Women in Physics
Why Aren’t There More of Us?
~All galaxies host supermassive black holes
- first stars form
- remnant black holes
- galaxy+BH grow

“big bang” (inflation)

CMB

time
Space Telescope Science Institute
founded 1981

Women in Astronomy I - Baltimore, MD 1992
Why Diversity?

- Excellence of science
- Fairness/justice
- It’s a great life!
  - Taxpayers support science, so should benefit equally
- Health of science profession
  - More scientifically literate public
    ⇒ more public support of science
- Workforce issues …
More women are earning science and engineering PhDs
Attrition between B.S. and Ph.D. degrees

Bachelor’s Degrees, 1966-2004

56% → 45%  All fields

Figure 7. Percent of PhDs earned by women in selected fields.
Attrition between B.S. and Ph.D. degrees

Bachelor’s Degrees, 1966-2004

47% → 28%  Math

Figure 7. Percent of PhDs earned by women in selected fields.
Attrition between B.S. and Ph.D. degrees

Bachelor’s Degrees, 1966-2004

43% → 33%  Chemistry
Attrition between B.S. and Ph.D. degrees

Bachelor’s Degrees, 1966-2004

19% → 15%  Physics
Differential Attrition

% Physicists who are women (U.S.)
Career Disparities

- Long 2001
- Sonnert & Holton 1996

Synthetic cohorts, e.g., NSF fellows – career advancement of women slower
Salary Disparities

- *Egan & Bendick 1994* – factors that affect salary
- *Tesch et al. 1995* – resource allocation in academic medicine appointments
- *MIT Report, 1999* – resource allocation much greater for men than women
Reasons for Disparities?

- Not family (Mason & Goulden 2002 “Do Babies Matter?”)
- Xie & Shauman 2003 – interest not correlated with ability in science
- Seymour & Hewitt studies 1990s – persistence in science not correlated with ability
What’s going on?  “Gender Schemas”

- Not conscious discrimination or overt prejudice
- Not differences in innate ability
- Lower expectations for women
- Uneven evaluation (“unconscious bias”)
- Accumulation of disadvantage

Virginia Valian  *Why So Slow? The Advancement of Women*
Uneven Evaluation

- Key issue: *tilted playing field*
  - Paludi & Bauer 1983 – Blind refereeing
  - Double-blind refereeing 2008 *Nature*
Women aren’t as good as men at science…

Paludi & Bauer 1983, psychology paper sent to 180 referees (men & women)

<table>
<thead>
<tr>
<th>Author</th>
<th>Referee</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>John T. McKay</td>
<td>Men</td>
<td>1.9</td>
</tr>
<tr>
<td>Joan T. McKay</td>
<td>Women</td>
<td>2.3</td>
</tr>
</tbody>
</table>

(1=excellent, 5=bad)
The Objectivity of Science …

Biernat, Manis & Nelson 1991 – height
Porter & Geis 1981 – leaders at table
Butler & Geis 1990 – speaker evaluation
Dovidio et al. 1988 – eye gaze
Uneven Evaluation

- **Heilman et al. 2004** – rating asst. VPs
  Women can be friendly or competent, not both

- **Norton, Vandello & Darley 2004** – rating resumes for construction job

- **Uhlman & Cohen 2005** – shifting criteria and (non)objectivity

- **Heilman 1980** – critical mass is \( \sim 30\% \)

Valian annotated bibliography:
Sanbonmatsu, Akimoto & Gibson 1994
(Evaluation of failing students)
Letters of Recommendation

- Trix & Penska 2003 – letters for a prestigious medical fellowship
  - Length
  - Specificity
  - Superlatives v. “grindstone” adjectives
  - Doubt
  - Explicit mention of gender, personality, family
  - (Tenure letters: women on women)
Coaching (Mentoring)

Tony DeCicco, U.S. women’s soccer coach
Boston Globe, June 18, 1999
When job searches are gender-blind ...

blind audition... ...works for orchestras, writers, abstracts, resumes ...

See story of Munich Philharmonic trombonist (Abby Conant)
What’s going on? “Gender Schemas”

- Lower expectations for women
- Uneven evaluation (“unconscious bias”)
- Accumulation of disadvantage
  - *Martell, Lane & Emrich 1996* – 1% bias, 8 levels → 65% male top management
- Most of us are biased

Mahzarin Banaji  implicit.harvard.edu
Common Myths
Women lack math ability …

- **Stereotype threat:** performing below ability because of expectations
- **Example:** “hard” math test
  - Men: 25/100
  - Women: 10/100
  - Gender gap in math?
- “This test has been designed to be gender neutral”
  - Women: 20/100
  - Men: 20/100
- Also important for minorities
There aren’t any good women to hire …

- Jane Doe
- John Doe
- Keisha Doe
- Jamal Doe

(Research shows name strongly affects success of resume, even among psychologists who are well aware of gender schemas.)
Women choose family over career...

- Women w/o children not more successful
- Many women in other demanding fields
- Countries w strong support systems (e.g., Scandinavia) have few women in physics
- Academic careers flexible: become a professor, have a family!
11 Things You Can Do To Succeed

1. Work hard
2. Do something interesting
3. Uneven playing field – don’t be discouraged
4. Reject “lower standards”
5. Mentor up, down, and sideways
6. WiS: find allies, take turns following & leading
7. Use your full name
8. Prepare an “elevator speech”
9. Practice confidence after brushing
10. Give great talks
11. Be confident & enjoy yourself
Back-up slides
NAS Study: “Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering”

Statistics (U.S.)
Learning and performance  *intrinsic difference?*
Persistence and Attrition
Evaluation of success  *implicit bias*
Strategies that work
Undergraduate  *Carnegie Mellon*
  Hiring faculty  *U. Washington toolkit*
  Training women faculty  *CoaCH*
  ADVANCE  *CRLT players*
Institutional structures, career paths
Recommendations
~50% women scientists unmarried (in developed countries)

Women marry scientists/professionals
higher attrition for women between B.S. and Ph.D. degrees

If you need mentoring, you’re not good enough …

Women in Astronomy I - *Baltimore, MD* 1992
Women in Astronomy II – *Pasadena, CA* 2003