

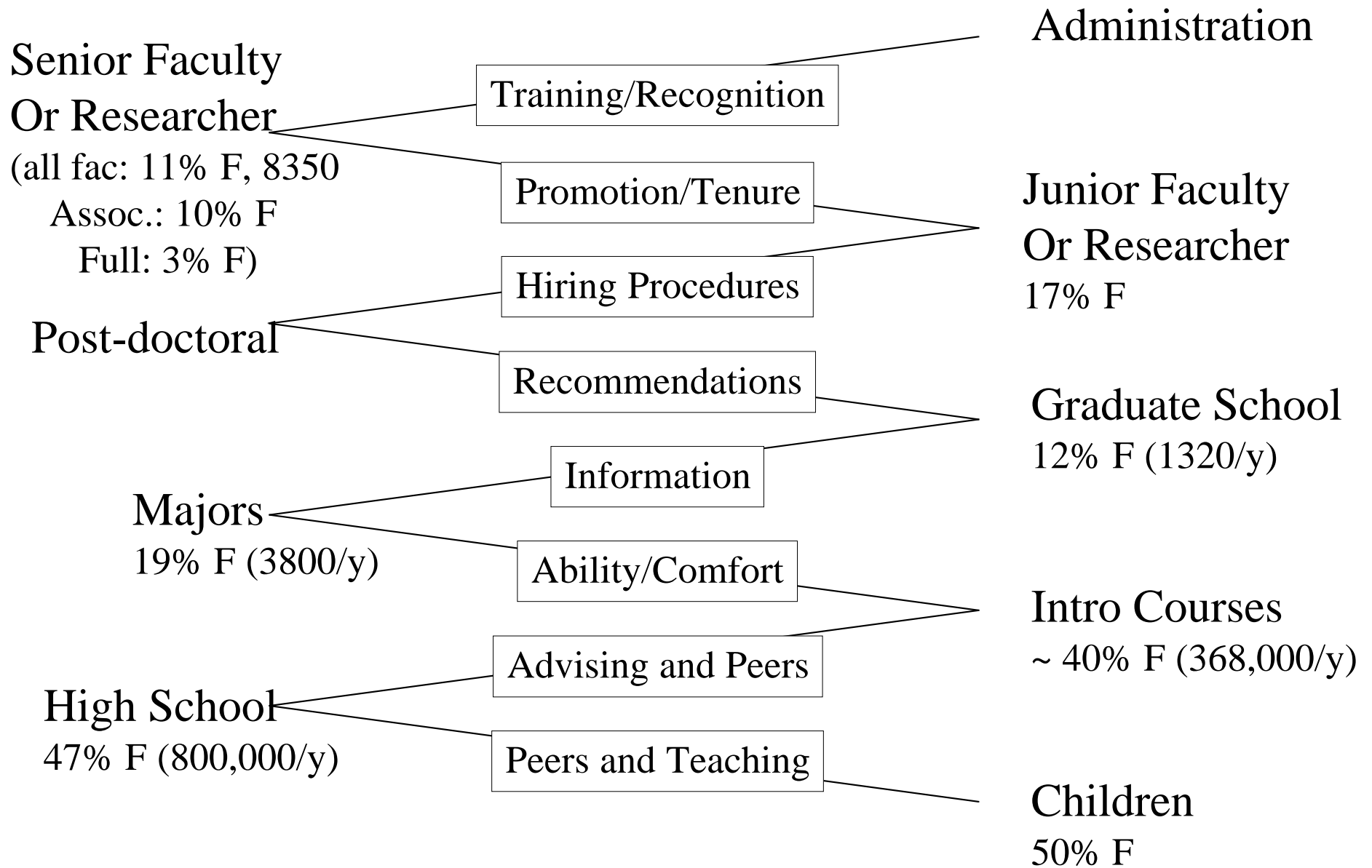
# Women in Science: Impressions of a US Physicist

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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



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

## Pre-College

- Seventh Grade (age 12) (*nces.ed.gov*)

| – <u>Favorite Subject</u> | <u>Boys</u> | <u>Girls</u> |
|---------------------------|-------------|--------------|
| Reading/Language Arts     | 6%          | 12%          |
| Social Studies            | 31%         | 12%          |
| <b>Science/Math</b>       | <b>63%</b>  | <b>76%</b>   |

- High School (*www.aip.org/statistics*)

|                            |   |                 |                      |
|----------------------------|---|-----------------|----------------------|
| – <u>Take HS Physics:</u>  | 28% all Students (highest since 1948)<br>(44% richest schools; 20% poorest schools) |                 |                      |
| – <u>% Girls in Class:</u> | <u>1987</u>   | <u>1997</u>     |                      |
|                            | 39%   | 47%             |                      |
| – <u>% Female Teachers</u> | <u>Public</u>   | <u>Catholic</u> | <u>Other Private</u> |
|                            | 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*)

| – <u>Subject</u> | <u>BS</u> | <u>MS</u> | <u>Ph.D.</u> | <u>Asst.</u> | <u>Assoc.</u> | <u>Full Prof.</u> |
|------------------|-----------|-----------|--------------|--------------|---------------|-------------------|
| 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

| – <u>Type</u> | <u>% Depts.</u> | <u># No-women/Total</u> | <u>Mean Size of Dept</u> |
|---------------|-----------------|-------------------------|--------------------------|
| 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

| – <u>#</u> | <u>1985</u> | <u>1998</u> |              |
|------------|-------------|-------------|--------------|
| 0          | 55%         | 24%         |              |
| 1          | 31%         | 30%         |              |
| 2          | 11%         | 19%         |              |
| 3          | 2%*         | 15%         | * =N or more |
| 4          |             | 12%*        |              |

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

# Historical Perspective

- Ph.D.'s Granted: *women/total* (US citizen & Perm. resident)

| – <u>Year</u> | <u>Engineering</u> | <u>Physical Science</u> | <u>Biological Science</u> |
|---------------|--------------------|-------------------------|---------------------------|
| 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*)

| – <u>Year</u> | <u>% Women</u> |
|---------------|----------------|
| 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

- | <u>Level</u> | <u>1992</u> | <u>1999</u> | (% female) |
|--------------|-------------|-------------|------------|
| Grad student | 23%         | 27%         |            |
| Post-Doc     | 17%         | 22%         |            |
| Asst. Prof.  | 17%         | 24%         |            |
| Assoc. Prof. | 12%         | 26%         |            |
| Full Prof.   | 5%          | 9%          |            |

# 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?

| – <u>Item</u>           | <u>Year 1</u> | <u>Year 2</u> | <u>Year 3</u> | <u>Year 4</u> | <u>Year 5</u> |
|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Lack of self-confidence | 23%           | 27%           | 26%           | 45%           | 49%           |
| Intimidation            | 23            | 36            | 42            | 19            | 26            |
| Isolation               | 8             | 13            | 8             | 50            | 46            |
| Lack of interest        | 13            | 18            | 17            | 38            | 31            |
| NONE                    | 23            | 18            | 22            | 3             | 9             |

# 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
  - Include : What if? Why? How? (not just What?)
  - Students in same groups for Physics, Chemistry, Math, English 1<sup>st</sup> 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
  - See *Science* article: 1999 November 12; 286: 1272-1278.
- 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