

Science, Technology,  
Engineering, and  
Mathematics

# Gender Equity in STEM: Leadership and Learning

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# Why should we care about women's participation in STEM?

Today's economy & culture based on STEM

Need to be competitive in global economy

Need strong STEM fields

Need strong STEM workers

Need strong STEM education

Need to encourage **EVERYONE** interested in STEM!

# Women have a lot to offer STEM

- “Until women can feel as much at home in [STEM] as men, our nation will be considerably less than the sum of its parts. If we do not draw on the entire talent pool that is capable of making a contribution to science, the enterprise will inevitably be underperforming its potential.”
- “Diversity within and between groups helps a whole population to survive and adapt to the changing demands of the environment.”
- “Diversity in the workplace is known to foster innovation; a diversity of experiences and perspective-taking yields greater opportunity for creativity.”
- “Women leaders on average manifest valued, effective leadership styles, even somewhat more than men do.”

Presidents of Stanford, MIT, Princeton. 2005.

Wittmann WW. 2005. Understanding and Measuring Intelligence.

Stout, Grunberg, Ito. 2016. Sex Roles.

Eagly, A. 2007. Psychology of Women Quarterly.

# Who are leaders in STEM?

- Professors?
- Administrators?
- Parents?
- Editors of elite journals?
- Nobel Prize winners?
- “Fellows” of scientific societies?
  
- Can women be these leaders in STEM?

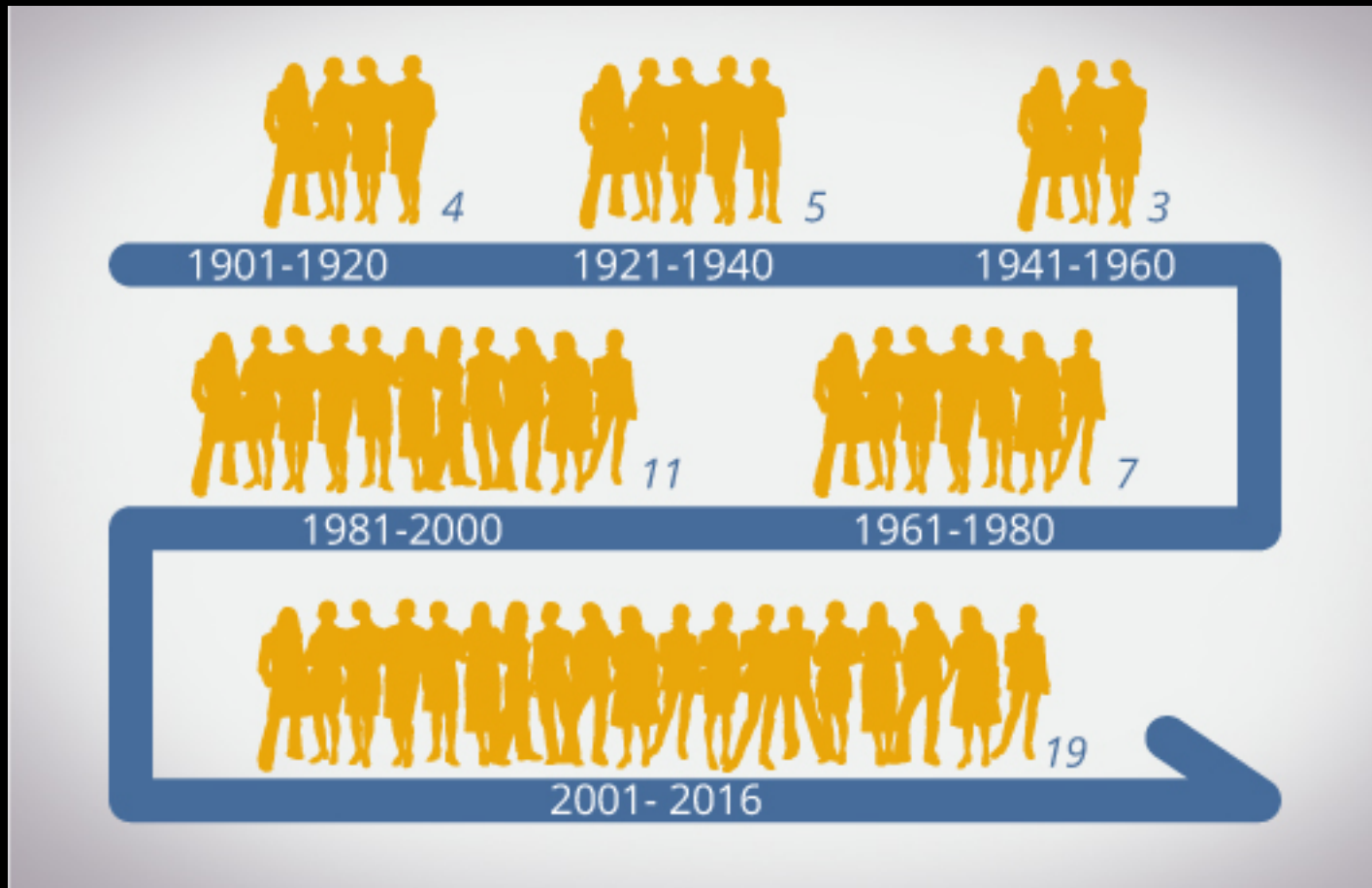
Are there women leaders in STEM?

Yes.

# Women as Department Chairs

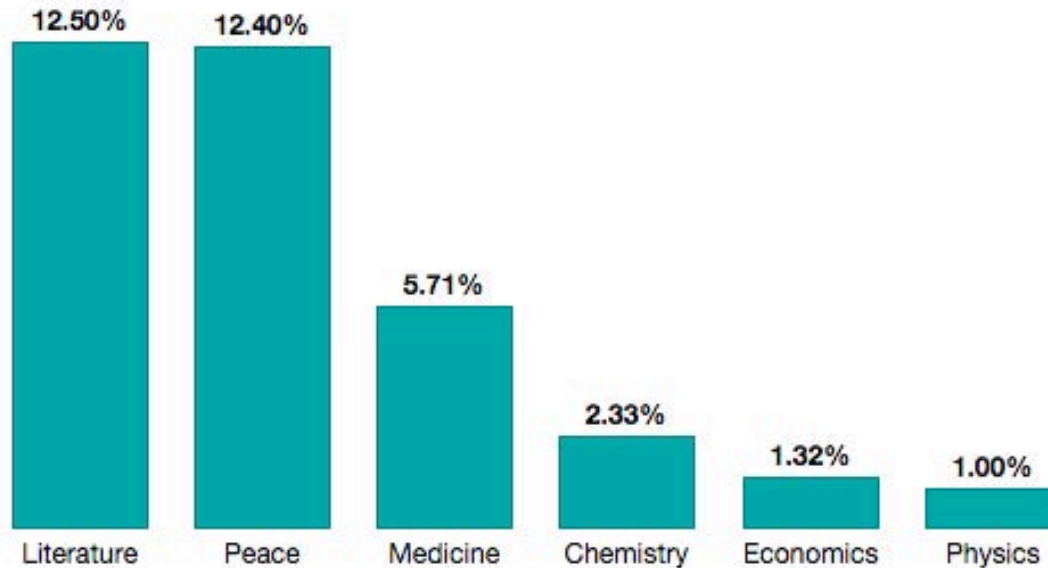
	Biology	Chemistry	Physics	Math
Random 30 departments in US	8 of 30	8 of 28	3 of 29	7 of 28
Top 20 departments in world	No ranking	3 of 18	2 of 19	2 of 20

# Women as Nobel Laureates



# Women as Nobel Laureates

## Percentage of Nobel Prizes awarded to women between 1901 and 2015\*



*\*The first Sveriges Riksbank Prize in Economic Sciences was awarded in 1969*

Source: NobelPrize.org

FORTUNE



# Women as Editors of Journals

	Science	Cell	Nature	PLOsone
# of women on Editorial Board	3 of 7	7 of 10	3 of 5	4 of 6

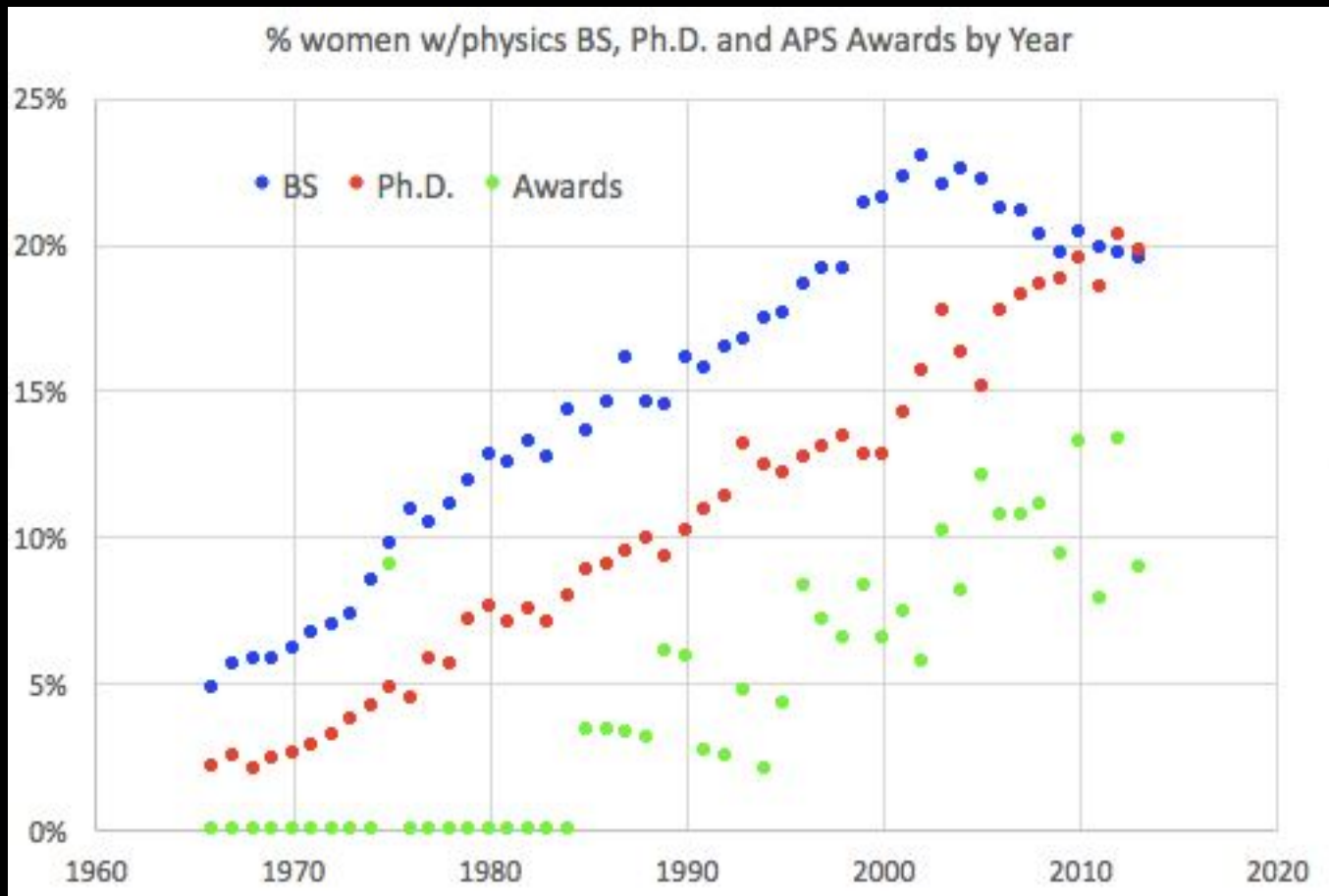
# Women as Elements?

Symbol and #	Name	Gender of name
Sm 62	Samarium	M
Am 95	Americium	M
Bk 97	Berkelium	M
Bh 107	Bohrium	M
Cn 112	Copernicium	M
Cm 96	Curium	M & F
Es 99	Einsteinium	M
Fm 100	Fermium	M
Fl 114	Flerovium	M
Ga 31	Gallium	M
Gd 64	Gadolinium	M
105	Hahnium/Dubnium	M
Lr 103	Lawrencium	M
Mt 109	Meitnerium	F
Md 101	Mendelevium	M
No 102	Nobelium	M
Og 118	Oganesson	M
Rg 111	Roentgenium	M
Rf 104	Rutherfordium	M
Sg 106	Seaborgium	M

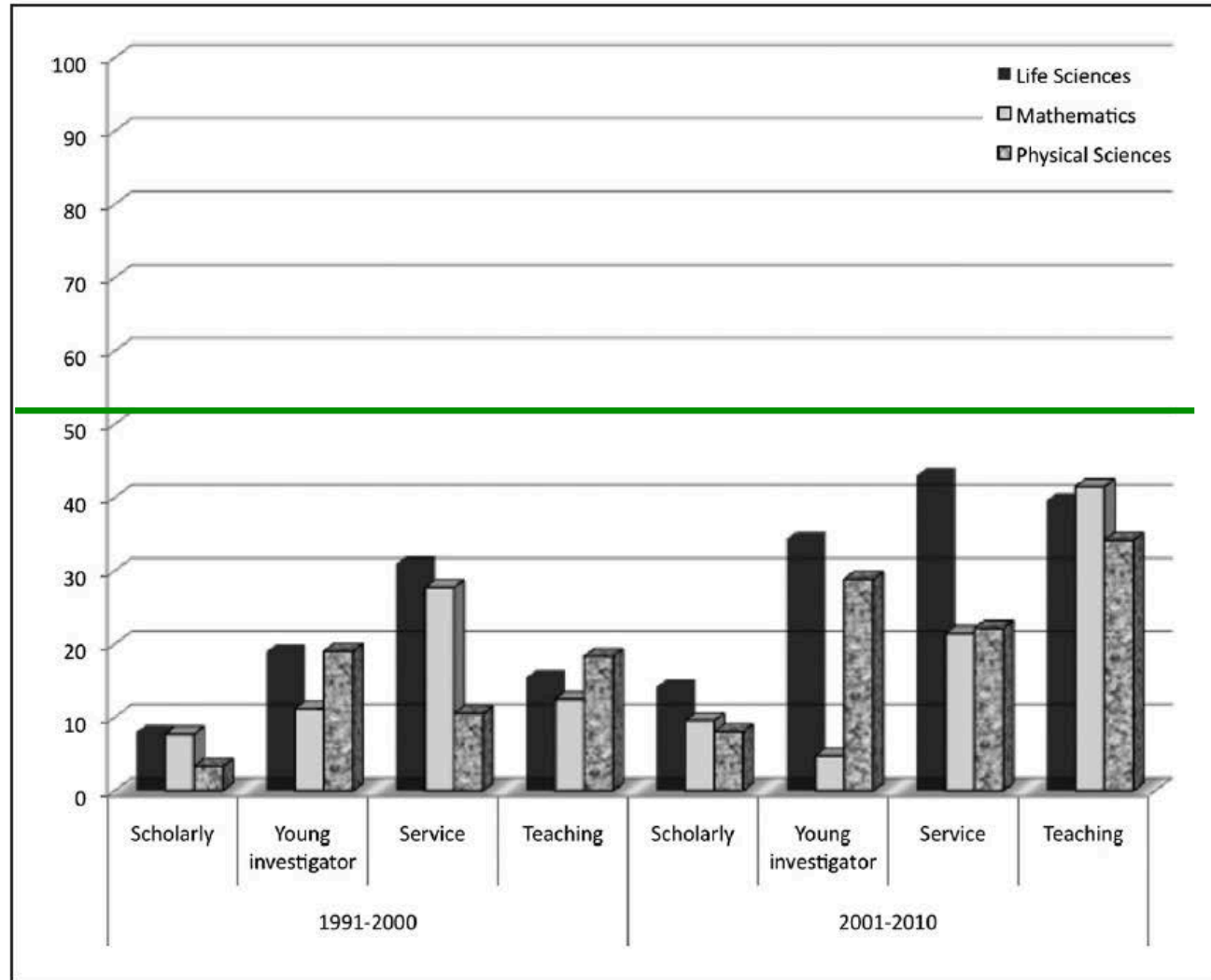
# Women as Directors of National Societies/Foundations/Institutes

	National Science Foundation	National Institutes of Health	National Academy of Science	Amer. Assn. for the Advancement of Science	National Labs
# of women	3 of 17 Directors (historical)	1 of 16 Directors (historical)	3 of 5 Officers	3 of 5 Officers	3 of 20 Directors
			8 of 12 Councilors	6 of 9 Board Members	3 of 18 Deputy Directors

# Women APS Award winners

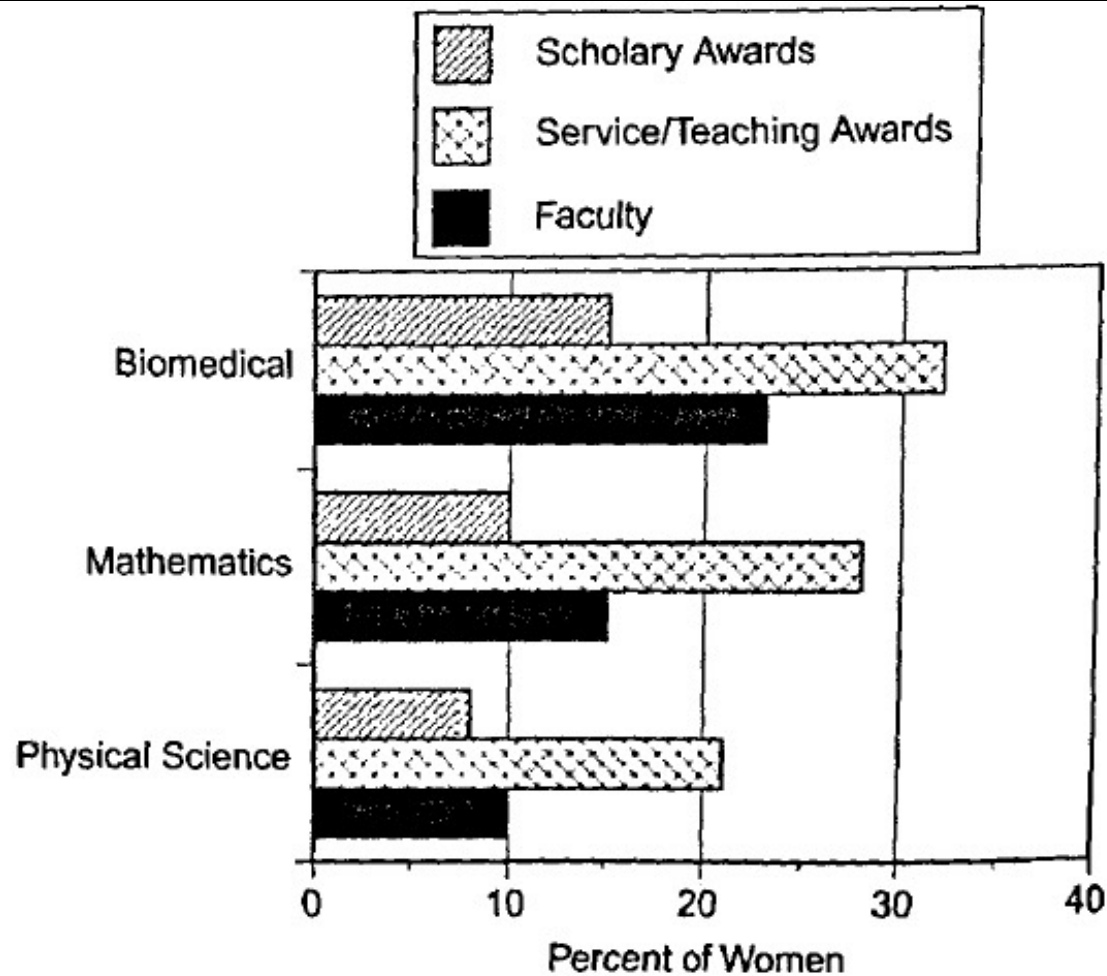


# Women Award Winners



**Figure I.** Percentage of female winners by award type and field, 1991–2010

# Women Award Winners, part 2



*Fig. 1. Proportion of Female Award Recipients for Scholarly and Service/Teaching Awards from Disciplinary Societies Grouped by Field of Study, Compared to the Proportion of Female Faculty (2001–2010).*

# Houston, we have a problem

- We need strong STEM fields
- Women as leaders offer advantages



- Need more women leaders in STEM!
  - How do we get there?

→ Get more women into STEM! ←

Are there women in STEM?

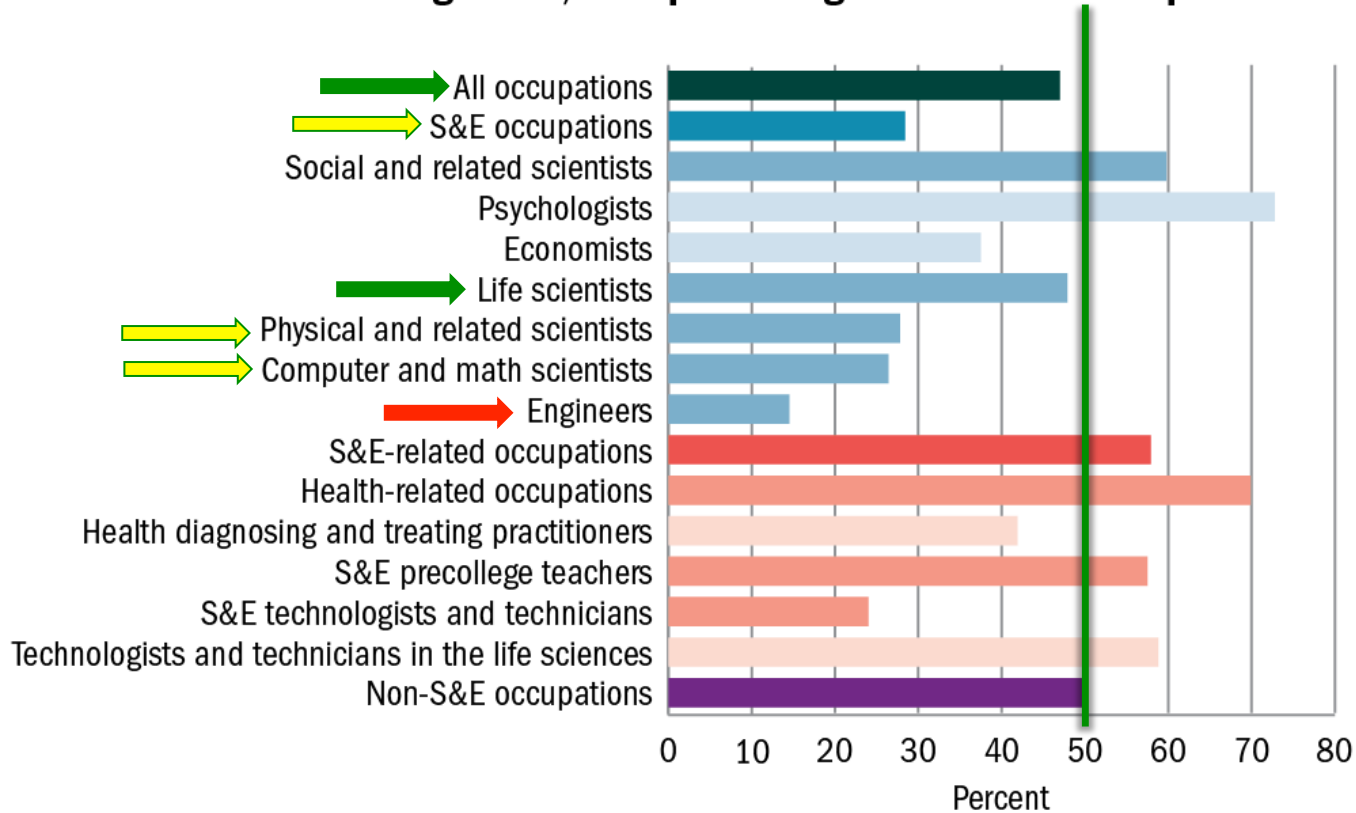
Yes



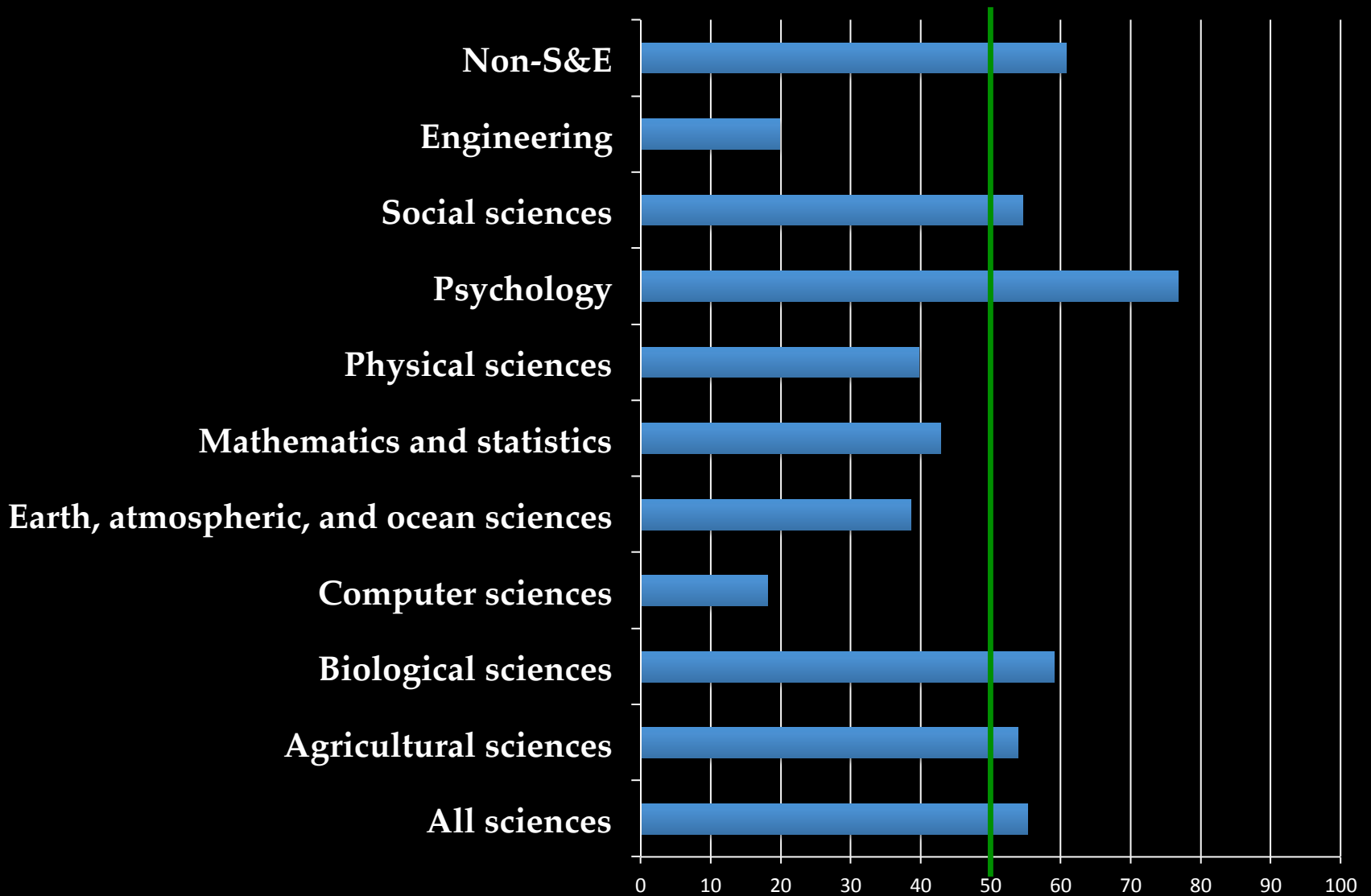
Are there women in STEM?

Yes...but

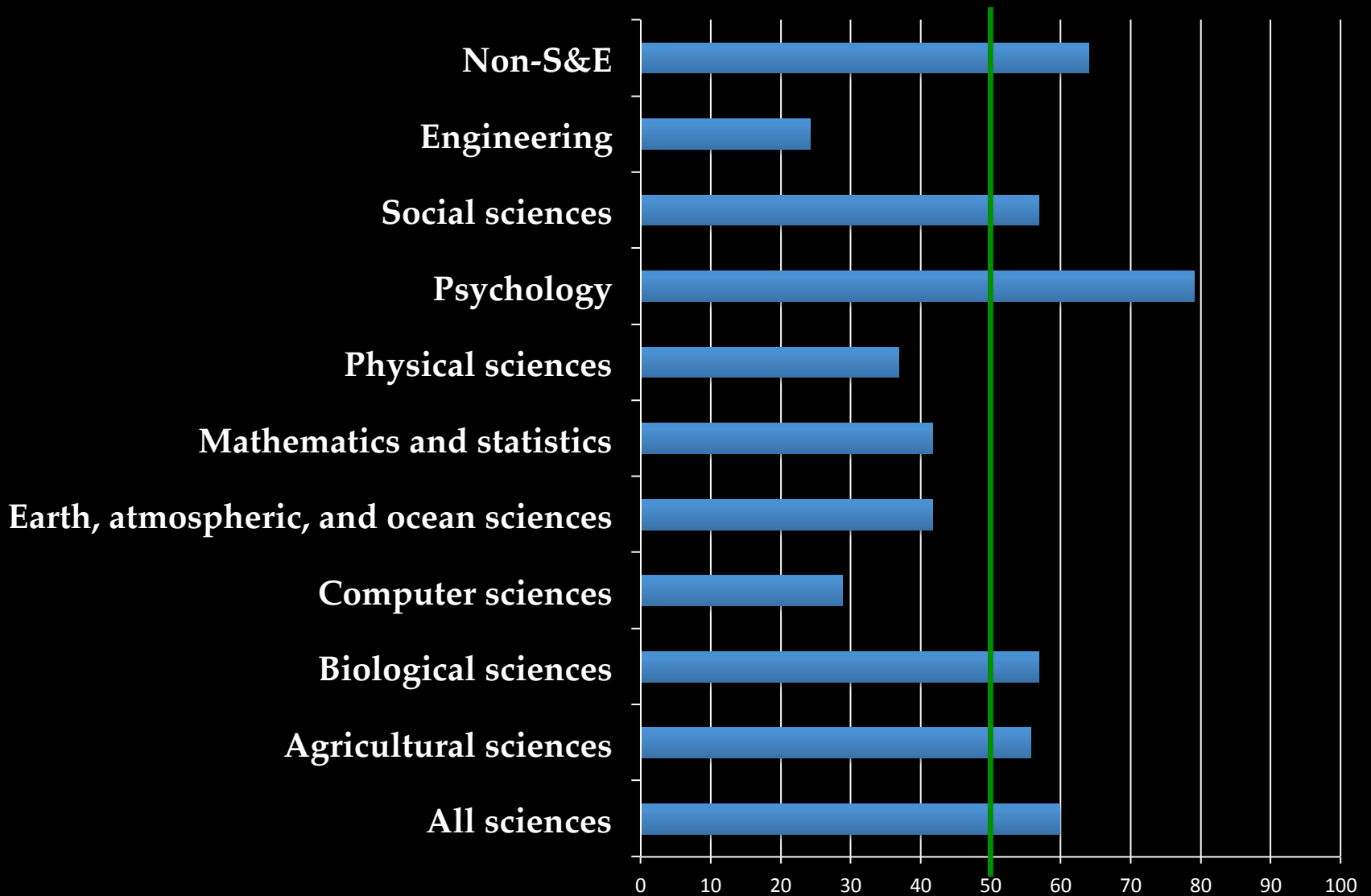
## Employed women scientists and engineers, as a percentage of selected occupations: 2015



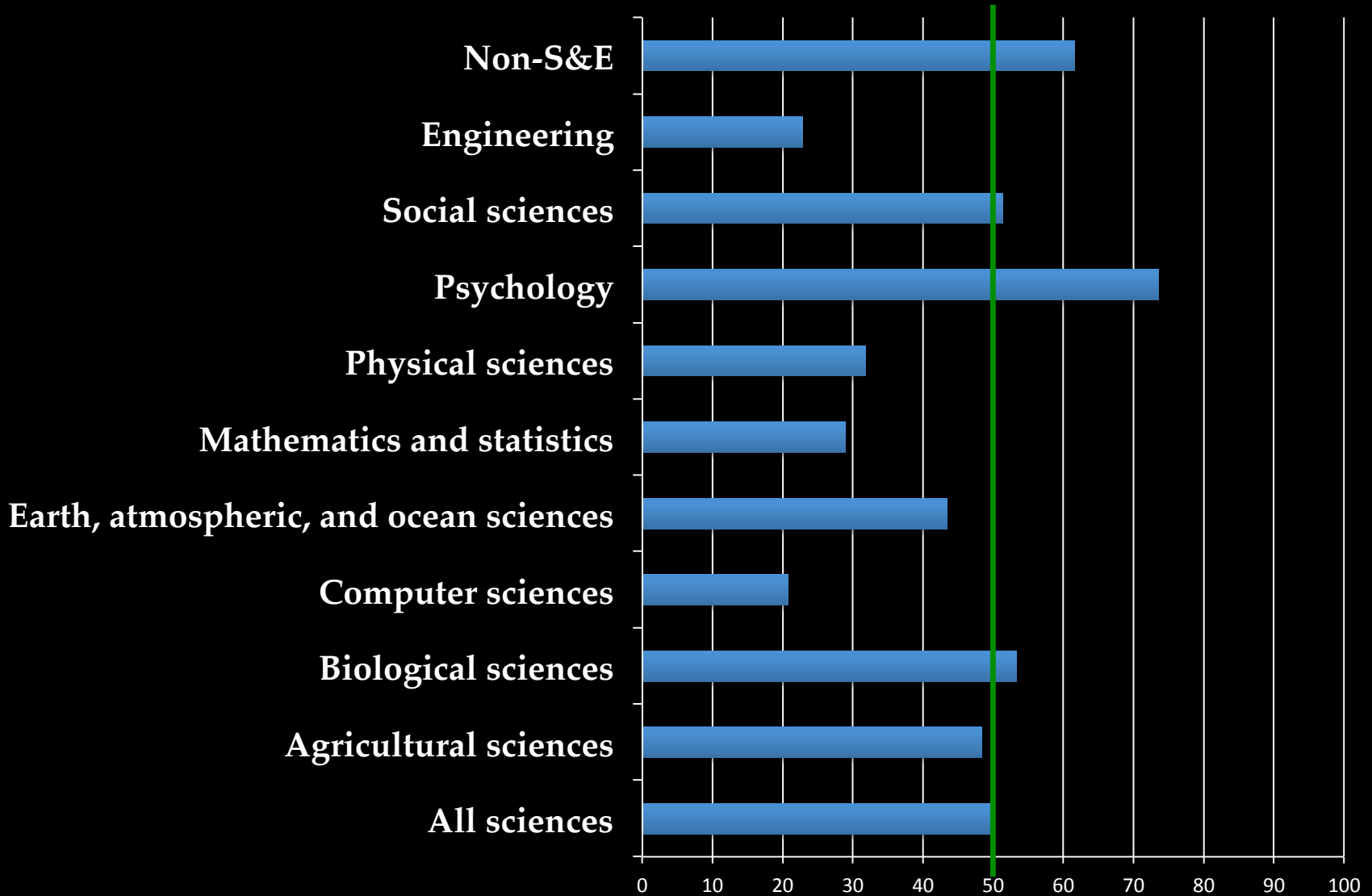
# Bachelor's: percent female 2014



# Master's: percent female 2014



# Doctorate: percent female 2014



- “The Larry Summers question: What’s up with chicks and science?”

- Can you name a female scientist?

- Now can you name a second?

# Google image search “physicist”

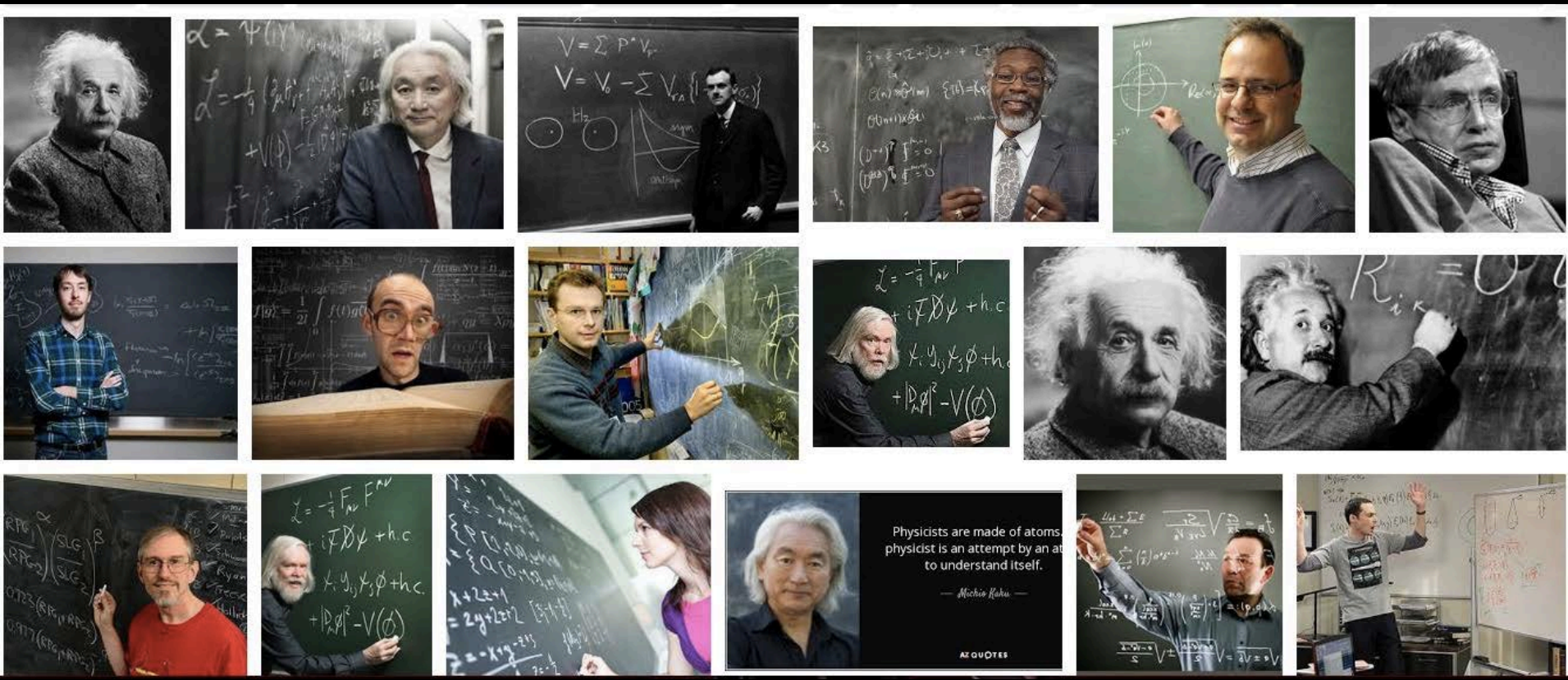




Image matters!



And image starts young...



# Why so few women?

- Family:
  - “21% of girls said their parents encouraged them to be actresses and only 10% were encouraged to be engineers.”
  - “Parents of daughters believed that their child was interested in science less than did parents of sons.”
  - “Parents were more likely to explain to boys than to girls during informal science activity.”
- Middle school:
  - Physics made her, “...think of scientists, like, the crazy scientists with the big goggles and the hair. And an explosion”
  - “I wouldn’t go for physics...I would do scientist...I would go for something like, a like of science area that I like.”
  - “Math class is tough.” —Barbie doll 1992

Purcell, K. 2012. *Unlocking Your Brilliance*.

Tenenbaum & Leaper. 2003. *Developmental Psychology*.

Crowley, K. 2001. *Psychological Science*

Dare, E. A., & Roehrig, G. H. 2016. *Physical Review Physics Education Research*.

Ibid.

# Why so few women?

- High school:
  - “I guess scientists, you can say, have power. I don’t know. And a lot of people don’t like the idea of women having power. Like women are supposed to be like at home or something. Or with the kids.”
  - “I do think it’s true that a lot of times girls are less interested. And that might be because of like society, how they’re like it might be like a cycle, you know? Like girls are told, ‘Oh girls are less interested in science.’ So they’re like, ‘Well, I’m less interested in science.’”
- College:
  - “College majors are not found in blue and pink aisles, but some might as well be.”
  - “Look at what that chick’s wearing, she obviously doesn’t know what she’s talking about!”
- Grad school:
  - “Women...left grad school because they lacked the self-confidence...They always questioned themselves, inherently.”
  - “Has anyone ever asked you if you know how to use a wrench?”

Grossman & Porche, 2014. Urban Education 49.

Ibid.

Sadker, Sadker, and Zittleman. 2009. Still Failing at Fairness.

Reddit commenter quoting bad advisor

Harsh, Maltese, Tai. 2012. J. Chem. Ed 89.

Barthelemy, McCormick, Henderson. 2014. PERC Proceedings.

# Why so few women?

- Workplace:
  - “You fall in love with them, they fall in love with you and when you criticize them, they cry.” Tim Hunt, 2015, Nobel Prize winner, on why he doesn’t like working with women in the lab
  - “Women were not treated equally. It wasn't because they weren't good enough. It was because they were not perceived as equal.”
  - A girl at girls’ science day asked how many of the female science presenters had children: “Not a single one of us [had children]...You could see the smiles on the girls’ faces just dissolve.”
  - “A female applicant had to be 2.5 times more productive than the average male applicant to receive the same competence score.”

Nobel Prize winner Tim Hunt, 2015.

Hopkins, N. 2002. MIT report.

Swanson, N. 2010. Penetrating the Tungsten Barrier.

Wenneras & Wold. 1997. Nature.

# No, really; why so few women?

- What is the cause? (Symptoms vs. disease)
- Underlying psychological theories
  - Implicit bias
  - Stereotype threat
  - Mindset

# Implicit (Unconscious) Bias

- Growing up → culturally instilled values
- Pervasive: everyone has them
- Different from explicit biases (can be same or different)
- May differ from our declared beliefs
- Tend to favor our own in-group
- Malleable—thank goodness!

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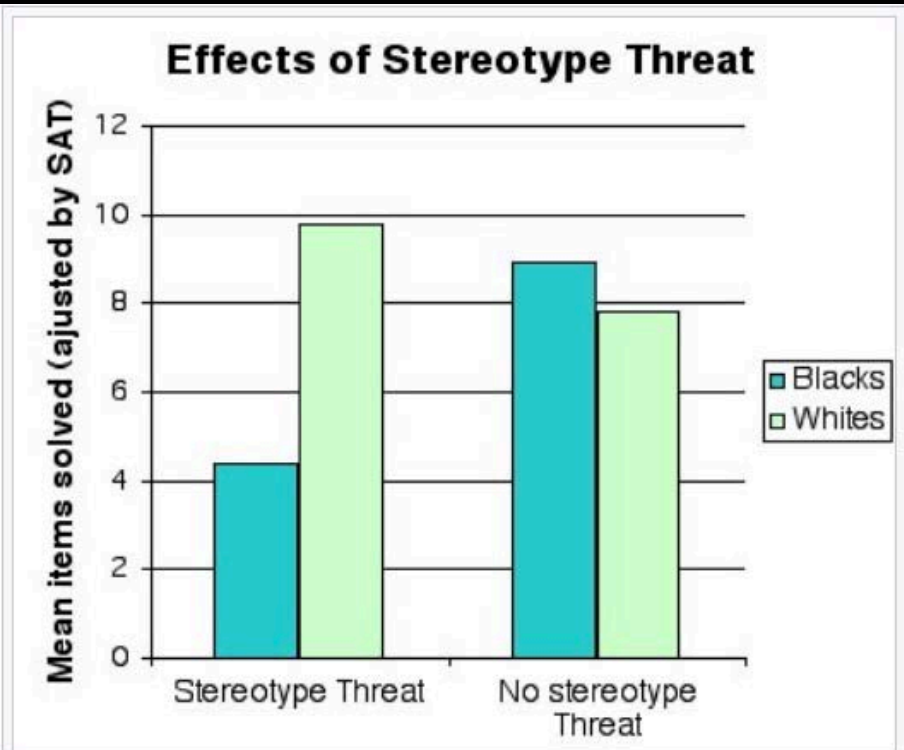
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# Stereotype Threat

- Risk of confirming a negative stereotype
- Triggered by mentioning stereotype
- Lowers performance of stereotyped groups



"The Effects of Stereotype Threat on the Standardized Test Performance of College Students (adjusted for group differences on SAT)". From J. Aronson, C.M. Steele, M.F. Salinas, M.J. Lustina, *Readings About the Social Animal*, 8th edition, ed. E. Aronson

# Mindset

- Fixed mindset: your qualities are set and unchangeable
- Growth mindset: your qualities can be cultivated and developed

# How do these explain the gender gap in STEM?

- Implicit biases cause a lot of the behaviors
- Stereotype threat reduces women's willingness to enter STEM and their self-efficacy in STEM fields
- Mindset?
  - Discipline needs “brilliance”? Fewer women!
  - Meritocracies/ “objective” fields MORE likely to show bias

# How do these explain the leadership gap in STEM?

- Implicit biases
- Stereotype threat
- Mindset?

What's the solution?

We are!

# What can YOU do?

- Parenting
  - Find your own implicit biases (Project Implicit)
  - Teach a growth mindset
  - Encourage all children to explore science
  - Use gender-neutral language
  - Use and support resources like “A Mighty Girl” and GoldieBlox

# What can YOU do?

- Classrooms
  - Find your own implicit biases
  - Teach a growth mindset, use growth-mindset language
  - Encourage all students/advisesees to explore STEM
  - Encourage all good students to continue in STEM
  - Use gender-neutral language
  - Use inclusive textbooks
  - Use inclusive contexts and examples
  - Hire women as TAs/LAs and tutors
  - Counter stereotype threat in your classroom

# What can YOU do?

- Colleagues
  - Find your own implicit biases
  - Listen for biased language (jokes, phrases, names)
  - Watch for microaggressions and biased behavior (who always gets the coffee? Who plans social events? Who is always missing meetings because of family care?)
  - Ensure women's voices are heard and women's ideas are attributed
  - View the other side: replace “men” with “women”



# What can YOU do?

- Leaders
  - Find your own implicit biases
  - Promote the positive (80% of groups have women instead of 20% of groups have none)
  - Collect data!
  - Transparency in decisions
  - Mentorship and sponsorship/advocacy
  - Negotiation training
  - Beware the “we’ve always done it this way” trap
  - Don’t use men as the standard for comparison
  - Female role models

# Take Home Message

- Women can do STEM
- Women DO do STEM
- Women lead in STEM
- We need more women in STEM
- Everyone needs to help improve STEM for women
- You can help!

Thank you!

[www.lauramccphd.com](http://www.lauramccphd.com)



# Treat scientists as celebrities!

[https://www.youtube.com/watch?v=sQ6\\_f0X7ITQ](https://www.youtube.com/watch?v=sQ6_f0X7ITQ)

Five centuries ago Francis Bacon formalized the scientific method. In his empirical vision of epistemology Bacon saw the lab-based experiment as providing the foundation for trusted knowledge, which could then be built up into higher level, more abstract thinking. From this point onward many began to see [physics as the queen of the sciences](#). To this day the Nobel Prize in Physics is awarded before the others which is in keeping with the field's role as the cornerstone of science.



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