Women in Physics: Context, Challenges, and Changes

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University Distinguished Professor of Physics
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Context
Percent of Bachelor's Degrees Earned by Women in Selected Fields, 1966-2009 (USA)

National Center for Education Statistics. Data for class of 1999 were not available.

Compiled by American Institute of Physics Statistical Research Center
Percent of PhDs earned by women in selected fields, 1958-2006 (USA)

AIP Statistical Research Center. Compiled from data collected by National Science Foundation.
The “scissors plot” summarizing these results reveals a relative scarcity of women physicists. This is a problem for Physics… and STEM!

Source: American Institute of Physics Statistical Research Center
THE FUNDING GAP

Women are earning an increasing share of research grants from the US National Institutes of Health (NIH) but the average size of their awards has consistently lagged behind what men receive.

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>31,801</td>
<td>10,199</td>
</tr>
<tr>
<td>2012</td>
<td>30,768</td>
<td>13,025</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Size of Grant Men</th>
<th>Average Size of Grant Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>$403,047</td>
<td>$330,169</td>
</tr>
<tr>
<td>2012</td>
<td>$507,279</td>
<td>$421,385</td>
</tr>
</tbody>
</table>

Proportion going to women: 24% in 2002, 30% in 2012.

THE SALARY GAP

Female scientists in the United States earn much less than men, on average, with the difference varying strongly by field.

<table>
<thead>
<tr>
<th>Field</th>
<th>2008 Median Salaries Men</th>
<th>2008 Median Salaries Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>$65,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Chemistry</td>
<td>$79,000</td>
<td>$62,000</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>$89,000</td>
<td>$54,000</td>
</tr>
</tbody>
</table>
There are 189 such departments and the median number of faculty is 25.
Causes for Concern

[adapted from APS Women in Physics site http://www.aps.org/programs/women/reports/bestpractices/ ]

No effort to develop a sense of community or improve the climate. Denial that such issues matter to people.

A sub-critical mass of female employees; premature departure of female employees.

Lack of investment in and/or promotion of female employees at all levels. No visible leadership roles for female employees in the unit.

Isolation or marginalization of female employees.

Derogatory comments about female employees to reduce their ability to bring about change (e.g., “difficult” or “troublemaker”).

A highly politicized climate where decision-making processes are not transparent.

Inability on the part of senior female scientists or engineers to get sufficient laboratory space, research funding, or other resources needed to become leaders in their fields.

Strong support for more junior employees who are not in a position to drive change, but weak support for senior female employees who attempt to change the climate.
Who has access to professional resources?

Table 1. Percentage of respondents with access to key resources.

<table>
<thead>
<tr>
<th></th>
<th>Less developed countries</th>
<th>Very highly developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Funding</td>
<td>34</td>
<td>51</td>
</tr>
<tr>
<td>Office space</td>
<td>64</td>
<td>74</td>
</tr>
<tr>
<td>Lab space</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>Equipment</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Travel money</td>
<td>31</td>
<td>47</td>
</tr>
<tr>
<td>Clerical support</td>
<td>22</td>
<td>38</td>
</tr>
<tr>
<td>Employees or students</td>
<td>42</td>
<td>53</td>
</tr>
</tbody>
</table>
Who has access to career-advancing experiences?

Table 2. Percentage of respondents with career-advancing experiences.*

<table>
<thead>
<tr>
<th>Experience</th>
<th>Less developed countries</th>
<th>Very highly developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Gave a talk at a conference as an invited speaker</td>
<td>51</td>
<td>67</td>
</tr>
<tr>
<td>Served on committees for grant agencies</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>Conducted research abroad</td>
<td>54</td>
<td>71</td>
</tr>
<tr>
<td>Acted as a boss or manager</td>
<td>38</td>
<td>53</td>
</tr>
<tr>
<td>Served as editor of a journal</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Advised graduate students</td>
<td>63</td>
<td>77</td>
</tr>
<tr>
<td>Served on thesis or dissertation committees (not as an adviser)</td>
<td>52</td>
<td>66</td>
</tr>
</tbody>
</table>
Challenges
Implicit Bias

The Gender Equity Project, Virginia Valian

• We are all (women and men) prone to unintentional bias
  Think not? try the Implicit Associations Test at
  https://implicit.harvard.edu/implicit/demo

• This affects many decisions we make in the course of our professional duties

• Relevant concepts include:
  – gender schemas
  – stereotype threat
  – accumulation of disadvantage
What are Gender Schemas?

- Gender schemas are hypotheses about what it means to be male or female.

- We all - male and female alike - share these hypotheses.

- Schemas assign different psychological traits to males and females (Martin and Halverson, 1987).
Has time cured this? Alas no... see Moss-Racusin et al., PNAS 12111286109 (2012).
Family Responsibilities


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**Leaks in the Academic Pipeline for Women**

- **Graduate School**
  - Women with Babies (29% less likely than women without babies to enter a tenure-track position)

- **PhD Receipt**
  - Women with Babies

- **Assistant Professor (Tenure Track)**
  - Women, Married (20% less likely than single women to enter a tenure-track position)

- **Associate Professor (Tenured)**
  - Women (23% less likely than men to become an Associate Professor)

- **Full Professor (Tenured)**
  - Women (25% less likely than men to become a Full Professor within a maximum of 16 years)

Mason, Stacy, and Goulden, 2004; Data from NSF Survey of Doctorate Recipients 1981-1995
Everybody is Very Busy

Mason, Stacy, and Goulden, 2004; Data on UC faculty, ages 30-50
Who does the Housework around the world?

Figure 1. The majority of housework is more likely to be done by women than by men. The results shown here were derived from the responses to a global survey conducted by the American Institute of Physics and filled out by almost 15,000 physicists. To generate this graph we disregarded the responses of those physicists whose spouse or partner was not employed. The disproportionate burden of housework on women holds independent of level of development of the respondent’s country.
For each year after the PhD, Married Men with Children under 6 are 50% more likely to enter a tenure track position than are Married Women with Children under 6.
What is the career impact of having children?

**Figure 2.** Having children tends to slow the career progress of women physicists but not that of their male counterparts. To generate the data that produced this graph, a global survey analyzed responses from some 15 000 physicists to compare their career progress with that of their colleagues.
A 2009 survey of postdoctoral fellows at the University of California showed that women who had children or planned to have them were more likely to consider leaving research.

**POSTGRADUATE POSITIONS**

**POSTDOCS WHO DECIDED AGAINST CAREERS AS RESEARCH FACULTY MEMBERS (2009)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>No children or plans to have them</td>
<td>19%</td>
<td>20%</td>
</tr>
<tr>
<td>No children, but plan to have them</td>
<td>17%</td>
<td>28%</td>
</tr>
<tr>
<td>Children previous to postdoc</td>
<td>19%</td>
<td>32%</td>
</tr>
<tr>
<td>New children since start of postdoc</td>
<td>20%</td>
<td>41%</td>
</tr>
</tbody>
</table>

**“The plan to have children in the future, or already having them, is responsible for an enormous drop-off in the women who apply for tenure-track jobs.”**

Wendy Williams, Cornell University

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**EARLY CAREER**

Female representation among science and engineering faculty members in the United States has lagged behind gains in graduate education, in part because many women do not apply for tenure-track jobs. But women who do apply are more likely than men to receive interviews and offers.

**“At least part of the lack of applications is due to the fact that women look at these careers and don’t see people like themselves.”**

Hannah Valantine, Stanford University

**Nature, Vol 495, 7 March 2013**
Negotiation

Women Don’t Ask: Negotiation and the Gender Divide (Linda Babcock & Sarah Laschever, 2003)

• Women avoid negotiation because they are
  - unsure what they “deserve”; fear asking too much
  - worried about harm to relationships
  - less optimistic about benefits of negotiation
  - not confident of their negotiation skills
  - relatively risk-averse

• In negotiations, women tend to
  ★ ask for less -- and therefore receive less
  ★ use “interest-based” negotiation approach, focused on underlying needs/motives rather than narrow concrete goals
  (Getting to Yes: Negotiating Agreement Without Giving In, Roger Fisher & William Ury, 1990)
• Context & Challenge: Scarcity!
  – Women’s participation rate in physics (and other STEM fields) remains low compared to that of men.
  – Social Science research reveals numerous causes: family responsibilities, dual-career issues, implicit bias, negotiation skills, isolation...

• The sessions you will participate in during this ICTP workshop will identify solutions that can make a difference — and equip you with skills to help you advance in your career.

• Let’s start working together!
FOR FURTHER INFORMATION

American Institute of Physics Statistical Research Center:  www.aip.org/statistics/

American Physical Society

Univ. of California Faculty Family Friendly Edge:  ucfamilyedge.berkeley.edu/

The Gender Equity Project:  www.hunter.cuny.edu/genderequity/

Women Don’t Ask [Negotiation and the Gender Divide]:  www.womendontask.com/
Ask for It [How Women can Use the Power of Negotiation...]

NSF ADVANCE Portal Website:  www.portal.advance.vt.edu/
Michigan State’s ADAPP-ADVANCE Project:  www.adapp-advance.msu.edu/


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