Consistently Ranked Among the "Top Ten" Scientists of All Time

Who Are They?

A)

B)

C)

D)

E)

F)

G)

H)

I)

J)

Who Are They?

A) Louis Pasteur

B) Galileo Galeli

C) Charles Darwin

D) Aristotle

E) Albert Einstein

F) Thomas Edison

G) Gregor Mendel

H) Nicola Tesla

I) Marie Curie

J) Isaac Newton


A
B
C
D
E
F
G
H
I
J
K
L
M
N

Who Are They?

A)
B)
C)
D)
E)
F)
G)
H)
I)
J)
K)
L)
M)
N)

Who Are They?

A) Clyde Tombaugh

B) Caroline Herschel

C) Carl Sagan

D) Jocelyn Bell Burnell

E) Maria Mitchell

F) Willian Herschel

G) Neil deGrasse Tyson

H) Albert Einstein

I) Edwin Hubble

J) Nicolas Copernicus

K) Subramayan Chandrasekhar

L) Steven Hawking

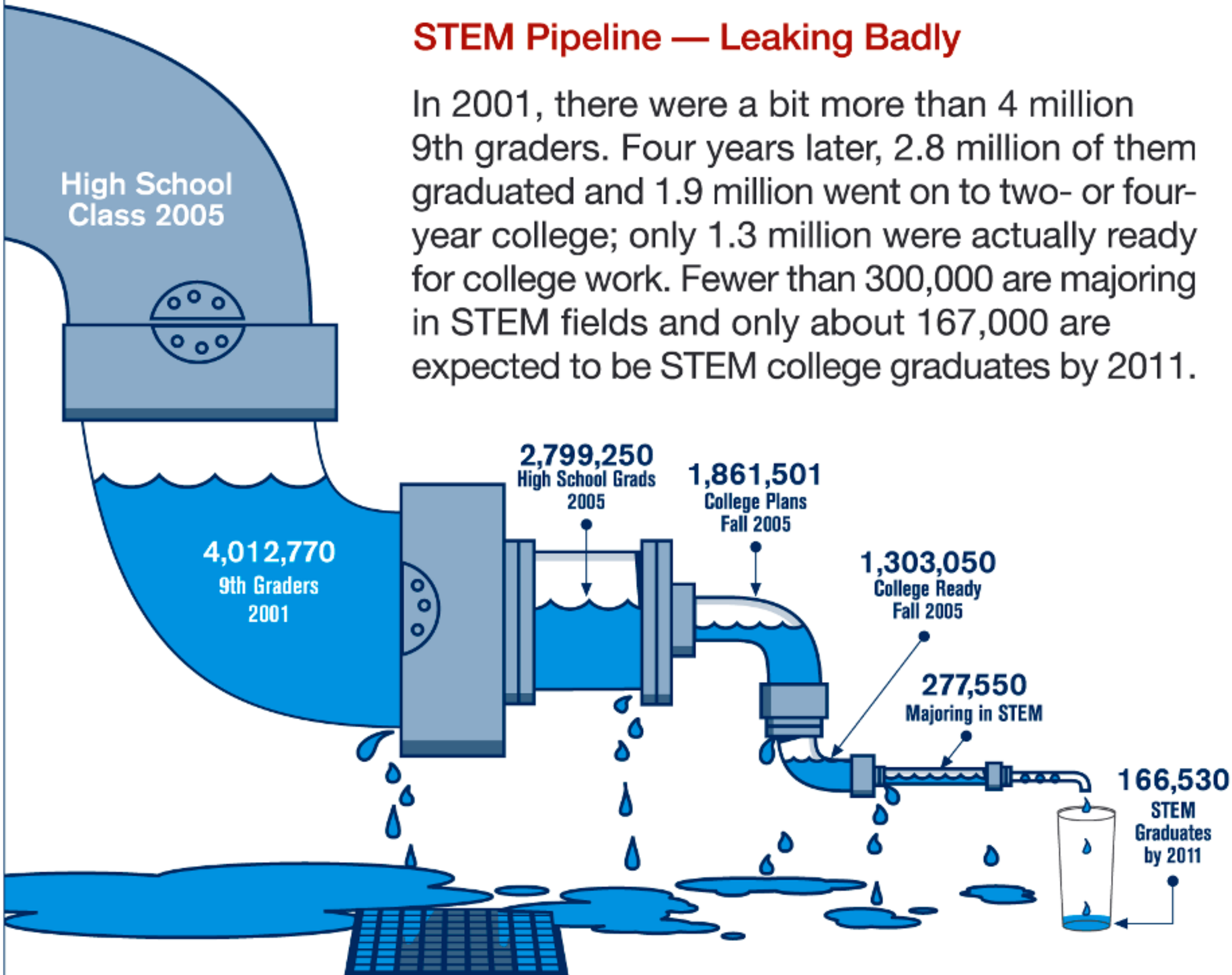
M)Isaac Newton

N) Galileo Galeli

Women in STEM

STEM Pipeline — Leaking Badly

In 2001, there were a bit more than 4 million 9th graders. Four years later, 2.8 million of them graduated and 1.9 million went on to two- or four-year college; only 1.3 million were actually ready for college work. Fewer than 300,000 are majoring in STEM fields and only about 167,000 are expected to be STEM college graduates by 2011.



Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008

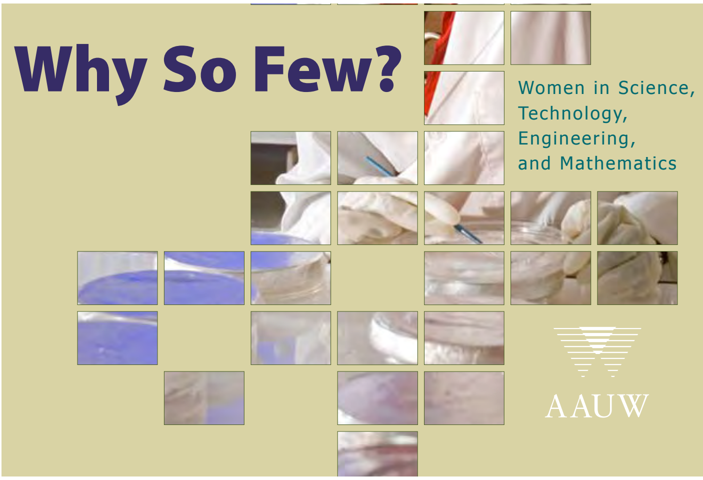
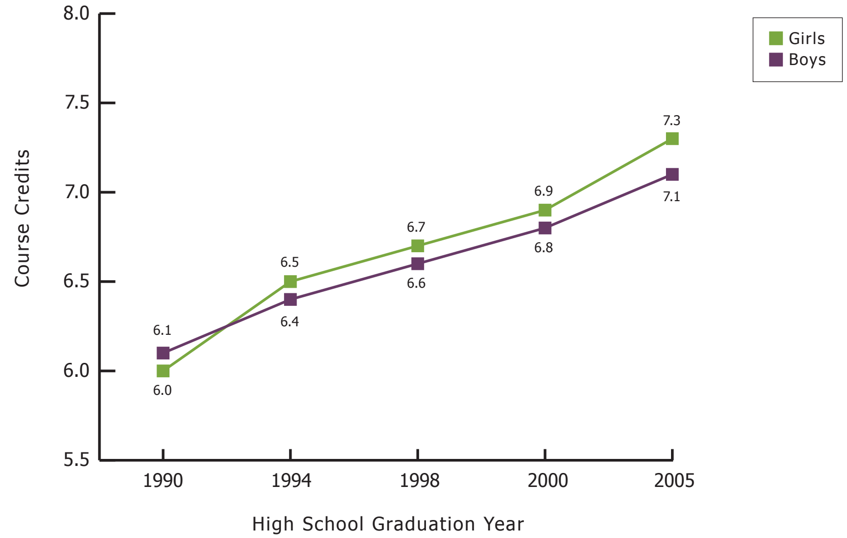
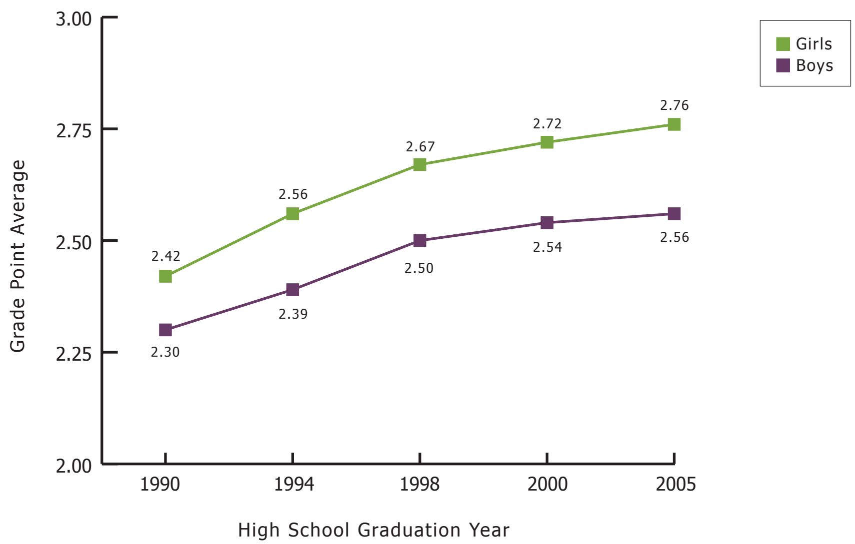


Figure 1. High School Credits Earned in Mathematics and Science, by Gender, 1990–2005



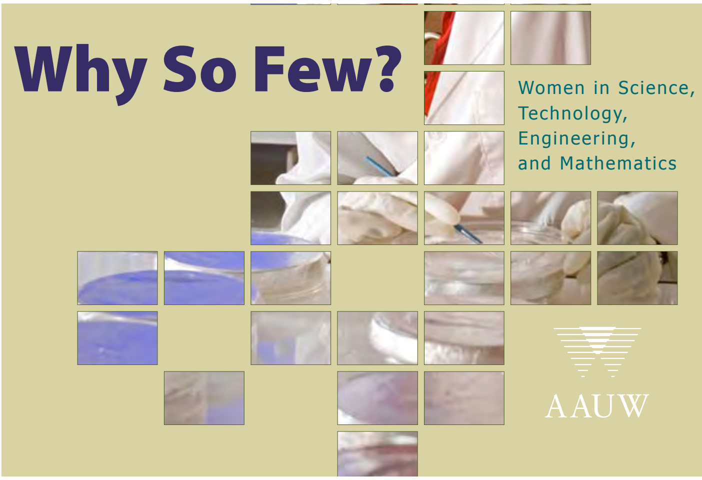
Source: U.S. Department of Education, National Center for Education Statistics, 2007, *The Nation's Report Card: America's high school graduates: Results from the 2005 NAEP High School Transcript Study*, by C. Shettle et al. (NCES 2007-467) (Washington, DC: Government Printing Office).

Figure 2. Grade Point Average in High School Mathematics and Science (Combined), by Gender, 1990–2005



Source: U.S. Department of Education, National Center for Education Statistics, 2007, *The Nation's Report Card: America's high school graduates: Results from the 2005 NAEP High School Transcript Study*, by C. Shettle et al. (NCES 2007-467) (Washington, DC: Government Printing Office).

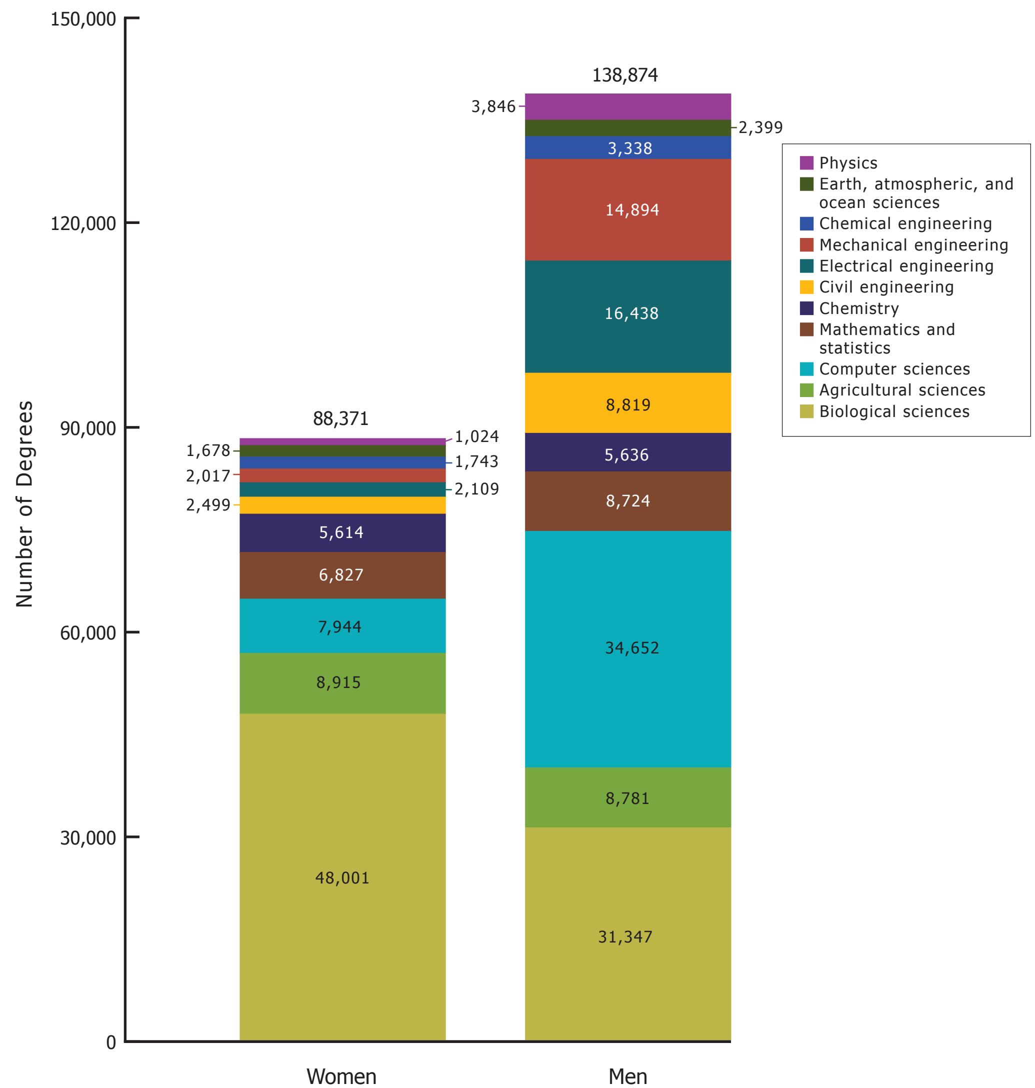
Women take more math, and perform better in High school



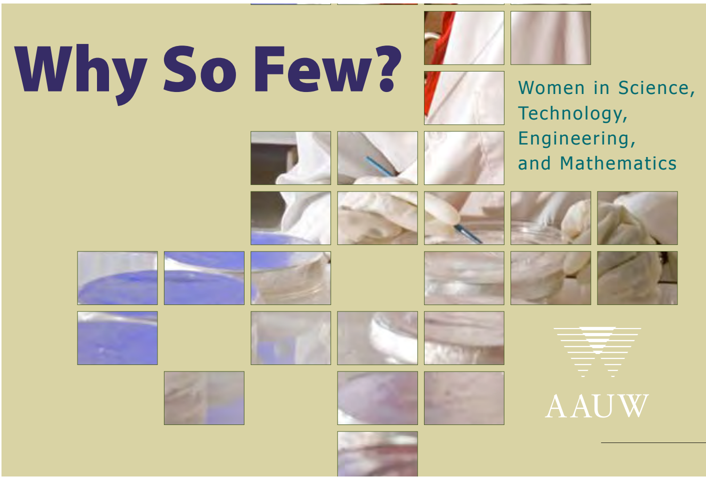
Women Physics Majors = 1024/227245=0.45% of STEM graduates
Men Physics Majors = 3846/227245=1.69% of STEM graduates

2007 Physics Bachelors Degrees:
1024/4870=21% Women
3846/4870=79% Men

Figure 7. Bachelor's Degrees Earned in Selected Science and Engineering Fields, by Gender, 2007



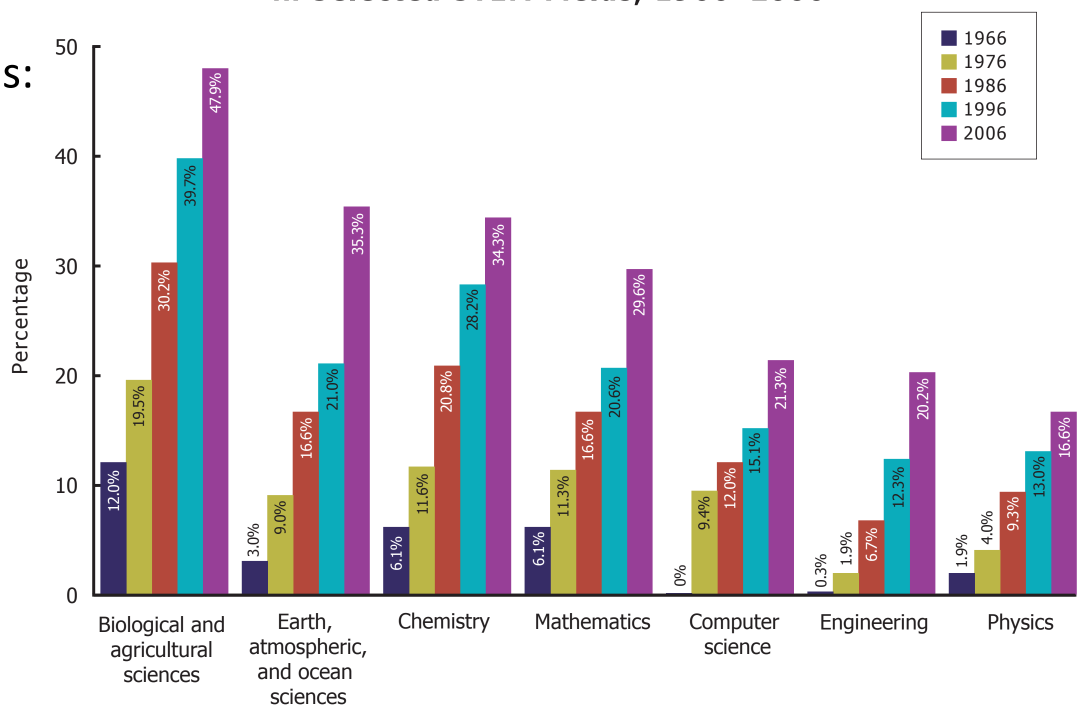
Source: National Science Foundation, Division of Science Resources Statistics, 2009, *Women, minorities, and persons with disabilities in science and engineering: 2009* (NSF 09-305) (Arlington, VA), Tables C-4 and C-5.



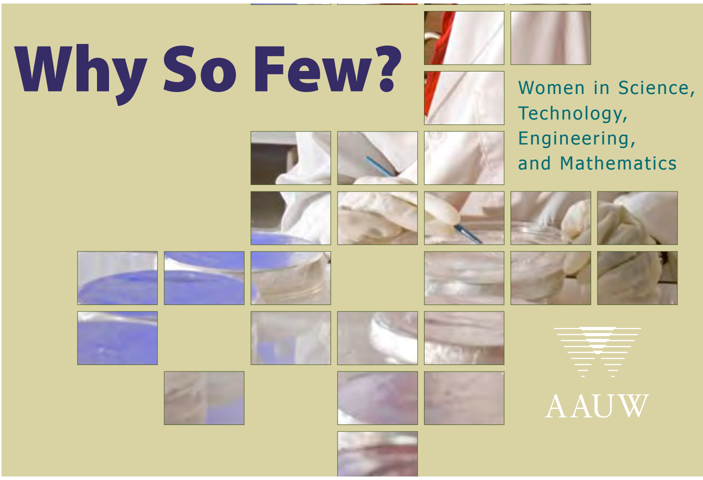
2007 Physics Bachelors Degrees:
1024/4870=21% Women
3846/4870=79% Men

Physics Doctorates:
16.6% women in 2006

Figure 9. Doctorates Earned by Women in Selected STEM Fields, 1966–2006



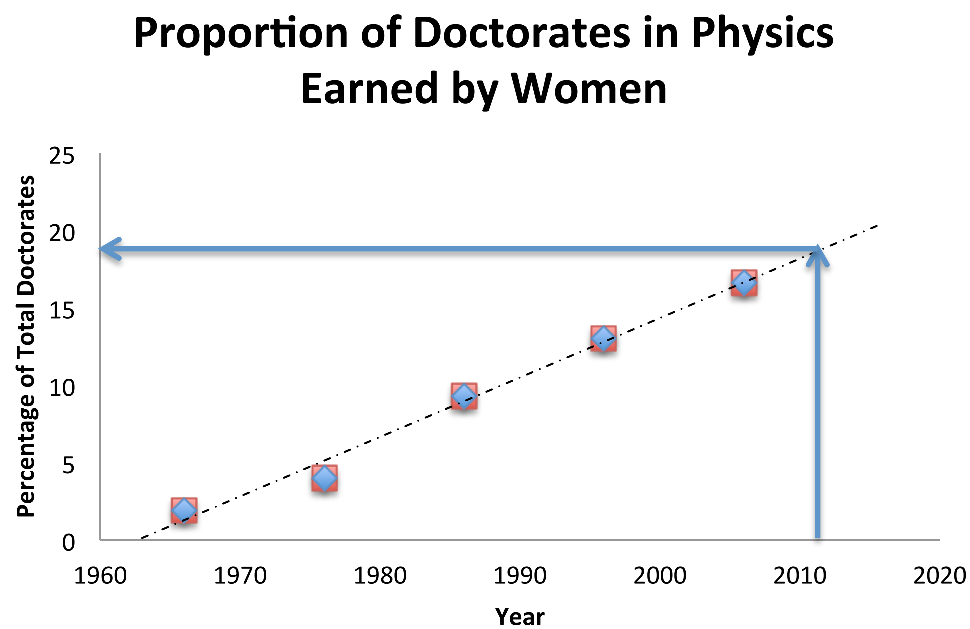
Source: National Science Foundation, Division of Science Resources Statistics, 2008, *Science and engineering degrees: 1966–2006* (Detailed Statistical Tables) (NSF 08-321) (Arlington, VA), Table 25, Author's analysis of Tables 34, 35, 38, & 39.

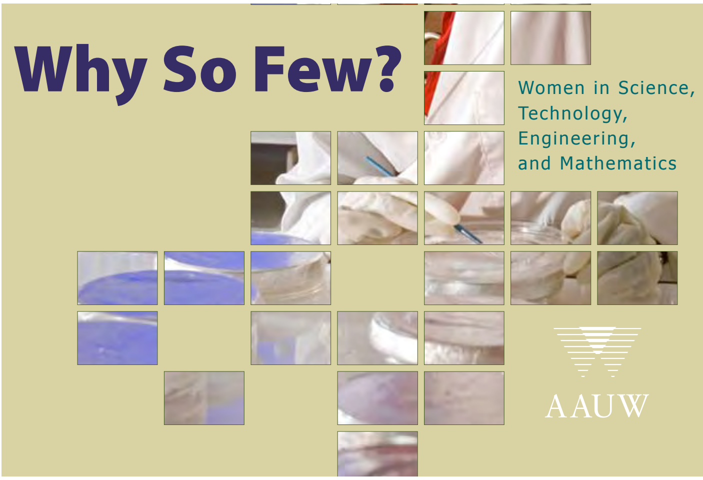


2007 Physics Bachelors Degrees:
1024/4870=21% Women
3846/4870=79% Men

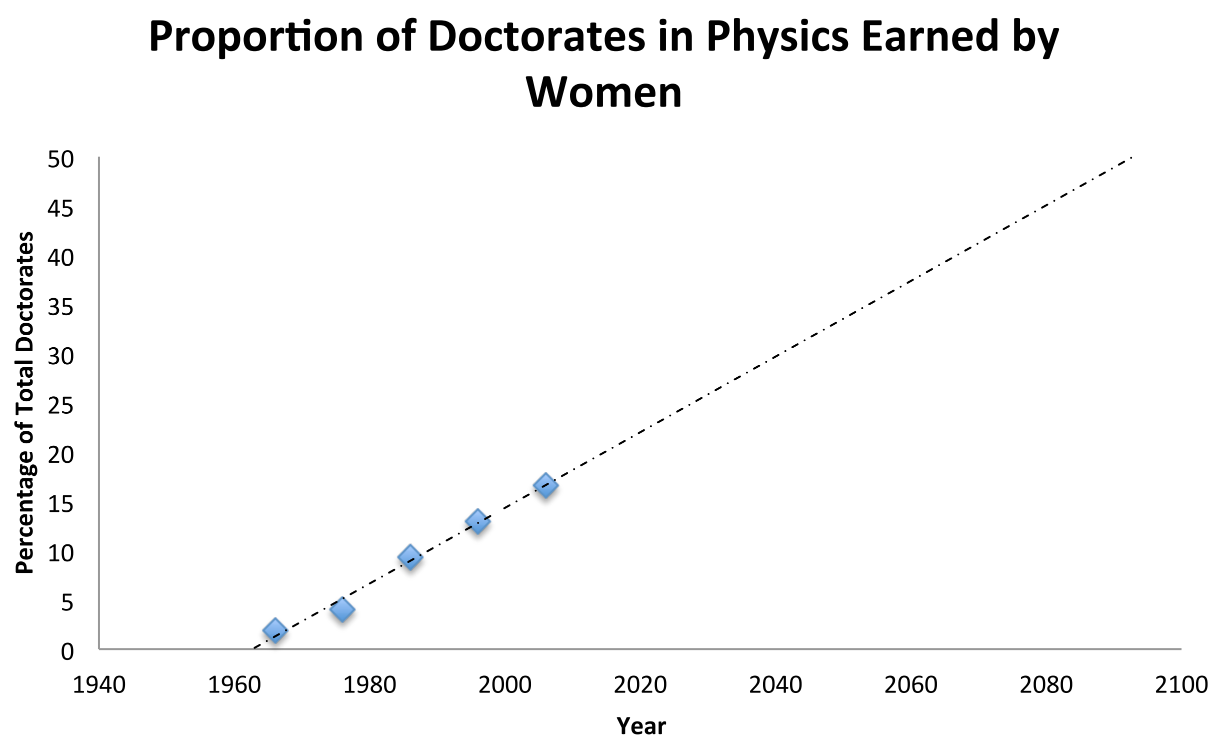
Physics Doctorates:
16.6% women in 2006

Extrapolate to 2013 for 2007 cohort of Physics bachelors degrees: 19.3% Women





How long until women are 50% of Physics doctorates?



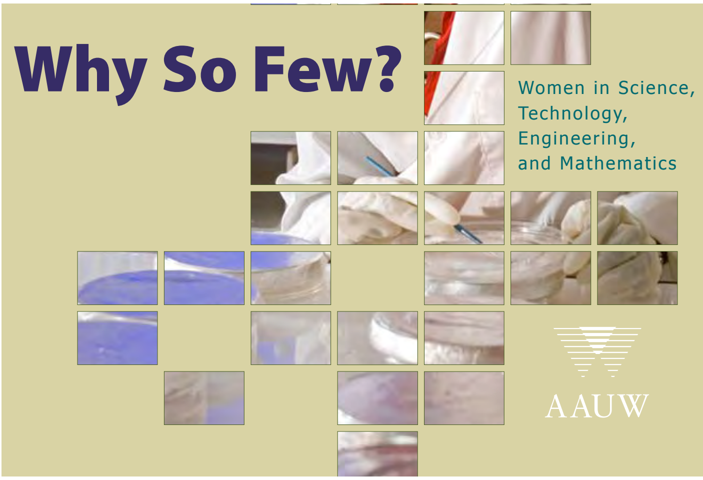
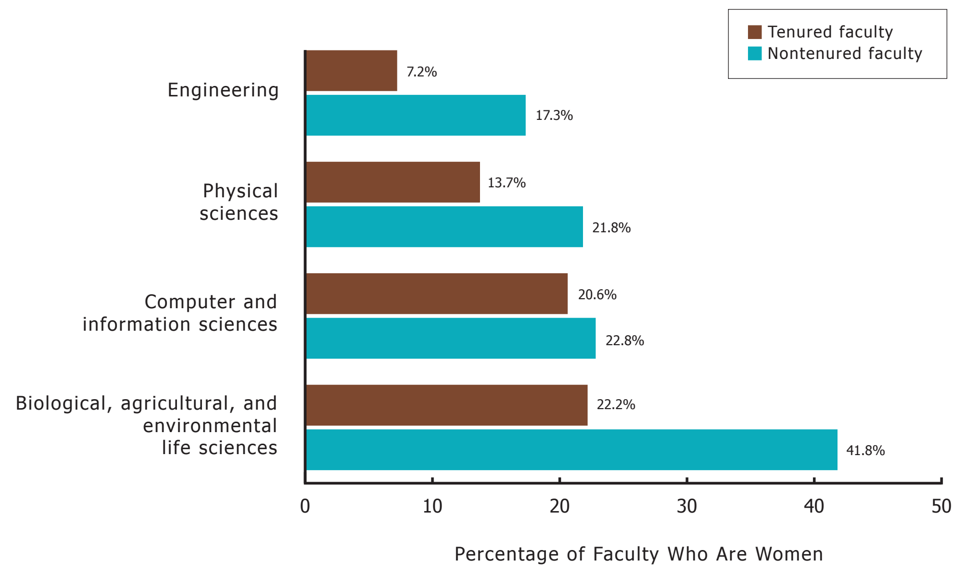
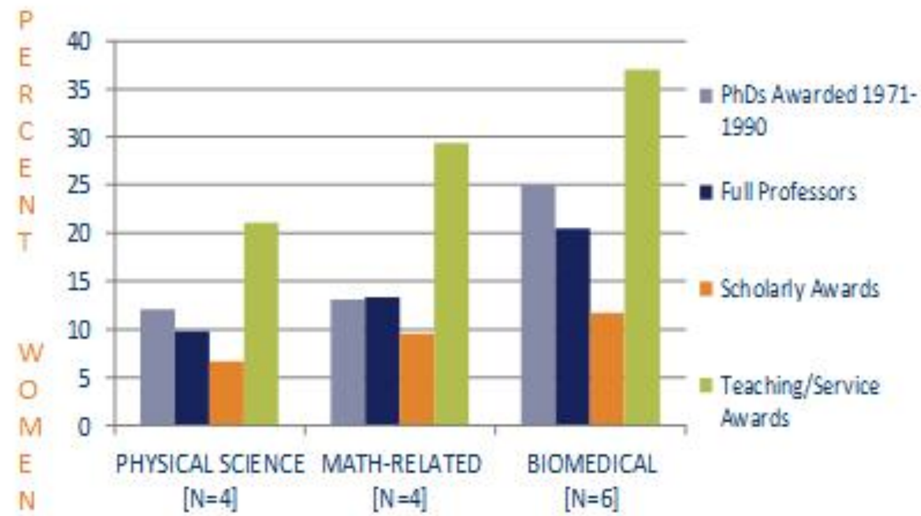


Figure 13. Female STEM Faculty in Four-Year Educational Institutions, by Discipline and Tenure Status, 2006



Source: National Science Foundation, Division of Science Resources Statistics, 2009, *Characteristics of doctoral scientists and engineers in the United States: 2006* (Detailed Statistical Tables) (NSF 09-317) (Arlington, VA), Author's analysis of Table 20.

Faculty Recognition



Women receive fewer scholarly awards than any other category.

Service/Teaching Awards > PhDs > Full Professors > Scholarly Awards

AWIS

TABLE 3-4 Top Reasons for Leaving Science, Engineering, or Mathematics Undergraduate Degree Program, by Sex

	Women		Men	
Reason for Switching to Non-SEM Major	%	Rank	%	Rank
Non-SEM major offers better education	**46**	1	35	5
Lack/loss of interest in SEM	43	2	42	1
Rejection of SEM careers and associated lifestyles	**38**	3	20	11
Poor teaching by SEM faculty	33	4	39	3
Inadequate advising or help with academic problems	**29**	5	20	10
Curriculum overload	29	6	**42**	2
SEM career options not worth the effort	27	7	**36**	4
Shift to more appealing non-SEM career option	27	8	27	6
Loss of confidence due to low grades	19	9	**27**	7
Financial problems	11	14	**24**	9
Morale undermined by competition	4	19	**26**	8

NOTE: Percentages in bold face indicate where differences between men and women were significant.

SOURCE: E Seymour and NM Hewitt (1997). *Talking about Leaving*. Boulder, CO: Westview Press.

Proportion of men and women citing this reason same (to within statistical significance)

Women more likely to cite this reason for leaving STEM

Men more likely to cite this reason for leaving STEM

TABLE 3-10 Reasons for Job Change by Sex, All Faculty Ranks, All Fields, 1995-2003

Reason for Job Change	Male	Female	P-value
Change in professional interest	**0.031**	**0.043**	0.00
Working xonditions	**0.035**	**0.054**	0.00
Family-related	**0.014**	**0.024**	0.00
Laid off/job terminated	**0.010**	**0.018**	0.00
Job location	**0.030**	**0.044**	0.00
Pay/promotion	**0.070**	**0.105**	0.00
Retirement	0.002	0.001	0.32
School related	**0.012**	**0.026**	0.00
Other reason	0.008	0.009	0.45

NOTES: Fields include life sciences, physical sciences, engineering, and social sciences. The means are weighted by sample probability weights. The p-values report the level of significance for a two-sided hypothesis of no significant differences in means.

SOURCE: National Science Foundation, *Survey of Doctoral Recipients, 1995-2003*.

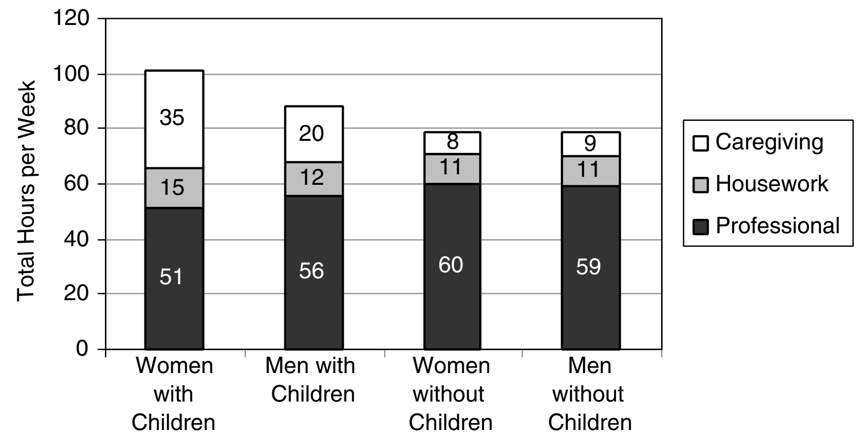


FIGURE 4-2 University of California faculty, 30-50 years old, self-reported hours per week engaged in professional work, housework, and caregiving.

SOURCE: Adapted from: MA Mason, A Stacy, and M Goulden (2003). *University of California Faculty Work and Family Survey*, *http://ucfamilyedge.berkeley.edu/workfamily.htm*.

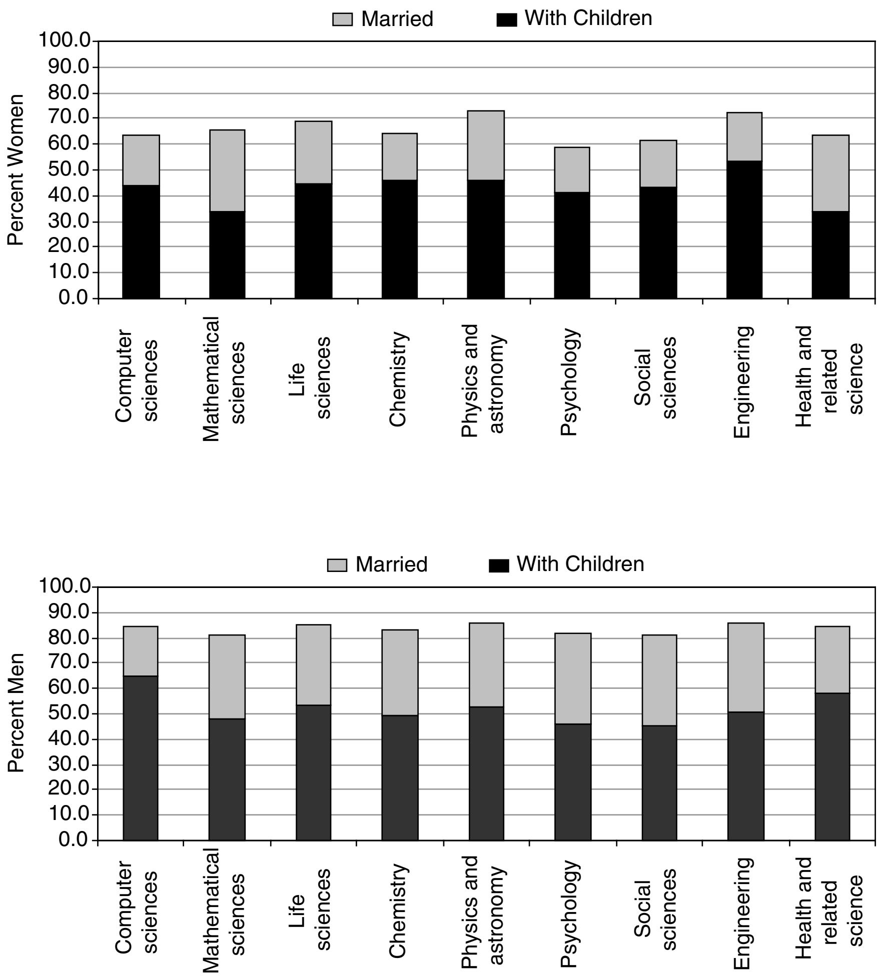
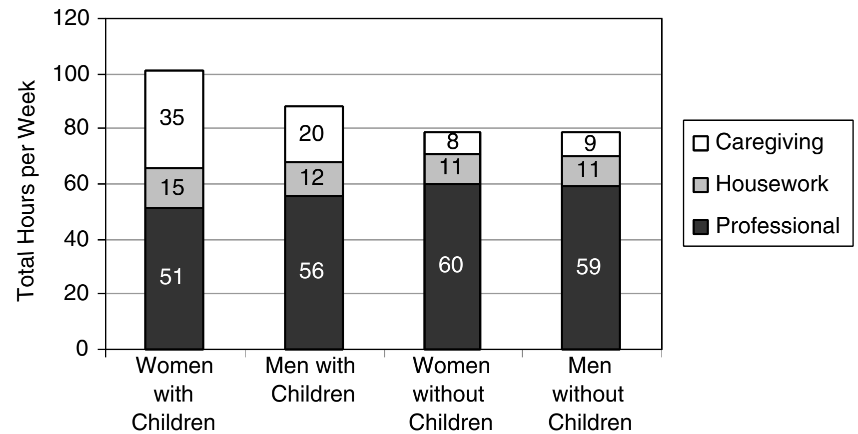


FIGURE 5-1 Percent of women and men doctoral scientists and engineers in tenured or tenure-track positions, by sex, marital status, and presence of children, 2003.

SOURCE: National Science Foundation (2003). *Survey of Doctorate Recipients, 2003*. Arlington, VA: National Science Foundation.



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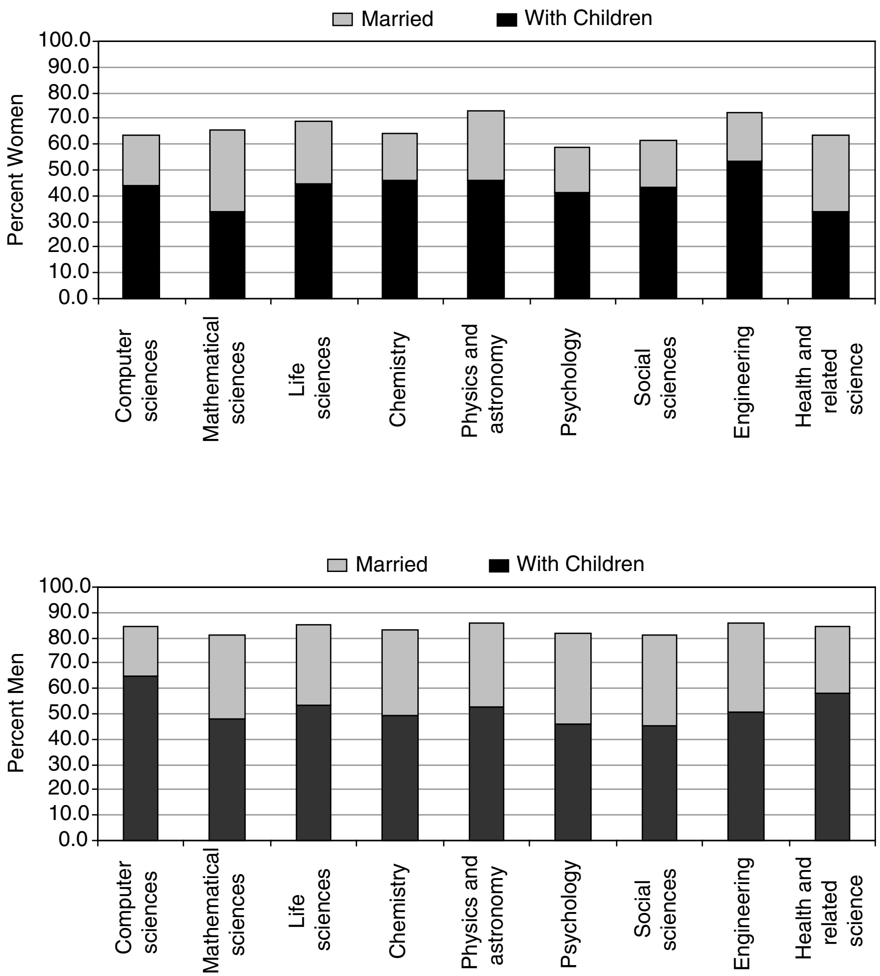

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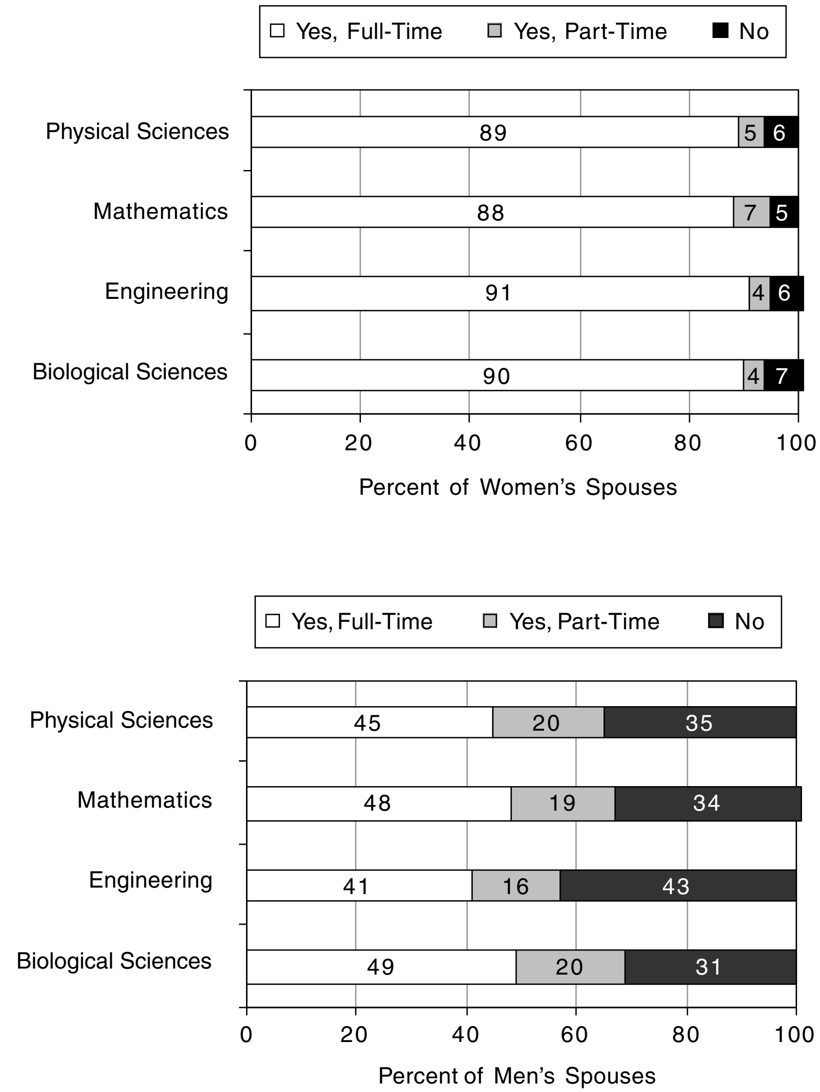


FIGURE 5-2 Spousal employment of science and engineering PhDs, 30-44 years old in 1999: Married PhDs.
SOURCE: National Science Foundation (1999). *Survey of Doctoral Recipients*. Arlington, VA: National Science Foundation.

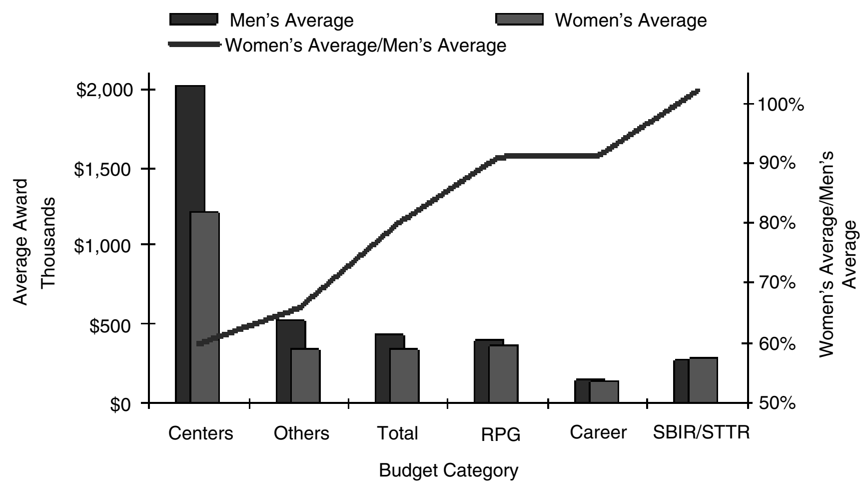


FIGURE 4-3 Average NIH research grant award to women and men by budget category, FY 2004.

SOURCE: Office of Extramural Research (2005). *Sex/Gender in the Biomedical Science Workforce*. National Institutes of Health, *http://grants2.nih.gov/grants/policy/sex_gender/q_a.htm#q5*.

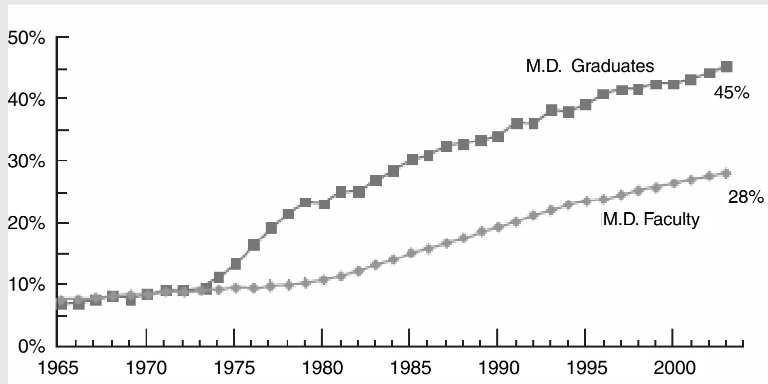
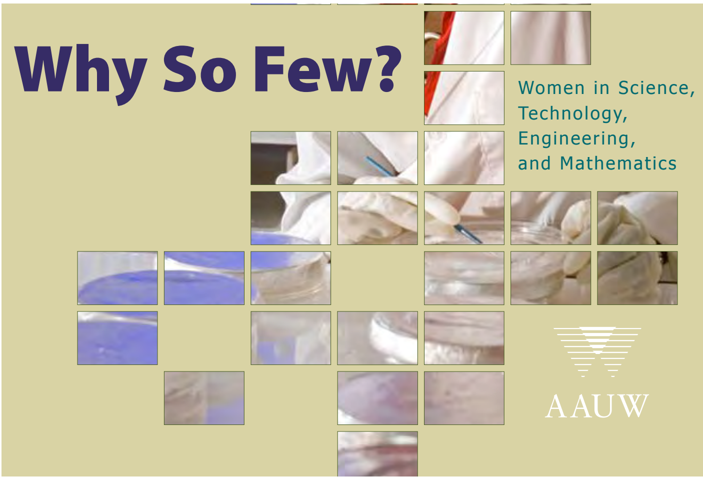


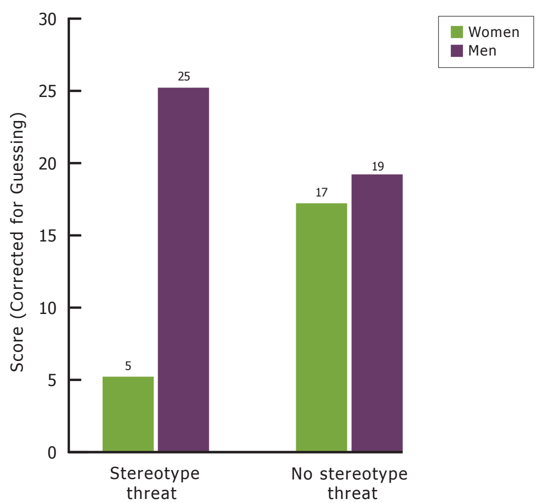
FIGURE B3-1 Representation of women MDs in academic medicine faculty positions, 1965-2004.

ADAPTED FROM: Association of American Medical Colleges (2005). The changing representation of men and women in academic medicine. *AAMC Analysis in Brief* 5(2):1-2, *http://www.aamc.org/data/aib/aibissues/aibvol5_no2.pdf.*



Stereotype Threat

Figure 15. Performance on a Challenging Math Test, by Stereotype Threat Condition and Gender



Source: Spencer et al., 1999, "Stereotype threat and women's math performance," *Journal of Experimental Social Psychology, 35*(1), p. 13.

Spencer et al 1999

- 54 University of Michigan psychology students (30 women, 24 men)
- ALL with strong math backgrounds
- ALL with similar math abilities (grades and standardized test scores)
- 2 groups given same computerized math exam
  - Group 1 told that men outperform women
  - Group 2 told no gender performance differences

300+ studies subsequently published to support this finding

Stereotype Threat: High Pressure Situations and Interventions

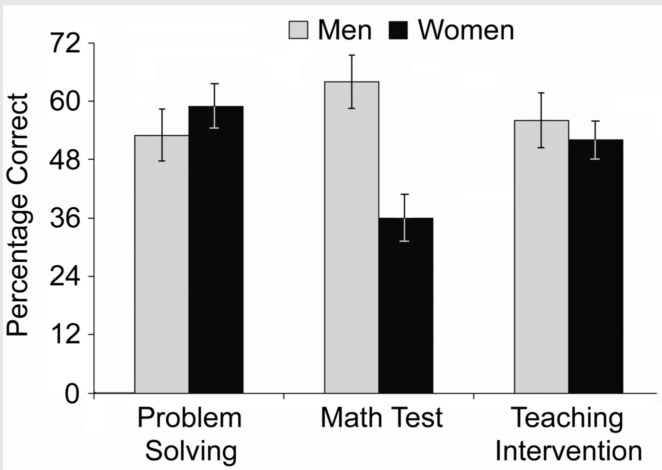
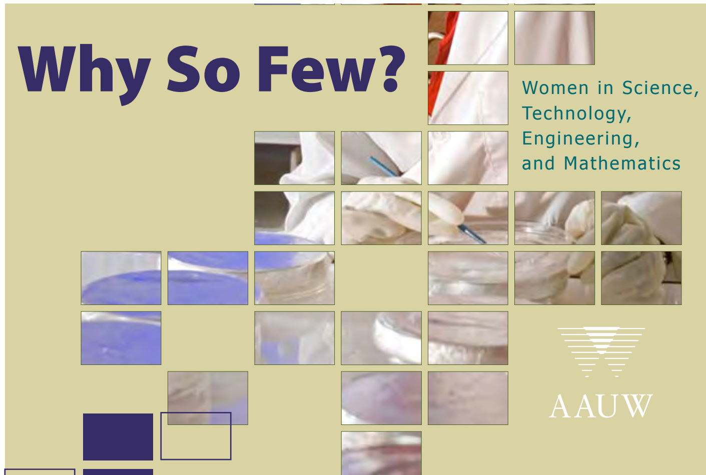


FIGURE B2-4 Teaching about stereotype threat inoculates against its effects.
ADAPTED FROM: M Johns, T Schmader, and A Martens (2005). Knowing is half the battle: Teaching stereotype threat as a means of improving women's math performance. *Psychological Science* 16:175-179.

Johns et al 2005

- Three Groups given the same problems
  - Group 1 told "problem solving exercise"
  - Group 2 told "diagnostic test of math ability", would be used to compare men's and women's scores
  - Group 3 same as Group 2, but also informed of stereotype threat, told that anxiety felt during test may be result of external stereotypes



Stereotype Threat

Induced by:

1) Telling students that men outperform women
2) Asking students to indicate gender before test
3) Having more men than women in testing situation

RECOMMENDATIONS

- **Encourage students to have a more flexible or growth mindset about intelligence.**

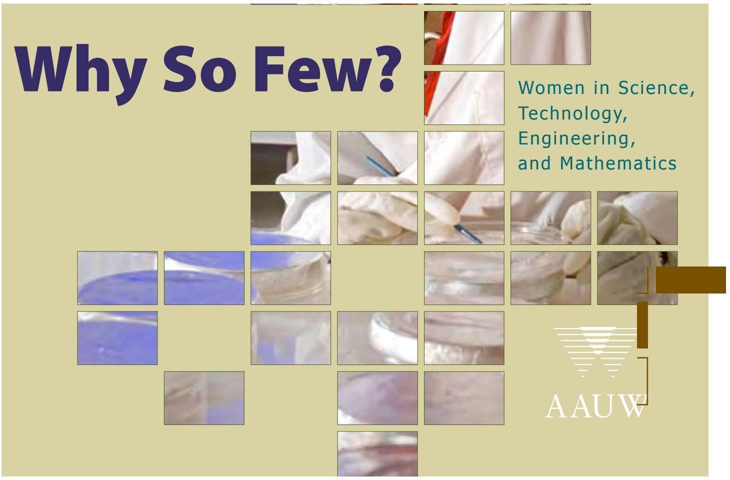
  Interventions designed to help students adopt a malleable mindset about intelligence and thus reduce their vulnerability to stereotype threat positively affect their academic performance.

- **Expose girls to successful female role models in math and science.**

  Exposing girls to successful female role models can help counter negative stereotypes because girls see that people like them can be successful and stereotype threat can be managed and overcome.

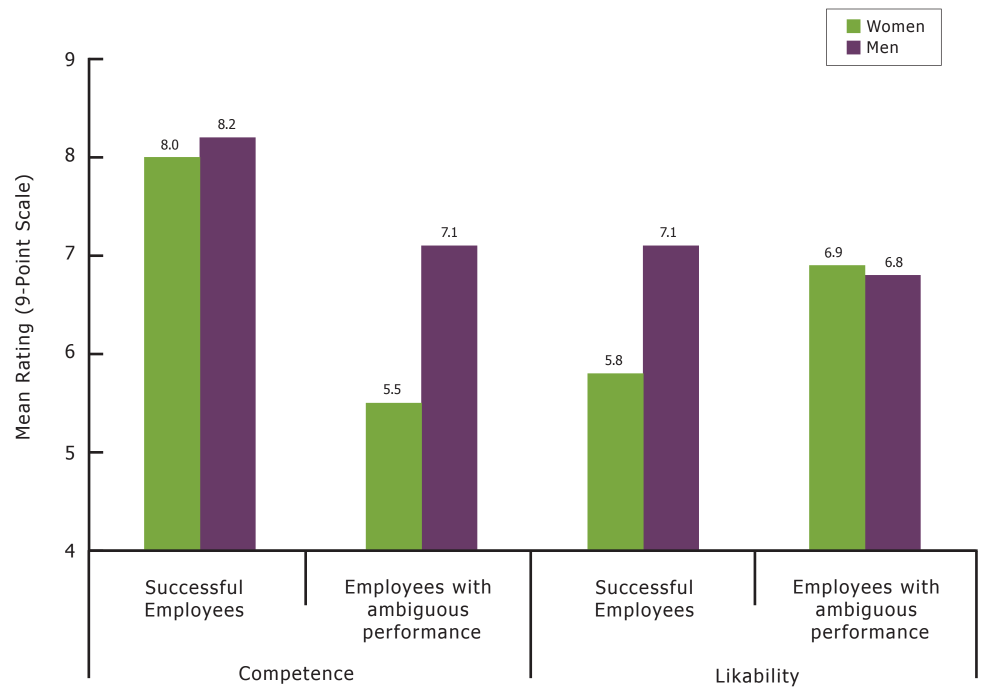
- **Teach students and teachers about stereotype threat.**

  Research with college students shows that acknowledging and explicitly teaching students about stereotype threat can result in better performance. Teachers and college faculty are best suited to do this and, therefore, need to be educated about stereotype threat.



Unconscious/Implicit Bias

Figure 21. Competence and Likability for Women and Men in "Male" Professions



Source: Heilman et al., 2004, "Penalties for success: Reaction to women who succeed in male gender-typed tasks," *Journal of Applied Psychology, 89*(3), p. 420, Table 2.

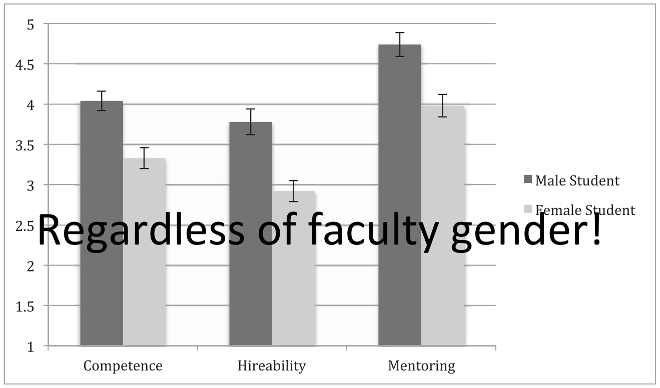


Fig. 1. Competence, hireability, and mentoring by student gender condition (collapsed across faculty gender). All student gender differences are significant ($P < 0.001$). Scales range from 1 to 7, with higher numbers reflecting a greater extent of each variable. Error bars represent SEs. $n_{\text{male student condition}} = 63$, $n_{\text{female student condition}} = 64$.

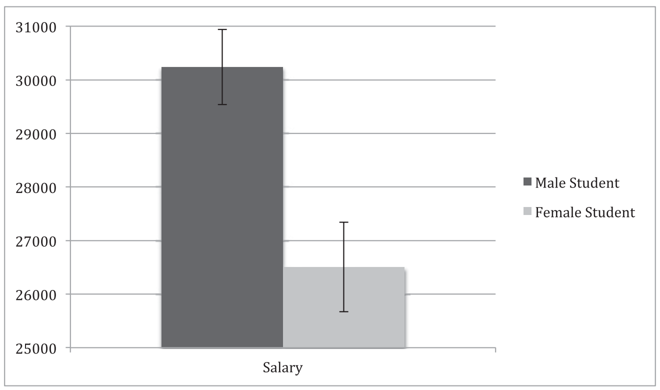


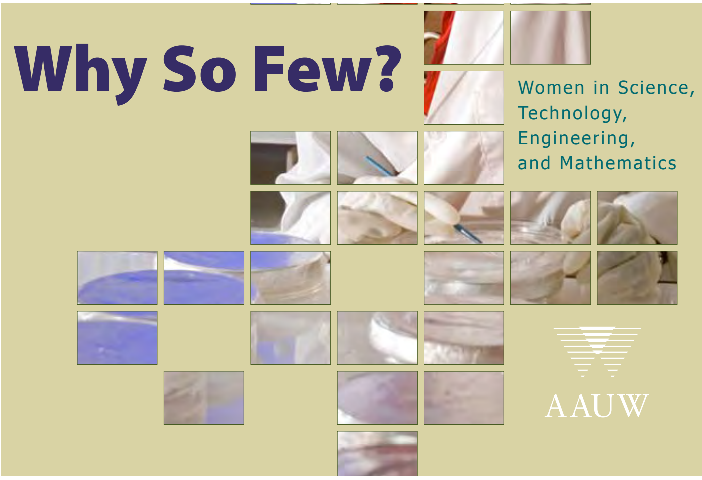
Fig. 2. Salary conferral by student gender condition (collapsed across faculty gender). The student gender difference is significant ($P < 0.01$). The scale ranges from \$15,000 to \$50,000. Error bars represent SEs. $n_{\text{male student condition}} = 63$, $n_{\text{female student condition}} = 64$.

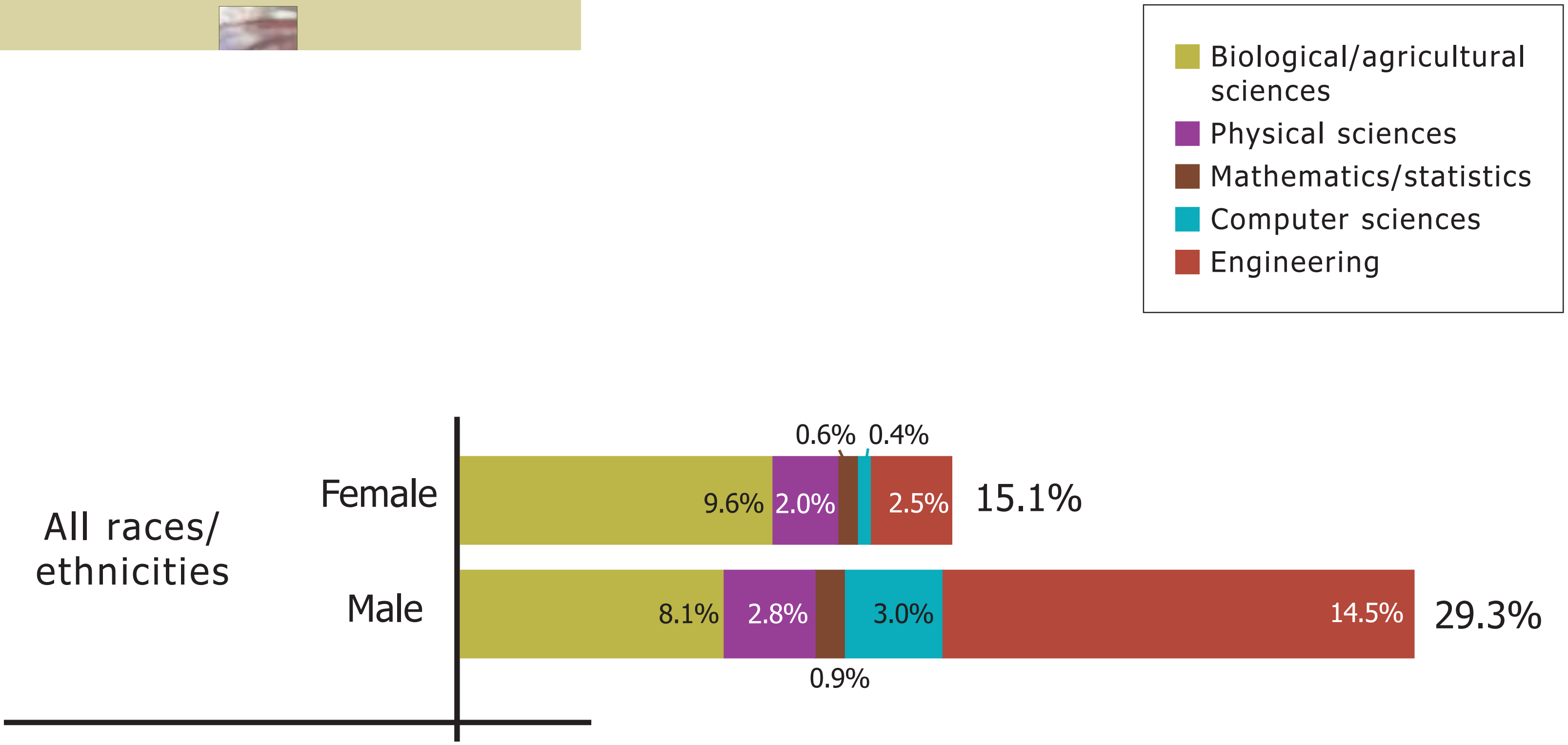
Moss-Racusin et al.

Unconscious/Implicit Bias: Resume Studies

Moss-Racusin et al. 2012

- ✧ 127 Biology, Chemistry and Physics Professors
- ✧ Resume of one undergraduate student applying for science lab manager position
- ✧ All resumes identical, but half given female name, half male
- ✧ Faculty rate competence and hireability, indicate how much mentoring the student deserves and estimate starting salry


Why So Few?
Women in Science,
Technology,
Engineering,
and Mathematics
AAUW


Biological/agricultural sciences
Physical sciences
Mathematics/statistics
Computer sciences
Engineering
All races/ ethnicities
Female
9.6%
2.0%
0.6%
0.4%
2.5%
15.1%
Male
8.1%
2.8%
0.9%
3.0%
14.5%
29.3%