Women in Science and Engineering: EXPLORING WHAT AMAZES US

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Women in Astronomy and Space Science 2009
October 22, 2009
Solving the Maze – “Are we there yet?”

• National Research Council
  - From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers (2001)
  - Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (2006)
  - Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty (2009)
  - More. See...
    • Committee on Women in Science, Engineering and Medicine
    • Committee on Science, Engineering and Public Policy
Solving the Maze - “Are we there yet?”

- **Federal Agencies**
  - **NSF**
    - Gender Differences in the Careers of Academic Scientists and Engineers (2003)
    - Thirty-Three Years of Women in S&E Faculty Positions (2008)
  - **NIH**
    - National Leadership Workshop on Mentoring Women in Biomedical Careers (2007: workshop report)
  - **NSF, NIH, DOE**
    - Workshop on Building Strong Academic Chemistry Departments Through Gender Equity (2006: workshop report)
Solving the Maze - “Are we there yet?”

• **Other**
  - Nepotism and Sexism in Peer Review (Wennerås and Wold, Nature 387/22, 1997)
  - Land of Plenty: Diversity as America’s Competitive Edge in Science, Engineering and Technology (2000, Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development—Morella Commission)
  - She Figures 2006: European Commission statistics
  - Many more!
Why Can’t we Break Out of the Maze?

K. L. Olsen
A. B. Carlson

One Path at a Time
Both men and women are significantly more likely to rank a perceived man higher than a perceived woman, using identical resumes.

Unconscious Bias: Impact of Blind Auditions

- Based on audition records of 14,000 individuals & rosters from symphony orchestras: 1970-1996:
  - The audition data show the use of a screen
    - increases the probability that a woman will advance from preliminary rounds by 50%
  - The roster data show the switch to blind auditions
    - accounts for 30% of the increase in the proportion of women among new hires

Why Can’t we Break Out of the Maze?

My High School!

One Path at a Time
WE HAVE MADE PROGRESS
High school graduates completing advanced mathematics courses, by sex and race/ethnicity: 2005

SOURCES: National Center for Education Statistics, National Assessment of Educational Progress, 2005 High School Transcript Study; and National Science Foundation, Division of Science Resources Statistics, special tabulations. See appendix table 1-9.

Science and Engineering Indicators 2008

AP = Advanced Placement; IB = International Baccalaureate.
High school graduates completing advanced S&E courses, by sex and race/ethnicity: 2005

SOURCES: National Center for Education Statistics, National Assessment of Educational Progress, 2005 High School Transcript Study; and National Science Foundation, Division of Science Resources Statistics, special tabulations. See appendix table 1-10.
Freshman Year!

- About 25-30% of students entering college intend to major in S&E field
  - Fewer than 50% of those intended complete S&E degree in five years
- Preparation of those interested in S&E study
  - 20% need remediation in math
  - 10% need remediation in science
Why Can’t we Break Out of the Maze?

MY MATH TA’S

One Path at a Time
WE HAVE MADE PROGRESS
Perceptions Matter!

- FACULTY: Where are my role models?
- “Can I see myself as a scientist or engineer?”
- “What kind of job can I get if I major in science or engineering?”
- The messages that female students receive shape their choices!
Why Can’t we Break Out of the Maze?

One Path at a Time
Because
SCIENCE & ENGINEERING IS A GREAT CAREER
S&E Unemployment Rates Usually Lower than Overall Rate
Increased Demand for Highly Skilled Workforce

Even in times of economic uncertainty, S&E jobs will continue to be in-demand, especially in the energy sector.

**Projected increase in employment, for S&E and selected other occupations: 2004–14**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer/mathematical scientists</td>
<td>36.5</td>
</tr>
<tr>
<td>Post-secondary teachers</td>
<td>28.1</td>
</tr>
<tr>
<td>Health practitioners/technicians</td>
<td>23.4</td>
</tr>
<tr>
<td>All S&amp;E</td>
<td>21.8</td>
</tr>
<tr>
<td>Life scientists</td>
<td>17.8</td>
</tr>
<tr>
<td>S&amp;E managers</td>
<td>17.1</td>
</tr>
<tr>
<td>Social scientists</td>
<td>16.8</td>
</tr>
<tr>
<td>Engineers</td>
<td>16.2</td>
</tr>
<tr>
<td>All occupations</td>
<td>15.8</td>
</tr>
<tr>
<td>S&amp;E technicians</td>
<td>11.7</td>
</tr>
<tr>
<td>Physical scientists</td>
<td>11.2</td>
</tr>
</tbody>
</table>


Science and Engineering Indicators 2008
Mean Annual Salaries of S&E Degree Holders 1-5 Years After Degree

Figure 3-8
Mean salaries of S&E and S&E-related degree recipients 1–5 years after degree, by field and level of highest degree: 2003

Dollars (thousands)


Science and Engineering Indicators 2008
Women & Minorities are underrepresented in science & engineering workforce

• In 2001, women were approximately 40% of the workforce but less than 20% of the S&E workforce

• Minorities were approximately 10% of the workforce but represented about 5% or less of the S&E workforce

Source: Council on Competitiveness US Competitiveness 2001
Representation of women in US graduate programs by field of science 1972-2001
Female S&E graduate students: 1995 and 2005

Doctoral Degrees Earned by Women
1985, 1995, 2005


Percent

- Non-S&E
- Social/behavioral sciences
- Life sciences
- Physical sciences
- Math/computer sciences
- Engineering

NOTES: Physical sciences include earth, atmospheric, and ocean sciences. Life sciences include biological sciences, agricultural sciences, and medical/other life sciences.

Some Statistics

- 94 percent of full professors in science and engineering are white; 90 percent are male.
- 91 percent of the full professors at research universities are white; 75 percent are male.
- 87 percent of the full-time faculty members in the United States are white; 64 percent are male.
- Only 5 percent of the full professors in the U.S. are black, Hispanic, or Native American.
- The gap between the percentage of tenured men and the percentage of tenured women has not changed in 30 years.

Trower and Chait, Harvard University Mag. (March-April, 2002)
Share of doctoral S&E faculty positions held by women, by rank: Selected years, 1973–2006

NOTE: Junior faculty includes assistant professors and instructors.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Doctorate Recipients, special tabulations (preliminary data for 2006).
Why Can’t we Break Out of the Maze?

MY EXODUS and Yes, I can Type!

One Path at a Time
WE HAVE MADE PROGRESS
Interesting Statistics Comparing 30 yrs

- Women currently represent 36% of full-time faculty compared to 23% in the early 1970s.

- Women constitute only 25% of the full-time faculty at research universities, versus 10% in 1970.

- Faculty of color remain a very small part of the professoriate. (Whites constituted 95% of all faculty members in 1972 and 83% in 1997.)
  - 4.4% in 1975 and 5 percent in 1997—and almost half of all Black faculty teach at historically black colleges.
  - 1.4% in 1975 to 2.8% in 1997 for Hispanic faculty.

- While a popular explanation of the problem holds that there are insufficient numbers of women and minorities on the pathway from graduate student to faculty member. Academics label this the "pipeline problem."
  - true for minorities
  - false for women.

Source: Nelson & Rogers, 2004. A National Analysis of Diversity in Science and Engineering Faculty at Research Universities
# Researchers in Higher Education in Europe (% Female)

<table>
<thead>
<tr>
<th></th>
<th>Natural Sciences</th>
<th>Engineering and Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portugal</td>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>Ireland</td>
<td>44</td>
<td>25</td>
</tr>
<tr>
<td>U.K.</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>Italy</td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>Finland</td>
<td>29</td>
<td>19</td>
</tr>
<tr>
<td>Sweden</td>
<td>29</td>
<td>18</td>
</tr>
<tr>
<td>France</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>Denmark</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>Austria</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Germany</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Belgium</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: European Commission, Eurostat
*Data from late 1990s.
Why Can’t we Break Out of the Maze?

Questions no longer asked???

One Path at a Time
WE HAVE MADE PROGRESS
Effect of Marital Status and Children

Women as a Percentage of Full Time Faculty in Science, Engineering and Health

- Married
- Not married
- With children in the home
- No children in the home

Source: 33 Years of Women in S&E Faculty Positions (NSF 08-308)
NSF Earth Sciences Postdoctoral Fellowships Program (revision announced 10-7-09)

- Award information includes the statement that Fellows may request a no-cost extension for parental leave for the birth or adoption of children.
- Award information includes a statement that Fellows may request to use two months of their stipend for paid parental leave.
Why Can’t we Break Out of the Maze?

$16,000-$20-$40-$60-

One Path at a Time
Table 3-13

Median annual salary of individuals in S&E occupations, by sex, race/ethnicity, and visa status: Selected years, 1993–2003

(Dollars)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1993</th>
<th>1995</th>
<th>1997</th>
<th>1999</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;E employed</td>
<td>48,000</td>
<td>50,000</td>
<td>55,000</td>
<td>60,000</td>
<td>66,000</td>
</tr>
<tr>
<td>Male</td>
<td>50,000</td>
<td>52,000</td>
<td>58,000</td>
<td>64,000</td>
<td>70,000</td>
</tr>
<tr>
<td>Female</td>
<td>40,000</td>
<td>42,000</td>
<td>47,000</td>
<td>50,000</td>
<td>53,000</td>
</tr>
<tr>
<td>White</td>
<td>48,000</td>
<td>50,500</td>
<td>55,000</td>
<td>61,000</td>
<td>67,000</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>48,000</td>
<td>50,000</td>
<td>55,000</td>
<td>62,000</td>
<td>70,000</td>
</tr>
<tr>
<td>Black</td>
<td>40,000</td>
<td>45,000</td>
<td>48,000</td>
<td>53,000</td>
<td>58,000</td>
</tr>
<tr>
<td>Hispanic</td>
<td>43,000</td>
<td>47,000</td>
<td>50,000</td>
<td>55,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Temporary residents</td>
<td>43,300</td>
<td>49,700</td>
<td>49,000</td>
<td>52,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>

NOTE: 2003 data includes some individuals with multiple races in each category.
Science and Engineering Indicators 2008
Median annual salaries of employed scientists and engineers, by broad occupation and sex: 1999
ADVANCE; Why do we need it?

- Program Goal: Increase the participation and advancement of women at all levels in academic science and engineering careers.
- Since 2000 ... Are we there yet?
NSF ADVANCE Program

Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers

- Three program levels
  - **Institutional Transformation (IT)**
    - “The big one”: Comprehensive, institution-wide change!
    - $2 M to $5 M total over 5 years
  - **Institutional Transformation Catalyst (IT-Catalyst)**
    - Early planning and assessment activities to prepare for transformational activities
    - $100 K to $200 K total for 2 years
  - **ADVANCE-PAID**
    - Helps institutions adopt successful practices demonstrated by other institutions
    - One year to five year projects; funding depends on the scope of the project

- Awards made every two years
Small IT awards to promote promising practices:
- Duke University
- New Jersey Institute of Technology
- Marshall University
- University of Maryland, Eastern Shore
NIH Women in Biomedical Careers Initiative

- Funding 14 grants focusing on factors that influence the careers of women in biomedical and behavioral science and engineering (Oct 2009)
- Influences on women's career choices: family and economic factors, institutional environments, and broader social and cultural issues
- Role mentoring and funding support throughout women's academic careers
- Impact of family-friendly policies on retention
- Underrepresented and financially disadvantaged women also examined
• Catalyst Study (1996): Survey of 1251 executive women who hold titles of vice president or above in Fortune 1000 companies - Most Effective Strategies for Overcoming Workplace Barriers
• #1 Strategy: Consistently exceed performance expectations
• #2: Develop style that men are comfortable with
• #3: Seek difficult or high-visibility assignments
• #4: Have an influential mentor
• ...

(Breaking the Glass Ceiling)
Why Can’t we Break Out of the Maze?

One Path at a Time
Enhance Visibility for Women Scientists and Engineers

• Enhance visibility through Presidential events
  - The Presidential Award for Excellence in Science, Math, and Engineering Mentoring (PAESMEM) **
    • recognize outstanding mentoring efforts/programs designed to enhance the participation of underrepresented groups
  - Presidential Early Career Award for Beginning Scientists and Engineers (PCASE)
  - Presidential Medal of Science (U.S. Nobel!)**
  - Waterman Award **
  - ** if you don’t nominate!!!
“The only way to discover the limits of the possible is to go beyond them ... into the impossible.”

Arthur C. Clarke
ADVANCE is a “NSF-wide” program
- The Assistant Directors (ADs) of each participating directorate reviews and approves the program solicitation and management plan
- Program funds are located in the participating directorates and offices

ADVANCE Implementation Committee (AIC)
- One or more representatives from each participating Directorate and Office
- Acts as an advisory committee
- Meets monthly to discuss program management and related issues
NSF EHR: Innovation through Institutional Integration – I$^3$

Goals of I$^3$:

• Creative integration of NSF awards
• Increase synergy and collaboration across NSF-funded projects and within/between institutions
• Expand and deepen the footprints of NSF-funded projects and enhance their sustainability