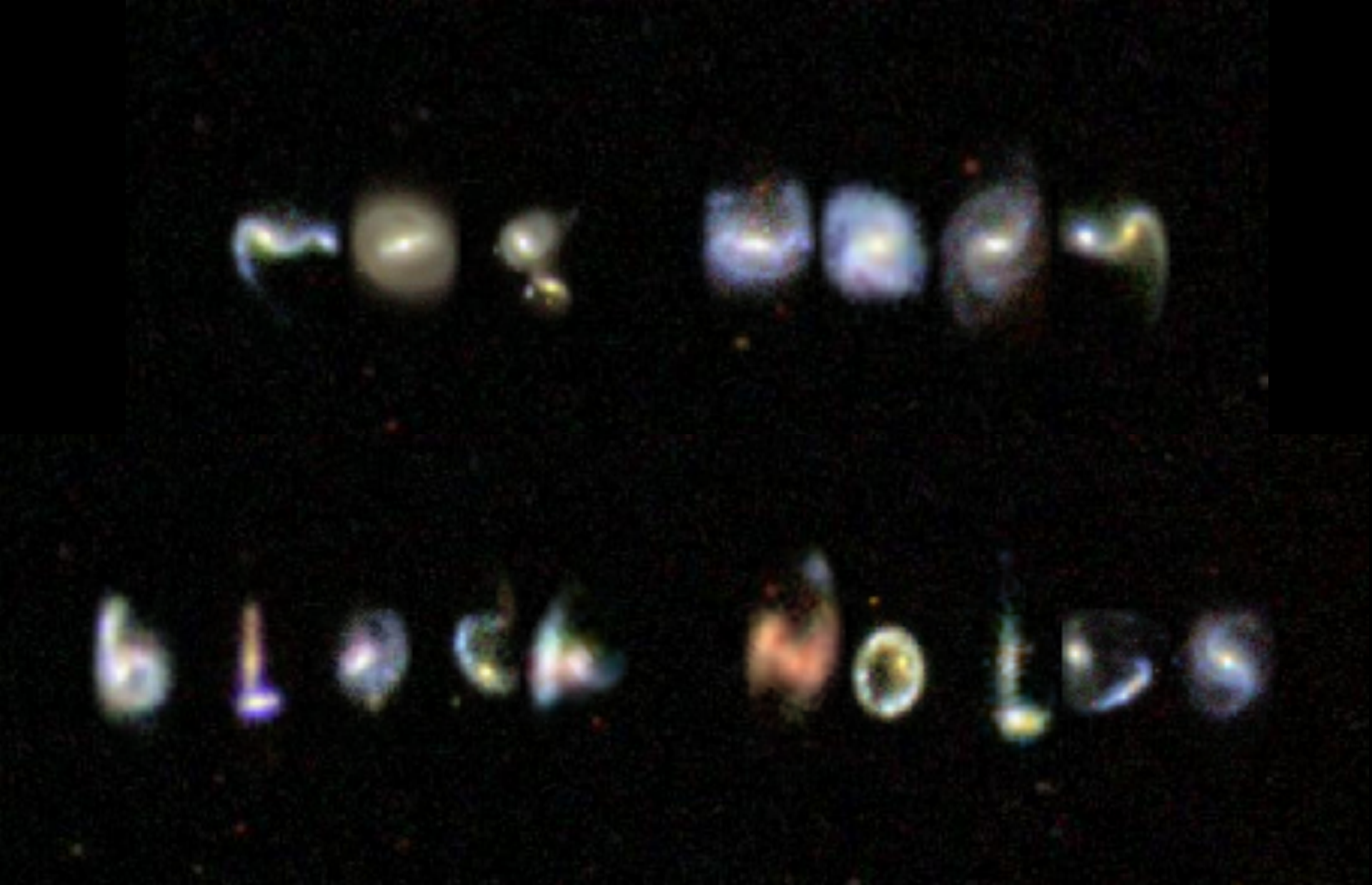


# Why Physics Is Still a Boys' Club

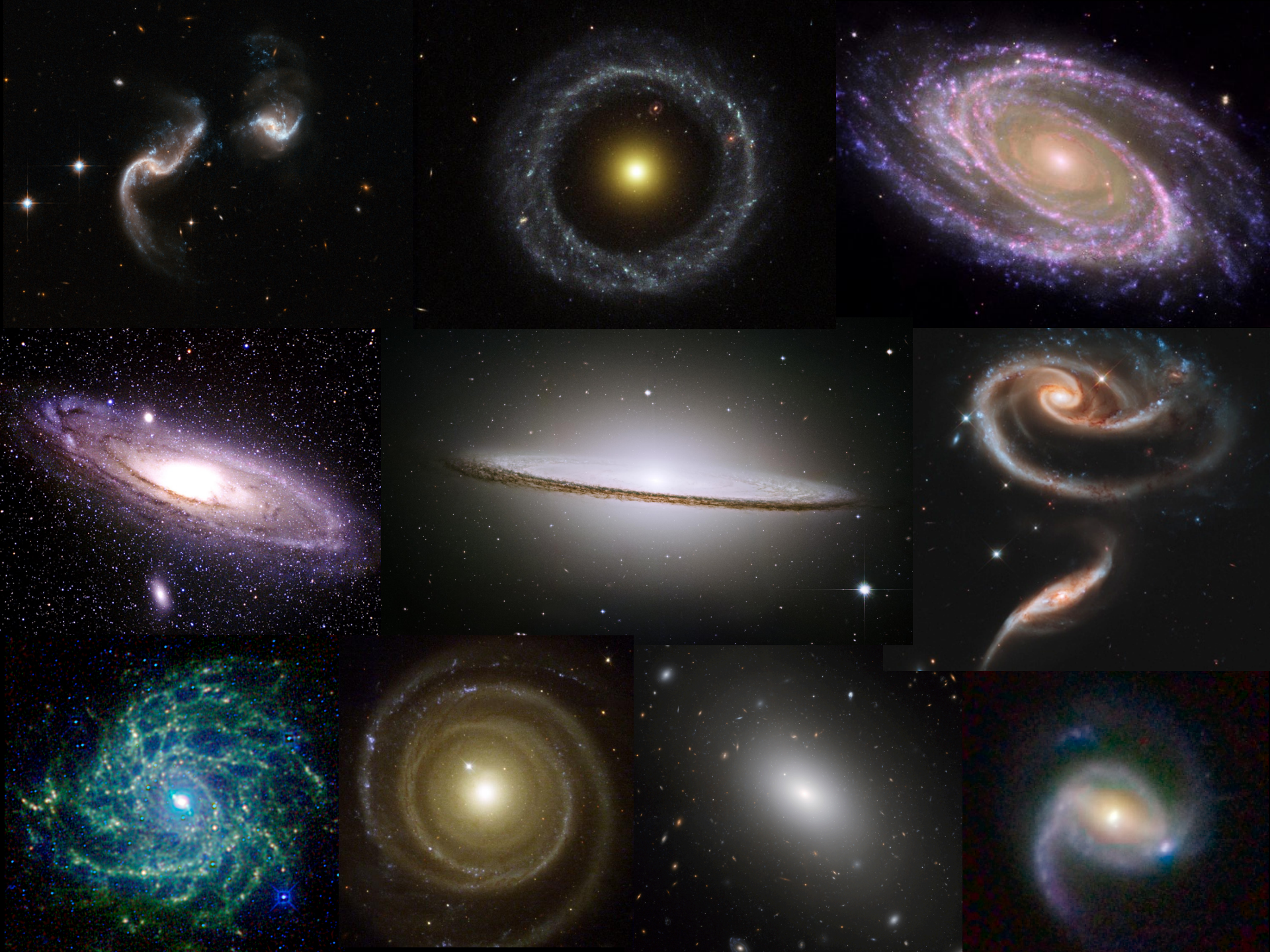
*And how to change it*



Meg Urry  
Physics Dept, Yale University



<http://writing.galaxyzoo.org/ucu8zm/>



# *Numbers of women in STEM*



# PERCENTAGE OF R&D DONE BY WOMEN

- Sub-Saharan Africa – 29%
- Arab States – 38%
- South & West Asia – 20%
- East Asia & Pacific – 20%
- Central Asia – 46%
- Central & Eastern Europe – 40%
- North America & Western Europe – 32%
- Latin America & Caribbean – 44%

*[http://www.uis.unesco.org/\\_LAYOUTS/UNESCO/women-in-science/index.html#overview!lang=en&region=40535](http://www.uis.unesco.org/_LAYOUTS/UNESCO/women-in-science/index.html#overview!lang=en&region=40535)*

# *Huge variations within regions:*

- Ethiopia 8%, South Africa 42%
- Saudi Arabia 1%, Egypt 42%
- Nepal 8%, Sri Lanka 37%
- Japan 14%, Myanmar 86%
- Tajikistan 24%, Azerbaijan 52%
- Czech Republic 27%, Latvia 53%
- Netherlands 24%, Portugal 46%
- Venezuela 56%, Honduras 27%

[http://www.uis.unesco.org/\\_LAYOUTS/UNESCO/women-in-science/index.html#overview!lang=en&region=40535](http://www.uis.unesco.org/_LAYOUTS/UNESCO/women-in-science/index.html#overview!lang=en&region=40535)

# % STEM researchers who are women in selected countries, 2001-2008

	2001	2002	2003	2004	2005	2006	2007	2008
Denmark	28.0	26.2	28.1	~~~	29.7	~~~	30.2	~~~
UK	~~~	~~~	~~~	~~~	35.7	~~~	36.6	~~~
France	27.5	27.8	27.8	27.9	28.0	27.4	~~~	~~~
Poland	~~~	~~~	39.3	38.9	39.3	39.5	39.9	39.5
Turkey	35.2	35.6	35.9	36.4	36.1	36.3	36.7	~~~
Korea	11.1	11.6	11.4	12.0	12.9	13.1	14.9	15.6
Japan	10.7	11.2	11.6	11.9	11.9	12.4	13.0	13.0

*National Academies of Science*  
[sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga\\_065697.pdf](http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_065697.pdf)

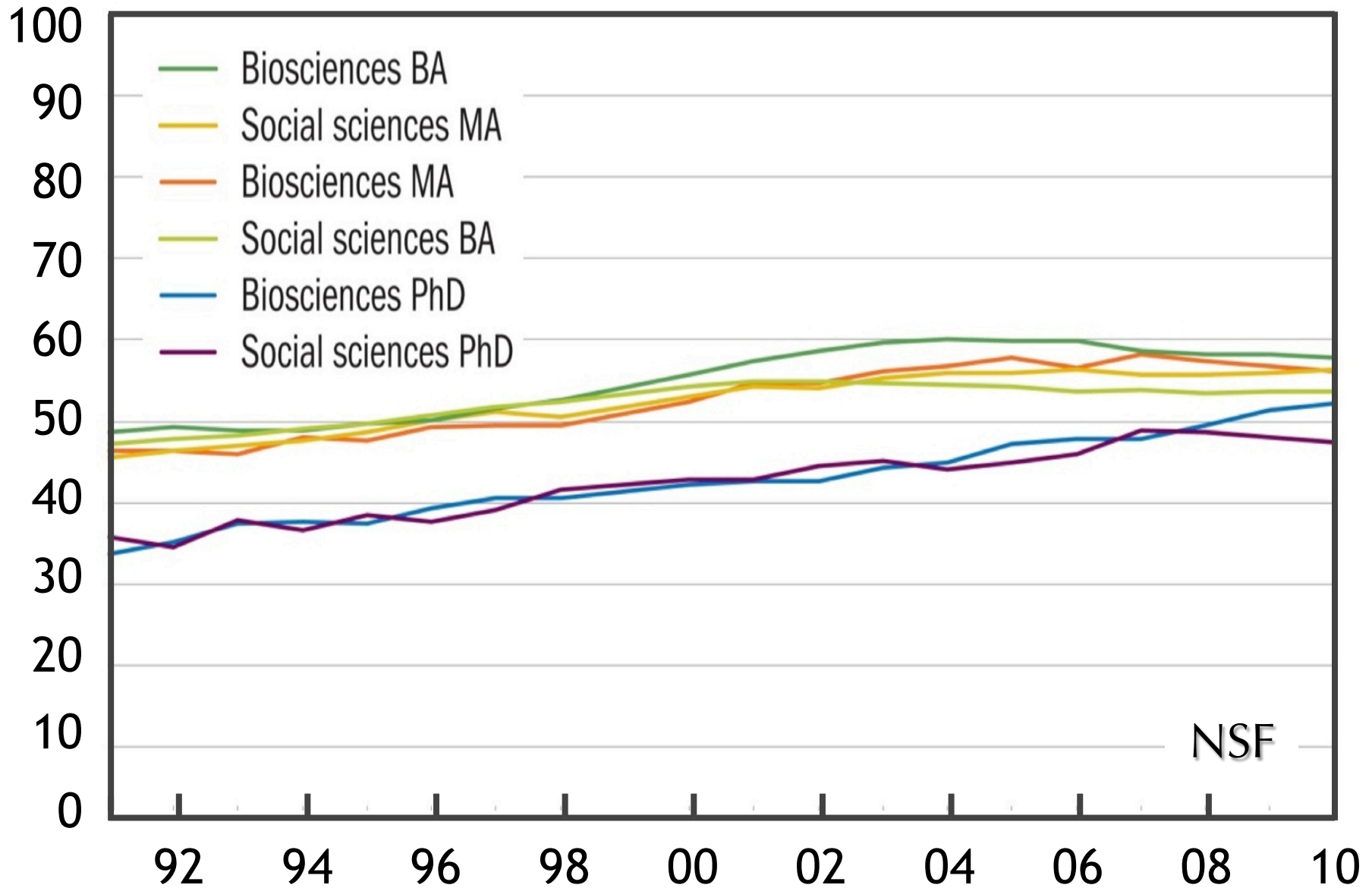
# % STEM researchers in the US who are women, by discipline

US in 2012	Phys	Comp Sci	Chem	Math	Bio/Life Science	Engnr	All Sci & Eng
PhD	20	21	39	28	53	22	23
Master's	22	27	47	40	56	23	30
Bachelors	19	18	49	45	58	19	40

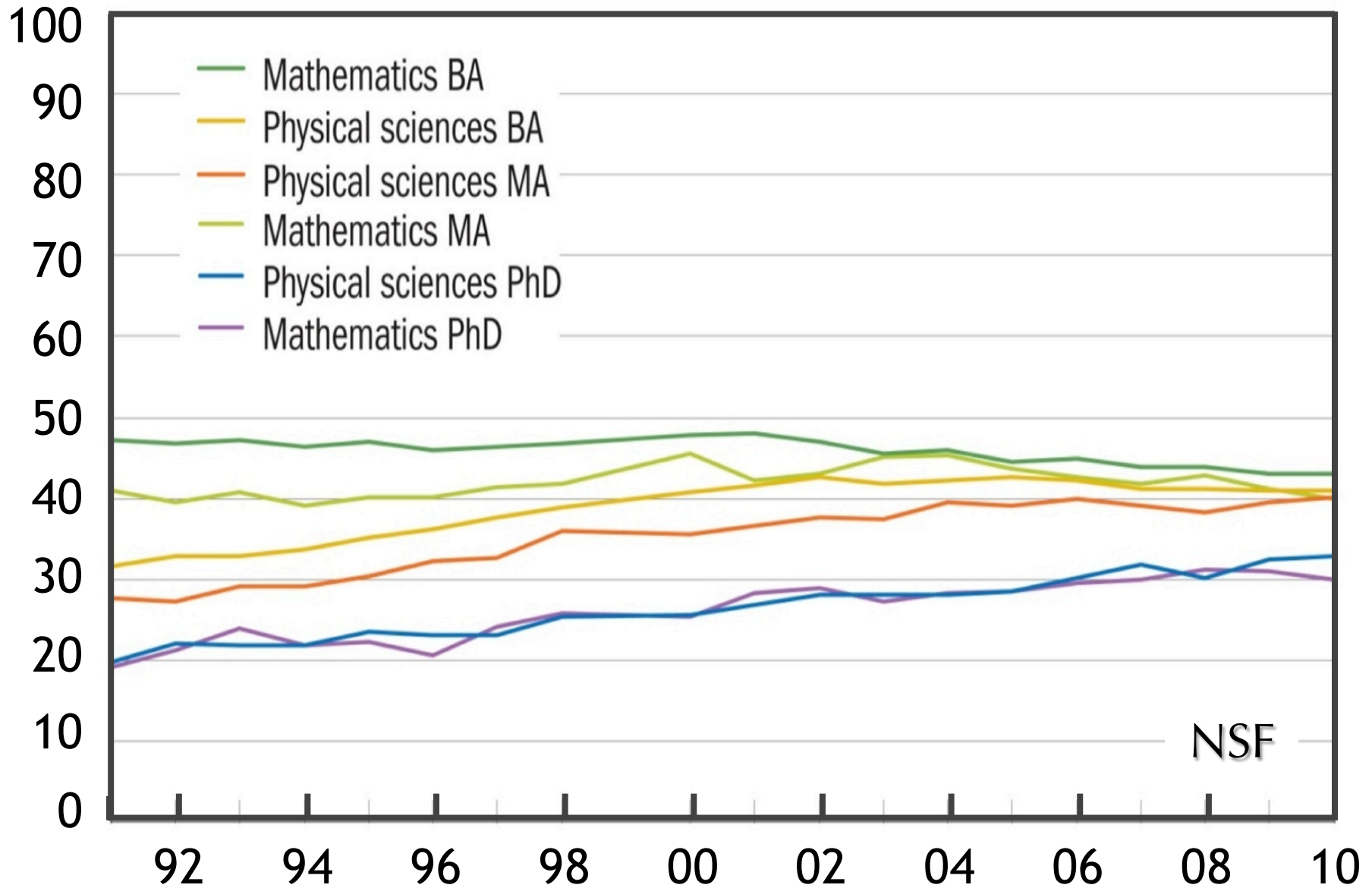
<http://www.nsf.gov/statistics/2015/nsf15311/tables.cfm>



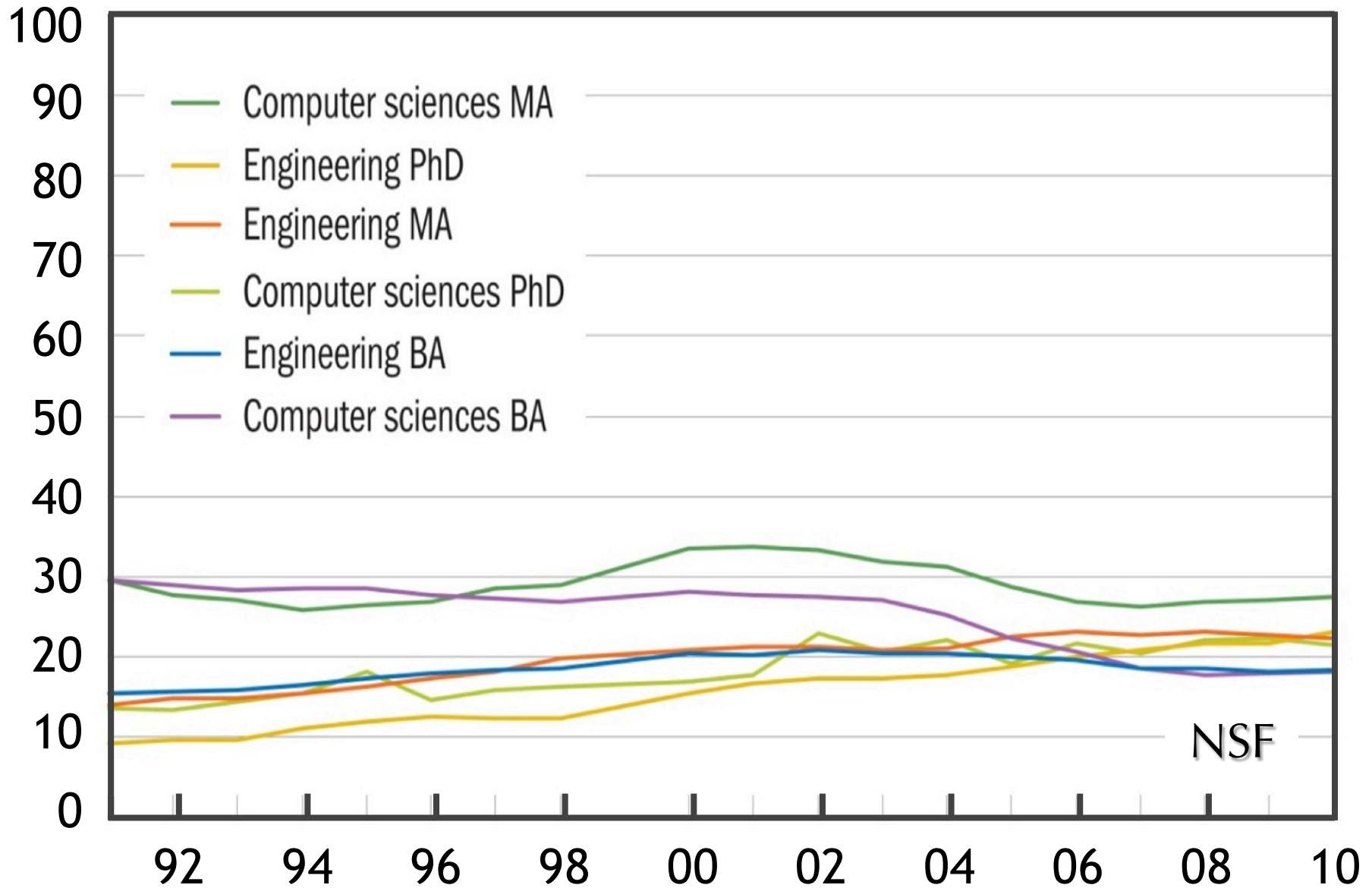
# Percent degrees to Women 1991-2010 (US)



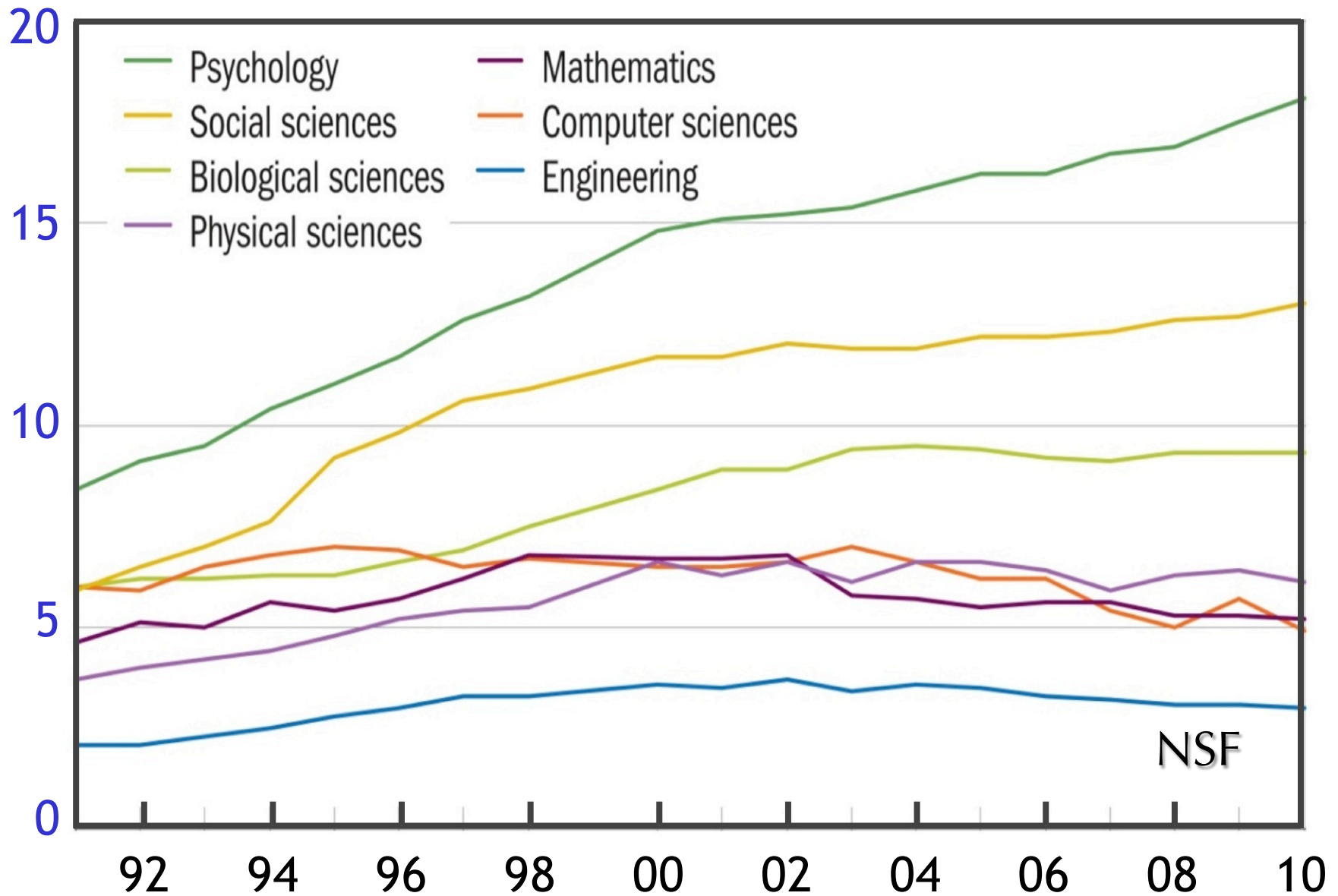
# Percent degrees to Women 1991-2010 (US)



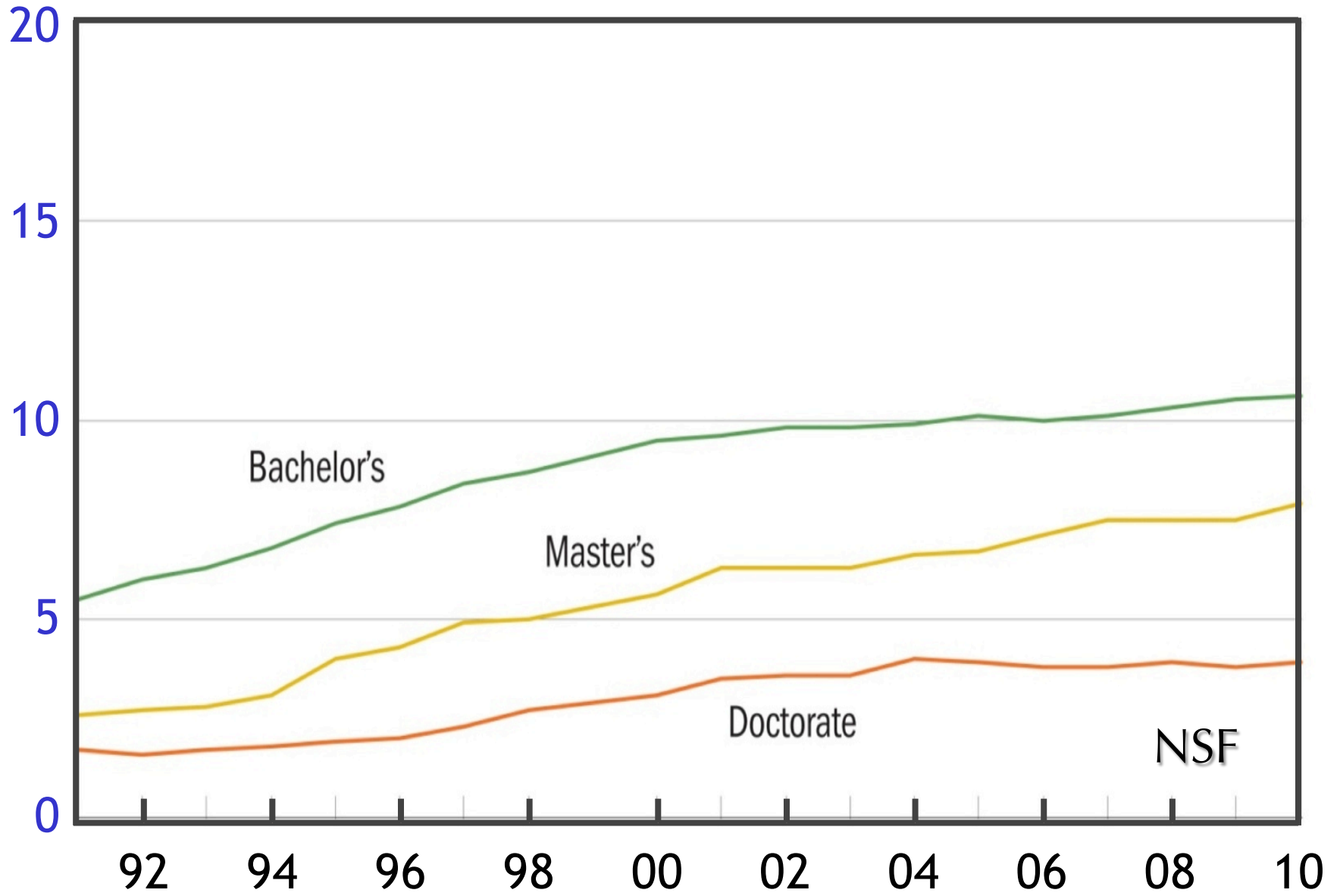
# Percent degrees to Women 1991-2010 (US)



# Percent Bachelor's degrees to URM Women 1991-2010



# Percent STEM degrees to URM Women 1991-2010



# Attrition between B.S. and Ph.D. degrees

## Bachelor's Degrees, 1966-2004

56% → 45% All fields

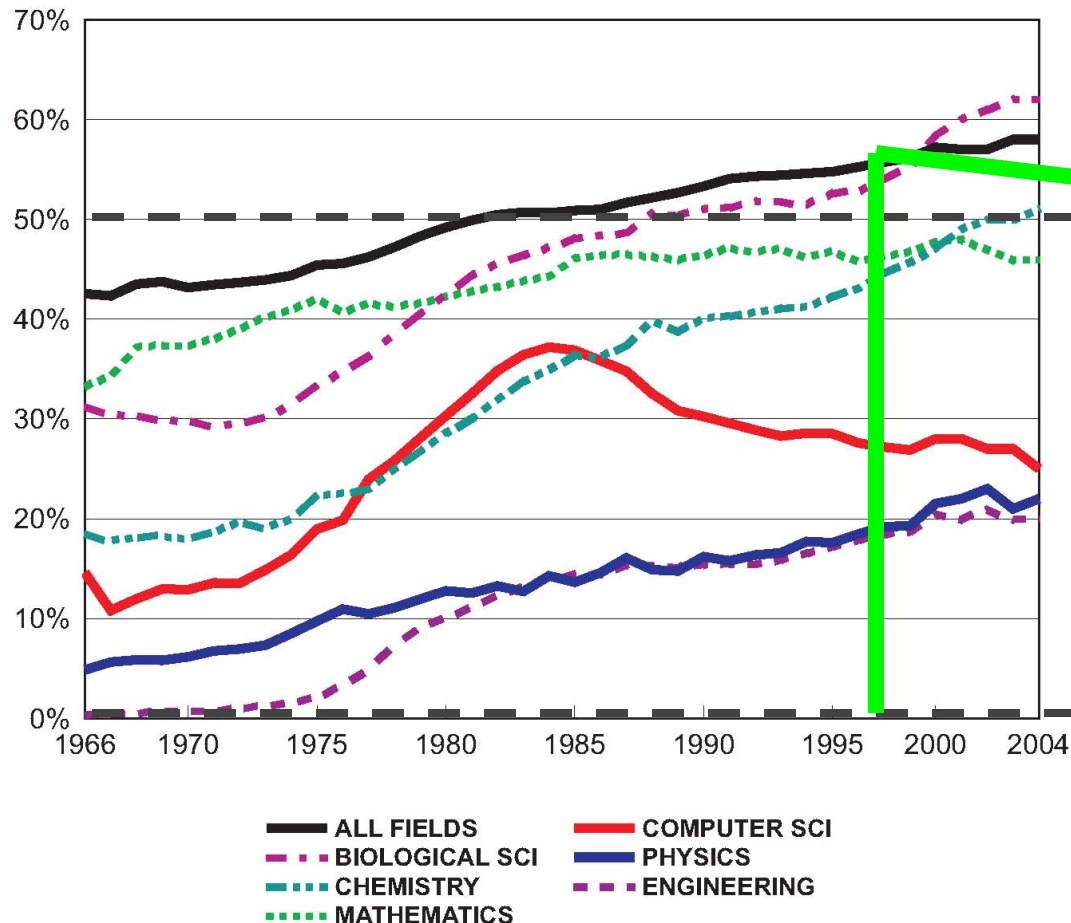
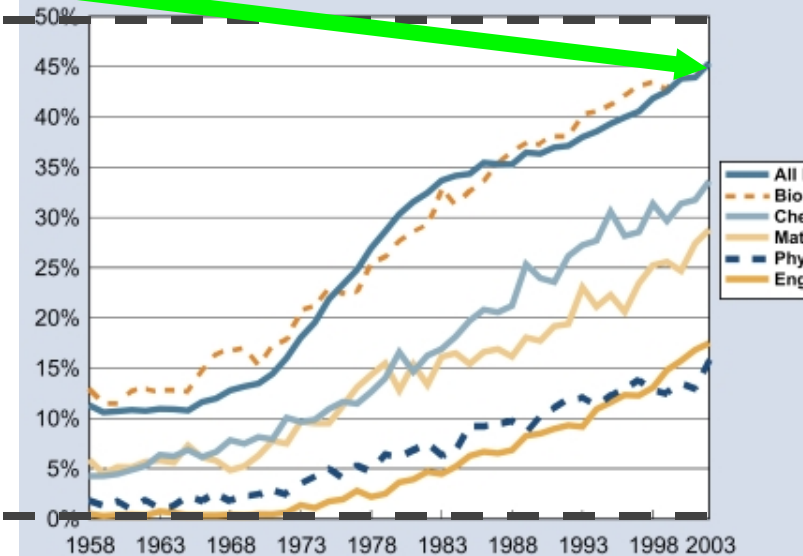


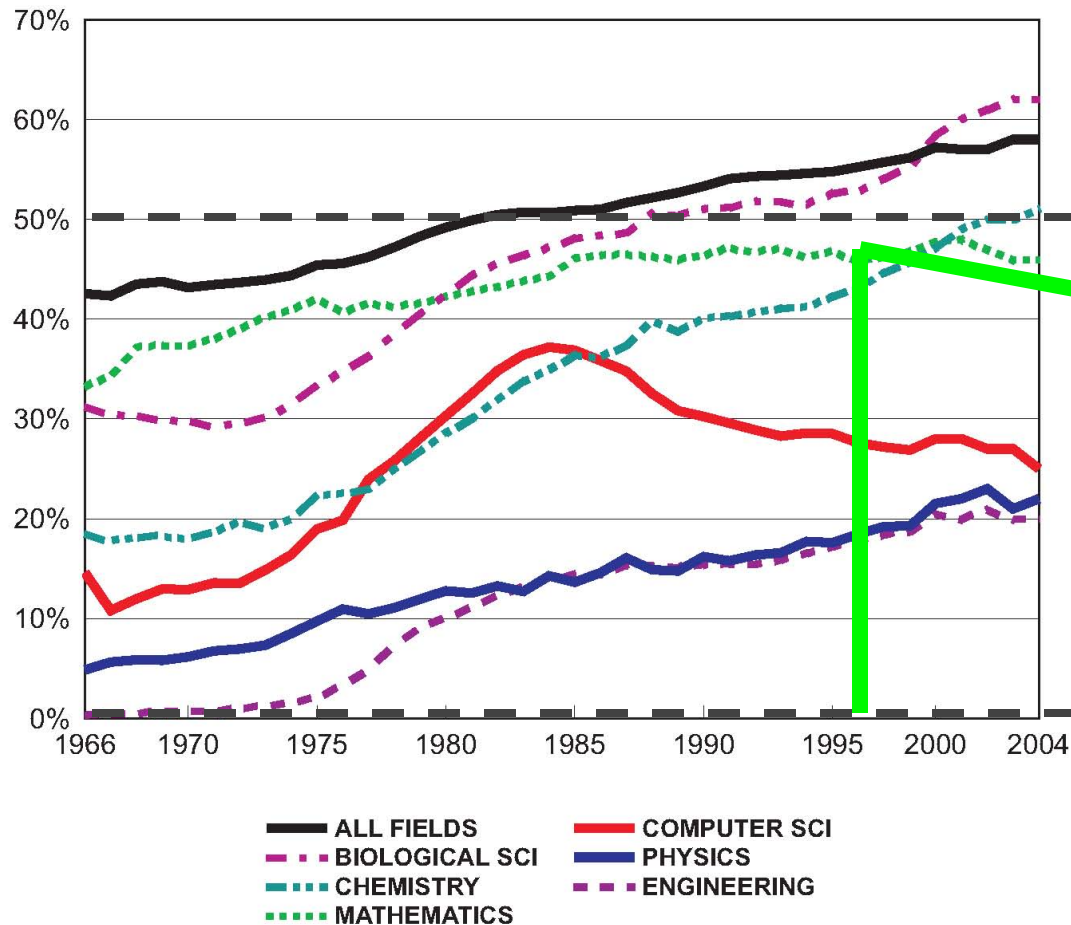
Figure 7. Percent of PhDs earned by women in selected fields



National Science Foundation. Compiled by AIP Statistical

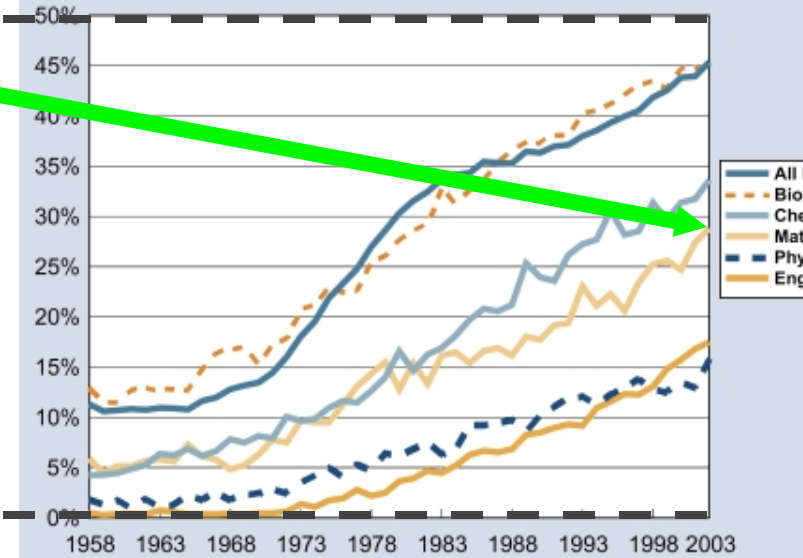
# Attrition between B.S. and Ph.D. degrees

## Bachelor's Degrees, 1966-2004



47% → 28% Math

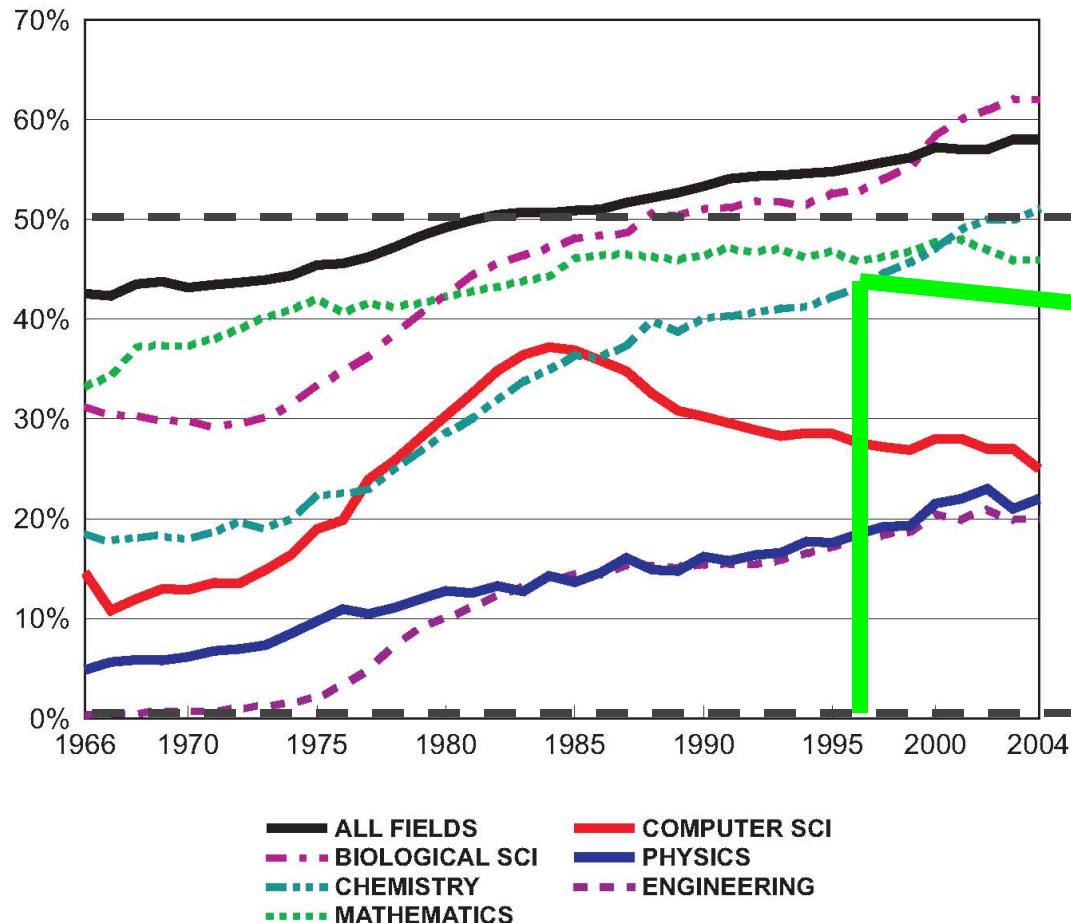
Figure 7. Percent of PhDs earned by women in selected fields



National Science Foundation. Compiled by AIP Statistical

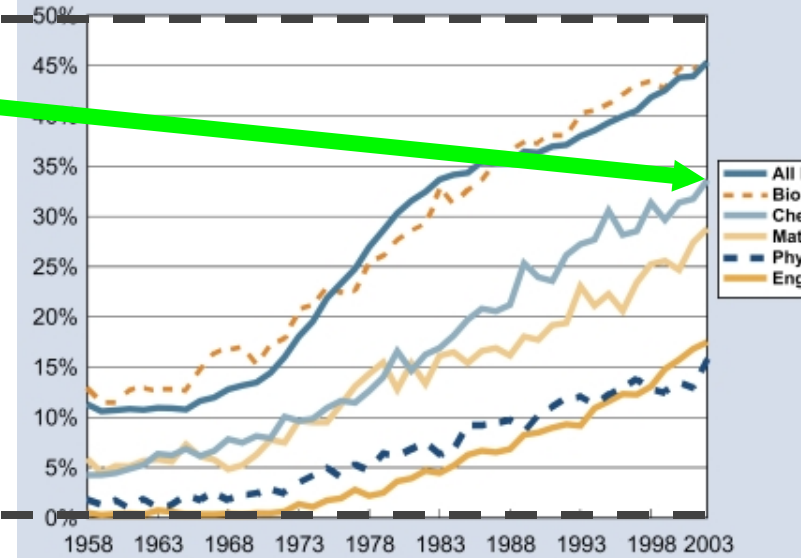
# Attrition between B.S. and Ph.D. degrees

## Bachelor's Degrees, 1966-2004



43% → 33% Chemistry

Figure 7. Percent of PhDs earned by women in selected fields



National Science Foundation. Compiled by AIP Statistical



# Attrition between B.S. and Ph.D. degrees

## Bachelor's Degrees, 1966-2004

19% → 15% Physics

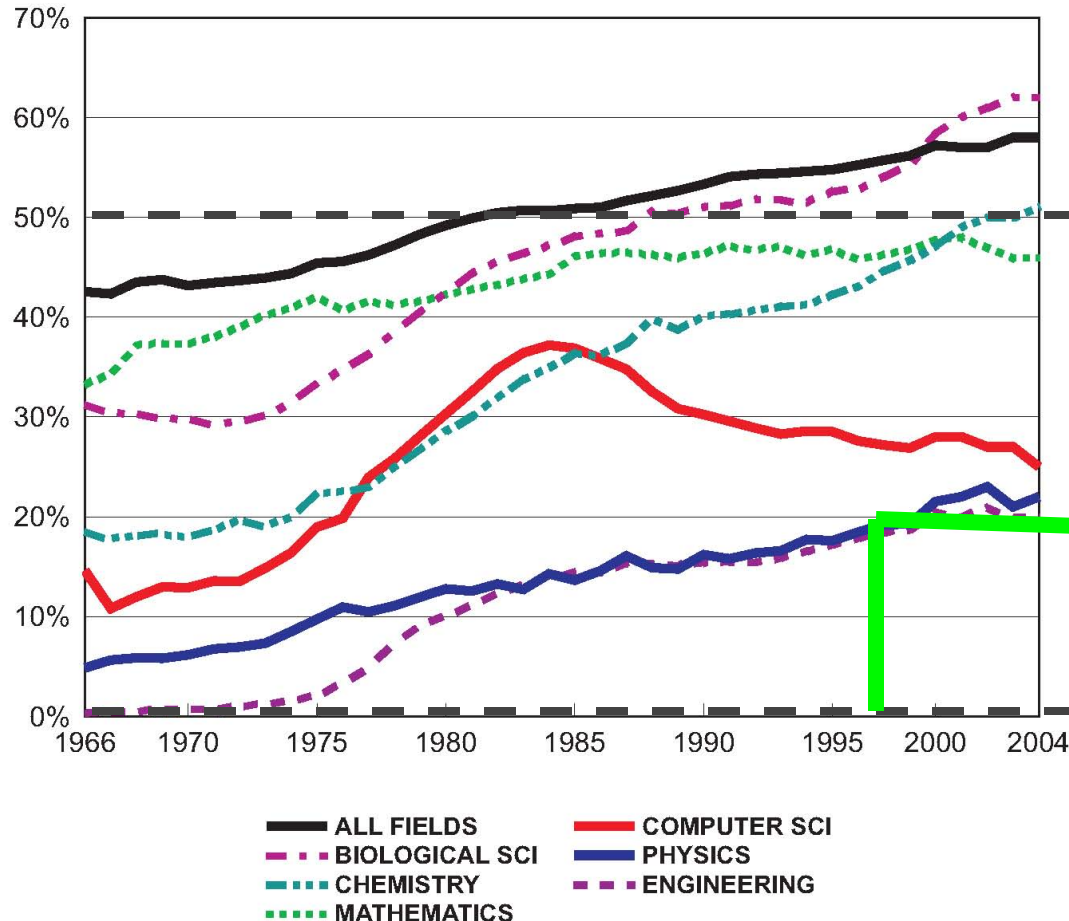
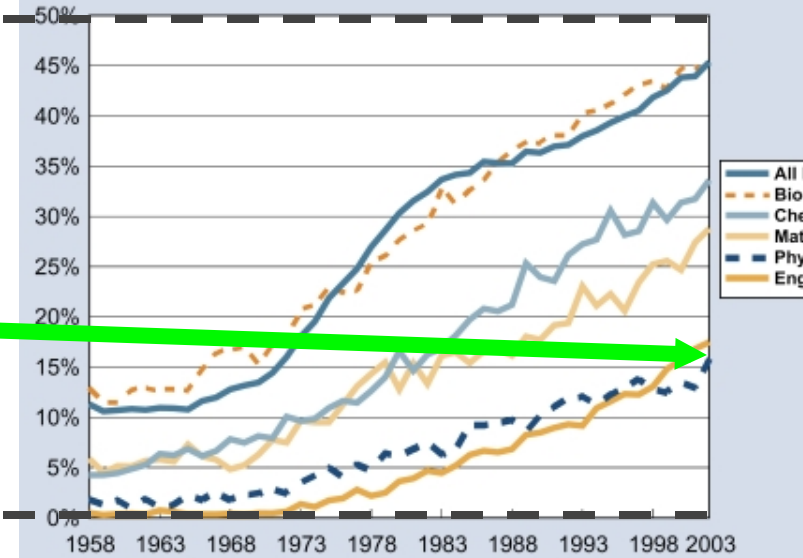


Figure 7. Percent of PhDs earned by women in selected fields



National Science Foundation. Compiled by AIP Statistical

# Why Diversity?

- Excellence of science
  - Broadest pool of talent
  - Different views → innovation
- Fairness/justice
- It's a great life!
  - Taxpayers should benefit equally
- Health of science profession
  - More scientifically literate (broad) public
  - ⇒ more public support of science
- Workforce needs

# *How Gender Affects Science*

- Cellular/developmental biology: *major impact*
- Anthropology, psychology, zoology: *interpretation of behavior*
- Physics, mathematics: *little/no impact on science, but culture determines how science gets done and by whom*

*Schiebinger et al. 2008,*  
*[sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga\\_065697.pdf](https://www.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_065697.pdf)*

*Why so few women in STEM?*

A light blue brushstroke underline that starts with a pointed left end and tapers to a flat right end, positioned directly below the text.

# Why do Women and Under-represented Minorities lag behind parity?

- Statistical career disparities
    - *Long 2001, Sonnert & Holton 1996, Egan & Bendick 1994, Tesch et al. 1995, MIT Report+*
  - *Not* ability, interest, effort
    - *Seymour & Hewitt 1990s, Xie & Shauman 2003, NRC's 2006 "Beyond Bias and Barriers" study*
- persistence in science not correlated with ability**
- *Not* family issues
  - *Not* conscious discrimination, overt prejudice

# Why do Women and Under-represented Minorities lag behind parity?

- “Gender schemas” *Virginia Valian, Why So Slow? The Advancement of Women*
    - Lower expectations for women
    - Uneven evaluation (“unconscious bias”)  
*Wenneras & Wold 1997, Paludi & Bauer 1983, Budden+ 2008*
    - Accumulation of disadvantage
- ➔ *Tilted playing field*

# The Objectivity of Science ...



*Biernat, Manis & Nelson 1991 – height*

*Porter & Geis 1981 – leaders at table*

*Butler & Geis 1990, Geis+ – speaker/leader evaluation*

*Dovidio et al. 1988 – eye gaze*

## Uneven Evaluation

**Uhlmann & Cohen 2014:** "... by defining merit in a manner tailored to the idiosyncratic strengths of an applicant of the desired gender, *evaluators who practice gender discrimination may feel especially convinced that their selected candidate is the obvious and objective choice.*"

Valian annotated bibliography: <http://www.hunter.cuny.edu/genderequity/repository/files/equity-materials/annobib.pdf>



# 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 ~30%

Valian annotated bibliography: <http://www.hunter.cuny.edu/genderequity/repository/files/equity-materials/annobib.pdf>

# Moss-Raucusin, Handelsman, et al. 2012 PNAS

- 63 male, 64 female science faculty
  - physics, chemistry, biology
  - 6 research universities: 3 private, 3 public
- CV of graduating senior looking for job as lab manager – “John” or “Jennifer”
- Both men and women:
  - See the **male candidate as more competent**
  - Were **more likely to hire and mentor him**
  - Starting salaries ~ **\$30k for him, \$26k for her**

# When job searches are gender-blind ...

blind audition...

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

*See story of Munich Philharmonic trombonist (Abby Conant)*

# Criteria for hiring, promotion, tenure...

- Letters of recommendation
- Number of publications (+prestige of journal)
- Citations
- Proposal success (grants, experiments)
- Number+prestige of invited talks
- Prizes (nominated)

Are you objective?

Mahzarin Banaji: [implicit.harvard.edu](http://implicit.harvard.edu)

∴ Playing field not level

But tilt can be leveled -  
*consciously*

# 12 11 Steps to Success for Young Women

1. Work hard (at something you love)
2. Do interesting, high impact work
3. (If) uneven playing field – don't be discouraged
4. Reject "lower standards"
5. Mentor up, down, and sideways
6. Network w WiS: find allies, take turns leading
7. Use your first & last names
8. Prepare an "elevator speech"
9. Practice confidence after brushing
10. Give great talks
11. Own your ambition
12. Be Professional (meetings are not about dating)

# Famous Berkeley Astronomer Violated Sexual Harassment Policies Over Many Years



*Petition: "I support the people who were targets of Geoff Marcy's inappropriate behavior and those who have spoken publicly about it. I agree that sexual harassment has no place in our community."*

- Marcy resigns 1 week after story breaks
- 3-4 other US profs fired more quietly
- Investigations ongoing



# 5 Steps for Leaders

1. Learn about bias [www.hunter.cuny.edu/genderequity/equityMaterials/Feb2008/annobib.pdf](http://www.hunter.cuny.edu/genderequity/equityMaterials/Feb2008/annobib.pdf) [implicit.harvard.edu](http://implicit.harvard.edu)  
*Beyond Bias and Barriers (NRC Study)*
2. Do job **searches** *UW hiring kit*
3. Validate women speakers, job candidates, colleagues *Introductions, appointments*
4. Mentor
5. Equate diversity with excellence



Back-up slides

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# Women lack math ability ...

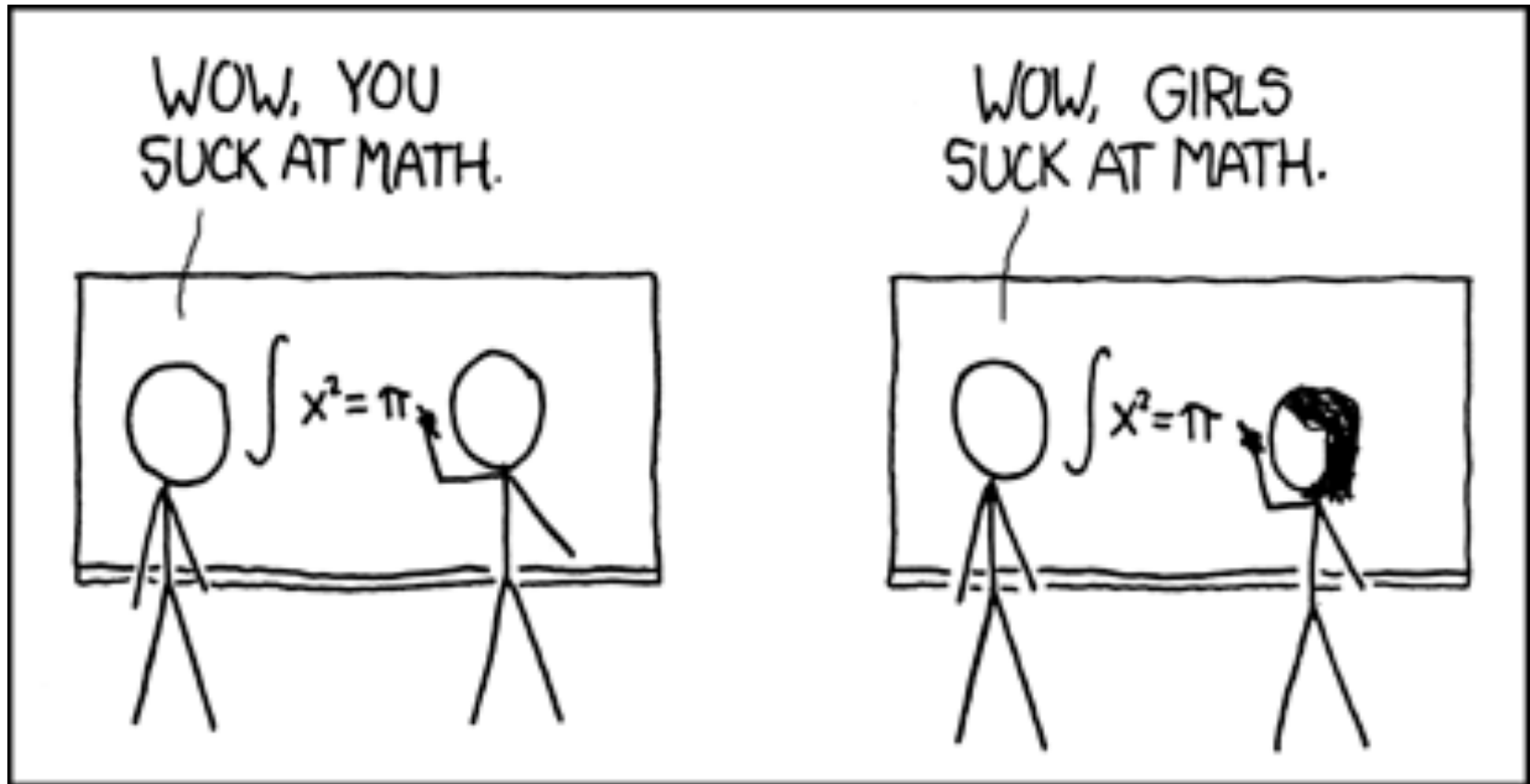
- STEREOTYPE THREAT: performing below ability because of expectations
- Example: “hard” math test
  - Men: 25/100
  - Women: 10/100
  - *Gender gap in math?*
- “This test has been designed to be gender neutral”
  - Women: 20/100
  - Men: 20/100
- Important for minority students

# Coaching (Mentoring)



*Tony DeCicco, U.S. women's soccer coach  
Boston Globe, June 18, 1999*

# Sanbonmatsu, Akimoto & Gibson 1994 (Evaluation of failing students)



# 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.)*

# Reason is not family

*“Do Babies Matter?” Mason & Goulden 2002*

- ❑ 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!*

*In Praise of Daycare, 2009 January STATUS newsletter*



# 2006 NAS Study: *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*

1. Statistics (U.S.)

2. Learning and performance

→ *No intrinsic difference could possibly lead to observed gender gap*

3. Persistence and Attrition

4. Evaluation of success *implicit bias*

5. Strategies that work

Undergraduate *Carnegie Mellon*

Hiring faculty *U. Washington toolkit*

Training women faculty *CoaCH*

ADVANCE *CRLT players*

6. Institutional structures, career paths

7. Recommendations

# 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 re women)



Amelia & Sophia