Beyond Bias and Barriers: Current Prospects for Women in Science

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Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering

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More women are earning science and engineering doctorates.
The problem is not simply the pipeline.

In several fields, the pipeline has reached gender parity

• For over 30 years, women have made up over 30% of the doctorates in social sciences and behavioral sciences and over 20% in the life sciences. Yet, at the top research institutions, only 15.4% of the full professors in the social and behavioral sciences and 14.8% in the life sciences are women.

• Women from minority racial and ethnic backgrounds are virtually absent from the nation’s leading science and engineering departments.
Scissors Diagram Showing the Gender Distribution within Career Stages in Biological Sciences at German Universities (2003)

Ladder for Booker T. Washington

Martin Puryear
1996
CHARGE TO COMMITTEE
(1) Review and assess the research on gender issues in science and engineering, including innate differences in cognition, implicit bias, and faculty diversity.

(2) Examine the institutional culture and practices in academic institutions that contribute to and discourage talented individuals from realizing their full potential as scientists and engineers.

(3) Determine effective practices to ensure women doctorates have access to a wide range of career opportunities, in academe and in other research settings.

(4) Determine effective practices on recruiting and retention of women scientists and engineers in faculty positions.

(5) Develop findings and provide recommendations based on these data and other information the committee gathers to guide the faculty, deans and department chairs, academic leaders, funders, and government officials on how to maximize the potential of women science and engineering researchers.
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Findings

[Supplemented by those of a subsequent NRC report (2009): “Gender Differences at Critical Transitions in the Careers of Science, Engineering and Mathematics Faculty”]
Evidence Refuting Commonly-Held Beliefs about Women in Science and Engineering.
Belief
Women are not as good in mathematics as men.

Finding
Female performance in high school mathematics now matches that of males.
Belief

It is only a matter of time until the proportion of women on faculties increases.

Finding

Women’s representation decreases with each step up the tenure-track and academic leadership hierarchy -- even in fields that have had a large proportion of women doctorates for 30 years.
Belief

Women are not as competitive and don’t want jobs in academe.

Finding

Similar proportions of men and women plan to enter postdoctoral study or academic employment.
Belief

Women and minorities are recipients of favoritism through affirmative-action programs.

Finding

Affirmative action broadens searches to include more women and minority-group members. It does not select candidates based on race or sex, which is illegal.
Belief: Academe is a meritocracy.

Finding: Scientists make biased decisions including factors such as race, sex, geographic location of a university, and age that have nothing to do with the quality of the person or work being evaluated.
Belief

Women faculty are less productive than men.

Finding

The publication productivity of women science and engineering faculty has increased over the last 30 years and is now comparable to men’s.
Belief
Women are more interested in family than in careers.

Finding
Many women scientists and engineers show high levels of dedication to their careers despite severe conflicts between their roles as parents and as scientists and engineers.
Belief

Changing the rules means that standards of excellence will be lowered.

Finding

The current process does not optimally select and advance the best scientists and engineers, because of implicit bias and disproportionate weighting of qualities that are stereotypically male.
Belief
The system as currently configured has worked well in producing great science; why change it?

Finding
The global competitive balance has changed the current science and technology climate. Traditional methods may no longer suffice.
It is not lack of talent, but rather unintentional biases and outmoded institutional structures that are hindering the access and advancement of women.
Women are very likely to face discrimination in every field of science and engineering.

Overall, scientists and engineers who are women or members of racial or ethnic minority groups have had to function in environments that favor—sometimes deliberately but often inadvertently—men. Small disadvantages accumulate and become especially acute in more senior positions.

Well-qualified and highly productive women scientists also contend with continuing questioning of their own abilities in science and mathematics and their commitment to an academic career. Minority-group women are subject to dual discrimination and face even more barriers to success.
A substantial body of evidence establishes that most people—men and women—hold implicit biases.

Decades of cognitive psychology research reveal that most of us carry prejudices of which we are unaware but that nonetheless play a large role in our evaluations of people and their work.

For example:

• On the average, people are less likely to hire a woman than a man with identical qualifications.

• People are less likely to ascribe credit to a woman than to a man for identical accomplishments.

• When information or time is scarce, people will far more often give the benefit of the doubt to a man than to a woman.
Exploring the color of glass: Letters of recommendation for female and male medical faculty

Evaluation criteria contain arbitrary and subjective components that disadvantage women.

Women faculty are paid less, are promoted more slowly, receive fewer honors, and hold fewer leadership positions than men. These discrepancies do not appear to be based on productivity, the significance of their work, or any other measure of performance.

Characteristics that are often selected for and are believed to relate to scientific creativity—namely assertiveness and single-mindedness—are given greater weight than other characteristics such as flexibility, diplomacy, curiosity, motivation, and dedication, which may be more vital to success in science and engineering. At the same time, assertiveness and single-mindedness are stereotyped as socially unacceptable traits for women.
Academic organizational structures and rules contribute significantly to the underuse of women in academic science and engineering.

Rules that appear quite neutral may function in a way that leads to differential treatment or produces differential outcomes for men and women.

• Structural constraints and expectations built into academic institutions assume that faculty members have substantial spousal support. Anyone lacking the work and family support traditionally provided by a “wife” is at a serious disadvantage in academe.

• The majority of faculty no longer have such support. About 90% of the spouses of women science and engineering faculty are employed full-time; close to half the spouses of male faculty also work full-time.
Career impediments for women deprive the nation of an important source of talented and accomplished scientists and engineers who could contribute to our nation’s competitiveness.

Transforming institutional structures and procedures to eliminate gender bias is a major national task that will require strong leadership and continuous attention, evaluation, and accountability.

The committee’s recommendations are large-scale and interdependent, requiring the interaction of university leaders and faculties, scientific and professional societies, funding agencies, federal agencies, and Congress.
Recommendations
Trustees, university presidents, and provosts:

- Provide clear leadership in changing institutional culture and structure
  - University strategic planning
  - Immediately remedy inequalities in hiring, promotion, and treatment
  - Hold leadership workshops for personnel
  - Require evidence for equitable practices before approving appointments
  - Develop and implement policies accounting for flexibility across life course
  - Provide adequate and flexible child-care facilities
Deans, department chairs, and tenured faculty:

• Take responsibility for creating a productive environment
  – Initiate faculty and chair discussions of climate issues
  – Develop and implement effective mentoring and evaluation programs for faculty and students
  – Expand faculty recruitment efforts
  – Review equity in treatment of faculty and of tenure processes and timelines
Higher education organizations:

- The American Council on Education should consider the creation of an inter-institution monitoring organization.
Scientific, professional, and honorary societies:

• Play a leading role in promoting equal treatment of women and men
  – Set professional and equity standards
  – Ensure keynote and invited speakers reflect diverse membership of society
  – Ensure representation of women on editorial boards and leadership positions
  – Recognize women for award nominations
  – Provide child-care and elder-care grants or subsidies for conference and meeting attendees
Journals:

Examine their entire review process, including the mechanisms by which decisions are made to send a submission to review or to re-review a paper. Take steps to minimize gender bias, such as considering blinded reviews.
Foundations and federal funding agencies:

- Ensure that practices support the full participation of women
  - Provide workshops to minimize gender bias
  - Collect, store, and publish composite information for all funding applications
  - Make possible the use of grant monies for dependent care expenses, and create additional funding mechanisms for providing support during caregiving, including extending grant support
  - Expand research support for programs designed to reduce and research gender bias
Congress should take steps to encourage adequate enforcement of antidiscrimination laws, including regular oversight hearings to investigate the enforcement activities of the Department of Education, the Equal Employment Opportunity Commission, the Department of Labor, and the science granting agencies.
Number of women faculty in the School of Science (1963-2006) at the Massachusetts Institute of Technology

But women are leaving academic careers

Increasing the number of women earning science and engineering doctorates will have little effect on the number of women in academic positions, unless attention is paid to recruiting women to these positions and retaining them once hired.
Reasons?

Social Identity (Stereotype) Threat:

• Recognition of a person that he/she may be devalued in a setting because of social identity (being in the minority). “Vigilence” can be assessed both cognitively and physiologically. [Murphy et al, Psychological Science (2007) 18: 879]

• Stereotype threat prevents conceptual learning. [Rydell et al, PNAS (2010) 107: 14042]

Excessive unrealistic worry about the future
Every Other Thursday
STORIES AND STRATEGIES FROM SUCCESSFUL WOMEN SCIENTISTS

Jacket photo: Steven P. Gross. The members of Group at the Albert Einstein statue in the garden of the National Academy of Sciences, Washington, D.C.
Call to Action

The fact that women are capable of contributing to the nation’s scientific and engineering enterprise but are impeded in doing so because of gender and racial/ethnic bias and outmoded “rules” governing academic success is deeply troubling and embarrassing.

Faculty, university leaders, professional and scientific societies, federal agencies and the federal government must unite to ensure that all our nation’s people are welcomed and encouraged to excel in science and engineering in our research universities. Our nation’s future depends on it.
More women are earning science and engineering doctorates

[Graph showing the percentage of women earning PhDs in various sciences from 1974 to 2004.]
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Women have the drive and capability to succeed in science and engineering.

Studies of brain structure and function, of hormonal modulation of performance, of human cognitive development, and of human evolution have not found any significant biological differences between men and women in performing science and mathematics that can account for the lower representation of women in academic faculty and scientific leadership positions in these fields.

The drive and motivation of women scientists and engineers is demonstrated by those who persist in academic careers despite barriers that disproportionately disadvantage them.
Women who are interested in science and engineering careers are lost at every educational transition.

- With each step up the academic ladder, the representation of women in science and engineering drops substantially.

- As they move from high school to college, more women than men who have expressed an interest in science or engineering decide to major in something else.

- In the transition to graduate school, more women than men with science and engineering degrees opt into other fields of study.

- From doctorate to first position, there are proportionately fewer women than men in the applicant pool for tenure-track positions.
The problem is not simply the pipeline.

In several fields, the pipeline has reached gender parity

- For over 30 years, women have made up over 30% of the doctorates in social sciences and behavioral sciences and over 20% in the life sciences. Yet, at the top research institutions, only 15.4% of the full professors in the social and behavioral sciences and 14.8% in the life sciences are women.

- Social and behavioral sciences are the only fields in science and engineering where the proportion of women reaches into the double digits.

- Women from minority racial and ethnic backgrounds are virtually absent from the nation’s leading science and engineering departments.
Congress: take steps necessary to encourage adequate enforcement of antidiscrimination laws
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ELLEN DANIELL

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Stories and Strategies from Successful Women Scientists

Transforming Undergraduate Science Education: Changing the Face of Those who Teach

IRACDA Conference
Houston, June 19, 2011