.**
This study examines the characteristics of minority faculty with science, engineering, and health (SEH) doctorates in 2008, including the types of schools from which they earned their doctorates and in which they teach, and compares them with non-minority faculty. SEH fields include biological/agricultural/environmental life sciences, computer and information sciences, mathematics, statistics, physical sciences, psychology, social sciences, engineering, and health

fields. African-American and Hispanic doctorates were employed in education at a higher percentage than most other racial/ethnic groups, though they also had a higher likelihood of having a social or behavioral sciences degree. African-American SEH faculty are employed at master's-granting institutions at a higher percentage than at research universities with very high research (RUVH) activity, even when their degrees were awarded by RUVH. This trend is unique to this racial/ethnic group and can be due to employment at historically black colleges and universities.

**National Science Board. Chapter 2: Higher Education in Science and Engineering. *Science and Engineering Indicators 2012*. Arlington, VA: National Science Foundation.**
This report highlights that the racial composition of those holding science and engineering (S&E) degrees is shifting due to increased numbers of minority group members, particularly Hispanics/Latinos, attending college. The proportion of S&E bachelor's degrees between men and women has been unchanged in the last 10 years and has decreased in computer sciences, math, and engineering. For graduate education, the number of S&E doctoral degrees earned by women, African-Americans, and Hispanics grew faster than the number of degrees earned by white men from 2000-2009, while the numbers of degrees earned by Native Americans has been largely unchanged.

**Nelson, D.J., and C.N. Brammer. 2007. *A National Analysis of Diversity in Science and Engineering Faculties at Research Universities.* Norman: Department of Chemistry, University of Oklahoma.**
This report summarizes the data gathered from a survey of the top 100 departments (according to research funds expended) in each of 15 science and engineering (S&E) disciplines, as ranked by the National Science Foundation (NSF). URMs among S&E faculty are underrepresented despite increased representation among B.S. and Ph.D. recipients. In most disciplines, representation drops at each transition point until the rank of full professor, reflecting increased recent hiring in those disciplines. In some disciplines, there are virtually no blacks, Hispanics, or Native Americans among assistant professors, with Hispanics generally encompassing the largest segment of URM professors.

**Towns, M.H. 2010. Where are the women of color? Data on African American, Hispanic, and Native American Faculty in STEM. *Journal of Science and College Teaching*, 39(4): 8-9.**
This article discusses data on African American, Hispanic, and Native American faculty in STEM disciplines based on data from NSF in 2007. When examining the number of tenured/tenure track faculty at the top 100 research institutions, for every science discipline, the numbers of underrepresented women in each racial group compared with the total number of faculty is well below 1 percent, while underrepresented minorities make up 9 percent of the general population.

**Turner, C.S.V., et al. 2008. Faculty of color in academe: What 20 years of literature tells us. *Journal of Diversity in Higher Education*, 1(3):139-168.**
This review gives a comprehensive summary of the literature from journal articles, books, dissertations, reports, and book chapters on the topic of faculty of color in higher education from 1988-2007. After analyzing the topics in all of the literature, the authors created a framework for

assessing the issue on a departmental, institutional, or national context and found both unique and overlapping themes in the challenges and support in each context. The authors also compile recommendations to address these challenges and track the main methods for researching faculty of color throughout the years, including the surge in interest in examining faculty of color in STEM and the health fields between the years 2003-2007. Finally, the authors describe the five main research gaps in the current literature.

**Zweben, S. 2010. Undergraduate CS enrollment continues rising; Doctoral production drops. *Computing Research News,* 22(3):7-24.**
This report documents data from the Computing Research Association on the trends in student enrollment, degree production, employment, and salaries in computer science (CS), computer engineering (CE) and information technology fields in the United States and Canada. The data shows that the number of Ph.D.s awarded has increased dramatically since 2002, yet only 20.8 percent of the CS Ph.D. recipients and 16 percent of the CE Ph.D. recipients are female. In addition, only 1.3 percent, 1.4 percent, 0.1 percent and 0.7 percent of the CS Ph.D. recipients are African American, resident Hispanic, American Indian and Native Hawaiian/Pacific Islander, respectively. Similar percentages apply when examining the gender and race/ethnicity of newly hired faculty in these fields, though the data of current full professors shows drops in the percentage of full African-American faculty.

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*Malcom, S., et al. The Double Bind: The Price of Being a Minority Woman in Science*. Washington, DC: American Association for the Advancement of Science.

Massachusetts Institute of Technology. 2010. *Report on the Initiative for Faculty Race and Diversity*. Cambridge, MA: MIT.

Massachusetts Institute of Technology. 2011. *A Report on the Status of Women Faculty in the Schools of Science and Engineering at MIT*. Cambridge, MA: MIT.

## The Academic Experience for Women of Color

While the references in the "Overview of the Pipeline" section provide a quantitative assessment of the state of women of color in STEM disciplines, there are many qualitative studies that examine additional, and more personal, details about the academic experience of women of color. Studies show that there are often differences between the issues and struggles of women of color faculty members and those of other women and men of color on the faculty. Common themes that emerge from these qualitative assessments revolve around feelings of sexism/racism, campus climate before and after the affirmative action cases, feelings of isolation, and lack of self-confidence in their coursework and/or profession.

### Annotated Bibliography

**Brainard, S. G. and L. Carlin. 1998. A six-year longitudinal study of undergraduate women in engineering and science. *Journal of Engineering Education* 87:369-376.**
This report describes the results of the first five years of the study of retention of undergraduate women in S&E disciplines by the Women in Engineering (WIE) Initiative at the University of Washington. Factors that positively affect retention of women S&E students include a continued interest in math and science courses, importance of career opportunities, gaining acceptance into the department, positive influence of advisor and/or mentor, ability to work independently and involvement in the WIE Big Sister Program. Perceived barriers to retention of women in S&E fields include lack of self-confidence, not being accepted into the department, discouragement about grades, poor advising, financial problems, and feelings of intimidation. There is a significant drop of self-confidence among women in science and engineering during their first and second years; self-confidence increases by their senior year, yet never returns to the level of entering first-year students.

**Carlone, H.B. and A. Johnson. 2007. Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching* 44(8):1187-1218.**
This study describes a model of science identity based on the experiences of 15 successful women of color from their undergraduate degrees to their science-related careers. The results identify three science identity trajectories: research scientist; altruistic scientist; and disrupted

scientist. Research scientists were passionate about science and were recognized by themselves and science faculty as scientists. Altruistic scientists regarded science as a vehicle for altruism and created innovative meanings of "science," "recognition by others," and "woman of color in science." Disrupted scientists sought, but did not often receive, recognition by meaningful scientific others and had more difficult trajectories because their bids for recognition were disrupted by the interaction with gender, ethnic, and racial factors. These different identities and ways that women of color experience and negotiate science suggest a rethinking of recruitment and retention efforts.

**Espinosa, L.L. 2011. Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Education Review* 81(2): 209-240.**
This study explores how factors in women's precollege and college experiences contribute to their persistence as STEM majors and explores these trends across racial and ethnic groups. The study suggests that women's experiences in their universities are more influential than their prior experiences in high school, suggesting the crucial role of undergraduate institutional climate. It sheds light on the role of faculty and peer interactions, pedagogy, and college selectivity, among other factors, in STEM persistence.

**MacLachlan, A.J. 2000. The lives and careers of minority women scientists. Presented at the National Association of Women in Education (NAWE) Conference, New Orleans, LA, January, 2000.**
This paper describes a study of ten minority women from the University of California System who received Ph.D.s between 1980 and 1990 that examined the graduate school experience of these women and presents the multiplicity of answers that individual women find for themselves. In general, the women in this study reported positive experiences such as support from teachers and families, support from their advisors, ability to secure funding, and participation in various forms of formal and informal minority support mechanisms. However, they also noted negative experiences such as discriminatory behavior directing them away from pursuing higher education, inadequate preparation of their post-graduate careers, and subtle racism within their departments. Even with these external environmental factors, these women completed their Ph.D. degrees due to their character, persistence, deep commitment to science, and tremendous personal discipline.

**Malcom, L.E., and S.M. Malcom. The double bind: The next generation. *Harvard Education Review* 81(2):162-171.**
This paper reflects how the experiences of women of color in STEM have changed and remained the same over the last thirty-five years. The understanding of the route to STEM for students has evolved due to increased enrollment in community college. While much progress has been made, there is variability by discipline, with social science and medical degrees increasing while others (such as computer science) remaining constant. Many of the current challenges deal with support structures and increasing the institutional responsibility for facilitating change.

**Settles, I.H. 2006. The climate for women in academic science: The good, the bad and the changeable. *Psychology of Women Quarterly* 30:47-58.**
This study examined the attitudes of female faculty at various stages in their careers in natural science, social science, and engineering at a large midwestern university. In this sample set, white women scientists had a greater likelihood of being higher in rank and felt more influential in their departments than women of color faculty. For women faculty, the greater the feeling of sexism exists within the department, the less the women perceived their influence and job satisfaction. Factors and actions that could improve outcomes include strong leadership among the department chair, encouraging collegiality, ensuring gender equity, discouraging sexist behavior, and facilitating mentorship relationships.

**Turner, C.S.V., et al. 2011. Faculty women of color: The critical nexus of race and gender. *Journal of Diversity in Higher Education* 4(4):199-211.**
This study provides results of a qualitative analysis from focus groups of women of color in various academic positions in major public research universities. The study underscores the need for institutions to renew and expand a commitment to diversity and to disseminate knowledge about campus wide opportunities. The faculty who were surveyed suggested that the climate on campuses after affirmative action cases (*Gratz* and *Grutter*) is more negative than before the cases. As a result of the focus group formation, women of color from across campus were able to form an informal network that allowed for the sharing of knowledge and experiences.

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Millett, C.M. and M. Nettles. 2006. Expanding and cultivating the Hispanic STEM doctoral workforce: Research on doctoral student experiences. *Journal of Hispanic Higher Education* 5(3): 258-287.

Souto-Manning, M. and N. Ray. 2007. Beyond survival in the ivory tower: Black and brown women's living narratives. *Equity & Excellence in Education* 40(4):280-290.

Vakalashi, H.F. and S.H. Starks. 2011. Health, well-being and women of color academics. *International Journal of Humanities and Social Science* 1(2): 185-190.

## Legal Efforts and Benefits of Broadening Participation

Recent studies have highlighted the need to broaden the participation of diverse groups in STEM disciplines in order for the United States to remain competitive in the global workforce. Other studies have described the power of diverse groups in decision making processes and the effect that diverse faculty may have on the student body at universities. Therefore, the need for

increasing diversity has been recognized, and legal strategies can be employed to facilitate the inclusion of diverse groups into the workforce. The references in this section identify the need and benefits of broadening participation, in addition to presenting legal efforts to ensure that these goals are achieved.

**Annotated Bibliography**

**Carrigan, C., et al. 2011. The Gendered Division of Labor Among STEM Faculty and the Effects of Critical Mass. *Journal of Diversity in Higher Education* 4(3):131-146.**
This study examined the connections between time allocation and satisfaction for STEM faculty within the context of a critical mass of women in the discipline. Using a weighted sample of 13,884 faculty from the 2004 National Study of Postsecondary Faculty, we found a gendered division of labor that is mitigated by a critical mass of women faculty in the discipline. Results lend empirical support to theories that argue critical-mass attainment positively impacts equity in resource distribution and time allocation.

**Chubin, D.E., et al. 2009. *Understanding Interventions That Broaden Participation in Research Careers: Embracing a Breadth of Purpose.* Washington, DC: American Association for the Advancement of Science.**
This report summarizes the presentations and discussions from the Third Annual Conference on Understanding Interventions that Broaden Participation in Research Careers in 2009 that was held by the Minority Affairs Committee of the American Society for Cell Biology and AAAS. The report was structured into five sections: a) the big picture; b) theory in practice; c) pathway programs; d) data and evaluation; and e) technology. Several success stories for broadening participation for postdoctoral researchers and faculty are described, including the SPIRE Program at University of North Carolina, the Preparing Future Faculty movement, the NSF ADVANCE Program and the Forward to Professorship Program.

**Malcom, S., et al. 2004. *Standing Our Ground: A Guidebook for STEM Educators in the Post-Michigan Era.* Washington, DC: American Association for the Advancement of Science.**
This report, published one year after the court case against the University of Michigan's use of race in its admission process, clarifies legally defensible options for protecting diversity in science and engineering programs. It proposes eight strategies for increasing the participation of minorities in science and engineering and urges campus leaders to specify diversity goals within their institutional missions even without the legal guidance from the federal government.

**Page, S. 2008. *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*. Princeton: Princeton University Press.**
This book examines how the collective wisdom of a group exceeds the sum of its parts and describes how teams of people can find better solutions due to the power of diversity, which includes an individual's identity and distinct tools and abilities.

*APPENDIX D ANNOTATED BIBLIOGRAPHIES*

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Darden, J.T., et al. 2006. Black faculty in predominantly white U.S. institutions of higher education: The influence of black student enrollment. *Equity & Excellence in Education* 31(2): 6-18.

Ong, M. 2011. The Status of Women of Color in Computer Science. *Communications of the ACM* 54(7):32-34.

## Exploring Bias

Studies show that individuals often display bias toward others solely due to their gender or race/ethnicity in an implicit and unconscious manner. These biases can affect aspects of the individual's career by altering perceptions in performance evaluations and perceptions of his or her abilities and likelihood of obtaining grant funding. Such biases can also negatively impact an individual's self-confidence and perceptions of success and achievement. The following references describe the effect of explicit and implicit bias on female and underrepresented minorities' ability to succeed in math and science disciplines and progress in their careers.

### Annotated Bibliography

**Bavishi, A. 2010. The effect of professor ethnicity and gender on student evaluations: Judged before met. *Journal of Diversity in Higher Education* 3(4):245-256.**
This study analyzed the perceptions of college preparatory students on the competence, interpersonal skills, and legitimacy of either humanities or science professors of different races and genders, based on sample CVs. African-American professors were regarded as less competent and as having fewer interpersonal skills than Asian-American and Caucasian professors, while Asian American professors were perceived to have fewer interpersonal skills than Caucasian professors. Women professors were voted less competent than male professors in science, and African-American women were rated the lowest in terms of competence, interpersonal skills, and legitimacy compared to all other groups.

**Brown, S.V. 1995. Testing the double bind hypothesis: Faculty recommendations of minority women fellowship applicants. *Journal of Women and Minorities in Science and Engineering* 2(4):207-223.**
This paper examines faculty and scientists' recommendations of applicants to the NSF Graduate Fellowship Program, spanning the years 1976 to 1991. Regression analysis was used to test the double bind hypothesis that minority women are doubly disadvantaged because they are both

minorities and women. The findings generally support the double bind hypothesis: Being a minority significantly lowered the Reference Report ratings of women NSF applicants, and being a woman significantly lowered the Reference Report ratings of minority applicants. This was supported by data showing that certain women, by virtue of their appearance or language, are unmistakable as minorities and impact faculty recommendations in a manner distinct from non-identifiable minority women. Compared to white women and minority men, being a Black, Puerto Rican, and other Hispanic woman significantly lowered faculty/scientists' recommendations.

**Ginther, D.K. et al. 2011. Race, ethnicity, and NIH research awards. Science 333:1015-1019.**
This study investigated the association between a U.S. National Institutes of Health (NIH) R01 applicant's self-identified race or ethnicity and the probability of receiving an award by using data from the NIH grant database and other sources. Even when proposals had strong priority scores, Asians were 4 percentage points and African-American applicants were 13 percentage points less likely to receive NIH investigator-initiated research funding compared with whites. After controlling for the applicant's educational background, country of origin, training, previous research awards, publication record, and employer characteristics, black applicants were 10 percentage points less likely than whites to be awarded NIH research funding.

**Nosek, B. et al. 2009. National differences in gender–science stereotypes predict national sex differences in science and math achievement. *PNAS* 106(26):10593–10597.**
Using results from more than half a million Implicit Association Tests completed by citizens of 34 countries, this study revealed that about 70 percent of people held implicit stereotypes associating science with males more than with females. Nation-level implicit stereotypes predicted nation-level sex differences in 8th-grade science and mathematics achievement, while self-reported stereotypes did not provide additional predictive validity of the achievement gap. The authors suggest that implicit stereotypes and sex differences in science participation and performance are mutually reinforcing, contributing to the persistent gender gap in science engagement.

**Stout, J., et al. 2010. STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering and mathematics. *Journal of Personality and Social Psychology* 100(2):255-270.**
This study tested a stereotype inoculation model, which proposed that contact with same-sex experts in academic environments involving STEM disciplines will alter women's attitudes toward STEM and motivation to pursue STEM careers. The studies revealed that exposure to female STEM experts promoted positive implicit attitudes and stronger implicit identification with STEM, greater self-efficacy in STEM, and more effort on STEM tests. The authors suggest that the benefit of seeing same-sex experts is driven by greater subjective identification and connectedness with these individuals, which in turn predicts enhanced self-efficacy, domain identification, and commitment to pursue STEM careers.

**Trix, F. and C. Psenka. 2003. Exploring the color of glass: Letters of recommendation for female and male medical faculty. *Diversity & Society* 14(2):191-220.**
This study examines over 300 letters of recommendation for medical faculty at a large American medical school in the mid-1990s. Letters written for female applicants were found to differ systematically from those written for male applicants in extremes of length, in the percentages lacking in basic features, in the percentages with doubt raisers, and in frequency of mention of status terms. Further, the letters commonly reinforce gender schema that tend to portray women as teachers and students, and men as researchers and professionals.

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## Barriers and Challenges

While progress has been made to assist women and underrepresented minorities in advancing their careers in STEM disciplines, barriers and significant challenges still remain. Due to the small number of women of color in the academy, difficulty remains for women of color to form same gender/race mentorship relationships, to avoid being stereotyped and to feel like they belong at their institutions. These factors can significantly affect a faculty member's ability and motivation to progress in their career. In addition, women of color often feel the stress of being underrepresented in their gender and race, as well as stress from cultural expectations. The following references describe some of the unique challenges for women of color in the academy.

**Annotated Bibliography**

**Coons, R. 2010. Survey: Women and minorities discouraged from science careers. *Chemical Week* 172(7):14.**
This article discussed the results from the Bayer Corporation survey, which shows that a significant number (40 percent) of today's women and underrepresented minority chemists and chemical engineers say they were discouraged from pursing a STEM career at some point in their lives. Leading workplace barriers for the female and minority chemists and chemical engineers include managerial bias, company/organizational/institutional bias, a lack of professional development, no/little access to networking opportunities, and a lack of promotional/advancement opportunities. Nearly three-quarters of the chemists/chemical engineers say that it is harder for women to succeed in their field than it is for men, while more than two-thirds think it is more difficult for minorities to succeed than it is for non-minorities.

**Obiomon, P.H. et al. 2007. *Advancement of Women of Color in Science Technology, Engineering and Math (STEM) Disciplines*. Retrieved on October 10, 2013 from www.nyu.edu/frn/publications/advancing.women/Adv.%20Women%20in%20Stem%20Tickles.html**
This paper identifies unique barriers faced by women of color in science, technology, engineering and mathematics (STEM) in faculty positions, as well as positions of leadership within the STEM industry. Stereotyping, bicultural stress, and tokenism are barriers that ultimately affect the extent to which women of color advance to tenure, receive research funding, obtain leadership positions, and remain in long-term faculty and leadership positions. Solutions to overcoming these barriers lie primarily in awareness, understanding, and training of women of color and the administrators, faculty, and STEM management involved in advancing their status.

**Reyes, M. 2011. Unique challenges for women of color in STEM transferring from community colleges to universities. *Harvard Education Review* 81(2):241- 262.**
This study investigates the experiences of women of color who transfer from community colleges to four-year institutions, an increasingly common path for STEM majors. The study finds that women of color who transfer feel that their new institutions send them signals that they do not belong because of their age, ethnicity, and gender, as well as because of preconceptions that transfer students are not adequately prepared or are not "high-quality students."

**Xu, J.Y. and C.L. Martin 2011. Gender differences in STEM disciplines: From the aspects of informal professional networking and faculty career development. *Gender Issues* 28:34-154.**
This study uses organizational network theories to study the differences between the function and value of informal professional networks (IPNs) for men and women STEM faculty at universities in the Southeastern University Research Association. In this study, IPNs encompass either mentoring or other informal work or social relationships. The authors found that woman had significantly fewer IPNs than male faculty, yet perceived IPNs as very important in their professional development. Women were more likely to have a gender-diversified IPN than male faculty, and a high percentage of women perceived that gender and/or ethnic background were a barrier for IPN access, while the majority of men did not believe those factors were relevant.

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Wyche, K.F., & Graves, S.B. 1992. Minority women in academia: Access and barriers to professional participation. *Psychology of Women Quarterly* 16:429-437.

## Recommendations and Policy Implications

While there are limited studies that specifically examine women of color in academic STEM disciplines, there have been proposed recommendations for policy interventions to increase the representation and support of this subset of faculty members. The following references describe some of the recommendations that have been proposed in journal articles, reports from the National Academies, and various workshops.

### Annotated Bibliography

**Bilimora, D. et al. 2008. Breaking barriers and creating inclusiveness: Lessons of organizational transformation to advance women faculty in academia science and engineering. *Human Resource Management* 47(3*)*:423-441.**
This article presents the experience of 19 U.S. universities, funded by the National Science Foundation's ADVANCE Institutional Transformation program, that have embraced comprehensive transformation for improved gender representation and inclusion in science and engineering disciplines. It describes the facilitating factors, program initiatives, institutionalization, and outcomes of their transformation, and suggests a transformation model that all organizations can use to create an inclusive and productive workplace for a diverse workforce.

**Johnson, A. 2005. Policy implications of supporting women of color in the sciences. *Journal of Women, Politics and Policy* 27(3): 135-150.**
This research suggests that there is a pool of women of color with interest in science and the academic skills to pursue that interest. If given the support necessary to persist in science, these women will choose careers that address many other needs, domestic and international, including schooling and science education; rural and urban healthcare; public health and medical research; the environment; and other public service fields. Investing in the retention of high-achieving women of color in science yields a return on multiple levels.

**National Institutes of Health. Office of Research on Women's Health. 1992. *Women in Biomedical Careers: Dynamics of Change: Strategies of the 21st Century*. Washington, DC: National Institute of Health.**
This report is a summary of the NIH-sponsored workshop from July 1992 that discussed the issues and barriers that women face when considering a biomedical career. It contains a section on minority women's perspectives, which describes some of the obstacles that African-American, Asian-American, Native American, Latino and other women face. It states that overemphasis on the common ground and the greater good of all women may cause minority women to suspend working toward addressing the biases attributed to their race/ethnicity or breaking through cultural norms that may limit promotion in the workforce. Recommendations for institutions to provide commitment to the special considerations of minority women include: (1) providing trustworthy mentoring and guidance; (2) implementing clear institutional policies; (3) providing resources to facilitate women meeting expectations; (4) gaining a thorough understanding of the pros and cons of early appointment into administrative roles; (5) shifting from traditional thoughts about affirmative action; (6) providing non-threatening opportunities for minority women that downplay stereotypes; (7) building programs with other minority men or women scientists; (8) supporting faculty development in pre- and postdoctoral programs without penalties; (9) disaggregating data on women faculty by race/ethnicity; and (10) clarifying the pathway to promotion and tenure.

**National Institutes of Health. Office of Research on Women's Health. 2007. *Meeting Proceedings of the National Leadership Workshop on Mentoring Women in Biomedical Careers.* Washington, DC: National Institutes of Health.**
This meeting proceedings includes recommendations that were specific to women of color that were discussed in a Mentoring Minority Women in Biomedical Research Workshop. These recommendations include (1) create overarching initiatives involving academic institutions and professional associations; (2) conduct and support both quantitative and qualitative research to capture and document experiences of women of color; (3) support practice recommendations in training and teaching for mentors regarding issues of women of color and provide resources for an ongoing dialogue on issues regarding women of color; and (4) support policy recommendations to disaggregate data on women of color and incorporate themes and issues regarding women of color in future meetings.

**National Institutes of Health. Office of Research on Women's Health. 2008. *Women in Biomedical Research: Best Practices for Sustaining Career Success Meeting Proceedings* (NIH Publication No. 09-7366). Washington, DC: National Institute of Health.**
This report summarizes the proceedings of a 2008 meeting planned by the Women in Biomedical Research Workgroup at the NIH that highlighted best practices in place or under development at academic health centers and in private industries to increase the participation of women in biomedical careers. Top-down strategies by many private corporations have retained and promoted talented women during a time when academic institutions were not able to achieve similar success in these goals, though isolated academic institutions have achieved successes that were highlighted at the meeting. Common themes that were discussed at the meeting demonstrate the importance of the following: analysis of programs to determine best practices, securing strong commitment from top management, having transparent policies for hiring, salaries and promotions, rewarding success, increasing recruitment pools, celebrating

achievement, instituting "family-friendly" policies, establishing support programs at each career stage, and including women on search committees.

**National Research Council. 2007. *Understanding Interventions That Encourage Minorities to Pursue Research Careers: Summary of a Workshop.* Washington, DC: National Academies Press.**
This workshop summary is addressed to a number of different stakeholders, including researchers and prospective researchers on the efficacy of interventions from a variety of disciplines; program directors and others involved with undergraduate research and mentoring programs; funders and other program supporters; individuals and institutions committed to recruiting and fostering the success of diverse student populations; professional societies, and others with interest in these issues.

**Ong, M. 2010. *The mini-symposium on women of color in science, technology, engineering and mathematics: A summary of events, findings and suggestions.* Cambridge, MA: Technology Education Research Center (TERC).**
This report captures the presentations and discussions at the Committee on Equal Opportunities in Science and Engineering (CEOSE) Mini-Symposium on Women of Color in STEM in October 2009. A list of recommendations resulting from this conference was presented to the CEOSE and includes: (1) increase funds for programs that help to augment the number and success of women of color in STEM fields; (2) increase the knowledge base on women of color in STEM through more research, evaluations, and support for publishing; (3) develop and support a centralized, digital clearinghouse of information about women of color in STEM; (4) create and sustain a professional network for women of color in STEM; (5) recognize and study transitions that represent the greatest points of loss of women of color from STEM fields; (6) hold grantees to greater accountability for meeting the NSF Broader Impacts criterion of broadening participation; (7) give recognition awards to grantees who demonstrate outstanding work in broadening participation in STEM; (8) protect the funding of and ensure the mentoring of minority and female graduate students, postdoctoral fellows, and junior faculty; and (9) support efforts to educate the public about the status of women of color, minorities, and women in STEM through citizen science efforts, informal science education, and other channels.

**Ong, M. et al. 2011. Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Education Review* 81(2): 172-208.**
This paper provides a synthesis of empirical research produced over the last forty years, highlighting the variety of factors that support or challenge underrepresented minority women in STEM undergraduate and graduate programs. The findings reveal that existing initiatives may not be effectively serving minority women and that the perceived lack of interest in STEM among women of color is a myth. The authors recommend that a) institutional policy should support the advancement of underserved populations through engagement in rigorous research, student-faculty mentoring relationships, and access to professional development and publishing opportunities; b) states should have transfer policies between two- and four-year institutions; and c) researchers should disaggregate data on women of color in STEM to further understand how the intersection of race and gender manifests in different subfields.

**Wong, E.Y. et al. 2001. Promoting the advancement of minority women faculty in academic medicine: The National Centers of Excellence in Women's Health. *Journal of Women's Health and Gender-Based Medicine*, *10,* 541-550.**
This paper summarizes national trends of women and minorities in U.S Academic Medicine programs and further highlights six programs funded by the National Centers of Excellence in Women's Health initiative that were required to develop a specific focus on careers of minority women faculty. The programs include Harvard Medical School, University of Illinois in Chicago, University of Puerto Rico, Tulane and Xavier Universities, University of Wisconsin and University of Washington. The programs implemented at these schools addressed many issues for women faculty such as networking for support, informal and formal mentoring, faculty development, dissemination of information, and installment of awards for women faculty members. The authors proposed four recommendations for institutions to address the underrepresentation of minority women faculty: (1) measuring progress; (2) institutional support for recruitment; (3) leadership commitment to faculty retention; and (4) further research and funding to define issues relevant to advancing minority women faculty.

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# Appendix E-1

## Call for Written Testimony & Summary of Programmatic Efforts and Recommendations from Written Testimonies

Conference planners sought to engage organizations and professional societies in discussions about the topics on the conference agenda by inviting organizations and individuals to submit a written testimony addressing issues specific to their discipline and/or organization. The written testimony could cover one or more of the following topics (but was not limited to these suggestions):

- Data on women of color within the organization or discipline by gender, race/ethnicity, educational level, and employment sector;
- Challenges or barriers to success that confront women of color in the organization at various stages in their careers from graduate student to working professional;
- Policies and/or programs implemented by the organization to enhance the participation of women of color and to advance their academic careers;
- Lessons learned from any policy and/or program efforts and overall policy recommendations to increase the representation and career satisfaction of women of color in their discipline or organization.

The written testimonies were reviewed by the conference planning committee members for content and suitability. It was the responsibility of the organization submitting the testimony to fact-check any statements or data submitted in their written testimony. All of the written testimonies were posted on the conference website, and distributed at the conference. They informed the conference's discussions and incorporated viewpoints from important stakeholders in these issues.

Based on the written testimonies that were submitted to the conference, the committee summarized and compiled a list of prevailing practices and recommendations from the written testimonies (See Table E-1-1, Table E-1-2, and Table E-1-3).

**Table E-1-1** List of professional societies and federal agencies that submitted written testimony.

| | |
|---|---|
| 1 | American Association for the Advancement of Science |
| 2 | American Astronomy Society |
| 3 | American Chemical Society |
| 4 | American Indian Science & Engineering Society[1] |
| 5 | American Institute of Physics |
| 6 | American Mathematical Society |
| 7 | American Meteorological Society |
| 8 | American Physical Society |
| 9 | American Political Science Association |
| 10 | American Psychological Association |
| 11 | American Society for Biochemistry and Molecular Biology |
| 12 | American Society for Civil Engineering |
| 13 | American Society for Engineering Education[2] |
| 14 | American Society for Mechanical Engineering |
| 15 | American Society for Microbiology |
| 16 | American Sociological Association |
| 17 | Association for Women in Mathematics |
| 18 | Biomedical Engineering Society |
| 19 | Computer Research Association |
| 20 | Geological Society of America |
| 21 | National Aeronautics and Space Administration |
| 22 | National Institutes of Health |
| 23 | National Organization for the Professional Advancement of Black Chemists and Chemical Engineers |
| 24 | National Postdoctoral Association |
| 25 | National Society of Hispanic Physicists |
| 26 | National Society of Black Physicists |
| 27 | Rutgers University Women of Color Scholars Initiative |
| 28 | Society for Neuroscience |

[1] This written testimony is based on the author's personal experience and the faculty composition at the Department of Civil and Environmental Engineering at the University of Utah.

[2] This written testimony is based on two programs funded by NSF ADVANCE Program at the North Carolina State University.

**Table E-1-2** Prevailing practices on women of color from written testimonies.[3]

| Prevailing practices | Professional Societies | Federal Agencies | Universities |
|---|---|---|---|
| The establishment of boards and committees (including diversity office) within its governance structure to focus on issues of women of color and address their challenges. | 2[4], 3, 7, 8, 9, 10, 12, 15, 16, 20, 24, 28 | 21, 22 | 27 |
| The creation of professional development programs (including mentoring programs). | 9, 10, 12, 16, 17, 18, 19, 23, 28 | 22 | 13, 27 |
| The creation of programs and awards that support women of color by providing travel funds, scholarships, research grant, etc. | 3,6, 8, 10, 16, 18, 24, 26, 28 | 22 | 27 |
| The promotion, endorsement, and conduct of surveys and studies to improve the collection and evaluation of data on women of color. | 1, 5, 9, 10, 12, 14, 15, 19 | 22 | |
| The inclusion of "diversity" in the professional societies' mission, core value and strategies. | 2, 3, 7, 14, 20, 23, 24, 28 | | |
| Programs to help improve institutional climate in academia, to initiate, or to sponsor diversity events. | 8, 14, 16, 17, 24 | 21, 22 | 4, 13, 27 |
| The development of partnership among professional societies, with federal agencies, universities and other entities. | 7, 9, 12, 14, 17, 23, 25 | | |
| Engagement students in the pipeline and increase recruitment and retention. | 2, 7, 8, 9, 12, 17, 25 | 21 | |
| Recognition of women of color's achievement and accomplishments; and encouragement nominations of women of color for awards/memberships. | 8, 10, 17, 18, 19 | 22 | |
| The integration of trainings and networking opportunities into the societies' meetings. | 7, 10, 11, 18, 26 | | |
| The engagement of women of color in leadership positions. | 1, 7 | | |
| Federal programs to increase recruitment and retention of women and minority workforce. | | 21, 22 | |
| Dissemination of effective practices and successful program experiences | 24, 25 | | |

[3] The summary is based on information distilled from the written testimonies. It does not include programs or policies that exist but were not mentioned in the written testimonies.
[4] Number correlates with organizations listed in Table E-1-1.

**Table E-1-3** Recommendations from written testimonies.

| Recommendations | Professional Societies | Federal Agencies | Universities |
|---|---|---|---|
| To better collect and report data, and to have more funding available for research related to women of color in STEM. | 1, 2, 7, 8, 10, 12, 18, 19, 24 | 21, 22 | |
| To have better and more mentoring (including more resources for building the mentoring network), and to provide role models. | 10, 11, 15, 17 , 18, 23, 24, 28 | 22 | 27 |
| To build, develop and sustain a community for women of color. | 1, 2, 7, 8, 19, 23 | | 13, 27 |
| To build awareness of the issues related to recruitment, retention and advancement of women of color in STEM, and to call for attention on the issues from the entire institution. | 1, 2, 7, 10, 18, 23 | 22 | 27 |
| To focus on the pipeline and attract younger generation to major in STEM and pursue a STEM career; to facilitate the critical transitions for students and faculty (e.g., from undergraduate to graduate, from students to professionals). | 8, 12, 15, 28 | 21, 22 | |
| To engage more women of color in leadership positions; to improve self-empowerment; and to recognize women of color's accomplishment and achievement. | 7, 15, 17, 18, 26 | | 13 |
| To develop and improve work-life balance policies in academia (e.g., flexible working hours, supplement to maternity leave). | 11, 17, 24, 18 | | |
| To reward and recognize institutions of individuals that support women of color. | 2, 10, 18 | | 13 |
| To engage various stakeholders in the conversation (professional societies, industry, government and academia). | 12, 18 | 21, 22 | |
| To identify, highlight, and disseminate model programs and best practices for maximizing talent of women of color. | 10, 19, 28 | 22 | |
| To ensure the diversity component of committees, conference speaker, and prize nomination. | 17, 18 | | 27 |
| To continue federal funding programs (e.g., NSF ADVANCE program), and to gain financial support for meetings, workshops, travels, etc. | 17, 24 | | |
| Federal agency to establish compliance programs to conduct compliance reviews of their grantees. | 26 | 21 | |

# Appendix E-2

## American Association for the Advancement of Science (AAAS) and Minority Women in Science

Shirley M. Malcom, Director and Yolanda S. George, Deputy Director,
Education and Human Resources Programs, AAAS

We are pleased to provide written testimony on the work of AAAS with regard to minority women in science for the NRC Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia Conference, June 7-8, Washington, DC. As indicated by the information provided in this testimony, we are proud of the AAAS record on advancing minority women in science, engineering and biomedicine—proudest, perhaps, of the fact that we, as a professional association, initiated this discussion and defined the related issues that have helped shape and guide the work in policy, programs, and practices over the past 37 years (http://archives.aaas.org/docs/1975-Double percent20Bind.pdf).The recommendations provided are based in part on the work that we describe in this document.

**History of AAAS Involvement**

In 1973 the AAAS Board of Directors appointed a Committee on Opportunities in Science (COOS) to advise the Association on matters related to increasing the representation of women and minorities in science, engineering and related fields. In 1975 the mandate of COOS was expanded to include persons with disabilities.

While, from its establishment, the committee's concerns implicitly included minority women, it was not clear in 1973 if or how these concerns might differ from those of "all women" or "all minorities." In summer 1975 Dr. Janet Welsh Brown, first director of the AAAS Office of Opportunities in Science, participated in a meeting of project directors of minority-focused programs and a subsequent meeting of women-focused projects, all supported by the National Science Foundation (NSF). She noted that, in the first meeting, the principal investigators were all minority men and in the latter the principal investigators were all white women. Thus, began the efforts of the AAAS to explore the particular concerns related to minority women in science and engineering.

With support from the NSF, the AAAS undertook the first study and convened the first conference on minority women in science in December 1975. The specific groups targeted for this effort included African American, American Indian, Mexican American and Puerto Rican women; the specific fields included those in the physical and biological sciences, mathematics, and engineering, as well as biomedicine. Despite the source of funding from the NSF, it was argued that the inclusion of biomedical fields was necessary if we were to identify a critical mass for example, American Indian women where the population in science-related areas was especially small.

Themes emerged from the organization of the initiative (surveys, interviews and conference discussions) that foreshadowed later work and advocacy by AAAS and others: the

need for better data collection and reporting by race, sex and field of study; the need to look at experiences of different age cohorts; the variation in experiences across racial/ethnic groups, across the educational spectrum and in the workforce; the role of HBCUs and other minority-serving institutions; career and family related issues; and the impact of affirmative action and the law on education and careers.

Though the report of the conference, *The Double Bind: The Price of Being a Minority Woman in Science* (Shirley Mahaley Malcom, Paula Quick Hall, and Janet Welsh Brown, AAAS, Washington DC, 1976) was published in 1976, it has remained a touchstone that has guided many researchers as they sought to move from the experiences shared by the conferees to a rigorous exploration of issues and circumstances first elaborated in the report.

AAAS highlighted the conference and reported it in the AAAS News section of *Science* magazine (*Science*, 6 February 1976:Vol. 191 no. 4226 p. 457DOI: 10.1126/science.191.4226.457), giving visibility to the issue to the larger science community. In 1977, a National Network of Minority Women in Science (MWIS) was established at an AAAS Annual Meeting with Yolanda Scott George as its founding chair. In addition, several local, independent networks were established, with at least one, the DC MWIS, operating to this day.

Subsequent work by AAAS was undertaken to address recommendations that emerged from the conference: the development and publication of career related materials specifically aimed at speaking to the challenges and tensions of minority women in science and engineering called out by the conferees; collaboration with the Scientific Manpower Commission (later the Commission on Professionals in Science and Technology) in promoting the availability and use of race by sex disaggregated data; networking at the AAAS annual meeting; greater recognition given to minority women, such as in nominations and appointments to committees, for prizes, etc.

Subsequently efforts have also been made to understand issues related to participation in science and engineering by Asian American women, especially with regard to barriers to their advancement.

**Mainstreaming Issues Related to Minority Women in Science**

AAAS is proud of its legacy related to minority women in science. Minority women are present across all aspects of the work of the Association: they have served on its Board and two have served as AAAS president; they have been present as members and leaders of its Board-appointed committees; they have participated in its programs, such as the highly regarded AAAS Science and Technology Policy and Diplomacy Fellowships; and they serve among its senior management.

A *Double Bind* conferee, Dr. Shirley Ann Jackson, president of RPI, has served as president of AAAS. Dr. Alice Huang of Caltech has also led the Association as its president.

AAAS, through the advocacy of its Committee on Opportunities in Science, has continued to express its concerns related to the availability of data from the NSF, in this case around newly emerging challenges related to suppression of data due to small "cell size," aggregated in many instances with increasing sub-field disaggregation. For example, this has proven problematic in accessing race by sex data at the Ph.D. level for science and engineering, making it very difficult to assess progress of minority women in science and engineering. In contrast, data systems of the Association of American Medical Colleges provide a model of data accessibility.

In the recent work of the AAAS on law and diversity, undertaken in partnership with the Association of American Universities, we have attempted to specifically understand the position of minority women as students and faculty in science and engineering as legal challenges to affirmative action increase, including in science and engineering fields.

AAAS staff continues to publish scholarly work and give presentations on minority women in science and engineering to the extent possible, to nurture and encourage the work of other researchers.

Profiles of minority women continue to be included among those highlighted in Science Careers (http://sciencecareers.sciencemag.org/), and minority women are included in projects and programs undertaken throughout the organization.

**Women of Color in STEM in the 21st Century**

While women of color are earning more bachelor's (10 percent vs. 7 percent of all STEM bachelors awarded in 2009) and advanced STEM degrees (7 percent vs. 4 percent of all such degrees awarded in 2009) than men of color, there are striking differences across fields. In addition, more men of color are employed in STEM fields than women of color (data sources include the *National Center for Education Statistics, IPEDS Completions and Fall enrollment surveys; Higher Education Research Institute, American Freshman Survey; and US Census Bureau, Current Population Survey*).

- Underrepresented minority women, like women in general, earn higher proportions of bachelor's degrees in medical and social sciences and lower proportions of bachelor's degrees in computer sciences and engineering (1989 to 2008 data). www.nsf.gov/statistics/wmpd/digest/theme2_3.cfm
- Unemployment rates are higher for minority scientists and engineers than for white scientists and engineers overall and are higher for minority female than for minority male scientists and engineers (2006 data). www.nsf.gov/statistics/wmpd/digest/theme3.cfm
- Black and Hispanic women are 2 percent of the STEM workforce, while black and Hispanic men are 5 percent. Asian women are 5 percent of the STEM workforce, while Asian men are 12 percent of the STEM workforce (2006 data). www.nsf.gov/statistics/wmpd/digest/theme4.cfm

Thirty-five years later, in 2011, as a result of a Harvard University symposium on *Unraveling the Double Bind: Women of Color in STEM*, Lindsey Malcom and Shirley Malcom examined the progress of women of color in STEM since the Double Bind Conference. In general, their research findings indicate that:

- The next generation women, The Double Bind Daughters, face different challenges…the responses required being less about the actions of the women, individually or collectively, and more about the responsibilities and action (or inaction) of institutions.
- Community colleges and all types of institutions play an increasing role in the STEM education of minority women.
- Minority women faculty are more likely to be in two-year colleges and non-doctoral granting four year colleges, and they spend more time on instructional activities versus research.
- Between the 1970's and now, there have been numerous legal challenges to special STEM educational programs for minorities and women.

- Small numbers are driving statistical agencies to suppress data needed to inform programs, policies, and practices (Lindsey E. Malcom and Shirley M. Malcom, The Double Bind: The Next Generation, 2011 Harvard Education Review).

Other studies, such as "Inside the Double Bind" (Maria Ong, Carol Wright, Lorelle Espinosa, and Gary Orfield, 2010 (www.terc.edu/work/1513.html), identified several characteristics across the undergraduate and graduate experiences that affect the progression of women of color in STEM, namely:

- the difficulties of transitions between academic stages (i.e. high school to college, community college to four-year institution, college to graduate school) and transitions from minority serving institutions to predominantly white institutions;
- the critical role that social climate – including issues of isolation, identity, invisibility, negotiating/navigation, micro-aggressions, sense of belonging, and tokenism – plays in women's satisfaction and retention in STEM; and
- the positive, as well as negative, effects of words and actions by faculty who serve as mentors, role models, teachers, and authorities on the intelligence and abilities of their students.

In light of the changing demographics, it is time once again to examine how to move a national agenda forward to support the success and advancement of minority women in STEM. Over the 37 years since the *Double Bind* conference there has been no coordinated national response to the challenges and opportunities for women of color in STEM. Federal efforts have been limited; responses of higher education institutions as well as professional societies have been spotty or non-existent. Perhaps the failure to mount a full program for women of color in STEM helps explain why so many of the concerns outlined in the Double Bind still resonate today, and why recommendations made at that time have yet to be fully implemented.

With better data come better understandings, such as around the issues related to Asian American women. At the time of the 1975 conference, participation was limited to women from underrepresented minority groups largely because of funder interest. As we explored data related to Asian American women we noted that there was the need to look much more closely at the notion of representation:

- to disaggregate statistics for citizens versus non-citizens and permanent residents;
- to distinguish among different Asian American populations (e.g., Chinese or Japanese origins versus Filipino or Hmong origins); and
- to focus on advancement, unemployment rates and salary differentials as well as educational outcomes and workforce participation.

Lack of data makes it difficult to say very much beyond anecdotes for women with disabilities (another double bind) or about those affected by the triple bind of race, sex and disability.

**Recommendations**

Moving into the future, we would recommend the following policies, programs and actions:

- **Awareness building** – More effort needs to be focused on building awareness of the issues related to advancement of women of color in STEM (science, technology,

engineering, mathematics, and related fields).The conference is an excellent place to start and should be a launch pad for continuing discussion and action.

- **Better data collection and reporting** – It is critical to be able to assess current conditions related to women of color in STEM as well as to measure progress and evaluate the impact of interventions undertaken to improve their status. Data must inform this work. Disaggregated data are essential if institutions and organizations are to identify baselines and measure progress.
- **More funding for research** – More funding is needed for research related to minority women in STEM. It will be difficult to make progress in advancing women of color in STEM without better information regarding effective strategies.
- **More funding of research** – Minority women in STEM need more support for research. Malcom and Malcom, 2011 note that minority women in STEM are more likely to be engaged in instructional as opposed to research activity in higher education institutions. Support for start-up research funding and for time to pursue research is critical. In the recent article in *Science* magazine related to disparities in RO1 grants (NIH funding) received by African Americans, data were not provided by sex, making it hard to determine the role of gender in contributing to the results seen (*Science* 19 August 2011: Vol. 333 no. 6045 pp. 1015-1019DOI: 10.1126/science.1196783).

In light of the continuing isolation and absence from many networks that provide informal mentoring and support, there remains the need for mainstreaming issues and concerns related to women of color in STEM even as we target, as needed, to address specific professional development and career-family issues that may be group specific. Guidance is needed for those who develop and implement STEM programs, K-grad, regarding strategies for identifying, recruiting, retaining and supporting women of color as well as for reaching out to and working with parents and communities to support these women's STEM career aspirations.

Professional societies have much to offer in creating professional development and support programs as well as online resources to benefit the recruitment, retention, and advancement of women of color and women with disabilities in the STEM workforce, and in fostering their recognition within and integration into their discipline and the profession.

# Appendix E-3

## Women of Color in Astronomy and Astrophysics

Dara Norman, Jedidah Isler, Hakeem Oluseyia[5]
Nancy Morrison, Caroline Simpson, and Laura Trouille[6]

### Introduction

Women of color (WoC) are at the intersection of race and gender. While they experience issues that arise for both women and minority groups, they are often overlooked in efforts on behalf of either category, to the detriment of their persistence in academia.[7]The next section of this article enumerates barriers that face WoC in astronomy, starting with those that particularly affect career establishment (early graduate student to postdoctoral) and moving to those that impact later career stages. Later sections describe steps toward solutions to these problems, measures taken by the American Astronomical Society (AAS), and lessons learned from academic programs.

### Nine Barriers

1. Difficulty building networks/collaborations: In astronomy and astrophysics (hereafter, astronomy), large collaborative projects that employ expensive, cutting-edge instrumentation and are designed to tackle many research questions simultaneously are increasingly important. Career success may require that young researchers join these high-profile collaborations. By doing so, they gain access and visibility, meet future employers and collaborators, establish career-enhancing networks, and are enabled to build skills and confidence. WoC often lack the connections that are required to join these collaborations and be supported in them.

2. Difficulty achieving insider status: In astronomy, some activities in addition to writing research papers identify experts in their field and give younger researchers insider status and the full recognition that comes with it. These by-invitation-only activities include: serving on peer review panels and on telescope time allocation committees; refereeing journal articles; delivering invited talks at conferences, etc. Again, WoC often lack the connections necessary to receive these invitations.

3. Lack of effective mentoring: Effective mentoring, especially by thesis advisors, would be a key to overcoming barriers 1 and 2, but it is often lacking, sometimes because suitable role models are unavailable. Effective mentoring is more than giving academic

[5] Members of American Astronomical Society (AAS), AAS Committee on the Status of Minorities in Astronomy
[6] Members of AAS, AAS Committee on the Status of Women in Astronomy
[7] Purdie-Vaughns & Eibach 2008, Sex Roles, 59, 377

advice and supervising thesis research; it involves these and other career-building activities.

4. Unfavorable department climate and lack of support: In the early years of graduate school, it can be crucial to know that at least some people in one's department expect and hope for one's success in astronomy. WoC in astronomy graduate programs encounter not only subtle signs that this is not the case but also even more damaging, overt indications, including: not being taken seriously in complaints of harassment or bias; inability to find department faculty to work with; and exclusion from department activities (e.g., meeting planning, departmental committees, social gatherings at professors' houses). These barriers are especially challenging early in graduate school; WoC who manage to persist to the later stages of their programs develop coping strategies.

5. Cultural alienation: Cultural alienation often results in WoC never considering astronomy as a career, leaving the field before or after degree completion, and having to manifest one personality while in their department and another outside.[8]

6. Hostility: Unfortunately, racism and sexism are still commonplace in STEM fields, including astronomy. In our experience, most WoC report having been subtly or overtly told that they owe whatever success they may have achieved to being women, minorities, or both, especially when WoC have achieved some milestone, such as landing a job or receiving an award. Such comments are clearly meant to diminish achievements and can be cumulatively devastating over time.

7. Accumulation of disadvantage and underestimation of performance: As WoC in their postdoctoral years seek junior faculty positions, the barriers that they have already faced are often not recognized. Thus, the performance "hit" they may have taken in overcoming these barriers is not taken into account.

8. Solo status/lack of critical mass in job searches: Since 1985, the percentage of astronomy Ph.D.'s awarded to all underrepresented minorities has been in the range 1 percent to 5 percent.[9] If the gender balance of the field as a whole holds for WoC, then they receive fewer than 1 percent of all Ph.D.'s in the field. Research has shown that a lack of like peers (women or minorities) leads to hiring disadvantages[10]. Because of their small numbers in the field, WoC in astronomy almost always suffer from solo status. All these barriers conspire to continue this situation.

9. Stereotype threat: WoC in astronomy are keenly aware that they are often the first, or nearly the first, WoC that colleagues and students have interacted with, sometimes in any STEM field. The pressure that WoC may feel as representatives of their gender and ethnic group, often called stereotype threat, can lead to stresses that manifest in poor self-esteem, underperformance, or ill health.

[8] Ong et al. 2011, Harvard Educational Review, 81, No. 2, 172
[9] http://csma.aas.org/Norman_minoritypaperI_DEM_EPO.pdf
[10] Thompson & Sekaquaptewa 2002, Analyses of Social Issues and Public Policy, vol. 2, no. 1

More generally, WoC face the same barriers as other women in science: insufficient science education, lack of support, and socialized lack of interest in STEM; and, in the professional years, the two-body problem and problems of work-life balance.

**Recommendations to External Communities**

The above barriers inform our interrelated, but largely independent, recommendations to external communities for action items in support of WoC in academia.

**Build cohorts of high achieving WoC graduate students at leading institutions** to provide supportive, interdisciplinary peer networks for WoC. Organizations like the Posse Foundation, Inc. and the Fisk-Vanderbilt Bridge Program[11] have valuable experience with this technique and should be seen as resources in establishing strong cohorts of WoC graduate students, in combination with HBCUs (historically black colleges and universities) and MSIs (minority serving institutions). For example, Florida International University (FIU) and Spelman College have successful undergraduate physics programs and can be expected to be able to extend their methods to the graduate level. Larger majority institutions should take the lead in providing the physical resources necessary to host these cohorts, and key participants should cooperate to build a framework for nurturing them.

Key external participants: Posse Foundation, Inc.; Fisk-Vanderbilt Bridge Program; leading STEM HBCUs (FIU, Xavier, Spelman, etc.); leading STEM MSIs; and funding agencies.

Barriers addressed: #1,4,5,9

**Require diversity and cultural awareness training for people in supervisory roles.** Lack of cultural awareness and understanding often leads to over-reliance on stereotypes. Requiring leaders in the academy, such as deans, department chairs, and search committee chairs, to participate in diversity training and awareness programs would force their attention to the issue. Funding agencies could make such training a requirement for federal research funding. In addition, professional societies could provide regular opportunities for such training at their conferences. An important resource is the University of Michigan ADVANCE Faculty Recruitment Guide.[12]

Key external participants: Funding agencies, leaders in the academy, experts in diversity, policy makers, and professional societies.

Barriers addressed: #1,2,3,4,5,6,7,8,9

**Encourage fair hiring practices that minimize implicit bias towards WoC.** Studies[13] have shown that only after reviewers are given specific metrics with which to assess candidates do they avoid giving unfair advantage to white males. The active dissemination of training

[11] Stassun & Holley-Bockelmann 2009, http://wia2009.gsfc.nasa.gov/WIA2009_proceedings.pdf, p. 197

[12] http://sitemaker.umich.edu/advance/faculty_recruitment_publications

[13] Martell 1991, Journal of Applied Social Psychology, 21, 1939; Trix & Psenka 2003, Discourse & Society, 14, 191; and Heilman 1980, Organizational Behavior and Human Performance, 26, 386

materials (such as University of Michigan and University of Wisconsin materials) to departments and at society meetings will promote the adoption of fair hiring practices. Also, encouraging interaction between HBCUs/MSIs and majority institutions may highlight applicants often overlooked in hiring decisions.

Key external participants: Professional societies, majority institutions, HBCUs/MSIs

Barriers addressed: #7,8,6,4

**Reward departments or individual mentors for support of WoC**. Departments, societies, advisors, etc. should be identified and rewarded for their support of WoC. Possible models are the "Woman Physicist of the Month"[14] and the mentoring award of the AAAS.

Key external participants: Funding agencies, policy makers, professional societies, academic departments

Barriers addressed: #1,2,3,4,5,6,7,8,9

**Maintain better statistics and connections to WoC** through graduate school and early career. The small number of WoC pursuing astronomy, together with the lack of information about them, portends a dismal future for recruiting and retaining more.

Creating a mechanism to engage and track WoC can provide significant insight into their obstacles and successes, which we can then begin to address. Once identified, these researchers can be invited to serve on review panels and similar bodies.

Key external participants: Funding agencies, professional societies, academic departments

Barriers addressed: #1,2

**Encourage the development of a network and support group among WoC** at the professional level as a part of, while distinct from, initiatives directed towards women or minorities in the field. This should include special networking opportunities at major conferences, digital venues for interaction between conferences, and funding to support regular meetings across the country for WoC. Professional societies, partnering with minority-focused, interdisciplinary societies, could lead this effort.

Alternating these meetings between majority- and minority-serving institutions will allow communication and networking with all possible participants.

Key external participants: Funding agencies, professional societies (AAS, NSBP, NSHP, SACNAS, etc.), majority institutions and HBCUs/MSIs

Barriers addressed: #1,2,5,6

[14] www.aps.org/programs/women/scholarships/womanmonth/2012.cfm

**Expand the Faculty and Student Teams (FaST) or Visiting Faculty Programs (VFP)**. WoC might get turned off by an initial group of people in a specific astronomy subculture, but might consider transitioning to another subculture (as opposed to out of the field completely) if they have the opportunity to engage a leader in another subfield. Funding for a researcher and 1–2 students to spend 2–3 summers with a leading expert can help.

Key external participants: Funding agencies, professional associations, leaders of fields, academic institutions

Barriers addressed: #1,2,3,4,5,7,9

**AAS Initiatives Relevant to WoC**

We hope that the AAS can be engaged in implementing the above steps. The following already existing initiatives are not specifically designed for WoC but are intended to lower barriers to an astronomy career.

- The AAS vision statement and strategic plan include language supportive of underrepresented minorities.
- The AAS has established committees on the status of women (1979) and of minorities (1997) in astronomy. Both committees have had WoC as active members and have often worked together to benefit underrepresented groups.
  – These committees individually and jointly sponsor special sessions and career workshops at AAS bi-annual scientific meetings, such as:
    "Mentoring a New Generation of Minority Astronomers" (2009)
    "Mentoring Astronomers: Students to Faculty I & II" (2010)
    "Addressing Unconscious Bias" (2010)
    "Mentoring and Networking Groups for Women and Minorities" (2011)
    "Strategies for Addressing Harassment and Prejudice" (2011)
    "Increasing Diversity in Your Department" (2012)
    "Straight Talk About an Astronomical Career: A Professional Development Session" (2012)
  – With assistance from the AAS, both committees maintain web sites, discussion boards, and list servers for their constituencies and both publish bi-annual newsletters.
  – Members of these committees collaborated on preparing this testimony.
- The AAS sponsors the Harlow Shapley Visiting Lectureship Program, in which professional astronomers discuss modern astronomy and astrophysics, mainly at colleges that do not offer an astronomy degree. This program is being redesigned with the aim of reaching out to underrepresented minorities.

**Lessons learned**

Although this testimony emphasizes the needs of WoC at the graduate and professional levels, we are impressed by the achievements of HBCUs and MSIs in improving their undergraduate science programs. For example, by creating inclusive learning communities, FIU grew its physics major from 10 to 150 students over ten years.

Since 1971, Spelman College has increased the percentage of its students earning STEM degrees from 9 percent to 30 percent.[15] Key factors in its success include: a strong institutional vision combined with cooperation between faculty and administrators; external funding; and strategic partnerships with research institutions, national labs, and private STEM companies. The recommendations in this testimony are consistent with this philosophy.

[15] McNair 2009, http://wia2009.gsfc.nasa.gov/WIA2009_proceedings.pdf, p. 85

# Appendix E-4

## American Chemical Society Written Testimonies

The American Chemical Society's (ACS) mission is "to advance the broader chemistry enterprise and its practitioners for the benefit of Earth and its people." In pursuing its mission and goals, ACS systematically applies the Core Value of Diversity and Inclusion for a diverse community of highly-skilled chemistry professionals and the advancement of chemistry as a global multidisciplinary science.

The data for chemistry and the physical sciences show an underrepresentation of women at all levels among Blacks, Hispanics, and American Indian/Alaska Natives relative to the general US population. The underrepresentation of these racial/ethnic populations increases in the trajectory from Bachelor's degrees to Doctoral degrees to employment. White females are underrepresented as well, but this underrepresentation decreases along the same course. In contrast, Asians are overrepresented at all levels in comparison to the general US population.

Among US citizens and permanent residents, of the 11,615 Bachelor's degrees awarded in Chemistry in 2009, 5,825 (50.2 percent) were awarded to women. Among these Chemistry degrees awarded to women, 3,518 (60.4 percent) were awarded to White students; 895 (15.4 percent) to Asian/Pacific Islander students; 592 (10.2 percent) to Black students; 508 (8.7 percent) to Hispanic students; 42 (0.7 percent) to American Indian/Alaska Native students; and 270 (4.6 percent) to students of other or unknown race/ethnicity. (National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 2001–2009).

For Doctoral degrees awarded, data for minority women are available for the Physical Sciences. Of the 2,486 Doctoral degrees in the Physical Sciences awarded to US citizens and permanent residents in 2009, 809 (32.5 percent) were awarded to women. Among these Physical Science degrees awarded to women, 565 (69.8 percent) were awarded to White students; 86 (10.6 percent) to Asian/Pacific Islander students; 41 (5.1 percent) to Black students; 46 (5.7 percent) to Hispanic students; 4 (0.5 percent) to American Indian/Alaska Native students; and 67 (8.3 percent) to students of other or unknown race/ethnicity. (National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 2001–2009).

Of the 334,000 employed physical scientists at all degree levels in 2006, 95,000 (28.4 percent) were women. Among these women employed as physical scientists, 68,000 (71.6 percent) were White; 17,000 (17.9 percent) were Asian; 3,000 (3.2 percent) were Black; and 5,000 (5.3 percent) were Hispanic. Numbers are not reported for American Indian/Alaska Natives because the estimate is less than 500. (National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System).

To enhance the participation of women of color and to advance their careers, the ACS received a grant from the National Science Foundation in 2010 to sponsor travel awards,

symposia, and networking events, and to produce online interview videos with successful women chemists of color. Based on outcomes from the grant, ACS established the Women Chemists of Color program in 2012 to continue the activities. These efforts have been aimed at broadening awareness of challenges for women of color found at the specific intersection of gender and ethnicity; gathering more data about women chemists of color; and providing a forum for building community among women of color. Full program information can be found at www.acs.org/wcoc.

Many of the ACS Women Chemists of Color program offerings have included evaluation components which have allowed participants to identify areas of need and prioritization. Some responses for needed resources were universal such as acquiring scholarships and identifying research topics. Other needs were more specific to this intersection of race/ethnicity and gender and included mentoring by other women of color and outside of gender and/or ethnicity; providing support mechanisms for the unique challenges women face with respect to their cultural norms and expectations; compiling and disseminating resources for women of color in the sciences; increasing numbers in academia; and networking. Priorities identified include resources for career and personal transition points; panel discussions with shared life experiences; data collection; mentoring and support; roles in Society leadership; and, broadening awareness among non-minority women and men. A dominant theme in evaluation responses was the significance of being 'the only one' with both positive and negative associations, such as hypervisibility, isolation, tokenism, and stereotyping.

In addition, three governance bodies of the ACS— – the Women Chemists Committee (WCC), the Committee on Minority Affairs (CMA), and the Diversity and Inclusion Advisory Board (D&I) —serve women of color within the Society. The WCC strives to be leaders in attracting, developing, promoting, and advocating for women in the chemical sciences in order to positively impact society and the profession. CMA aims to lead change in institutional culture within the ACS and the chemical enterprise and achieve full participation and expression of intellectual and creative capacity of underrepresented minorities. D&I is tasked with promoting and advancing diversity and inclusion within and on behalf of the Society.

# Appendix E-5

## American Indian Science and Engineering Society Written Testimony

Otakuye Conroy-Ben[16]

My name is Otakuye Conroy-Ben, and I'm an Assistant Professor of Civil and Environmental Engineering at the University of Utah and an Officer of the Board of Directors for the American Indian Science & Engineering Society. I am from the Pine Ridge Indian Reservation in South Dakota, and may be one of the only American Indian female tenure-track engineering faculty in the country. I received a BS in Chemistry from the University of Notre Dame, and an MA in Chemistry, an MS in Environmental Engineering, and a Ph.D. in Environmental Engineering from the University of Arizona.

Female STEM faculty and faculty of color are severely lacking at institutions of higher education across the country. While an undergraduate at the University of Notre Dame I did not encounter a single female or minority faculty member in my science curriculum. During my Ph.D. engineering program, there were no female faculty members in Environmental Engineering, but there was one Hispanic male professor. It wasn't until I ventured to the Chemistry department when I found two female professors in the Analytical division. Needless to say, I was successful academically without the presence of a female or minority professor, however working with one would have made the path to success easier.

The Department of Civil and Environmental Engineering at the University of Utah is making efforts to diversify its faculty, much to the credit of our departing Chair, Dr. Paul Tikalsky. Of the 17 tenured and tenure-track faculty, two are Hispanic males, one is American Indian (myself), and there are four Caucasian women. I believe our department is the most diverse in the College of Engineering, and our students understand and appreciate this aspect.

The number of American Indian STEM faculty at mainstream institutions across the country is scarce. Presently, there are three American Indian male engineering faculty, located at UC Davis, Colorado School of Mines, and the University of Idaho. There are more (~20) American Indian science faculty across the country. At the University of Arizona, the Provost and Dean of Engineering have developed an initiative to make the University the top institution for American Indian STEM research. They believe academic success for our student population begins with the recruitment of American Indian STEM faculty, and have invested financially in this endeavor.

I encourage the National Academy of Sciences to pursue programs to support faculty development for women and people of color. It is true that often times the female faculty member is the only diverse individual at the decision table. This has been the case in several instances when I sat on panels at the National Science Foundation and the Environmental Protection Agency. In order to bring additional perspectives to the decision-making table at the

[16] Otakuye Conroy-Ben, Ph.D., PE, Secretary, Board of Directors, American Indian Science and Engineering Society; and Civil and Environmental Engineering, University of Utah.

National level, more women and minorities need to be prepared to enter to and succeed in academia.

# Appendix E-6

## Women of Color in Physics Departments: A Data Picture[17]

Rachel Ivie, Statistical Research Center, American Institute of Physics

Most readers know that there are very few women of color in physics, and it is important to know exactly how few there are. However, the numbers alone do not adequately portray the day-to-day inequality that women of color experience in physics. In my years of studying women in physics, I have seen many people make the mistake of assuming that if the representation of women in physics increases to some "acceptable" level, then the problem of inequality will be solved. This is far from the truth. While it is essential to document and remedy the small numbers of women of color in physics, it is also necessary to collect data on other areas of inequality so that they can be addressed. To my knowledge, a few researchers have begun to collect these data (Maria Ong and Sharon Fries-Britt, for example), but the results are either not yet available or have not been widely disseminated among the physics community. **This article will document the tiny numbers of women of color in physics and will also point to areas of potential inequality about which we have no data. These include hiring, salaries, promotions, working conditions, and the general experiences of women of color in physics.**

*Representation.* Figures E-6-1 (bachelor's degrees), Table E-6-1 (Ph.D.s), and Table E-6-2 (faculty members) show just how small the numbers of women of color in physics are. At the beginning of the academic pipeline, there is only a trickle of women of color into physics, and the numbers don't improve farther along. For comparison, approximately 5000 people, mostly white male U.S. citizens, earn bachelor's degrees in physics annually. In 2007, only 181 women of color (including Asian American women) earned bachelor's degrees in physics. In the 33 years shown on Table E-6-1, more than 35,000 people have earned physics Ph.D.s in the U.S., but only 111 under-represented minority women have done so. In all 800 physics and astronomy departments in the U.S. (Table E-6-2), there are approximately 9100 full-time equivalent faculty positions, but there are only 29 black women and 38 Latinas on physics faculties.

[17] A version of this article was originally published in *CSWP Gazette*, Spring 2010.

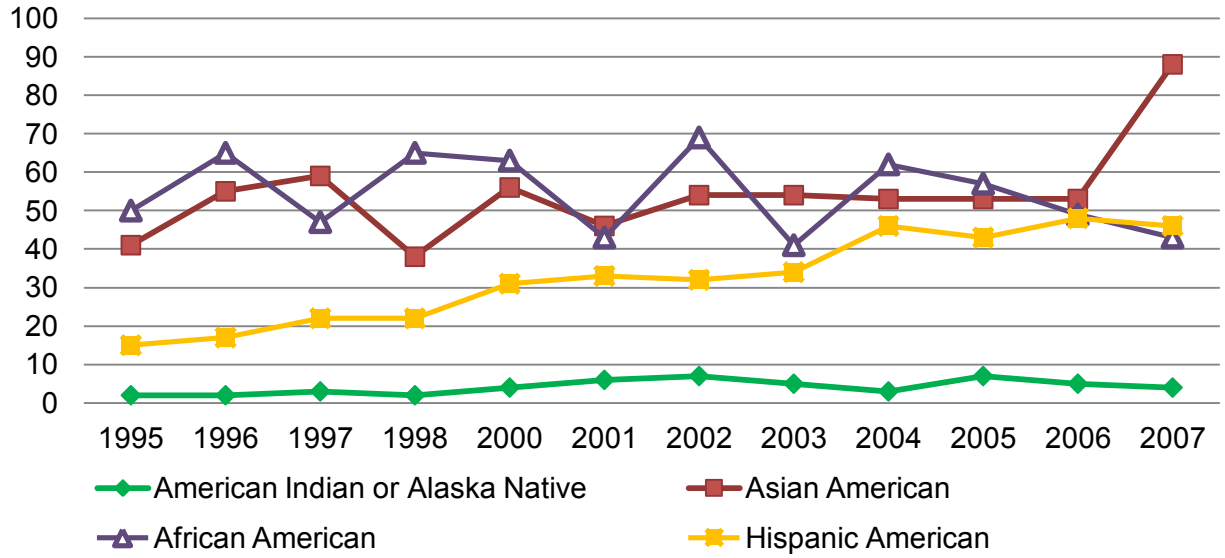


**Figure E-6-1** Number of Women of Color Earning Bachelor's Degrees in Physics in the US, 1995-2007
Source: National Center for Education Statistics. Data are not available for 1999.

**Table E-6-1** Number of women who have earned Ph.D.s in Physics in the US, 1974-2006.

| US Citizens and Permanent Residents | | Number in 33 years | percent |
|---|---|---|---|
| | African American | 46 | 1.2 |
| | American Indian or Alaska Native | 4 | 0.1 |
| | Asian American | 492 | 12.8 |
| | Hispanic | 61 | 1.6 |
| | White | 1784 | 46.3 |
| Temporary Residents | | 1466 | 38.0 |
| **Total** | | **3853** | **100** |

Source: National Science Foundation.

**Table E-6-2** Number of women faculty in US Physics and Astronomy Departments, 2008.

| | Highest Degree Granted by Department | | | | |
|---|---|---|---|---|---|
| | **Ph.D.** | **Masters** | **Bachelors** | **Total** | **Percent of All Women** |
| **African American or Black** | 14 | 3 | 12 | 29 | 3 |
| **Asian or Asian American** | 106 | 14 | 56 | 176 | 16 |
| **Hispanic or Latina** | 19 | 7 | 12 | 38 | 3 |
| **White** | 465 | 64 | 340 | 869 | 78 |
| **Total** | | | | **1112** | **100** |

Source: AIP Academic Workforce Survey.

*URM women.* The category "under-represented minority" (URM) applies to minority groups that are represented in science at rates lower than their representation in the US population. Therefore, African Americans, Hispanic Americans, and American Indians are considered URMs in science and in physics. Table 1 reveals just how low the numbers of URM women are. These data represent the numbers of physics Ph.D.s earned by women in a **33-year** period. African American women average a little more than one physics Ph.D. per year. Hispanic women average fewer than 2. And the smallest number of all is American Indian women: there have been only four physics Ph.D.s earned by American Indian or Alaskan Native women since 1974.

*Asian American Women.* The statistics on the representation of Asian American women in physics help illustrate why additional data on the experiences of women of color are needed. Compared to their proportion in the US population (about 5 percent), Asian Americans are not under-represented in science generally or in physics specifically. Asian American women are more than adequately represented in physics, but they may be just as likely to face discrimination in the workplace as other women of color.

*Representation doesn't tell the whole story.* Women of color in physics are "double minorities:" minorities because of race and sex. For all minorities, representation does not tell the whole story, although it certainly plays a large part. As double minorities, women of color may be subject to inequities in hiring, salary, promotions, etc. Their experiences are likely to be different from men's and from white women's experiences. But data on these topics generally have not been collected. Data are missing about the experiences of women of color in physics, along with quantitative data on hiring, salary, and promotions. However, women of color are likely to experience inequity in most, if not all, of these areas. Furthermore, we don't know if the problems are happening in the higher education system, in the workplace, in both, or if the reasons for low representation happen much earlier in the pipeline.

*Conclusion.* Sometimes scientists think that their work environments and classrooms are not affected by issues of race or sex. By studying the actual experiences of women of color in physics, we can determine whether or not this is true. These data also have important implications for efforts to recruit and retain women of color in physics. Because of the lack of data on where the problems lie, such efforts may be ineffective if they are directed to situations that do not need correction. **Programs to increase the representation women of color in science should be based on data documenting the exact nature of the problems, rather than on assumptions about these problems.** These data can only be gathered by studying women physicists of color at a more detailed level, perhaps using in-depth interviews and collecting data on facts other than representation.

Correcting the low representation of URM women in physics will go a long way toward ending the inequities they experience. However, this will not remedy all problematic areas. It will not address discrimination that *all* women of color may experience in their daily lives as physicists. Inequities such as these, if they exist, should be documented so that corrective steps can be taken by institutions. At that point, we will truly have made progress toward an equitable situation for women of color in physics.

*Thanks to Arnell Ephraim and Kenneth Nunn for their assistance with this article.*

# Appendix E-7

## American Mathematical Society Written Testimony

**A Demographic Profile of the Faculty in Fall 2010**[18]

The following tables provide estimates of the numbers of faculty in various categories within departments housing the undergraduate mathematical sciences programs at two-year and four-year colleges and universities in the US. These tables are taken from a publication in preparation by the American Mathematical Society as part of the report of the 2010 Conference Board of the Mathematical Sciences Survey of Undergraduate Program in the Mathematical Sciences. The reported is scheduled for publication and distribution in September 2012. This project is supported by a grant from the National Science Foundation.

The tables provided are those that provide a view of the gender breakout of the faculty in various appointment categories and also the gender by race/ethnicity where available.

The numbers that appear throughout these tables are estimates based on the responses to a survey distributed to approximately 600 institutions selected as part of a stratified random sample of mathematics departments at the approximately 1400 four-year institutions and 1000 public two-year institutions in the US. Some of the tables for the four-year faculty also provide data for a subdivision of the mathematics departments according to the highest mathematics degree awarded by the department. There are approximately 200 PhD-granting mathematics departments, 180 master's-granting mathematics departments, and 1000 bachelor's-granting mathematics departments. In addition, data on the faculty at 78 departments of statistics which house undergraduate programs in statistics are also provided.

The first seven tables describe the mathematics and statistics faculty at four-year colleges and universities, and the final seven are for public two-year colleges.

Questions about these tables should be directed to Dr. James Maxwell, Associate Executive Director, AMS, jwm@ams.org and 401-455-4035.

[18] Questions about data tables should be directed to Dr. James Maxwell, Associate Executive Director, AMS, jwm@ams.org and 401-455-4035.

**Table E-7-1** Number of faculty, and of female faculty (F), of mathematics departments combined and of statistics departments combined in fall 2010. Postdocs are included within Other Full-time counts. (Fall 2005 figures are in parenthesis for Math Departments combined but are not available for Masters Statistics Departments.)

| | Tenured | Tenure-eligible | OFT | Postdocs | Total Full-time | Total Part-time |
|---|---|---|---|---|---|---|
| **Mathematics Depts** | **Univ (Ph.D.) + Univ (MA) + Coll (BA)** | | | | | |
| Total Mathematics | 12,747 | 3,617 | 5,929 | 1,025 | 22,293 | 6,050 |
| | (12,875) | (4,381) | (4,629) | (819) | (21,885) | (6,536) |
| Total Mathematics (F) | 2,740 | 1,227 | 2,449 | 233 | 6,416 | 2,678 |
| | (2,332) | (1,250) | (2,059) | (191) | (5,641) | (2,578) |
| **Statistics Depts** | **Univ. (Ph.D.) + Univ (MA)** | | | | | |
| Total Statistics | 727 | 267 | 272 | 86 | 1266 | 133 |
| | (NA) | (NA) | (NA) | (NA) | | (NA) |
| Total Statistics (F) | 117 | 102 | 108 | 24 | 327 | 32 |
| | (NA) | (NA) | (NA) | (NA) | | (NA) |

**Table E-7-2** Percentage of gender and of racial/ethnic groups among all tenured, tenure-eligible, postdoctoral and other full time faculty in mathematics departments of four-year colleges and universities in fall 2010.

| Mathematics Departments | Asian | Black, not Hispanic | Mexican American/Puerto Rican/other Hispanic | White, not Hispanic | Other / Unknown |
|---|---|---|---|---|---|
| | percent | percent | percent | percent | percent |
| **Tenured Men** | 6 | 1 | 1 | 36 | 1 |
| **Tenured Women** | 1 | 0 | 0 | 10 | 0 |
| **Tenure-eligible men** | 2 | 0 | 0 | 7 | 0 |
| **Tenure eligible women** | 1 | 0 | 0 | 4 | 0 |
| **Postdoctoral men** | 1 | 0 | 0 | 2 | 0 |
| **Postdoctoral women** | 0 | 0 | 0 | 1 | 0 |
| **Full-time men not included above** | 1 | 1 | 0 | 10 | 1 |
| **Full-time women not included above** | 1 | 0 | 0 | 9 | 1 |
| **Total full-time men** | 9 | 2 | 2 | 56 | 2 |
| **Total full-time women** | 3 | 1 | 1 | 23 | 1 |

Notes: The column "Other/Unknown" includes the federal categories Native American/Alaskan Native and Native Hawaiian/Other Pacific Islander. 0 means less than half of 1 percent and this may cause apparent column sum inconsistencies.

**Table E-7-3** Percentage of gender and racial/ethnic groups among all tenured, tenure-eligible, postdoctoral, and other full-time faculty in doctoral and masters statistics departments (combined) at universities in fall 2010.

| **All statistics Departments** | **Asian** | **Black, not Hispanic** | **Mexican American/Puerto Rican/other Hispanic** | **White, not Hispanic** | **Other /Unknown** |
|---|---|---|---|---|---|
| | percent | percent | percent | percent | percent |
| **Tenured Men** | 11 | 0 | 1 | 34 | 2 |
| **Tenured Women** | 2 | 0 | 0 | 6 | 1 |
| **Tenure-eligible men** | 5 | 1 | 0 | 6 | 1 |
| **Tenure eligible women** | 5 | 0 | 0 | 3 | 0 |
| **Postdoctoral men** | 3 | 0 | 0 | 3 | 0 |
| **Postdoctoral women** | 0 | 0 | 0 | 1 | 0 |
| **Full-time men not included above** | 1 | 0 | 0 | 6 | 0 |
| **Full-time women not included above** | 1 | 0 | 0 | 5 | 1 |
| **Total full-time men** | 20 | 1 | 1 | 49 | 3 |
| **Total full-time women** | 8 | 0 | 1 | 15 | 2 |

Notes: The column "Other/Unknown" includes the federal categories Native American/Alaskan Native and Native Hawaiian/Other Pacific Islander. 0 means less than half of 1 percent and this may cause apparent column sum inconsistencies.

**Table E-7-4** Number of tenured, tenure-eligible, postdoctoral, and other full-time faculty in mathematics departments at four-year colleges and universities by gender and type of department in fall 2010. (Note: Postdoctoral faculty are included in other full-time totals.)

| | Univ (PhD) | | | | Univ (MA) | | | | Coll (BA) | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tenured | Tenure-eligible | Other full time | Post-docs | Tenured | Tenure-eligible | Other full time | Post-docs | Tenured | Tenure-eligible | Other full time | Post-docs | Tenured | Tenure-eligible | Other full time | Post-docs |
| Men, 2010 | 4096 | 724 | 1549 | 775 | 1829 | 490 | 470 | 10 | 4082 | 1175 | 1461 | 6 | 10007 | 2390 | 3480 | 792 |
| Women, 2010 | 525 | 270 | 946 | 226 | 605 | 284 | 516 | 7 | 1611 | 673 | 987 | 0 | 2740 | 1227 | 2449 | 233 |
| Total, 2010 | 4621 | 994 | 2495 | 1001 | 2434 | 775 | 986 | 18 | 5693 | 1848 | 2448 | 6 | 12747 | 3617 | 5929 | 1025 |
| Men, 2005 | 4292 | 713 | 1314 | 616 | 2011 | 682 | 495 | 4 | 4239 | 1737 | 761 | 8 | 10542 | 3132 | 2570 | 628 |
| Women, 2005 | 427 | 220 | 735 | 148 | 532 | 337 | 532 | 2 | 1373 | 693 | 792 | 41 | 2332 | 1250 | 2059 | 191 |
| Total, 2005 | 4719 | 933 | 2049 | 764 | 2544 | 1019 | 1027 | 7 | 5612 | 2429 | 1553 | 48 | 12874 | 4382 | 4629 | 819 |

Notes: A postdoctoral appointment is a temporary position primarily intended to provide an opportunity to extend graduate training or to further research experience. Postdoctoral faculty are included in the other full-time faculty totals throughout CBMS2010. This contrasts with publications of the AMS-ASA-IMS-MAA-SIAM Annual Survey since 2003, which list postdoctoral faculty as a category separate from other full-time faculty. Before 2003, separate counts of postdoctoral faculty were not collected by the Annual Survey. Round-off may make marginal totals seem inaccurate.

**Table E-7-5** Number of tenured, tenure-eligible, other full-time, and postdoctoral faculty in statistics departments, by gender, in fall 2010 and 2005. (Postdoctoral faculty are included in other full-time faculty totals. Data for Masters Statistics Departments was not collected in 2005.)

| | Doctoral Statistics Departments | | | | Masters Statistics Departments | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tenured | Tenure-eligible | Other full time | Post-docs | Tenured | Tenure-eligible | Other full time | Post-docs | Tenured | Tenure-eligible | Other full time | Post-docs |
| Men, 2010 | 485 | 125 | 133 | 53 | 125 | 40 | 31 | 9 | 610 | 165 | 164 | 62 |
| Women, 2010 | 95 | 84 | 82 | 18 | 22 | 18 | 26 | 7 | 117 | 102 | 108 | 24 |
| Total, 2010 | 580 | 209 | 215 | 71 | 147 | 57 | 57 | 15 | 727 | 267 | 272 | 86 |
| Men, 2005 | 525 | 113 | 97 | 35 | na | na | na | na | na | na | na | na |
| Women, 2005 | 79 | 66 | 66 | 16 | na | na | na | na | na | na | na | na |
| Total, 2005 | 604 | 179 | 163 | 51 | na | na | na | na | na | na | na | na |

Notes: A postdoctoral appointment is a temporary position primarily intended to provide an opportunity to extend graduate training or to further research experience. Postdoctoral faculty are included in the other full-time faculty totals throughout CBMS2010. This contrasts with publications of the AMS-ASA-IMS-MAA-SIAM Annual Survey since 2003, which list postdoctoral faculty as a category separate from other full-time faculty. Before 2003, separate counts of postdoctoral faculty were not collected by the Annual Survey.

**Table E-7-6** Percentages of full-time faculty belonging to various ethnic groups, by gender and type of department, in fall 2010. Except for round-off, the percentages within each departmental type sum to 100 percent.

| | Percentage of full-time faculty | | | | |
|---|---|---|---|---|---|
| | Asian % | Black, not Hispanic % | Mexican American/Puerto Rican/Other Hispanic % | White, not Hispanic % | Other /Unknown % |
| PhD Mathematics Departments | | | | | |
| All full-time men | 13 | 1 | 2 | 59 | 3 |
| All full-time women | 4 | 0 | 1 | 16 | 1 |
| MA Mathematics Departments | | | | | |
| All full-time men | 12 | 4 | 2 | 47 | 2 |
| All full-time women | 5 | 2 | 1 | 26 | 1 |
| BA Mathematics Departments | | | | | |
| All full-time men | 4 | 2 | 2 | 57 | 2 |
| All full-time women | 2 | 1 | 1 | 28 | 1 |
| Combined Statistics Departments | | | | | |
| All full-time men | 20 | 1 | 1 | 49 | 3 |
| All full-time women | 8 | 0 | 1 | 15 | 2 |

Notes: The column "Other/Unknown" includes the federal categories Native American/Alaska Native and Native Hawaiian/Other Pacific Islander. Zero means less than one-half of one percent.

**Table E-7-7** Percentages of part-time faculty belonging to various ethnic groups, by gender and type of department, in fall 2010. Except for round-off, the percentages within each departmental type sum to 100 percent.

| | Percentage of part-time faculty | | | | |
|---|---|---|---|---|---|
| | Asian % | Black, not Hispanic % | Mexican American/Puerto Rican/Other Hispanic % | White, not Hispanic % | Other /Unknown % |
| PhD Mathematics Departments | | | | | |
| All part-time men | 5 | 2 | 1 | 46 | 6 |
| All part-time women | 4 | 1 | 1 | 30 | 3 |
| MA Mathematics Departments | | | | | |
| All part-time men | 3 | 4 | 2 | 38 | 11 |
| All part-time women | 3 | 3 | 2 | 27 | 7 |
| BA Mathematics Departments | | | | | |
| All part-time men | 2 | 1 | 0 | 43 | 8 |
| All part-time women | 1 | 1 | 0 | 38 | 5 |
| Combined Statistics Departments | | | | | |
| All part-time men | 3 | 4 | 0 | 64 | 5 |
| All part-time women | 1 | 0 | 0 | 19 | 4 |

Notes: The column "Other/Unknown" includes the federal categories Native American/Alaska Native and Native Hawaiian/Other Pacific Islander. Zero means less than one-half of one percent.

## Faculty at Public Two-year Colleges

**Table E-7-8** Percentage of full-time permanent faculty and part-time faculty in mathematics programs at public two-year colleges by gender, in fall 2010. Also master's degrees in mathematics and statistics granted in the U.S. to citizens and resident aliens, by gender, in 2008-09. Part-time faculty paid by a third party are not included.

| | **Percentage of** | | |
|---|---|---|---|
| | **Full-time permanent faculty** | **Part-time faculty** | **Masters degrees in mathematics and statistics granted in the U.S. in 2008-09 to citizens and resident aliens*** |
| **Men** | 50 | 51 | 59 |
| **Women** | 50 | 49 | 41 |
| **Total** | 100% | 100% | 100% |
| **Number** | 9790 | 23453 | 3137 |

Notes: * denotes the data source of that column is from Report Table 65 from IPEDS Fall 2009 Compendium Tables, National Center for Education Statistics. nces.ed.gov/library/ipeds_com.asp. (These figures include resident aliens but do not include a total of 2074 nonresident aliens who also received masters degrees.)

**Table E-7-9** Percentage and number of ethnic minority full-time permanent faculty in mathematics programs at two-year colleges in fall 1995, 2000, 2005, and 2010.

| | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|
| **Percentage of ethnic minorities among full-time permanent faculty** | 13% | 13% | 14% | 16% |
| **Number of full-time permanent ethnic minority faculty** | 948 | 909 | 1198 | 1566 |
| **Number of full-time permanent faculty** | 7578 | 6960 | 8793 | 9790 |

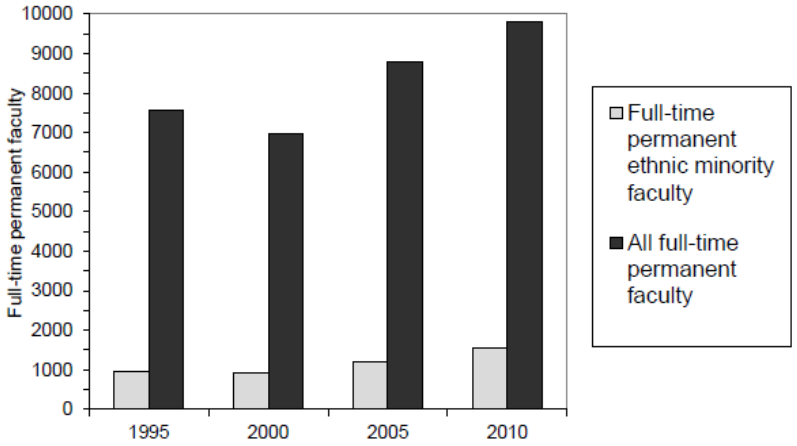


**Figure E-7-1** Number of ethnic minority full-time permanent faculty and number of all full-time permanent faculty in mathematics programs at two-year colleges in fall 1995, 2000, 2005, and 2010.

**Table E-7-10** Percentage of full-time permanent faculty in mathematics programs at two-year colleges by ethnicity, in fall 1995, 2000, 2005, and 2010.

| | Percentage of full-time permanent faculty | | | |
|---|---|---|---|---|
| **Ethnic Group** | **1995** | **2000** | **2005** | **2010** |
| **American Indian/Eskimo/Aleut** | 0 | 1 | 0 | 0 |
| **Asian/Pacific Islander** | 4 | 4 | 6 | 6 |
| **Black (non-Hispanic)** | 5 | 5 | 5 | 6 |
| **Mexican American / Puerto Rican / Other Hispanic** | 3 | 3 | 3 | 4 |
| **White (non-Hispanic)** | 87 | 85 | 84 | 79 |
| **Status unknown** | 1 | 2 | 2 | 5 |
| **Number of full-time permanent faculty** | 100%<br>7578 | 100%<br>6960 | 100%<br>8793 | 100%<br>9790 |

Notes: Zero means less than half of one percent.

**Table E-7-11** Number and percentage of full-time permanent faculty in mathematics programs at two-year colleges by ethnic group and percentage of women within each ethnic group, in fall 2010.

| Ethnic Group | Number of full-time permanent faculty | Percentage of ethnic group in full-time permanent faculty | Percentage of women in ethnic group |
|---|---|---|---|
| **American Indian/Eskimo/Aleut** | 20 | 0 | 63 |
| **Asian** | 605 | 6 | 48 |
| **Native Hawaiian, Pacific Islander** | 42 | 0 | 49 |
| **Black or African American (non-Hispanic)** | 544 | 6 | 37 |
| **Mexican American / Puerto Rican / Other Hispanic** | 356 | 4 | 34 |
| **White (non-Hispanic)** | 7733 | 79 | 52 |
| **Status unknown** | 490 | 5 | 50 |
| **Total** | 9790 | 100% | 50% |

Notes: Zero means less than half of one percent.

**Table E-7-12** Percentage of ethnic minority part-time faculty in mathematics programs at public two-year colleges, in fall 2005 and 2010.

| | 2000 | 2005 | 2010 |
|---|---|---|---|
| **Percentage of ethnic minorities among part-time faculty** | 13 | 16 | 17 |
| **Number of part-time faculty** | 14887 | 18227 | 23453 |

**Table E-7-13** Number and percentage of part-time faculty in mathematics programs at public two-year colleges by ethnic group and percentage of women within each ethnic group, in fall 2010.

| Ethnic Group | Number of part-time faculty | Percentage of ethnic group among part-time faculty | Percentage of women within ethnic group |
|---|---|---|---|
| **American Indian/Eskimo/Aleut** | 44 | 0 | 6 |
| **Asian** | 1341 | 6 | 49 |
| **Native Hawaiian, Pacific Islander** | 59 | 0 | 34 |
| **Black or African American (non-Hispanic)** | 1796 | 8 | 36 |
| **Mexican American / Puerto Rican / Other Hispanic** | 762 | 3 | 44 |
| **White (non-Hispanic)** | 18105 | 77 | 51 |
| **Status unknown** | 1346 | 6 | 46 |
| **Total** | 23453 | 100% | 49% |

## American Mathematical Society Committee on the Profession Award for Mathematics Programs that Make a Difference[19]

This Award for Mathematics Programs that Make a Difference was established in 2005 by the AMS's Committee on the Profession to compile and publish a series of profiles of programs that:

- aim to bring more persons from under-represented minority backgrounds into some portion of the pipeline beginning at the undergraduate level and leading to advanced degrees in mathematics and professional success, or retain them once in the pipeline;
- have achieved documentable success in doing so; and
- are replicable models.

### Mathematics Programs That Make a Difference 2007

### Citation 2007

This year the AMS recognizes Enhancing Diversity in Graduate Education (EDGE), run collaboratively by Bryn Mawr College and Spelman College, and the Mathematical Theoretical Biology Institute (MTBI), currently conducted at Arizona State University. Both of these are successful programs that have made significant contributions to the effort of supporting and encouraging underrepresented minorities to continue in the study of mathematics.

### Enhancing Diversity in Graduate Education (EDGE)
### Bryn Mawr College and Spelman College

The EDGE program pairs an academic component (a four-week summer program) with a mentoring component. The program's long-range goals are to increase the presence of women, with a special focus on women of color, in the upper ranks of mathematical scientists, and to create models for mathematics programs that allow people from all backgrounds and cultures to thrive, advance and contribute to the profession. The four-week Summer Program provides intense exposure to material and mastery through problem solving by a combination of individual effort and teamwork. The curriculum consists of two, four-week core courses, one in abstract and linear algebra and one in analysis; problem sessions conducted by three graduate student mentors; a mini-course and guest lectures on timely areas of mathematical research; TeX sessions and presentations by participants. The Follow-Up Mentoring Program provides support, both socially and professionally, for the graduate school experience. The co-directors and local coordinator arrange for a faculty mentor at each student's graduate institution. In addition, they maintain contact with students during the year and provide a small research allowance for books and professional travel. Each student is invited to return to EDGE the following summer for a

[19] This information is drawn from the following page on the AMS website: www.ams.org/profession/prizes-awards/ams-supported/make-E-diff-award. For more information about this program, please contact Dr. Ellen Maycock, Associate Executive Director, AMS, via e-mail at ejm@ams.org or by phone at 800-321-4267, ext. 4101.

reunion, and an electronic bulletin board allows alumnae to share triumphs and challenges throughout their graduate school years.

One hundred five outstanding women were accepted into the EDGE Program from 1998 to 2006. As of 2005, data show that EDGE participants are from diverse racial (49 percent underrepresented minorities) and educational (44 percent liberal arts) backgrounds. In the first eight years of EDGE (1998-2005), 90 EDGE students entered graduate programs; approximately 92 percent of these students either are actively pursuing or have earned a graduate degree. By 2006, 28 percent of the total group had earned a master's degree and discontinued their education, most often to accept employment, and 58 percent were continuing in a graduate degree program. To date, six EDGE participants (6.7 percent) and three other EDGE graduate mentors have earned their doctoral degrees in mathematics, and several other participants expect to complete their degree requirements by the end of 2007. Among the six doctoral recipients, three are white and three are African American.

EDGE web site: www.edgeforwomen.org/
Full program description: www.ams.org/programs/diversity/EDGEdescription.pdf

***The AMS commends the program co-directors, Sylvia Bozeman (Spelman College) and Rhonda Hughes (Bryn Mawr College), for their success in improving the diversity of the profession of mathematics in the United States.***

**Mathematical Theoretical Biology Institute (MTBI) Arizona State University**

Every summer MTBI offers sequential research experiences for undergraduates and graduate students, most of whom come from underrepresented minority groups. The program has run for eleven years in conjunction with Cornell University, Los Alamos National Laboratory and Arizona State University. MTBI focuses on the field of applied mathematics, in particular on applications to the biological and social sciences, and provides research training and mentorship for students. New students take three and a half weeks of intense training in dynamical systems (broadly understood to include stochastic processes) and modeling in the biological and social sciences. At the end of the initial training period, students set their own research agenda each summer by forming research groups of 3-4 participants around a project of their choice. Each group is assigned a faculty advisor and provided with appropriate graduate student support.

MTBI has mentored and supported 285 undergraduate students and 31 graduate students, 14 of whom had participated previously in MTBI as undergraduate students. Over its first ten years of existence, MTBI sent 128 students from underrepresented minority groups to graduate school, and a total of 152 students overall. Furthermore, 53 percent of those were females, including 66 from minority groups. MTBI's efforts have significantly increased the number of U.S. Ph.D.s awarded to members of underrepresented groups. For example, in 2005, Ph.D.s in the mathematical sciences were awarded to 10 MTBI alumni, 8 of whom are members of underrepresented minorities. Those 8 Ph.D.s represent about one-quarter of the total number of doctorates awarded that year to members of underrepresented minority groups. In 2005, 6 of the 15 women who have received Ph.D.s in mathematics and are members of underrepresented minorities are MTBI alumnae.

MTBI web site: http://mtbi.asu.edu/
Full program description: www.ams.org/programs/diversity/MTBIdescription.pdf

***The AMS commends the director of MTBI, Carlos Castillo-Chavez, for his high level of commitment and his successful efforts to improve the diversity of the profession of mathematics in the United States.***

For more information about the nomination process, please contact Dr. Ellen Maycock, Associate Executive Director, AMS, via e-mail at ejm@ams.org or by phone at 800-321-4267, ext. 4101.

# Appendix E-8

## American Meteorological Society Written Testimony

**Data on women of color within AMS**

It is difficult to provide data on women of color in the atmospheric sciences for two reasons. First, there are relatively small numbers of degree recipients (especially at the graduate level) and the statistics aren't disaggregated to atmospheric science by ethnicity and gender at any level beyond the bachelor's degree. Second, the atmospheric and related sciences is a field that includes people with formal degrees in several disciplines—in fact the 2005 survey of AMS members revealed that only 64 percent of AMS members had terminal degrees in Atmospheric Science (Murillo et al, 2008). With those caveats, we can get some idea of the educational pathways of women of color in the atmospheric and related sciences from NSF compiled statistics (NSF 2010).

- From 2001 to 2009, women of color[20] earned 161 out of 5,645 Bachelor's degrees awarded in atmospheric science (3 percent), and 1403 out of 36,683 degrees in Atmospheric, Oceanic, and Earth Sciences (4 percent).
- From 2001 to 2009, women of color earned 134 PhD's out of the 3,605 PhD's earned by US citizens or permanent residents in the fields of Atmospheric, Oceanic, and Earth Sciences, approximately 4 percent.

Based on the most recent survey of AMS members, conducted in 2005:

- Of the 5,394 members who responded to the survey, 1,016 indicated that they were female, and of those 159 were woman of color (suggesting women of color comprised only 15 percent of the women in the society). Of those, 83 of the women indicated their race or ethnicity as Africa American or Black, Hispanic, American Indian of Alaskan Native.
- Of the respondents who indicated they were women of color, 46 (29 percent) held PhD's, 54 (34 percent) held Master's degrees, and 43 (27 percent) held BS degrees. For comparison, 38 percent of all members held PhD's, 26 percent Master's degrees, and 27 percent Bachelor's degrees (Murillo et al 2008).
- Sixty-six of the women of color reported working in the university environment, which was by far the largest employment sector. Six of them held the rank of full professor, two were associate professors, and four were assistant professors. For comparison, 14 women and 129 men held the position of full professor, seven women and 64 men held the rank of associate professor, and 12 women and 59 men held the rank of assistant professor (Tucker et al 2009).
- Thirty of the women of color reported working for a government agency or FFRDC.

[20] In this paper, women of color includes US citizens identified as Asian/Pacific Islander, Black, Hispanic and American Indian/Alaska Native. Because the first category includes women from groups that have not been historically under-represented in science, this is not synonymous with women from under-represented communities.

- More recently, McPhee and Canetto (yet to be published) examined faculty and graduate student demographics of 35 graduate programs carefully chosen to represent the full range of graduate programs in climate science. Of the 834 faculty surveyed, four were females from a historically under-represented group and 16 were Asian females. Of the graduate students, only 2.8 percent were females from an underrepresented group.

**Challenges or barriers to success that confront women of color in AMS**

Like many scientific societies, the culture of AMS reflects the culture of its members. While the society has become more diverse, especially in its early-career members, the membership is still dominated by majority ethnicities and males. It is hard to quantify the impact of the *double-bind*, i.e. being simultaneously part of two under-represented groups. One AMS member talked about having to "unzip herself" before coming to work. She described the effort it takes to suppress her social and cultural practices and instead adopt the communication styles and norms that are common in majority cultures. The very small numbers of women of color is itself a barrier. In describing a series of in depth interviews with female graduate students in atmospheric sciences, Canetto wrote "we have not analyzed the data on women of color separately because given the small sample, to report on them separately would jeopardize the respondents' anonymity and/or confidentiality --even simply the privacy of their decision to participate in the study." There have been several other barriers proposed, based on either personal experience or generalization from barriers that may be shared by many women or ethnic minorities. These include:

- Lack of role models, as suggested by the small number of women of color in faculty positions.
- Lack of support networks or community, a probable impact of the relatively few women of color in the field overall.
- Challenges of balancing family and career, which seems to disproportionately affect women (in the 2005 survey, female members were less likely to be married then male members, see Murillo et al. 2008).
- Many minorities and particularly women are drawn into more educational, outreach or service-related activities, which tend to provide less reward and advancement than traditional academic research.
- While everyone is affected in tight budget environments, declining grant opportunities and career openings constrict the career pathways and options available to women of color.

**Policies and/or programs implemented by AMS to enhance the participation of women of color and to advance their academic careers**

AMS practices and policies reflect a commitment to inclusivity and have benefited women of color, though none specifically and uniquely address women of color. A list of relevant policies and programs follows.

- AMS statements affirm an organizational commitment to diversity and inclusivity. The diversity statement, one of the few AMS statements without an expiration date, is the most obvious example, and a newer statement requiring respectful and appropriate behavior at AMS meetings is in development.
- The AMS Board of Women and Minorities, founded in 1975 in recognition of the fact that AMS demographics didn't reflect the diversity of the US, is charged with examining

workplace issues, including educational and professional opportunities, for all segments of the society, with a special emphasis on women, people from groups historically under-represented in society, people with disabilities, and lesbian, gay, bisexual, and transgender AMS members. It includes women of color in its purview and has been led by a number of women of color.

- Women of color hold and have held other leadership positions, including serving on the AMS Council (which acts as the chief governing body), heading committees and chairing boards, and serving in high-level staff positions. Women of color have also won prestigious society awards, including the Anderson Award for outstanding contributions to diversity, and the rank of Fellow for outstanding contributions over a substantial period of years.
- The *Women in Atmospheric Sciences Luncheon* provides a place for women, including women of color, to network and interact with role models, explore issues and develop career strategies, and explore the intersection of gender and science. The luncheon at the 2012 Annual Meeting included specific discussion of the unique circumstance for women of color as part of a general discussion of how gender, ethnicity, and race impact vulnerability and resilience in meteorological disasters.
- Several less formal events at the AMS annual meeting are provide networking and professional development for newer members from many communities. The *Color of Weather* welcomes students and young professionals of color, the *Coriolis Reception* promotes awareness and creates a welcoming community for lesbian, gay, bisexual, and transgender people and friends and allies, and the *Young Professionals Reception* reaches out to people who are close to the transition from student to professional member. None of these events are designed for specifically for women of color, but all of them welcome women of color and reach out to women of color in planning and inviting.
- AMS has hosted a number of programmatic sessions that explore diversity as part of the annual meeting. Topics have included examining K-12 and college programs that promote diversity, exploring Dr. Martin Luther King's teachings and their relevance to AMS (taking advantage of the annual meeting including MLK day) and careful statistical analysis of atmospheric science demographics. Recently, a session on ways of knowing has explored traditional ecological knowledge related to weather and climate and sought to build collaborations between AMS scientists and indigenous communities. A disproportionate number of women of color participated in this session.
- A biennial meeting of Heads and Chairs of departments in the atmospheric and related sciences organized by the AMS has frequently included sessions on increasing recruitment of minorities into meteorology programs.
- Since 1993, the AMS has sponsored minority scholarships for undergraduate students pursuing degrees in the atmospheric and related sciences. In the last five years, 15 of the 27 minority scholarships have gone to women.

The AMS has also partnered with external programs to broaden participation in the atmospheric and related sciences, including women of color. These include:

- SOARS, which for 15 years has helped talented undergraduate students from diverse backgrounds transition to graduate programs in the atmospheric and related sciences through research experiences at the National Center for Atmospheric Research, strong scientific, academic and life-skills mentoring, and a learning community model. Over 147

protégés have participated in SOARS, 90 percent are members of ethnic minorities, and over 50 percent are women. Most SOARS protégés have presented their work at AMS-sponsored meetings and participated in the AMS events described above.

- The incoming president of AMS, Dr. J. Marshall Shepherd, is co-PI along with two women of color, on an NSF-funded grant called the Diversity Climate Network. The goal of the program is to use longitudinal tracking of Earth Science students from Grade 9 through graduate studies to pinpoint effective practices for student recruitment and retention in the climate sciences.
- Howard University, a Historically Black University, has an active graduate program in the atmospheric sciences, and has contributed substantively both to the overall diversity of the field as well as to the number of women of color to enter the atmospheric sciences. In addition to close to ties to AMS, with faculty members serving on AMS Boards and faculty and students active in AMS meetings, Howard is the primary impetus behind the AMS-supported *Color of Weather* reception.
- The AMS has been an organizational partner in the Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science (MS PHD'S) initiative since its inception.

**Lessons learned and overall policy recommendations to increase the representation and career satisfaction of women of color**

- Engage women of color in leadership positions. While the number of women of color in the AMS is small overall, they are well-represented in leadership positions within the society. This provides role models, visibility, improved decision making via the inclusion of diverse perspectives, and facilitates responsiveness to a diverse set of communities and issues.
- Focus on the overall climate of meetings and society efforts. AMS, like many historic societies, has practices that date back to its time as a male, majority dominated society. It has been in the process of revising those practices with input from its newer members. Examples include the proposed statement on professional and welcoming conduct, the increased number of networking and career-oriented receptions, outreach events that target local communities, a prestigious award for diversity, and an active Board on Women and Minorities.
- Expand the scope of research to address issues related to gender and ethnicity. While it is tempting to believe that a predominantly physical science is independent of gender, ethnicity or socio-economic consideration, it is clear that the impact of meteorological events and climate variability and change has components along these axes. Making this a legitimate field of research, through additions to the scientific program and special meetings, has made the science relevant to a more diverse audience, including women of color. Similarly, as outreach and community engagement have been increasingly embraced as an AMS priority, we have welcomed and honored a diversity of skills and an accompanying diversity of people.
- Build a community for women of color, even if it requires combining with other disciplines. The small size and relative lack of diversity of the AMS makes it difficult, currently, to offer a robust professional network for women of color. By joining with other societies in complementary disciplines, it might be possible.

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An Overview and Longitudinal Analysis of the Demographics of the AMS, *Bulletin of the American Meteorological Society, **vol. 89**, issue 5, p. 727.*

Tucker, Donna; Ginther, Donna K.; Winkler, Julie A., 2009: Gender Issues Among Academic AMS Members: Comparisons with the 1993 Membership Survey*, Bulletin of the American Meteorological Society**,** vol. 90, issue 8, pp. 1180-119.*

# APPENDIX E-9

## American Physical Society Written Testimony

Committee on Minorities in Physics & Committee on the Status of Women in Physics

**Trends**

The field of physics has struggled to increase representation of women and minorities into undergraduate and graduate physics programs. Although about 50 percent of the students who take physics in high school are female, the ratio of females to males in the awarding of undergraduate bachelor degrees is only about 20 percent. Further, the percentage of women that take AP physics roughly reflects the ratios seen in undergraduate degrees. Roughly the same percentage of females receives PhD's in physics. According to Rachel Ivie[21] of the American Institute of Physics (AIP), "physics continues to have the lowest representation of women."

The situation for Hispanics and African Americans is somewhat worse. The fraction of physics undergraduate degrees, when normalized for changes in the US population, shows that these two groups remain woefully underrepresented. Hispanics have increased their numbers significantly in the US population (more than a factor of 2.5x increase in the past 15 years). However, the gains show only a small increase in representation in physics. African Americans, on the other hand, have decreased both in actual numbers and as a fraction of degrees granted. White and Asian students continue to be overrepresented.

Additionally, while 40-50 percent of white and Asian students take at least one physics course in high school, only about 25 percent of the students of color have taken one physics course in high school. Despite the low numbers, there has been a steady increase among all groups in the percentage of students taking physics in high school.

[21] Rachel Ivie and Casey Langer Tesfaye, *Women in physics: A tale of limits*, Physics Today 65, February 2012.

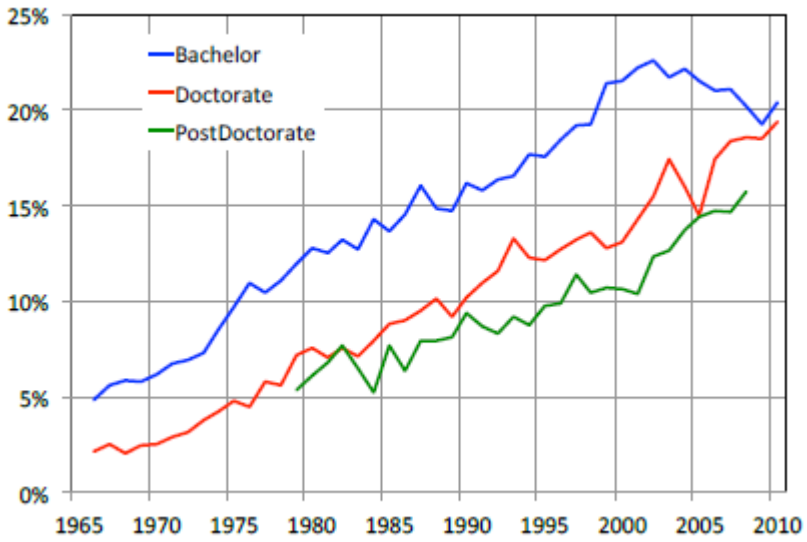


**Figure E-9-1** Percentage of women receiving degrees and postdoctoral positions in the U.S. Source: National Science Foundation and Department of Education.

With employment data from the AIP overlaid onto Figure E-9-1, Figure E-9-3 indicates that assistant professors in physics are hired at rates at or above the production rate of PhDs. This is especially apparent when one considers that the data for professors should be moved to the left on the graph to indicate the population of PhDs that feed this crop of professors.

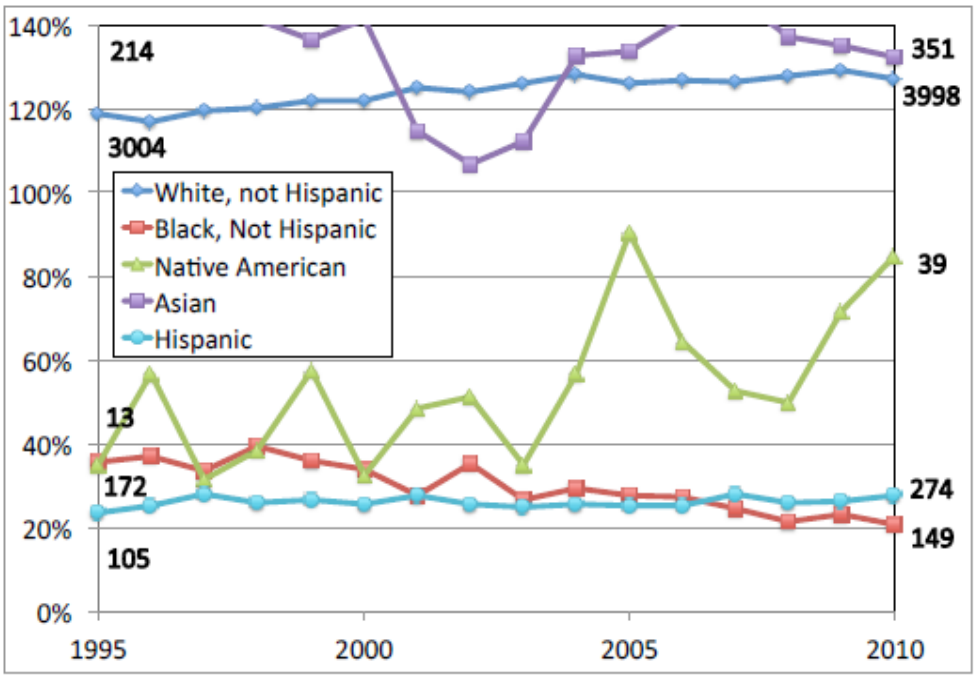


**Figure E-9-2** Undergraduate degrees in physics adjusted for the changing demographics of the U.S. 100 percent indicates representation in line with US population fractions.
Source: Department of Education, IPEDS; US Census.

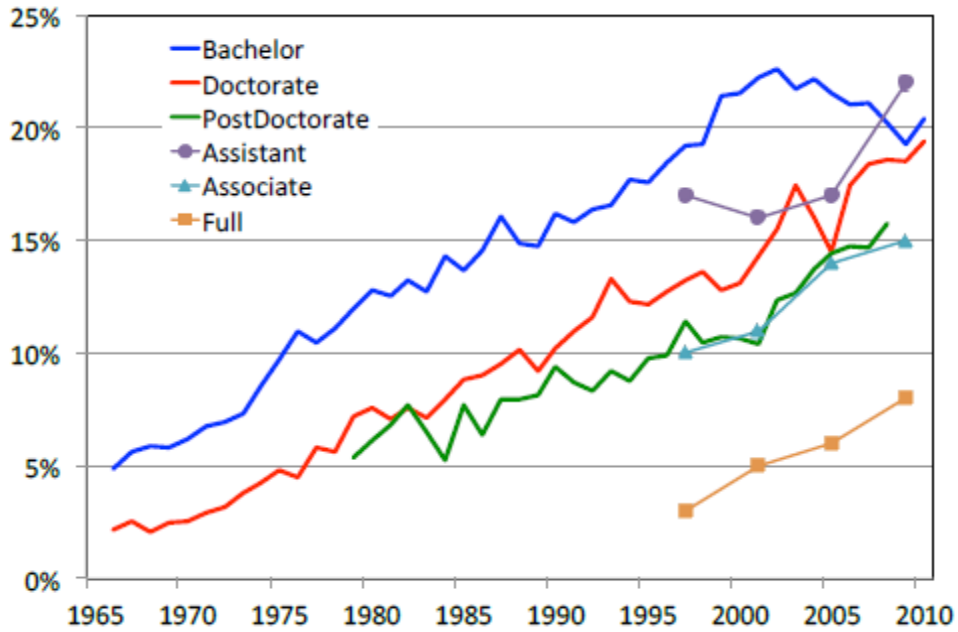


**Figure E-9-3** Data on the fraction of professors at each level is overlaid on data from Figure E-9-1. Since these are total numbers in each category, the represent a hiring average over a number of years. To match the group with the supply, each one should be "slid" left the number of years representing the mean number of years since their PhD.
Source: AIP.

Although women are hired at a rate consistent with their graduation rate, it is also clear that they remain underrepresented in physics. Minority women suffer from the combined factors of underrepresentation as women and as minorities. Figure E-9-4 shows that only about 5-6 percent of all PhDs granted to US citizens are given to underrepresented minorities (African Americans, Hispanics, and Native Americans). The numbers of these individuals are exceedingly low, amounting to only about 30-35 PhDs per year. When this is coupled with the roughly 20 percent of PhDs given to women, we are counting only 6 or 7 PhDs given to women of color each year in physics in the entire US. The good news is that it appears that minorities are hired as Assistant professors at the same rate as they receive PhDs, and given the similar data for women, one can probably assume that women of color are hired at roughly the same rate as their majority colleagues.

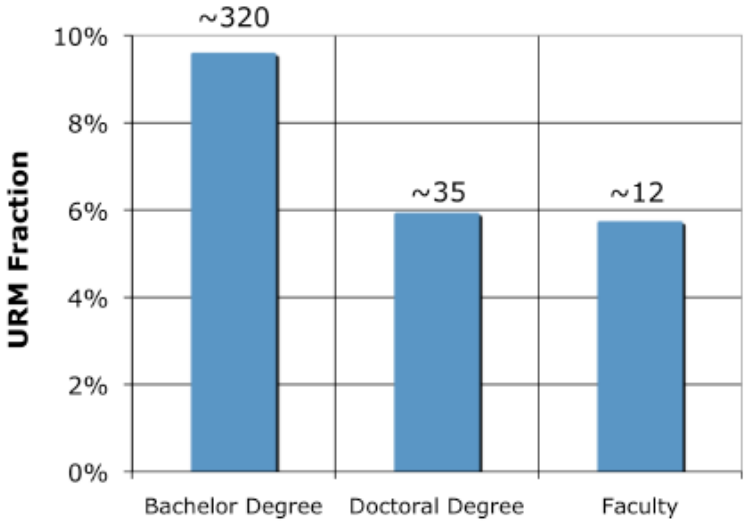


**Figure E-9-4** Percentage of degrees and appointments at the assistant professor rank for underrepresented minorities. Numbers on each bar represent roughly the number each year.

**Challenges**

When considering these data, there are two clear issues to consider when discussing possible actions to improve the situation faced by underrepresented women in physics:

1) Isolation
2) Representation

There are a number of studies that indicate isolation as a factor that significantly impacts women of color as well as minorities and women more generally. If only 6 PhDs are granted each year to women of color, and only a third of these seek academic positions (based on the averages for the field), then these two women are unlikely to see themselves as much of a cohort or peer group. Some APS programs begin to address this issue, and we also have recommendations of possible avenues to pursue to lessen the impact of this concern.

Second, minority women PhDs are produced in very small numbers, so an obvious set of solutions seeks to address how to increase these numbers. Again, there are numerous studies and papers addressing potential remedies. These typically address "STEM" (Science, Technology, Engineering and Mathematics) as a single discipline, but clearly this is not the case as representation of these various groups varies considerably between disciplines. In biological sciences, the rate of graduation of PhDs is roughly equivalent between men and women, and in fact bachelor's degrees in this field are overrepresented in women. Any reasonable set of solutions needs to take this into account.

As US colleges are already majority female (57 percent) and are increasingly enrolling more minority students (44 percent), women — especially those living in the intersection of race and gender — represent a growing source of untapped domestic talent to help meet the nation's STEM needs. Moreover, although policies aimed at increasing women of color should be based on empirical research on women of color pursuing STEM educations, there is a documented paucity of such work.

**Programs of the American Physical Society**

The American Physical Society (APS) is the largest organization of physics in the country and has long been a supporter of increasing diversity in the field of physics. There are two committees in the APS who focus on this particular mission. The Committee on Minorities (COM) and the Committee on the Status of Women in Physics (CSWP). COM works to increase the number of historically underrepresented minorities, notably African Americans, Hispanic, and Native Americans, who earn degrees in physics and pursue successful careers in physics in the United States. COM conducts site visits and offers a minority scholarship for undergraduate physics majors. The APS is also beginning a major effort to build sustainable bridge programs throughout the country that will help improve the pipeline of minority undergraduates into graduate school and beyond. Other programs include the annual Edward A. Bouchet Award, travel grants, and a roster that provides names and qualifications of several hundred women and minorities in physics. (aps.org/programs/minorities/).

The CSWP is committed to encouraging the recruitment, retention, and career development of women physicists at all levels. This is accomplished through a number of initiatives such as the Climate for Women in Physics Site Visit program, organized by the CSWP, which helps physics departments and research facilities assess and improve the climate for women in physics at their institutions. (aps.org/programs/women/) The Blewett Fellowship for Women Physicists enables women to return to physics research careers after a career interruption. The CSWP promotes recognition of women physicists through its Woman Physicist of the Month program (aps.org/programs/women/scholarships/womanmonth/) and publishes The Gazette, the official newsletter of the CSWP, in conjunction with the Committee on Minorities. The APS COM and CSWP have each taken on important roles in the issues that face minorities and the issues that face women in the field of physics.

**Policy Recommendations**

To address the two issues related above, we recommend the following actions:

1) Isolation

a. Provide networks that allow women to link up and form support networks. These should be discipline specific to allow access to information that is critical to success within the discipline.

b. Develop and support projects that look toward understanding identity in science. There are a number of studies that identify conflicts between identities as women or minorities and identity as science learners. Methods to develop physics identity need to be further studied and implemented.[22]

2) Representation

**a. Improve the transition between undergraduate and graduate studies**. The data in Figure E-9-4 indicates that the fraction of underrepresented minorities who receive bachelor's degrees is nearly twice the fraction who subsequently complete a PhD. We recommend that support be found to plug this significant hole in the

[22] Zahra Hazari, Gerhard Sonnert, Philip M. Sadler, Marie-Claire Shanahan, *Connecting High School Physics Experiences, Outcome Expectations, Physics Identity, and Physics Career Choice: A Gender Study*, Journal of Research in Science Teaching, December 2009; Angela Johnson, Jaweer Brown, Heidi Carlone, and Azita K. Cuevas, *Authoring Identity Amidst the Treacherous Terrain of Science: A Multiracial Feminist Examination of the Journeys of Three Women of Color in Science*, Journal of Research in Science Teaching, December 2010

education pipeline by supporting bridging efforts between these degrees. Current examples of such programs in physics exist at Vanderbilt University, Columbia, MIT, and the University of Michigan.

**b. Improve retention of students in the introductory courses**. As indicated in the recent PCAST report, "*Engage to Excel*," a significant loss of talent for this country is dismissed from studying physics by their first course in the subject as an undergraduate. Physics is particularly egregious at this boundary, and education research has demonstrated techniques that have documented success at lowering the drop/fail/withdraw rates particularly for women and minorities using enhanced pedagogical techniques. These active engagement methods e.g., SCALE-UP from NC State, have been tested and successfully implemented at a number of schools, but there are insufficient resources to more widely disseminate the professional development needed to successfully adopt these new techniques in a more widespread manner. These could be successfully enhanced through the NSF Transforming Undergraduate Education in Science (TUES) program, or by other methods through national professional societies. Curriculum revision in introductory physics guided by results from Physics Education Research has also played a major role in increasing the quality of these courses and has promoted better prepared students who are more likely to continue on in physics.

**c. Directly address stereotype threat**. Stereotype threat has been widely documented as a key factor in reducing the success of women and minorities in a number of studies.[23] Straightforward interventions are possible, but again professional development is required to help faculty implement such solutions. The critical point is in the first courses of an undergraduate education, but making known the issues and techniques that can ameliorate these factors at all levels is needed. Programs within NSF's Education and Human Resources Directorate and especially within the Division of Undergraduate Education have the greatest potential to impact faculty in these areas.

**d. Make high quality physics instruction available to every high school student**. Currently only 37 percent of all high school students take physics, and less than half of the classes are taught by a teacher with significant background in the subject according to the Department of Education's Schools and Staffing Survey. In addition, studies have shown that poverty is most strongly correlated with the failure of schools to offer courses in physics.[24] Consequently, students, including women of color, who are educated in poor school districts, suffer from a lack of adequate preparation for college and technical jobs. Currently high school physics teachers are in drastically short supply with only about a third of the needed positions filled with adequately educated teachers. Support through the NSF, and Department of Education to address this is needed. The NSF Noyce Program, which supports preservice teachers and places them in high-needs school districts can also aid in providing high quality physics instruction. The APS PhysTEC project, which focuses specifically on physics can also aid in this

[23] A. Miyake, L.E. Kost-Smith, N.D. Finkelstein, S.J. Pollock, G.L. Cohen & T.A. Ito, *Reducing the Gender Achievement Gap in College Science: A Classroom Study of Values Affirmation,* Science 330, 1234 (2010)

[24] Kelly, A.M., & Sheppard, K., Secondary physics availability in an urban setting: The relationship to academic achievement and course offerings, American Journal of Physics, 77(10), 902-906, (2009)

effort. Addressing this issue also directly addresses the transition between high school and university where we lose a significant amount of underrepresented students.

# Appendix E-10

## American Political Science Association Written Testimony

In the last thirty years, the discipline of political science has experienced notable increases in the proportion of women – and women of color – among the professoriate. Still, women comprise less than 30 percent of the faculty, and women of color less than 15 percent of all female faculty. While the data indicate an increase in recent years in the proportion of female job candidates, they also suggest differential advancement among women – and among women of color. The American Political Science Association (APSA) actively engages the issues of women of color in the profession through various programs, committees, task forces, and conferences. And, the work of addressing the challenges faced by women of color in political science continues.

According to data collected by APSA and presented in a 2011 report by the APSA Task Force on Political Science in the 21st Century, political science has seen a steady increase in the number of female faculty in the profession over the last several decades. From 1980 to 2010, the proportion of female political scientists more than doubled from 10.3 percent to 28.6 percent (APSA Task Force 2011, 41). Also during this time, the proportion of female faculty of color doubled, from 6.6 percent to 13.5 percent (APSA Task Force 2011, 43). Despite the increase, however, the profession remains largely male and white. The underrepresentation of women of color is particularly notable when the group is disaggregated by race and ethnicity. In 2010, among these women of color, African Americans comprised the greatest proportion at 6.1 percent; Asian/Pacific Islanders accounted for 4.4 percent and Latinas for 3.0 percent of the total women of color among political science faculty.

Data on the political science job market and placement reveals additional divergences and underrepresentation among women – and particularly among women of color – in the profession. For example, women accounted for nearly 40 percent of the (U.S. citizen) candidates on the market in 2009-10 (Diascro 2011, 598), a 2 percent increase from the previous year, but over three-quarters of these women were white. African Americans comprised 7 percent, Asian/Pacific Islanders 7 percent and Latinas 3 percent of the women on the market.

Similarly, differences emerged in the job placement of women of color in 2009-10 (Diascro 2011, 601-2). While these women got jobs in permanent academic positions with greater frequency than white women, there was notable variation among race and ethnicity in these placements. Two-thirds of the Latinas, 53 percent of African Americans, and 48 percent of Asian/Pacific Islanders secured these positions (compared to 41 percent of white female candidates), yet more African American women remained unemployed (26 percent) than their Asian/Pacific Islander (10 percent) and Latina (0 percent) colleagues on the market. Additionally, more African American women went on the market without their degrees in hand (as ABDs) (11 percent) than Asian/Pacific Islanders (6 percent) or Latinas (0 percent). Finally, African American women were placed in BA-granting institutions more often (58.3 percent) and in Ph.D.-granting institutions less often (25 percent) than other women of color.

More than half of female Asian/Pacific Islander candidates took jobs at Ph.D.-granting institutions (55 percent), while 38 percent of Latinas were placed at these institutions. White women were employed equally by Ph.D.- and BA-granting institutions (42 percent and 43 percent, respectively).

In political science, we have seen some advancement of women in color with gradually increasing diversity among job candidates and the professoriate. Still, these political scientists are significantly underrepresented in the discipline, highlighting research findings that, "there are some persistent challenges that…faculty of color face in trying to succeed within the academy," particularly in so far as recruitment, retention and climate are concerned (APSA Task Force 2011, 47). Many of these challenges are especially apparent for women of color (APSA Task Force 2011, 48), who also experience the obstacles faced by women more generally in the academy.

APSA addresses the challenges confronting women of color in a variety of ways. Among them are the following programs, committees, and task forces.

APSA Programs (selected):

- Minority Fellows Program (MFP): Established in 1969 as the Black Graduate Fellowship, this program is designed to increase the number of minority scholars in the discipline by providing graduate student support to facilitate the completion of doctoral studies. Since its inception, over 500 students have gone through the program, and more than 100 have completed doctoral programs in political science. Ralph Bunche Summer Institute (RBSI): Established in 1986, the goal of this program is to encourage undergraduates to pursue graduate studies in political science. A competitive application process yields 20 students each summer who participate in this rigorous program. The program is hosted and supported by Duke University and Dr. Paula McClain, a National Science Foundation award, and APSA funds.
- Minority Student Recruitment Program (MSRP) (formerly Minority Identification Program): Established in 1989, this program assists undergraduate and graduate political science departments identify college students from under-represented backgrounds who are interested in or show potential for graduate study. Through graduate program recruitment efforts, the goal is to provide these students with information about political science graduate programs.
- Mentoring Initiative: This program derived from the Task Force on Mentoring (2002-2005) and seeks to connect members of the discipline through an application process that identifies areas of similar substantive and professional interests and concerns.
- Surveys and Research: This program is the primary source of data – including demographic data – on the political science profession. For decades, it has been responsible for administering regular membership and professional surveys that collect data necessary for the association. This program provides much of the data that informs the reports cited in this testimony, and provides the basis of numerous reports produced by the association.

APSA Standing Committees:

- Committee on the Status of Blacks in the Profession, established 1969;
- Committee on the Status of Women in the Profession, established 1969;

- Committee on the Status of Latinos y Latinas in the Profession (originally, the Committee on the Status of Mexican Americans in the Profession), established 1970;
- Committee on the Status of Lesbians, Gays, Bisexuals and Transgendered in the Profession, established 1992; and,
- Committee on the Status of Asian-Pacific Americans in the Profession, established 2003.

APSA Ad Hoc and Other Committees (selected):

- Minority Program Review Committee, 2005
- Ad Hoc Committee on Workable Solutions to Advancing Women in the Profession, 2010

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# Appendix E-11

## American Psychological Association Written Testimony

Suzanne Bennett Johnson, President of American Psychological Association

I am Dr. Suzanne Bennett Johnson, the 120th President of the American Psychological Association (APA) and APA's 14th woman president. On behalf of the Association, I am pleased to submit this testimony addressing APA's efforts to maximize American talent by advancing women of color in academia.

The APA is the largest scientific and professional organization representing psychology in the United States. We are also the world's largest association of psychologists, with more than 137,000 researchers, educators, clinicians, consultants, and students as members. Our mission is to advance the creation, communication, and application of psychological knowledge to benefit society and improve people's lives.

Over the past 40 years, the APA Council of Representatives (APA's governing body) has approved numerous resolutions and policy actions addressing discrimination and equal rights for women of color including: Discrimination Against Women (1970), Training to Include Women and Minority Groups (1988), Ethnic Minority Education (1993), Affirmative Action and Equal Opportunity (1999), and the Resolution on Enhancing Diversity in APA (2005).

APA has also worked to ensure that women of color psychologists achieve equality as members of the psychological community, establishing within its governance structure boards and committees that focus on the issues and concerns of underrepresented groups, such as the Board for the Advancement of Psychology in the Public Interest, the Committee on Women in Psychology, and the Committee on Ethnic Minority Affairs. Moreover, APA governance groups often include explicit language encouraging nominations of women of color psychologists in Calls for Nominations for membership and/or awards.

APA membership divisions provide another vehicle for increasing the participation of women of color psychologists in academia. Divisions offer mentoring, networking, and leadership opportunities for women of color within APA. This is particularly true for The Society for the Psychology of Women (Division 35) and its four Sections: Psychology of Black Women; Concerns of Hispanic Women/Latinas; Psychology of Asian Pacific American Women; and Alaska Native/American Indian/Indigenous Women.

In 2006, the APA Central Office began developing a **Diversity Implementation Plan**, which entails an association-wide inventory of ongoing programs and mechanisms. The plan includes the following goals: to enhance the "welcomeness" of APA to diverse groups; to promote recognition of the value of diversity in APA policies, publications, and programs; to enhance access to, and encourage participation by, diverse groups in APA meetings and other activities; to expand support for diversity in the training of psychologists; and to promote diversity in psychological research and practice.

Within the Central Office, the Public Interest Directorate (PI) works to fulfill APA's commitment to apply the science and practice of psychology to the fundamental problems of

human welfare and social justice and to promote equitable and just treatment of all segments of society through education, training, and public policy. Within PI, the Women's Programs Office, the Office of Ethnic Minority Affairs, and the Minority Fellowship Program Office house the majority of APA programming focused on women of color in academia.

**Education and Employment Data on Women of Color**

APA's Center for Workforce Studies (CWS) is focused on collecting data on the pipeline and workforce in psychology and describing the field according to gender, race/ethnicity, age, employment activities and settings, and other relevant dimensions. We examined member profiles for 1987, 1995, 2003, and 2011. Over time, the proportion of women of color at Member and Fellow levels has increased. Particularly at the higher membership status of Fellow, women of color increased both in numbers (14 in 1987 vs. 149 in 2011) and percentage (1.3 percent in 1987 vs. 3.5 percent in 2009).

The biennial CWS Doctorate Employment Survey targets all recent doctorate recipients in psychology. We examined survey results from 1986 to 2009 (see Table 1 in the Appendix). In 1986, there were 123 (5 percent) women of color in the sample. In 2009, this number increased to 225 (18 percent). Between 1986 and 2009, there was an overall decline in full-time employment and an increase in part-time employment and post-doctoral fellowships, which is partly due to changes in the survey, as well as reflective of a general trend. This trend held true for women of color, who reported employment status at the same rates as the total sample (i.e., 90 percent in 1986 and 68 percent in 2009).

The annual Psychology Faculty Salary Survey targets graduate psychology departments. Although the survey focuses on salary, it also includes information on rank and tenure. We examined survey results from the 1987-88 and 2010-11 academic years (see Table 2 in the Appendix). In 1987-88, 138 (2 percent) full-time faculty were women of color. In 2010-11, 576 (8 percent) full-time faculty were women of color. Women of color had the highest percentage of tenure-track positions but also the lowest percentage of tenured positions at each survey. There were more women of color in lower ranks (associate and assistant professor) than in higher ranks.

**Challenges or Barriers Experienced by Women of Color in their Education and Professional Career Pathways**

To more closely investigate the challenges and barriers faced by women of color in academia in their education and professional career pathways, we surveyed graduates of APA's Minority Fellowship Program (MFP). One respondent, now a faculty member at a university in the US, captures a common theme: "They (women of color) are celebrated as evidence of diversity in academia, but not protected in a way that will allow them to be successful in the long run." Other challenges and barriers mentioned included: isolation and exclusion; tokenism; lack of mentors, role models or support; work-life balance; student loan debt; unreasonable service expectations; course assignment segregation; and overt and implicit bias. These anecdotal responses mirror what we know from the literature (American Psychological Association, 1998; Kawahara & Bejarano, 2009; LaFromboise & Marquez, in press; Miles-Cohen**,** Twose**,** Houston, & Keita, 2009; Syed & Chemers 2011).

**Programs and Resources Implemented by APA to Enhance Career Progression**

APA has been committed to combating these barriers in order to maximize the talents of women of color in academia for decades. This commitment may be best demonstrated by our publication **Surviving and Thriving in Academia: A Guide for Women and Ethnic Minorities** (1998), our most comprehensive resource specifically created to help women and ethnic minorities maximize their talents in academia. This publication provides strategies for seeking and selecting jobs, maximizing chances of gaining promotion and tenure, and identifying support strategies to overcome emotional and strategic challenges. Such guidance is supported by a robust array of APA programming.

**APA Leadership Institute for Women in Psychology (LIWP)** was established in 2008 to empower, prepare, and support women psychologists as leaders to promote positive changes in institutional, organizational, and practice settings, as well as APA and State, Provincial, and Territorial Psychological Associations governance, and increase the diversity, number, and effectiveness of women psychologists as leaders. The LIWP Executive Committee is diverse, including four women of color. The 111 total participants have included 41 (37 percent) women of color.

**Women in Academe: Two Steps Forward, One Step Back** (2000) (www.apa.org/pi/women/programs/academe/taskforce-report.pdf) explores the characteristics, roles, and status of women psychologists working in academic settings and documents the continued need for improvement in women's standing in academic institutions.

**Minority Fellowship Program Psychology Summer Institute** has served both advanced doctoral students and early career psychologists of color by providing educational, professional development, and mentoring experiences, helping participants develop a grant proposal, postdoctoral fellowship, dissertation, treatment program, publication, or program evaluation. All projects focus on issues affecting ethnic minority communities. Participants receive one-on-one mentoring and attend seminars by expert faculty on selected topics such as grant writing, publishing, research, or service delivery. Since 2003, 74 percent of participants have been women of color (87 women in all). About 40 percent of the women of color participants have subsequently had one or more grants funded by federal agencies, private foundations, and other sources.

**Resource Guide for Ethnic Minority Graduate Students** (2010) (www.apa.org/pubs/books/ethnic-minority-guide.aspx) advises students on strategies that will increase competitiveness when searching for a faculty position, such as securing a research and/or teaching assistantship and establishing a publication record.

**APA Commission on Ethnic Minority Recruitment, Retention, and Training in Psychology (CEMRRAT2) Task Force Implementation Grants Fund (IGF)** has served as a source for "seed funding" since 1999 to energize, empower, and support interested individuals, organizations, and educational institutions committed to enhancing ethnic minority recruitment, retention, and training in psychology.

**Promoting Psychological Research and Training on Health Disparities (ProDIGS)** seeks to increase the capacity of ethnic minority-serving postsecondary faculty and students to engage in health disparities research and training. Since 2003, ProDIGS has offered small grants and a program of professional development activities targeted to early career faculty to support research or program/curriculum development applications for federal or foundation funding.

**Women Mentoring Women (WMW)** is held annually during APA's Convention and is sponsored by the American Psychological Association of Graduate Students (APAGS), which facilitates making connections with mentors and role models.

APA promotes diversity in psychological scholarly research and in the peer review process with programming to engage women of color psychologists at every stage of the **Editorial Pipeline**, from reviewing a manuscript to becoming a successful journal editor.

APA has initiated **outreach campaigns** to encourage more graduate students and junior scholars of color to join the association. APA offices actively seek and promote diversity through convention programming, summer institutes, workshops, and awards, which are presented during the annual convention and throughout the calendar year. These initiatives include: **Academic Career Workshops, Advanced Training Institutes**, **Leadership Conferences**, and **Social Networking Sites.**

**Promoting Diversity in Science across the Legislative and Executive Branches**

The APA **Government Relations (GR)** staff monitor federal legislation, as well as regulatory and other federal agency proposals, to promote the successful recruitment and retention of women and ethnic minorities in careers in science. In addition, GR staff represent APA within the **Collaborative for Enhancing Diversity in Science**, a coalition with the goal of increasing collaboration among associations, societies, federal agencies, and private foundations in creating a more diverse scientific workforce. The coalition recently held a workshop, "Enhancing Diversity in Science: Working Together to Develop Common Data, Measures and Standards." GR staff also coordinated APA's response to the NIH Diversity in Biomedical Research Working Group on enhancing diversity throughout the various research career stages.

**Key Policy Recommendations to the External Communities Represented at the Conference**

- Improve the **collection and evaluation of empirical data** on women of color along the academic pipeline, with a special focus on career transition points. Collect and analyze **disaggregated data** by ethnicity, gender, and other key variables to identify core issues and inform policy more effectively.
- Identify, highlight, and reward **model programs and best practices** for maximizing talent of women of color in academia.
- **Encourage mentoring** of women of color by including protected time for mentoring in grants and contracts.
- Recognize psychology as a Science, Technology, Engineering, and Math (**STEM) discipline**.
- Offer financial support for the development of training materials for departments of psychology, including material for chairs and faculty that provide **explicit proactive guidance on how to promote a supportive and welcoming climate** for women of color in academia.
- Offer financial incentives for institutions and departments of psychology to develop comprehensive programs to address underrepresentation of women of color that include **curriculum development, programs to enhance access to role models and mentors, scholarship and fellowship funding, and changes in the institutional climate.**
- Highlight **innovative models that support women of color in academia as they navigate multiple roles and identities** (e.g., motherhood, wife/partner, and academician).

APA values the contributions of women of color psychologists. We remain committed to the continued development of organizational supports and mechanisms to increase education and training and to promote opportunities to maximize the talents of women of color in academia. Together with psychology departments, professional schools, institutions, policymakers, and our federal agency partners, we can further enrich our discipline, addressing the grand challenges of the future while more fully representing and utilizing the diversity of the scientific community.

**Table E-11-1** Gender and race/ethnicity of new doctorate recipients by employment status.

| | Employed | | Post-doctoral fellow | | Unemployed | | Not specified | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | percent | N | percent | N | percent | | | Total |
| **1986** | | | | | | | | | |
| Total | 2072 | 90.6 | 159 | 6.9 | 57 | 2.5 | -- | -- | 2288 |
| | 111 | 90.2 | 6 | 4.9 | 6 | 4.9 | -- | -- | 123 |
| **2009** | | | | | | | | | |
| Total | 849 | 68.4 | 294 | 23.7 | 69 | 5.6 | 29 | 2.3 | 1241 |
| | 155 | 68.9 | 52 | 23.1 | 12 | 5.3 | 6 | 2.7 | 225 |

Source: 1986 and 2009 Doctorate Employment Survey, APA Center for Workforce Studies.

**Table E-11-2** Gender and race/ethnicity of full-time faculty in Graduate Department of Psychology, by academic rank.

| | Full Professor | | Associate Professor | | Assistant Professor | | Lecturer, Instructor, no rank, not specified | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | percent | N | percent | N | percent | N | percent | Total |
| **1987-1988** | | | | | | | | | |
| Total | 3488 | 49.0 | 2084 | 29.3 | 1375 | 19.3 | 173 | 2.4 | 7120 |
| Women of Color | 27 | 19.6 | 35 | 25.4 | 63 | 45.7 | 13 | 9.4 | 138 |
| **2010-2011** | | | | | | | | | |
| Total | 2794 | 38.3 | 2025 | 27.7 | 1876 | 25.7 | 604 | 8.3 | 7299 |
| Women of Color | 86 | 14.9 | 185 | 32.1 | 257 | 44.6 | 48 | 8.3 | 576 |

Source: 1987-88 and 2010-11 Faculty Salary Survey, APA Center for Workforce Studies.

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*APPENDIX E WRITTEN TESTIMONIES*

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# Appendix E-12

## American Society for Biochemistry and Molecular Biology Written Testimony

The American Society of Biochemistry and Molecular Biology (ASBMB) is one of the world's largest professional Societies for the specific advancement of biochemists and molecular biologists and the disciplines that they represent. Many of its members are internationally recognized in their respective scientific disciplines, and include 97 recipients of Nobel Prizes in chemistry, or physiology and medicine between 1922 and 2009. ASBMB publishes several journals for the dissemination of scientific findings, including the highly prestigious Journal of Biological Chemistry. Moreover, it formally advocates for national funding of basic research and education, supports science education at all levels, and promotes the diversity of individuals pursuing scientific degrees and entering the scientific work force. Nevertheless, it is clear that much more work needs to be done to meet the challenge of integrating people of color fully into its organization and the scientific enterprise at large.

**Data on women of color within ASBMB**

Currently, ASBMB has an overall membership of ~11,019 word wide. Of the 9132 members who chose to report their gender during 2012 registration and membership renewal (~83 percent), ~67 percent are male and ~33 percent are female. Unfortunately, statistics on ethnicity are not particularly strong because of gross underreporting of that data by registrants. Of the domestic undergraduate members (1762 total), 22 of the 106 females that reported ethnicity are African American, 19 are Asian, 20 are Hispanic, and 4 are Other. Of the domestic graduate members (555 total), 17 of the 127 females that reported ethnicity are African American, 26 are Asian, 15 are Hispanic, and 9 are Other. Of the domestic postdoctoral (Associate) members (520 total) 6 of the 100 females that reported ethnicity are African American, 34 are Asian, 6 are Hispanic, and 7 are Other. Of the domestic regular members (5623 total), 16 of the 243 females who reported ethnicity are African American, 58 are Asian, 8 are Hispanic, and 2 are Other. Similar data are also available for 2011 and 2010. At present, there are no underrepresented women of color (i.e. African Americans, Hispanics, Native Americans etc) who serve as voting members of council, which are positions that are elected by members of the society. However, women of color, typically appointed by the president of the society, play key roles on various society committees.

**Challenges or barriers to success that confront women of color in ASBMB**

Many of the barriers faced by women of color are also faced by women in general, or people of color from both genders. However, these barriers are often heightened for women of color, who suffer from being a dual minority. Some of the barriers are cultural in nature. For example, Hispanic women in the Southwest, particularly first generation students, find it difficult to leave home to pursue science careers because of familial pressures to remain nearby. Other barriers result from the competitiveness and workload associated with an academic career in science, which interfere with familial responsibilities. Negative stereotypes of women and people

of color, as well as low expectations, also present challenges for career advancement for women of color. Although it is not expected that these barriers will fade away in the near future, many can be overcome through effective mentoring.

A lack of a cohesive network among women of color in the sciences is a major obstacle for career advancement. Although it is clear that people from a variety of backgrounds can offer valuable relationships, women of color at large research institutions are often in environments with few minority peers, while faculty at smaller institutions often have few colleagues who can serve as role models and mentors. Professional societies are uniquely positioned to serve women of color by fostering career advancement through mentoring resources, leadership experiences, and networking opportunities. The ASBMB annual meeting serves as a fertile intellectual environment for all scientists making specific efforts to nurture the scientific growth of women, particularly women of color. The society has a standing policy that requires at least 33 percent female or minority representation among lecturers in the many theme-based scientific programs at the annual meeting. This policy is enforced at an annual meeting of program organizers, wherein each platform is thoroughly vetted by a committee to ensure diversity. Moreover, all members of the annual meeting program-planning committee are actively encouraged to identify potential minority scientists from the society's database of minority scientists. These policies have inarguably increased the visibility of minorities and women at the annual meeting, although the representation of women of color remains limited.

The annual ASBMB meeting is also an ideal place to become apprised of the most current advances within and outside of a scientist's discipline and to interact with professionals from industry, government, and academics. One such opportunity offered by the ASBMB is the women's networking reception that often features a renowned female scientist who leads discussions related to the unique challenges faced by women in the sciences. These interactions are particularly critical for early career scientists. However, the participation of women may be limited by childcare needs. The ASBMB meeting offers affordable, on-site childcare during the annual meeting to meet this need and has previously offered travel subsidies to off-set the additional cost of travel in these cases. The society also understands that sustained awareness of these issues requires adequate representation of women of color in the society's leadership. In preparing this document, the society agrees that there has been adequate representation of women with four of the past five society presidents being women. A more challenging goal will be adequate representation of women of color in the society's top leadership posts.

Although all women in academia are challenged with maintaining a balance between career and family, women of color are acutely faced with additional demands, making the advancement up the academic ladder even more arduous. These challenges stem from a diverse array of factors, including cultural differences related to the role of females as the primary caretaker and excessive institutional responsibilities. For example, not only are minority females expected to serve on institutional committees, but also to lead and/or actively champion diversity initiatives. Collectively these challenges can impair advancement towards promotion and tenure. To address this issue, the ASBMB MAC recommends the following: 1) Supplements to support maternity-related absence and 2) Formal mentoring programs to facilitate academic advancement.

*Maternity-Related Supplements*

To facilitate increased retention of women of color in academia and ensure their professional success, supplemental funding is needed to support postdoctoral scientists who are

on maternity leave or absent for other child care-related activities. The postdoctoral tenure is a formative period in which one establishes research prominence by exhibiting a strong record of productivity and initiating an independent research program. To ensure that minority women are competitive for assistant professor positions and maximize productivity during maternity leave, funding institutions like NIH and NSF should establish supplements to provide technical support for pregnant postdoctoral scientists who are on maternity leave. This funding mechanism would allow a PI to hire a technician to carry out studies while the postdoctoral researcher is unable to work in the laboratory. Not only would the supplement benefit the postdoctoral scientist and minimize the risk of low productivity during this critical period, but also ensure that the postdoctoral researcher's absence does not negatively impact the PI's research program. In addition to establishing supplements to support postdoctoral scientists who are on maternity leave, mechanisms to extend funding for PIs who are on maternity leave would also increase the likelihood of a successful academic career. This type of funding mechanism may also provide for additional technical support while the PI is on maternity leave.

*Mentorship at Key Transition Points*

Although the number of women of color in academia is very low, this number decreases precipitously with advancement up the career ladder from postdoctoral researcher to full professor. Moreover, the number of women of color in administrative academic positions (e.g., chair, dean) is a very small percentage of the overall scientific academic workforce. These daunting statistics point to an urgent need for mentoring programs that help women of color navigate key transitions in the academic career. While funding agencies like NIH have programs such as the Minority Access to Research Careers and the Predoctoral Ruth Kirschstein-NRSA Fellowships to promote diversity and increase the number of minority undergraduate and graduate students in research, funding mechanisms to support women of color who are independent investigators are nonexistent. Given that mentoring is integral in building a successful academic career, establishing funding mechanisms to support mentor-mentee partnerships that would assist women of color junior faculty in navigating the promotion and tenure process, developing effective grant writing skills, negotiating institutional resources, and serving on departmental and institutional committees without undermining the success of their research program is key. Many of these mentor-mentee relationships can be forged through professional societies, which have significantly greater extensive networks that can allow for the most effective pairings.

# Appendix E-13

## American Society for Civil Engineering

Patrick J. Natale, Executive Director

The American Society of Civil Engineers (ASCE) welcomes the opportunity to provide written testimony in support of the conference ***Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia***. As stewards of the nation's infrastructure and leaders in building a better quality of life, we find this conference and its goals timely, if not well overdue, and core to the ability of our nation to innovatively build a workforce capable of addressing the urgent issue of rebuilding our nation's aging and insufficient infrastructure to remain competitive in a global economy.

Over a decade ago, ASCE expanded its efforts to address the issue of underrepresentation in civil engineering with the creation of a Committee on Diversity & Women in Civil Engineering (CDWCE) and the establishment of a Diversity Programs office with a dedicated staff member. Recently renamed the Committee on Diversity & Inclusion (CDI), the committee is charged with leading the Society in all matters related to Diversity & Inclusion. CDI has taken a "broad stroke" approach to broadening the participation and retention of underrepresented talent in the civil engineering workforce. This is evidenced by ASCE's policy statement on Diversity & Inclusion, several popular and noteworthy workforce-related publications (*Changing our World* and *Diversity by Design*), and a steady increase in the representation of women in both our membership and volunteer leadership. This can also be seen in our active and results-focused partnerships with the Society of Women Engineers (SWE), Women in Engineering Proactive Network (WEPAN), the National Society of Black Engineers (NSBE), and the Society of Hispanic Professional Engineers (SHPE).

ASCE has proactively taken on leadership roles with the American Association of Engineering Societies (AAES) and the National Engineers Week Foundation, which have enabled us to facilitate collaboration across engineering disciplines and sectors to create and participate in global programs and initiatives that address the nation's urgent workforce issue of underrepresentation in engineering. An example of a successful collaboration is the ASCE-led Extraordinary Women Engineers Coalition, which brought together more than 60 organizations to address the challenges of attracting academically-prepared young women to careers in engineering. The result of this effort was the widely recognized Engineer Your Life campaign.

### THE CIVIL ENGINEERING LANDSCAPE

According to the Bureau of Labor Statistics, (in accordance with the BLS civil engineering Occupational Titles and definitions), 11 percent of all engineers identify as female, while 7 percent of all civil engineers identify as female. In the race/ethnicity categories, 19 percent of all engineers identify as Black or Other, while 16 percent of all civil engineers identify as Black or Other. When looking at anticipated growth, civil engineering outpaces almost all

other engineering disciplines and is expected to grow 24.3 percent by 2018, with the most growth anticipated in the Engineering Services arena.

According to the Engineering Workforce Commission (EWC), in 2010**,** 19.7 percent of all civil engineering degrees were awarded to women, in comparison to 18.2 percent of all engineering degrees awarded to women. The EWC also reports that over the past five years, civil engineering consistently awards more Master's and doctoral degrees to women than any other engineering discipline, at 26 percent for each degree category, respectively. (Civil engineering outpaces all other engineering disciplines by 3 percent in the awarding of Master's degrees and 4 percent in the awarding of Doctoral degrees.)

Of our 140,000 global members, 11 percent identify as female; of those, 4.4 percent identify as working in the academic sector and 4.2 percent identify as students.

## OUR "NOT SO UNIQUE" DILEMMA

While ASCE takes great pride in our broad stroke accomplishments and the productive partnerships we have established with diversity-focused organizations, like other membership-based professional societies, our greatest challenge has been obtaining meaningful membership representation data. As a result we are unable to report complete quantitative data and draw meaningful conclusions related to the status of women of color in civil engineering. Specifically, the challenges we currently face are:

**Difficulty in collecting up to date and complete member data:** As a membership-based professional society, historically, our membership database and related data collection efforts have been primarily focused on capturing data directly related to our members' professional and technical work. The systems we used previously provided limited demographic reporting and analysis capabilities, making the seemingly simple task of capturing and analyzing demographic data arduous. While our current system includes fields for robust demographic data, we have yet to build a sufficient data history to allow trend analysis**.**

**Reluctance of our members to provide demographic data:** Membership data is self-reported, allowing members to determine which information they choose to provide. As technical professionals concerned with the practice of civil engineering, we have found that our members prefer to be recognized for their technical and professional merits, rather than their gender and racial/ethnic identities. We have received candid feedback from our members in previous attempts to capture this data, expressing a wide range of objections to providing this information.

In an effort to address our challenge in obtaining demographic information from members, ASCE's Membership Division has aligned the demographic data fields with those used by the US Census Bureau and, during the member renewal process, encourages members to update their member profiles inclusive of information such as their industry sector, professional designations, etc. Leaders within our Society units and professional practice committees have also begun their own efforts to encourage members to complete their full member profiles, as they have seen the value in being able to analyze the data to encourage strategic outreach,

research and professional development resources aimed at addressing issues of underrepresentation within the profession.

While ASCE will continue to partner with allied organizations in efforts to expand the number of individuals from underrepresented groups that enter the engineering profession, CDI recently adopted a strategic focus to target ASCE's efforts on the retention (rather than recruitment) of women and those from underrepresented groups in the civil engineering pipeline and workforce. Within the past year, CDI has leveraged relationships with the EWC and the BLS to share baseline data with members, staff, and partners in an effort to raise awareness around the status of underrepresented talent within the civil engineering pipeline and workforce.

We plan to increase retention by supporting more career exploration and professional development initiatives with our diversity partners. Our strategy also calls for us to introduce leading civil engineering employers to successful programs like the National GEM Consortium's GEM Fellowships, and leveraging webinars to share contemporary research similar to the 2011 report by Dr. Nadya Faoud and Dr. Romila Singh entitled *Stemming The Tide: Why Women Leave Engineering* and the recent WEPAN hosted webinar entitled *Stereotype Threat-The Nature and Nurture of Intelligence*, facilitated by an internationally recognized expert on the subject, Dr. Joshua Aronson.

## RECOMMENDATIONS

The following are a few key recommendations that would support ASCE's efforts to increase the career satisfaction of talent currently underrepresented in the civil engineering workforce:

- Increase the body of knowledge and related symposia around the unique ways that race, ethnicity, and gender intersect in the experiences of faculty and students, similar to those explored in original report authored by Dr. Shirley Malcolm *The Double Bind: The Price of Being a Minority Woman in Science* report and the 2009 *CEOSE-sponsored Mini Symposium on Women of Color in STEM*, focused on personal testimonies and proven interventions aimed at unraveling the double bind. We strongly recommend that a focus on **proven interventions that increase retention** are a crucial part of this body of knowledge.
- Encourage the active engagement of STEM professional societies and industry in **support of policies and legislation** similar to *H.R. 4483, the "Broadening Participation in STEM Education Act."* This bill aims **to increase the number of students from underrepresented groups who receive undergraduate degrees in STEM disciplines**. It also seeks to **increase the number of STEM faculty members from underrepresented groups** at institutions of higher education.
- Leverage professional societies and academic leadership to **conduct research aimed at identifying and promoting strategies that help students transition into professional practice**.

At ASCE, we view engineering not about NOW, but NEXT, and consider the issue of underrepresentation in STEM a critical workforce issue that our nation must solve if we are to lead the world in innovation and thus sustained economic prosperity. We applaud the organizers of this and similarly focused symposia for your urgent, action-oriented and visionary approaches

and leave you with this quote by famous cultural anthropologist Margaret Mead, *"Never doubt that a small group of committed people can change the world. It is the only thing that ever has."*

# Appendix E-14

## American Society of Engineering Education

Christine S. Grant[25]

Underrepresented Minority (URM) women faculty have emerged as successful leaders in engineering academia at a myriad of universities across the United States. Increased exposure of this important group raises the conversation in academia to a new level and creates partnerships based on scholarship with diversity as an added benefit. There are, however, still unique challenges and opportunities. The representation of URM women faculty at the Top 50 institutions (based on research expenditures) is not reflective of demographics due to a combination of selection/self selection processes and hidden biases in academia (Nelson, 2007). As they progress in their faculty careers, Underrepresented Minority Women (URM) women are very familiar with unique issues at the intersection of race and gender (DeCuir-Gunby, Long-Mitchell, & Grant, 2009). This familiarity results from their own personal experiences in the Academy and provides a myriad set of responses ranging from leaving the professoriate to a single-minded pursuit of success no matter what obstacles are presented (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007; National Research Council, 2006). One must recognize that there is a common denominator between the URM women engineering faculty and all other engineering faculty; to train students, conduct transforming research, create products and services to impact society and to be successful (and recognized) for their progress.

The changing demographics of the U.S. mandate that we engage a diverse pool of talent in STEM; this includes the pipeline of students into engineering and the current leaders (e.g., current engineers and engineering academics) in the field. In the academy, there are myriad types of institutions that have varying levels of URM women at the undergraduate, graduate and faculty levels. In the past 5 years, there have been initiatives to empower URM women engineering faculty that have arisen from support from the NSF ADVANCE program. The comments in this testimonial are based on: (i) a three-year ***NSF ADVANCE Leadership Award*** entitled initiative to bring together a group of women engineering faculty that were diverse in their race, ethnicity, discipline and institution type to conduct targeted peer mentoring, and (ii) an ***NSF ADVANCE PAID Award*** to NCSU to Develop Diverse Departments across disciplines (see Notes for details). During a summit for URM women engineering faculty, the participants were asked about their perspectives on why women faculty of color are not working at 'top 50 institutions.' This information was captured through various sources including a demographics survey and discipline-specific discussions. Several themes emerged when examining these data

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sources. The women of color engineering faculty asserted the following reasons as to why women faculty of color are not at 'top 50 institutions' (as defined by the Nelson study):

1. Job searches sometimes want to check the box saying that they included women of color but based on the climate may not intend to actually hire the demographic
2. Women of color prefer to go where we are supported
3. Women of color often choose otherwise due to 'perception' of less pressure at non-top 50
4. Life goals of women of color often includes more than just the discipline of specific research community and education
5. The current faculty don't know what to do with women of color, how to treat us; how to mentor; how to extend normal collegiality; how to bring us into the 'male club'
6. Inadequate or incomplete mentoring experiences (women of color have to 'see themselves' there to pursue a career there)
7. Location (do we want to be there?; culture)
8. Reputation of institution with regards to women of color

We recognize that the "Nifty Top Fifty" based on research expenditures is just one place where women of color are in STEM academia; there is a dearth of women of color at all ranks and all institution types in the professoriate. We also suspect that the above comments may also represent the perspectives of women of color in other STEM fields. The next section presents our perspectives on several approaches that can be taken to *empower, engage, and exchange* with this group of engineering faculty to address the important questions in the realm of **Maximizing American Talent by Advancing Women of Color in Academia.**

**EMPOWERMENT:**

Self empowerment is a powerful concept that when presented in the right context can be a very forward moving vehicle for women of color. This concept has actively taken the form of conferences, summits and workshops to enable women faculty to address the unique aspects at the intersection of race and gender, with the goal of upward movement in the academy. There have also been initiatives that speak to the critically important role of mentoring of faculty at all stages in their careers. Mentoring is not an issue unique to women of color; there has been increased dialog on the dynamics of "faculty mentoring faculty" as a way to create an academic environment that utilizes and celebrates talent in research, teaching and engagement. Targeted workshops, summits and events for women of color in the academy are one aspect of the recruitment, retention and promotion process. However, it is critically important to fully connect this same group of women into existing networks in the professional academic network. This includes: membership on committees (e.g., National Research Council), leadership in national professional organizations, "serious consideration" for national awards and leadership roles and respectful collaborations/partnerships in the educational and research arenas.

**ENGAGEMENT and EXCHANGE:**

Full and serious engagement is a critical next step to address the full exchange of important perspectives and talent of women of color in the Engineering Academy. As was stated in our opening remarks, at the core of women of color in the academy is the desire to be excellent in scholarship with a commitment to educating students, serving the profession, and connecting/collaborating with colleagues at the local and global level. This is a point that needs to be recognized in any discussion of this group who are located at the interesting intersection of

race and gender. Often, however, due to the low numbers in STEM, women of color in the Academy are often studied as data points (or missing data points) and treated as such in national discussions of the demographics of the field. Sometimes this group is not easily identifiable at large national and international conferences in a particular arena…but they do exist. Women have reported being in meetings addressing the subject of diversifying the professoriate that range from departmental faculty meetings to large conferences on women in STEM and not being asked to engage in the dialog. This is an interesting phenomenon, especially since they are already dashes (due to the small amount of data) on graphs, charts and tables. In an attempt to not put her on the spot and ask one woman of color to represent (via comments on the subject) her entire race/gender in all STEM fields, the pendulum often swings the other way, and she can become invisible in a room in which she is the topic of discussion. Or even worse, she can be the subject of a research experiment that has certain preconceived notions on this group and asks questions that support the outcome of the research. This is exacerbated when the leaders of the study are not fully engaged with or understanding of the women they are "studying."

The full engagement of women of color STEM faculty requires an enlightened set of leaders that come from a range of positions in the academy (e.g., department, college, upper administration) and national organizations (e.g., funding agencies, National Academies, and professional organizations). There needs to be a robust and real dialog between faculty of color who are ***already leaders*** in the faculty and administrative ranks. This group understands the unique challenges of leading at the university level, while balancing a number of other priorities in the fiscal, academic, and "political" arena. It is the further engagement of women of color leaders (both past and present) who have actively served colleges and universities in capacities similar to current decision-makers who will enable us to collectively get to the heart of the matter. These initiatives should include, but are not limited to:

- A mini-summit of women of color at core meetings of the National Academies, with the opportunity to interact in a focused/targeted manner with the key constituencies in the Academies. These targeted women of color faculty groups "in the trenches" should include current and former: dept. heads, and all ranks (e.g., assistant, associate, vice, etc.) of deans, provosts and chancellors.
- An active working group within a national organization focused on faculty success; this group would work towards synergistic goals that support women of color faculty and faculty overall.
- A "requirement" that NSF ADVANCE programs and other federally funded initiatives connect with women of color faculty/leader/administrators in an honest, meaningful dialog using mechanisms that are respectful of the time and discretion of this group of women.
- Sustained financial support of grassroots career development/mentoring/community building programs "in the trenches" that have successfully worked with women of color faculty. Full engagement of groups of "women of color working with women of color" will insure that their initiatives are not just perceived as short-term fixes to a long-term academy development opportunity.

Women of color faculty are unique in their demographic aspects and should be celebrated and promoted. But the element of surprise at their successes should not override the discussion as they continue to move up the ladder in the pursuit of the same success as their colleagues. That

expectation will become accepted as the norm as honest engagement and exchange becomes the honest mechanism of empowerment for women of color faculty in the academy.

**Notes:**

**1. ASEE Mission:** The American Society for Engineering Education is committed to furthering education in engineering and engineering technology. This mission is accomplished by promoting excellence in instruction, research, public service, and practice; exercising worldwide leadership; fostering the technological education of society; and providing quality products and services to members. The Society seeks to encourage local, national, and international communication and collaboration; influence corporate and government policies and involvement; promote professional interaction and lifelong learning; utilize effectively the Society's human and other resources; recognize outstanding contributions of individuals and organizations; encourage youth to pursue studies and careers in engineering and engineering technology; and influence the recruitment and retention of young faculty and underrepresented groups. (Source: www.asee.org/about-us/the-organization/our-mission)

**2. Diversity Excerpt from ASEE Annual Report (October 2010 – September 2011)**
***www.asee.org/about-us/annual-report/ASEE_Annual_Report_FY11.pdf***
ASEE created a Diversity Committee in fiscal 2011 which has a strategic plan to position the Society in partnership with appropriate organizations to increase diversity in the profession. The committee encourages each member division to hold at least one activity per year that features inclusiveness and engages ASEE leaders and members 1) to articulate the importance to the profession of advancing diversity and 2) to promote individual and organizational opportunities and responsibilities in developing an engineering community that "looks like" America. In 2011-12, the committee is focusing its efforts on developing tools and processes to support ASEE members in promoting diversity. Specific activities include devising methods for reaching out to diverse groups and collaborating with diversity organizations, as well as developing tools for diversity education and training. The root causes of diversity will be used to educate ASEE members on the history of exclusion, enabling them to better understand why we must be proactive in addressing this issue. The overall goal is to help ASEE members, particularly elected officers, learn about and promote diversity.

**3. An Aspect of the Data**

The following table summarizes the updated data found in the aforementioned Nelson reports in 2005 and 2007:

**Table E-14-1** Female URM faculty at "top 50" science and engineering departments. (FY 2002/FY 2007)

| | Native American females | Hispanic females | Black females |
|---|---|---|---|
| Chemistry | 1/3[2] | 5[1]/9[3] | ¼ |
| Math ('07 includes statistics) | 0/0 | 7[3]/9[6] | 2/4[3] |
| Computer Science | 0/0 | 0/3 | 0/3[1] |
| Physics | 0/1 | 8[3]/5[1] | 0/1 |
| **Chemical Engineering** | **0/0** | **3/6[1]** | **2/4[2]** |
| **Electrical Engineering** | **0/0** | **3/3[2]** | **7/8[1]** |
| **Mechanical Engineering** | **0/1** | **2[1]/7[1]** | **3/5** |
| **Civil Engineering** | **0/0** | **3[1]/8[2]** | **2/5** |
| **Total** | **1/5** | **33/50** | **19/34** |

Notes: The few "full" professors (in Table E-14-1) in each discipline are designated by superscript after the corresponding number.

Before we present the core aspects of the initiative, we will put the potential impact of a national effort into context by reviewing the statistics on URM Women Engineering Faculty. In doing so, we will refer to a recent (2002), well-cited report by Nelson on research faculties of the top 50 universities (based on NSF expenditures) with science and engineering departments. Underrepresented Minority Women Faculty are all but invisible: *"In some disciplines, there is no representation of URM (Black, Hispanic, or Native American) women on the faculty at all. In the "top 50" computer science departments, there are no women in tenured or tenure-track positions. With the exception of one Black "full" professor in astronomy, there are* ***no*** *female Black or Native American "full" professors in the physical science or engineering disciplines surveyed. Similarly, in physics there are no Black female professors, and in eight of the nine physical science and engineering disciplines surveyed, Native American female professors are nonexistent." (Nelson, 2005) "The data show URM women are less likely than either White women or men of any racial group to be "full" professors and to be awarded tenure. Other studies have also concluded that URM minority females are less likely to get tenure than White women or men of any racial group (Trower and Chait, 2002; Leggon, 2001).*

**4. NSF ADVANCE Awards referenced in document:**

**(i) ADVANCE LEADERSHIP AWARD: Peer Mentoring Summits for Women Engineering Faculty of Color;** Christine S. Grant and Jessica Decuir-Gunby (Principal Investigators)

This award addresses the persistent underrepresentation of women of color (African-American, Hispanic, Native American) on engineering faculties in the US This proposal presents an initiative to bring together a group of women that are diverse in their race, ethnicity, discipline, and institution type to conduct targeted peer mentoring and set in motion an infrastructure for discipline-specific career enhancement networks. The primary activity (over a three-year period)

will be a series of professional development summits that are both discipline-specific and multidisciplinary. The broader impact of this effort will be seen in enhanced understanding of the factors contributing to the retention and advancement of women engineering faculty and in improved research and professional networks among a highly trained group of faculty who are often isolated in their professional settings in academic departments.
*Source: http://nsf.gov/awardsearch/showAward.do?AwardNumber=0545269*

**(ii) ADVANCE Partnerships for Adaption, Implementation, and Dissemination (PAID) Award: Developing Diverse Department (3-D) at NC State;** Marcia Gumpertz (Principal Investigator)
"Developing Diverse Departments (3-D) at NC State" is designed to adopt/adapt a companion set of ADVANCE initiatives in order to address implicit biases and rarely articulated cultural stereotypes held within the university. Project goals are: (1) to increase the number of women and faculty of color in the professoriate, (2) to create a climate that promotes the success of all faculty, and (3) to eliminate factors that elevate women's and ethnic minorities' risk of leaving NCSU faculty positions.
*Source: http://nsf.gov/awardsearch/showAward.do?AwardNumber=0820013*

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# Appendix E-15

## American Society of Mechanical Engineering

Thomas G. Loughlin, Executive Director

On behalf of ASME, I would like to thank you for the opportunity to submit written testimony for the National Academies conference, *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*, which will take place on June 7-8, 2012, and will bring together academic administrators, federal officials and policy makers to engage in discussions aimed at increasing the representation and career advancement of women of color in academic science, engineering and medicine.

Founded in 1880 as the American Society of Mechanical Engineers, ASME is a 120,000-member professional organization that enables collaboration, knowledge sharing, and skills development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education, and professional development programs provide a foundation for advancing technical knowledge and a safer world. ASME conducts one of the world's largest technical publishing operations, holds more than 30 technical conferences and 200 professional development courses each year, and sets some 600 industrial and manufacturing standards.

ASME is committed to diversity and inclusion within our organization and to achieving a truly diverse engineering workforce. This commitment includes representation and career advancement of women of color. Diversity is a key component of ASME's mission statement: "*To serve diverse global communities by advancing, disseminating and applying engineering knowledge for improving the quality of life; and communicating the excitement of engineering."* Diversity is included among the Core Values of ASME: *"Embrace diversity and respect the dignity and culture of all people."* ASME also has a specific Society policy on diversity and inclusion, which helps to guide the Society's actions.

ASME's Committee on Diversity and Inclusion Strategy promotes diversity within ASME and also within the broader profession as a whole. This is done by advocating and advising ASME's leadership on inclusive excellence, valuing global diversity, and developing solutions to improve the quality of life.

Programmatically, ASME provides diversity and inclusion training for all staff and volunteers, including the nominating committee who selects ASME leadership like the Society's President. Our Diversity Action Grant program assists student sections in sponsoring events that promote the diversity and inclusion of women and under-represented minorities in ASME Student Sections and in mechanical engineering. ASME is also very active on diversity issues in the public policy area. Since 2005, ASME has partnered with the Society of Women Engineers (SWE) on various activities, i.e., SWE's diversity-focused Capitol Hill Day or briefings for the House Diversity and Innovation (D&I) Caucus. In February, ASME also revised its General Diversity Position Paper entitled, "Diversity and Inclusion in the STEM Workforce: A Strategic Global Imperative." In this paper, ASME urges policymakers to strengthen and re-examine

oversight of existing legislation and programs aimed specifically at broadening participation by under-represented groups in STEM fields, including those which:

- Increase public awareness of STEM careers, including supporting efforts to foster outreach to all students, teachers, parents, and K-12 guidance counselors;
- Enable all students to have access to a rigorous STEM curriculum, hands-on laboratory experiences, and informal learning that increases academic performance and interest in STEM careers;
- Offer incentives and mentoring for women and under-represented groups to pursue STEM coursework and careers, including teaching careers, and continue to provide professional achievement opportunities post-graduation and throughout their careers;
- Provide all members of society the opportunity to fully participate in the STEM pipeline and workforce by addressing current obstacles to the participation of women and underrepresented groups in the STEM workforce, as well as ensuring to acknowledge past accomplishments.

Again, we appreciate the opportunity to submit written testimony. If you, or your staff, have any questions or if we can be of further assistance, please contact Melissa Carl, Government Relations Manager, at 202/785-7380 or carlm@asme.org.

# Appendix E-16

## American Society for Microbiology Written Testimony

Roberto Kolter[26] and Marian Johnson-Thompson[27]

The American Society for Microbiology (ASM) appreciates the opportunity to respond to the Academy's request to submit written testimony for the upcoming conference hosted by the National Academies called *Seeking Solutions: Maximizing American Talent by Advancing Women of Color in Academia*. As the largest single life science membership organization in the world with more than 38,000 members and a mission to advance the microbiological sciences, the ASM is concerned about full participation of underrepresented minority (URM) women in ASM and in microbiology. Indeed, the ASM recognizes the importance of full representation and the richness that diversity offers, as well as our country's changing demographics.

**ASM Demographics**

As of May 15, 2012 ASM membership is 30,391[28]. Because member identification of race and ethnicity is voluntary, these data are incomplete. Accordingly, only 21,435 identify gender. Of those, 37 percent (7,916) are female. Using the same gender specific data for women, 10 percent (808) identify as URM women, representing 2.7 percent of the total membership. Likewise, employment data are incomplete, but of the self identified women, 40 percent indicate they work in academia. Unfortunately, workplace data for URM women are unavailable. While 55 percent of women indicate that they have an M.D. or PhD, only 40 percent of URM women have the same.

**ASM Programs to Enhance the Participation of URM Women**

To actively address the concerns of full participation in ASM activities and to support and increase the career advancement of URM members, the ASM established two relevant committees: (a) The Committee on the Status of Minority Microbiologists (now the Committee on Microbiological Issues Impacting Minorities, CMIIM) in 1984 and (b) The Committee on the Status of Women Microbiologists (CSWM) in 1979, as part of ASM's Public and Scientific Affairs Board. Both committees address URM women's issues by focusing on URM and women, respectively. These issues include increased representation in the profession, increased participation in ASM leadership activities, training, career development and mentoring needs and relevant public policy issues. In 1992, CMIIM was a key founder of the SuperMac, a coalition of minority affairs committees of other professional organizations with similar objectives.

While the CSWM realized notable successes in terms of increased participation in the microbiological sciences, career development, and significant participation in ASM leadership

[26] Roberto Kolter, Ph.D., Chair, Public and Scientific Affairs Board.
[27] Marian Johnson-Thompson, Ph.D., Chair, Committee on Microbiological Issues Impacting Minorities (CMIIM)
[28] The demographic information for this section was collected on May 15, 2012. The ASM is in its membership renewal cycle for 2012 and the information collected was based on members who had renewed as of May 15, 2012.

activities, these did not include URM members. As a result, during the 1990s, the ASM contracted with a consulting firm to conduct focus groups among URM members and appointed a Minority Task Force of ASM members to make recommendations for enhancing URM participation. The findings led to the establishment of a Minority Education Committee under the Board of Education (1993), an Underrepresented Members Committee (UMC) under the Membership Board (1997) and a Diversity Committee within the American Academy of Microbiology (AAM) (1999). The American Academy of Microbiology is an honorific leadership group within the ASM and the AAM Diversity Committee was established to increase the number of URM and women in its membership. One initiative of ASM's UMC is an informal online mentoring program for URM members.

**URM Women Microbiologists**

A brief overview of advancements to AAM membership and leadership positions within the ASM and the AAM, and ASM award receipts, demonstrates little success for URM, in general, and an even lesser degree among URM women. Of the last 28 ASM presidents, 12 have been females. The first and only URM male was elected president in 2008, and no URM women have held this post, or other top leadership positions. In other metrics, URM women have extremely limited success in receiving ASM awards, with the exception, in general, of minority associated awards.

Over the past 50 years, 2700 individuals have been elected to the AAM (approximately 9-10 percent of ASM membership), but fewer than 9 (0.25- 0.30 percent) are URM women. A 2007 article by Johnson-Thompson provides an overview of African American participation in the ASM, beginning in 1921.[29] Interestingly, the first African American to earn a PhD in microbiology was a female. Ruth Moore (1903–1994) earned the PhD in bacteriology in 1933 from Ohio State University. Though racial barriers prevented her attendance at some annual meetings, especially those below the Mason Dixon Line, she paid dues and attended her last meeting in Washington, DC in 1986.

For URM women some advances have included successful appointments on an editorial board, on ASM committees and as committee chairs (again, primarily on minority associated committees), elections to the AAM and award receipts. Most of the latter, too, have been minority focused awards. On the other hand, the ASM has made significant advancements in addressing pipeline issues. These have included a variety of training programs from the undergraduate to postdoctoral levels and faculty travel awards to attend the ASM General meeting. Additionally, for more than 10 years, the ASM has supported the NIH's Annual Biomedical Research Conference for Minority Students. In every facet of these programs, URM women are represented, and in some instances, supersede the number of URM men.

**Recent Survey of ASM URM Women Members**

Given the limited demographic data relative to URM women and the realization that their representation in ASM programs is limited, the CMIIM and CSWM conducted a brief survey in of women members in May of 2012. The purpose of the survey was three-fold: (a) to obtain a better demographic representation of URM women membership, (b) to determine if ASM was meeting their needs, and (c) to obtain information on how the ASM might best meet their needs.

[29] www.microbemagazine.org/images/stories/arch2007/feb07/znw00207000082.pdf, and www.asm.org/asm/files/ccLibraryFiles/Filename/000000004509/Feb97Johnson-ThompsonFeature.pdf

**Demographics**

These data, though limited in total responses (n=143), came from 2.1 percent American Indian/Alaskan Native, 12.1 percent Asian American, 15.6 percent African American, 1.4 percent Hawaiian or other Islander and 73 percent white racial groups. In terms of ethnicity, 9.9 percent identified as Hispanic and 90.1 percent identified as non-Hispanic.

Of the data received from URM women, some questions were skipped, and calculable data could be obtained only from African Americans and Hispanic women. African Americans and Hispanic women reported an average of 17 and 18 membership years, respectively. More than 78 percent of both groups reported ASM as their primary professional organization.

Educational attainments revealed that PhD degrees were earned by 59 percent of African Americans and 69 percent of Hispanics. While 2.1 percent of African Americans earned M.D. degrees, none were earned by Hispanics. The range of years that African Americans earned the PhD or M.D. was between 1978 and 2000; and the corresponding years for Hispanics were between 1967 and 2012.

**Career Goals**

Forty-six per cent (46 percent) of African Americans identified their original career goal as academia, while 50 percent of Hispanics identified academia. The second highest rated choice was clinical (32 percent) for African Americans, followed by government (23 percent); and the second and third highest choices for Hispanics were industry (29 percent) and government (14 percent), respectively. The majority of both groups reported having spent their greatest number of years in academia and the overwhelming majority are currently in tenured positions (African Americans 64 percent; Hispanics 69 percent) at research intensive universities (African Americans 72 percent; Hispanics 50 percent). The majority of both groups believed their salaries to be commensurate with their colleague's salaries. Sixty-six per cent (66 percent) of African Americans were satisfied in their careers and 79 percent of Hispanics reported satisfaction.

**How has ASM been helpful in URM women training and career advancement?**

The majority (61 percent) of respondents cited that the ASM had been helpful in training advancement through various conferences and meetings, including ASM's Kadner Institute and ASM's Conference on Undergraduate Education (ASMCUE), both held annually, and the annual meeting. These meetings not only provided training but allowed respondents to network, present their own research data, and hear cutting edge research by other attendees. Respondents also stated that ASM journals have been critical in increasing their scientific knowledge.

In response to career advancement, only 50 percent responded positively. However, similar to their written responses to training advancement, most respondents indicated that ASM had been helpful in their career advancement by providing high quality scientific journals, meetings and conferences and opportunities to network and make career connections at meetings. Some respondents cited the ASM's travel awards to attend the general meeting or ASMCUE as beneficial. ASM certification and continuing education programs were also listed as career advancement tools.

**How might ASM and other organizations be more helpful in advancing women of color in academia?**

A number of respondents were not certain about how ASM and other organizations could be more helpful in advancing women of color in academia, which indicates that articulating the

problem may be one of the main difficulties in providing assistance. Some of the solutions offered by respondents included providing more encouragement for young women of color and women in general in early education (K-12) and college to promote career awareness and opportunities. Other respondents suggested that more mentoring programs be developed to help young women as they travel through the different levels of education, including programs to help women write successful grant proposals and also programs that would allow women with families to take time off without fear of reprisal to have and raise children. Some respondents said that the problem with women of color advancing in academia was not isolated to just women of color, but all women have to deal with cultural and institutional biases. ASM was also complimented on the fact that the organization has had women in high profile leadership roles. These examples of successful women in science should be highlighted, either through award programs or publicizing in newsletters. It seems that the overall theme of responses was that while maybe a clear cut solution to addressing the problem is not known, "continual drum beating" about the problem is critical to ensure that the discussion is on-going to find solutions.

**Conclusion**

As with other professional organizations and government initiatives, ASM has not focused on programs to specifically support the career advancement of URM women scientists and microbiologists. Their needs have been traditionally addressed within the programs for URM and for women. It is clear that these programs have not been effective, though some strides have been made within URM scientists' programs. Interestingly enough, in 1976, Malcom *et al.* at the AAAS published "The Double Bind: The Price of Being a Minority Woman Scientist," [30] an influential document addressing the low participation of URM women in the sciences; many of its findings and recommendations were unique to URM women microbiologists and those pursuing this career path. A follow-up symposium, 35 years later in 2011, "Unraveling the Double Bind: Women of Color in STEM"[31] revisited this topic. Data presented revealed that while URM made up 0.6 percent of earned doctorates in 1975, by 2008, this number had increased to 6 percent. However, the participation of URM in productive careers as compared to white women and men was still dismal. One important causative factor was the failure in thesis publications, which is indicative of a total failure of proper mentoring along the training and career pathway and limits career advancement. Again, though this covers the entire STEM field, anecdotal information suggests that this is a barrier to full participation of URM women in the microbiological sciences as well.

In summary, ASM clearly has provided much administrative and supportive attention to increasing the numbers and full participation of URM women microbiologists. The many training programs appear to have been successful in increasing numbers, but full participation in the ASM's activities and career advancements have not been as successful when compared to majority men and women. While many of the barriers that confront URM women are shared by all women, it is apparent that URM women do not receive similar assistance to include supportive, strong, and meaningful mentoring as those enjoyed by men and a significant cohort of women. Interestingly, the recent survey, though limited in responses, revealed that URM women are generally satisfied in their careers and are generally satisfied with career support provided by ASM. Lacking in this survey was a query to address participation in ASM leadership activities. However, the survey did provide suggestions for ASM to add to its support

[30] http://archives.African Americansas.org/docs/1975-Double%20Bind.pdf.
[31] www.hepg.org/her/abstract/814

of URM women. The ASM will attempt to use the information from this survey and that from the NAS Conference to enhance its efforts in supporting URM women microbiologists.

# Appendix E-17

## American Sociological Association Written Testimony

### Introduction

Since the 1960s, the American Sociological Association (ASA) has been focused on improving the success of women and underrepresented racial/ethnic minorities in the scientific workforce. Founded in 1905, ASA now has over 14,000 members. Its nearly 50 special interest sections have more than 21,000 memberships, and it publishes 9 scholarly journals and a research-based magazine. As the national organization for sociologists, the ASA, through its Executive Office in Washington, DC, provides a wide range of services to its members, and promotes the vitality, visibility, and diversity of the discipline.

### Support Structure

ASA has been successful at improving the participation, visibility, and status of underrepresented minorities and women in the discipline by focused efforts to create an organizational support structure that includes appointed status committees, dedicated personnel, and innovative programs. In 1970-71, ASA's elected Council appointed a permanent Committee on the Status of Women in Sociology (CSWS) and a Committee of the Status of Racial and Ethnic Minorities in Sociology (CSREMS). The mandate of both was "to increase the degree of participation by minority and women sociologists in the opportunity structure of the discipline." These Status Committees remain vigorous today and report regularly to the ASA leadership. Most recently, the CSREMS prepared a study of differences between white students and students of color on the importance of peer social climate, faculty mentoring, and professional socialization. The CSWS is currently studying time in rank, comparing faculty members by race, ethnicity, and gender.

### Women of Color in Sociology

Sociology has the highest representation of minority women in sciences in American higher education at all degree levels. Minority women are awarded slightly more than a quarter of bachelor's degrees in sociology, about 17 percent of master's degrees, and 10 percent of doctoral degrees. The difference between the percentages of women in sociology and physics is more than seven-fold at all degree levels (see Table E-17-1).

**Table E-17-1** Percent minority women among US college graduates by degree and discipline, 2009.

| | Baccalaureate | Master's | Doctorate |
|---|---|---|---|
| **Sociology** | 25.8 | 17.2 | 10.1 |
| **Biological sciences** | 19.6 | 12.1 | 8.8 |
| **Chemistry** | 16.8 | 9.6 | 5.7 |
| **Political science and public administration** | 15.8 | 16.8 | 8.7 |
| **Economics** | 9.9 | 5.1 | 2.9 |
| **Math and computer science** | 7.4 | 4.8 | 2.8 |
| **Engineering** | 5.6 | 4.8 | 2.8 |
| **Physics** | 3.6 | 2.2 | 1.3 |

Source: IPEDS Completion Survey by Race, 2009. Available at https://webcaspar.nsf.gov.

An important factor in the strong representation of women of color in sociology is the discipline's core fields of research. They include: social inequalities of race, ethnicity, class, and gender; medical sociology; sociology of culture; sociology of education; occupations, organizations, and work; and sociology of the family. Sociologists conduct scientific research in these areas Women of color are more likely than men of color to participate in the ASA and in these special interest sections.

ASA has supported programs at both the undergraduate and graduate levels to increase the representation and eventual career success of men and women of color in the discipline. Two of the most successful programs are known by their acronyms, MOST and MFP.

**At the Undergraduate Level**

During 1993-1994, ASA began an innovative effort to foster diversity and excellence in higher education by working with individual undergraduate sociology departments to bring about *systemic* changes that impact the participation and place of minority students in the discipline. The Minority Opportunities through School Transformation program (MOST) helped departments bring about organizational change by specific changes in the curriculum, mentoring, research, training, climate, and pipeline. Eleven sociology departments participated in this 8-year program, ranging from liberal arts colleges to large research-extensive universities.

MOST emphasized increased rigor in scientific methods, direct research experiences, and the integration of content on race, ethnicity, class, and gender in *all* courses and aspects of the curriculum; the responsibility of *all* faculty members in a department to mentor *all* students; a departmental climate sensitive to diversity; and increasing the number of undergraduates of color going to graduate school. The outcomes of this program were overwhelmingly positive, as the course offerings including diversity content doubled and the percent of minority students who graduated increased from 18 to 33 percent. ASA published a monograph of "best practices" and principles so that other departments*, regardless of discipline*, could pursue similar models. [32]

[32] Levine, Felice J., Havidan Rodriguez, Carla B. Howery, and Alfonso R. Latoni-Rodriguez. 2002. *Promoting Diversity and Excellence in Higher Education Through Department Change.* Washington, DC: American Sociological Association.

**At the Graduate Level**

ASA's now 38-year-old pre-doctoral Minority Fellowship Program (MFP) provides annual stipends, mentoring, training support, access to professional networks, and continuous guidance and evaluation to individual scholars in close cooperation with host university doctoral programs. Through 2010, MFP was supported by a series of large T-32 training grants from the National Institutes of Mental Health (NIMH). After 2010, a discipline-wide pledge campaign was instituted to ensure ongoing support of the MFP from sociological organizations and individuals. Sociologists for Women in Society, for example, donated $100,000 plus ongoing annual support. Through MFP, ASA has supported the training and career development of nearly 300 minority scholars earning the Ph.D. in sociology. MFP Fellows are nationally recruited and competitively selected by an appointed advisory panel each spring, and their progress is monitored both during and after the PhD.

*Findings from Recent National Science Foundation-Funded Research about MFP*

ASA received an NSF research grant to compare the past 13 years of MFP PhDs to a random sample of sociology PhD recipients from the same period. We hypothesized that MFP leveled the playing field and that Fellows would be equally successful at securing the "ideal" academic career as measured by employment at research-extensive schools, number of peer reviewed journal articles (including in "top" journals), grants awarded, on-time tenure receipt, and disciplinary recognition. Table E-18-2 shows that MFP scholars are equally likely as the random sample of largely white students to receive tenure, are more likely to receive grants, and are more likely to become leaders in the discipline. They are, however, less likely to publish. However, if their dissertation advisor was a minority faculty member, they were more likely to publish in graduate school, suggesting the importance of increasing the number of minority senior scholars in the discipline.

**Table E-17-2** Comparative career achievements for tenure track/tenured academic scholars in 2010.

| Variables | Randomly selected PhDs | MFP Fellows |
|---|---|---|
| ***Career Achievements:*** | | |
| Tenured | 45.9 % | 43.1 % |
| Employed at a Research I university | 26.5 % | 21.5 % |
| Received at least 1 NSF and/or NIH research grant | 9.2 % | 15.4 % |
| Elect as an ASA section officer (at least once) | 7.1 % | 13.8 % |
| ***Graduate School Scholarly Productivity:*** | | |
| Published at least one article | 62.2 % | 50.8 % |
| By co-authorship[a] | | |
| Solo-authored | 34.7 % | 18.5 % |
| With someone other than advisor | 30.6 % | 30.8 % |
| With dissertation advisor | 14.3 % | 15.4 % |
| *By kind of advisor:* | | |
| Minority[b] | 12.5 % (8) | 21.4 % (14) |
| White female[b] | 12.6 % (32) | 10.5 % (19) |
| White male[b] | 17.3 % (52) | 11.5 % (26) |
| ***Post-PhD Scholarly Productivity through 2010:*** | | |
| Total number of articles and books published[c] | 4.5 (6.7) | 3.6 (4.9) |
| Total number of articles published in top three sociological journals[c] | 0.2(0.74) | 0.1 (0.21) |

Notes: a. Categories are not mutually exclusive; b. In parentheses is the total number of Ph.D. graduates who had this kind of advisor. Advisors with missing race/ethnicity are not reported; and c. Shows group means and standard deviations in parentheses.

**Women in MFP**

Women MFP alumnae have become leaders in the discipline in terms of scholarship and service. **Patricia Hill Collins** is a Distinguished University Professor of Sociology at the University of Maryland. She became the 100th President of the ASA in 2009, both the first African American woman and former MFP alumna to do so. **Linda M. Burton** is the James B. Duke Professor of Sociology at Duke University. She recently completed her term on the National Research Council's Board on Behavioral, Cognitive, and Sensory Sciences. And MFP alumna **Patricia E. White** is Program Director for the Sociology Program, Division of Social and Economic Sciences, at the National Science Foundation. She has also coordinated the Social and Political Sciences Cluster, was a senior analyst in the Division of Science Resources Statistics, and Program Officer in the Methodology, Measurement and Statistics program, all at NSF.

Despite the distinguished records of many MFP alumna of color, our recent study of MFP Fellows finds that, in general, alumna are not doing as well as alumni in terms of achieving that "ideal" academic career. Table E-18-3 shows that MFP women are half as likely as MFP men to be employed at research-extensive universities, half as likely to receive NSF and/or NIH grants, and about two-thirds as likely to become ASA section leaders; they also have about half the peer-reviewed journal publications since receiving their PhDs. More are full professors (4.8 percent

compared to 0 percent), and they are equally likely to have a publication in one of the discipline's top three journals (4.8 percent versus 4.6 percent).

This gap between women and men is not true for the comparison groups of non-MFP minority scholars and white scholars. The data give one hint as to why there is this difference among MFPs. Women in MFP may be less well socialized into the academic norms of the discipline than MFP men. Publications in graduate school usually signal a career of scholarly publishing that is forthcoming. Over three-quarters (77.3 percent) of MFP men had a least one publication prior to receiving their PhDs, compared to 38.1 percent of the women. MFP men appear to be better prepared by their dissertation advisors for scholarly careers; three times the percent of advisors co-authored at least one article in a peer-reviewed journal with men compared to the dissertation advisors of women (27.3 percent compared to 9.5 percent). This gender gap among MFP alumnae/i is cause for concern and still requires further study and improvement.

**Table E-17-3** Career outcomes of MFPs employed in academia by gender, 2010.

| | MFP Fellows | |
|---|---|---|
| | **Men** | **Women** |
| ***Scholarly Productivity and Employment for 1997-2009 PhD Graduates:*** | | |
| Employed at a Research I University | 31.8 % | 16.7 % |
| At least One Publication with Mentor prior to Graduation | 27.3 % | 9.5 % |
| Mean Total Number of Publications since PhD Graduation[a] | 5.5 (1.5) | 2.7 (0.5) |
| At least One Article Published in Top Sociology Journals | 4.6 % | 4.8 % |
| Received NSF and/or NIH Grants | 22.7 % | 11.9 % |
| ASA Section Officer Service | 18.2 % | 11.9 % |
| ***Rank of 1997-2002 PhD Graduates:*** | | |
| Full Professor | 0.0 % | 9.5 % |
| Associate Professor | 72.7 % | 66.7 % |
| Assistant Professor | 27.3 % | 23.8 % |

Notes: a. Standard errors are in parentheses.

ASA will continue its research with particular attention to the issues women of color face in MFP and in the discipline, including what impacts co-authorship networks during graduate school, potential marginality in departments, and the effects of more MFP programmatic emphasis on early post-PhD mentoring. ASA has formed a collaborative research network of former MFP scholars to supplement the quantitative findings, with in-depth micro-level data on motivations, perceptions, and experiences of individual minority graduate students and early career faculty to explore gender differences in the roles of choice and social exclusion in minorities' pursuit of "ideal" versus other career trajectories. As such, ASA is moving to continue MFP support into Fellows' early post-PhD careers to help enhance grant and publication productivity. And organizationally, ASA is working to increase the collaboration between CSREMS and CSWS—ASA's status committees focused on minority and women sociologists—so that they can jointly examine both professional socialization and structural issues of inclusion/exclusion experienced by women sociologists of color. Following the success of ASA's MOST report, ASA is planning a monograph "best practices" and demonstrated principles for increasing the success of minority PhD candidates and early career faculty, especially women, so that departments can continue to pursue successful program models.

# Appendix E-18

## Association for Women in Mathematics Written Testimony

Ruth Charney, President-Elect; Maghnild Lien, Executive Director; and Jill Pipher, President

The **Association for Women in Mathematics (AWM)** is a non-profit organization with over 3,000 individual, student, and institutional members. The purpose of the Association is to encourage women and girls to study and to have active careers in the mathematical sciences, and to promote equal opportunity and the equal treatment of women and girls in the mathematical sciences.

AWM has a strong history of attention to diversity issues. We have had a significant number of women of color in leadership positions, we participate actively in variety of programs aimed at increasing diversity, and we have a record of honoring women of color for their contributions to mathematics or math education.

AWM also works closely with other non-profit organizations to further these goals. In particular, the Mathematics Institutes in the US and Canada, which sponsor workshops, conferences, and semester-long research programs, play an important role in the vitality of the mathematics community. The effect of their programs on young people entering the field is well documented, and the AWM has worked extensively with the institutes to promote participation by under-represented groups. In addition, the AWM serves as an advocate for government and work-place policies that address the barriers encountered by women in mathematics.

While most AWM programs target all women in the field, we make a strong effort to include women of color. In addition, we believe that our programs provide potential models for designing new programs aimed specifically at women of color. Below we describe some relevant programs and activities that AWM has helped to develop and run.

**Mentoring and Building Networks**

Research conferences and workshops aimed at under-represented groups offer both a chance to showcase the achievements of members of the group, and an opportunity to provide mentoring and create networks crucial to their continued success. This is especially important at the early stages of a career.

Recognizing the importance of mentoring, AWM established the **AWM Mentor Network** in 2001 with the support of 10 mathematics institutes. The network seeks to match mentors, both men and women, with girls and women who are interested in mathematics or are pursuing careers in mathematics. The network links mentors with a variety of groups: recent PhD's, graduate students, undergraduates, high school and grade school students, and teachers. Matching is based on common interests in careers in academics or industry, math education, balance of career and personal life, or general mathematical interests.

Communication between mentor pairs is primarily via email, but in some cases personal contact has been possible. Currently, there are approximately 150 matched mentor-mentee pairs.

The primary means of connecting young people with research mentors and potential collaborators is through workshops and conferences. For over 20 years, the AWM has run a highly successful series of **AWM Workshops for graduate students and early career researchers** at the annual Joint Mathematics Meetings. The workshops provide young women an opportunity to present their work to a broad audience and to develop mentoring relationships at a crucial point in their careers. The event includes a pre-workshop dinner or reception, a series of research talks by recent PhD's, a poster session for graduate students, and a lunch. Participants are selected competitively for funding and presentations, but the workshop events are open to all those attending the joint meetings.

In addition to the workshops organized by AWM, we frequently assist other organizations in creating events aimed at mentoring young women in the field and showcasing their work.

In 2011, the Institute for Pure and Applied Mathematics (IPAM) sponsored a **Women in Mathematics Symposium** in cooperation with AWM. The stated aim was "to expose new female mathematicians to a wide range of possibilities and experiences in academia, government, business and industry." Graduate students and recent PhD's had opportunities to present their research and to learn about the career opportunities and professional development. AWM sent six representatives to the conference, including three who served on the organizing committee, Andrea Bertozzi, Alissa Crans, and Ami Radunskaya. We also helped to publicize the symposium to our membership.

Trachette Jackson, AWM executive committee member, has played a major role in several other conferences aimed at addressing the issue of minority participation. The **Spring Opportunities Workshop** is a new series of workshops, organized by the Mathematical Sciences Research Institute (MSRI) in Berkeley, aimed at cultivating a diverse community of mathematical scientists. The goal of the series is to educate current and aspiring mathematical scientists in underrepresented groups about professional opportunities in academia, industry, and government, as well as to help young researchers find jobs and mentors within the profession through networking. Jackson was a co-organizer of the first workshop in the series, held in March 2012. It focused on the professional advancement of underrepresented minorities in the mathematical sciences and introduced MSRI research programs to faculty in minority-serving and primarily undergraduate institutions.

The **Infinite Possibilities Conference (IPC)** series is specifically aimed at minority women in mathematics and statistics. The most recent of these was held in March 2012 at the University of Maryland and featured Jackson as a plenary speaker. Conference activities included professional development workshops, a panel discussion on graduate studies in mathematics, research talks given by professionals, student poster sessions, events for high school students, and roundtable discussions on experiences with mathematics. AWM has begun a program of awarding two free memberships in the organization to winners of the IPC poster sessions.

**Awards and Distinguished Lectures**

One of the keys to advancing women of color in the field is to increase their visibility. Awards and Distinguished Lecture series are an effective means toward this end. AWM sponsors several lecture series at large annual meetings, designed to increase the visibility of women in mathematics. One of these, the **Falconer Lectures series,** held at the annual summer Mathematical Association of America (MAA) MathFest, is named for and honors Dr. Etta Z.

Falconer, a gifted and influential African American mathematician. AWM and MAA sponsor this series to honor women like Falconer who have made distinguished contributions to the mathematics or mathematics education. This lecture advances Dr. Falconer's mission to increase the number of African American women in the mathematical sciences by re-articulating in public her goals and by celebrating the achievements of women mathematicians of color; four of the past seven lecturers have been women of color. Showcasing these women at a national meeting provides high visibility at the meeting, on the AWM and MAA websites, and through the dissemination of videos of the lectures. By acknowledging the research accomplishments of the Falconer Lecturers, AWM and MAA are taking a step towards dismantling stereotypes and are providing strong and inspiring role models for younger women.

Another prize designed to honor mathematicians (men or women) of color is the **Blackwell- Tapia Award**. This prize is given biannually at the Blackwell-Tapia Conference, which rotates among the NSF Mathematics Institutes. The prize, and the annual conference, honors the legacy of two distinguished mathematicians, David Blackwell, an African-American, and Richard Tapia, a Latino American. It is given to a mathematical scientist who has contributed significantly to research in his or her field of expertise, and who has served as a role model for mathematical scientists and students from underrepresented minority groups or contributed in other significant ways to addressing the problem of the underrepresentation of minorities in mathematics. In 2010, Trachette Jackson, a member of the AWM Executive Committee, became the first woman to receive the Blackwell-Tapia Award.

**Focusing on the Issues**

While activities such as those described above are making inroads, there is still a need for a better understanding of the problems and for creative new ideas for solutions.

In 2008, an NSF-supported national forum, **Promoting Diversity at the Graduate Level in Mathematics,** was held at MSRI. This workshop provided a forum for the interchange of information among key constituencies involved in graduate education: research universities, small colleges, and graduate students. Organizers of the workshop included AWM Past President Rhonda Hughes, AWM Executive Committee member Sylvia Bozeman, and current AWM Treasurer Ellen Kirkman.

Lectures at the workshop focused on framing the issues and developing strategies for broadening participation. Panel discussions and other talks highlighted personal experiences, obstacles that prevent fuller participation, and success stories. Among these presentations was the plenary lecture by Trachette Jackson, a member of the AWM Executive Committee, who gave an inspiring narrative of her journey from her undergraduate days to her current position as head of a cancer modeling group at the University of Michigan. Her distinguished contributions have been recognized by many organizations, including by AWM with its Falconer Lectureship.

Recognizing the importance of cultivating a diverse community in the mathematical sciences, 15 mathematical science institutes in North America have formed the **Institute Diversity Committee.** The goal of this committee is to support the participation of underrepresented groups in the mathematical sciences, including women, underrepresented racial and ethnic minorities, and persons with disabilities. Jill Pipher, the current President of AWM and Director of the Institute for Computational and Experimental Research in Mathematics (ICERM) and Georgia Benkart, former President of AWM are members of this Committee.

One of the key initiatives undertaken by the Institute Diversity Committee was the creation of a universal database used by NSF Mathematics Institutes to connect participating

individuals to programs of potential interest to them. Individuals elect to participate and provide information about their research interests. AWM has sent an announcement to its members informing them of the existence of this resource.

AWM also takes an active role in advocating policies favorable to increasing participation of women in the sciences. On two separate occasions, in 2010 at an NSF retreat and in 2011 at an NSF seminar of program officers, Georgia Benkart spoke on career-life and diversity issues as AWM President. In her talks at NSF, she encouraged NSF to have more openness concerning their policy for taking time off or requesting a grant extension because of family leave, and she encouraged them to consider supplemental grant funds to be used for child care at conferences. Her testimony helped to inform a new NSF Career-Life Balance Initiative.

The AWM also represents the interests of women in the mathematical sciences through its participation in the Conference Board on Mathematical Sciences (CBMS). This is an umbrella organization representing 16 professional societies.

**Challenges and Policy Recommendations**

The initiatives described above point to several possible strategies for increasing the participation of women of color in the mathematical sciences.

- Conferences and workshops aimed at women in the mathematical and physical sciences, or specifically at women of color, including both research and mentoring components.
- Prizes and Distinguished Lecture series aimed at celebrating accomplishments of women of color.
- A database and diversity committees to assure appropriate representation of women of color in major research conferences, prize nominations, etc.
- Advocacy for policies addressing work-life balance issues.

The nature of the funding for such programs is also crucial. Many women in the mathematical sciences express the opinion that they are asked to perform more than their share of service. While there are many women eager to help organize events such as those described above, it can take a serious toll on their time and their research. Thus, funding for conferences and workshops should include, in addition to travel money for participants, funding for extra staff support and/or teaching release for organizers.

AWM has a minimal staff. Most of the work within AWM is done by active mathematicians on a purely volunteer basis. AWM could have more programs, increase its visibility and that of its members, and support the productivity of some of its most active volunteers if AWM had the resources to hire more paid staff.

A perennial problem for women is the need for child care. There is little doubt that young women would attend more conferences and special programs and travel more frequently to work with collaborators if adequate child care were available. Directors of NSF Mathematics Institutes report that the percentage of women declining invitations to participate in institutes programs is much higher than that of their male counterparts. More attention and more funding should be directed toward this problem.

Most of the programs we have discussed here focus on women at the graduate level or above. Recent data shows that the percentage of mathematics Ph.D.'s awarded to U.S. women is declining, from a high of nearly 33 percent to 25 percent (2011). In the case of women of color, however, the percentages are very small; thus, additional attention to attracting more women of color at the high school and undergraduate levels is critical. AWM recognizes the need to

address pipeline issues and offers programs and prizes aimed at middle school, high school, and college students. AWM and Math for America sponsor an Essay Contest highlighting the achievements of a woman in mathematics. AWM and the NSF Mathematics Institutes sponsor a mentoring program (Mentor Network). AWM's grants support activities for middle and high school students (Sonia Kovalevsky Days). AWM encourages the development of undergraduate student chapters and offers the Alice T. Schafer Prize for Excellence in Mathematics by an undergraduate woman at the Joint Mathematics Meetings. AWM participates in the USA Science and Engineering Festival.

AWM recommends that funding be made available for an extensive and comprehensive mentoring network for middle and high school girls of color who are interested in mathematics and sciences.

**Resources**

**Data**

The American Mathematical society collects data on the ethnicity of new PhD's in their annual survey. These can be found at www.ams.org/profession/data/emp-survey

Membership data: In 2010-2011, 82 percent of AWM individual members were female, 13 percent were male, and the rest did not identify. In this same year, 68 percent were Caucasian, 6 percent Asian, 3 percent African American, 2 percent Spanish or Latino, and the rest did not identify.

**Links**

AWM: http://sites.google.com/site/awmmath/

Falconer Lectures: http://sites.google.com/site/awmmath/programs/falconer-lectures

Blackwell-Tapia Conference: http://icerm.brown.edu/blackwell-tapia-2012

AWM Workshop Series: http://sites.google.com/site/awmmath/programs/workshops

MSRI Promoting Diversity Conference: www.msri.org/web/msri/scientific/show/-/event/Wm466

Infinite Possibilities Conference: www.ipcmath.org/conference.html -ConferenceRegForm

Spring Opportunities Workshop: www.msri.org/web/msri/scientific/workshops/show/-/event/Wm9345

Institute Diversity Committee: www.mathinstitutes.org/diversity.php

# Appendix E-19

## Biomedical Engineering Society Written Testimony

Gilda Barabino, Ph.D., President Elect

The Biomedical Engineering Society (BMES) was founded in 1968 "to encourage the development, dissemination, integration and utilization of knowledge in biomedical engineering (BME)." Its vision is to serve as the world's leading society of professionals devoted to developing and using engineering and technology to advance human health and well-being. BMES recognizes that diversity promotes a healthy society and is a driver of innovation, excellence and new discoveries. The field has experienced rapid changes related to technologies, complex global challenges, and shifting demographics and—as reported by the American Society of Engineering Education (ASEE) —has sustained the largest growth of any engineering discipline at the bachelor's, master's and doctoral levels. While the field has attracted a significant portion of women at the undergraduate and graduate levels (37 percent of bachelor's degrees and 38.6 percent of Ph.D.s in biomedical engineering were awarded to women in 2010), the numbers of women diminish sharply at the faculty level, and the numbers of women of color are alarmingly low at all levels; at the faculty level, women of color are virtually invisible. To enhance the career advancement of women of color and broaden the participation of all underrepresented groups, BMES strives to intentionally infuse diversity throughout the organization and its programs and activities and to seek equally committed partners and collaborators to promote the diversification of the field.

BMES President-Elect Dr. Gilda Barabino, one of the few African American women in the field, is the first underrepresented minority and the second woman to lead the Society. When she first joined BMES in the early 1990's, there were no other African American female members and there was no specific programming targeted toward diversification. She began serving the Society as a member of the Membership Committee, was elected to the Board of Directors in 1997 for a 3-year term, was elected as Treasurer in 2005 and again in 2007, initiated the formation of the Diversity Committee in 2007 and from 2010- 2011 served as the Finance Committee Chair. Her trajectory in the Society and record of service and leadership speaks to the need for and benefit of active engagement of women of color and others from various backgrounds. Service to a professional society provides opportunities for networking, advocacy, professional mentoring, and recognition. In 2010, Dr. Barabino was elected as a Fellow in BMES and received the Diversity Award, which was accompanied by a plenary at the annual meeting. The BMES Diversity Award honors an individual, project, organization, or institution for outstanding contributions to improving diversity in biomedical engineering community. In awarding it to Dr. Barabino, BMES played a role that professional societies can model for others in recognizing the achievements of women of color and promoting their career advancement. For broader impact, it is important that scientific achievements be recognized as well.

Strong and inclusive leadership and an infusion of diversity and inclusion in all aspects of the society and its activities are essential for professional societies to contribute to the

advancement of women of color. Current BMES leadership headed by the Executive Committee (President and other officers) and the Board of Directors is diverse in its membership and fully committed to diversity and inclusion. Of the 6-member Executive Committee, two are women and one, the President Elect, is African American. Of the 12 elected directors on the Board of Directors, 7 are women. Through its strategic planning process, BMES established specific diversity goals and objectives, namely to promote lifelong high quality education and career advancement of a diverse community of biomedical engineers. One avenue toward meeting these goals is to increase participation of women and underrepresented minorities. To that end, luncheons and professional development workshops celebrating women and minorities are now offered routinely at annual meetings, winners of the Diversity Award are invited to serve on the Diversity Committee for a 3-year term, travel awards have been established for underrepresented minorities, in partnership with the American Institute for Medical and Biological Engineering (AIMBE), a mentoring program for women and underrepresented minorities is under development, in partnership with the Wallace H. Coulter Foundation, an educational program on translational research will be offered to faculty with special encouragement to women and minorities to participate, and BMES has recently hired an Education Director to oversee development and implementation of education and outreach activities and programming.

The power of individual and organizational commitment and of the presence of strong women of color as role models is illustrated by an interchange between Dr. Barabino and a student at the 2010 BMES annual meeting after Dr. Barabino delivered her Diversity Award plenary lecture. During the Q&A, a female African American BME graduate student stood up to say that she was moved by the lecture on a number of levels; in all of her years of schooling she had never had an African American female professor and had never heard a lecture by one. She was able to relate to shared experiences and most importantly, she was inspired with a sense that she could make it, too, by having a role model who shared her heritage and gender. Dr. Barabino was moved by the experience as well and has remained in touch with the student as a mentor and career advisor. She invited the student to attend a sickle cell disease symposium at Georgia Tech that she organized a month after the BMES annual meeting. That symposium gave the student an opportunity for mentoring, networking, socialization into the discipline and expansion of her scientific knowledge; during their regular e-mail correspondence, the student reported to Dr. Barabino that she is excelling in her research and becoming active in organizing student activities for professional development, mimicking her role model and mentor. Though this interchange described here is anecdotal, the role modeling and mentoring that occurred has been noted in the literature as key factors that promote the career success of women of color.

Historically, women faculty of color have experienced barriers to participation in the academy, and not until the Civil Rights Movement did their foray into the academy begin to increase. To date the numbers are disturbingly low, and career progression for women faculty of color is disturbingly slow. In engineering, recent data compiled by the ASEE reveal that as of Fall 2010, of the 24,419 engineering faculty in ABET accredited programs, 3,232 were women, and of those women, 119 were African American, 20 of whom were full professors, 39 of whom were associate professors, and 60 of whom were assistant professors. The barriers facing women of color in the academy are well documented, and policy implications to mitigate these barriers deserve immediate and forceful attention. Low numbers and inherent biases contribute to the marginality, invisibility, isolation, heavier burdens, and retarded career progression that women faculty of color face. Legislation such as the Civil Rights Act of 1964, the Title IX Law of 1972, and the Equal Opportunities for Women and Minorities in Science and Technology Act of 1981

along with commissions, task forces and reports have the potential for significant impact if properly implemented. It is important that agencies, institutions and organizations work together and that the collective voice of women faculty of color is present in these efforts.

BMES offers the following recommendations toward solutions to maximize American talent by advancing women of color in academia:

1. Expand, and make a priority, research and data collection on the academic career progression of women of color, and disaggregate data by race and ethnicity, sex, discipline and institutional type. NSF, NIH and other agencies should collect and report data on minority women at all stages of the academic pathway.
2. Recognize the achievements of women of color through increased nominations and selections for Fellow status, membership in the Academies, and other career impacting awards.
3. Increase advocacy for women of color through existing and new policies at national and institutional levels.
4. Enhance opportunities for funding, networking, mentoring, and professional development; existing programs that target women and minorities should include components that specifically address women of color; mechanisms should be established to develop women of color leaders.
5. Enforce accountability within institutions and agencies, require evaluations and invoke consequences for a lack of progress in advancing the careers of women of color.
6. Draw national and sustained attention, including White House involvement, to efforts to advance the academic careers of women of color; the NSF Career-Life Balance program and the attention it has received can serve as a model.
7. Revise the academic reward structure so that credit is given to women of color for mentoring, serving as a role model and other service-related activities for which they bear a disproportionate responsibility.
8. Educate agency officials, academic administrators, educators, and others who have career-impacting influence over women of color on barriers they face and on how to mentor and advance the careers of women of color.

# Appendix E-20

## Academic Women of Color in Computing: A Testimony on the Issues and Possible Solutions

**Computing Research Association (CRA)**
www.cra.org
**Center for Minorities and People with Disability in Information Technology (CMD-IT)**
www.cmd-it.org
**Coalition on Diversify Computing (CDC)**
www.cdc-computing.org
**Committee on the Status of Women in Computing Research (CRA-W)**
www.cra-w.org
**Computing Alliance of Hispanic Serving Institutions (CAHSI)**
http://cahsi.cs.utep.edu
**Anita Borg Institute for Women and Technology (ABI)**
http://anitaborg.org
**National Center for Women and Information Technology (NCWIT)**
www.ncwit.org
**Association of Computing Machinery's Council on Women (ACM-W)**
http://women.acm.org
**IEEE Computer Society**
www.computer.org
**Latinas in Computing**
http://latinasincomputing.org
**Black Women in Computing (BWiC)**
http://anitaborg.org/initiatives/systers/bwic
**Alliance for Access to Computing Careers (AccessComputing)**
www.washington.edu/accesscomputing

### Introduction

The lens through which women of color view their environment is that of ethnicity ***and*** gender as indicated by Malcom et. al. (1976). It is this intersection that results in unique experiences and perspectives for women of color, including women with disabilities. The focus of this testimony is on the broad field of computing, which is dominated by whites and men. As noted by Malcom (2011), in 1975 minority women earned just 0.6 percent of the science and engineering doctorates; while this percentage has grown over time, it is only 6.4 percent in 2008 (33 years later). It was further noted that within computer science, the percentage of minority women earning doctorates went from zero in 1975 to only 2.1 percent in 2008 (corresponding to just fourteen minority women).

The CRA Taulbee[33] survey counts 3,509 US citizens or permanent residents who received PhDs in computer science from US institutions in 2006-2011. Of these, only 69 (2 percent) were women of color. While the numbers are extremely small, women of color took academic positions at a higher rate than other resident PhD recipients (36 percent compared to 23 percent overall) and industry/government lab positions at a lower rate (22 percent compared to 42 percent overall). Of PhD recipients entering academia, minorities were more likely to take positions in non-PhD-granting departments (25 percent for men and 28 percent for women, compared to 20 percent for both white men and women). This outcome is in contrast to career interests among students, as found in the fall 2011 surveys from the CRA-W/CDC Data Buddies project[34]. Those results indicate that, among US resident PhD students, women of color are less likely to report interest in an academic career at a non-PhD institution (33 percent said they were somewhat interested, very interested, or considered it a top choice, compared to more than 55 percent of men of color and white students of both genders). Without additional research, we can only speculate the difference between interest and actuality.

Computer science is a field for which the underlying technology changes rapidly and the technology permeates all fields. As such, computer science is a very diverse field that includes such areas the theoretical foundations, graphics, networks, security, robotics, human computer interaction, software, information as well as applied areas such as bioinformatics and computational science. Below, we identify the key issues particular to women of color faculty in computing, highlight three strategies for success, and provide several recommendations to address the key issues.

**Key Issues**

The key issues that are often identified with any group for which there are very small numbers are isolation, self-doubt, and heavy load (Malcom et. al. 1976, Moody 2004, Stanley 2006). These issues are discussed below as they relate to women of color in computing.

**Isolation**. The dismal number of women of color in academia, especially in computer science, results in one having to deal with isolation. It is often the case that a woman of color faculty member is the only woman of color in a given department. For example, within the top 100 computer science departments, only one department has two women of color; the other nine women of color are at different institutions (Nelson 2007). The remaining 90 institutions have zero women of color faculty. We note that these top 100 computer science departments represent only 10 percent of the number of institutions that award baccalaureate degrees in computer science. The isolation is further exacerbated within the different sub-areas of computing; women of color faculty are usually "the only" within a department, as well as "the only" at conferences and professional activities.

**Self-doubt**. The very small number of faculty in computing who are women of color results in a lack of sufficient role models, which can often lead to self-doubt. When a person has never seen another person of similar ethnicity and gender in a job for which they are engaged, a person often wonders if that job is the right fit (Stanley 2006).

**Heavy load**. Diverse representation is very important with respect to membership on committees, ranging from institutional committees to professional committees. In computing,

[33] The CRA Taulbee survey data includes approximately 150 US institutions granting PhDs in Computer Science. http://cra.org/resources/taulbee.

[34] The CRA-W/CDC Data Buddies project includes 21 US institutions granting PhDs in Computer Science. http://www.cra.org/databuddies.

there are also review committees for peer-reviewed conferences, in addition to editorial boards for journals. As noted previously, computing technology changes rapidly. Thus, refereed conference publications (which includes presentations) are just as important as journal publications in computing. Women of color are often viewed as covering "double minorities—women and minorities." As such, women of color receive a large number of requests to serve on committees and often feel obligated to accept a larger load than normal, in order to represent the perspective of women of color.

**Strategies for Success**

The impact of dealing with all three aforementioned issues, in an environment where you may be the only women of color, can be overwhelming. This section focuses on three strategies for success: (1) mentoring women of color, including women with disabilities, in computing, (2) role models for women of color, including women with disabilities, in computing, and (3) acknowledging culture.

**Mentoring/Networks for Women of Color, including Women with Disabilities, in Computing**: The Catalyst Group conducted a survey involving 1,735 Hispanic, Asian, and African-American women professionals and managers in 30 Fortune 1000 companies (Catalyst 2006). The study focused on two types of informal networks: "*blending in"* and "*sticking together." Blending in* means the woman of color would develop a network that includes those with power, which are often white and/or male. An example of a *blending in* network for an Hispanic woman first line manager includes people in positions that are at least one level or beyond the first line manager; the people may be at the same company but in different groups or divisions and/or different companies. *Sticking together* means the woman of color would create a network consisting of those similar to herself. An example of a *sticking together* network for the Hispanic woman first line manager includes other Hispanic women at the given company. The results of the study are given below by ethnicity:

- African-American women followed a *sticking together* strategy, for which they had the largest number of women of their race in their networks.
- Latinas followed a somewhat *blending in* and *sticking together* strategy, for which they had high numbers of white members in their networks. They also had mainly female members.
- Asian women followed a *blending in* strategy, whereby more than half of their network members were white and 53 percent male.

It is often the case that both types of networks are needed for women of color. The *sticking together* networks are necessary to identify good strategies for (1) dealing with situations that are particular to a given culture and (2) providing significant support based upon common experiences. The *blending-in* networks are necessary to identify effective strategies for navigating the political environment and being successful with promotions. For example, *sticking together* networks can help women of color navigate work-life balance (especially with respect to giving back to the community), and can provide a social outlet for sharing common experiences. *Blending-in* networks can help women of color navigate the politics of major decisions within a department or college, as well as identify important committees for participation.

With respect to academic women of color in computing, the networks are very small. Because of isolation, there is no network of women of color faculty in computing within a given

department. To have such a network, one must reach out to other women of color faculty in computing departments at other institutions. Further, to reach a critical number in one's mentoring network, the woman of color often needs to expand her network to industrial women of color researchers in computing. Currently, there are networks such as Latinas in Computing and Black Women in Computing that include women from industry, government labs and agencies, and academia.

**Role Models**: As discussed previously, for women of color faculty in computing, it is very hard to find role models that have the same gender and ethnicity because of the very low numbers. This is also the case for women with disabilities. Having such role models, however, is very important to provide validation and inspiration with respect to achieving one's goals (Moody 2004, Stanley 2006). It is very important for established women of color faculty (e.g., tenured faculty) to serve as role models, especially for aspiring women of color faculty. Because of the very small number of women of color faculty in computing, it is often the case that one has to seek role models outside of computing.

**Acknowledging Culture**: As discussed previously, women of color represent the intersection of race and gender. The intersection requires the appreciation of race and gender to be truly engaging to women of color. The appreciation of race requires knowledge about culture. This knowledge can be obtained via books, articles, and/or time spent engaged with a culture—all of which requires an investment of time. Departments that spend time acknowledging different cultures through activities and discussions are often considered very welcoming by all cultures.

## Recommendations

In developing this testimony, we learned that there is little research about academic women of color in computing. In particular, it is unclear where the "leaks" occur with respect to the different paths that lead to the position of tenured faculty positions for women of color in computing. Hence, our first recommendation is to endorse the need to conduct a detailed study of the factors that influence women of color in computing to successfully navigate their paths to becoming a tenured faculty member. Research is also needed to explore the impact of disability with academic women of color in computing.

Second, it is important that demographic data be disaggregated to ensure that trends related to women of color faculty in computing, including those with disabilities, can be identified. We recognize that the numbers are very small, but it is important to understand the trends to avoid developing programs that neglect academic women of color in computing.

Lastly, it is important to provide resources for establishing virtual and in-person networks of academic women of color in computing to allow for the needed "*sticking together*" and "*blending in*" mentoring, the sharing of best practices, and for senior academic women of color in computing to be visible role models to junior academic women of color as well as women students of color.

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# APPENDIX E-21

## Geological Society of America Written Testimony

John W. Geissman[35]

My name is John W. Geissman. I am the President of the Geological Society of America, a Full Professor of Geosciences at the University of Texas at Dallas, and Full Professor Emeritus at the University of New Mexico. I am testifying today on behalf of the Geological Society of America (GSA). Founded in 1888, the Geological Society of America is the oldest professional geoscience scientific society in North America. It represents over 25,000 members from academia, government, and industry in all 50 states and more than 103 countries. Through its meetings, publications, and programs, the society advances the geosciences, enhances the professional growth of its members, and promotes the geosciences in the service of humankind. GSA encourages cooperative research among earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of earth science education. GSA has a standing Committee on Diversity in the Geosciences, a commitment to diversity in the GSA leadership (three women of color on the 16 member Council), as well as a new staff position focused on diversity.

The Geological Society of America recognizes the great need for and importance in enhancing the diversity of workforce that is to fill the growing and broadening workforce in Geoscience-related fields, be they in industry; local, state, tribal, or federal government positions; or higher as well as K-12 education. As the demand for a geoscience workforce grows, it is vital that we encourage all students to pursue educational experiences in the geosciences. In higher education in the United States, women of color are very poorly represented as Geoscience faculty, as documented by research by the American Geosciences Institute, and changing this situation is and will continue to be a focus of discussion by professional geoscience societies. As geoscience faculty, women of color play tremendous roles in encouraging our diverse youth to become interested in the sciences, and geosciences in particular, as a rewarding career. In October, 2011, the Geological Society of America and American Geosciences Institute met with representatives from their Associated Societies and Member Societies, respectively, to discuss enhanced efforts to coordinate activities in geoscience education across all professional geoscience societies. A major component of this discussion was how to build the diversity of the future geoscience workforce.

The Geological Society of America adopted a Position Statement on Diversity in the Geosciences in June, 2010. Part of this statement reads, "This GSA Position Statement on diversity addresses GSA staff and the membership, headquarters activities, meeting, and special functions, and the role of GSA and its members in their larger communities. In this latter regard, the statement challenges the membership and all GSA units to deal with the complexity of issues

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related to diversity in their home institutions, whether they are academic, governmental, non-profit, or industry."

Thank you for the opportunity to provide testimony about the importance of woman of color in all professions in the Geosciences. The Geological Society of America is grateful to the National Research Council's efforts to assure a greater representation by women of color in the sciences. For additional information or to learn more about the Geological Society of America – including GSA Position Statements on geoscience education and diversity in the geosciences– please visit www.geosociety.org or contact Kasey White at kwhite@geosociety.org.

# Appendix E-22

## NASA and Women of Color: Recruitment, Building a Pipeline, and Ensuring Inclusion and Diversity in the Workforce

The cultivation of diversity and inclusion is both a management philosophy and core value for all of NASA's education, equal opportunity, and human capital efforts. A diversity of skills and talents in our future workforce is critical to NASA's success. Agency-wide efforts to promote and advance the principles of diversity and inclusion serve to maximize individual and organizational potential. Such efforts do so by fostering awareness, understanding, and respect for individual differences. The knowledge, expertise, and unique background and life experiences, including the racial, ethnic, and gender diversity of each individual, serve to strengthen the Agency, as described below.

**Data on Women of Color[36] at NASA**

At NASA, approximately 62 percent of the workforce occupies positions in Science and Engineering (S&E), and the vast majority of these S&E professionals (89 percent) are Aerospace Technology (AST) engineers. As shown in the table below, for the period covering Fiscal Years (FY) 2008 through the first half of FY 2012, women of color comprised between 5.4 and 5.6 percent of the AST engineering component of NASA's workforce.

**Table E-22-1** Women of color's representation in AST occupation of NASA's workforce from FY 2008-2012.

| | FY 08 | FY 09 | FY 10 | FY 11 | FY 12 |
|---|---|---|---|---|---|
| Total AST Engineers | 9657 | 9909 | 9990 | 10167 | 10229 |
| Total Women | 21.1% | 21.4% | 21.5% | 21.7% | 21.8% |
| Women: White | 15.7% | 16.0% | 16.0% | 16.0% | 16.2% |
| **Women of Color** | **5.4%** | **5.4%** | **5.6%** | **5.6%** | **5.6%** |
| **2000 Census Relevant Civilian Labor Force (RCLF) Women of Color** | **2.3%** | **2.3%** | **2.3%** | **2.3%** | **2.3%** |

Note: RCLF includes general, electrical, computer, electronic, and aerospace engineers.

Differential analyses conducted by NASA to prioritize outreach, recruitment, and advancement efforts identified potential barriers for women of color at NASA, particularly in AST occupations. For example, Hispanic and Asian American women comprise less of the general engineering series (OPM series 801) than expected, based on the RCLF, and no African American females were selected as physical or space scientists (OPM series 1301 and 1330) in

[36] Women of Color includes African American, Hispanic, Asian and Pacific Islanders, Native Hawaiian, and American Indian.

the last fiscal year. The data also indicate a lower-than-expected representation of women of color in the higher grade levels (GS 14, GS 15, and SES/ST/SL) of AST occupations, in comparison to the RCLF. NASA has established planned actions for focused outreach, recruitment, and advancement in its Model Agency Equal Employment Opportunity Plan and Model Center EEO Plans.[37] For example, some of the actions in the Agency plan include improving women's participation in leadership development programs, short-term rotations, and other developmental assignments; apprising the Executive Resources Board and other senior councils regarding lack of diversity in senior level positions; improving the participation of underrepresented groups in student programs that lead to potential employment with NASA; coordinating education and awareness events to showcase success stories of women and help eliminate negative stereotypes; and examining the nomination processes for Agency honor awards to ensure all employees have equitable opportunities to be recognized. In addition, there are a number of other efforts that NASA is undertaking to increase the recruitment of women of color, as well as to build a pipeline to ensure there is a future workforce that is well represented by women of color. These are discussed below.

**Enhancing the Career Progression of Women of Color at NASA**

Research has identified some of the challenges in terms of recruitment and advancement of women in the fields of science and engineering. There are inherent biases and stereotyping that exist for women of color in the science and engineering workplace. In addition, there are challenges related to the lack of mentorship and isolation. While there is a need to ensure that more women of color choose to study in the Science, Technology, Engineering, and Mathematics (STEM) fields, which will be addressed later, there is also a need to focus on recruitment and retention of women. NASA is working to develop an Agency-wide hiring and recruitment plan that will address issues involving diversity, including women of color. This plan will build off of some of the best practices that already exist in the Centers.

Of particular note is the Johnson Space Center's (JSC) effort on the recruitment front. JSC has employed numerous initiatives to increase recruitment of women of color. They developed the "Recruiting Working Group" to enhance collaboration between Human Resources, Education, and the Office of Diversity and Equal Opportunity (ODEO) in recruiting underrepresented populations, including women of color. The group meets quarterly to discuss recruiting strategies and recruiting schedules. They routinely work with the Education Office to pipeline top performing interns, including women of color, into the co-op program. They also conduct focus groups with minority co-ops, including women of color, on ways to enhance recruiting and onboarding practices.

Additionally, JSC is conducting a study of best practices in minority recruitment, retention, and executive advancement to gain insight from Fortune 500 companies, aerospace companies, and other government organizations. They are in the process of analyzing the study report and plan to implement some of the lessons learned.

Last year, JSC initiated five Employee Resource Groups (ERGs). Three of the groups are race based (African American, Asian Pacific American, and Hispanic). The groups are:

- Fostering responsibility, engagement, and connection for all employees involved by asking them to assist with recruiting and onboarding activities.
- Providing a path for feeling connected and valued.

[37] The Agency plans can be found at http://odeo.hq.nasa.gov/documents/NASA_Model_EEO_Agency_Plan_FY12-13.pdf

- Providing an environment where members can participate in activities that continually improve the workplace.
- Providing leadership development and networking opportunities.

**Education at NASA: Building a Pipeline**

NASA has long recognized the potential contributions of minorities and women as a largely untapped resource to support the STEM workforce. NASA's education programs and projects support the academic training of qualified future workers necessary for accomplishing the Agency's missions. Many of these projects specifically target recruitment and retention of women and minorities. In turn, NASA seeks to leverage the Agency's student development pipeline to facilitate entry-level hirings on the basis of proven performance.

NASA assists minority institutions and faculty through multiyear research grants and provides scholarships, internships, mentoring, and tutoring to underserved and underrepresented students. Through the Minority University Research and Education Program (MUREP), students attending minority institutions, including Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), and Hispanic-Serving Institutions (HSIs), participate widely in the Agency's research and education programs and its overall mission. Many of these efforts have also had notable success in attracting women. Since 2001, the Harriett G. Jenkins Predoctoral Fellowship Project (JPFP) has sought to increase the number of graduate degrees awarded to underrepresented and underserved persons, women, minorities, and persons with disabilities in STEM disciplines. The ultimate goal is to increase the U.S. talent pool by developing a more inclusive, multicultural, and sustainable STEM workforce. JPFP has supported 210 students since its inception, of which 74 percent have been minority candidates and 60 percent are women.

Having greater numbers of female, underserved, and underrepresented students participating in NASA programs supports the entry of these students into the scientific and technical workforce, as well as their pursuit of advanced STEM degrees. The Motivating Undergraduates in Science and Technology (MUST) project awards scholarships and internships to undergraduates pursuing degrees in STEM fields. In FY 2010, the MUST project hosted 100 students: 55 percent were women, and 27 percent of the scholars self-reported being the first in their family to attend college.

In FY 2010, 5,605 participants in NASA higher education programs self-reported being a member of an underserved or underrepresented race or ethnic group. This represents 35 percent of the total number of higher education students served by NASA in FY 2010. NASA's solid recruitment efforts of students meet or exceed the percentages of underrepresented minorities pursuing higher education studies in STEM fields nationwide, according to the National Science Foundation Report "Women, Minorities and Persons with Disabilities in Science and Engineering: 2011."

In FY 2010, of all higher education students served by the Agency, 6,042 participants self-reported being women. This represents 39 percent of the total number of higher education students served by NASA in FY 2010. Within the Space Grant program in FY 2010, of the 12,410 Space Grant participants who self-reported their gender, 4,773, or 38 percent, were women. There were 5,697 higher education students receiving direct awards through Space Grant, with 41 percent being made to female students. Additionally, there were 4,617 significant awards (i.e., $5,000 or more in support or more than 160 hours of participation in an activity)

made to higher education students through Space Grant in FY 2010, with 38 percent being made to female participants.

NASA also has an opportunity to inspire and engage learners through its unique people, resources, and facilities. Several projects, focused on middle and high school learners, have been successful in engaging girls of color.

The NASA Science Engineering Mathematics and Aerospace Academy (SEMAA) is a national, innovative project designed to increase participation and retention of historically underrepresented K-12 youth in the fields of STEM. SEMAA is located at community colleges; Historically Black Colleges and Universities; Hispanic Serving Institutions; Tribal Colleges and Universities; high schools, middle schools, and elementary schools; and science centers/museums in urban and rural cities throughout the United States. In 2011, 40 percent of the SEMAA participants were young women of color (49 percent total female participation).

NASA's Summer of Innovation (SoI) project and Mary J. Blige's Foundation for the Advancement of Women Now (FFAWN) both show students the possibilities available if they follow their dreams and reach for the stars. The SoI project is part of the President's Educate to Innovate Campaign. It started in 2010 to help keep middle school students engaged in fun and stimulating STEM-related activities during the school break, and over 45,000 learners have participated in activities over the past two years.

**Recommendations**

***Recruitment***

Policy memoranda could further encourage agencies to collect data, benchmark results and best practices, and share information regularly among decision makers. Where possible, participation in programs should be tracked and evaluated. Following participants will focus their attention on the outcomes and benefits of Agency initiatives in recruitment, career progression, and training for women of color.

Agencies should also be encouraged to ensure that internship programs and other educational partnerships expand the pool of minority and female candidates. Many opportunities for minority women arise as a result of successful career pursuits of the women who came before them. Minority women pursuing STEM degrees and working in STEM careers should be encouraged to mentor girls as early as elementary or middle school and guide them to pursue the fields of mathematics and science.

***STEM Education***

NASA is actively involved in the Administration's comprehensive effort to improve STEM education in America. Through the National Science Technology Committee's Committee on STEM, NASA is collaborating with other Federal agencies to identify interagency STEM education goals, and to define objectives and strategies to coordinate Federal investments in STEM education to efficiently achieve those goals. One of the priority areas identified is supporting groups traditionally underserved in STEM fields.

***Title IX and Title VI Compliance Programs***

NASA recommends, as a matter of policy, that Federal agencies with the authority to provide Federal grants to educational institutions, establish and sustain vigorous civil rights compliance programs under Title VI of the Civil Rights Act of 1964 (Title VI), as amended, and

Title IX of the Education Amendments Act of 1972 (Title IX). These compliance programs need to implement a compliance assessment strategy that includes conducting full compliance reviews of their grantees under the combined statutory mandates of Title VI and Title IX. This strategy will allow for the differential analysis of how institutional policies and practices impact Federal financial assistance beneficiaries by gender and also how women of color are specifically impacted.

In this regard, NASA conducts a robust Title IX compliance program of the Agency's university and college grant recipients to ensure equal opportunity on the basis of gender in STEM programs. Consistent with NASA's Title VI/Title IX programs, NASA recommends:

- combined Title VI/Title IX compliance reviews, including appropriate findings and recommendations to the head of the institution;
- agencies' Assurance of Compliance forms required from all grant recipients should contain text requesting specific information from grant selectees on their compliance with equal opportunity obligations. This information should be obtained prior to the award of grant funding; and
- agencies enhance their civil rights compliance programs with a strong technical assistance and outreach component.

**Conclusion**

While progress has been made to increase the number of women of color at NASA and in the fields of engineering and science, there is still work to be done. NASA's focus on education to build a strong pipeline, as well as the development of an Agency-wide plan on recruitment and hiring, will build upon the existing work. Diversity is a core value at NASA, and the Agency will continue to work to ensure an inclusive environment with opportunities for all.

# Appendix E-23

## National Institutes of Health Efforts to Promote Advancement of Women of Color in Biomedical Research

As the largest supporter of biomedical research in the United States, the National Institutes of Health (NIH) seeks fundamental knowledge about biological systems to advance health and reduce the burden of disease. Achieving this mission requires continuous input of creativity and innovation from the nation's most talented scientists. Maintaining biomedical workforce diversity is vital to ensure participation of the most talented individuals from all groups, as well as to ensure commitment to broad research priorities, address health disparities, and enhance recruitment of diverse subjects into clinical research protocols.[38]

**Underrepresentation of Women and Minorities in Biomedical Research**

Despite growing recognition of the importance of diversity in the research workforce, troubling discrepancies remain. Women and minorities are underrepresented in the biomedical workforce, especially in leadership positions. At the intersection of these two categories, women of color face challenges at all stages of the educational and professional pathway leading to a research career. From early education through graduate and postgraduate studies, tenure track, and beyond, women of color can face a staggering array of obstacles. While they share subsets of these challenges with other women and men of color, others are unique. Their extreme underrepresentation can be associated with feelings of isolation and a scarcity of role models and culturally competent mentors. It can also result in repeated and excessive requests to serve on committees, due to low overall minority representation. Some women of color feel caught in a "double bind," pressured to align themselves with either women or with minority groups, rather than embracing their whole identities.[39] To address challenges experienced by women of color, there must be efforts to identify and eliminate institutional and organizational biases that impede success.[40]

How do women of color fare at the NIH? According to the National Science Foundation, underrepresented minority women earn approximately 0.3% of doctorate degrees in science and engineering.[41] Based on the Association of American Medical Colleges 2011 medical school graduates self-identified data, 8.5 percent of graduates were Black or African-American women,

[38] NIH Health Disparities Strategic Plan and Budget Fiscal Years 2009-2013: www.nimhd.nih.gov/about_ncmhd/NIH%20Health%20Disparities%20Strategic%20Plan%20and%20Budget%202009-2013.pdf.

[39] Malcom, S.M., Hall, P.Q., Brown, J.W. "The Double Bind: The Price of Being a Minority Woman in Science." AAAS Report 75-R-3. April 1976.

[40] Obiomon, P.H., *et al.* (2007). **"**Advancement of Women of Color in Science Technology, Engineering and Math (STEM) Disciplines." Retrieved from www.nyu.edu/frn/publications/advancing.women/Adv.%20Women%20in%20Stem%20Tickles.html.

[41] National Science Foundation, Division of Science Resources Statistics. "Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011." Special Report NSF 11-309. Arlington, VA. 2011.

7.8 percent were Hispanic women and 0.8 percent were American Indian women.[42] Of the Federal workers employed by the NIH in scientific or technical positions for General Schedule (GS, GM, GP, or GR) grades 13 through 15, which are the higher grades, Black, Hispanic, and American Indian/Alaskan Native women make up 4.61 percent, 1.41 percent, and 0.21 percent respectively.[43]

Trends in NIH awards to trainees, fellows, and researchers were evaluated over fiscal years (FYs) 2000 to 2011. The data are shown in Figures E-23-1 to E-23-4. [44] For this report, the results are presented by self-reported gender and race (White, Asian and Other Races (including Black, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and persons reporting more than one race), and gender and ethnicity (Hispanic versus non-Hispanic). The results presented in graphs include *only persons reporting both gender and race, or gender and ethnicity* – they exclude those for whom any of these demographic characteristics was unknown or withheld. To provide perspective, the graphs also show the percentage of the total population that appears in the graph because they reported both gender and race, or gender and ethnicity.

Overall, women, Hispanics and underrepresented race groups comprised a higher proportion of NIH-funded trainees and fellows than researchers. Despite slight gains over the last decade, women reporting to be Hispanic or from underrepresented race groups represented a small fraction of the trainee and fellow pool, and an even smaller portion of the researcher pool.

**NIH Trainees and Fellows: Trends in Gender and Race, and Gender and Ethnicity**

In 2000, men trainees and fellows were slightly more prevalent than women. By 2011, this trend reversed. For the subset of trainees and fellows *reporting both gender and race*, women from underrepresented racial groups remained constant at 6% to 7%, whereas both Asian and White women increased slightly over the time period evaluated. Men from underrepresented racial groups remained constant at 4% and comprised a smaller fraction of trainees and fellows than women from the same racial groups. (Figure E-23-2).

From 2000 to 2011, the proportion of trainees and fellows reporting their ethnicity greatly increased over 2000 to 2011, from 30% in 2000 to 88% in 2011. This shift was likely linked to the onset of collecting ethnicity and race status separately, which NIH began in 2001. Subsequently, those identifying as Hispanic grew from 6% to 9% from 2000 to 2011, while those reporting they were not Hispanic grew more rapidly, from 25% to 81%. For those reporting gender and ethnicity, the proportion of Hispanic women decreased relative to the proportion of non-Hispanic women; however, these relative differences were due to increases of persons reporting ethnicity, with most of them identifying as non-Hispanic. Within the total population of trainees and fellows, including the subset which did not report their gender and/or race, the percentage of Hispanic women actually increased slightly from 3% to about 5% in 2011. (Figure E-23-1)

**NIH Research Awardees: Trends in Gender and Race, and Gender and Ethnicity**

From 2000 to 2011, among NIH funded researchers, men were more highly represented. Women researchers made gains over this time period, growing from about a quarter to a third of

[42] Association of American Medical Schools, Table 29: Total US Medical School Graduates by Race and Ethnicity within Sex, 2002-2011, www.aamc.org/data/facts/enrollmentgraduate/, accessed May 29, 2012.
[43] Source: NIH Data Warehouse as of 3/24/12
[44] Source: NIH Office of Extramural Research, Division of Information Services

the total. The proportion of underrepresented race groups was about 2% in 2000, increasing slightly to about 3% in 2011. The proportion of White awardees declined from 80% to 68%, offset by increases in those identifying as Asian or not reporting their race. The percentage of research awardees reporting Hispanic ethnicity was about 3% in 2000, and increased slightly to about 4% by 2011. The percentage of those reporting as non-Hispanic rose from 60% to 64% in the same time period, due to a higher proportion of researchers reporting ethnicity status.

- Among NIH Research awardees *reporting both gender and race* (Figure E-23-4):
    - In 2000, men researchers identifying with an underrepresented race group were 1.4% of the awardees, whereas women from those same groups constituted 0.8% of awardees. By 2011, these proportions increased to 1.8% for men and 1.4% for women. White men awardees declined from 65% to 53% from 2000 to 2011, offset by relatively large increases for Asian women and men, and smaller gains by White women.
- Among NIH research awardees *reporting both gender and ethnicity* (Figure E-23-3):
    - There were about half as many Hispanic women as Hispanic men, representing a small proportion of those reporting and grew very slightly over time (ranging about 1-2% for Hispanic women and 3-4% for Hispanic men).

**Addressing Disparities in the NIH Peer Review Process**

An NIH-commissioned study examining NIH competing research and training awards in 2008 found that women generally performed as well as men, but men were more successful on renewal type 2 grant applications.[45] NIH also commissioned an analysis of how race or ethnicity affects the probability of an applicant receiving an R01 grant.[46] This study revealed that R01 applications from self-identified minorities were less likely to receive funding when compared to applications from White investigators. High scoring grants were equally likely to be funded, regardless of the race or ethnicity of the investigator, but applications from minority investigators received lower scores. While discrepancies in grant funding for Hispanic and Asian investigators were explained by confounding factors, no identified variables explain the considerably lower funding rates for Black investigators. Even after controlling for education and training, employer characteristics, previous awards, publication record, and country of origin, Black applicants were ten percentage points less likely to receive funding than White investigators. NIH views these findings as a call-to-action to the biomedical research community.

Why do White applicants fare better in the NIH review process? One possibility is that White applicants have greater access to mentors and other resources that affect the quality of grant applications. A more disturbing possibility is that minority applicants face bias in the grants review process. NIH is using experiments and further analyses to evaluate the review process and identify areas that might be influenced by conscious or unconscious bias.[47] To address these issues, NIH has created internal and external task forces charged with examining diversity issues and advising the NIH Director on decisive action. The Diversity Working Group, chaired by NIH Deputy Director, Dr. Lawrence Tabak is part of the NIH Director's Steering Committee. The Diversity in Biomedical Research Working Group of the Advisory Committee

[45] Pohlhaus, J.R., Jiang, H., Wagner, R. M., Schaffer, W. T.,, Pinn, V.W. Sex differences in application, success, and funding rates for NIH extramural programs. *Academic Medicine.* 86: 759-767. 2011.

[46] Ginther, D.K., Schaffer, W.T.Schnell, J., Masimore, B., Liu, F., Haak, L.L., Kington, R. Race, Ethnicity, and NIH Research Awards. Science. (333)1015-1019. 2011.

[47] Tabak, L.A. and Collins, F.S. Weaving a Richer Tapestry in Biomedical Science. *Science.* 333: 940-941. 2011.

to the Director is an external panel of experts, chaired by Dr. Tabak, Dr. John Ruffin, Director of the National Institute of Minority Health and Health Disparities, and Dr. Reed Tuckson, Executive Vice President and Chief of Medical Affairs, United Health Group. This group has held public meetings and issued a Request for Information seeking public input. Their recommendations are due in June 2012[48]. Further, the NIH Deputy Director for Intramural Research has formed senior advisory committees to analyze recruitment, retention, and promotion of women and minorities in the Intramural Research Program.

**NIH has a variety of programs that support women and minorities in biomedical research. A selection of these programs is highlighted here**:

*The NIH Working Group on Women in Biomedical Careers* develops innovative strategies and tangible actions to promote entry, recruitment, retention, and sustained advancement of women in biomedical careers. Under the current leadership of NIH Director Dr. Francis Collins and Office of Research on Women's Health Acting Director Dr. Janine Clayton, this trans-NIH working group promotes changes to institutional policies in the NIH intramural and extramural communities. Recent outcomes include modifying the biographical sketch section of NIH grant application to allow description of factors contributing to reduced productivity; tenure-clock extension for family leave; increasing paid parental leave for NIH trainees; and instituting a Back-Up Care Pilot Program for short-term care for dependents of NIH employees. Career advancement of women of color researchers is addressed by one of the seven committees of the Working Group, the Women of Color in Biomedical Careers Committee which recently launched WoCRn (www.wocrn.nih.gov), a new social media site for women of color and all interested in diversity in the scientific workforce. The goals of WoCRn include providing information about the NIH grants process, facilitating access to colleagues and mentors, and promoting community among women of color scientists. There are currently over 600 members, from academia, government, and industry. NIH Working Group on Women in Biomedical Careers website: http://womeninscience.nih.gov/index.asp

*Research into Underrepresented Groups in Biomedical Research.* Current NIH funding initiatives to support diversity research include: the NIH Director's *ARRA Pathfinder Award to Promote Diversity*, *Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering*, and the *Research to Understand and Inform Interventions that Promote the Research Careers of Students in Biomedical and Behavioral Sciences initiative*.

NIH has a variety of programs designed to increase minority participation in biomedical research. *The Research Supplements to Promote Diversity in Health-Related Research program* uses administrative supplements to support high school, undergraduate and graduate students, postdoctoral researchers, and eligible investigators from groups underrepresented in biomedical research. One example of the impact of these supplements on women of color comes from the National Institute of Biomedical Imaging and Bioengineering (NIBIB), where 76 diversity supplements were awarded to 72 grantees in 2011. 32 of grantees (44.4%) were females, and 94% of these women were minorities. 13 (40.63%) of the women were Hispanic, another 13 (40.63%) were Black, 3 (9.38%) were American Indian/Alaskan Native, and 1 was a Pacific Islander (3.13%). Within the past eight years, Black women received 17% of the diversity supplements and F31 diversity predoctoral fellowships from the *Eunice Kennedy Shriver*

[48] The report is accessible at http://acd.od.nih.gov/Diversity%20in%20the%20Biomedical%20Research%20Workforce%20Report.pdf

National Institute of Child Health and Human Development. NIH also supports loan repayment programs and an undergraduate scholarship program to help relieve financial barriers to pursuing a research career. Many of the NIH Institutes and Centers have additional programs. For instance, the Minority Access to Research Careers (MARC) program within the National Institute of General Medical Sciences supports mechanisms for underrepresented biomedical and behavioral scientists. The National Cancer Institute manages the Center to Reduce Cancer Health Disparities, supporting multiple programs focused on underserved populations. In many of these programs, women outnumber men. The National Institute of Environmental Health Sciences manages a Scholars Connect Program, providing internships for STEM-focused undergraduates from Historically Black Colleges and Universities, Minority Serving Institutions, and other nearby academic institutions with high minority enrollment. Additional NIH activities that support biomedical workforce diversity can be found within *The NIH Health Disparities Strategic Plan:* www.nimhd.nih.gov/about_ncmhd/NIH%20Health%20Disparities%20Strategic%20Plan%20and%20Budget%202009-2013.pdf.

In 2011, NIH unveiled the *Early Career Reviewer Program.* Goals of the program include training qualified scientists lacking significant prior review experience to become effective reviewers, helping emerging reviewers advance their careers by exposing them to the review process, and enriching the pool of NIH reviewers by including scientists from less-research- intensive institutions as well as those from traditional research-intensive institutions. NIH has reached out to a wide range of institutions to solicit nominations for early career reviewers, and has made a special effort to publicize this program to underrepresented minorities. http://public.csr.nih.gov/ReviewerResources/BecomeAReviewer/Pages/Overview-of-ECR-program.aspx

NIH is taking concrete steps to address issues of diversity in the biomedical workforce. Realizing the NIH mission requires the engagement of the best and brightest female and male scientists, from all backgrounds. NIH welcomes the opportunity to collaborate with other stakeholders to comprehensively address these challenges. Increasing representation of women of color in biomedical research requires a multipronged approach to reach women throughout the educational and career pipeline. The following areas could be considered:

- *Enhance the quality of science and math education* at all levels so that students enter college poised to succeed.
- *Develop strategies to support women scientists of color in completion of undergraduate and graduate science degrees.* Provide programs to promote successful navigation of critical transition periods.
- *Ensure quality mentoring* to support career development and mitigate isolation. Provide mentor training that incorporates culturally competent mentoring. Evaluate mentoring, and recognize exceptional mentors.
- *Perform research* on barriers and effective interventions for women of color in the sciences. Collect and report data, disaggregated by sex and race/ethnicity, to accurately assess the representation of women of color across academia, industry, and government.
- *Fight implicit bias* with effective training programs informed by evidence.
- *Evaluate existing diversity programs* to determine their effectiveness. Replace ineffective programs with ones informed by research and proven best practices.
- *Form creative partnerships* among academia, industry, and government to share best practices and increase access to role models in underrepresented groups.

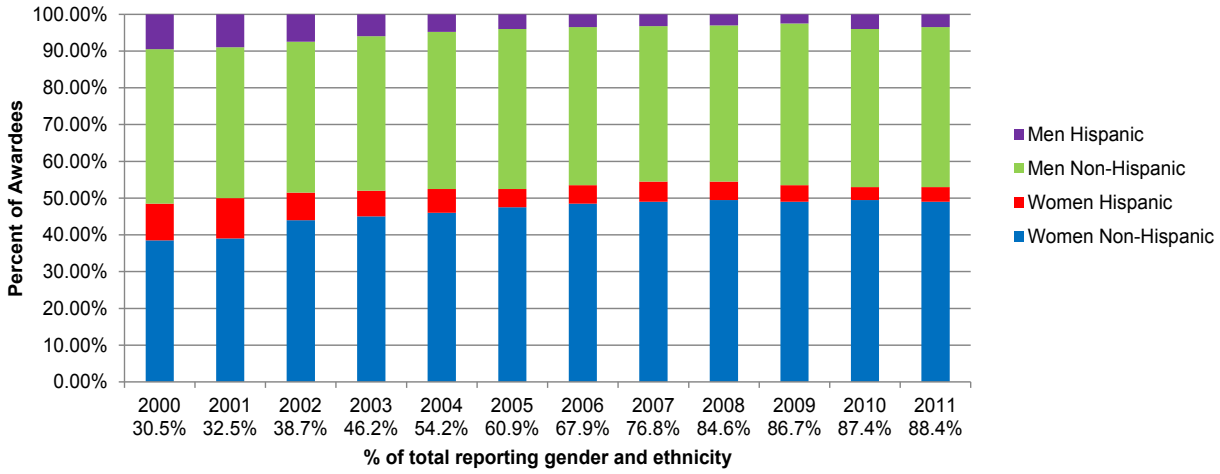


**Figure E-23-1** Self-identified Gender and Ethnicity of NIH Trainees and Fellows, Fiscal Years 2000-2011(Excludes awards funded by American Recovery and Reinvestment Act of 2009)

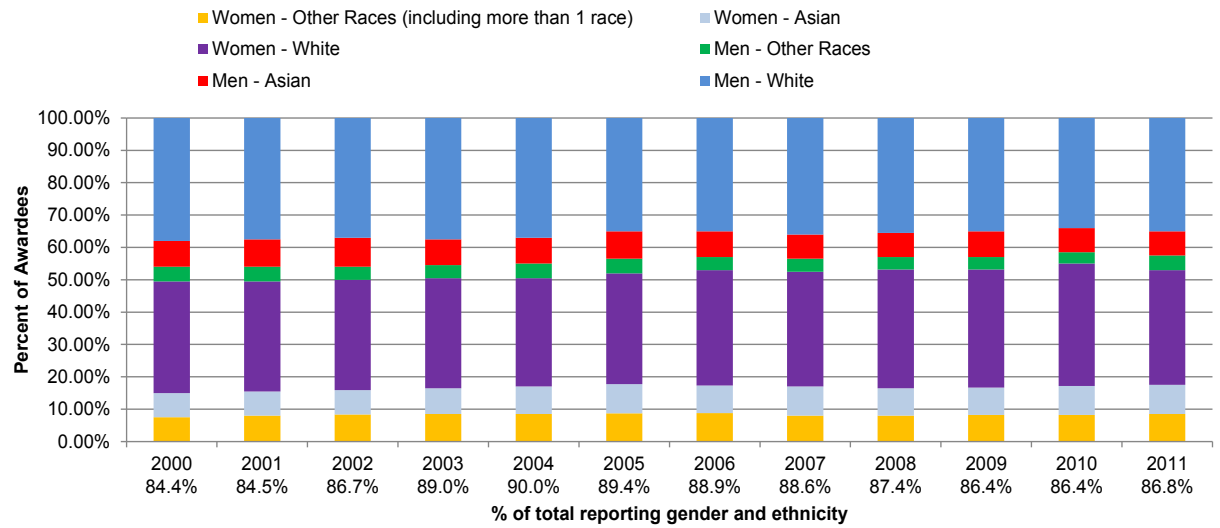


**Figure E-23-2** Self-identified Gender and Race of NIH Trainees and Fellows, Fiscal Year 2000-2011 (Excludes awards funded by American Recovery and Reinvestment Act of 2009)

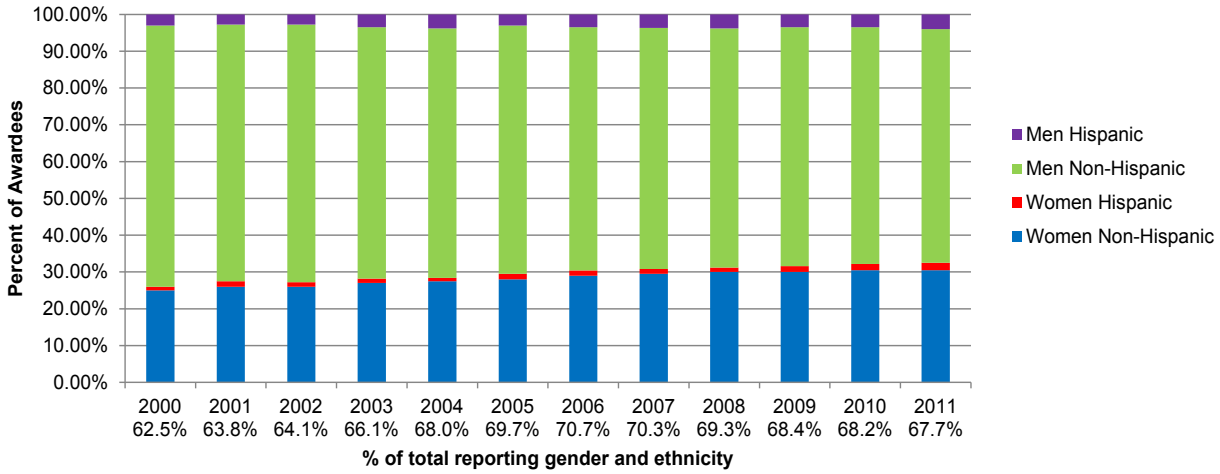


**Figure E-23-3** Self-identified Gender and Ethnicity of NIH Research Grant Awardees Fiscal Years 2000-2011(Excludes awards funded by American Recovery and Reinvestment Act of 2009)

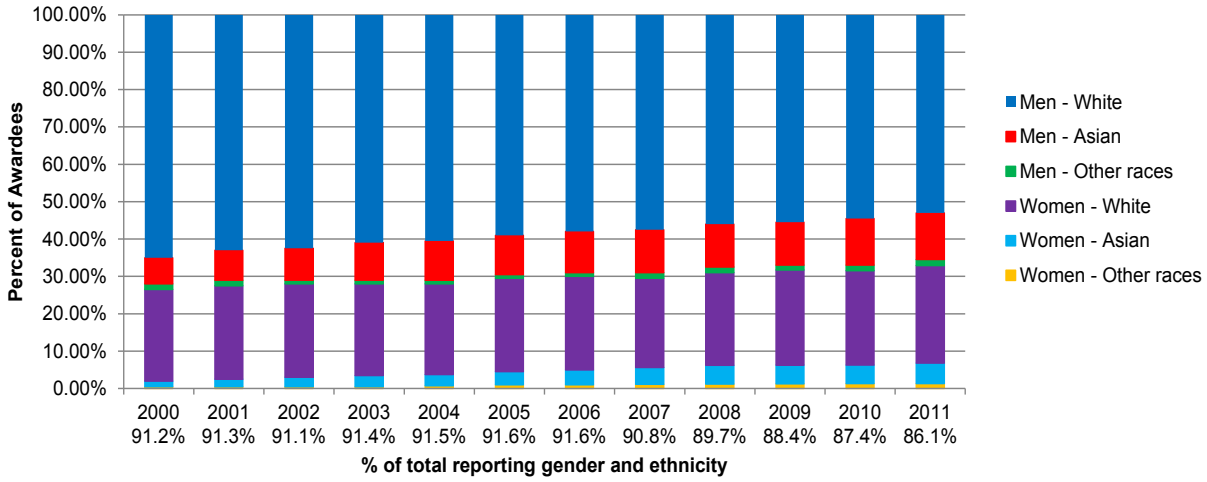


**Figure E-23-4** Self-identified Gender and Race of NIH Research Grant Awardees, Fiscal Years 2000-2011 (Excludes awards funded by American Recovery and Reinvestment Act of 2009)

# Appendix E-24

## National Organization for the Professional Advancement of Black Chemists and Chemical Engineers Written Testimony

This document reports on the challenges faced by women of color in science and outlines selected programs within the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) that address these issues and offers a series of general recommendations that would serve to advance the status of women of color in science. Presented below are two actionable proposals that if implemented will greatly improve the attraction, retention, and career success of women of color in science, especially in academia.

**Women of Color in Science – Proposed Action Items**

1. Establish a Travel Award Program that will provide funding to support the attendance of women of color at National and Regional Conferences of NOBCChE.
2. Develop and implement a Career Development Program focused on the specific challenges experienced by women of color that can be presented throughout the year to professional and student groups around the country.

**Women of Color in Science – Status**

The status of women in science has changed measurably over the years since the founding of The National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE). This change can be illustrated by the progression seen in the leadership of the NOBCChE organization. NOBCChE resulted from a meeting in April 1972 of an Ad Hoc Committee of seven African American scientists and engineers. All seven of those progressive scientists were also male. However, fast forward to 2012 and note that of the seventeen elected members of the NOBCChE Executive Board, eight are female. However, the representation by women on corporate boards and academic faculties does not mirror that level of improvement. In addition, the challenges faced by all women in science and engineering disciplines are greater for women of color.

**Women of Color in Science – Challenges**

Historically women of color needed to learn to deal with significant challenges during their academic and professional careers. These challenges include both racial and gender biases, family complexities, and, in general, a feeling of being the only person "who looks like me." The following testimonies illustrate the challenges faced by women of color in science:

> "The offspring from my grandmother is about 120 person, and my cousins are still having children (by the way, I'm done – I have two great children). I mention this to make the point that not one other person in my family has pursued a career in science. Not anyone from my neighborhood or my church. I felt alone early in my educational career. I was a black woman who wanted to study science, yet I was

> trapped in a nowhere zone working as a cashier. It was considered a good job. Once in college, I learned about NOBCChE, and it has made the difference for me to learn about other women and men who want to become faculty members, scientists. Now that I have a large NOBCChE family, I feel like I can call on a brother or sister to help guide me. And I do. The NOBCChE network is indispensable. It is 'ginormous' in its impact." *V. G., BS, MS, NOBCChE Member*
>
> "Although some of my leaders have good intentions, there have been times when my abilities are questioned when my peers are not. I may have done a very thorough explanation, but I am drilled to the ninth degree, whilst my White, male colleague was not drilled as toughly.
>
> "In addition, the quality of my work was far above his. With the same White male colleague, during one troubleshooting session, I suggested a path forward for a particular problem. My comment and I were ignored. But, five minutes later, the White male said the exact same thing and he was almost given a standing ovation. I am not a soft-spoken female nor a very brusque woman, however, they chose to ignore what I had to say. Many times, since, I have been made to feel as though I am invisible. I see that as their problem, not mine. If I didn't, then I would go insane.
>
> "Once in a discussion with a female associate about permanent make-up, a male co-worker told me that I "should get some of those big plates for my lips and put permanent lipstick on those babies." I was appalled as his comments were directed at me. I mentioned this inappropriate comment to my supervisor, a White male. He said that I was being too sensitive. So, I am cognizant to ensure that I do not internalize such comments. I have done no wrong although I am made to feel badly." *S. B. PhD, MBA/HRM, NOBCChE Leader*

At a recent NOBCChE leadership conference, students and early career professionals raised the question of appropriate appearance for a professional. Since African American women have very different hair and skin types compared to those of their Caucasian counterparts, the hairstyles and the products they use are not the same. It is a significant challenge for a new graduate or young professional to find a fashion style that they feel comfortable wearing and yet that is acceptable to the conventional scientific community. As a final challenge, the minority woman scientist who moves to a new community may find it difficult to find a hairdresser who can manage her hair, and she may not be able to purchase at a local store the products she is used to using in her home community.

Women in general have always juggled their academic and professional activities and the responsibilities and expectations they have as mothers and wives. For African American women, this challenge is even greater because African American culture is matriarchal in nature and typically expects women to contribute the major portion of care to the children and the home. This challenge is even more difficult for the woman who is raising her children as a single mother.

**Women of Color in Science – NOBCChE Programs**

As an organization, NOBCChE has helped countless women deal with these challenges. NOBCChE is committed to the discovery, transmittal, and application of knowledge in the fields of science and engineering. The mission of NOBCChE therefore is to build an eminent community of scientists and engineers by increasing the number of minorities in these fields. NOBCChE attempts to achieve its mission through diverse programs designed to foster professional development and encourage students to pursue careers in science and technical fields. To this end, NOBCChE has established educational partnerships with school districts, municipalities, businesses, industries, other institutions and organizations in the public and private sectors.

NOBCChE's first national meeting was held in March 1974 in New Orleans. Dr. William Guillory, one of NOBCChE's seven founders, was elected the first President at that meeting. The organization has held national meetings every year since then. The national meetings provide opportunities for Black chemists and chemical engineers to discuss issues of significance to their careers, to present technical papers, to mentor high school students, undergraduates, and graduate students in the areas of science and technology, and to present several fellowships to deserving graduate students. The first graduate fellowship was established by the Proctor & Gamble Company in 1976. This was followed in 1980 by the Kodak Fellowship Award and in 1990 by the DuPont Company Fellowship Award. In recent years additional graduate fellowships have been established by GlaxoSmithKline and the Dow Chemical Company. A new joint National Institute of Standards & Technology (NIST) - University of Maryland – NOBCChE fellowship began in 2007. To date, more than one million dollars have been distributed through these fellowships. In addition, national meetings serve as occasions to recognize professional members through the Percy L. Julian Professional Achievement Award and the Dr. Henry C. McBay Outstanding Teacher Award. Professor McBay, who was one of NOBCChE's seven founders, taught chemistry at Morehouse College until his death at the age of 80. NOBCChE also administers the Henry A. Hill Lectureship sponsored by the Northeast Section of the American Chemical Society.

Students and professionals who receive these NOBCChE awards and fellowships also receive invaluable NOBCChE support and mentorship. Although much of this mentorship is not and likely cannot effectively be formalized, time and again NOBCChE members comment that the experience of being a part of this organization has helped them in ways that cannot be measured or quantified – "But, if it weren't for their love of NOBCChE, and the collective love of the entire organization, I can honestly say that I would be pretty shallow, and you could read my thoughts in a femtosecond." V. G., BS, MS, NOBCChE Member. The opportunity to see, interact with and learn from scientists who "look like me" but who have nonetheless succeeded provides critical encouragement to women of color who are struggling to manage the challenges they are experiencing in their careers.

Included in NOBCChE programs are formal training sessions that are specifically aimed at addressing the challenges faced by women of color in science. For example, the agenda at the NOBCChE Annual Conference for the last several years included a workshop presented by COACh in partnership with NOBCChE. COACh programs are designed to: "Provide training in professional skills for women and minorities in STEM fields. The topics covered are ones not traditionally taught in science and engineering programs and include effective leadership styles and techniques, negotiation and management skills, career advancement strategies, time

management and work-life balance issues, effective communication methods, and preparing for and landing that first job". (http://coach.uoregon.edu/coach/index.php)

**Women of Color in Science – Recommendations**

Success in dealing with the challenges faced by women of color in science hinges on education and training for the scientific community and support for the women of color in science. The key to encouraging women of color to be successful in science and engineering is ensuring they get to know other women of color "who look like me" but who have succeeded and, thus, they will know "I can too."

Members of the scientific community-at-large need to be trained to eliminate discriminatory actions and to improve the atmosphere in the workplace for all employees. The scientific community also should be educated about the cultural differences inherent in different ethnic groups. In general, if the scientific community could be encouraged to recognize, understand, value, and respect the differences of each other, we would all be more effective and successful.

Finally, women of color, as with other "minorities," need the support that allows them to see and get to know other "people like me" who are successful in their chosen career. Scientific women of color will benefit from the opportunity to know other women scientists of color. The supportive, family-like atmosphere of NOBCChE is critical to helping shape the success of women scientists at all career levels.

# Appendix E-25

## National Postdoctoral Association Written Testimony

The National Postdoctoral Association (NPA) respectfully submits the following testimony regarding the status of postdoc women of color in the academic science, engineering, and medicine disciplines to the Committee on Advancing Institutional Transformation for Minority Women in Academia, under the auspices of the National Academies Committee for Women in Science, Engineering, and Medicine (CWSEM).

**Postdoc Women of Color**

Reliable data on postdoc women of color is limited. The National Postdoctoral Association (NPA) does not currently collect data on the postdoc population at the national level but has identified the following data collected by other groups related to this population:

- In 2005, approximately 10 percent of postdocs who responded to the Sigma Xi Postdoc Survey (http://postdoc.sigmaxi.org/) indicated they were underrepresented minorities. Of those who reported themselves as underrepresented minorities, 62 percent were women (www.sigmaxi.org/postdoc/by_minority/about_you_short.html).
- The 2012 Science and Engineering Indicators reported that the percentage of woman doctorate holders who were employed in academic postdoc positions in 2008 was 39.4 percent, a percentage that has steadily increased since 1973, when it was 14.3 percent[49].
- The 2012 Science and Engineering Indicators reported that the percentage of underrepresented minorities who were doctorate holders employed in academic postdoc positions in 2008 was 8.3 percent[50]. This percentage has also steadily increased since 1973, when it was 2.4 percent.

**Current Data on Women of Color in the National Postdoctoral Association**

The NPA tracks data on gender, race/ethnicity, citizenship, country of origin, education, and employment of its members when they enroll. Responses to such questions are always optional; for example, some 38% of our members chose "prefer not to say" or did not respond to questions regarding race/ethnicity when enrolling.

Currently, some 37% of our members have identified themselves as women, and 7 percent of our members have further identified themselves as women of color (American Indian/Alaskan Native; Black or African American; East Indian; Inter-racial; Middle Eastern; Hispanic/Latino; Asian/East Indian; Asian/Inter-racial; and Other). Within this group, the majority also reported on their terminal degrees, titles, and citizenship:

[49] National Science Board. (2012). Science and Engineering Indicators 2012. Arlington, VA: National Science Foundation. (Table 5-8).
[50] Ibid. (Table 5-9)

- Fifty-nine percent of the women of color responded regarding their terminal degrees: Of those responding, the majority holds doctorate degrees, while 7 percent hold bachelor's degrees and 4 percent hold master's degrees.
- Eighty-eight percent of the women of color reported their title/position: Of those responding, the majority are postdoctoral researchers, while 5 percent are graduate students, and 13 percent hold other positions, including but not limited to president or CEO (1.4 percent of the women of color responding) or assistant dean, associate dean, director, or coordinator of postdoctoral affairs (3.5 percent of those responding).
- All but two of the women of color responded regarding U.S. citizenship: Of those responding, 83% identified themselves as U.S. citizens or U.S. permanent residents, while 15% identified themselves as "U.S. Temporary Visa (J1, H1-b, other)" and 2.5% as "Other."

**The NPA's Efforts and Activities to Promote Diversity**

One of the NPA's strategic priorities is to facilitate diversity in the postdoc community. It is hoped that our efforts will foster the retention of women of color through the postdoctoral period of the career. The NPA is a 501(c)3 educational non-profit organization, and our activities are guided by our official Diversity Statement and Statement of Inclusion:

Diversity Statement

*The National Postdoctoral Association seeks to promote diversity and ensure equal opportunity and inclusion for all persons in the membership, leadership and activities of the National Postdoctoral Association regardless of race, ethnicity, sex, disability, country of origin, field of research, socioeconomic status, religion, age, marital status, sexual orientation, or gender identity.*

Statement of Inclusion

*The National Postdoctoral Association aims to advance the United States' research enterprise by maximizing the effectiveness of the research community and enhancing the quality of the postdoctoral experience for all participants. A diverse postdoctoral community has positive effects on research and teaching and enhances the work environment by offering broadened perspectives and encouraging critical thinking. It is therefore a goal of the NPA to create an environment that promotes diversity and inclusiveness, and to create opportunities for all of its members to interact with tolerance, understanding, and respect for others.*

*The NPA is committed to achieving diversity and inclusiveness among its constituency, and advocates equality for all postdocs, regardless of race, ethnicity, sex, disability, country of origin, socio-economic status, religion, age, marital status, sexual orientation, or gender identity, in all disciplines at all organizations that train postdoctoral fellows. This commitment to diversity and inclusiveness extends to the practices and policies of the NPA, and the NPA strongly urges institutions to embrace this commitment as part of their individual missions.*

*The NPA strives to ensure that all members have open access and opportunities to contribute to the organization through leadership positions, involvement within the committee structure, and participation in annual meetings and other NPA sponsored events. The NPA promotes advocacy for increased diversity among postdoctoral scholars and fosters diversity through activities, policies, and practices that are attuned to this commitment.*

The NPA Diversity Officers

Since its inception, the NPA staff and volunteers have devoted time and energy to increasing diversity in the postdoctoral community. Currently, the NPA's two volunteer Diversity Officers serve as the public face of diversity postdoc issues for the NPA and as the primary resource and expert advisor for the NPA Board of Directors, the staff, and committees.

Recommended Strategies to Increase the Participation of Underrepresented Groups

In 2011, the NPA Diversity Officers led a taskforce that developed the *NPA Recommended Strategies to Increase the Participation of Underrepresented Groups (*www.nationalpostdoc.org/underrepresented-groups).

The NPA Annual Meeting Postdoc Travel Awards

Preference is given to applicants who are from underrepresented groups in their fields of study.

The NPA Workshop Program

The NPA requires that at least one workshop covering some aspect of increasing diversity be offered at its Annual Meetings. Most recently, at its 2012 meeting, the workshop *Effective Strategies to Diversify Your Institution's Postdoctoral Population* was organized and moderated by Albert Roca, PhD, Diversity Consultant, www.minoritypostdoc.org.

The NPA staff and volunteers also organize and host or present workshops for postdocs in other venues. In regard to fostering diversity, the NPA hosted the 2010 workshop *LET'S TALK! Expanding Dialogue in the Postdoctoral Community towards Broadening Participation in the Social, Behavioral, and Economic (SBE) Sciences*[51]. Participants included postdocs from the National Science Foundation (NSF) Directorate for Social, Behavioral & Economic Sciences (SBES) Minority Postdoctoral Research Fellowships (MPRF) program, as well as SBES postdocs from the NPA membership.

The NPA ADVANCE Program

The goal of the NPA ADVANCE project *From Postdoc to Faculty: Transition Issues for Women Scientists* is to foster the transition of women postdocs into the professoriate[52]. The NPA ADVANCE staff has been working to adapt and disseminate promising institutional practices for assisting women scientists and engineers in making this transition, drawing on successful models from past ADVANCE programs as well as from the postdoctoral community. These models have been promoted through workshops at our Annual Meetings, the National Summit on Gender and the Postdoctorate, and an online informational clearinghouse (www.nationalpostdoc.org/advance). Currently, a resource handbook is being developed that will be published in the fall of 2012 and will include commentary on retaining women of color in the academic career pipeline.

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[51] The workshop was supported by the National Science Foundation under Grant No. 1049638. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

[52] The NPA ADVANCE project is supported by the National Science Foundation Grant No. #0819994 through an ADVANCE Partnerships for Adaption, Implementation, and Dissemination (PAID) Award. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

**Challenges or Barriers Faced by Women of Color**

Through the NPA ADVANCE and other programs, the NPA has identified challenges and barriers faced by postdoc women as they advance in their careers. The key findings of focus groups conducted as part of the NPA ADVANCE project (www.nationalpostdoc.org/advance-focus-groups) were:

- Family concerns loom large for these women, primarily due to "dual-career" issues with their spouses or partners and secondarily due to children.
- Finances were a major source of secondary concern, since family formation often created additional financial hardships that were hard to manage on a postdoc salary (e.g., childcare costs, mortgages, "supporting the family").
- Participants talked about various struggles with the "postdoc clock," namely the unspecified but limited amount of time one should be a postdoc.
- A common concern for participants was being in "limbo" or having a lack of clear status, and in many cases this concern was linked to feelings of isolation and lack of confidence.

For postdoc women of color, our work to date suggests that:

- the sense of isolation is more pronounced;
- they face unconscious bias related to both gender and race/ethnicity; and
- there is a lack of role models.

In regard to role models, mentoring of postdoc women of color is impacted by cultural identity, "political" power, and other factors. The participants in the 2010 "Let's Talk" workshop offered their insights in regard to effective mentoring of those from underrepresented groups[53]:

*Having an effective mentor of the same cultural identity is beneficial but there are at least two other factors to consider:*

- *A mentor of the same cultural identity may have little resources or power within an institution; if so, the postdoc should seek an additional mentor with those resources and power.*
- *A mentor who understands and respects a postdoc's personal or social background and the ways in which that background informs the postdoc's research is not always someone who shares the postdoc's ethnic background.*
    - *For example, for a postdoc married and/or with children, it may be **as** beneficial to have a mentor who is married and/or with children (or who understands the challenges of balancing career and family needs) **as** having a mentor from the same ethnic background.*

*Such factors strengthen the case for building a network of multiple mentors.*

[53] Johnson Phillips, C. (2011). *Workshop Proceedings: The Postdoctoral Experience in the SBE Sciences.* Washington DC: National Postdoctoral Association.

**Key Policy Recommendations**

The NPA recommends:

- Federal agencies, institutions of higher education, and professional societies/associations should continue/expand any efforts or engage without delay in a long-term effort to collect data on women of color in the scientific academic workforce. The dearth of reliable data on this population and the issues they face makes it extremely difficult to make informed recommendations regarding the advancement of women of color in the workforce.
- Federally-funded programs such as the NSF ADVANCE program and the NSF MPRF program should continue to be funded. Such programs should emphasize the need to identify challenges and barriers and promote practices and policies that facilitate the advancement of women of color.
- Funding agencies and institutions should review their policies and, if needed, take steps to ensure that they are family-friendly to postdoc women, including postdoc women of color. They should assertively disseminate information regarding these policies to postdocs.
    - As part of the NPA ADVANCE project, the NPA has developed an online Clearinghouse of Promising Practices (www.nationalpostdoc.org/advance/clearinghouse) as well as maternity and paternity guides for postdocs (www.nationalpostdoc.org/publications/family-friendly).
- Funding agencies should offer/continue to offer administrative supplements for support during family leave, such as the National Institute of Allergy and Infectious Diseases (NIAID) primary care-giver technical assistant supplements, and assertively market these opportunities.
- Funding agencies and institutions should hold supervisors/principal investigators accountable for facilitating effective mentoring for postdocs, including recognizing the challenges faced by postdoc women of color in this regard, and provide the supervisors with the resources needed for effective mentoring to take place. *Please note:* The NPA recognizes that not every supervisor makes an effective mentor nor has time to mentor those who report to him/her, but certainly the supervisor should be obligated to facilitate such mentoring.

# Appendix E-26

## National Society of Hispanic Physicists

**Introduction**

The goals of the National Society of Hispanic Physicists are to promote the study of physics to all people, but particularly among Hispanic Americans; recognize the accomplishments of Hispanic physicists; and provide for the professional well being of Hispanic American physics students, faculty, and professional scientists. The Society's strategic vision encompasses four primary activities to achieve its goals.

> By promoting the study of physics among Hispanic students. This includes encouraging and mentoring students; developing resources for undergraduate study, research, and participation in the scientific community; and serving as role models for the students and a resource for their families.
>
> By identifying and heralding the accomplishments of Hispanic faculty and students. Our society recognizes and celebrates the accomplishments of faculty and students in research, teaching, study, mentoring, and outreach.
>
> By providing a forum through which Hispanic faculty and students can come together and celebrate not just the pursuit of, and passion for, science … but also sharing a rich and vibrant culture.
>
> By working with the larger physics community as teachers, faculty, administrators, and societies work to transform the physics community into a more inclusive and diversified one. This work includes joining with other societies, developing resources, highlighting effective practices and programs, and improving access of minority serving institutions to physics resources.

Our vision is not merely to mentor Hispanic-American students and junior faculty but also to guide and support the larger physics community as under-represented groups become a larger factor in STEM.

**Mentoring at National Meetings**

We have had our greatest success reaching students and junior faculty at our annual meetings. NSHP partners with select organizations to host meetings. Each of our partners offers different environments and opportunities for our students and members.

*Joint Meeting with National Society of Black Physicists*

The professional meeting serves as a forum for the work of students and faculty, as a grounding point for faculty and programs attempting to access our communities, and as a place

for the NSBP and NSHP to touch bases to share common concerns. The two societies have been meeting jointly since 2004, and the meeting brings together as many as 600 attendees from primarily under-represented (African-Americana and Hispanic-American) groups. Approximately half of these are students.

Student programming provides career advice, mentoring, academic support, networking, and development. Typically the professional sessions have focused talks that are accessible to undergraduates. Many of our students have their first professional presentation as a contributed oral or poster presentation at the Joint NSBP/NSHP meeting. For this reason the posters are judged and the student presenters are given ample feedback about their presentation and research.

In addition, students interact with faculty and students from other schools at the common meals. For many it is their first experience with large cohorts of students with similar backgrounds, challenges, and needs.

At the Joint NSBP/NSHP 2011 meeting in Austin, women made up 30% of the 248 students and 28% of the 167 professionals attending, and 25% of the papers presented were by women (tentative numbers based on preliminary registrations, data still under analysis).

Dr. Sharon Fries-Britt and her research team have conducted student interviews at the Joint NSBP/NSHP meeting as a systematic scholarly study of minority STEM majors. Two book chapters based on this research have been accepted for publication. One chapter, *Lessons from High Achieving Minorities in Physics* (Fries-Britt, Younger, & Hall), will appear in **New Directions for Higher Education**. The second book chapter, *Underrepresented Minorities in Physics: How Perceptions of Race and Campus Climate Affect Student Outcomes* (Fries-Britt, Younger, & Hall), will appear in **Managing Diversity: (Re)Visioning Equity on College Campuses**.

In their evaluations, or in interviews with PER researchers, students frequently mention the Joint conferences as fundamental to their progress in physics.

> I*'ve learned that in this field networking is really important. I really didn't know how to network until I came to this conference and by attending various conferences like this I am able to connect with other students and then learn about internship opportunities or just meet other people in my field and that's hard to do on my campus because I come from a small physics department, so there is only like four of us in my program, so we can't really do much networking among ourselves.*
> —Female undergraduate, 2007

> *Well with me, coming here is very important. I go to an all white school in *** and there were a lot of racial problems on campus ... so that along with my school stuff made it really stressful at times, you know ... it's sometimes hard to study ... and so when I come here and find other students going through similar situations, it kinda motivates me and helps me know that we can help and encourage one another and get our work done and get through school, I mean just being [at the Conference] is just really important to me.*
> —Male undergraduate, 2005

> *My peers are really important to me. They tend to help you push a little bit harder [...] and just like by coming here and interacting with other students, it's like I have been able to overcome some of my limitations [...] and then it kinda helps me learn how to interact*

> *more with other students on my campus too. I guess being [at the Conference] has helped me develop some of my social skills.*
> —Female graduate student, 2005

Students listed as among the top goals for attending the conference.

- Meeting with Black/Hispanic Faculty
- Meeting with other Black/Hispanic students
- Learning about further physics study
- Meeting with recruiters
- Hearing research talks

Faculty programming focuses on development and support of graduate students, post-docs and junior faculty.

A comment from the 2011 meeting initiated a reflective pause.

> *Where are the Hispanic physicists our age?*
> —First-year, male faculty member at an RI university

But a quick calculation showed that the 32 faculty and post-docs at the meeting accounted for nearly a fifth of the Hispanic physicists in academia.

*Joint Meeting with SACNAS*

The Society for the Advancement of Chicanos and Native Americans in Science is one of the oldest and most dynamic societies devoted to minority students and faculty. It has one of the largest gatherings of students at any national meeting. The physics presence has steadily grown since NSHP began meeting with SACNAS in 2004.

SACNAS has a strong emphasis on programming for students and for junior faculty. And though we (NSHP) promote the study of physics, the mentoring at the meeting crosses disciplines.

The SACNAS 2011 Annual meeting brought in over 3600 participants, of which 1600 identified themselves as female (about 20% of the attendees declined to complete the demographics information) and 1500 of the participants identified themselves as Chicano/Latino/Hispanic.

*Joint Meetings with Other Societies*

In order to better reach students, NSHP meets with other societies as time and resources allow. Our principle focus at these other meetings is to reach our students and to promote our mission to the mainstream physic community. We have joined with the American Association of Physics Teachers twice at national meetings and annually with regional sections of the American Physical Society, primarily the Texas section (TSAPS) and the Southeast section (SESAPS).

**Promoting Inclusive Pedagogies**

One of the aims of NSHP at the Joint meeting is to bring in greater understanding of the work being done in Physics Education Research (PER) to the NSBP/NSHP community as a way to improve and strengthen the pedagogy of the undergraduate curriculum at HBCUs and MSIs.

*Sample Sessions at the Joint NSBP/NSHP Annual meeting*

**Teaching Undergraduates: What do we know that works? What is important?**
*NTFUP Report on What Works for a Vital Undergraduate Physics Program*
Jim Gates – University of Maryland
*What Works for Women*
Barbara Whitten - Colorado College
*High Achieving Minority Students*
Sharon Fries-Britt - University of Maryland
*Personal Epistemologies*
Apriel Hodari - The CNA Corporation

**Missing: The Disappearing Minority Male in Science**
*The Gender Gap Among African Americans in Physics: A Statistical Overview*
Roman Czujko, AIP (Statistics)
*Building Trust in the Face of Small Numbers: Diversity Cues and Reduction of Threat in American Mainstream Institutions*
Valerie Purdie-Vaughns, Yale (Psychology)

In addition, we promote pedagogies and programmatic design that address the challenges encountered by under-represented groups in the study and pursuit of physics to the mainstream physics community.

*Sample Sessions at national AAPT meetings sponsored by NSHP*

**Building Success: Curricular Strategies and Pedagogical Initiatives**
*Building Community in Female-Friendly Physics Departments*
Barbara Whitten, Colorado College
*Community Building: Bridging Boundaries and Forming Connections*
Jan M. Yarrison-Rice, Miami University
*Personal Epistemologies and Student Participation*
David Hammer, University of Maryland
*A Review of Epistemologies in Various Cultural Contexts*
Apriel Hodari, The CNA Corporation

**Closing the Gap Between Understanding and Action: Strategic Issues in Diversity**
*Research on Undergraduate Persistence*
Teri Murphy, UO
*The Complexity and Changing Landscapes of Race and Ethnicity*
Eric Hsu, SFSU
*Recommendations for Undergraduates in Preparing for Graduate Schoo*l
James Dickerson, Vanderbilt University
*How and Why Diversity Initiatives Must Work*
Jorge Zeballos, Guilford College

**The Changing Community of Physics: Resources and Programs that Promote Inclusion and Diversity**
*Teaching for Retention (invited)*

James H. Stith, AIP (retired)
*Programs and Resources of the American Physical Society (invited)*
Theodore Hodapp, American Physical Society
*AAPT-Sponsored Activities Supporting Diversity (invited)*
Daniel M Smith Jr, South Carolina State University
*Engaging Physics Students in Diversity Conversations with SPS (invited)*
Gary White/Kendra Rand, Society of Physics Students/AIP
*Report from AIP Liaison Committee on Underrepresented Minorities in Physics (invited)*
Quinton L. Williams, Jackson State University

*Sample Invited Talks by Officers of NSHP*

*How Do We Increase the Participation of Under-Represented Groups in Physics*
Juan R. Burciaga, Education Officer
**AAPT July 2008 – Edmonton**

*The Role and Preparation of Faculty for the Changing Community of Physics*
Juan R. Burciaga, Education Officer
**NW APS Regional Meeting May 2009, Vancouver, BC**

*A Practical Guide for Diversifying Physics*
Jesús Pando, Treasurer
**Regional SPIN-UP Workshop June 2009 – Milwaukee**

*Recruiting and Retaining Hispanics in Physics*
Jorge Lopez, Communication Officer
**Western Regional SPIN-UP Workshop June 2010 – San Luis Obispo**

*The Role of the NSHP in Promoting Diversity and Inclusion*
Juan R. Burciaga, Education Officer
**AAPT July 2010 – Portland**

*Mentoring Science Students* – Workshop
David Ernst, Past President
**SACNAS 2011 – San Jose**
*Mentoring Science Students* – Workshop
David Ernst, Past President
**NSBP/NSHP 2011 Joint Annual Meeting – Austin**

**International Conference on Women in Physics**

The NSHP has had either members of NSHP or friends of NSHP attend each of the IUPAP's International Conferences on Women in Physics and report back to the Society of the work being pursued on behalf of women in physics on a global scale. Our current President, Dr. Luz Miranda-Martinez, has attended Conferences 2 through 4. Members of NSBP and NSHP have usually made up half the delegation to the Conferences.

**Resources**

Our website now houses a variety of outreach and mentoring resources.

The website **Hispanic American Physicists: Past, Present and Future** (www.hispanicphysicists.org/recognition/index.html) recognizes the accomplishments and contributions of Hispanic Americans who are both near the end of a long and successful career and those near the beginning and who already show significant promise. An important factor of these brief bios is that they lead to more resources, so that students can start here and follow the trail to learn more about scientists who they may not normally encounter in their studies.

We made the decision to grow this list of prominent Hispanic physicists at a rate that insures that no fewer than one-third of these highlighted physicists are women.

Another resource is the **StudentGateway** which tries to anticipate student questions from high school through graduate school. Included are study and career sites, general physics resources, and sites devoted to women in physics.
Website: www.hispanicphysicists.org/StudentGateway/index.html

In a similar way, the **FacultyGateway** is designed to address the questions of Hispanic American faculty as they move into the world of academia or industry. And the site also houses resources for faculty who are trying to meet the needs and respond to the challenges of under-represented groups as they begin the study of physics.
Website: www.hispanicphysicists.org/FacultyGateway/index.html

# Appendix E-27

## National Society of Black Physicists

Paul Gueye, President, National Society of Black Physicists

This report was provided by the Women in Physics Committee (WIP) of the National Society of Black Physicists (NSBP) to address the suggested topics:

- ***Trends in your organization's data on women of color, including education and employment data*** The data used for this report was gathered from our largest annual activity (*i.e.*, NSBP annual meeting) held in February most years. Our conference attendees for 2009 included 310 students of whom 127 were women. Nearly all the students attending the NSBP conferences are African Americans and Hispanic Americans, with perhaps twenty from other ethnicities. Graduate and undergraduate students are included in this population. We have not analyzed our data regarding attrition and employment of our women members.
- ***Challenges or barriers experienced by women of color in their education and professional career pathways and the policies and/or programs implemented by your organization to enhance their career progression.***
  NSBP attempts to provide a safe, inviting, and supportive environment for all of our members. We have a committee that is specifically addressing the needs of our women members and is currently chaired by Jarita Holbrook.

NSBP has successfully employed two methods of supporting its women members: aiding and facilitating individual careers, and supporting group activities.

1. NSBP is best known for its annual meeting, which brings together primarily African American scientists, in addition to a diverse community of undergraduate students, graduate students, postdocs, faculty and people in industry studying and doing research in physics and related fields. These annual meetings have been an important resource for our women to network and to build a professional support system. The friendships that are made cannot be overlooked and have been important for the morale of our women. NSBP has always made a special effort to feature women prominently in the conference program, a point emphasized by the former President of the National Science Teachers Association, Dr. Carolyn Randolph, in her keynote address at the 2003 NSBP conference. Since then, many women have been invited or plenary speakers at the NSBP conferences such as: Ellen Ochoa, Hazel O'Leary, and South African Minister of Science, Naledi Pandor. At the 2007 NSBP conference, there was a dedicated luncheon panel that was organized specifically to address the issues surrounding women in physics.
2. In 2005, NSBP supported the participation of five of its members plus the then-President of the National Society of Hispanic Physicists (NSHP) in the Second International Union of Pure and Applied Physics International Conference on Women in Physics (IUPAP/CWIP) in Brazil. This action was motivated by the fact that no person of color

was part of the NSF-funded and American Physical Society-organized U.S. delegation. Since then, NSBP members Elaine Lalanne, Apriel Hodari, Jarita Holbrook, Herman White, Theda Daniels-Rice, Jami Valentine, Ivy Krystal Jones, Christophe McCray and Elvira Williams, along with NSHP's Luz Martinez- Miranda have all been U.S. delegates to subsequent IUPAP/CWIPs. The catalyst for the 2005 delegation, Renee Horton, was then a graduate student at University of Alabama, and rose in such prominence that she served as the Co-Chair of the fourth IUPAP/CWIP conference in Cape Town, South Africa. She also served a term as Chair of the NSBP Women in Physics Committee.

3. NSBP has the capability of managing grants for our members primarily for recruiting, retaining, and promoting the careers of African and African American scientists. One of our current grants from the Kellogg Foundation has allowed us to support the careers of two of our women: Drs. Jarita Holbrook and Nia Imara. Through this grant, both traveled to South Africa to teach in an astronomy program focused on diversifying astronomy in South Africa (NASSP).
4. NSBP members actively support the careers of our women by fostering summer research opportunities, postdoctoral and research positions, and encouraging them to apply for permanent positions. Our members are very proactive in keeping our women working as scientists as well as working together to find the support needed to stay in the sciences. The students tend to identify their own mentors but equally our senior members reach out to students also.

***Key policy recommendations to the external communities represented at the conference (e.g., federal agencies and institutions of higher education) that would support your organization's efforts to increase the career satisfaction of women of color and retain them in the scientific academic workforce.*** The Women in Physics Committee of the National Society of Black Physicists supports the following suggestions made by the Committee on Equal Opportunity in Science and Engineering (CEOSE) in their 2009-2010 biennial report that emerged from their mini-symposium on Women of Color in STEM, which we see as particularly relevant and helpful to our members.

*Suggestion 1*. Invest in developing women of color leaders in STEM, through efforts that include 1) Providing leadership training to midlevel professionals in academia, industry, and government; and (2) Providing funding for senior women of color to visit campuses that would not otherwise have access to these mentors.

*Suggestion 2*. Restructure grant funding so that a portion is withheld until a follow-up report is submitted by the grantee on how the broadening participation component of the broader impacts criterion will be met.

# Appendix E-28

## Rutgers University Women of Color Scholars Initiative

***Overview***. Rutgers University is one of the most historically, geographically and organizationally complex universities in the U.S.A. The original Rutgers College was a private, colonial college founded in 1766 (as Queens College). It was designated the State University of New Jersey by acts of the New Jersey Legislature in 1945 and 1956. The current Rutgers University also encompasses Douglass Residential College, founded as a public coordinate college for women in 1918 as the New Jersey College for women and The School of Environmental and Biological Sciences (formerly the New Jersey College for Agriculture and Cook College), founded as a land grant school in 1864. The Newark campus (formerly the University of Newark), founded in 1936, merged into the Rutgers system in 1946. The Camden campus (formerly the College of South Jersey and the South Jersey Law School) was added in 1950. Rutgers University is centrally administered from New Brunswick; however, chancellors at the Newark and Camden campuses hold significant autonomy. There is no chancellor on the New Brunswick campus where the Executive Vice President serves this role. The University offers more than 100 distinct bachelor, 100 master, and 80 doctoral and professional degree programs across 175 academic departments, 29 degree-granting schools and colleges, 16 of which offer graduate programs of study. Across the three campuses, Rutgers has approximately 57,000 students and 2,800 faculty. The New Brunswick campus is by far the largest unit at Rutgers and is home to 14 different schools and colleges and more than 38,000 students.

Rutgers is a member of the Association of American Universities (AAU), an organization that comprises North America's 61 leading research universities. The AAU ranks Rutgers among the top 50 universities in the United States. It is also one of the most diverse. Since 1997, the first year that *US News & World Report* began ranking colleges on the diversity of their student bodies, *US News* has rated Rutgers-Newark the most diverse national university in the United States. At the student level, compared to its 34 public AAU peers, Rutgers is sixth in total minority enrollment: approximately 47 % are white, 20% are Asian, 11% Latino and 10 % African American. In terms of degrees awarded, it ranks first in the number of master's degrees and second in the number of bachelor's degrees earned by African Americans. For Latinos, it is eleventh in enrollment and eleventh in the number of baccalaureate degrees earned. At the faculty level, compared to its 34 public AAU peers, Rutgers University ranks fourth for full time female faculty, fifteenth for full time minority faculty and fourteenth for full time African American faculty.

*Diversity Inc.* ranks Rutgers University among the nation's top five higher education institutions for commitment to diversity. This commitment, however, is observed in the student population but not among faculty members. In fact, an internal report conducted by Rutgers professor of political science, Mary Hawkesworth, demonstrated that the Rutgers faculty has become *less* diverse over the last 25 years. Specifically, the total numbers and percentages of all African-American and Latino faculty members steadily declined between 1976 and 2004. Out of the total full-time Rutgers faculty, African Americans constituted 6.8% (175) in 1976, 5% (128)

in 1992, and 4% (97) in 2004. A similar trend was seen for Latinos, who constituted 2.1% of the faculty in 1976, and 2% in 2004. In 2009, Rutgers employed only 50 Latinos, down from 63 in 1999. The numbers of women of color are even smaller, especially in the sciences. For the current academic year (2011-2012), a total of 15 African American women and 11 Latina women (respectively 6 and 4 % of the female faculty) are tenured/tenure tracked in STEM disciplines.

***Rutgers SciWomen and NSF ADVANCE***. In 2006, Rutgers University established the Office for the Promotion of Women in Science, Engineering, and Mathematics ("SciWomen"). Two years after its creation, SciWomen was awarded an ADVANCE Institutional Transformation grant from the National Science Foundation (RU FAIR ADVANCE). A major goal of the ADVANCE grant at Rutgers University has been to increase the number of women on the science, engineering, and mathematics faculty, with a special emphasis on women of color.

One mechanism used by the Rutgers ADVANCE program is the award of "mini grants." In 2010, building on the *Black Women Academics in the Ivory Tower* conference previously held at Rutgers on March 5 and 6, 2009, Drs. Robyn Rodriguez (Sociology) and Zaire Dinzey-Flores Flores (Sociology & Latino and Hispanic and Caribbean Studies) applied for a mini-grant. They proposed a project specifically to serve women of color faculty at the University. Their initial vision was "to enhance the experience of women of color in academia and open institutional spaces supportive of women of color [by] … carv[ing] out a lasting intellectual space for women of color at Rutgers."

RU FAIR ADVANCE awarded the mini grant and subsequently has supported a Women of Color Scholars Initiative (WoCSI) that employs various strategies including professional development training, mentoring workshops, social gatherings, and discussion-based meetings to help build a sense of community among women of color faculty, to reduce institutional seclusion and increase the retention of these faculty members. Since the RU FAIR ADVANCE grant began, there has been a 54% increase in the number of female faculty of color and a 19% increase in male faculty of color in STEM fields.

**Rutgers Women of Color Scholars Initiative (WoCSI).** Since its inception in 2010, the WoCSI initiative has been supported by funds from NSF ADVANCE and by staff from the SciWomen office, including director Natalie Batmanian and graduate assistant Crystal Bedley. The Initiative also has received guidance from Professor of Sociology Patricia Roos. The Rutgers Institute for Research on Women has provided administrative personnel, as well as securing space for events and assisting in the early coordination of programming to attract as many participants as possible. Finally, this past year, for the first time, the university's central administration through the Office of the Vice President for Academic Affairs has contributed funds to support programming.

In the initial year, WoCSI provided a research forum for women of color to showcase research; workshops including speakers and facilitators to guide discussions on topics such as institutional and disciplinary networking, identity at the academy, mentoring, promotion and tenure, etc.; and a focus group session to examine the experiences of women of color at Rutgers. An important outcome of the activities for this initial year was to create a resource center on the Rutgers' Sakai site (an Internet repository and social media resource platform), where the group has been able to share insights in a comfortable, secure setting.

In the second year of the Initiative (2010-2011), Dr. Niki Dickerson von Lockette (Labor Studies and Employment Relations) directed the program. During this year, Dr. Dickerson von Lockette organized a series of professional development (including time management, academic writing and effective teaching) and writing circle sessions.

The report of the third year NSF ADVANCE site visit report specifically identified WoCSI as one of the stronger retention programs at Rutgers. In response, the executive committee of the ADVANCE grant significantly ramped up funding for the Women of Color Scholars Initiative, guaranteeing $35,000 per year for academic years 2011-12 and 2012-13. Drs. Rocío Magaña (Anthropology) and Yolanda Martínez-San Miguel (Institute of Research on Women) developed a new leadership model whereby a junior, non-tenured faculty member leads the group, identifies areas of need in consultation with other junior faculty members and graduate students, and coordinates the actual programming. The senior faculty member facilitates the institutional arrangements and fundraising activities.

***Examples of recent WoCSI programs:***

*Women of Color Fall Meet & Greet*
Newly recruited and established faculty members meet at a social event coordinated by the Office of Academic Engagement and Programming.

*Welcome Back Planning & Assessment Dinner*
Rutgers faculty members and graduate students discuss goals and expectations for the year and began building networks for women of color.

*"Writing, Procrastination, and Resistance: How to Identify Your Funk and Move Through It," a Kerry Ann Rockquemore Workshop.* A networking workshop to assist in research and writing. Participants paired with a writing partner, a writing accountability group, and/or online writing community. One important outcome of this workshop was that several junior faculty members began hosting writing hours during which they supported each other in their respective projects.

*The Rutgers Faculty of Color & University Scholars for Excellence in Diversity (RUFoCUSED) Hour.*
This monthly, off-campus event is a series of supportive social gatherings to promote community formation as well as creating positive networking and collaborating opportunities among women of color.

*A University Press Editors Roundtable*
This roundtable focused on academic publishing and publishing strategies with representatives from Cornell University Press, Duke University Press, Johns Hopkins University Press, and Rutgers University Press.

*Book Prospectus Workshop*
WoCSI faculty reviewed current writing projects with one another and worked on their manuscripts with an editing consultant.

*Dean's Panel on Attrition and Retention of Faculty of Color*
This event was a panel comprising deans and administration representatives who clarified procedures about tenure and promotion. Importantly, several concrete recommendations were made by faculty to promote the retention of faculty of color. While recruitment is good, retention is key to increasing the number of women of color on the faculty.

***Recommendations*** included the following:

- Appoint a dean of diversity to liaison between faculty and administrators.
- Create some kind of structure to make departments accountable for the lack of diversity among their faculty.
- Establish a mentoring program for both junior and senior faculty of color
- Support diversity cluster hiring. Continue diversity cluster hires to create a critical mass.
- Understand that the hiring of faculty of color in joint appointments (as often happens) renders these individuals especially vulnerable to competing academic pressures.
- Create a policy of matching diversity lines.
- Review alternative routes to tenure and promotion based on service and make them available to faculty who would want to consider that route.

***Evaluation and assessment.*** Over the past year, Ms. Bedley (under the guidance of WoCSI co-founder Dr. Robyn Rodriguez) has been interviewing WoCSI participants to explore the extent to which a sense of belonging can serve to mitigate barriers to retention and promotion. The findings from these interviews are preliminary, but suggest that while faculty overall have positive experiences at the University, they still encounter forms of antagonism and alienation. The majority of interviewees who had participated in the WoCSI reported that the Initiative had a positive impact on their careers by reducing feelings of isolation. Junior women of color faculty members also expressed a need for more and better mentorship from senior colleagues who are attuned to the unique challenges faced by women of color faculty in academia, which include professional isolation and experiences of "micro-aggressions" from others ranging from students to higher level administrators. For women of color, it is important to have a "safe space" where individuals feel that they don't have to "perform all the time."

***Summary.*** The current goals of the Rutgers WoCS Initiative are as follows:

1. Highlight the contributions that women of color and scholars of underrepresented backgrounds make to the university communities, their scholarly disciplines, and society;
2. Build a campus-wide network that supports the scholarship of women of color and promotes their research, career development, and satisfaction;
3. Advocate on behalf of women of color faculty by working collectively and resourcefully for progressive institutional change towards equitable, inclusive environments that thrive through diversity; and
4. Foster institutional conditions in which women of color faculty may thrive as scholars and as individuals, and thus contribute to their success, promotion, and retention at Rutgers.

We hope that this description of Rutgers University's Women of Color Scholars Initiative may provide a useful model. Programs with similar goals and programs could be developed to fit the culture and circumstances of other large research universities.

# Appendix E-29

## Society for Neuroscience Written Testimony

Joanne Berger-Sweeney and Michael Lehman
Co-chairs, Professional Development Committee

From its inception in 1969, the Society for Neuroscience (SfN) has been committed to promoting diversity within neuroscience – gender as well as racial/ethnic diversity. SfN's mission statement speaks to "bringing together scientists of diverse backgrounds" and increasing "participation of scientists from diverse cultural, ethnic, and geographic backgrounds." This commitment is further articulated in SfN's Strategic Plan, which includes a Diversity Strategy that has as one of its guiding principles: "to increase diversity within SfN's leadership and governance structures, its membership, and its professional development activities."

***Trends/data:*** While comprehensive data are not available regarding overall trends in the numbers of women of color within the field of neuroscience, information from SfN's membership surveys, as well as surveys of neuroscience departments and programs, show women dropping out at every career transition point, and in particular, during the transition from postdoctoral fellow to tenure-track faculty member. Because underrepresented minorities (URMs) also drop out at every career transition point, the situation for women of color is no doubt worse and is not unique to neuroscience.

At the same time, data from the Society's Neuroscience Scholars Program (NSP), a highly competitive program for underrepresented trainees in neuroscience, show that there has been a steadily increasing majority of women among both applicants and selected participants. Between 2004 and 2011, the percent of NSP Scholar applicants that were female went from 46% to 63%, and the percent selected as Scholars increased from 52% in 2004 to 67% in 2011. This suggests that women of color are entering the field of neuroscience as trainees in increasing numbers. If there are not increasing numbers of women of color entering tenure-track positions, then they are dropping out along the way (the "leaky pipeline" phenomenon). It would be interesting to determine if women of color are dropping out of neuroscience at the same (or different) rate as majority women.

***SfN programs/initiatives:*** The Society's Diversity Strategy is implemented through the Professional Development Committee (PDC), which includes subcommittees on Diversity in Neuroscience and Women in Neuroscience, both of which are concerned with fostering career development for women in general, and women of color in particular. Programs and activities SfN supports to enhance the participation of women of color and to advance their academic careers include the following:

- ***Representation within SfN's governance/organizational leadership:*** SfN is dedicated to achieving diversity within its governance and leadership structure to reflect the gender and ethnic/racial diversity of the overall SfN membership. As part of the annual committee nomination cycle, a subcommittee of the PDC is charged with making recommendations to the Committee on Committees of qualified women and URMs for

service on SfN committees. As a result, women and URMs have been appointed increasingly to SfN committees, and prominent women of color have also served on SfN's Council.

- ***Representation within SfN annual meeting programming:*** SfN is also committed to ensuring diversity within the scientific program of the annual meeting. The Program Committee encourages inclusion of diverse presenters in symposium and mini-symposium proposals and uses diversity as an important criterion in the selection process. In addition, the nano-symposium format introduced in 2009 helps promote presentations by younger members, including women and scientists of color.
- ***Mentoring:*** SfN has identified mentoring as a high-priority need among many of its member constituencies, including women of color. SfN offers an online mentor-matching program as well as mentoring events at the annual meeting and year-round resources. *NeurOnLine*, SfN's online community for member-to-member networking, dialogue, and sharing of experiences, offers a virtual venue where mentoring on a range of career-related topics and issues occurs alongside scientific exchange.
- ***Plugging the "leaky pipeline":*** SfN also supports several grant-funded programs aimed at helping URMs to advance through various career stages. The Neuroscience Scholars Program (funded by the NINDS) aims to increase the likelihood that the most promising URM neuroscience trainees successfully advance in their careers. The Program includes annual funds for career enrichment activities, mentoring and networking opportunities, support for SfN annual meeting attendance, and more. To date, nearly 600 have participated in the program and, since 1996, 55% of all Scholars have been women. Data from a survey and interviews of former Scholars document the significant impact the program has had on helping foster the careers of numerous URMs, many of them women.
    - SfN is also implementing a pilot Grant Proposal Mentoring Program to help increase the success rate for URMs submitting proposals to NSF/NIH. Of the 20 beneficiaries of the two-year pilot program, which involves intensive coaching and mock review of proposals, half are women of color. We expect this program to target the important transition from postdoctoral fellow to tenure-track faculty member where the "pipeline" appears to be most leaky.
    - SfN's NSF-funded project, Department Chair Training to Increase Women in Neuroscience (IWiN), seeks to increase the number of women, including underrepresented minority women, among faculty in neuroscience. SfN has implemented five workshops that have provided participating department chairs and university leaders from 43 academic institutions with concrete strategies focusing on recruitment, advancement, and creating a favorable work climate for female faculty and faculty from diverse backgrounds in neuroscience and neuroscience-related departments and programs around the country. A major topic of the workshops was the prevalence of unconscious bias. The reviews by participants of these workshops suggest that they will have a significant impact on hiring and retention practices at numerous academic institutions.

Challenges or barriers to success experienced by women of color in the field of neuroscience are no different than in other areas of science. The dearth of strong role models and of a supportive community of people of similar background/color, effective mentoring, and unintended/implicit biases in faculty recruitment and promotion policies and practices are among

the key issues identified in numerous studies. Additional challenges include retention of dual-career couples and support for work-life balance in scientific careers – challenges SfN is also trying to address through its professional development programming. One of many approaches is to assist women scientists who are raising families with added technical and childcare support.

Lessons learned by SfN from the programs and initiatives listed above, including 30 years of the Neuroscience Scholars Program and early lessons from the IWiN Project, suggest the need to work at each career transition level with focused and targeted interventions. Support for programs (including more pilot programs), as well as the identification and dissemination of best practices from successful programs, are key to helping professional societies address directly the challenges and ultimately contribute to increasing representation and career satisfaction of women of color and retaining them in the scientific academic workforce. Furthermore, strategies to increase retention of women of color in the sciences will help increase the retention of everyone in science, thereby benefitting the broader scientific community and the overall scientific enterprise.