

Is Science a Meritocracy? Issues of Diversity & Equity

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18 Sep 2020

What This Talk *IS*

- Simplified
- Some evidence for *inequity* & *exclusion* in STEM
- Arguments *for* diversity, equity & inclusion
- 3 “diseases” adversely affecting success
- What you can do for yourself

What This Talk Is *Not*

- Comprehensive

National Science Board *Science & Engineering Indicators 2014–2020*

DEMOGRAPHICS

Canonical **Underrepresented** Minorities in S&E

- Males: 49.2%; **Females: 50.8%**
- **Hispanic or Latino: 16.3%**; **Not: 83.7%**
18.3% 81.7%
- **White: 72.4%**
72.2%
- **Black or African American: 12.6%**
12.7%
- **American Indian and Alaska Native: 0.9%**
- **Asian: 4.8%**
5.6%
- **Native Hawaiian and Other Pacific Islander: 0.2%**
- **Some other Race: 6.2%**
5.0%
- **Two or More Races: 2.9%**
3.4%

Leaky Science Pipeline: Logic

- In the science pipeline (from high school to undergrad to grad to workforce)...
<http://www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm>
- URM's are smaller and smaller fractions *compared to national representation.*

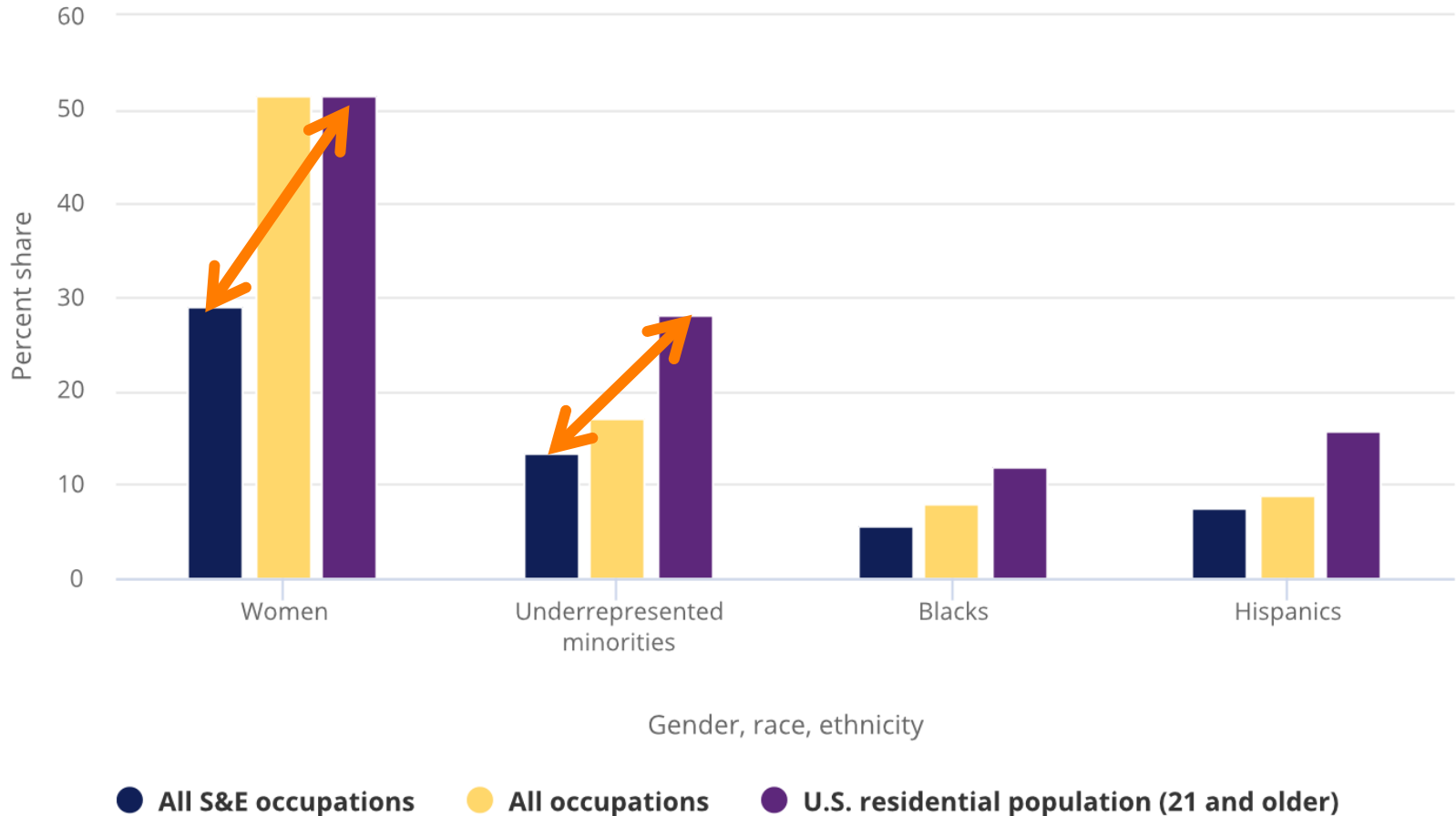
51.5% and  Women are 29% and 28.1% of population

 Racial URMs are 13% of S&E Workers

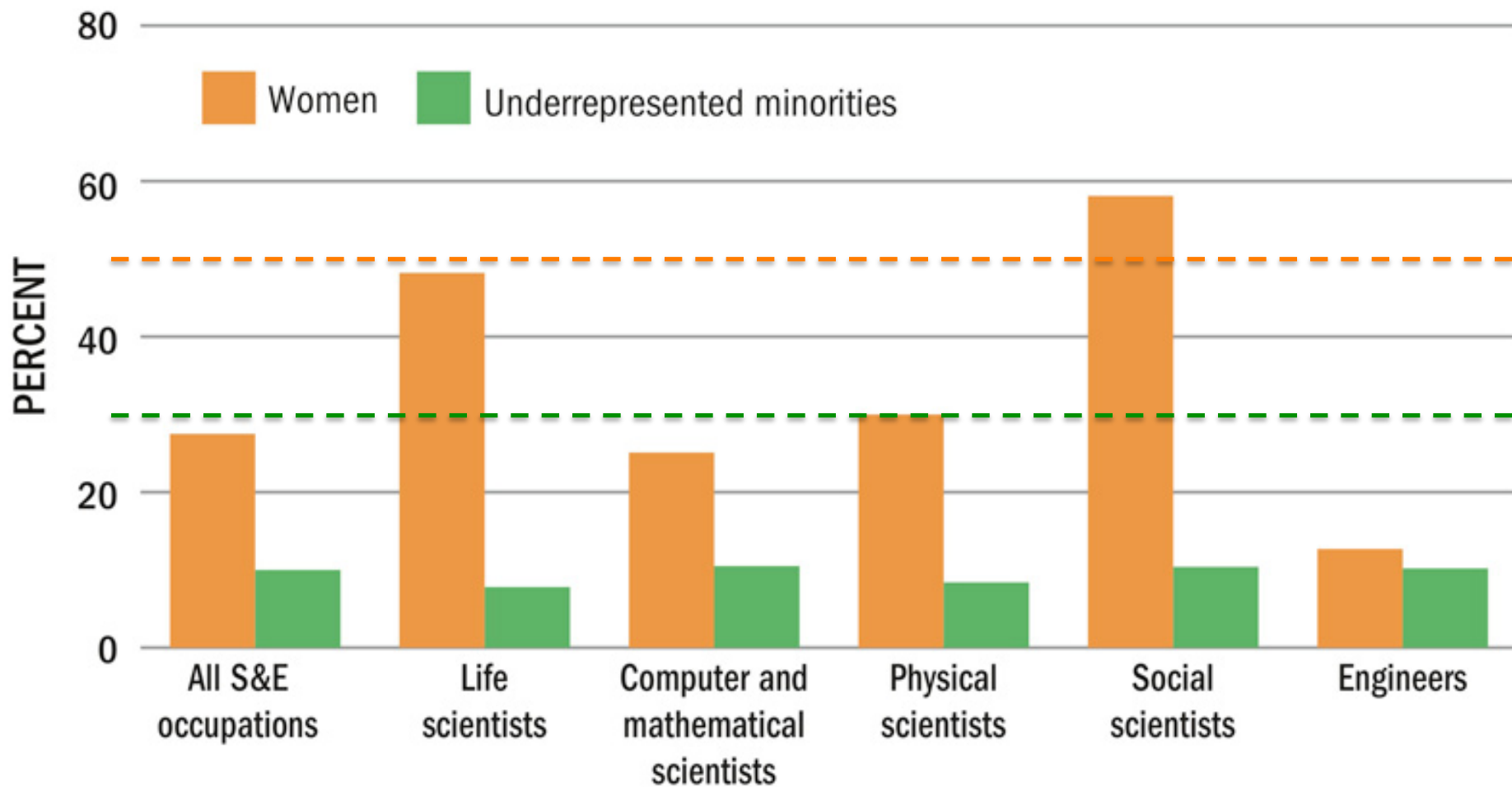
National Science Board | Science & Engineering Indicators | NSB-2020-1

FIGURE 6

Women, underrepresented minorities, blacks, and Hispanics in S&E and all occupations: 2017



Racial URM Percent Depends on Field

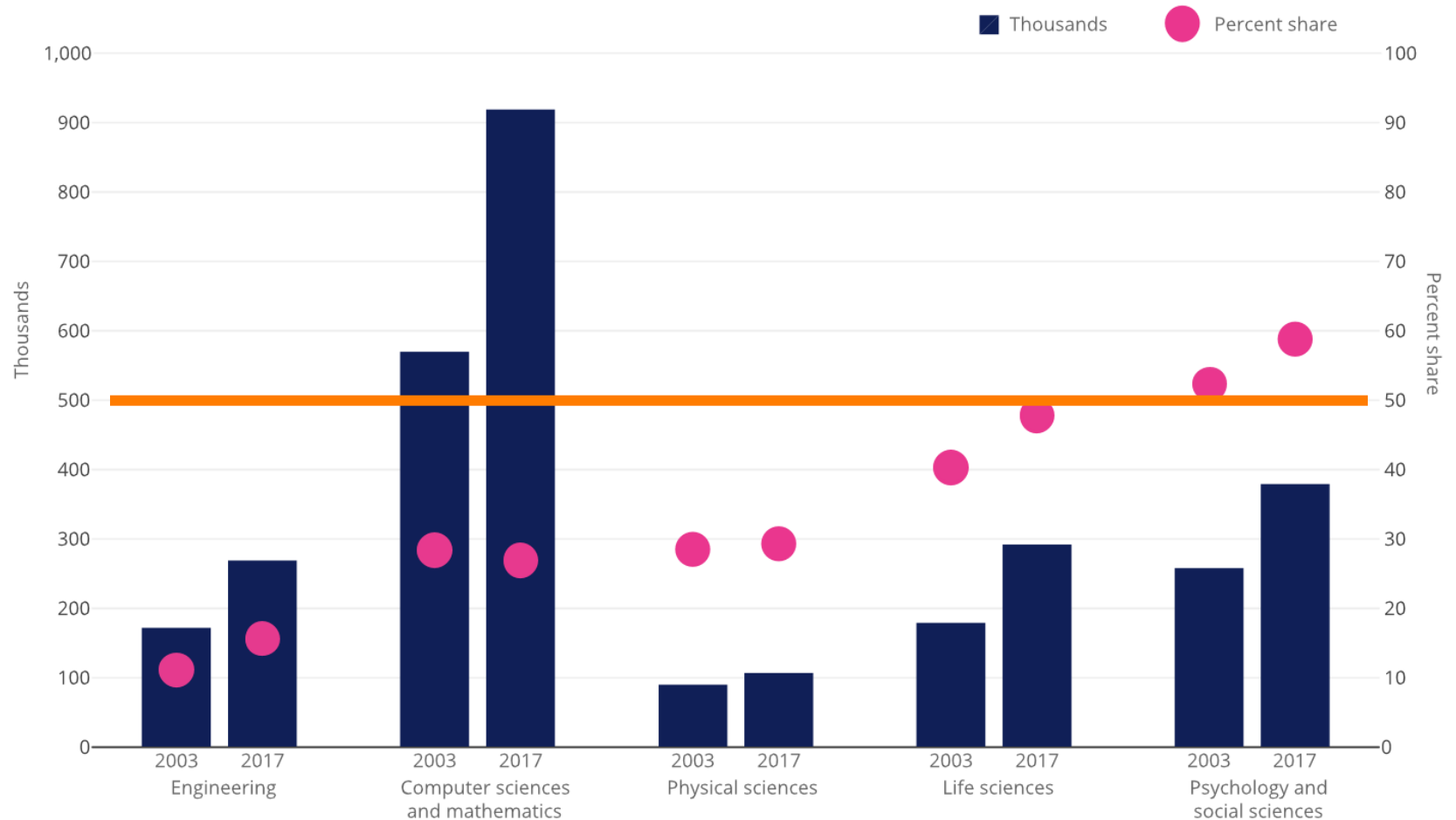


Female Fraction Depends on Field

National Science Board | Science & Engineering Indicators | NSB-2020-1

FIGURE 7

Women in S&E occupations, by broad occupational category: 2003 and 2017

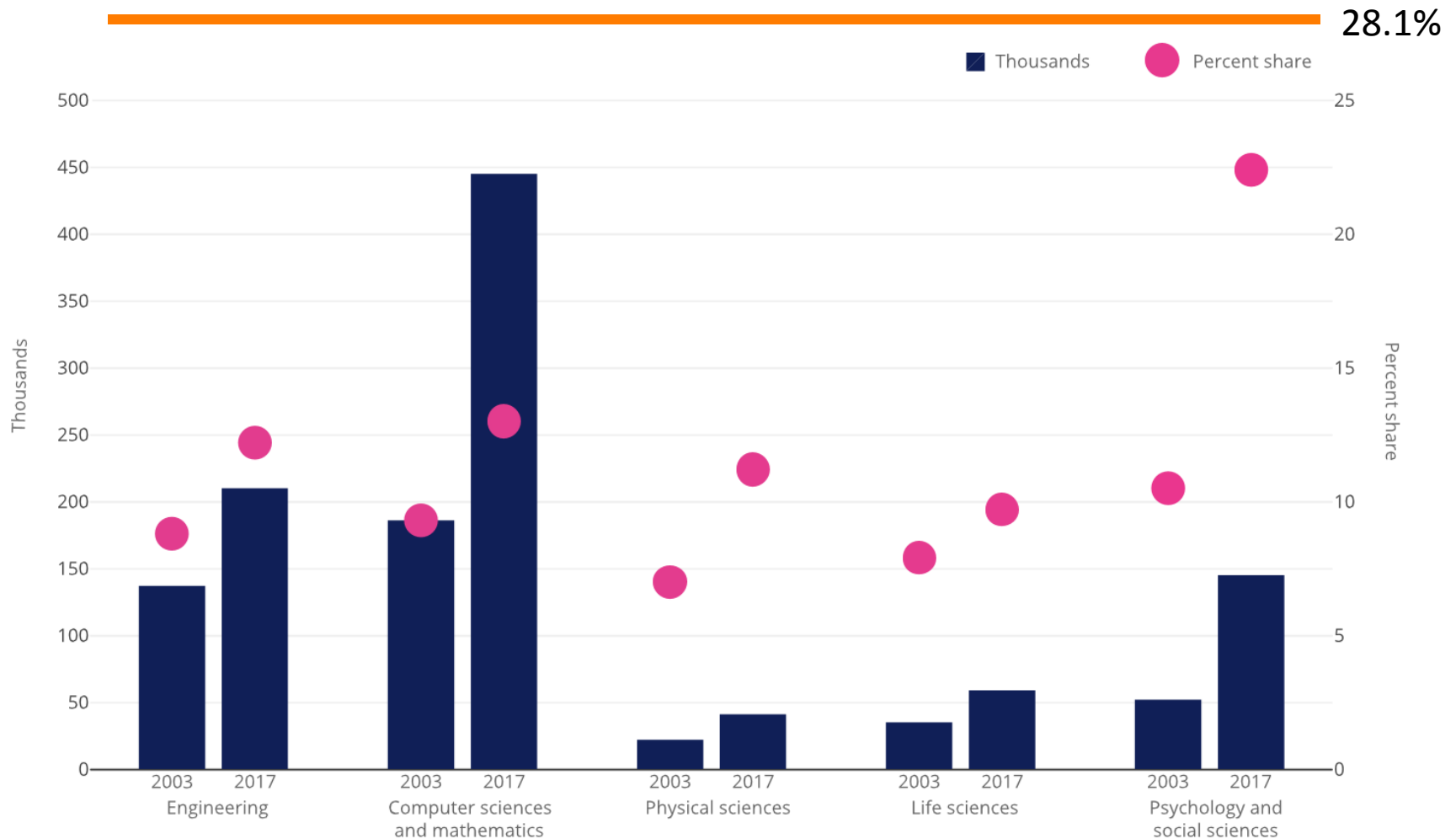


Racial URM Fraction Depends on Field

National Science Board | Science & Engineering Indicators | NSB-2020-1

FIGURE 8

Underrepresented minorities in S&E occupations, by broad occupational category: 2003 and 2017



Leaky Science Pipeline: Logic

- In the science pipeline (from high school to undergrad to grad to workforce)...
<http://www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm>
- URM students are smaller and smaller fractions *compared to national representation*.
- Assuming (though there is evidence) ability and initial interest are not genetic...
- We conclude systemic issues induce URM students to “leak out”

Why Should STEM Be More Diverse?

- Fairness:
 - “... it is simply unjust for a profession to organize itself, intentionally or unintentionally, in such a way as to exclude a significant portion of the population.”
- Talent pool:
 - “... if we are not tapping into the entire talent pool that is available to make a contribution to science, the enterprise will by definition be underperforming its potential.”

Princeton President Shirley Tilghman

[Response](#) to Harvard former-president Lawrence Summer's words in 2005

Not Just Talent Pool *Answering* Questions

The questions *asked* will be more diverse.

- Medical research used to ignore females in clinical research

– Louann Brizendine 2007, *The Female Brain*

Why Should STEM Be a Meritocracy?

- Everyone should have a chance to set the record straight
 - Grace Hopper (c. '50s–'60s)
 - Neil deGrasse Tyson (c. now)
 - Just read or watch *Hidden Figures* (c. '60s)
 - And so many [more](#) (starting with [Hypatia](#), c. 400 AD)
- Grant process attempts to be meritocratic
 - [NASA moves to “dual-anonymous peer review”](#)

Stereotype Threat, Imposter Syndrome, Implicit Bias

“DISEASES” ADVERSELY AFFECTING DIVERSITY & EQUITY IN STEM

What is Stereotype Threat?

“...being at risk of confirming, as self-characteristic, a **negative** stereotype about **one's group** (Steele & Aronson 1995). [...] Research has shown that stereotype threat can harm the academic performance of any individual for whom the situation invokes a stereotype-based **expectation** of poor performance.”

What is Imposter Syndrome?

- Feelings of not deserving to be in the position one is in
- Feelings of being afraid that employers, instructors, peers, etc. will come to realize one is not as capable as may seem
- AKA imposterism

Lucas Laursen, *Science Careers*, 15 Feb 2008 ([10.1126/science.caredit.a0800025](https://doi.org/10.1126/science.caredit.a0800025))
Kathy Cooksey, AAS CSMA SPECTRUM, January 2014
(http://csma.aas.org/spectrum_files/spectrum_Jan14.pdf)

Negative Effects of Stereotype Threat and Imposter Syndrome

- Negative stress
 - Overworking, unhappiness, anxiety...
- Self-sabotage
 - Underworking, under-aspiring
- Unconscious underperforming
 - (primarily induced by stereotype threat)

What is Implicit Bias?

- “positive and negative evaluations that occur outside of our conscious awareness and control.”
- AKA unconscious bias

Negative Effects of Implicit Bias

- Resumes with female or “black” names land less jobs
 - <http://abcnews.go.com/blogs/business/2013/07/man-named-kim-adds-mr-to-resume-lands-job/>
 - <http://www.cbsnews.com/news/black-names-a-resume-burden/>
- Recommendation letters with softer language
 - <http://das.sagepub.com/content/14/2/191.abstract>

Implicit (or Explicit) Bias in Hiring

Women in Science

Elite Male Faculty Employ Fewer Women

By Vijaysree Venkatraman

June 30, 2014

Consequently, women are underrepresented as postdocs in these important feeder labs—surely an explanation for the paucity of women faculty at these top institutions.

Vijaysree Venkatraman, *Science Careers*, 30 Jun 2014 ([10.1126/science.caredit.a1400167](https://doi.org/10.1126/science.caredit.a1400167))

Implicit bias in allotting resources

([http://web.mit.edu/fnl/women/women.html#The Study](http://web.mit.edu/fnl/women/women.html#The_Study))

Implicit Bias in Promotion



Women in Science

Equally productive women are tenured less

By Beryl Lieff Benderly

August 18, 2014

“It’s not that we need to make women more productive. It’s that we need to change the processes.” —Kate Weisshaar

Beryl Lieff Benderly, *Science Careers*, 18 Aug 2014 ([10.1126/science.caredit.a1400212](https://doi.org/10.1126/science.caredit.a1400212))

More negative course evaluations ([Inside Higher Ed, 11 Jan 2016](#))

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- Recommendation letters with softer language
 - <http://das.sagepub.com/content/14/2/191.abstract>
- Resumes with stereotypical activities viewed poorly
 - http://www.nytimes.com/2013/06/09/opinion/sunday/coontz-richer-childless-women-are-making-the-gains.html?_r=0
- Situation interpreted to confirm implicit bias
 - Sharon Traweek 1992, *Beamtimes and Lifetimes: The World of High Energy Physicists*

Stereotype Threat, Imposter Syndrome, Implicit Bias

SO WHAT HELPS?

Combating Stereotype Threat

- Knowing is half the battle
- Community
- Little things: mindfulness of decorations
 - [Cheryan, Plaut, Davies, & Steele](#) (2009, Journal of Personality and Social Psychology)
- Not asking for demographics before standardized tests!

Stereotype Busting

Girls Love Blue Too

Fun clothing, toys, books & accessories that crush gender stereotypes and let kids express who they are!



Biana Betz, *Scientific American*, 11 Sep 2012
(the-trouble-with-barbie-science)

Beryl Lief Benderly, *Science Careers*, 17 Sep 2013
(10.1126/science.caredit.a1300200)

Combating Imposter Syndrome I

- Growth mindset (as opposed to fixed)
 - Carol Dweck, *Scientific American Mind*, Dec 2007/Jan 2008
- Community (trusted external metric)
- “Fake it until you make it.”
- Be the worst on the team (and be fine with that)
 - Being surrounded by and working with talented people improves your ability
 - Attempting to be the worst stops you from selling yourself short
 - Chad Fowler 2005, *My Job Went to India (And All I got Was This Lousy Book)*

Combating Imposter Syndrome II

- Calibrate:
 - the more you know, the more you know there is to know, so the less you *think* you know
 - $\sum_{e=\text{everyone} \neq \text{you}} N_{\text{success},e} \gg \sum_{u=\text{you}} N_{\text{success},u}$
 - Fisher Files, <http://scripts.mit.edu/~podcast/wordpress/about/>, “Imposter!”, ep. 1, seq. 2
- Accept “zone of proximal development” is uncomfortable... that’s learning
 - Vygotsky 1978, *Mind in Society: The Development of Higher Psychological Processes*
- In research, it’s your job not to know
- And... suffering from Imposter Syndrome beats suffering from Dunning-Kruger Effect...

Counterpoint to Imposter Syndrome:

Dunning-Kruger Effect

“When people **are incompetent** in the strategies they adopt to achieve success and satisfaction, they suffer a dual burden: Not only do they reach erroneous conclusions and make unfortunate choices, but their **incompetence robs them of the ability to realize it.**”

Errol Morris, *NYT*, 20 Jun 2010

(<http://opinionator.blogs.nytimes.com/2010/6/20/the-anosognosics-dilemma-1/>)

Combating Implicit Bias

- Everyone being aware
- Letter writers being aware
 - Be comfortable discussing
- Dual-anonymous peer review (i.e., double blind)
 - NASA SMD: <https://science.nasa.gov/researchers/dual-anonymous-peer-review>
- Initials on resumes, CVs, applications, proposals...



We're Well Situated to Be Diverse S&E Community

THE CHRONICLE OF HIGHER EDUCATION Almanac of Higher Education 2014

HOME PROFESSION STUDENTS DIVERSITY FINANCE TECHNOLOGY INTERNATIONAL STATES

August 18, 2014

Most-Diverse Campuses, Fall 2012

Among states, California had by far the highest number of most-diverse campuses appearing on this list: 36. It was followed by Hawaii, with 14, and New York, with 10. The diversity index measures, on a scale of 0 to 100, the probability that any two students at an institution are from different racial or ethnic groups.

4-year public												
Rank	Institution	Total enrollment	Nonresident alien	American Indian/Alaska Native	Asian	African-American	Hispanic	Hawaiian/Pacific Islander	White	2 or more races	Race unknown	Diversity index
1.	U. of Hawaii at Hilo	4,157	4.4%	0.4%	22.1%	1.2%	9.1%	11.3%	23.4%	28.2%	0.5%	87.32

Am. Indian/ Alaska Native	Asian	Black	Hispanic/Latino	Hawaiian/ Pacific Isl.	White	Two or more races	Unknown
0.4%	22.1%	1.2%	9.1%	11.3%	23.4%	28.2%	0.5%
0.9%	4.8%	12.6%	16.3%	0.2%	72.4%	2.9%	6.2%



Issues Not Even Addressed

- Economic background
 - e.g., [“What’s it like to be poor at an ivy league school?”](#), Foster, *Boston Globe*, 9 Apr 2015
- Age
 - e.g., [“Tech industry job ads: older workers need not apply”](#), Kopytoff, *Fortune*, 19 Jun 2014
- Disabilities
 - e.g., [“Biologist with a vision”](#), McKarney, *Science Magazine*, 6 Jun 2003
- LBGQTQI
 - e.g., [“Gravitational wave research succeeds by being herself”](#), Venkatraman, *Science Magazine*, 1 Jun 2012
- Affirmative action
 - e.g., [Fisher vs University of Texas](#)
- ...

Take-Home Messages

- Decide yourself whether science should be a meritocracy
 - And if so, is it?
 - If it should be and isn't, what can you do?
 - URM—by definition—need overrepresented pluralities/minorities' support
- Knowing is half the battle
 - Stereotype threat, imposter syndrome, implicit bias
- Possible recourses:
 - Growth mindset, diverse applicant pools, community

Resources

- National Science Board Science & Engineering Indicators: <https://nces.nsf.gov/indicators>
- <http://reducingstereotypethreat.org/>
- <https://implicit.harvard.edu/implicit/iatdetails.html>
- Center for Research on Gender in STEMM https://crg_stemm.ucsd.edu/
- Just Google terms; there's a lot of literature

Big mahalo!

Questions?