

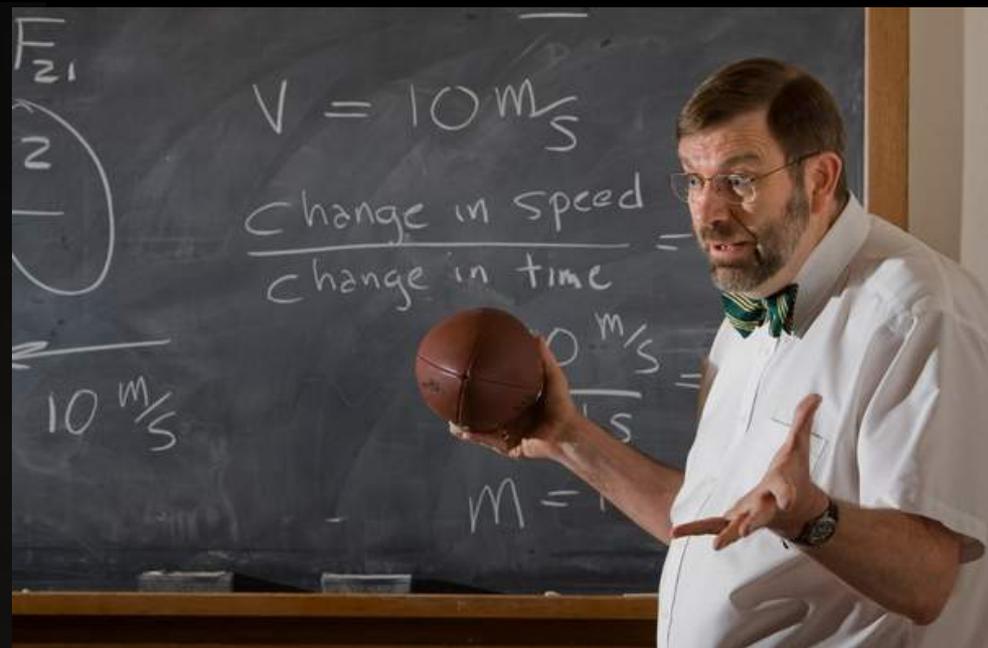


What Role Do Our Attitudes Play in the Composition of Our Field?

Paul Sorensen

How did I become a physicist?

At least partially by my professors assuming I had done better than I actually had!



STEREOTYPES EXIST

theguardian

Women in Leadership

67% of Europeans don't believe women have the skills to be scientists

A new survey from L'Oreal looks at the public's perception of female scientists with shocking results. Particularly if you live in China

Professor Dame Athene Donald

Professor of experimental physics at the University of Cambridge

Thursday 24 September 2015 07.14 BST



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5572 70



Most popular



Svetlana Alexievich wins 2015 Nobel prize in literature



Sepp Blatter, Michel Platini and Jérôme Valcke suspended for 90 days



Harvard's prestigious debate team loses to

STEREOTYPES EXIST

Original Photo

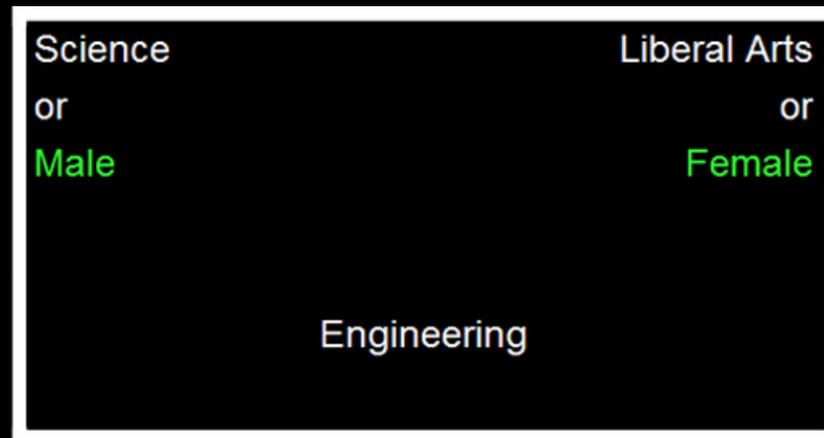


Subliminal Queue:

Educated → recollection of the photo →

← recollection of the photo ← **Ignorant**

BIASES CAN BE MEASURED

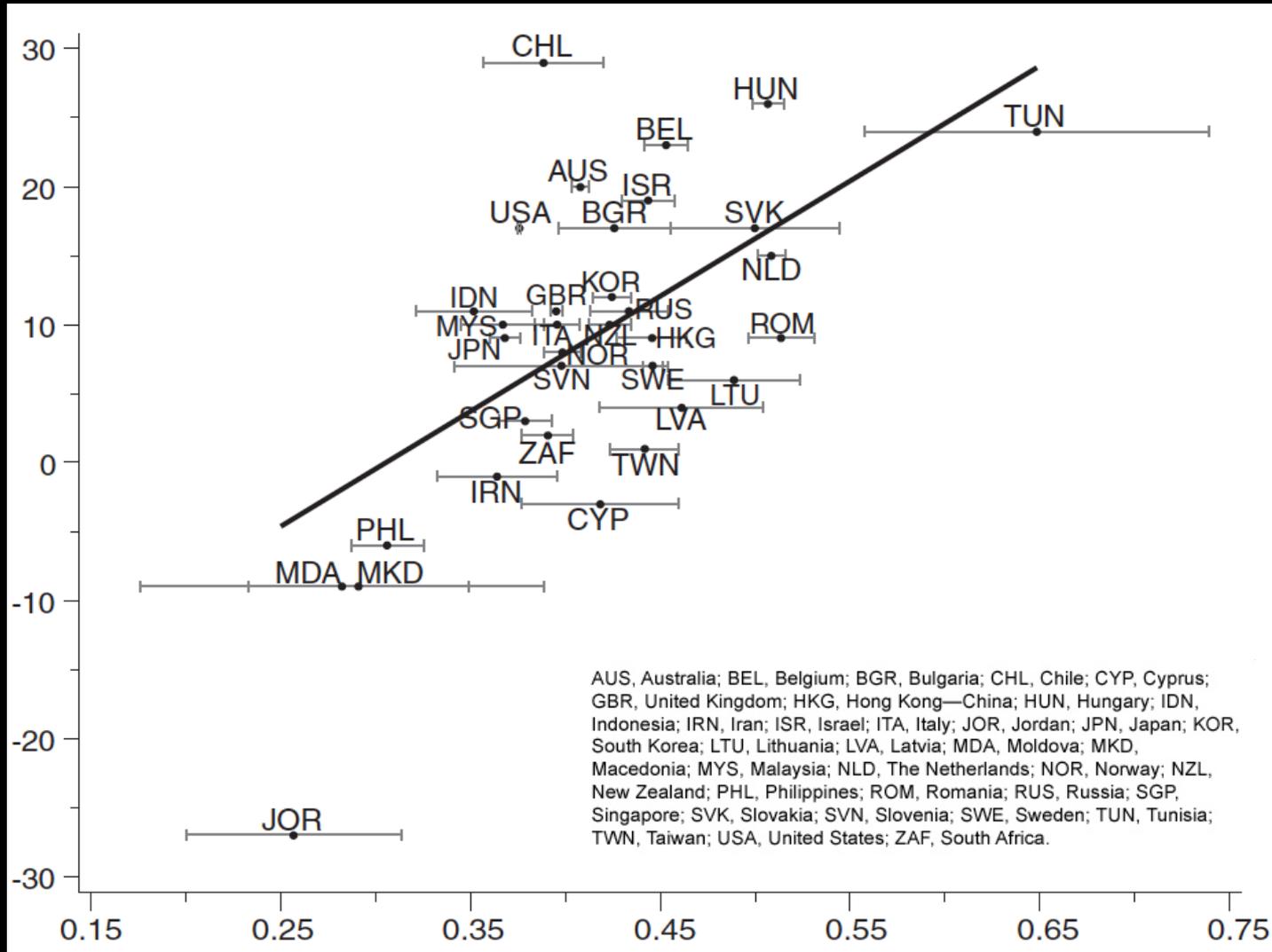


Implicit Association Test

WWW.IMPLICIT.HARVARD.EDU

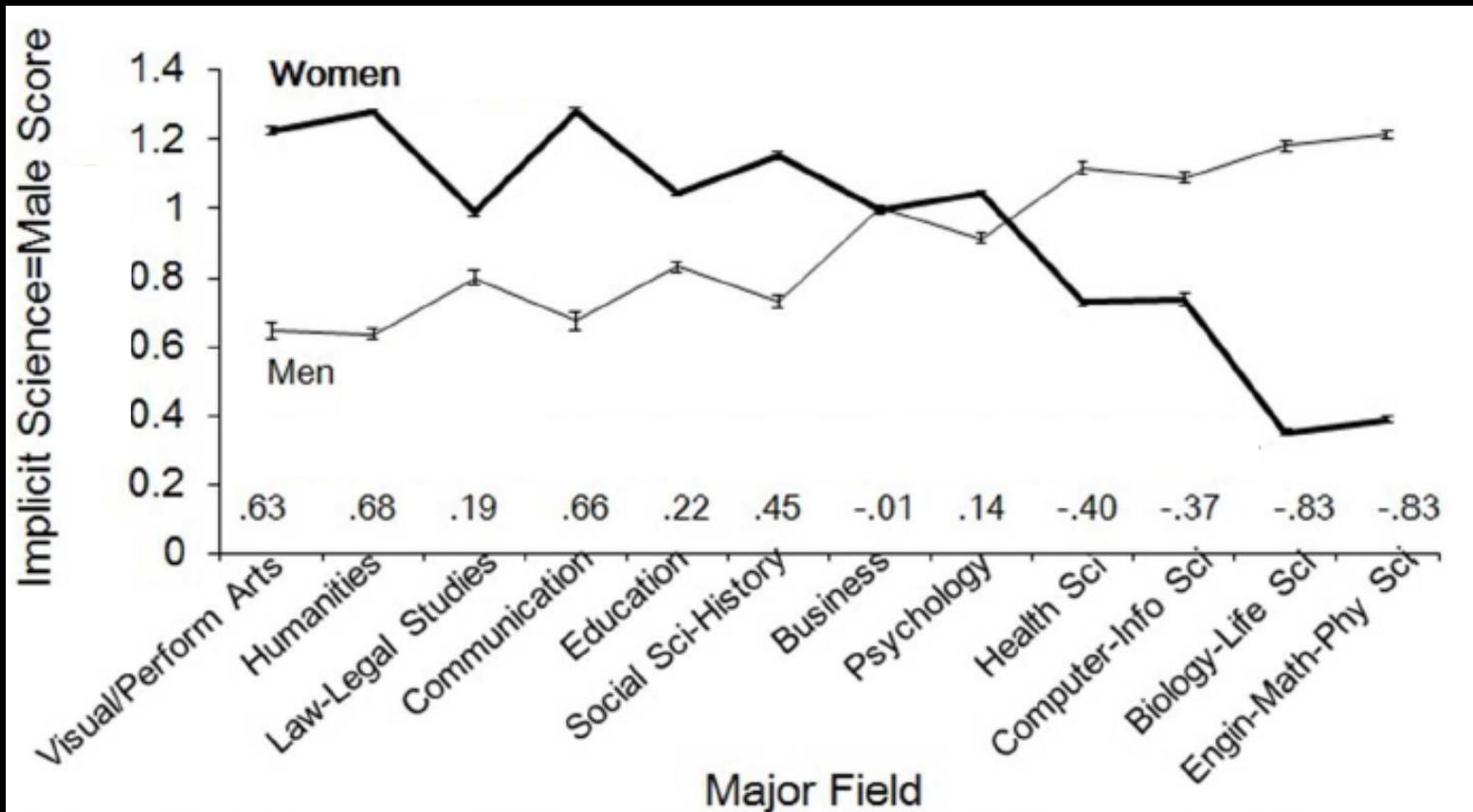
Our Biases Influence Reality

male math score advantage



“science-is-male” implicit association

Everyone is Biased...

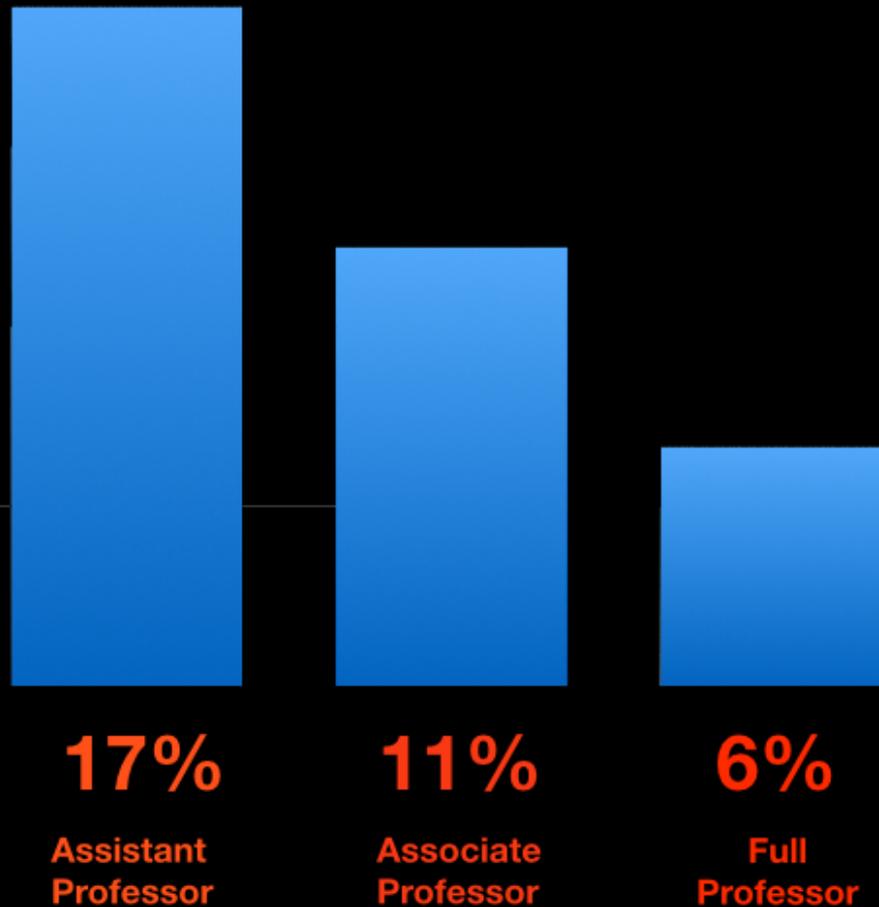


Especially male scientists and female artists

Do women leave the field because of bias?

% Female Faculty in Physics

WWW.APS.ORG/PROGRAMS/EDUCATION/STATISTICS



Contradictory Messages?

Science faculty's subtle gender biases favor male students

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Edited* by Shirley Tilghman, Princeton University, Princeton, NJ, and approved August 21, 2012 (received for review July 2, 2012)

Despite efforts to recruit and retain more women, a stark gender disparity persists within academic science. Abundant research has demonstrated gender bias in many demographic groups, but has yet to experimentally investigate whether science faculty exhibit a bias against female students that could contribute to the gender disparity in academic science. In a randomized double-blind study ($n = 127$), science faculty from research-intensive universities rated the application materials of a student—who was randomly assigned either a male or female name—for a laboratory manager position. Faculty participants rated the male applicant as significantly more competent and hireable than the (identical) female applicant. These participants also selected a higher starting salary and offered more career mentoring to the male applicant. The gender of the faculty participants did not affect responses, such that female and male faculty were equally likely to exhibit bias against the female student. Mediation analyses indicated that the female student was less likely to be hired because she was viewed as less competent. We also assessed faculty participants' preexisting subtle bias against women using a standard instrument and found that preexisting subtle bias against women played a moderating role, such that subtle bias against women was associated with less support for the female student, but was unrelated to reactions to the male student. These results suggest that interventions addressing faculty gender bias might advance the goal of increasing the participation of women in science.

diversity | lifestyle choices | science education | science workforce

A 2012 report from the President's Council of Advisors on Science and Technology indicates that training scientists and engineers at current rates will result in a deficit of 1,000,000 workers to meet United States workforce demands over the next decade (1). To help close this formidable gap, the report calls for the increased training and retention of women, who are starkly underrepresented within many fields of science, especially among the professoriate (2–4). Although the proportion of science degrees granted to women has increased (5), there is a persistent disparity between the number of women receiving PhDs and those hired as junior faculty (1–4). This gap suggests that the problem will not resolve itself solely by more generations of women moving through the academic pipeline but that instead, women's advancement within academic science may be actively impeded.

With evidence suggesting that biological sex differences in inherent aptitude for math and science are small or nonexistent (6–8), the efforts of many researchers and academic leaders to identify causes of the science gender disparity have focused instead on the life choices that may compete with women's pursuit of the most demanding positions. Some research suggests that these lifestyle choices (whether free or constrained) likely contribute to the gender imbalance (9–11), but because the majority of these studies are correlational, whether lifestyle factors are solely or primarily responsible remains unclear. Still, some researchers have argued that women's preference for nonscience disciplines and their tendency to take on a disproportionate amount of child- and family-care are the primary causes of the

gender disparity in science (9–11), and that it “is not caused by discrimination in these domains” (10). This assertion has received substantial attention and generated significant debate among the scientific community, leading some to conclude that gender discrimination indeed does not exist nor contribute to the gender disparity within academic science (e.g., refs. 12 and 13).

Despite this controversy, experimental research testing for the presence and magnitude of gender discrimination in the biological and physical sciences has yet to be conducted. Although acknowledging that various lifestyle choices likely contribute to the gender imbalance in science (9–11), the present research is unique in investigating whether faculty gender bias exists within academic biological and physical sciences, and whether it might exert an independent effect on the gender disparity as students progress through the pipeline to careers in science. Specifically, the present experiment examined whether, given an equally qualified male and female student, science faculty members would show preferential evaluation and treatment of the male student to work in their laboratory. Although the correlational and related laboratory studies discussed below suggest that such bias is likely (contrary to previous arguments) (9–11), we know of no previous experiments that have tested for faculty bias against female students within academic science.

If faculty express gender biases, we are not suggesting that these biases are intentional or stem from a conscious desire to impede the progress of women in science. Past studies indicate that people's behavior is shaped by implicit or unintended biases, stemming from repeated exposure to pervasive cultural stereotypes (14) that portray women as less competent but simultaneously emphasize their warmth and likeability compared with men (15). Despite significant decreases in overt sexism over the last few decades (particularly among highly educated people) (16), these subtle gender biases are often still held by even the most egalitarian individuals (17), and are exhibited by both men and women (18). Given this body of work, we expected that female faculty would be just as likely as male faculty to express an unintended bias against female undergraduate science students. The fact that these prevalent biases often remain undetected highlights the need for an experimental investigation to determine whether they may be present within academic science and, if so, raise awareness of their potential impact.

Whether these gender biases operate in academic science remains an open question. On the one hand, although considerable research demonstrates gender bias in a variety of other domains (19–23), science faculty members may not exhibit this

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The authors declare no conflict of interest.

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National hiring experiments reveal 2:1 faculty preference for women on STEM tenure track

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Edited* by Richard E. Nisbett, University of Michigan, Ann Arbor, MI, and approved March 5, 2015 (received for review September 30, 2014)

National randomized experiments and validation studies were conducted on 873 tenure-track faculty (439 male, 434 female) from biology, engineering, economics, and psychology at 371 universities/colleges from 50 US states and the District of Columbia. In the main experiment, 363 faculty members evaluated narrative summaries describing hypothetical female and male applicants for tenure-track assistant professorships who shared the same lifestyle (e.g., single without children, married with children). Applicants' profiles were systematically varied to disguise identically rated scholarship; profiles were counterbalanced by gender across faculty to enable between-faculty comparisons of hiring preferences for identically qualified women versus men. Results revealed a 2:1 preference for women by faculty of both genders across both math-intensive and non-math-intensive fields, with the single exception of male economists, who showed no gender preference. Results were replicated using weighted analyses to control for rational sample characteristics. In follow-up experiments, 144 faculty evaluated competing applicants with differing lifestyles (e.g., divorced mother vs. married father), and 204 faculty compared same-gender candidates with children, but differing in whether they took 1-y-parental leaves in graduate school. Women preferred divorced mothers to married fathers; men preferred mothers who took leaves to mothers who did not. In two validation studies, 35 engineering faculty provided rankings using full curricula vitae instead of narratives, and 127 faculty rated one applicant rather than choosing from a mixed-gender group; the same preference for women was shown by faculty of both genders. These results suggest it is a propitious time for women launching careers in academic science. Messages to the contrary may discourage women from applying for STEM (science, technology, engineering, mathematical) tenure-track assistant professorships.

gender bias | hiring bias | underrepresentation of women | faculty hiring | women in science

Women considering careers in academic science confront stark portrayals of the treacherous journey to becoming professors. Well-publicized research depicts a thicket of obstacles standing between female graduate students and tenure-track positions, including inadequate mentoring and networking (1); a chilly social climate (2); downgrading of work products such as manuscripts (3), grant proposals (4), and lectures (5); and gender bias in interviewing and hiring (6–9). Numerous blue ribbon panels and national reports have concluded that implicit, and sometimes explicit, attitudes pervade the hiring process and negatively influence evaluations of female candidates and their scholarship, contributing to women's underrepresentation within the academy (e.g., refs. 10–13).

Women's underrepresentation in academic science is hardly trivial. In life and social sciences, women now earn the majority of doctorates, but they make up a minority of assistant professors. In 1993–1995, 28.4% of assistant professors were women, but 41.6% of PhDs awarded in the same cohort went to women. That is, almost one-third of the women did not advance from receiving their PhD to an assistant professorship (see ref. 14, figure 5). More recently, in 2008–2010, this gap widened to 22 percentage points (53.2% of doctorates to women; 31.6% of assistant professorships to women), and this gap persisted after

controlling for demographics, degree characteristics, and field (15). [This winnowing of women in the STEM (science, technology, engineering, mathematics) tenure-track pipeline is a result of women PhDs being far less likely than men to apply for tenure-track jobs, rather than to women applying but being rejected at higher rates than men (14).] Against this bleak backdrop, it is perhaps no surprise that talented young women opt out of the STEM tenure track either by not applying for assistant professorships at the same rate as men or, in some fields, by not majoring in them in college in the first place (14).

The point at which scientists choose to apply for tenure-track assistant professorships is a key juncture in understanding the problem of women's underrepresentation. Once hired, women prosper in the STEM professoriate (14, 16–18): They are remunerated, persist, and are promoted at rates roughly comparable to men's (14) after controlling for observable characteristics, including academic productivity. However, to be hired and eventually tenured, women must first apply. Unfortunately, despite their success once hired, women apply for tenure-track positions in far smaller percentages than their male graduate student counterparts (14, 16, 18). Why might this be?

One reason may be omnipresent discouraging messages about sexism in hiring, but does current evidence support such messages? Despite this question's centrality to any informed discussion about women's underrepresentation in academic science, only one experimental study (7) contrasted faculty ratings of the relative “hireability” of hypothetical identically qualified women and men. Results showed that both female and male psychology faculty members downgraded a hypothetical woman's academic record compared with an identical man's. However, this study

Significance

The underrepresentation of women in academic science is typically attributed, both in scientific literature and in the media, to sexist hiring. Here we report five hiring experiments in which faculty evaluated hypothetical female and male applicants, using systematically varied profiles disguising identical scholarship, for assistant professorships in biology, engineering, economics, and psychology. Contrary to prevailing assumptions, men and women faculty members from all four fields preferred female applicants 2:1 over identically qualified males with matching lifestyles (single, married, divorced), with the exception of male economists, who showed no gender preference. Comparing different lifestyles revealed that women preferred divorced mothers to married fathers and that men preferred mothers who took parental leaves to mothers who did not. Our findings, supported by real-world academic hiring data, suggest advantages for women launching academic science careers.

Author contributions: W.M.W. and S.J.C. designed research; performed research, analyzed data, and wrote the paper.

The authors declare no conflict of interest.

*This Direct Submission article had a preassigned editor.

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Encouraging New Hiring trends

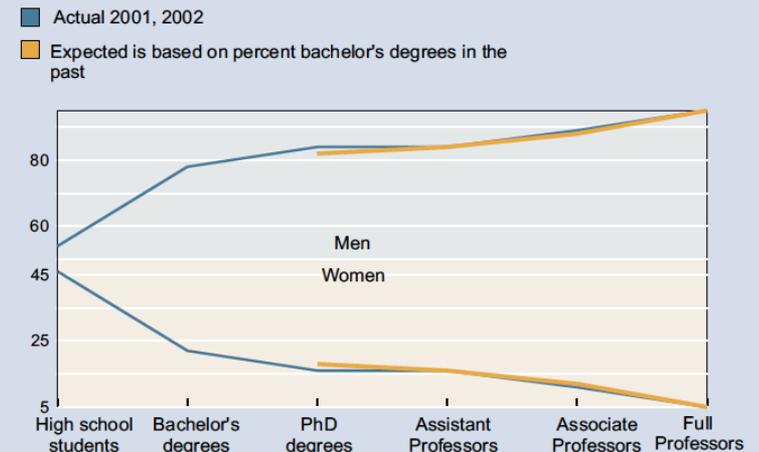
Percentage of Physics Faculty Members Who Are Women

	Year			
	1998	2002	2006	2010
by Academic Rank	(%)	(%)	(%)	(%)
Full Professor	3	5	6	8
Associate Professor	10	11	14	15
Assistant Professor	17	16	17	22
Instructor / Adjunct	*	16	19	21
Other ranks	13	15	12	18

Percentage of Newly-Hired Physics Faculty Who Are Women

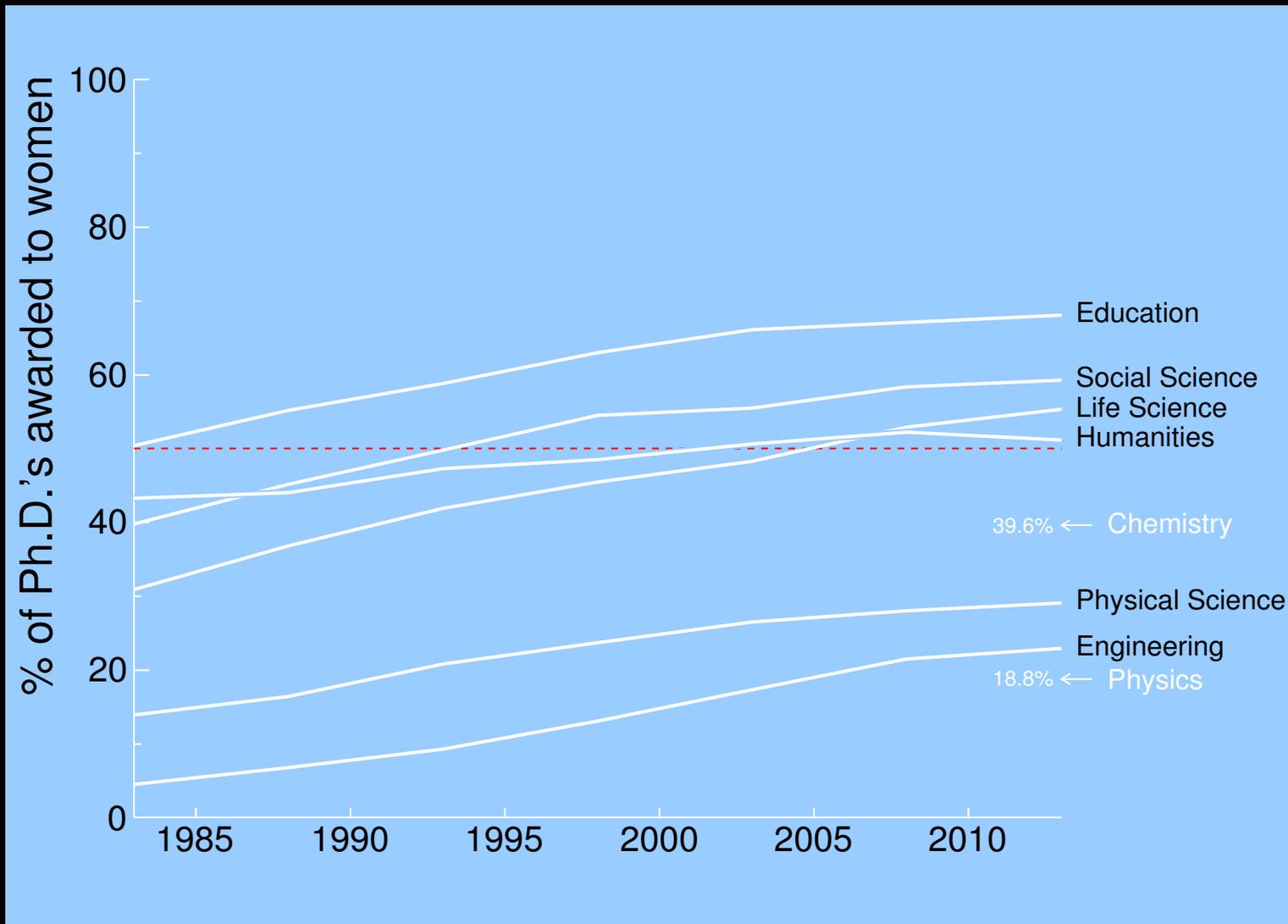
by Academic Rank	Year		
	2006	2008	2010
	(%)	(%)	(%)
Full Professor	9	10	20
Associate Professor	8	20	14
Assistant Professor	25	22	29
Instructor / Adjunct	23	23	24
OVERALL	22	21	26

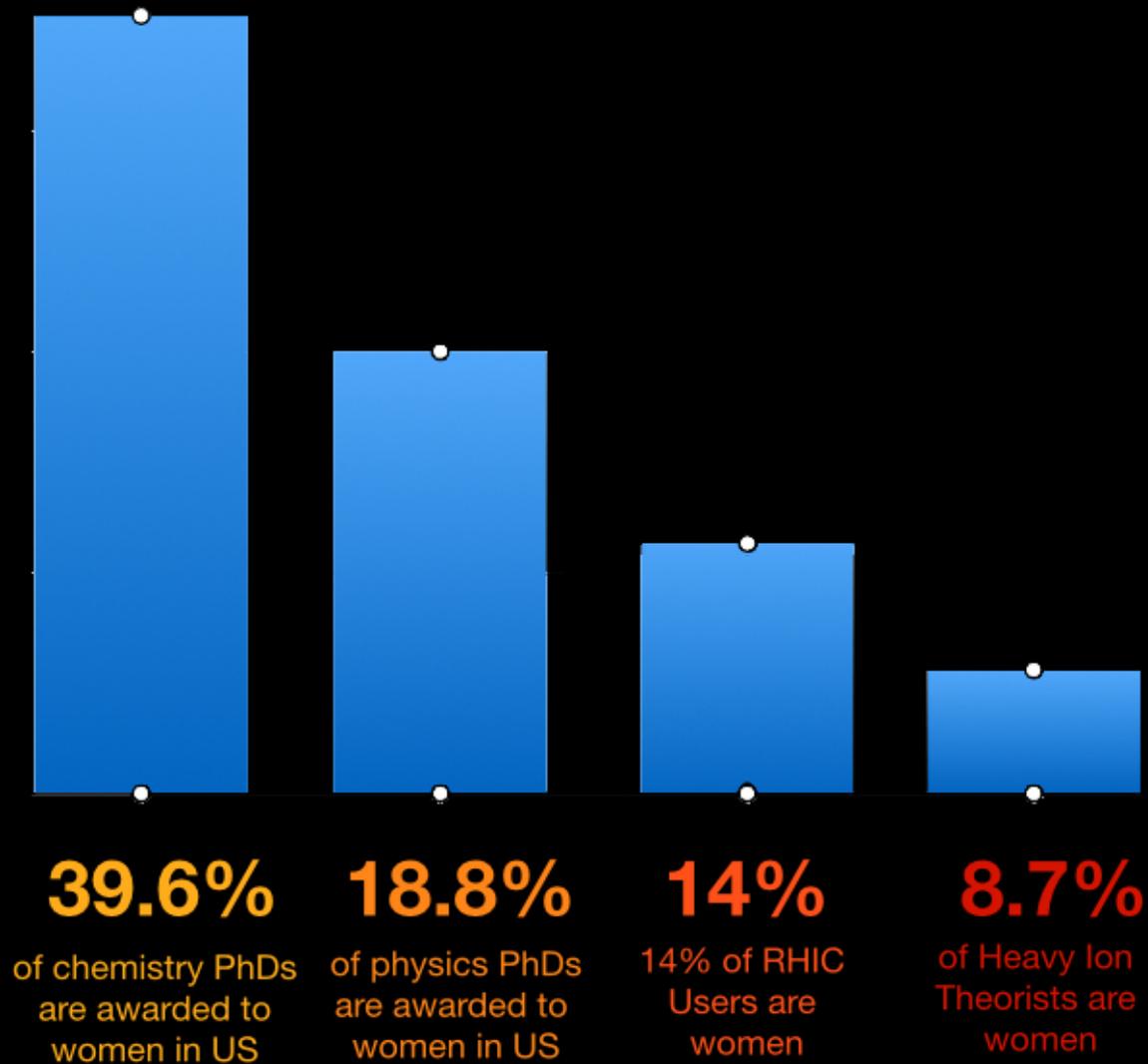
Figure 11. Actual and expected percentage of women and men in physics in the US.



AIP Statistical Research Center.

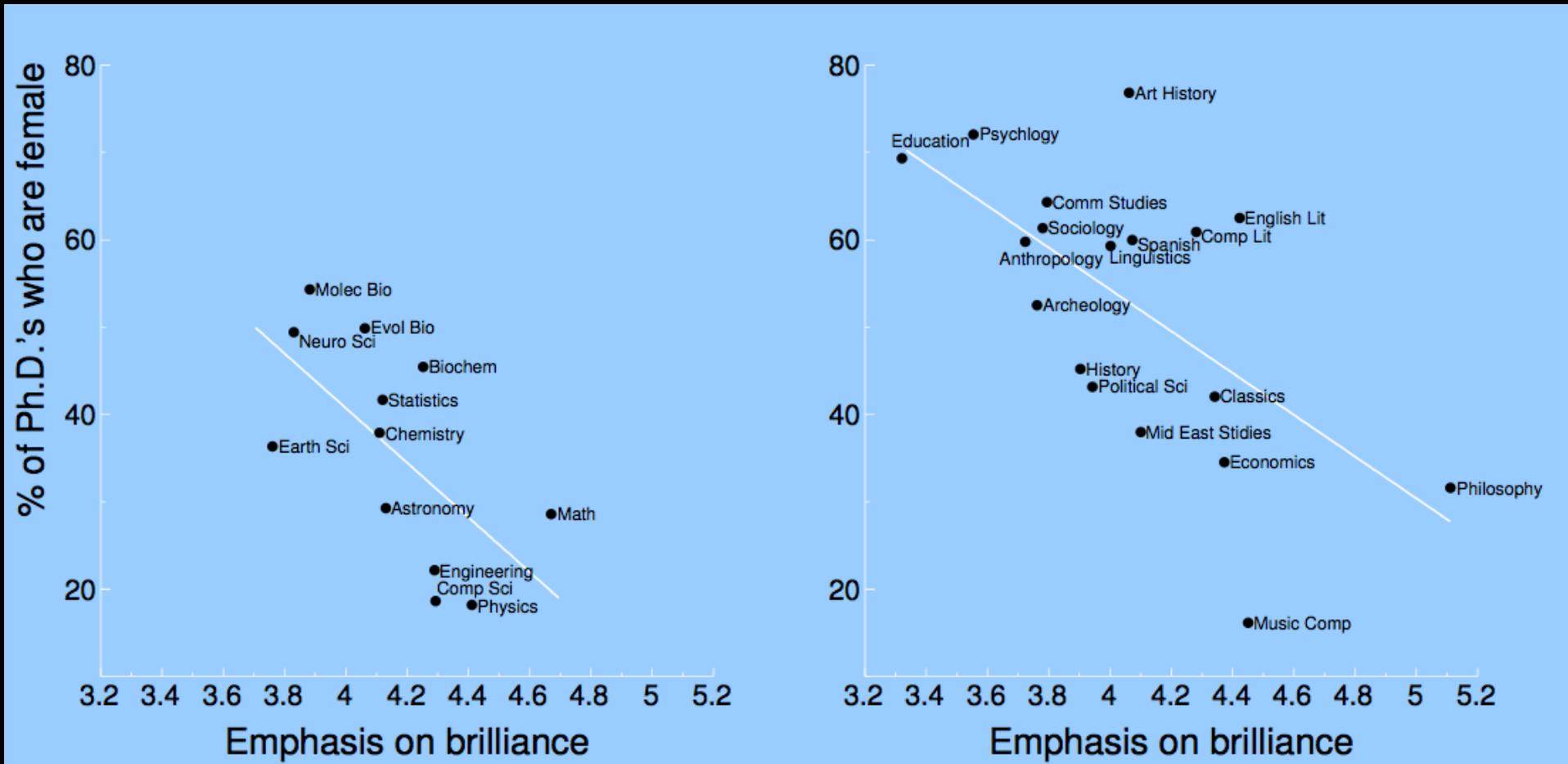
Doctorates to Women In the US





The “Lone Genius” Paradigm

FIELD SPECIFIC ABILITY BELIEF



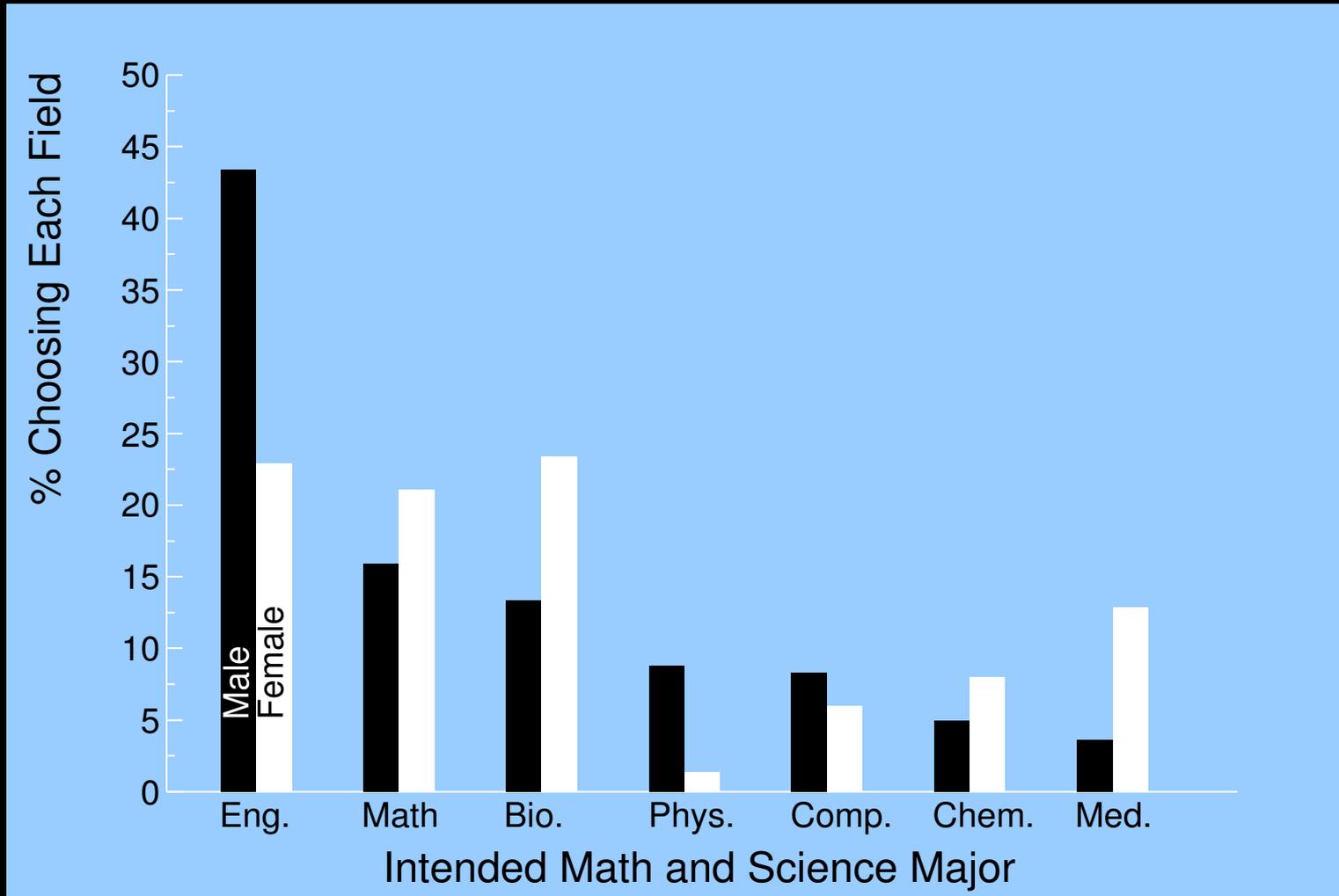


Graphics Young Kim

Ágnes Mócsy

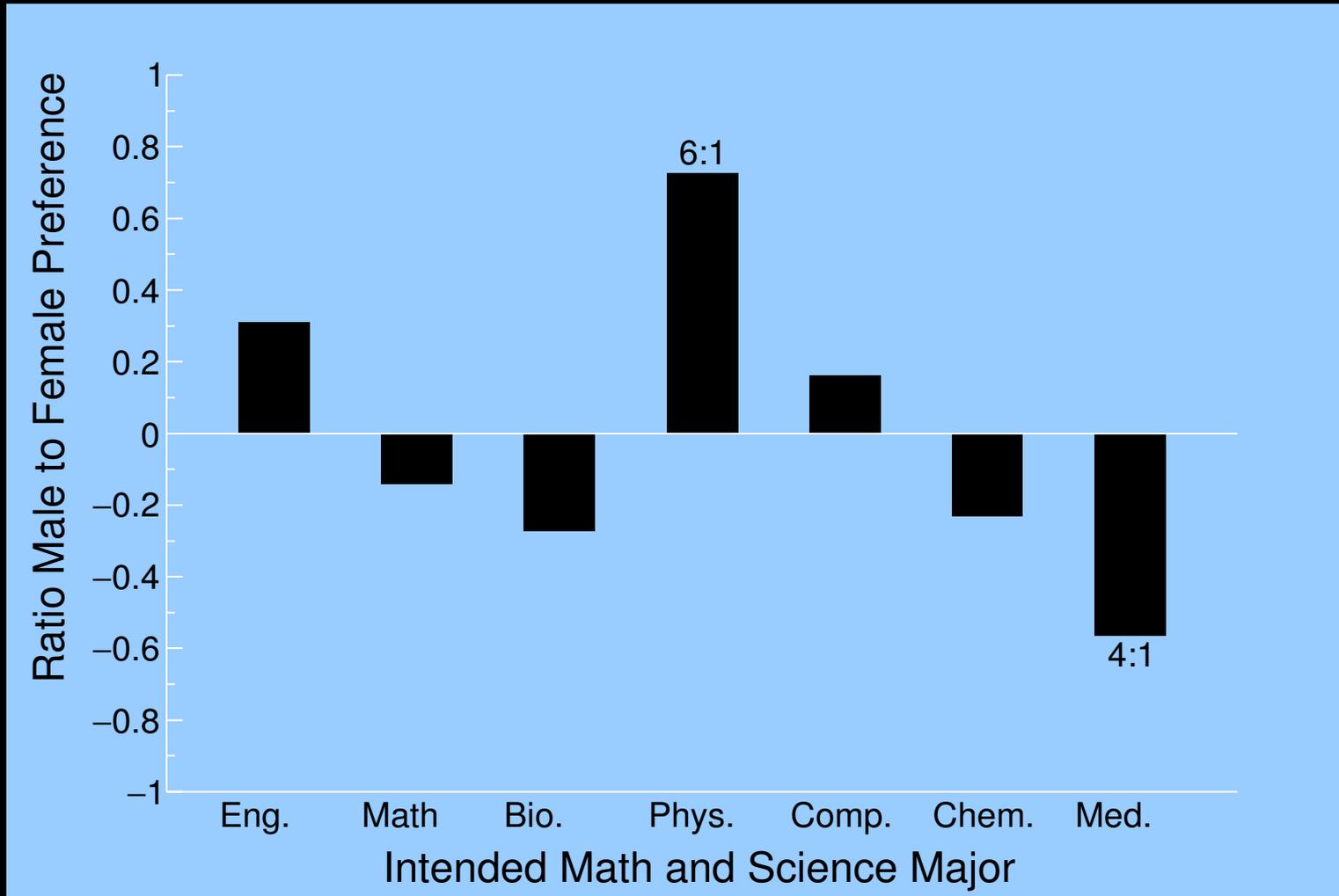
http://www.huffingtonpost.com/agnes-macsy/the-lone-genius-paradigm_b_9422682.html

Suppressed Interest



Majors chosen by a sample of highly mathematically gifted high-school juniors
Webb, Lubinski, Benbow, J. of Ed. Psych. (94) 785, 2002

Suppressed Interest



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No Escape From Black Holes? Stephen Hawking Points to a Possible Exit

By DENNIS OVERBYE JUNE 6, 2016



Gravitational Waves Detected, Confirming Einstein's Theory



Dennis Overbye

OUT THERE FEB. 11, 2016



We don't tell stories about people working together, instead we ask: *who was the genius behind that*

Implying the key to success is innate talent, puts an unnecessary psychological road-block to negatively stereo-typed groups

Emphasizing *this can be learned* creates opportunities for more to thrive

see Catherine Good's Talk

Different Experiences

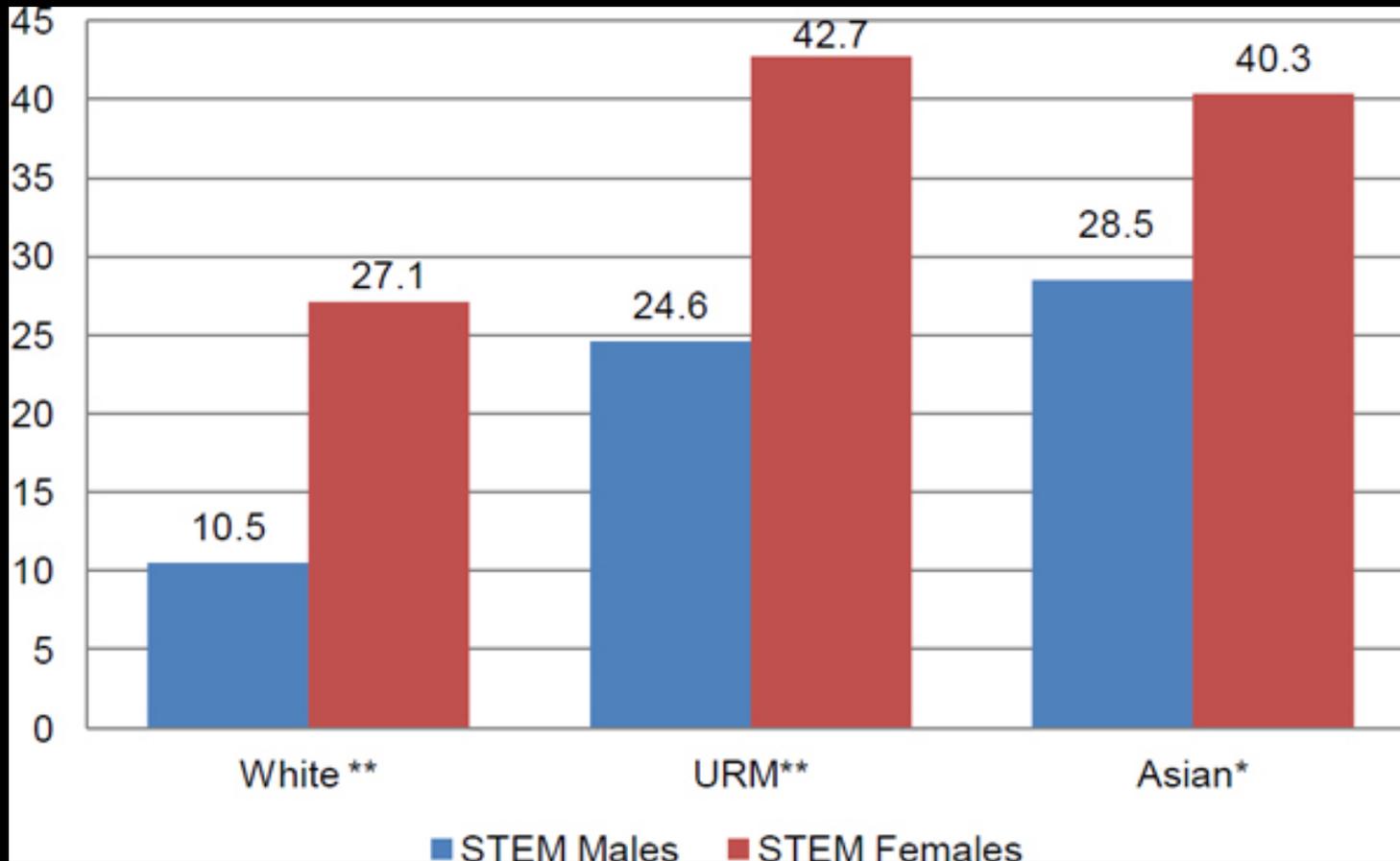


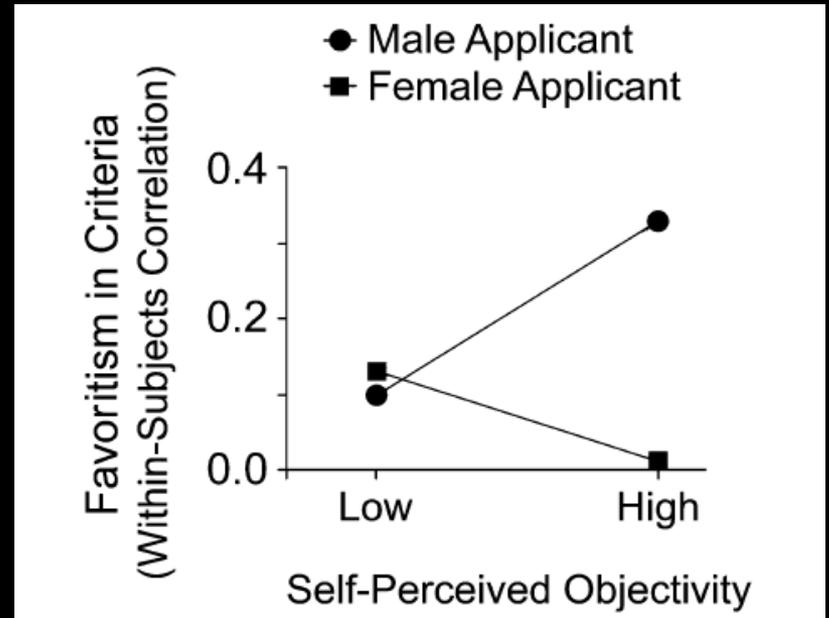
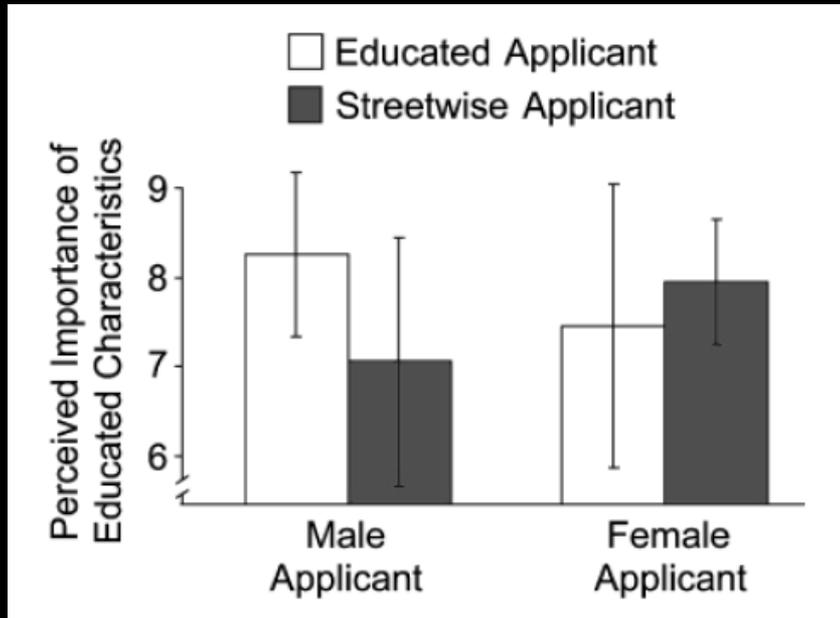
Figure 2. Source of Stress in the Last Two Years: Subtle Discrimination (e.g., prejudice, racism, sexism) % Responding “Somewhat” or “Extensive”.

Note: Significant male/female differences within group ** $p < .01$; * $< .05$.

Source: HERI Faculty Survey. Presented by S. Hurtado at the Seeking Solutions: Maximizing American Talent by Advancing Women of color in Academia Conference, June 2012, Washington, DC.

ONE OF THE MOST DANGEROUS BIASES

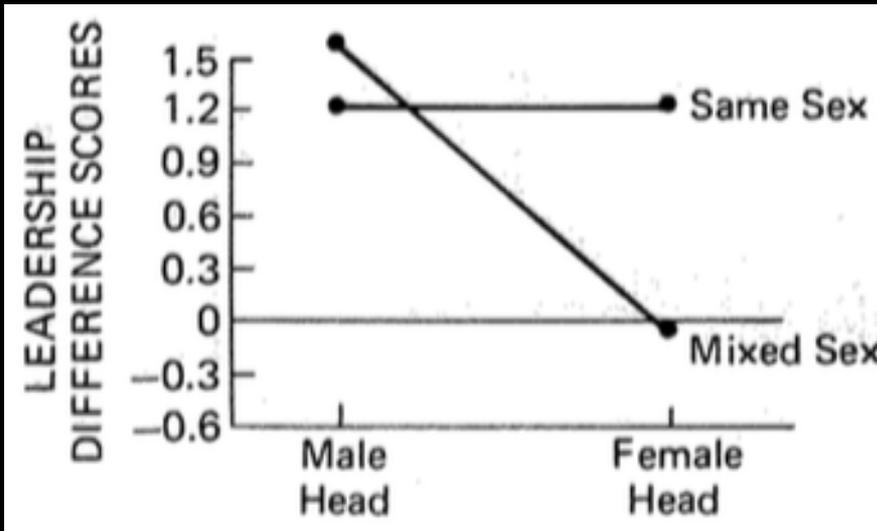
Shifting Criteria



Job criteria shifted so the applicant from the desired group appears most qualified

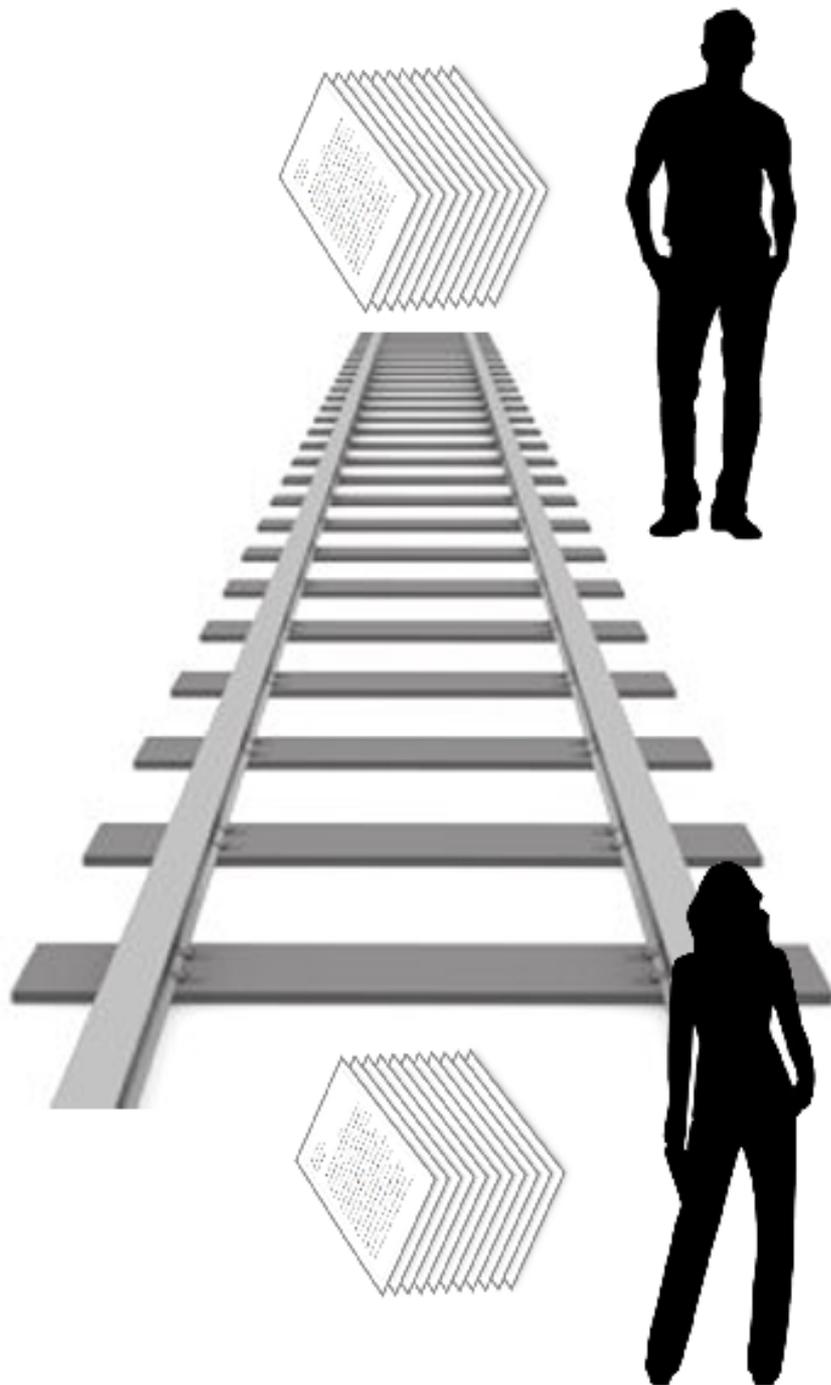
Shifting criteria can be traced to those claiming the most objectivity

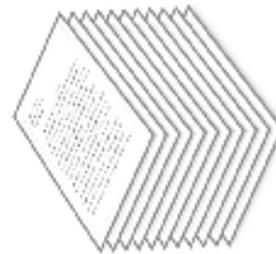
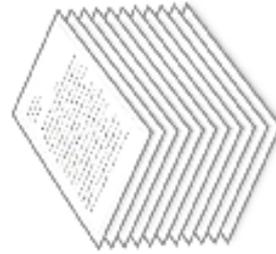
Do We View Women as Leaders?



All males or all females at table:
whoever is at the head of the
table is viewed as the leader

Mixture of men and women:
If the man is at the head, he is
seen as the leader. If the woman
is at the head, not so much...





What Role Do Our Attitudes Play in the Gender Composition of Our Field?

Hiring data coupled with evidence-of-bias seems to suggest the message: *“we realize we need you, but we don’t respect you.”*

Even when women are hired, it appears that attitudes in the field still create challenges and obstacles

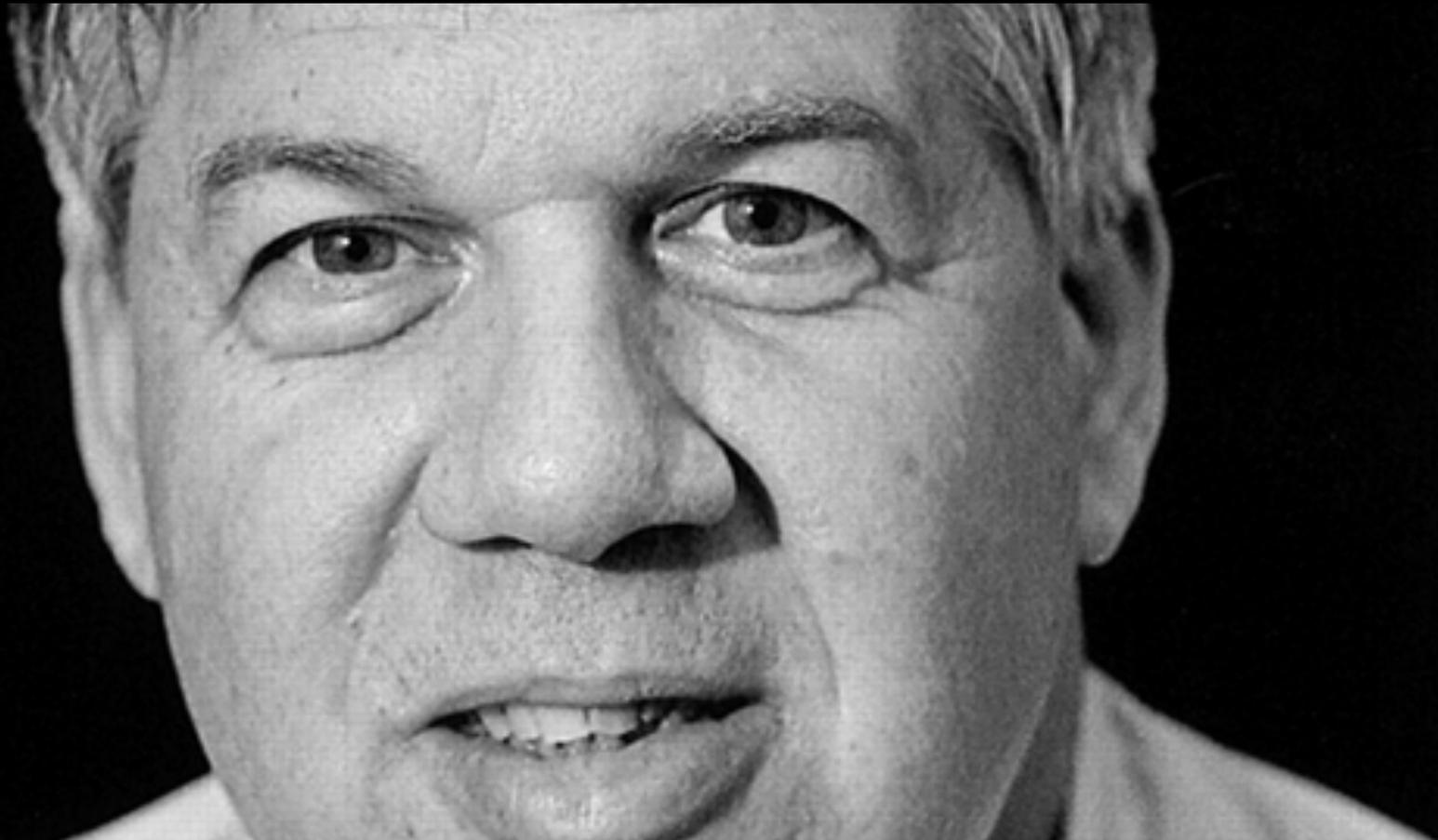
What could be helpful for all diversity:

awareness of tendencies and biases

de-emphasizing stereotypes, instead emphasize that physics is hard but success is not contingent on looking like Einstein: we all succeed through hard work and mentorship.

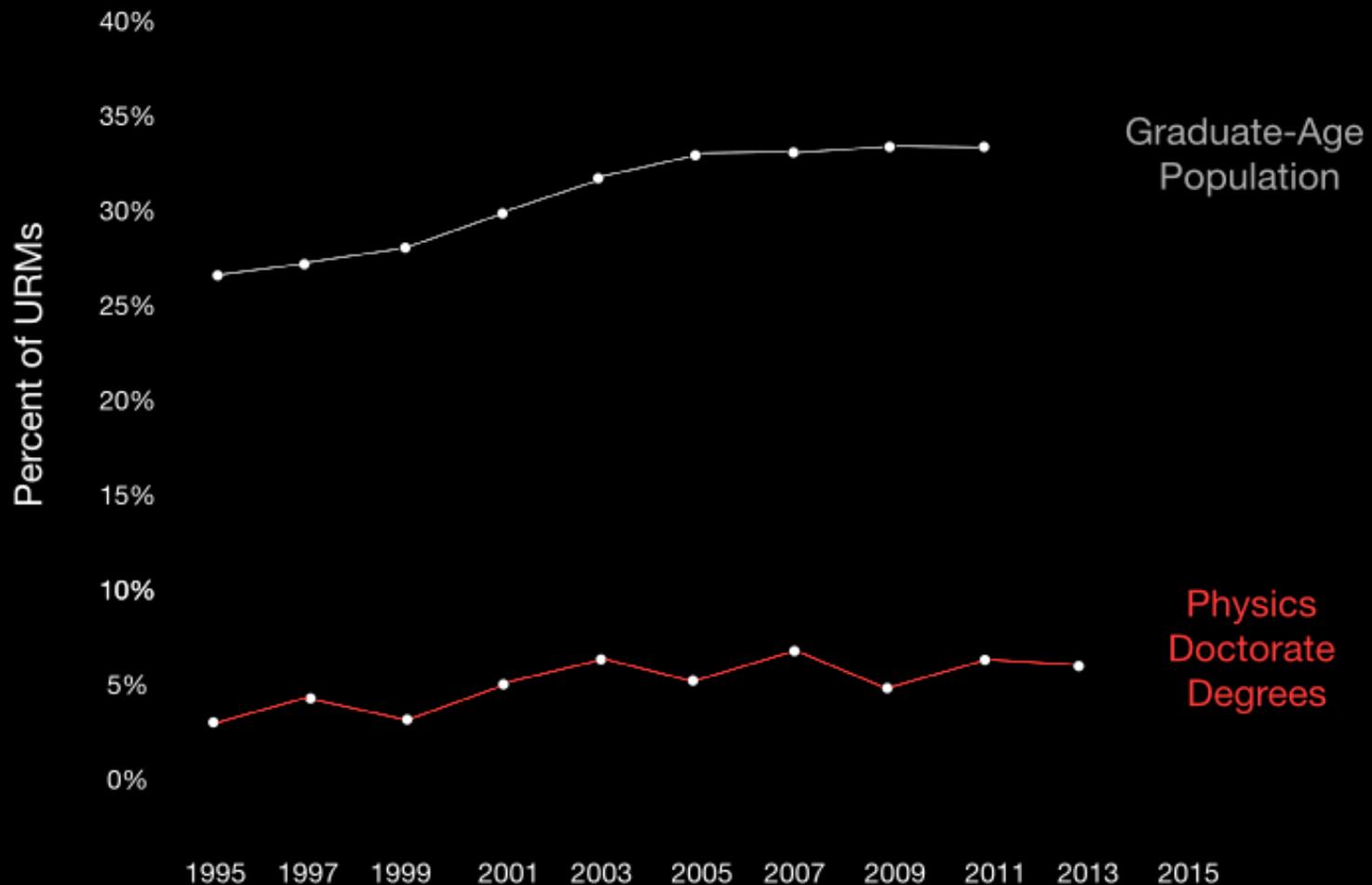
“Few tragedies can be more extensive than the stunting of life, few injustices deeper than the denial of an opportunity to strive or even to hope, by a limit imposed from without, but falsely identified as lying within.”

– STEPHEN JAY GOULD



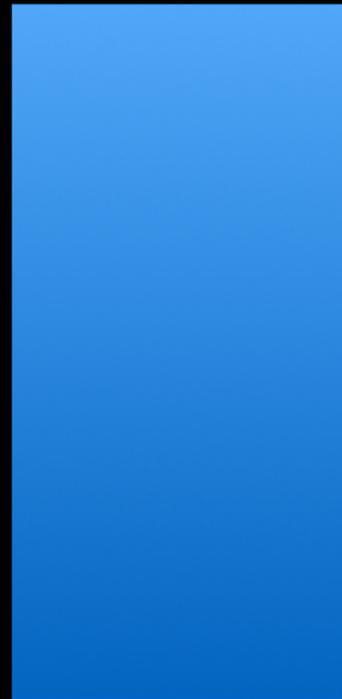
Doctorates to URM In the US

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% Female in Heavy-Ion Theory USA

DATA SELF-COLLECTED



15%

Postdocs



6%

All Professors