Is Science a Meritocracy?

Issues of Diversity & Equity

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WXYZ495AB: Seminar
19 Sep 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)
Canonical Underrepresented Minorities in S&E

- Males: 49.2%; Females: 50.8%
- Hispanic or Latino: 16.3%; Not: 83.7%
- White: 72.4%
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(https://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf; c2010br-02.pdf)
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

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

(www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm)
Leaky S&E Pipeline: Women and College

(www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm)
Leaky S&E Pipeline: Racial URM and College

Figure 2-14
Natural sciences: Freshmen intentions and degrees, by race and ethnicity

Percent

25


White or Caucasian Asian American or Asian African American or black Hispanic or Latino

Figure 2-12
Engineering: Freshmen intentions and degrees, by race and ethnicity

Percent

25


White or Caucasian Asian American or Asian African American or black Hispanic or Latino

(http://www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm)
Demographics of S&E Job Seekers

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

Percent

80
70
60
50
40
30
20
10
0

Psychology
Biological/agricultural sciences
Mathematics
Social sciences
Physical sciences
Computer sciences
Engineering

2000 2003 2005 2007 2009 2011

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

URM and Asian or Pacific Islander (Percent)

White (Percent)

Asian or Pacific Islander
Hispanic
Black or African American
White
American Indian or Alaska Native


(https://www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm)
Women are 33% of S&E Workers

(50.8% of population)

SEI 2014: Women and Minorities in the S&E Workforce, Chapter 3.
Racial URM are 10% of S&E Workers

(30% of population)


SEI 2014: Women and Minorities in the S&E Workforce, Chapter 3.
URM Percent depends on Field

- **Women**
- **Underrepresented minorities**

**PERCENT**

- **All S&E occupations**
- **Life scientists**
- **Computer and mathematical scientists**
- **Physical scientists**
- **Social scientists**
- **Engineers**

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

The questions being 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
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.”

(http://reducingstereotypethreat.org/)
Unpacking Stereotype Threat

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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](10.1126/science.caredit.a0800025))
Kathy Cooksey, AAS CSMA SPECTRUM, January 2014
Negative Effects of Stereotype Threat and Imposter Syndrome

• Negative stress
  – Overworking, unhappiness, anxiety...

• Self-sabotage
  – Underworking, under-aspiring

• Stereotype threat
  – Unconscious underperforming
What is Implicit Bias?

• “positive and negative evaluations that occur outside of our conscious awareness and control.”

• AKA unconscious bias

(https://implicit.harvard.edu/implicit/iatdetails.html)
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.

(https://implicit.harvard.edu/implicit/selectatest.html)
Negative Effects of Implicit Bias

• Resumes with female or “black” names land less jobs

• Recommendation letters with softer language
  – [http://das.sagepub.com/content/14/2/191.abstract](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

Jason Sheltzer is a graduate student in cancer

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)

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)
Negative Effects of Implicit Bias

• Resumes with female or “black” names land less jobs

• 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
Hubble Space Telescope Gender Bias

Over 10 yr of proposal review analyzed:

• Every year, higher success rate for male PIs
• No dependence on:
  – Geographic origin of PI
  – Gender of primary reviewers
  – Gender distribution of panels
• Last year, success rate of recent female PhDs (after 2000) more comparable to male peers.
• Sometimes more-comparable female-PI success rate if panel more junior

SO WHAT HELPS?
Combating Stereotype Threat

- Knowing is half the battle
- Community
- Not asking for demographics before standardized tests!

R Dyer-Barr 2013, "What Works In STEM Intervention Programs (Sips) For URM Undergraduates: Perspectives from SIP Administrators"
Stereotype Busting (?)

[the-trouble-with-barbie-science](the-trouble-with-barbie-science)

Beryl Lief Benderly, *Science* Careers, 17 Sep 2013  
[10.1126/science.caredit.a1300200](10.1126/science.caredit.a1300200)
Combating Imposter Syndrome

• Malleable mindset (as opposed to fixed)

• 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
  \[ \sum_{i=\text{everyone} \neq \text{you}} N_{\text{success},i} \gg \sum_{u=\text{you}} N_{\text{success},u} \]

• Accept “zone of proximal development” is uncomfortable... that’s learning

• 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/)
MIT’s Thoughts on Combating Imposter Syndrome

- “I!mposter”
- “Imposters unite!”
- “Feel like an imposter? So do I! We are the 99%.”
- “Imposters Welcome!”
- “No one can make you feel inferior without your consent.” (Eleanor Roosevelt)
- “I didn’t get into MIT” poster campaign by current faculty.

Kathy Cooksey, AAS CSMA SPECTRUM, January 2014
(http://csma.aas.org/spectrum_files/spectrum_Jan14.pdf)
Combating Implicit Bias

• Everyone being aware
• Letter writers being aware
• Double blinds
• Initials on resumes, CVs, applications, grants...
By the way,

WHAT’S UP WITH BIOLOGICAL SCIENCES?
URM Percent depends on Field

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

Beryl Lieff Benderly, Science Careers, 4 Dec 2013 (10.1126/science.caredit.a1300265)


Many Demographics Interested in Community

MySciNet
An Inclusive 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.

Beryl Lieff Benderly, Science Careers, 3 Dec 2010 (10.1126/science.caredit.a1000117)
Of course...

NONE OF THIS IS SIMPLE
When is it bias/discrimination?
When is it statistics?

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.

Jim Austin, Science Careers, 29 Jul 2013 (10.1126/science.caredit.a1300156)
In Scandinavia, High-Level Women Experience More Stress at Work

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

Elisabeth Pain, *Science Careers*, 25 Sep 2013 (10.1126/science.caredit.a1300208)
Here at

UNIVERSITY OF HAWAI`I AT HILO
We’re Well Situated to Be Diverse S&E Community

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.

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

<table>
<thead>
<tr>
<th>Am. Indian/Alaska Native</th>
<th>Asian</th>
<th>Black</th>
<th>Hispanic/Latino</th>
<th>Hawaiian/Pacific Isl.</th>
<th>White</th>
<th>Two or more races</th>
<th>Unknown</th>
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<td>0.9%</td>
<td>4.8%</td>
<td>12.6%</td>
<td>16.3%</td>
<td>0.2%</td>
<td>72.4%</td>
<td>2.9%</td>
<td>6.2%</td>
</tr>
</tbody>
</table>
Exploring Diversity and Gender Equity (EDGE) at UH Hilo

• NSF ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers
  – Chancellor Donald Straney, PI & Prof. Misaki Takabayashi, Co-I

• UH Hilo Goals:
  – 40% STEM faculty be women (+12%)
    • 35% STEM assoc. prof. be women (+9%)
    • 30% STEM full prof. be women (+10%)
  – ≥1 Dean of college with STEM be women
  – ≥25% dept. chairs in STEM be women
Issues Not Even Addressed

• Disabilities
• Economic background
• LBGTQI
• Affirmative action
• ...

Disabilities
Economic background
LBGTQI
Affirmative action...
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?
    • URMs—by definition—need “white males” support

• Knowing is half the battle
  – Stereotype threat, imposter syndrome, implicit bias

• Possible recourses:
  – Malleable mindset, recruitment, community
Resources

• [http://reducingstereotypethreat.org/](http://reducingstereotypethreat.org/)
• [https://implicit.harvard.edu/implicit/iatdetails.html](https://implicit.harvard.edu/implicit/iatdetails.html)
• Center for Research on Gender in the Professions [http://crgp.ucsd.edu/sciencetechnologyengineering.shtml](http://crgp.ucsd.edu/sciencetechnologyengineering.shtml)
• Just Google terms; there’s a lot of literature

Big mahalo!
US Bachelor’s Degrees by Field

SEI 2014: Undergraduate Degree Awards, Chapter 2.
NS Bachelor’s Degrees by Country

Eng Bachelor’s Degrees by Country

China
South Korea, Taiwan
France, Germany, United Kingdom
Japan
United States

PhD by Country

SEI 2014: Global Comparison of S&E Doctoral Degrees, Chapter 2.
Foreign-born S&E Workers

SEI 2014: Immigration and the S&E Workforce, Chapter 3.
Hubble Space Telescope Gender Bias

- Success rate - all proposals
- Success rate - male PI
- Success rate - female PI
- Fraction female PI

Excess/deficit (# proposals) wrt average acceptance fraction

Cycle:
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- All

83
HST Gender Bias Not All Due to Men

**HST Gender Bias by Generation of PI**

- **Graph 1:** Cumulative fraction of accepted proposals by PI generation. The line colors represent different generations: Male PI - submitted (blue), Female PI - submitted (red), Male PI - accepted (green), Female PI - accepted (purple).


**Source:** Neill Reid (STScI), "Gender-based Systematics in HST Proposal Selection" (arXiv:1409.3528)
HST Gender Bias by Panel Generation

**Cycle 20**

- **Average year of Ph.d.**
- **F/M Acceptance Rate**

**Cycle 21**

- **Average year of Ph.d.**
- **Success rate F/M**
HST Gender Bias by Nationality

Cycles 19 & 20

Male PI: accept  |  triage  |  reject  |  Female PI: accept  |  triage  |  reject

Europe  |  North America  |  Rest of the world
I. Neill Reid (STScI) “Gender-based Systematics in HST Proposal Selection”
(https://arxiv.org/abs/1409.3528)

- AGN – active galactic nuclei (AGN & quasars)
- QAL – quasar absorption lines (AGN & quasars)
- COS – cosmology (Cosmology)
- CS – cool stars (Stars)
- HS – hot stars (Stars)
- SF – star formation (Planets & Star formation/Stars)
- SS – solar system objects (Planets & star formation)
- EXO – exoplanets (Planets & star formation)
- IEG – interstellar medium in external galaxies (Galaxies)
- USP – unresolved stellar populations in distant galaxies (Galaxies)
- RSP – resolved stellar populations in nearby galaxies (Stellar Populations)
HST Gender Bias by PI and TAC Generation

![Graph showing the acceptance fraction over the years of Ph.D. and the generation of PI and TAC. The graph indicates variations in acceptance fractions over time, suggesting changes in gender bias.](image)
Many Paths to STEM Careers

Described by Tania Rabesandratana, Science Careers, 7 Aug 2014
(10.1126/science.caredit.a1400200)
Women Make Less for Same Work

Figure 3-33
Estimated salary differences between women and men with highest degree in S&E employed full time, controlling for selected characteristics, by degree level: 2010

(ftp://www.nsf.gov/statistics/seind14/index.cfm/etc/figures.htm)