Women in Science: Impressions of a US Physicist

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  - Humboldt-Stiftung Supported Sabbatical:
    - 10/99-3/00: Forschungszentrum Jülich
    - 4/00-8/00: Technische Universität Darmstadt

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Outline

• Status of Women in Physics: Selected Statistics
  – Leaky pipeline: Where are patches needed?

• Positive Interventions to Improve Status of Women in Science
  – Professional Societies:
    • CSWP Dual Career Survey, CSWA Baltimore Charter
  – Local Activities
    • UW Women in Science and Engineering Program
  – Institutions:
    • Teaching styles to match learning styles, Corning Intervention Program

• Agenda for Action
  – MIT Report
  – Think Globally, Act Locally
Leaky Ladder

Senior Faculty
Or Researcher
(all fac: 11% F, 8350
Assoc.: 10% F
Full: 3% F)

Post-doctoral

Majors
19% F (3800/y)

High School
47% F (800,000/y)

Intro Courses
~ 40% F (368,000/y)

Graduate School
12% F (1320/y)

Junior Faculty
Or Researcher
17% F

Administration

Teachers and Teaching
Advising and Peers
Ability/Comfort

Recommendations
Information

Promotion/Tenure
Hiring Procedures
Training/Recognition

X% Female (total number) in Physics] see www.aip.org/statistics

Children
50% F
Pre-College

• Seventh Grade (age 12) (*nces.ed.gov*)
  - Favorite Subject
    | Boys | Girls |
    |------|-------|
    | Reading/Language Arts | 6%  | 12%  |
    | Social Studies         | 31% | 12%  |
    | Science/Math           | 63% | 76%  |

• High School (*www.aip.org/statistics*)
  - Take HS Physics: 28% all Students (highest since 1948)
    (44% richest schools; 20% poorest schools)
  - % Girls in Class: 1987 1997
    | 39% | 47% |
  - % Female Teachers
    | Public | Catholic | Other Private |
    | 25% | 40% | 19% |
College/University

- **Persistence**
  - Start with interest in Science/Engineering and Graduate with B.S.
    61% Males 46% Females
  - See Seymour and Hewitt, “Talking about Leaving”

- **US National Figures in 1997 (% Female) (www.aip.org)**
  - Subject | BS | MS | Ph.D. | Asst. | Assoc. | Full Prof.
  - Physics  | 19% | 18% | 12%  | 17%  | 10%  | 3%
  - Astro    | 33% | 30% | 19%  | 24%  | 26%  | 9%

- **UW in 1998-1999 (% Female)**
  - Algebra-Based Intro 56% (700 students)
  - Calculus Based Intro 26% (900 students)
  - Physics B.S. Graduates 28% (40 students)
  - Engineering B.S. Graduates 21%
Physics Faculty in US

- Departments with NO Woman Faculty Member in 1998
  - | Type | % Depts. | # No-women/Total | Mean Size of Dept |
  - |-----|---------|-----------------|-----------------|
  - | Ph.D. | 24% | (44/183) | 27 |
  - | M.S. | 49% | (35/72) | 12 |
  - | B.S. | 61% | (306/502) | 5 |

- Number of Women Faculty in Ph.D. Granting Departments
  - | # | 1985 | 1998 |
  - |----|------|------|
  - | 0  | 55%  | 24%  |
  - | 1  | 31%  | 30%  |
  - | 2  | 11%  | 19%  |
  - | 3  | 2%*  | 15%  |
  - | 4  | 2%*  | 12%* |

- Annual Turnover Rate: 3.6% (17% of positions to women)
Historical Perspective

- Ph.D.’s Granted: women/total (US citizen & Perm. resident)
  - Year  | Engineering | Physical Science | Biological Science
  - 1950-59  | 20/5756     | 685/18745         | 1174/9953       
  - 1960-69  | 77/18965    | 1577/34300        |               
  - 1995     | 518/3336    | 1178/4500         | 1854/4321       

- Medical School Population (www.nsf.gov)
  - Year | % Women
  - 1970  | 8%
  - 1980  | 25%
  - 1990  | 37%
  - 1997  | 43%

1972: Discrimination on sex basis made illegal
Positive Interventions

– Professional Societies:
  • American Physical Society Committee on the Status of Women in Physics
    – CSWP Dual Career Survey (1998)
  • American Astronomical Society CSWA
    – Baltimore Charter (1992)

– Local Activities:
  • UW Women in Science and Engineering Program

– Institutions:
  • University: Teaching Styles to Match Learning Styles
  • Industry: Corning Intervention Program (1987)
CSWP Dual Career Survey: Statistics

- APS membership: 6% women (14% of members under 30)
- 51% women members married. Of these:
  - 68% married to other scientists (vs. 17% of married men physicists)
  - 44% married to other physicists (vs. 6% of men)
- % of Dual Career Couples who --
  - had one member take a lower position to accommodate dual career issues -- 60%
  - had short-term goals impacted by dual-career issues -- 85%
  - had long-term goals impacted -- 55%

- Full report: http://www.physics.wm.edu/dualcareer.html
Dual Career Bad/Good News

• Problems reported in most recent job search
  – Reduced consideration of dual career candidates
  – Illegal questions (are you married?, etc.)
  – Nepotism considerations (ruled illegal in 1972)
  – Insulting offer to captive spouse
  – Egregious remarks

• Good things reported
  – Large institutions with spousal hiring programs
  – Small institutions with split/shared position policies
  – Alternative positions (lecturer, soft-money research, etc.)
  – Help with scheduling for long-distance relationships
Dual Career Recommendations

• See web site:  http://www.physics.wm.edu/dualcareer.html

• Institutions need to:
  – Recognize existence of problem and decide to deal with it
  – Take action before it is needed
  – Develop contacts with other employers in area

• Scientists need to:
  – Give institutions time to act
  – Bring constructive suggestions to administration
  – Police colleagues on search committees for appropriate behaviour
AAS CSWA Baltimore Charter (1992)

• Preamble: We hold as fundamental that:
  – Women and men are equally capable of doing excellent science.
  – Diversity contributes to, rather than conflicts with, excellence in science.
  – Current recruitment, training, evaluation and award systems often prevent the equal participation of women.
  – Formal and informal mechanisms that are effectively discriminatory are unlikely to change by themselves. Both thought and action are necessary to ensure equal participation for all.
  – Increasing the number of women in astronomy will improve the professional environment and improving the environment will increase the number of women.

This Charter addresses the need to develop a scientific culture within which both women and men can work effectively and within which all can have satisfying and rewarding careers.
Baltimore Charter: Recommendations

• Affirmative Action
  – Search criteria clearly defined;
  – Women involved in searches;
  – Female population reflected in applicant pool and short list. If not, explain.

• Broaden criteria to allow for alternative career paths
  – Child-bearing/rearing breaks, Dual-career detours, etc.

• Strong action to prevent sexual harassment
  – Clear administrative positions, Education of workforce,
    Swift and substantial punishment of perpetrators

• Gender-neutral language and illustrations

• Physical safety considerations for work at any hour by any one
Progress in Astronomy

• Awareness Increase, Especially at Administration Level

<table>
<thead>
<tr>
<th>Level</th>
<th>1992</th>
<th>1999</th>
<th>(% female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grad student</td>
<td>23%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Post-Doc</td>
<td>17%</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Asst. Prof.</td>
<td>17%</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Assoc. Prof.</td>
<td>12%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>Full Prof.</td>
<td>5%</td>
<td>9%</td>
<td></td>
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</tbody>
</table>
Women in Science and Engineering Mentoring Program

• Local University of Washington Program
• Received 1999 Presidential Mentoring Award
• Provides:
  – Mentor in local industry
  – Study groups
  – Regular meetings: information about possible majors, careers
  – Networking, contacts, reassurance
• Successful
  – 97% Retention Rate to Science/Engineering Degree
    • Compare to 76% General Science/Engineering; 56% Overall
**WISE Survey**

- % of Women in Program Reporting the Following when asked: What Impediments Have You Felt to Pursuing Science/Engineering Degree?

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of self-confidence</td>
<td>23%</td>
<td>27%</td>
<td>26%</td>
<td>45%</td>
<td>49%</td>
</tr>
<tr>
<td>Intimidation</td>
<td>23</td>
<td>36</td>
<td>42</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td>Isolation</td>
<td>8</td>
<td>13</td>
<td>8</td>
<td>50</td>
<td>46</td>
</tr>
<tr>
<td>Lack of interest</td>
<td>13</td>
<td>18</td>
<td>17</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>NONE</td>
<td>23</td>
<td>18</td>
<td>22</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>
Teaching Styles to Match Learning Styles

• UT Austin Survey
  – Abstract vs. Concrete; Sequential vs. Random
  – Science Professors all fell in Abstract-Sequential Quadrant
  – Introductory Science Students were evenly distributed

• UT Austin Program
  – Combine Lecture with Group Learning
  – Students in same groups for Physics, Chemistry, Math, English 1st year

• UW Physics Education Group
  – Tutorial, Socratic Dialog replaces 1/4 of weekly instruction
  – Laboratory required
  – Conceptual questions 1/3 of exams
Industry: Dow-Corning Example

• 1987: Attrition Rate for R&D Scientists
  – Men: 5%/yr  Women: 15%/yr

• Major “Bottom Line” Issue

• Instituted program to improve climate for women

• 1991: Attrition Rate for Women = that of Men (~ 5%/year)

• What did they do?
Dow-Corning Program -- Environment Issues

• Corning Professional Women’s Forum
  – Regular meetings, Newsletter, Network

• Parent Resource and Referral Center for Childcare
  – Established jointly with other community organizations

• Confidential Counseling by Outside Consultant

• New Career Planning and Management System
  – All individuals exercise more control over own careers

• Coaching (Mentoring) Program

• Part-time and Flex-time policies for all salaried employees

• Required workshop for all R&D employees addressing gender-related workplace issues

• And…. 
Corning: “Glass Ceiling” Issues

• Establish targets for increasing number of women and minorities in higher level jobs
• Early identification of high-potential women and minorities
• Assign responsibility to supervisors for providing job opportunities to identified employees within a specified time.
• Detailed annual performance appraisals, including discussions of career development
Agenda for Action

• MIT Report (http://web.mit.edu/fnl/women/women.html)
  – Women Professors in Science Compared Notes, Brought to Receptive Dean
  – Five years later: doubled number of women science faculty, all much happier

• Get Receptive Administrators Involved
  – Seminar series: have them do the introductions
  – Check for historical legacy of discrimination (low pay, etc.)
  – Bring constructive ideas to them
  – Volunteer to help bring ideas to fruition
  – Form advisory committees
  – Create search guidelines
  – Survey resource allocation (MIT Report)
Ten Things to Do (From Meg Urry)

• Do what you CAN do
• Be a mentor
• Involve others
• Ask (male) colleagues to nominate, invite women
• Maintain the high ground
• Admit subjectivity
• Listen -- agree to disagree
• Look at outcome
• Be Pessimistic -- Don’t lose hope when nothing happens
• Be Optimistic -- The net slope is positive