

Is Science a Meritocracy? Issues of Diversity & Equity

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16 Sep 2016

National Science Board *Science & Engineering Indicators 2014*

DEMOGRAPHICS

2010 US Census

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

(<http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf>; [c2010br-02.pdf](http://www.census.gov/prod/cen2010/briefs/c2010br-02.pdf))

Canonical Underrepresented Minorities in S&E

- Males: 49.2%; Females: 50.8%
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Leaky S&E Pipeline

High School to College Leak

Figure 1-18
On-time graduation rates of U.S. public high school students, by race and ethnicity: 2006 and 2010

Percent

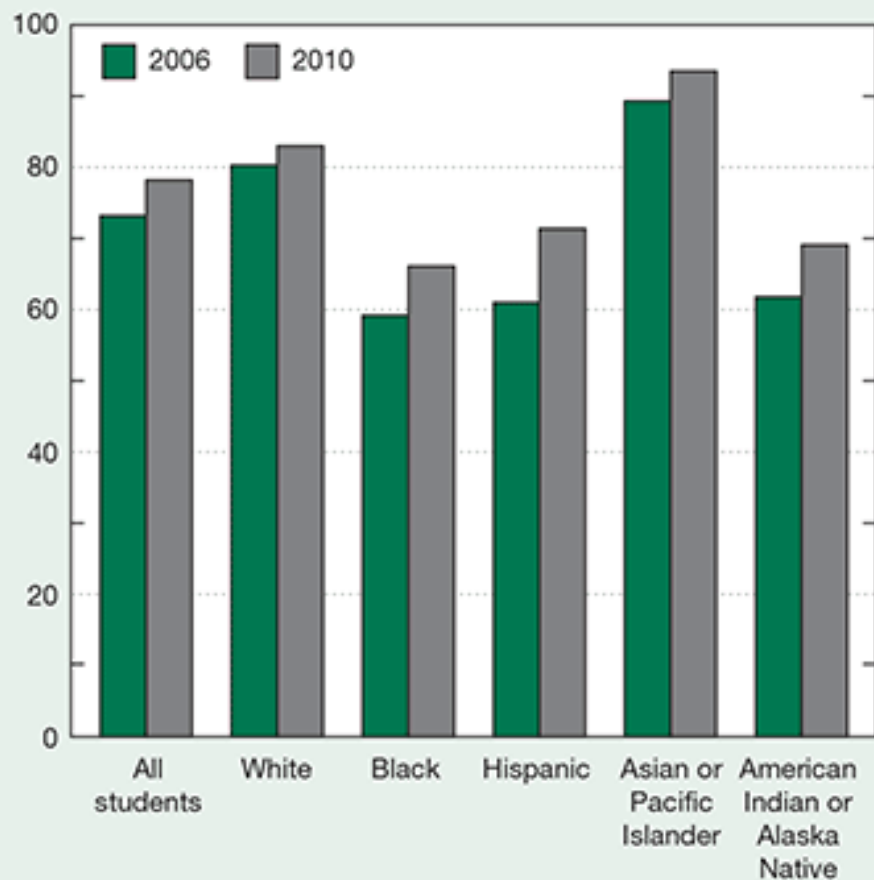
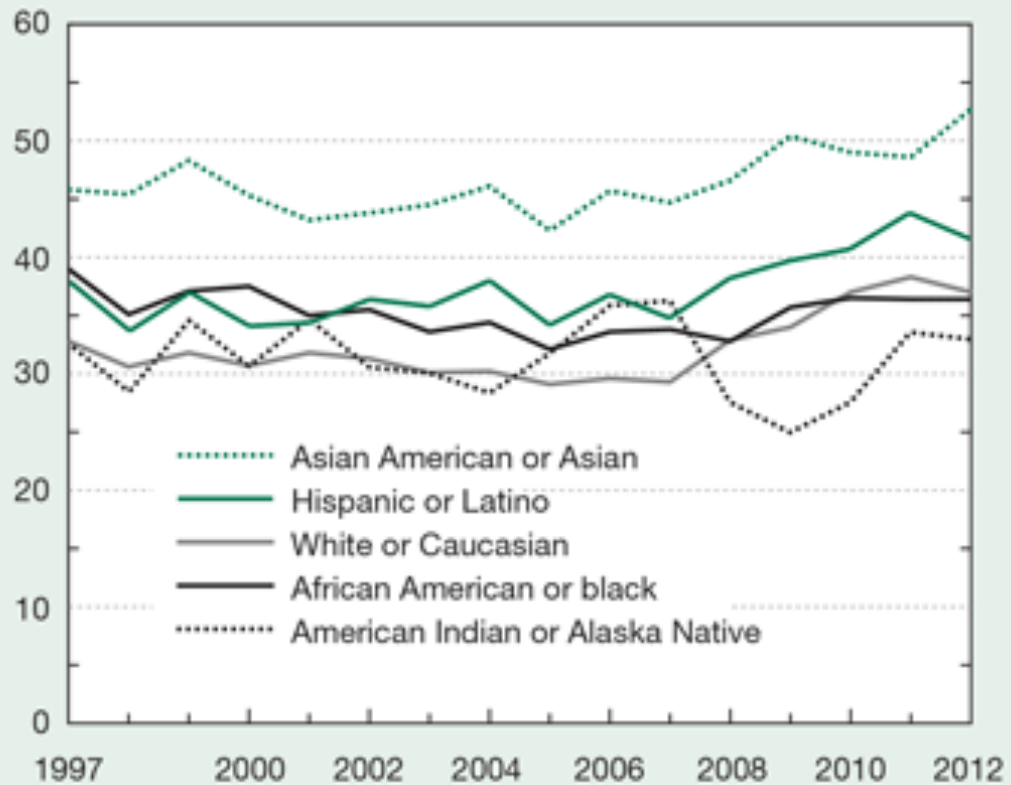


Figure 2-10
Freshmen intending S&E major, by race and ethnicity: 1997-2012

Percent



Leaky S&E Pipeline: Women and College

Figure 2-13
Natural sciences: Freshmen intentions and degrees, by sex

Percent

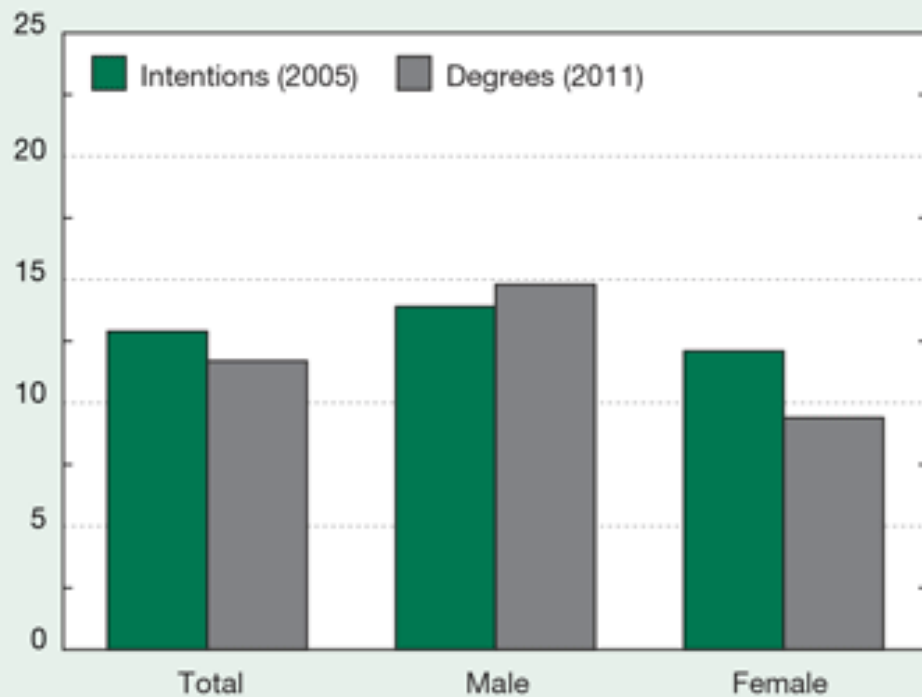
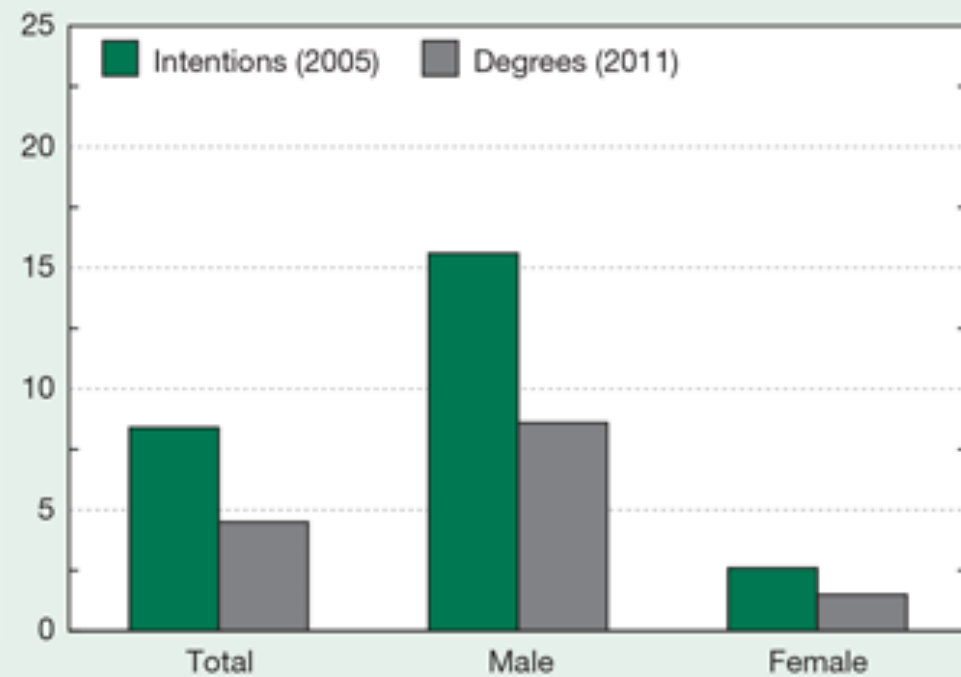


Figure 2-11
Engineering: Freshmen intentions and degrees, by sex

Percent



Leaky S&E Pipeline: Racial URM and College

Figure 2-14

Natural sciences: Freshmen intentions and degrees, by race and ethnicity

Percent

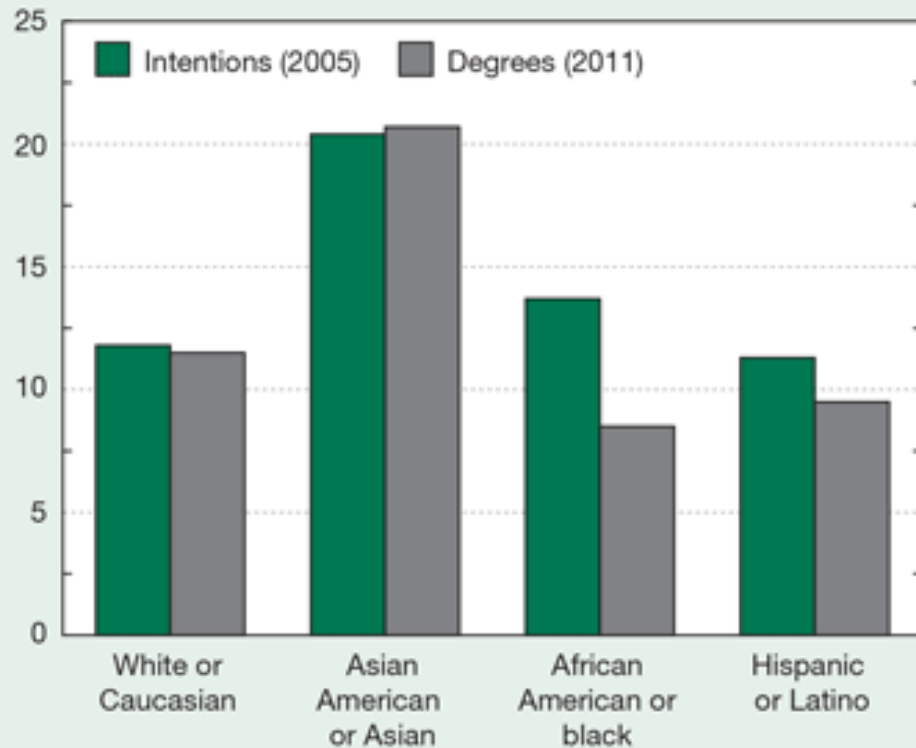
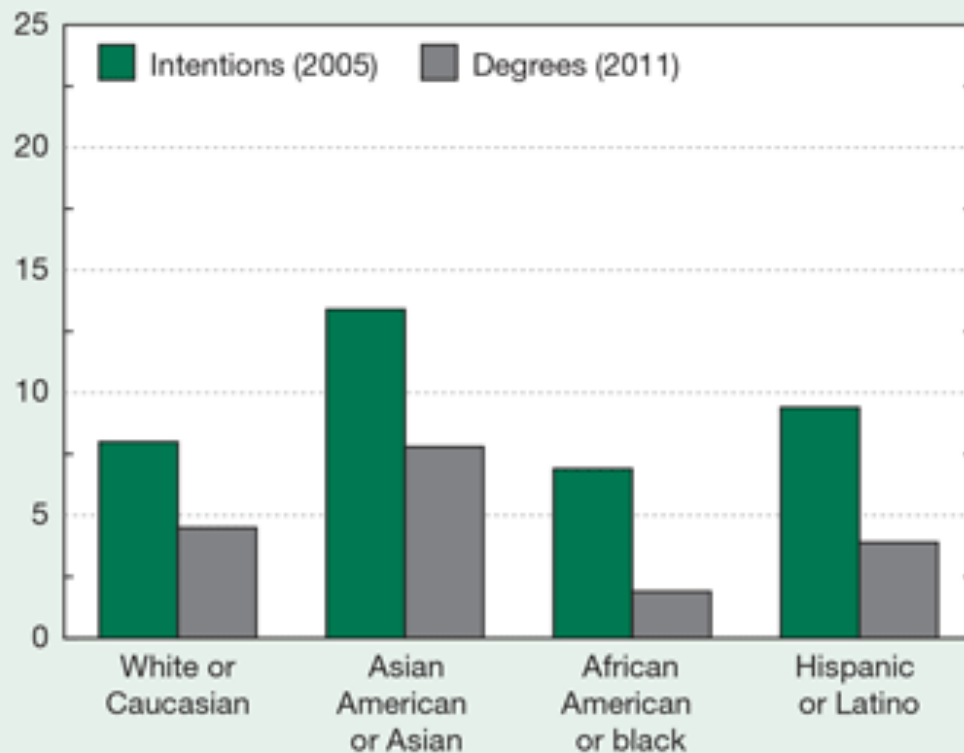


Figure 2-12

Engineering: Freshmen intentions and degrees, by race and ethnicity

Percent



Demographics of S&E Job Seekers

Figure 2-18
Women's share of S&E bachelor's degrees, by field: 2000–11

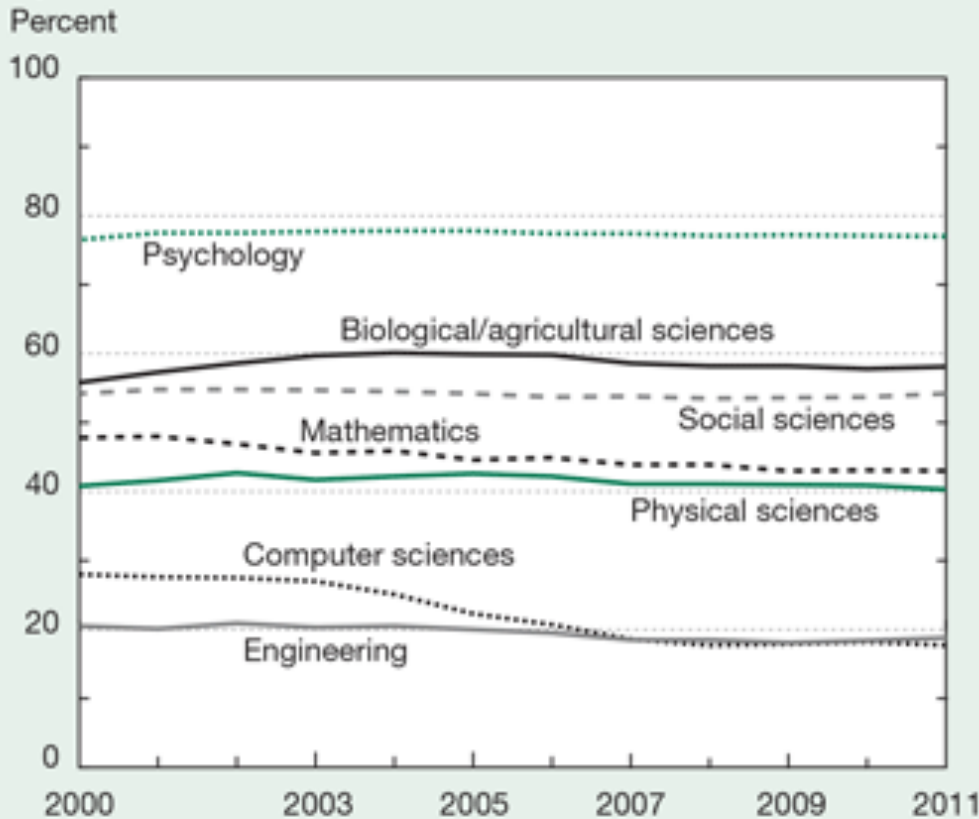
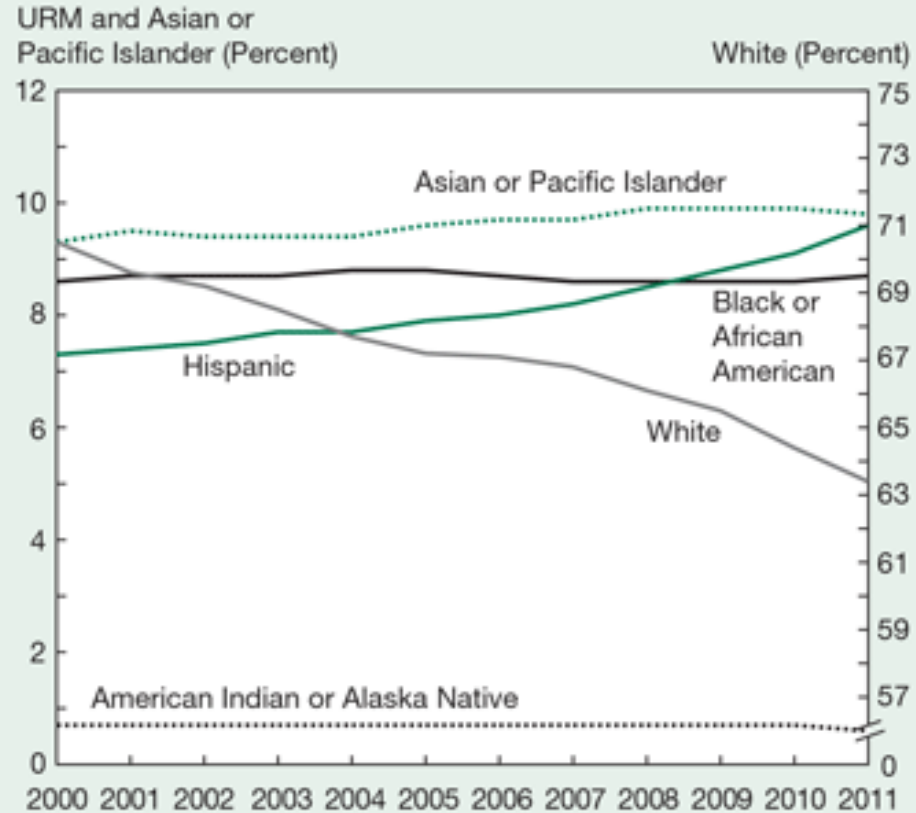
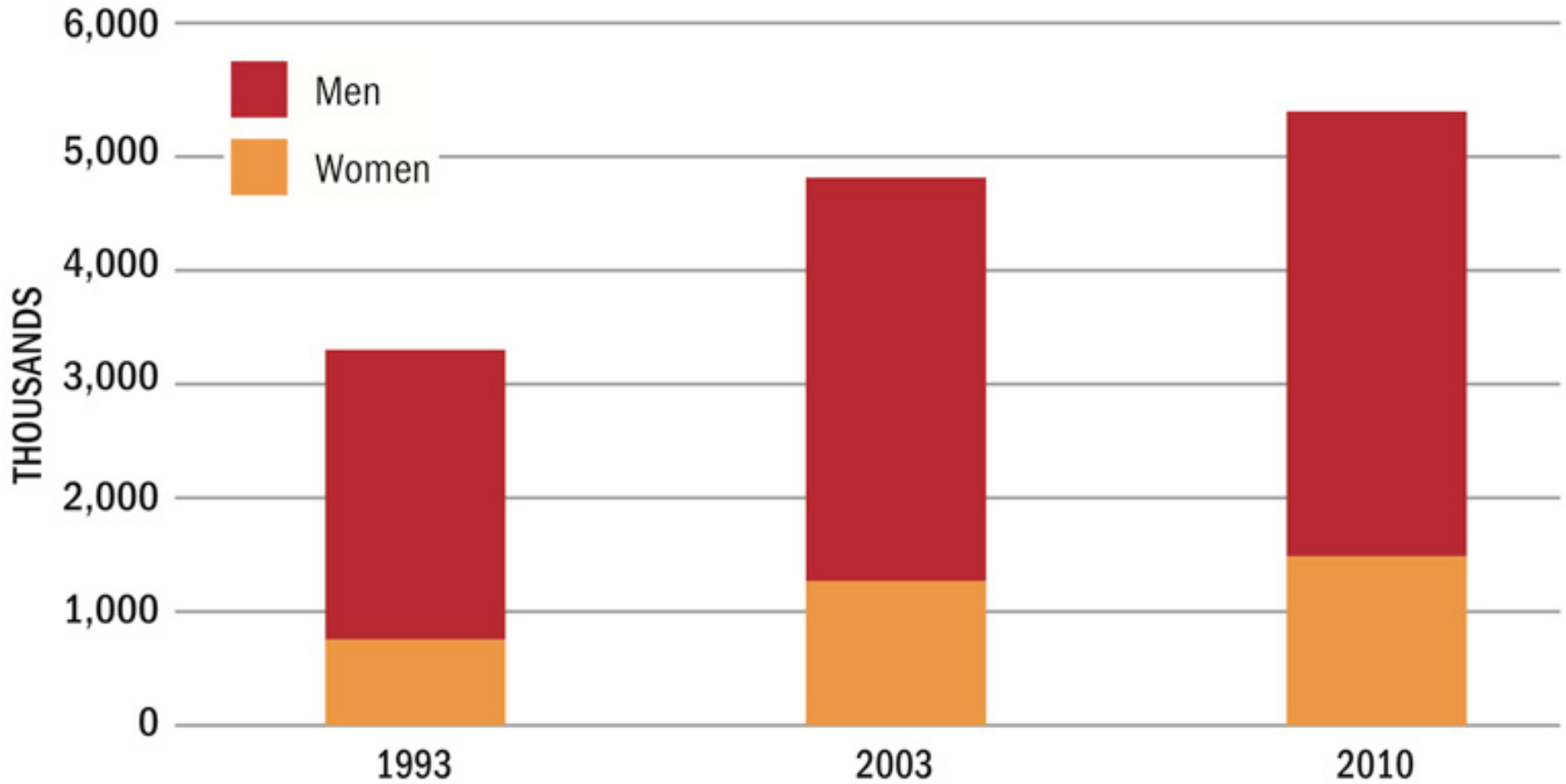


Figure 2-19
Share of S&E bachelor's degrees among U.S. citizens and permanent residents, by race and ethnicity: 2000–11



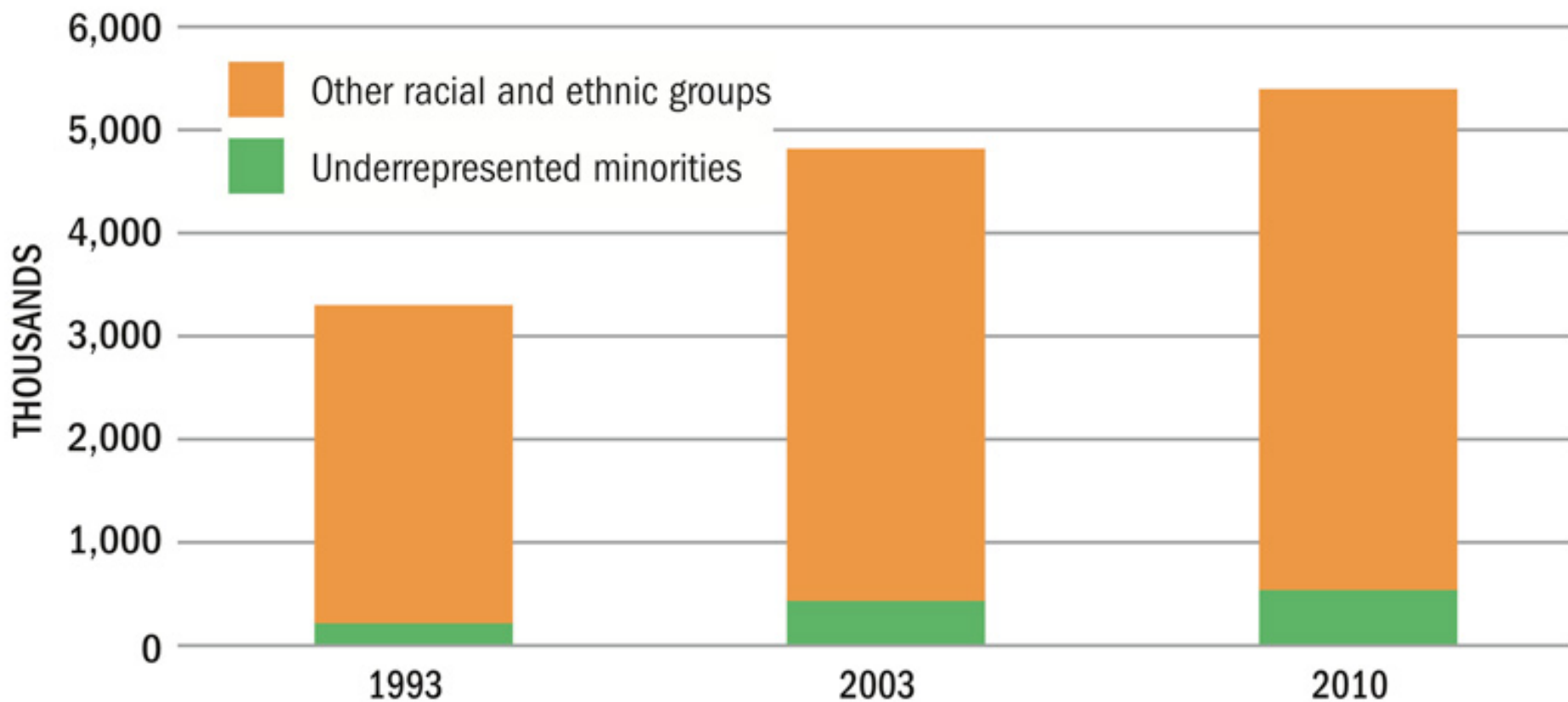
Women are 33% of S&E Workers

(50.8% of population)



Racial URM are 10% of S&E Workers

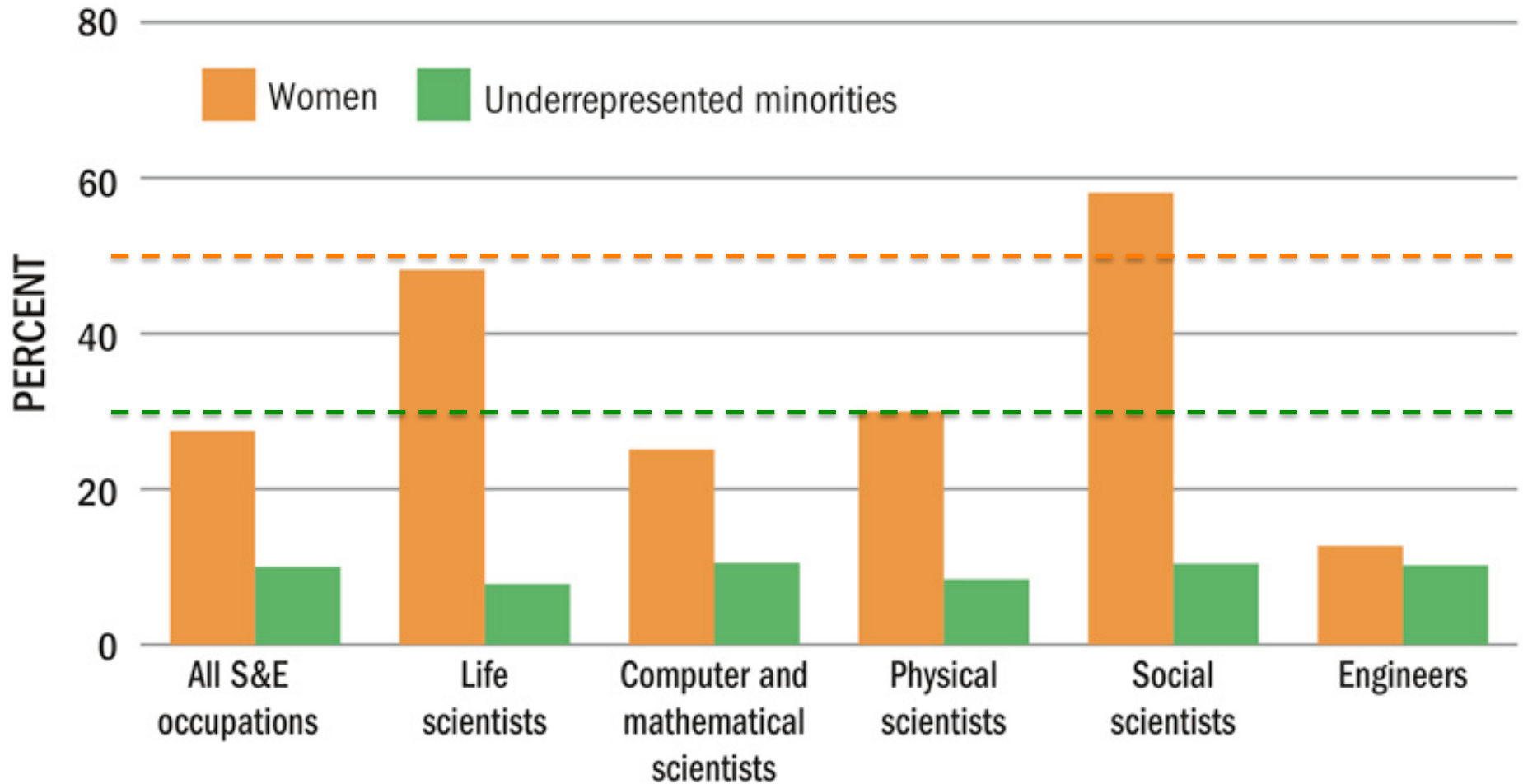
(30% of population)



NOTE: Underrepresented minorities comprise blacks, Hispanics, and American Indians and Alaska Natives in 2003 and 2010 and blacks and Hispanics in 1993.

SEI 2014: **Women and Minorities in the S&E Workforce**, Chapter 3.

URM Percent depends on Field



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

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
 - Neil deGrasse Tyson
- Grant process attempts to be meritocratic

**“DISEASES” AFFECTING
DIVERSITY & EQUITY IN STEM**

<http://reducingstereotypethreat.org/>

STEREOTYPE THREAT

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.”

Unpacking 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.”

IMPOSTER SYNDROME

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
- Stereotype threat
 - Unconscious underperforming

<https://implicit.harvard.edu/implicit/iatdetails.html>

IMPLICIT BIAS

What is Implicit Bias?

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

Implicit Association Test

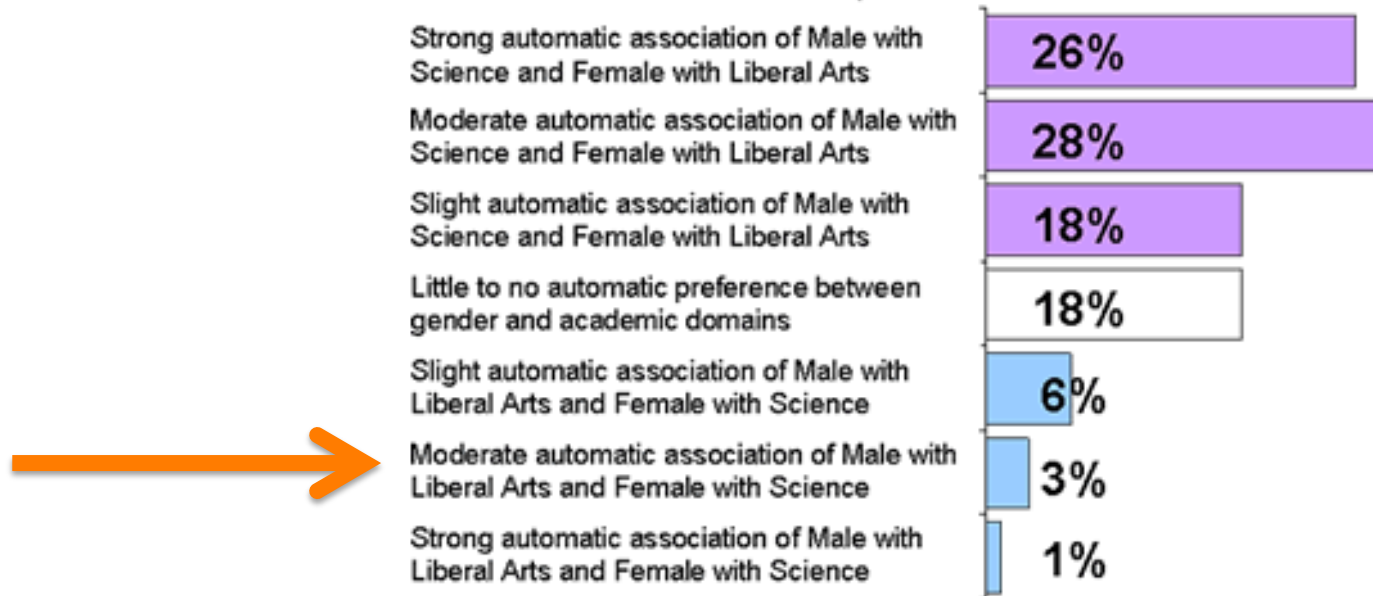
You have completed the Gender - Science IAT.

Your Result

Your data suggest a moderate association of Female with Science and Male with Liberal Arts compared to Male with Science and Female with Liberal Arts.

Thank you for your participation. Just below is a breakdown of the scores generated by others. Most respondents find it easier to associate *Male* with *Science* and *Female* with *Liberal Arts* compared to the reverse.

Percent of web respondents with each score



Click for detailed summary

<https://implicit.harvard.edu/implicit/selectatest.html>

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>)

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](#))

Negative Effects of Implicit Bias

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 - <http://www.cbsnews.com/news/black-names-a-resume-burden/>
- 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
- Actions 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
- Mindfulness of decorations
 - [Cheryan, Plaut, Davies, & Steele](#) (2009, Journal of Personality and Social Psychology)
- Not asking for demographics before standardized tests!

Stereotype Busting (?)



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

- Malleable 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

- Calibrate:
 - the more you know, the more you know there is to know
 - $$\sum_{i=\text{everyone} \neq \text{you}} N_{\text{success},i} \gg \sum_{u=\text{you}} N_{\text{success},u}$$
 - 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/>)

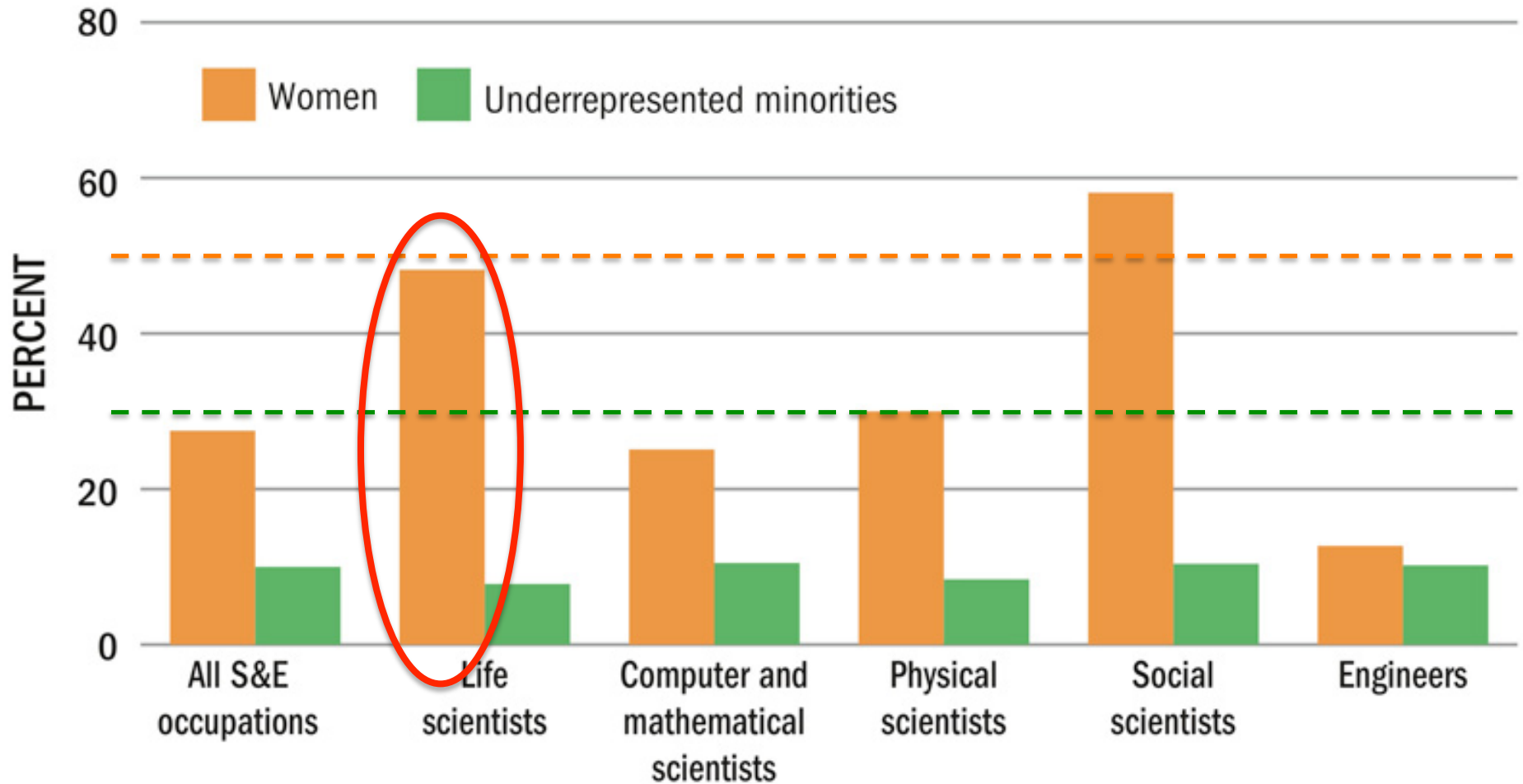
Combating Implicit Bias

- Everyone being aware
- Letter writers being aware
- Double blinds
 - Goldin & Rouse, NBER Working Paper No. 5903
(<http://www.nber.org/papers/w5903>)
- Initials on resumes, CVs, applications, grants...

By the way,

WHAT'S UP WITH BIOLOGICAL SCIENCES?

URM Percent depends on Field



Women Interested in Community



Women in Science

Women Benefit from Project-Based Approach to Learning STEM

By Beryl Lieff Benderly
December 04, 2013

Beryl Lieff Benderly, *Science Careers*, 4 Dec 2013 ([10.1126/science.caredit.a1300265](https://doi.org/10.1126/science.caredit.a1300265))

Margolis, Fisher, & Miller 1999,
“The Anatomy of Interest: Women in Undergraduate Computer Science”

Brunner 1997, “Opening Technology to Girls,” *Electronic Learning*, February.

Many Demographics Interested in Community



Taken for Granted

Choosing Between Science and Caring?

By Beryl Lieff Benderly
December 03, 2010

Diekman's data suggest that many college students on the verge of setting a career direction see STEM careers as "inhibiting communal goals," the article states.

Of course...

NONE OF THIS IS SIMPLE

When is it bias/discrimination?

When is it statistics?



Diversity Issues

Physics Departments Without Women

By Jim Austin

July 29, 2013

With so few women overall on physics faculties—currently about 13% of physics faculty are women—it is to be expected that quite a few smaller departments will have no female members.

Better Employment and Social Policies: Not the Panacea



Scandinavia

In Scandinavia, High-Level Women Experience More Stress at Work

By Elisabeth Pain
September 25, 2013

Almost universally, the highest occupational class was most exposed to hazards, but this effect was largest in Scandinavia.



Here at

UNIVERSITY OF HAWAI'I AT HILO



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 meritocracy
 - And if so, is it?
 - If it should be and isn't, what can you do?
 - URM—by definition—need “white males” support
- Knowing is half the battle
 - Stereotype threat, imposter syndrome, implicit bias
- Possible recourses:
 - Malleable mindset, recruitment, community

Resources

- National Science Board Science & Engineering Indicators 2014 Digest:
<http://www.nsf.gov/statistics/seind14/index.cfm/digest>
- <http://reducingstereotypethreat.org/>
- <https://implicit.harvard.edu/implicit/iatdetails.html>
- Center for Research on Gender in the Professions
<http://crgp.ucsd.edu/sciencetechnologyengineering.shtml>
- Just Google terms; there's a lot of literature

Big mahalo!

Question?