

KEEPING WOMEN IN PHYSICS

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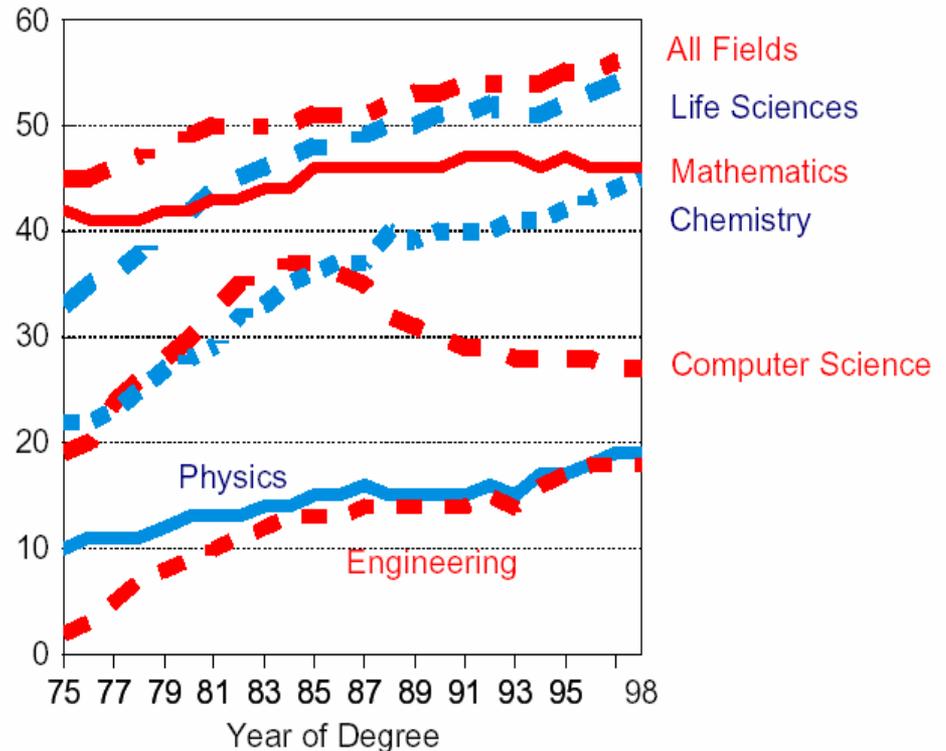


BACHELOR'S DEGREES IN SCIENCE

IN MOST FIELDS,
DEGREES ARE
INCREASINGLY
AWARDED TO
WOMEN.

BIOLOGY & MEDICINE
~ 50%.

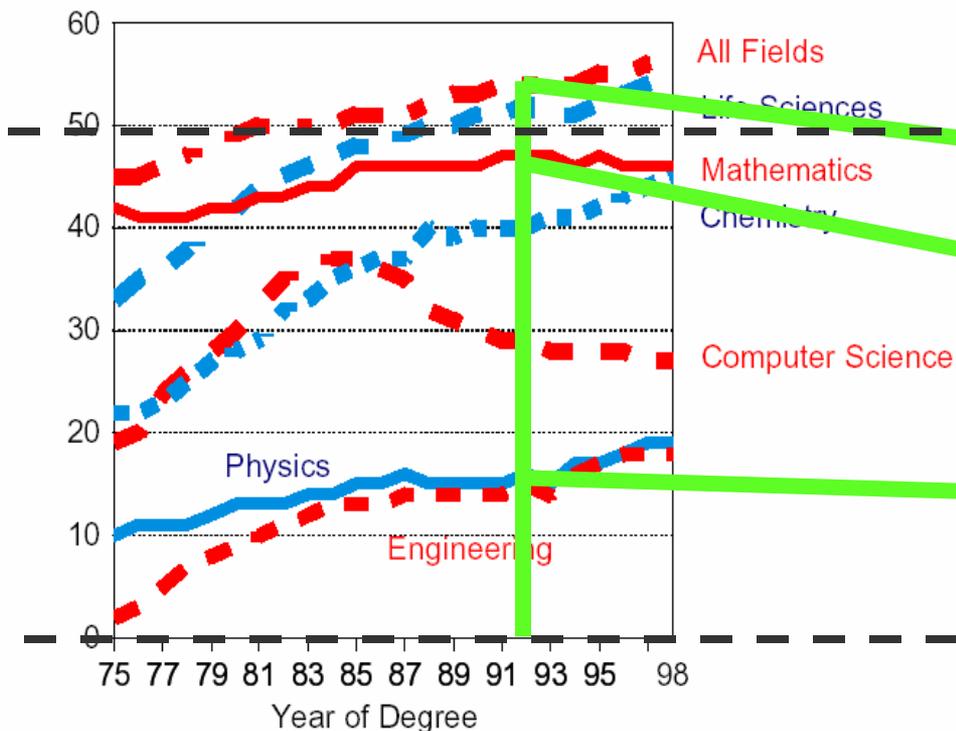
Figure 4. Percent of Bachelor's Degrees in Selected Fields Earned by Women, 1975-1997.



Source: AIP Statistical Research Center, Data from Mulvey & Nicholson, Enrollments and Degrees Report, and the National Center for Education Statistics.

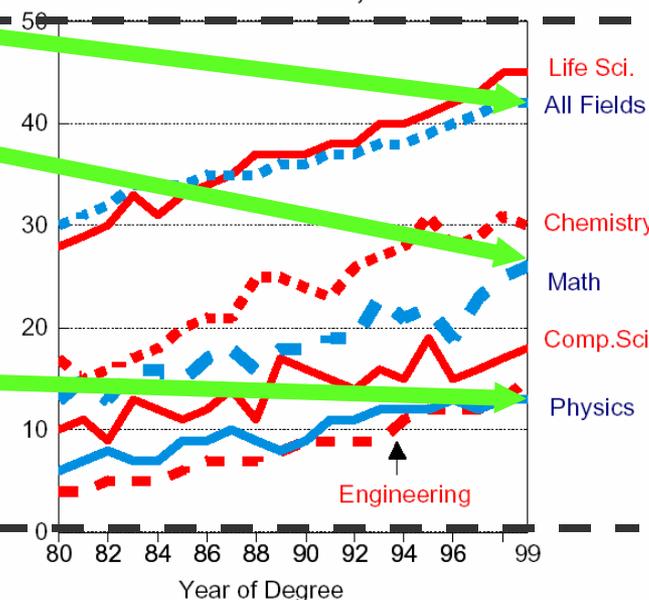
ATTRITION BETWEEN B.S. AND PH.D. DEGREES

Figure 4. Percent of Bachelor's Degrees in Selected Fields Earned by Women, 1975-1997.



16% → 12% Physics

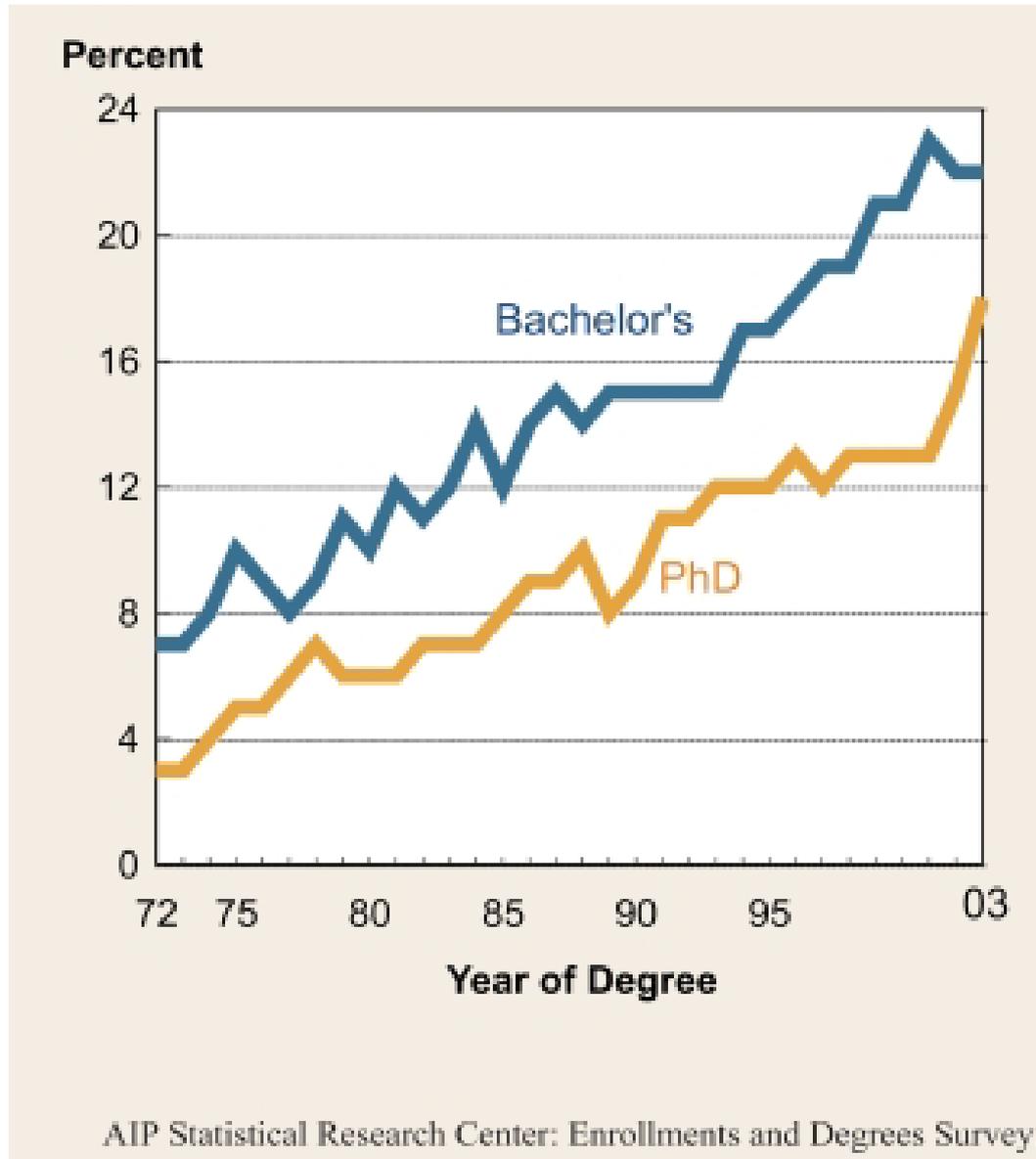
Figure 6. Percent of PhDs Earned by Women in Selected Fields, 1980-1998.



Source: AIP Statistical Research Center, Data from Mulvey & Nicholson, Enrollments and Degrees Report, and the National Center for Education Statistics.

Source: AIP Statistical Research Center. Data from Mulvey & Nicholson, Enrollments and Degree Report, and National Opinion Research Center.

WOMEN IN PHYSICS



Ivie & Ray 2005

WHY WORRY?

- Excellence of science
- Fairness/justice/equity
- 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
- Future workforce issues ...

Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering



THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

NAS STUDY: “BEYOND BIAS AND BARRIERS: FULFILLING THE POTENTIAL OF WOMEN IN ACADEMIC SCIENCE AND ENGINEERING”

Statistics

Learning and performance *no significant intrinsic differences*

Persistence and Attrition *higher attrition of women at all levels*

Evaluation of success *unconscious bias has strong effects*

Strategies that work *NSF ADVANCE programs*

Undergraduate *e.g., Carnegie Mellon*

Hiring faculty *e.g., U. Washington toolkit*

Training women faculty *e.g., CoaCH (Chemists)*

ADVANCE *CRLT players*

Institutional structures, career paths

Recommendations

WHAT'S GOING ON?

- Not overt discrimination or prejudice
- Not differences in innate ability
- Key issue: *tilted playing field*
- Uneven evaluation
 - *Wenneras & Wold 1997 Nature*
 - *Double-blind refereeing*

COMMON MYTHS



WOMEN LACK MATH ABILITY ...

- Stereotype threat: performing below ability because of expectations
- Example: “hard” math test given to undergraduates
 - Men: 25/100
 - Women: 10/100
 - Gender gap in math ???
- Other students given same test, except marked thus:
“This test has been designed to be gender neutral”
 - Women: 20/100
 - Men: 20/100

Now they get the same score! Extensive testing shows women under-perform when in stressful situations for which they, according to stereotype, lack talent.
- Same results found for minorities

WOMEN DON'T LIKE PHYSICS...

They prefer “caring” fields like medicine...

But women in academic medicine are equally far behind, so it can't be subject matter.

Hypothesis: More elite, competitive culture

→ fewer women

THERE AREN'T ANY GOOD WOMEN TO HIRE ...

- Jane Doe *Research shows the name at the top of*
 - John Doe *a resume strongly affects the*
 - Keisha Doe *candidate's probability of getting an*
 - Jamal Doe *interview, even among psychologists*
- who are well aware of gender schemas.*

Heilmann, using resume studies, showed that women are judged less competent than men with equal qualifications. She then showed that when the women are pre-validated by an external authority, they are judged equal to the men but are perceived as hostile and unfriendly.

So: Women can be friendly or competent, not both

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 are very flexible: *become a professor, have a family!*

SCIENTISTS ARE COMPLETELY OBJECTIVE ...



Biernat, Manis & Nelson 1991

Porter & Geis 1981

Butler & Geis 1990

Experiment: subjects shown photos of men and women standing near familiar objects, asked to estimate heights.

Photos were selected so distribution of heights was the same for men and for women.

Because men are taller on average than women, subjects routinely underestimated the height of women in the photos and overestimated the height of the men, such that their estimates conformed to their expectations (and population norms).

In our society, there are far more men in science than women. In analogy to the height experiment, it is conceivable that people's expectations are shaped by this demographic fact – so that people believe men are better at science than women, creating unconscious bias in evaluations (i.e., higher expectations and ratings of men compared to women).

JOB SEARCHES ARE GENDER-BLIND ...

Some professions have “blind auditions” for jobs. E.g.,

- The Modern Language Association uses blind reviews to vet abstracts for its influential annual meeting.
- Most orchestras now audition performers behind a screen, with a carpeted walkway to hide the clicking of women’s heels.

The results are that far more women pass the hurdle than was the case before blind review.

Unfortunately, this approach is not possible for scientific job talks.

See story of Munich Philharmonic trombonist (Abby Conant)

COACHING (MENTORING)



Tony DeCicco, who coached the U.S. women's soccer team that won the World Cup, was profiled in the Boston Globe, June 18, 1999.

He explained the transition from coaching men's teams to coaching women. At first, he treated them as he had the men. After all, these

were tough, highly competitive, outstanding athletes at the top of their game. Then he realized the women were obsessing for days about every critical comment he made. So he consciously switched to making many more positive remarks, and rarely making critical remarks. The players performance improved markedly.

This could be very relevant to supervising graduate students in the lab – not all students benefit from the same style of “coaching.”

WHAT'S GOING ON? “GENDER SCHEMAS”

- Lower expectations for women – *leading to:*
- Uneven evaluation – *that over time leads to a dramatic:*
- Accumulation of disadvantage

See Virginia Valian's “Why So Slow? The Advancement of Women” (1999, MIT Press) for a thorough discussion.

- *Martell, Lane & Emrich 1996* – ran a computer simulation that showed that a 1% bias, operating through 8 promotion levels in an organization, quickly led to 65% male top management.



REMEDIES

- Women and men: educate yourselves
 - Recognize uneven playing field
 - Nix “lower standards” – the goal is excellence, not social engineering. If someone thinks hiring minorities or women requires lowering standards, they fundamentally do not understand the disparities in evaluation that are prevalent today.
- Young women:
 - *Don't pay attention to disparities, let others (senior scientists) fight those battles for you – not because you don't care or aren't effective, but because you need to guard your time carefully, and the most important thing you can do for women in science is to do outstanding science and to become successful as a scientist. Later, when you are in a position of power, please do speak out about this issue – but don't use the time when you so need it to advance your research (and when you have relatively little power).*
 - *Be prepared – recognize discouragement or a sense of difference as that, and not as a sign you do not belong in the field.*
- Leaders: *lead*
 - Pressure from the top can be highly effective
 - Training (e.g., how to hire, Denton/UWa)
 - Accountability – hold yourself and others accountable for success in attracting and retaining top women and minority scientists.