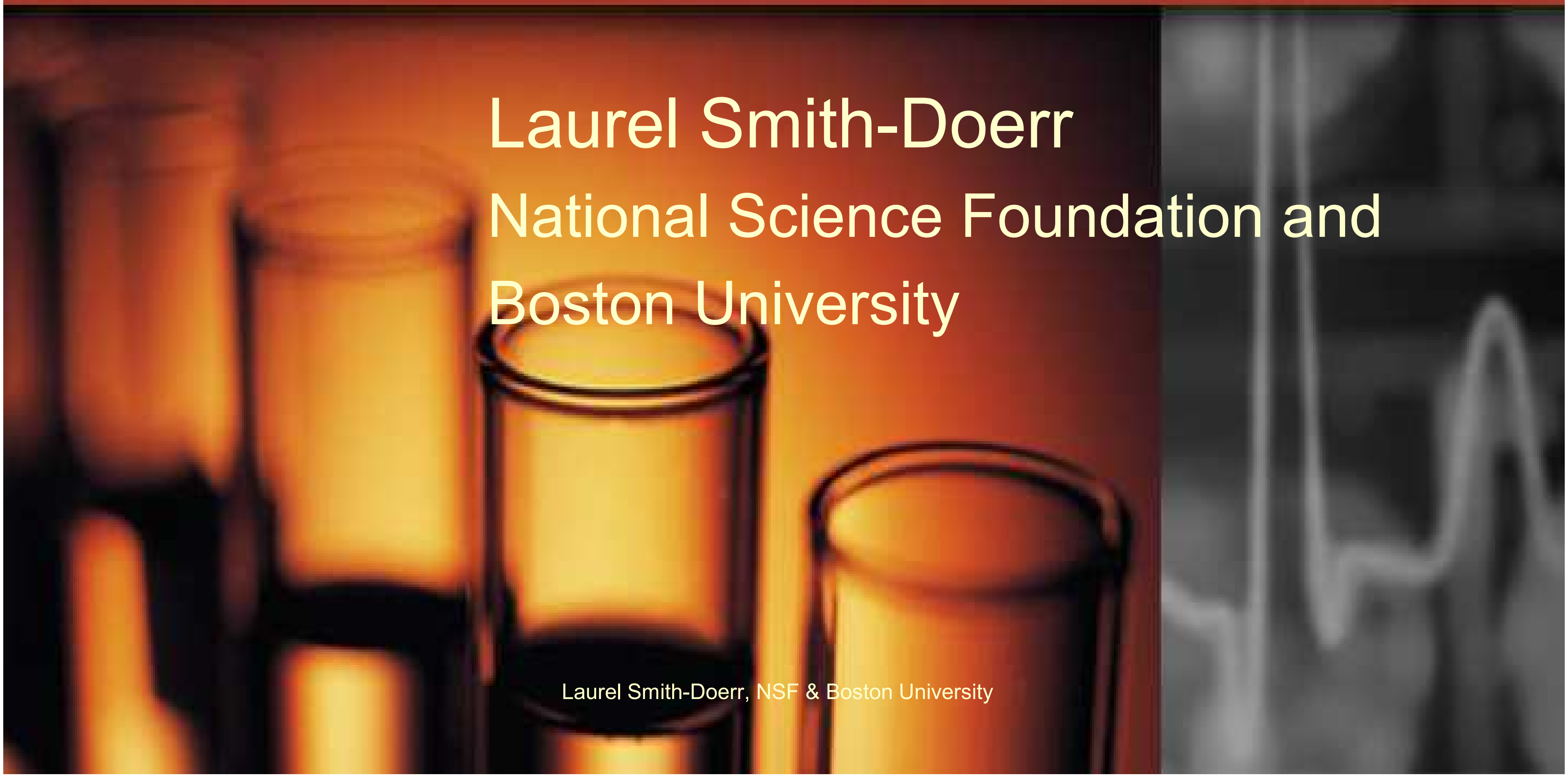
Gender Equity in Science: Lessons from the Life Sciences



Laurel Smith-Doerr

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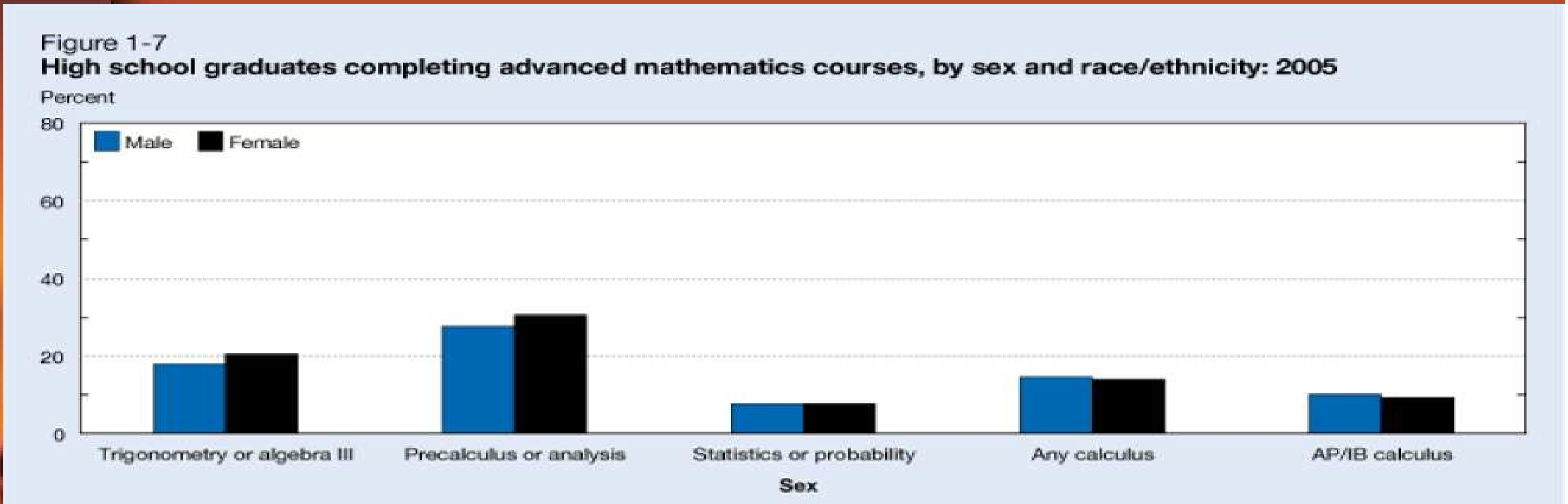
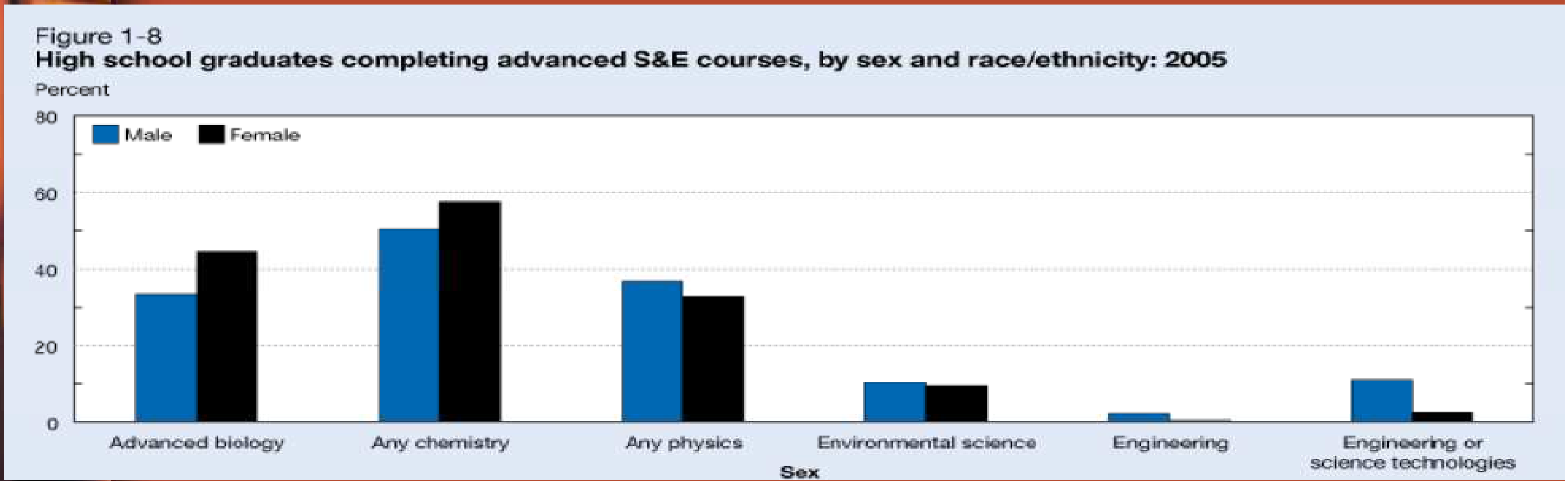
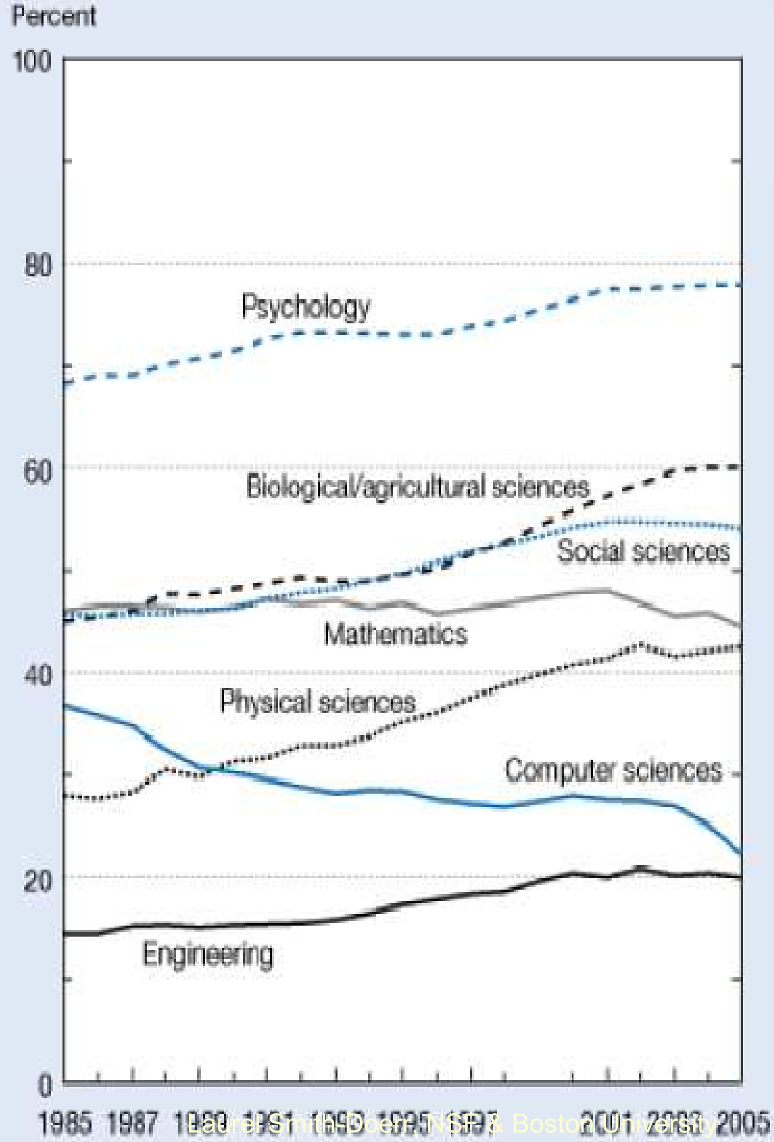




NSF, Science & Engineering Indicators, 2008

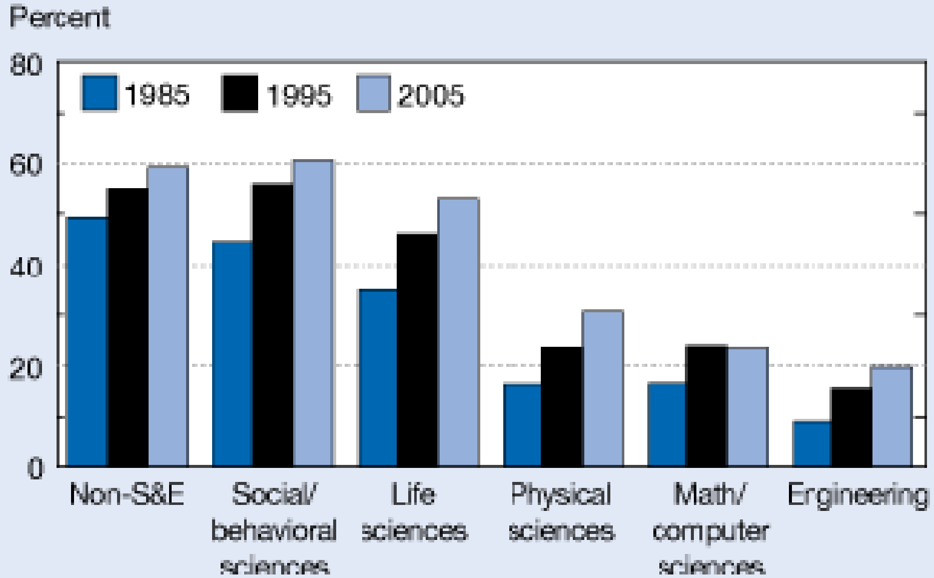
Figure 2-15
Female share of S&E bachelor's degrees, by field: 1985–2005



NSF, S&E Indicators, 2008

Figure 2-21

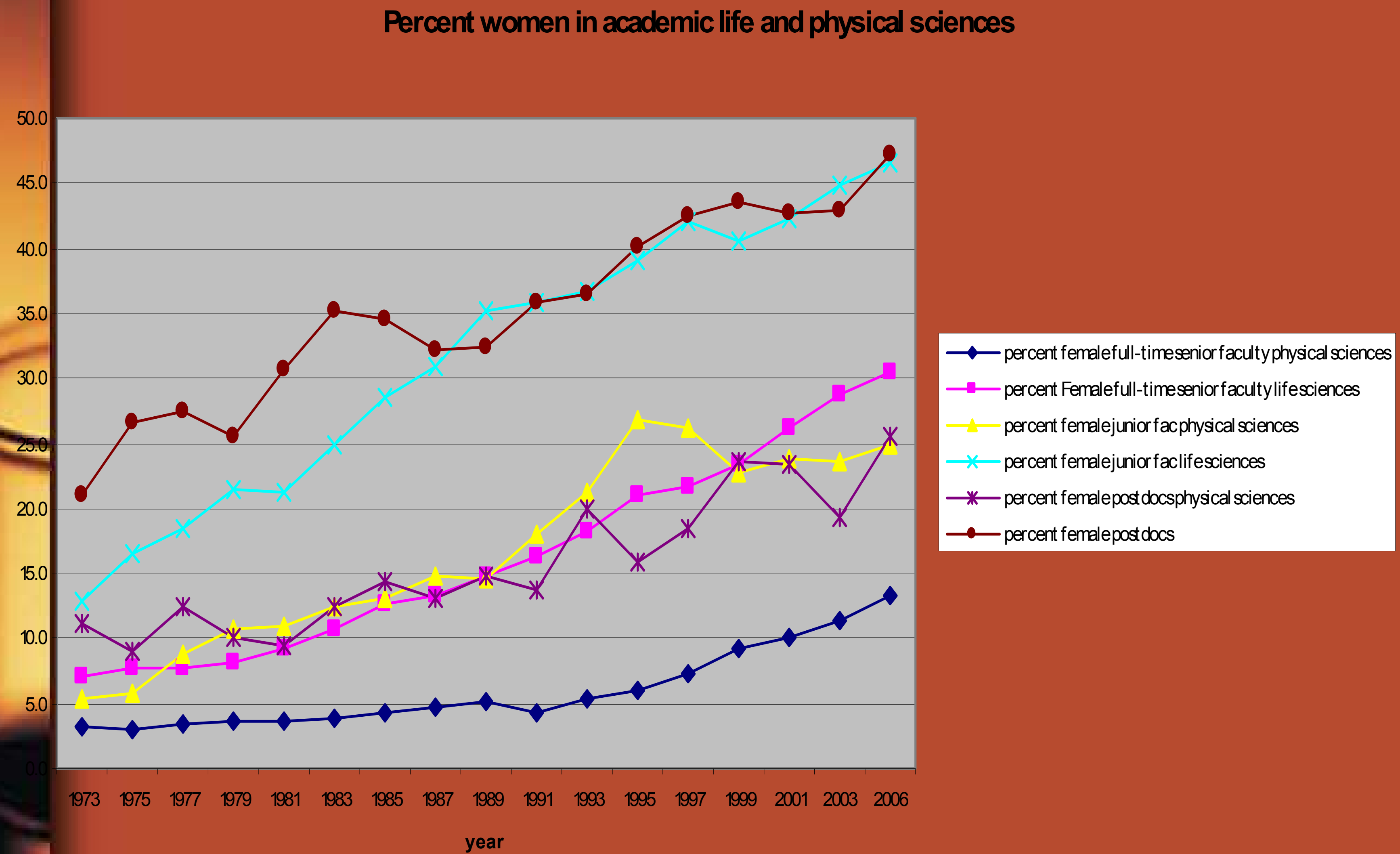
U.S. citizen female share of doctoral degrees, by field: 1985, 1995, and 2005



NOTES: Physical sciences include earth, atmospheric, and ocean sciences. Life sciences include biological sciences, agricultural sciences, and medical/other life sciences.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates, WebCASPAR database, http://webcaspar.nsf.gov. See appendix table 2-31.

Science and Engineering Indicators 2008



Laurel Smith-Doerr, NSF & Boston University

Calculated from NSF S&E Ind 2008, app table 5-19

Table 12. Female Professors by Rank and Year at Top 50 Departments

Discipline	FY2002*				FY2007			
	Assistant	Associate	Full	All Ranks	Assistant	Associate	Full	All Ranks
Chemistry	21.5%	20.5%	7.6%	12.1%	21.7%	21.3%	9.7%	13.7%
Math	19.6%	13.2%	4.6%	8.3%	28.0%	15.5%	7.2%	12.1%
Computer Sci	10.8%	14.4%	8.3%	10.6%	19.5%	11.3%	11.5%	13.5%
Electrical Engr	10.9%	9.8%	3.8%	6.5%	14.5%	14.1%	6.2%	9.7%
Mechanical Engr	15.7%	8.9%	3.2%	6.7%	18.2%	12.0%	4.9%	9.0%
Physics	11.2%	9.4%	5.2%	6.6%	17.5%	12.6%	6.8%	9.5%
Civil Engr	22.3%	11.5%	3.5%	9.8%	25.3%	14.3%	7.1%	12.7%
Chemical Engr	21.4%	19.2%	4.4%	10.5%	23.7%	17.8%	8.3%	12.9%
Astronomy**	20.2%	15.7%	9.8%	12.4%	25.3%	21.6%	12.3%	15.8%
Economics	19.0%	16.3%	7.2%	11.5%	30.7%	16.0%	8.5%	15.1%
Political Science	36.5%	28.6%	13.9%	23.5%	35.9%	30.1%	17.4%	25.6%
Sociology	52.3%	42.7%	24.3%	35.8%	57.9%	45.6%	28.0%	39.7%
Psychology	45.4%	40.1%	26.7%	33.5%	44.8%	41.9%	29.9%	36.0%
Biological Sci	30.4%	24.7%	14.7%	20.1%	36.0%	30.9%	17.7%	24.8%
Earth Sciences	not available				28.6%	21.7%	10.6%	16.1%

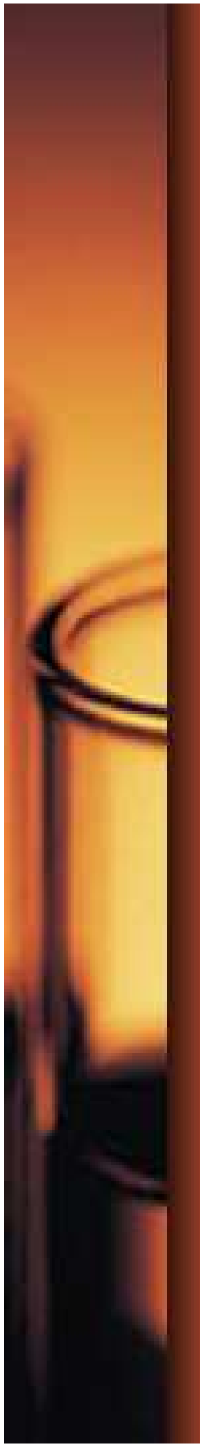
*Chemistry and astronomy data are for FY2003. **Top 40 departments

Donna Nelson, 2007,
http://cheminfo.chem.ou.edu/~djn/diversity/Faculty_Tables_FY07/07Report.pdf

Women as percent of scientists in 2003

- Life Scientists employed in business/industry: 42%
- Life Scientists employed in academia: 44%
- Physical Scientists employed in business/industry: 30%
- Physical Scientists employed in academia: 28%

Calculated from NSF, 2006, *Women, Minorities and Persons with Disabilities in Science & Engineering*, table H-19



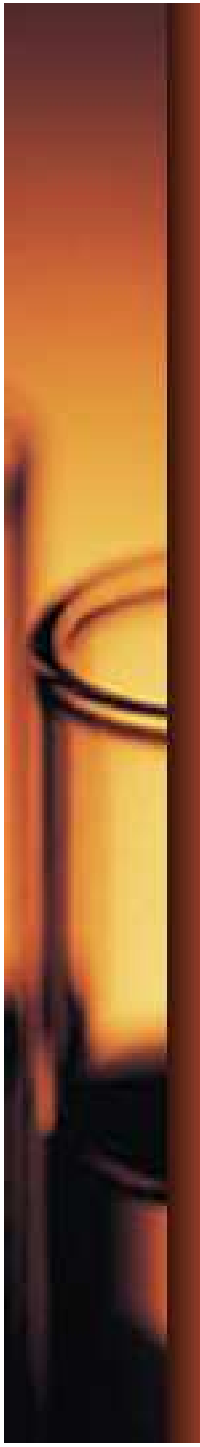
Understanding the gender gap in science

- Social psychological studies of cognitive bias
- Individual level studies of career attainment—socialization, work/family roles, discrimination

✓ Organizational level studies

  - Most often focus only on academic settings

  ✓ My focus—looking at life science careers across academic and industry contexts



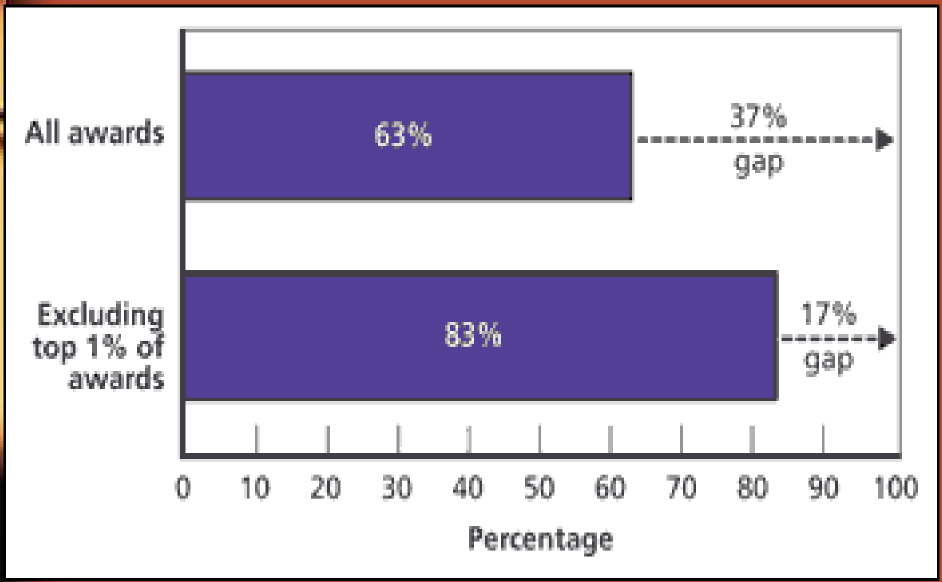
Unconscious bias—one example

- Randomized experiment on 238 faculty members (Steinpres et al. 1999)
  - Evaluating CV's of tenure candidates,
  - Evidence of bias by both male/female respondents when CV had female name
- Test yourself online: https://implicit.harvard.edu/implicit/research/

Socialization and work/family roles

- Gendered expectations about family roles changing, but Gender distribution of household labor changing more slowly
  - One study of faculty (Suitor et al. 2001), male faculty report same number of hours as US male avg (10 hours), but female faculty ‘only’ 50% more household hours.
- Family characteristics have different impacts on women's and men's promotion probabilities in academic science (Ginther and Kahn 2006).
  - Single women do better at each stage than single men.
  - For women: Children make it less likely that women in science will advance up the academic job ladder beyond their early post-doctorate years
  - For men: both marriage and children increase men's likelihood of advancing.

Women scientists receive 63 cents for every $1 men get from NIH



- In FY 2001-3, controlling for age, education, institutional and grant factors.
- Source: RAND study 2005, Hosek et al., *Gender Differences in Major Federal External Grant Programs*. (http://www.rand.org/publications/RB/RB9147/)

The double standard

- Life sciences (Wenneras and Wold 1997)

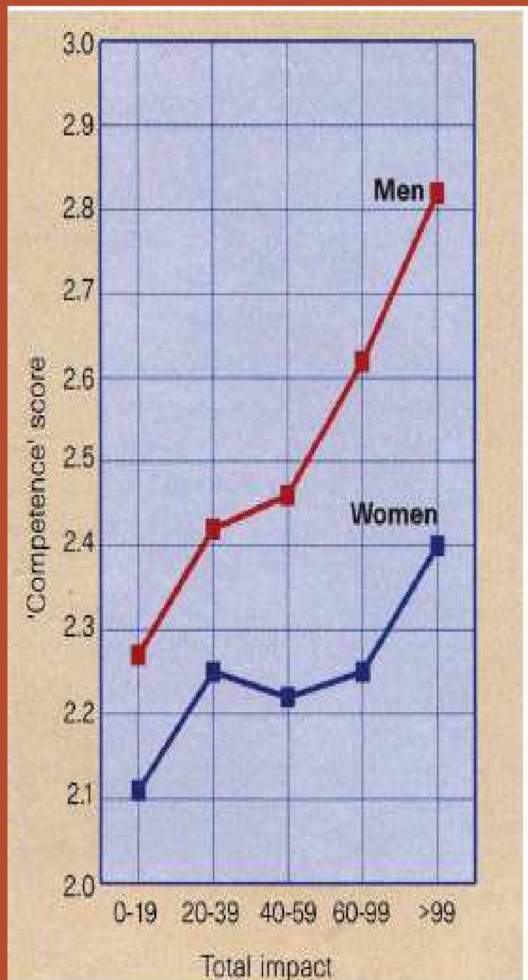
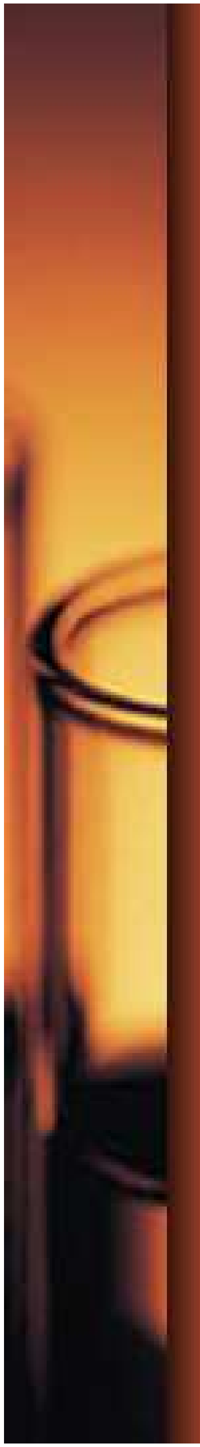


Figure 1 The mean competence score given to male (red squares) and female (blue squares) applicants by the MRC reviewers as a function of their scientific productivity, measured as total

- Physics (Towers 2008)
  - Fermilab experiment, Run II Dzero
  - Women postdocs more productive than men postdocs, but awarded 1/3rd as many conference paper presentations on average



Network Organizations v. Hierarchies

- Network Organizations:

  Indefinite and sequential interaction structure, norms govern relations, partners pool resources, expectations foster collaboration but are not rule bound, flows of non-redundant “freer” info (Powell 1990).

  Life sciences example: biotechnology firms dedicated to human therapeutics (often locally clustered)

  Question for women in science—do old boy networks flourish in the absence of rules?

- Hierarchies:

  Employment in formal authority structure patterns interaction, rules govern relations, resources (including info) distributed according to rank, mass production of reliable products of a given quality.

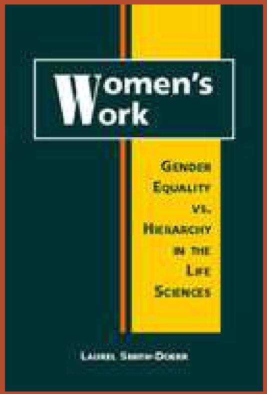
  Life sciences examples: multinational pharmaceutical corporations (global), universities (less clustered)

  Question for women in science—does bureaucratic procedure combat discrimination, or hide biased informal organization?

Table 5.4 **Likelihood of male and female scientists moving into supervisory positions, in biotechnology firms compared to hierarchical settings**

Gender	Change in odds of supervising in biotech	Change in odds of supervising in hierarchy
Male	No difference	No difference
Female	7.9 times more likely	60% decrease in odds

Source: All else being equal, based on logistic regression results reported in Appendix,



Source: Smith-Doerr (2004, *Women's Work*) based on logistic regression analysis controlling for years since PhD, prestige of PhD program; N=2,062

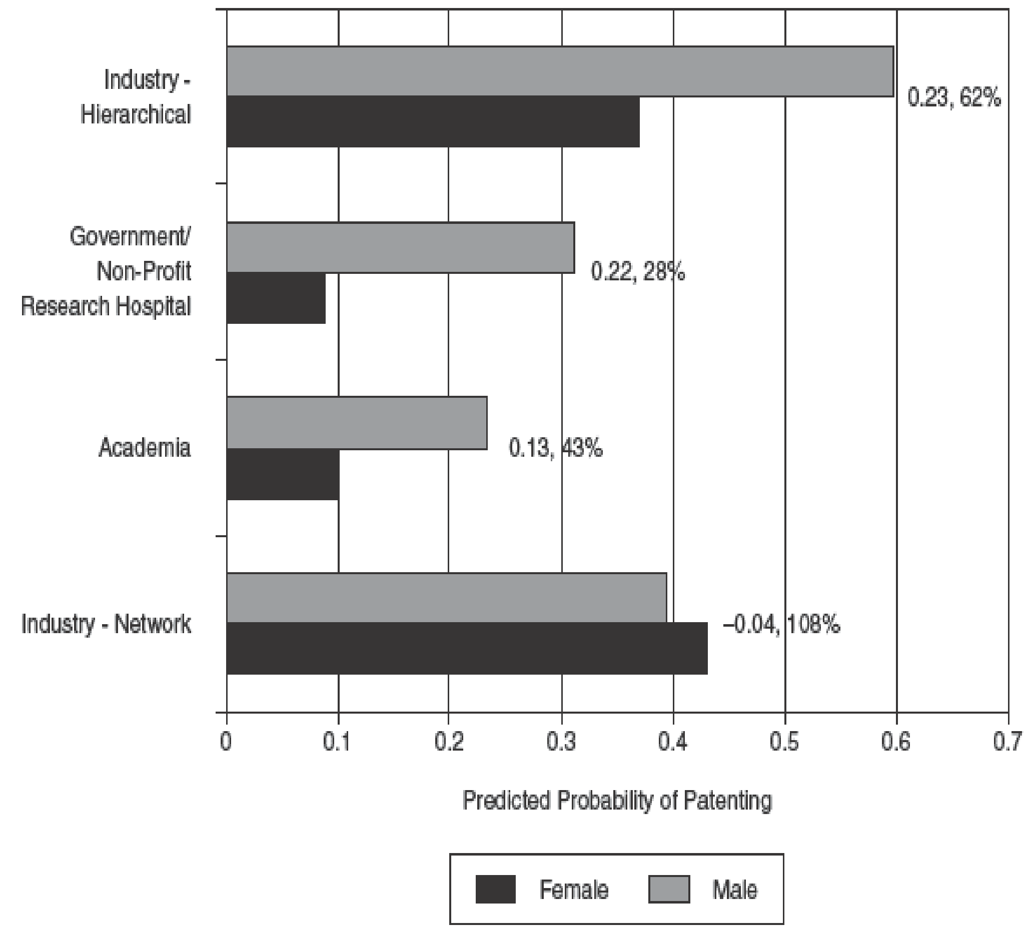
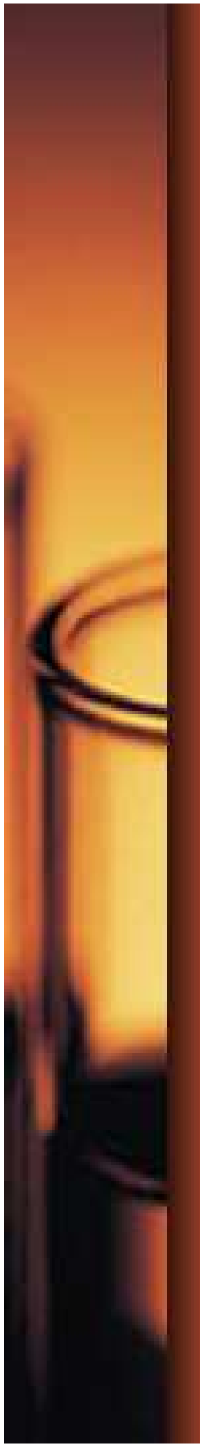


Figure 1: Predicted Probabilities of Patenting, by Sex and Sector

NOTE: Numbers in boxes refer to the difference in probabilities between men and women (M-F) and the F/M predicted probability ratio (multiplied by 100).

Note: All other variables are held at mean.

Source: Whittington and Smith-Doerr (2008). N=961.



Why greater equity in biotech firms?

Clues from interviews (Smith-Doerr 2004, N=47).

- 1. Flexibility in collaboration
  - About a woman scientist friend: “left a tenured position at [an elite university] to go to [a biotechnology firm]…said the university department under [Chairman] was an autocracy…could do science there [at firm]—working with who they wanted to rather than dealing with [Chairman].”
- 2. Transparency
  - “From my experience at [academic setting] I could tell you many a true story about political infighting…[at biotech firm] we are not compartmentalized—and get to work with many good scientists both here and outside the firm. And we choose who to work with based on nonfinancial considerations, like how good they are in their field.”
- 3. Collective rewards
  - “While I was on maternity leave here [biotech firm] I could keep in touch with my colleagues who kept it moving forward…when I was a postdoc at [prestigious academic institute], people collaborated somewhat, on the fringes of their work, but still had their main turf which they guarded carefully.”

Some lessons

- Environment matters—organizations with greater transparency and collaborative flexibility have greater equity
- Awareness matters—unconscious bias mitigated by attention to equity
- Diversity matters