Equity Issues in Physics (and STEM)

Mike Childress

“String Theory & Gender” Workshop
Thursday 16 March 2017

Outline

Part 1:

Gender Demographics in Physics in the UK

Part 2:

Factors contributing to inequity

Closest comment(s):

how can we make (lasting) progress!!

Preface: the many axes of diversity

Examples / issues that follow are frequently framed in terms of gender or race but keep in mind there are other axes of diversity which have similar (but distinct!) difficulties.

Each individual's personal identity is more like a matrix than a scalar[1].

(People with multiple aspects of diversity may have experiences that are not the simple product of experiences from each individual aspect.)

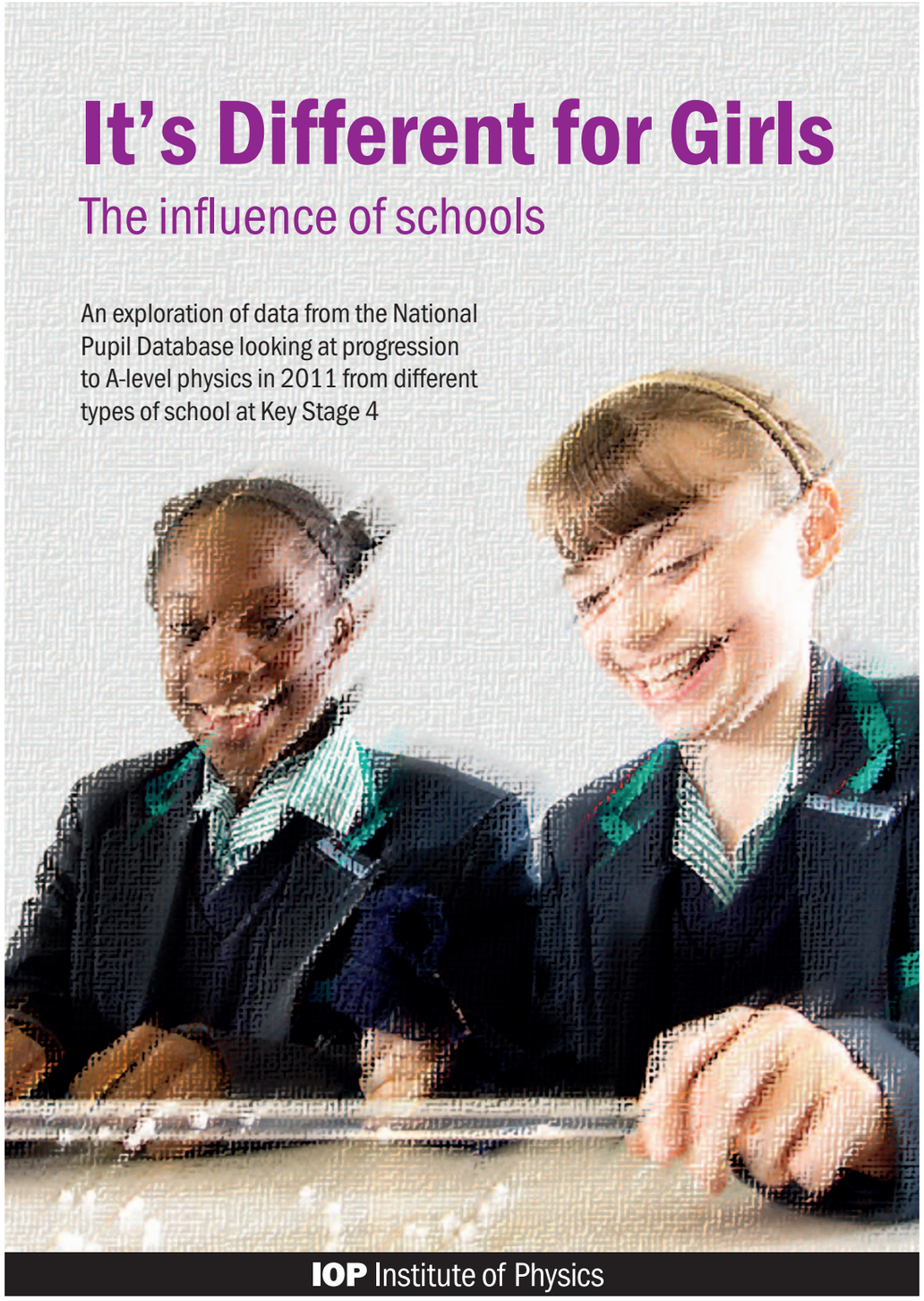
[1]from "Intersectionality as a blueprint for postcolonial scientific community building" by Dr. Chanda Prescod-Weinstein

PART 1:

Demographics Data in Physics
(+ other STEM fields)

Gender statistics for A-level students

subtitle: we're already behind by the time students get to Uni

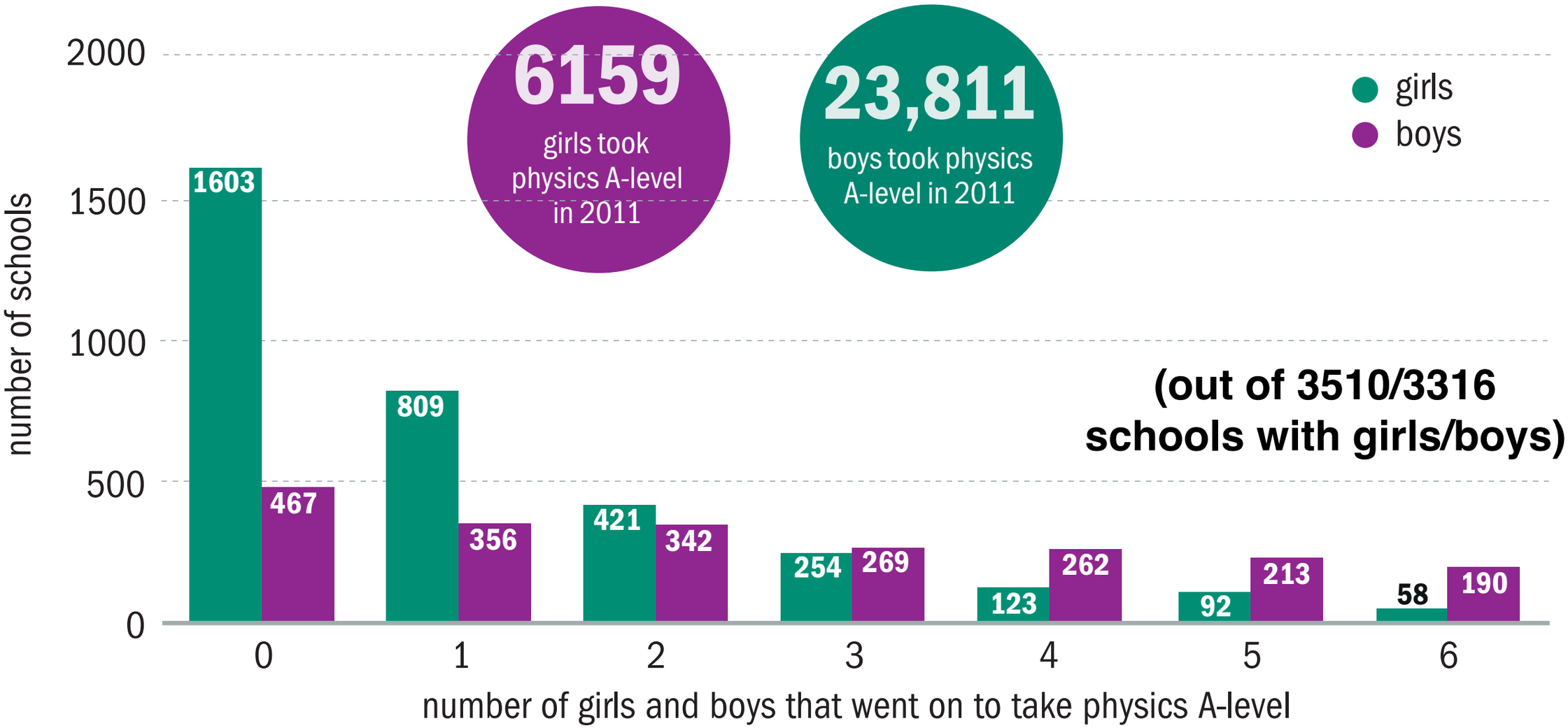


Source: "It's Different for Girls: The Influence of Schools"; IOP report 2012

Gender statistics for A-level students

subtitle: we're already behind by the time students get to Uni

Figure 1a: Number of schools against the numbers of girls and boys progressing to A-level physics in 2011



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Gender statistics for A-level students

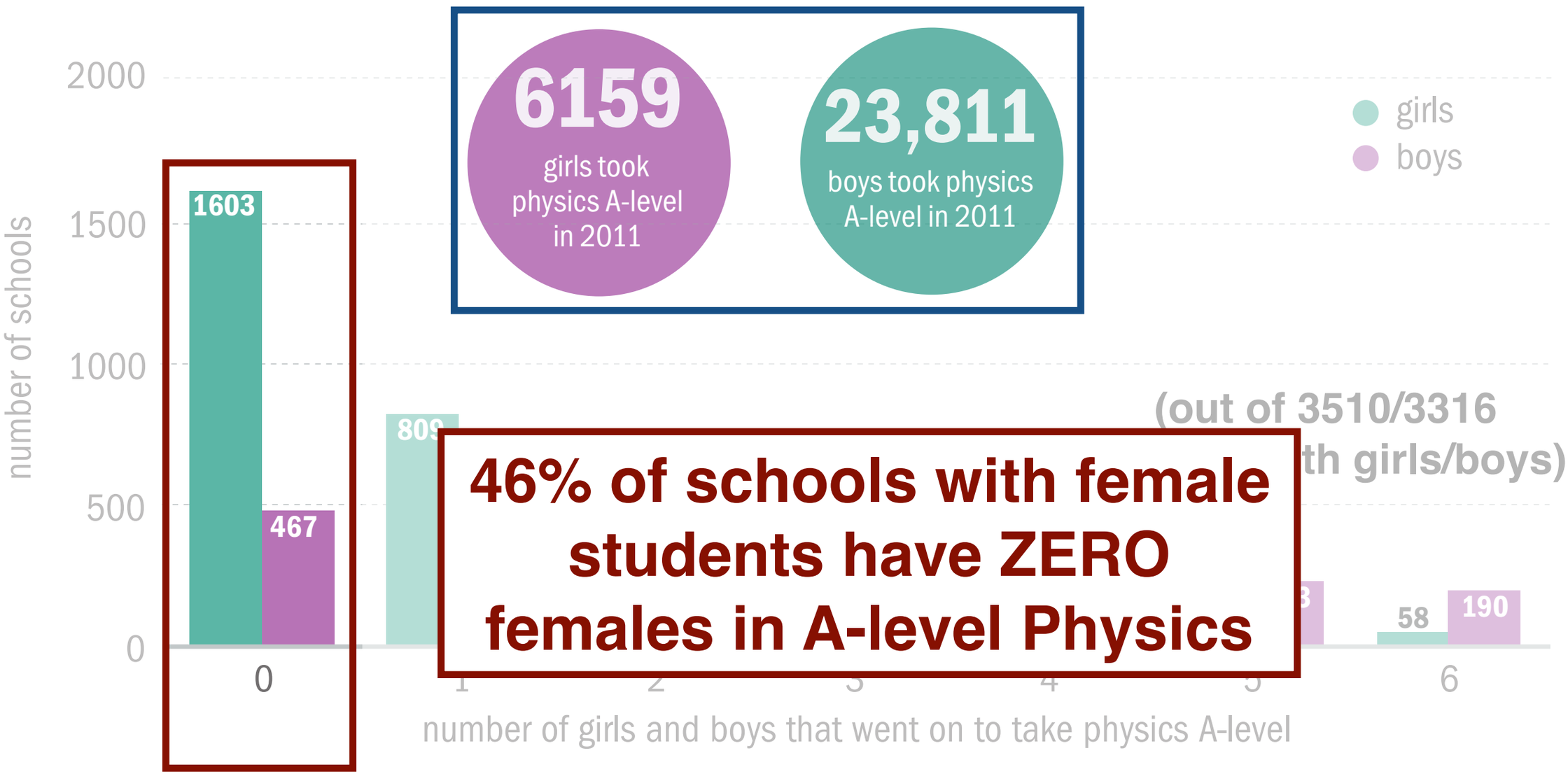
subtitle: we're already behind by the time students get to Uni

Figure 1a: Num physics in 2011

79% of A-level physics students are male

6159
girls took physics A-level in 2011

23,811
boys took physics A-level in 2011



46% of schools with female students have ZERO females in A-level Physics

Source: "It's Different for Girls: The Influence of Schools"; IOP report 2012

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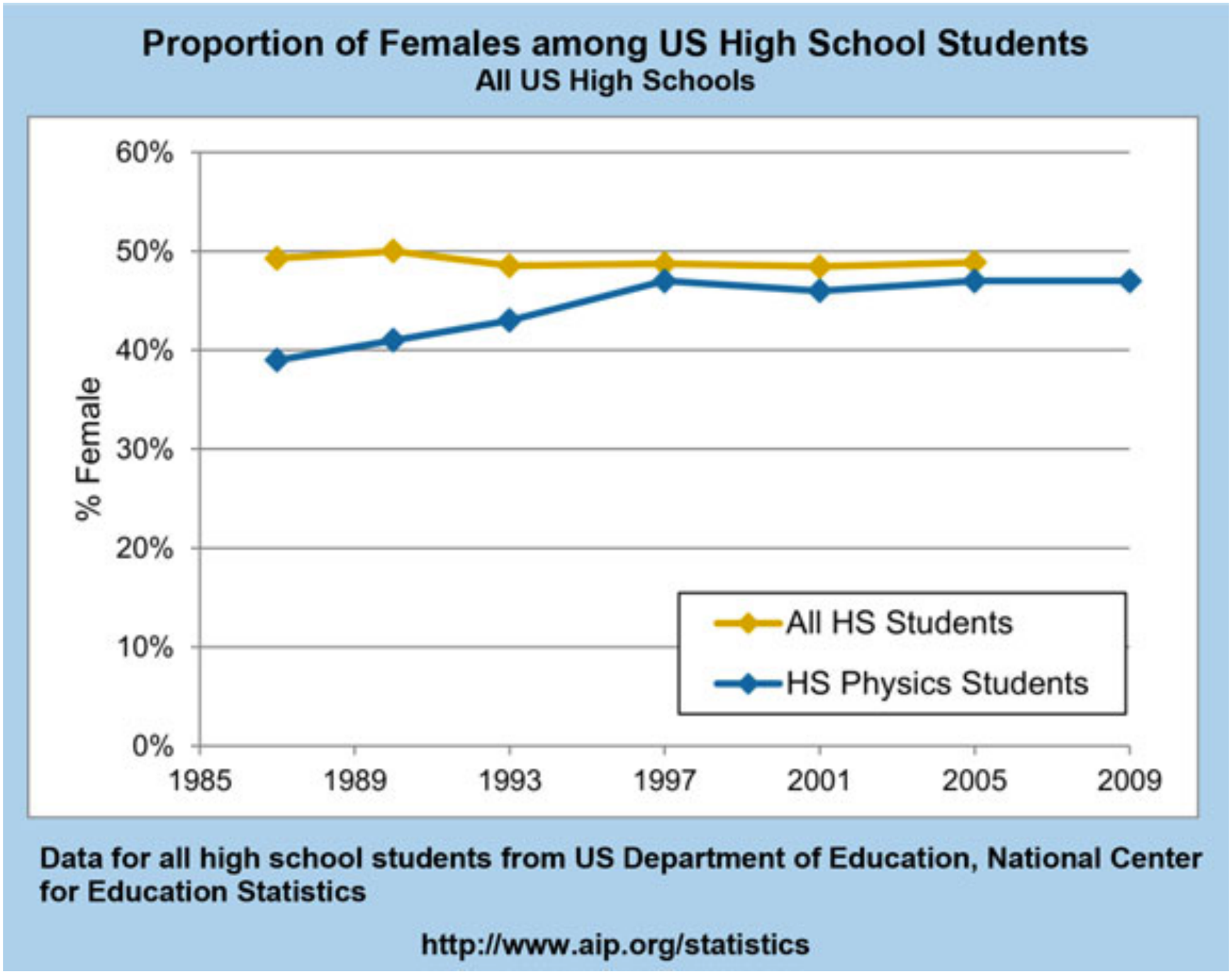

Data for all high school students from US Department of Education, National Center for Education Statistics

http://www.aip.org/statistics

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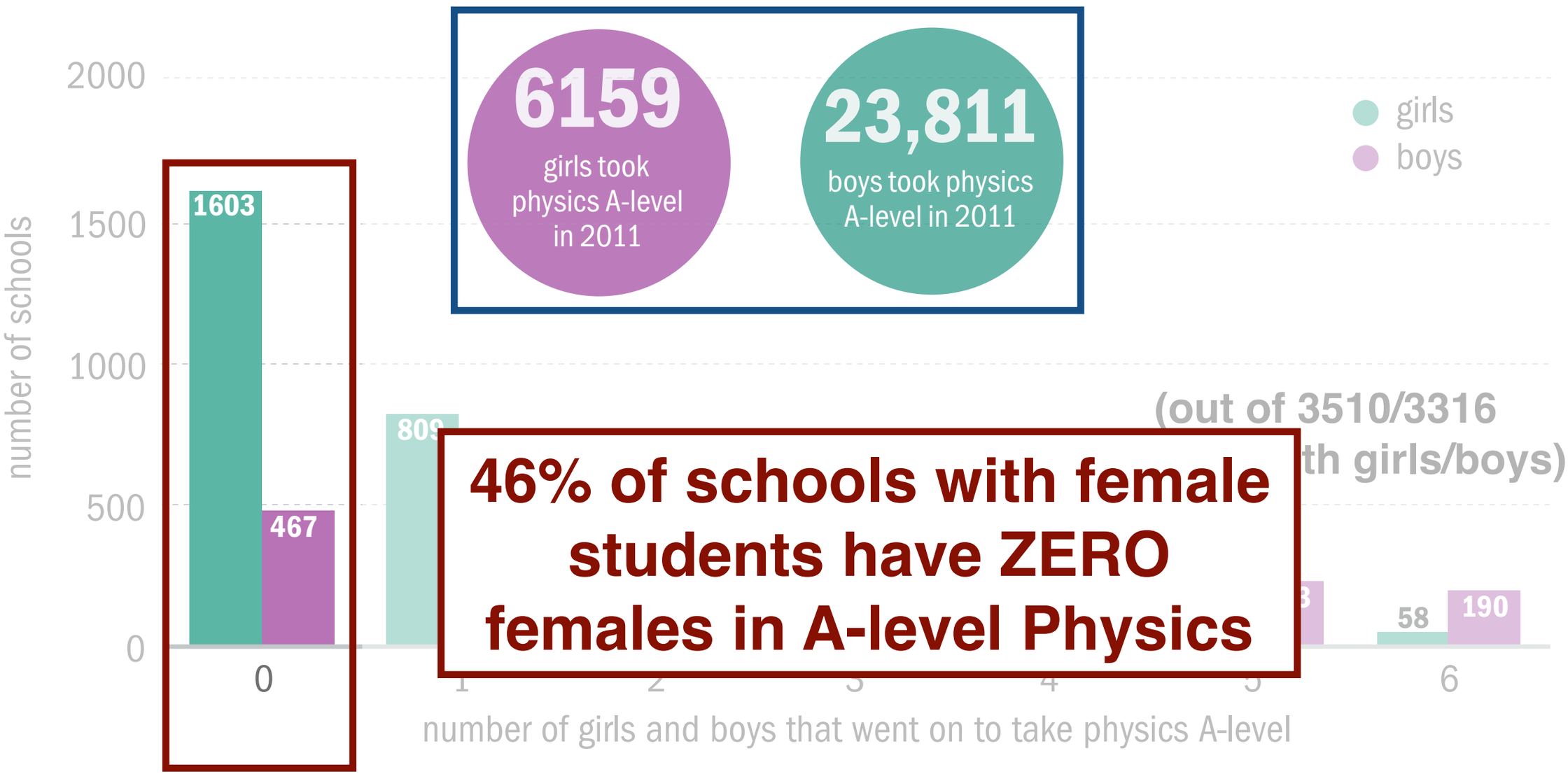

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Gender statistics for A-level students

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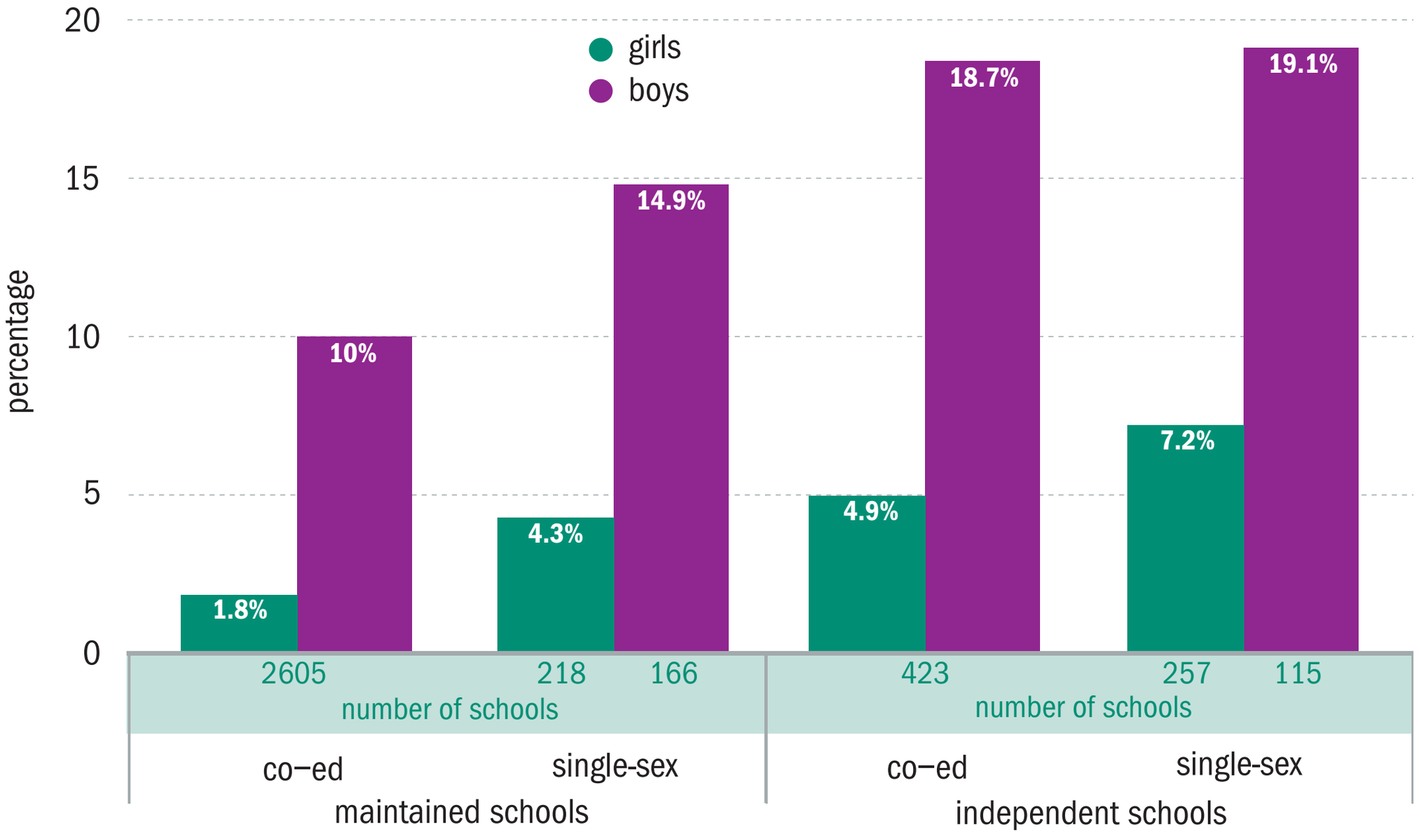
Figure 2: Percentages of girls and boys who went on to take physics A-level in 2011 by type of school



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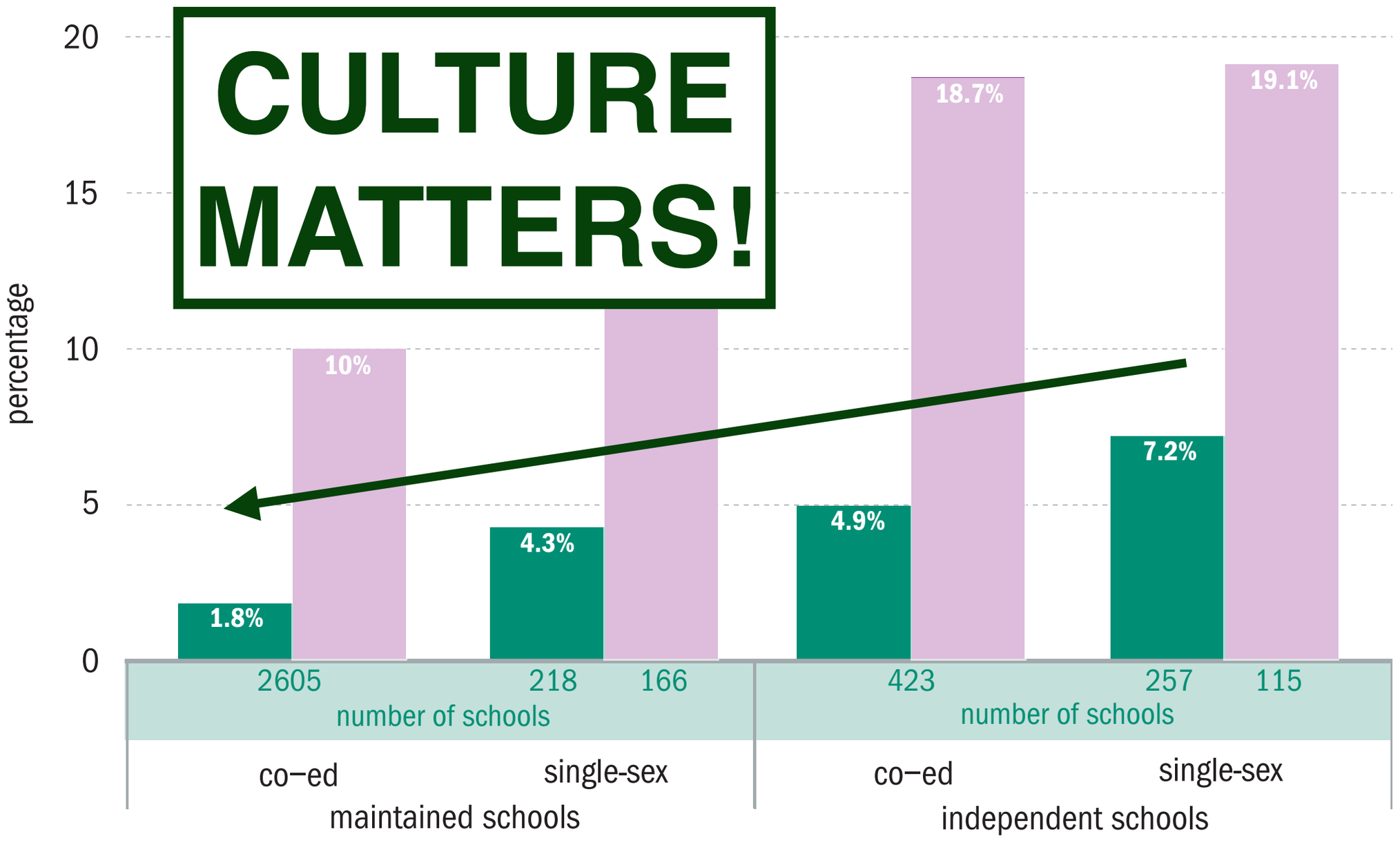


Source: "It's Different for Girls: The Influence of Schools"; IOP report 2012

Gender statistics for physics university students

Table 8: The proportion of physics graduates that is female by level of study 2004/05 to 2011/12

Degree level	Proportion of graduates that is female*							
	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
First degree	21.0%	21.6%	21.6%	21.2%	20.6%	21.4%	22.9%	22.1%
Masters	32.8%	33.1%	29.0%	27.5%	29.8%	23.9%	28.8%	29.7%
Doctorate	22.2%	21.3%	22.5%	24.6%	26.6%	23.5%	24.0%	24.6%

**Proportions are based on headcounts of graduates iwho spent 50% or more of their time studying physics.*

Source: "Academic Physics Staff in UK Higher Education Institutions"; IOP report 2013

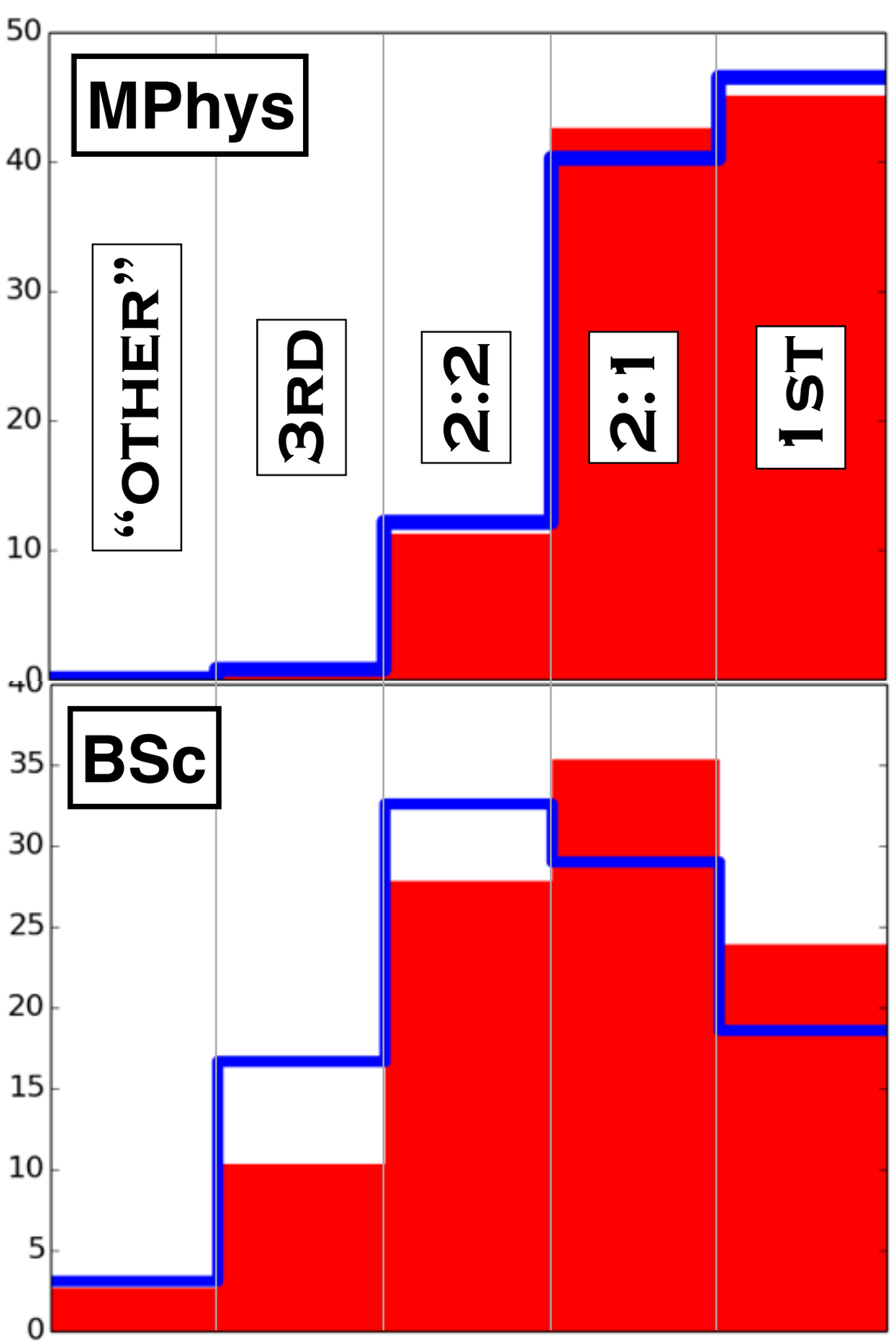
We're recruiting female physicists at a level consistent with A-level demographics, and retaining females through PhD level at a consistent (adequate) rate.

Gender statistics for physics students

Degree classifications by gender for: enhanced first degree (i.e. MPhys — top) and bachelors (BSc — bottom) averaged for graduates from 2009-2014

Male

Female



Source: "Physics Students in UK Higher Education Institutions"; IOP report 2012

Gender statistics for physics students

Anyone who says "women aren't as good at physics as men" is an idiot (here's the proof).

bachelors (BSc — bottom) averaged for graduates from 2009-2014

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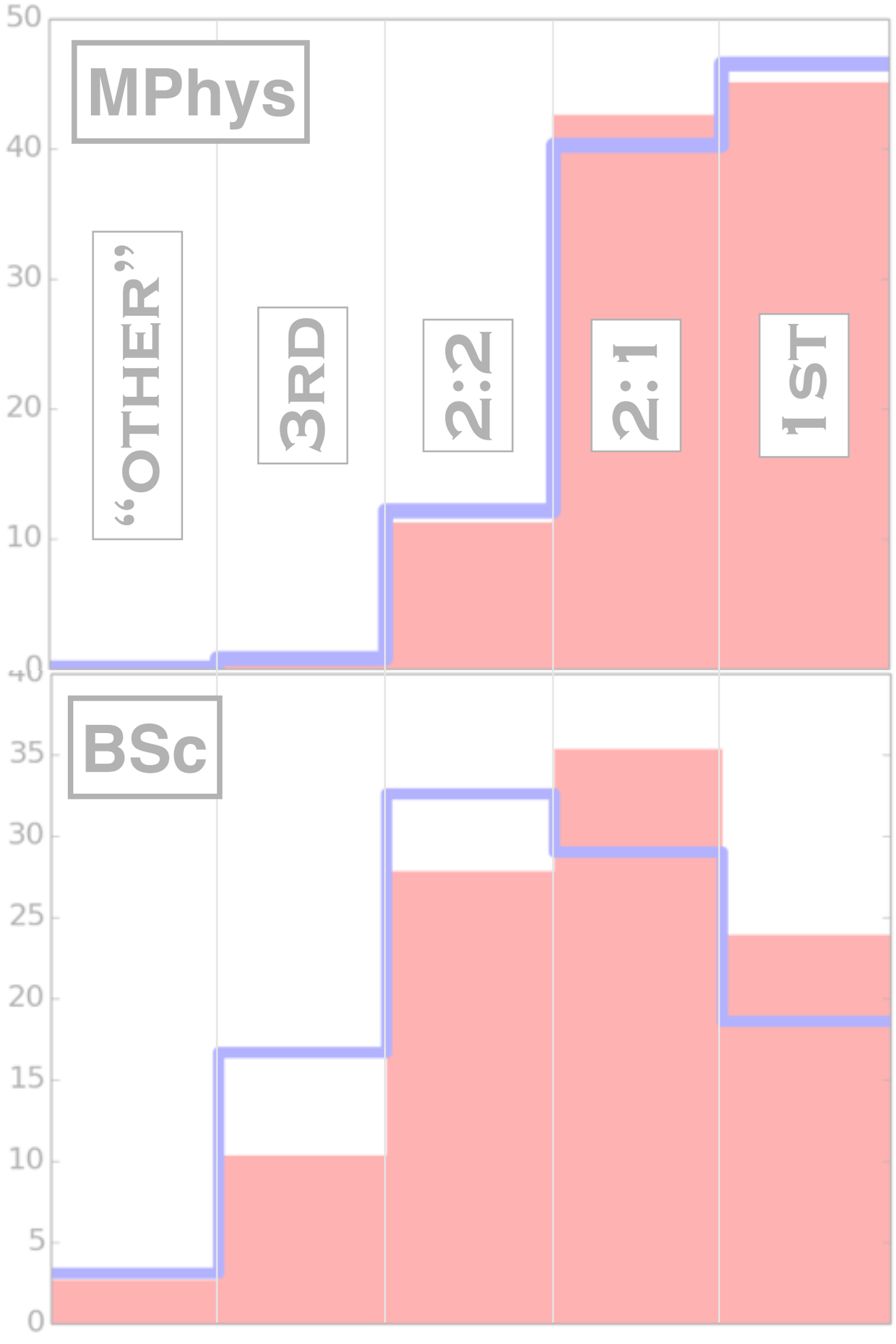
Female



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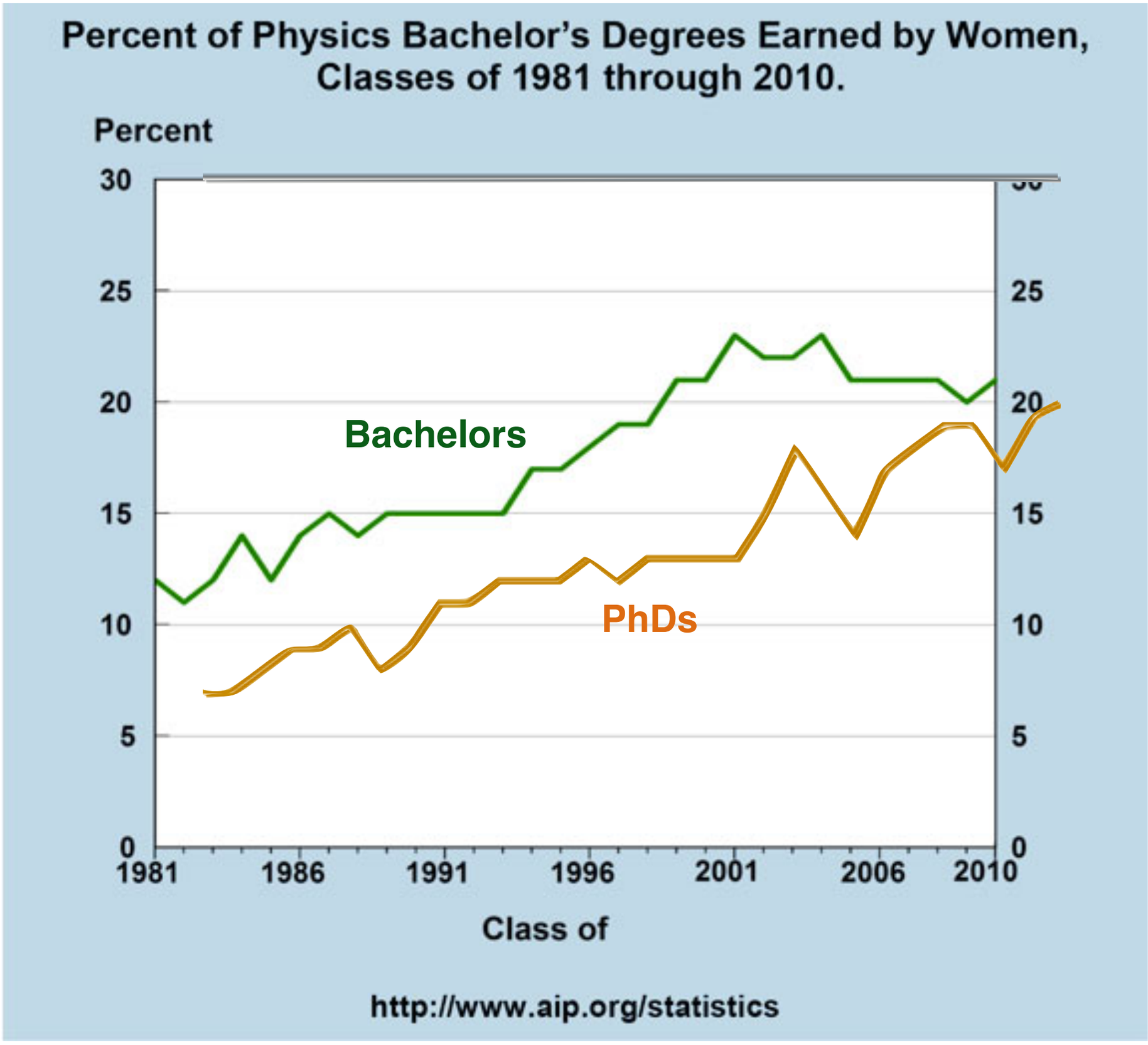
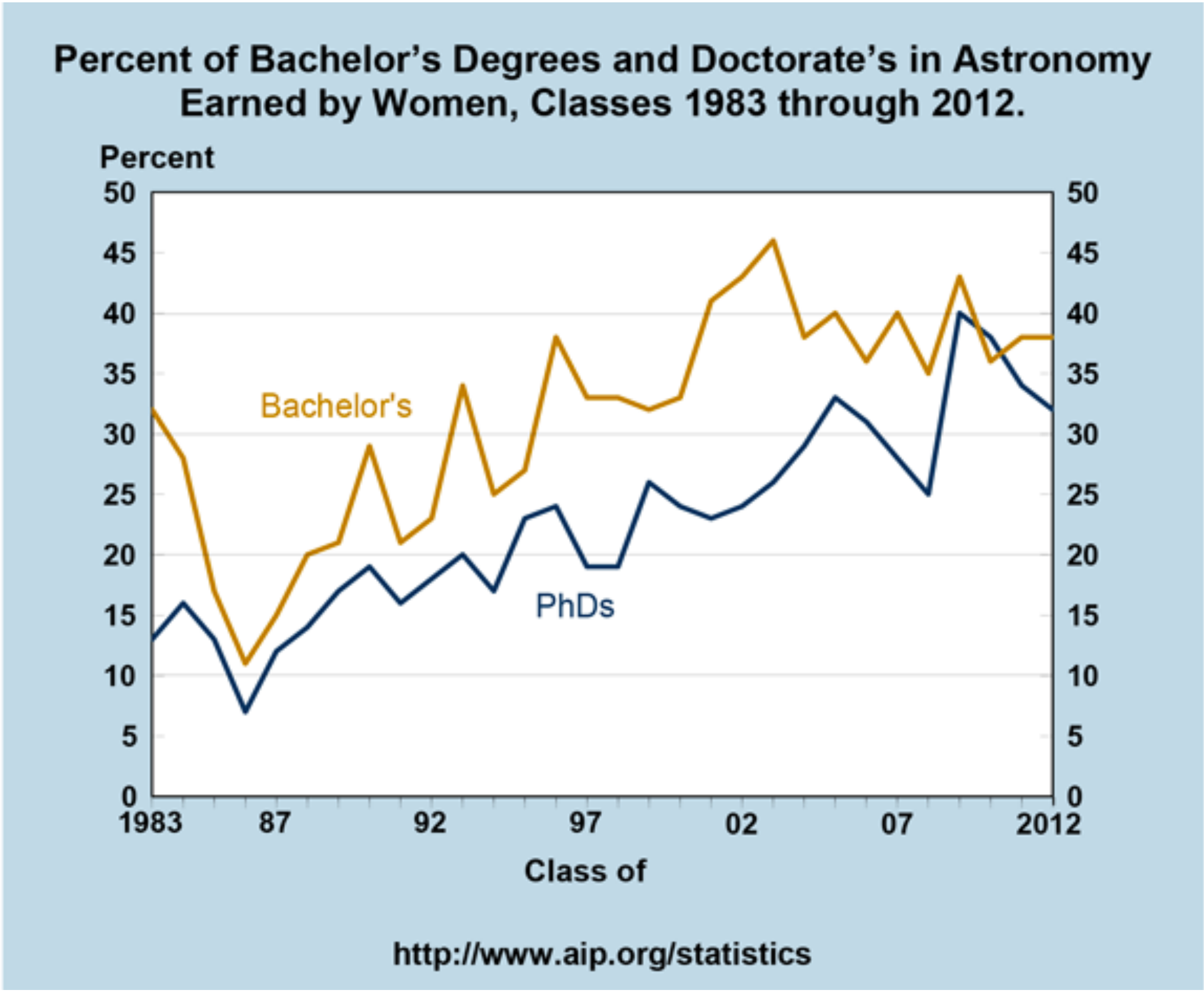


Gender statistics for ASTRONOMY university students



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You may think we're doing well at recruiting students and advancing them through academic degrees…

but here is where things start to get bad

Gender statistics for physics academics

Gender statistics for physics academics

In physical sciences & engineering, females make up a low percentage of academic staff <u>THAT IS NOT GROWING</u>

Table 5: The proportion of all staff* that is female in selected academic cost centres 2003/04 to 2011/12, excluding teaching-only staff

Cost centre	Proportion of staff that is female								
	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Physics	14%	15%	15%	14%	15%	15%	16%	16%	16%
Mathematics	18%	21%	22%	16%	18%	18%	18%	17%	18%
Chemistry	23%	23%	24%	23%	23%	24%	24%	24%	24%
Electrical, electronic & computer engineering	12%	12%	13%	12%	11%	12%	12%	13%	13%
Biosciences	39%	40%	41%	40%	40%	41%	41%	41%	42%
All cost centres	40%	41%	42%	40%	40%	41%	41%	42%	42%

**All staff comprises professors, senior lecturers, lecturers, other staff and researchers.*

Source: "Academic Physics Staff in UK Higher Education Institutions"; IOP report 2013

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Physics	14%	15%	15%	14%	15%	15%	16%	16%	16%

Table 1: The number of staff in selected academic cost centres by grade 2003/04 to 2011/12

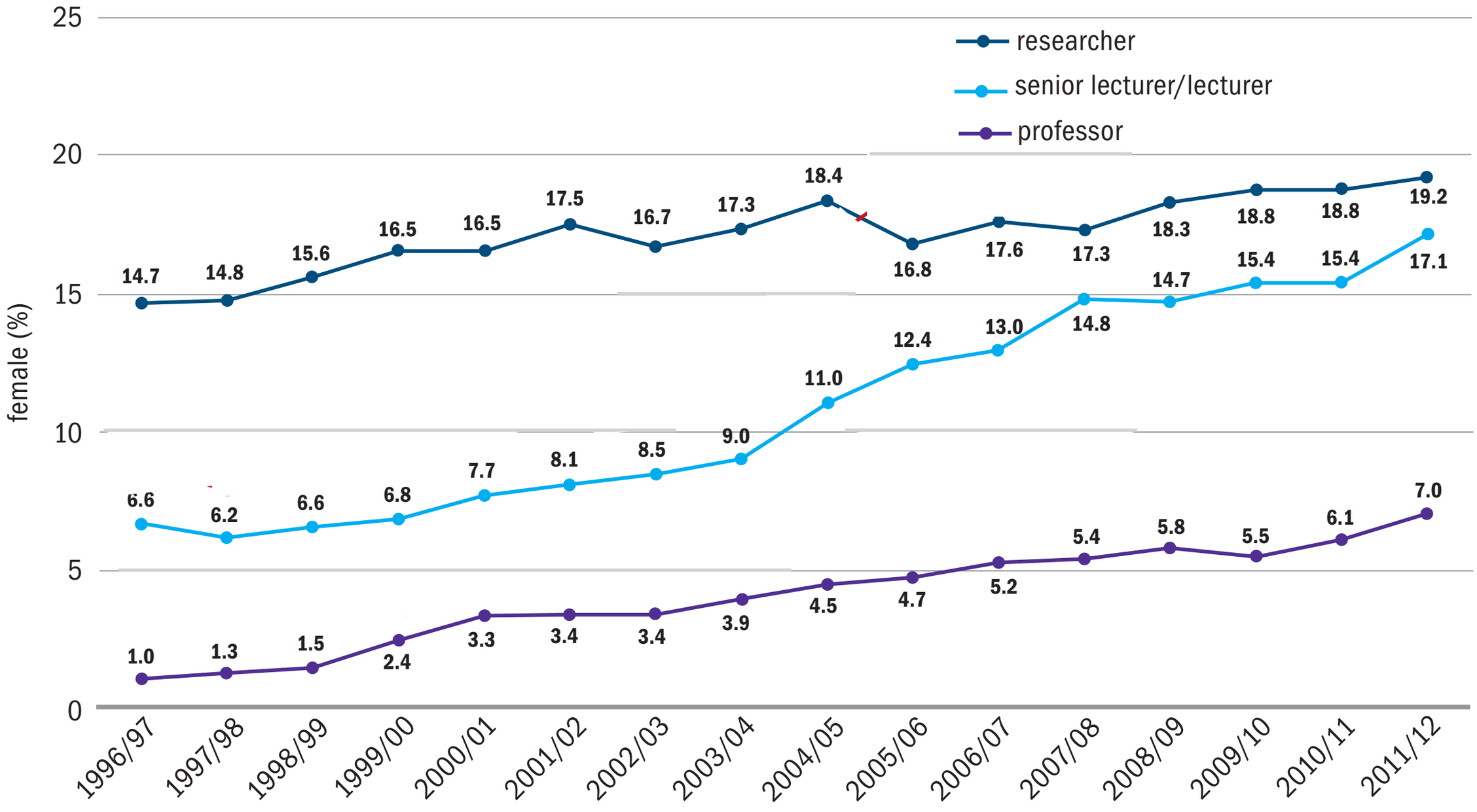
Cost centre	Grade	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Physics	Professor	485	515	570	590	620	635	650	670	745
	Senior lecturer	590	600	570	555	585	1355	1335	1320	1350
	Lecturer	390	380	375	400	420				
	Other grades	255	265	350	330	350	10	0	0	0
	Researcher	1790	1745	1900	1995	2125	2210	2180	2145	2110
	Teaching only				310	335	385	365	345	355
	Total staff	3510	3505	3765	3865	4100	4210	4170	4140	4205

Note: Stats dominated by # of postdocs

Source: "Academic Physics Staff in UK Higher Education Institutions"; IOP report 2013

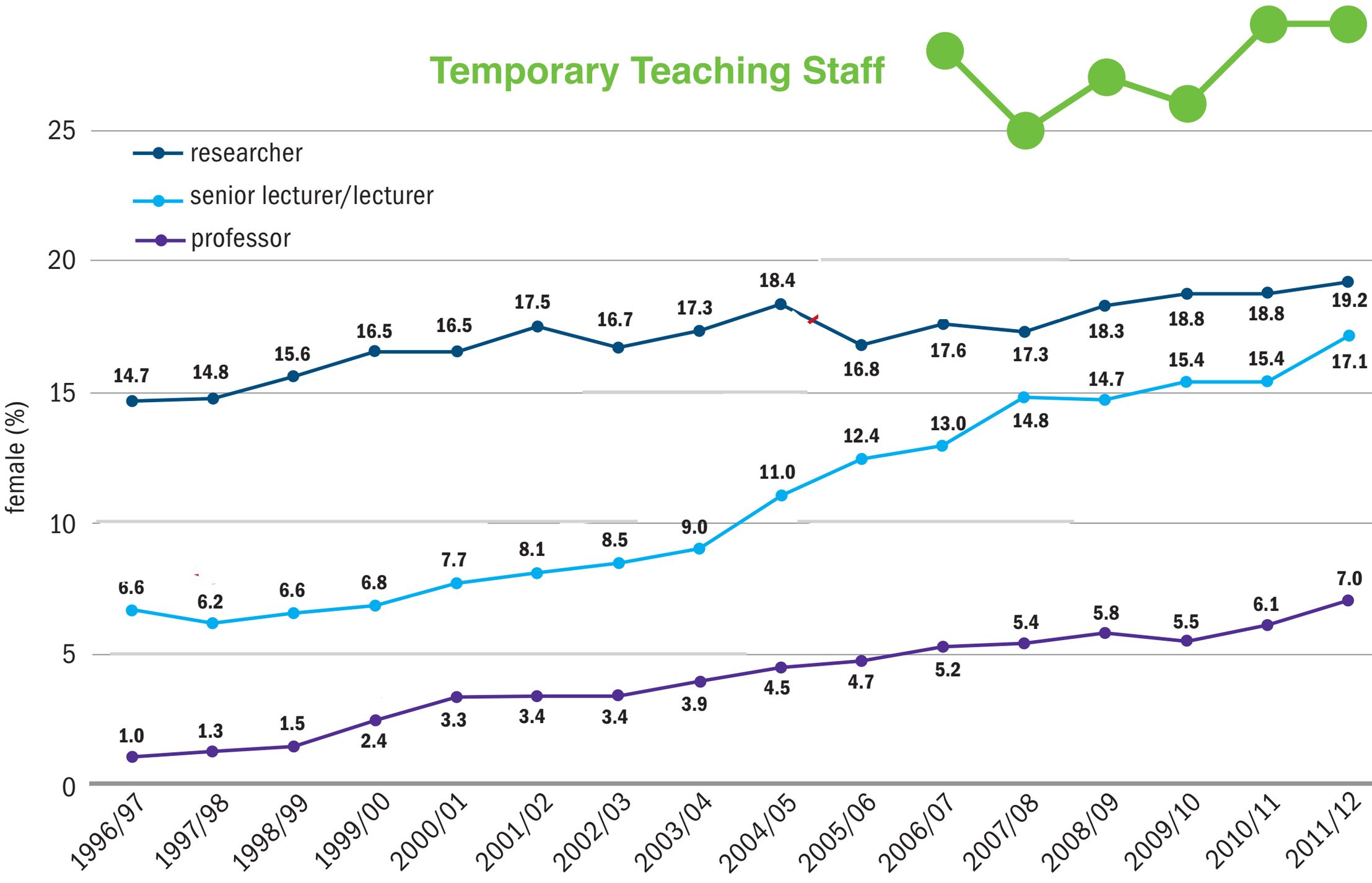
Gender statistics for physics academics

Figure 3: Proportion of all staff that is female in the physics cost centre at each grade 1996/97 to 2011/12



Source: "Academic Physics Staff in UK Higher Education Institutions"; IOP report 2013

Gender statistics for physics academics



Source: “Academic Physics Staff in UK Higher Education Institutions”; IOP report 2013

Gender statistics for physics academics

= Reader
= Lecturer
=Teaching

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
by Highest Degree Offered by Department	(%)	(%)	(%)	(%)
PhD	6	7	10	12
Master's	9	13	14	15
Bachelor's	11	14	15	17
OVERALL	**8**	**10**	**12**	**14**

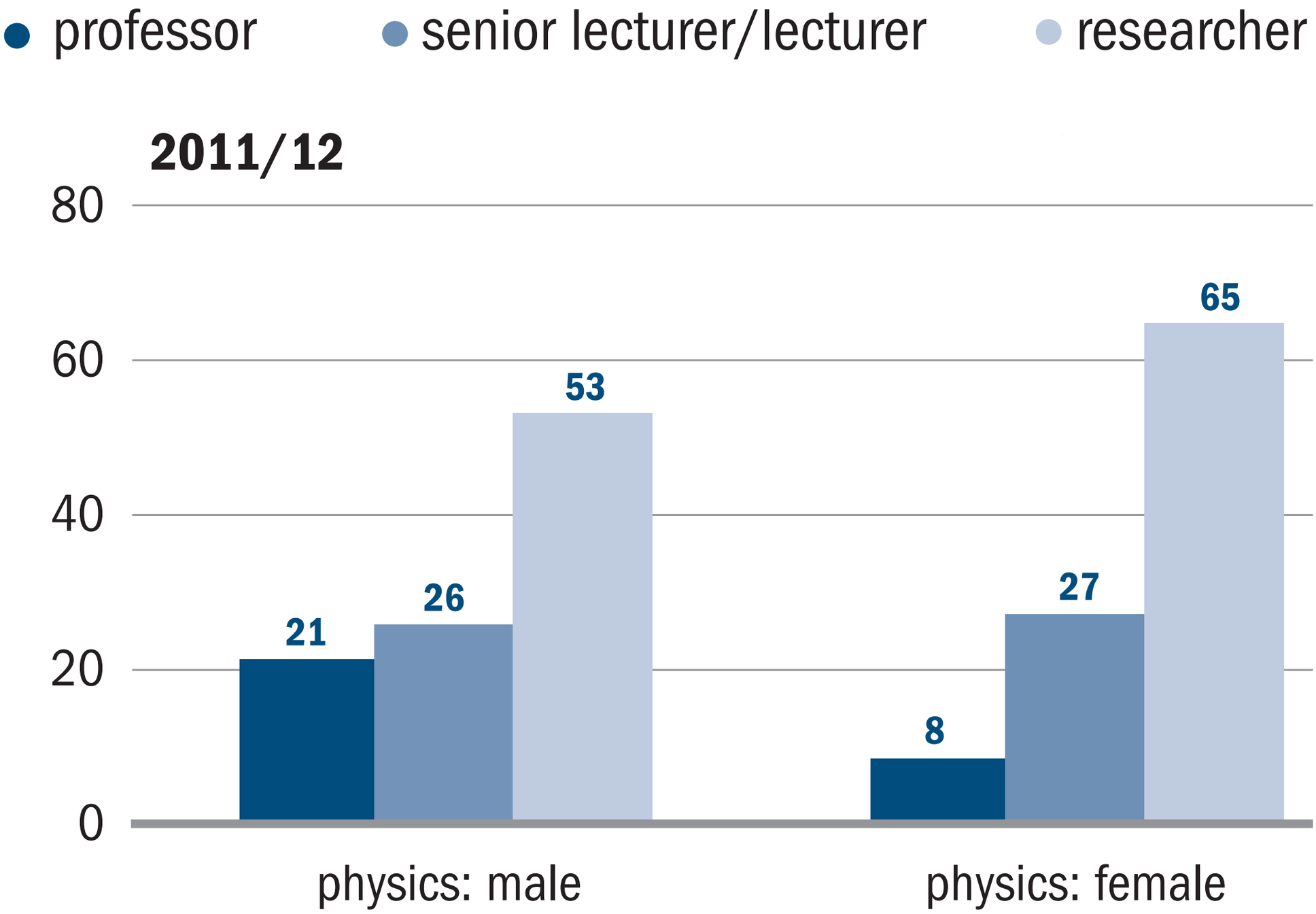
The year in the table refers to the spring semester; for example, 2010 represents the 2009-10 academic year.

* These data were not collected in this survey year.

http://www.aip.org/statistics

Gender statistics for physics academics

Figure 4: Percentage distribution of male and female academic staff* excluding teaching-only staff, between grades in physics and all academic cost centres 2003/04 to 2011/12



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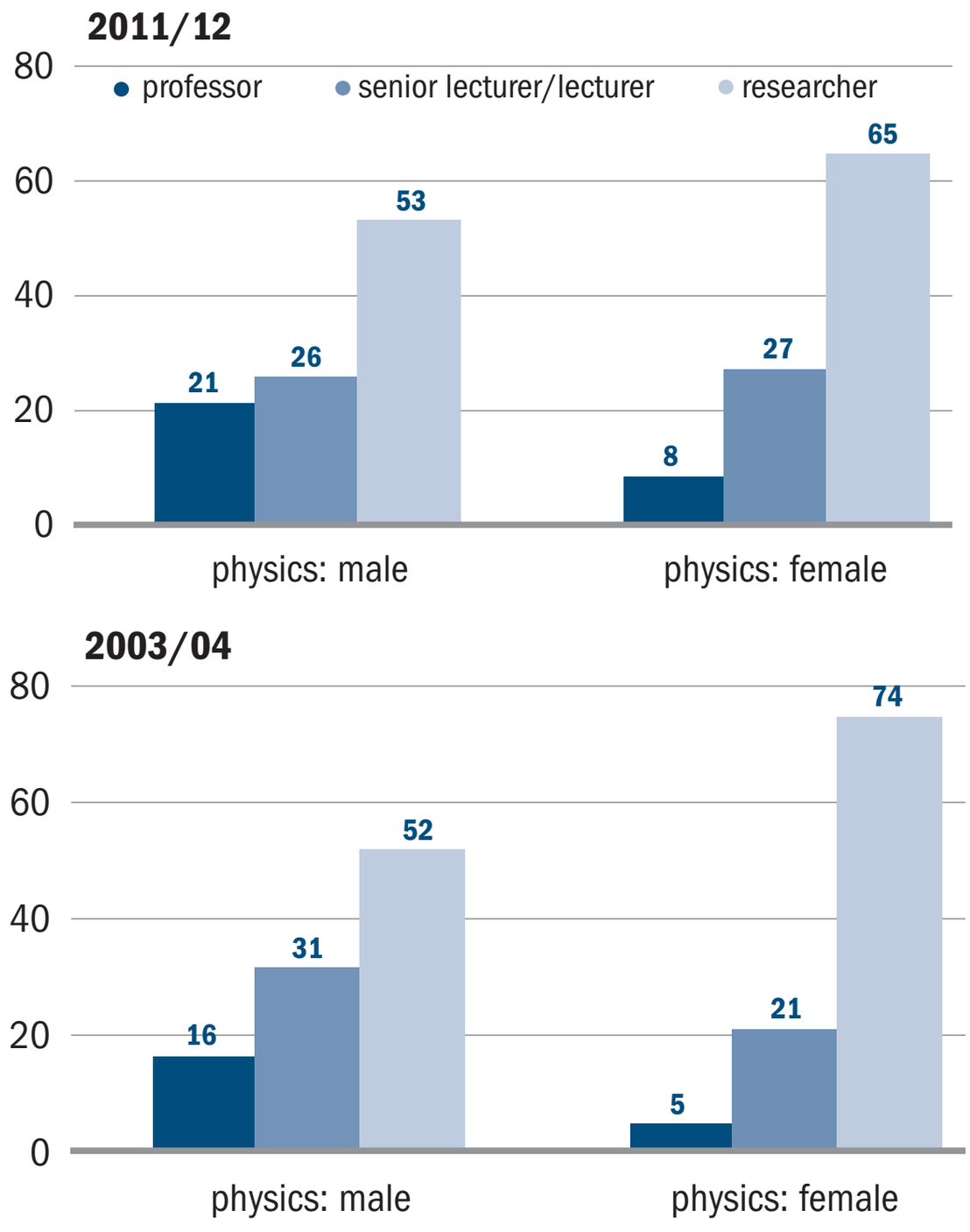

The fraction of male academics occupying senior roles is higher than that for females, AND THE SITUATIONS WAS EXACTLY THE SAME A DECADE AGO

STATUS QUO:

Male academics are consistently being given more senior promotions than female academics in physics

Source: "Academic Physics Staff in UK Higher Education Institutions"; IOP report 2013

Gender statistics for physics academics

Figure 7: Proportion of male and female permanent academic* staff who were professors by age in selected academic cost centres 2011/12, excluding teaching-only staff

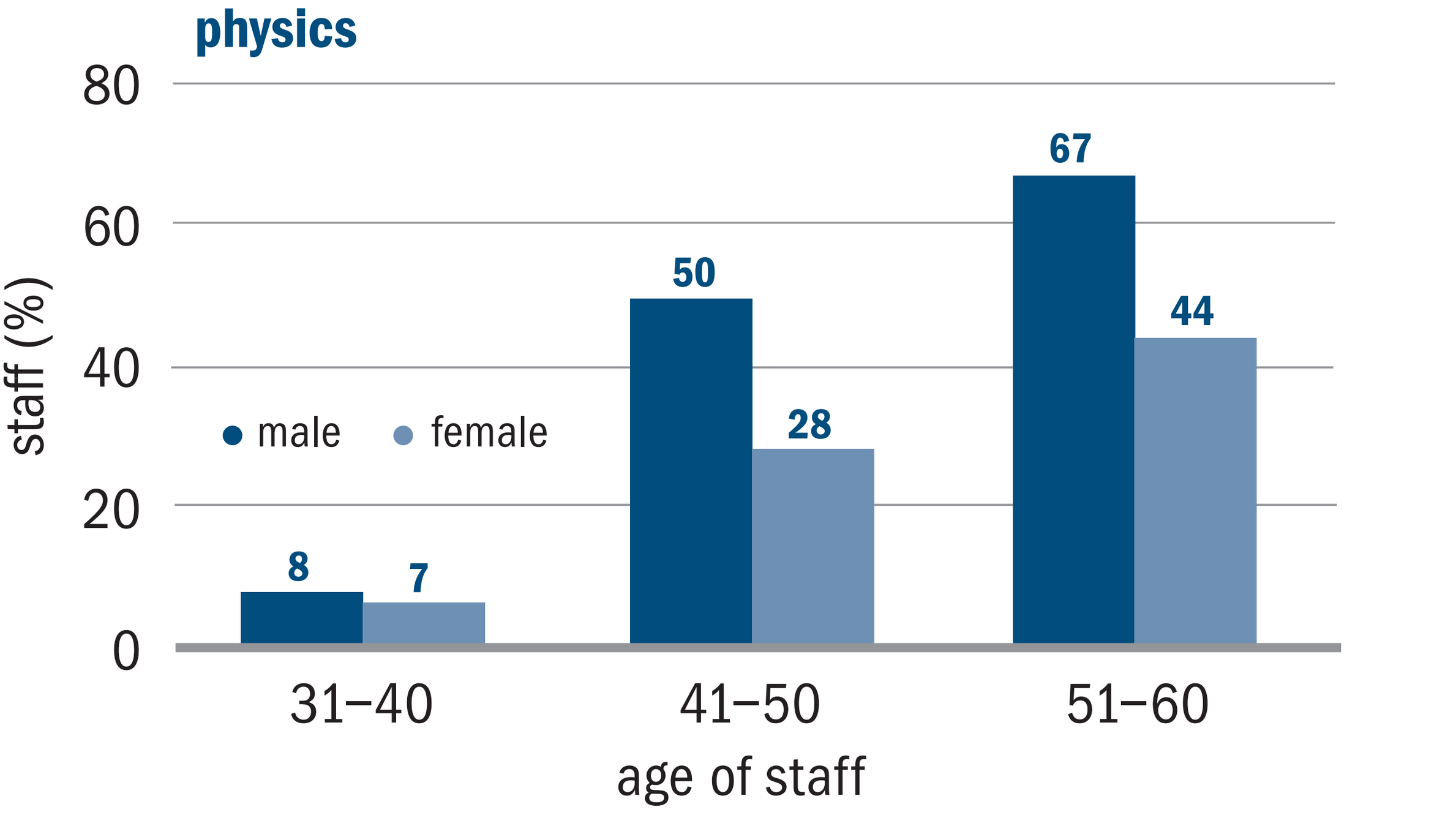

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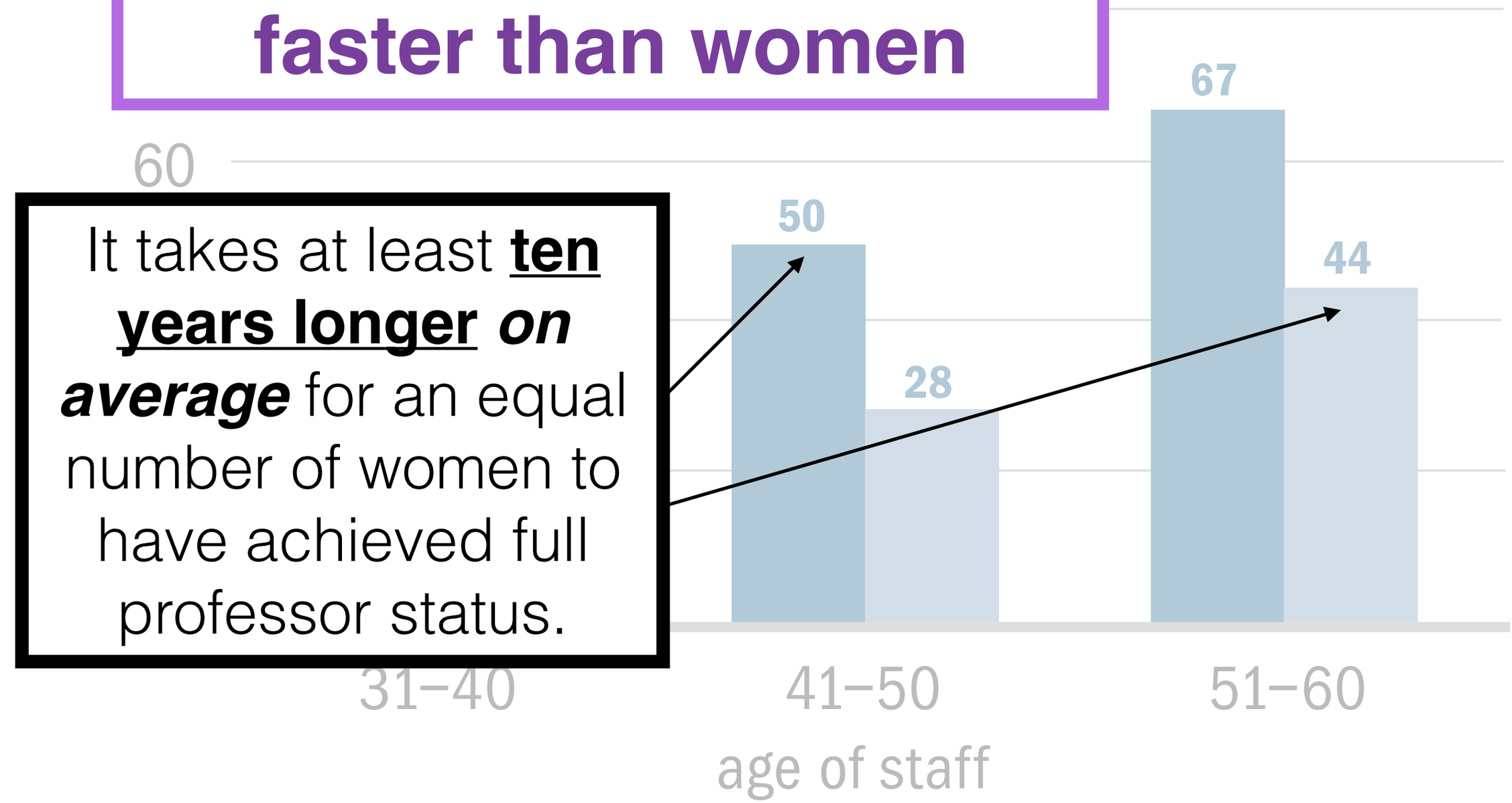
Figure 7: Proportion of male and female permanent academic* staff who were professors by age in selected academic cost centres 2011/12, excluding teaching-only staff

Men are being promoted faster than women

It takes at least **ten years longer** ***on average*** for an equal number of women to have achieved full professor status.



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Gender statistics for physics academics

Men are being promoted faster than women *in all STEM disciplines*

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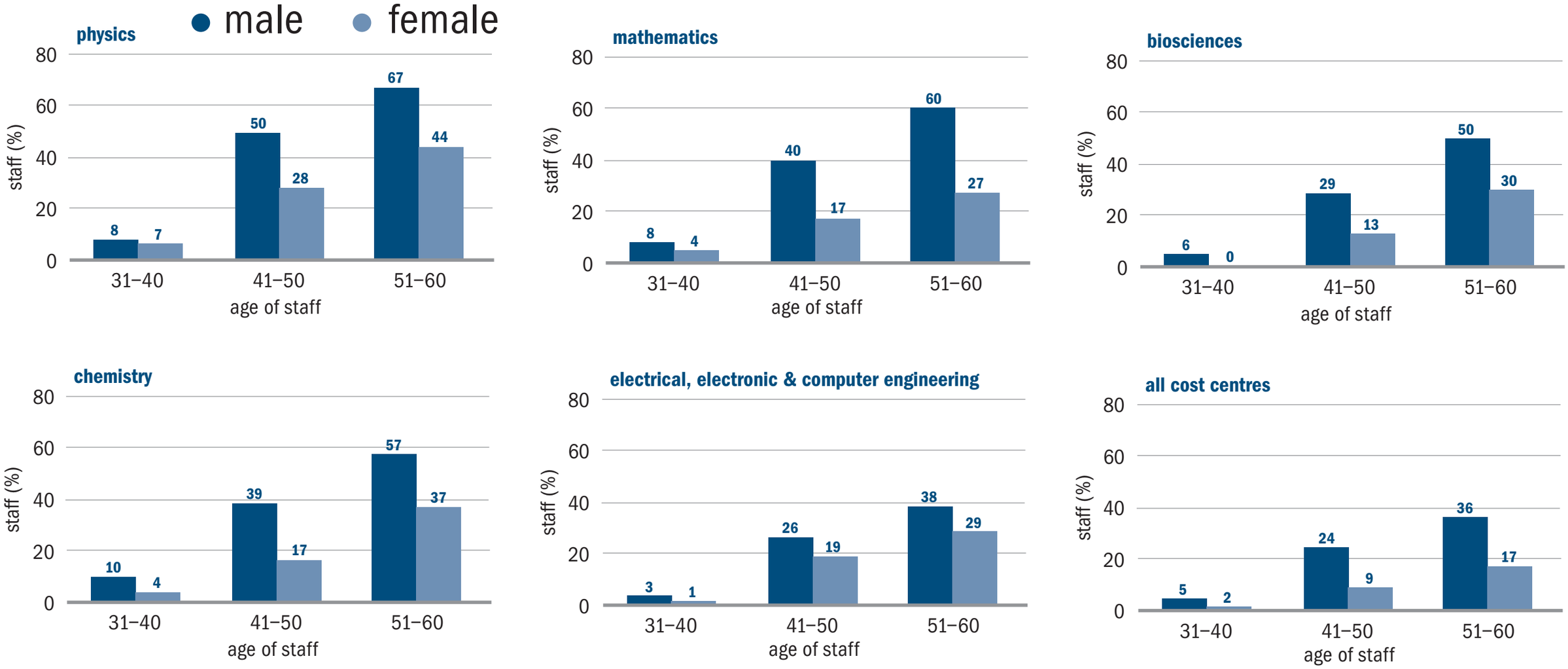

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PART 1:

Summary:

(1) Student demographics in physic *NOT* reflective of general population (gender and race).

(2) Demographics of academic staff are WORSE, and get progressively worse the higher you go (promotion levels).

PART 2:

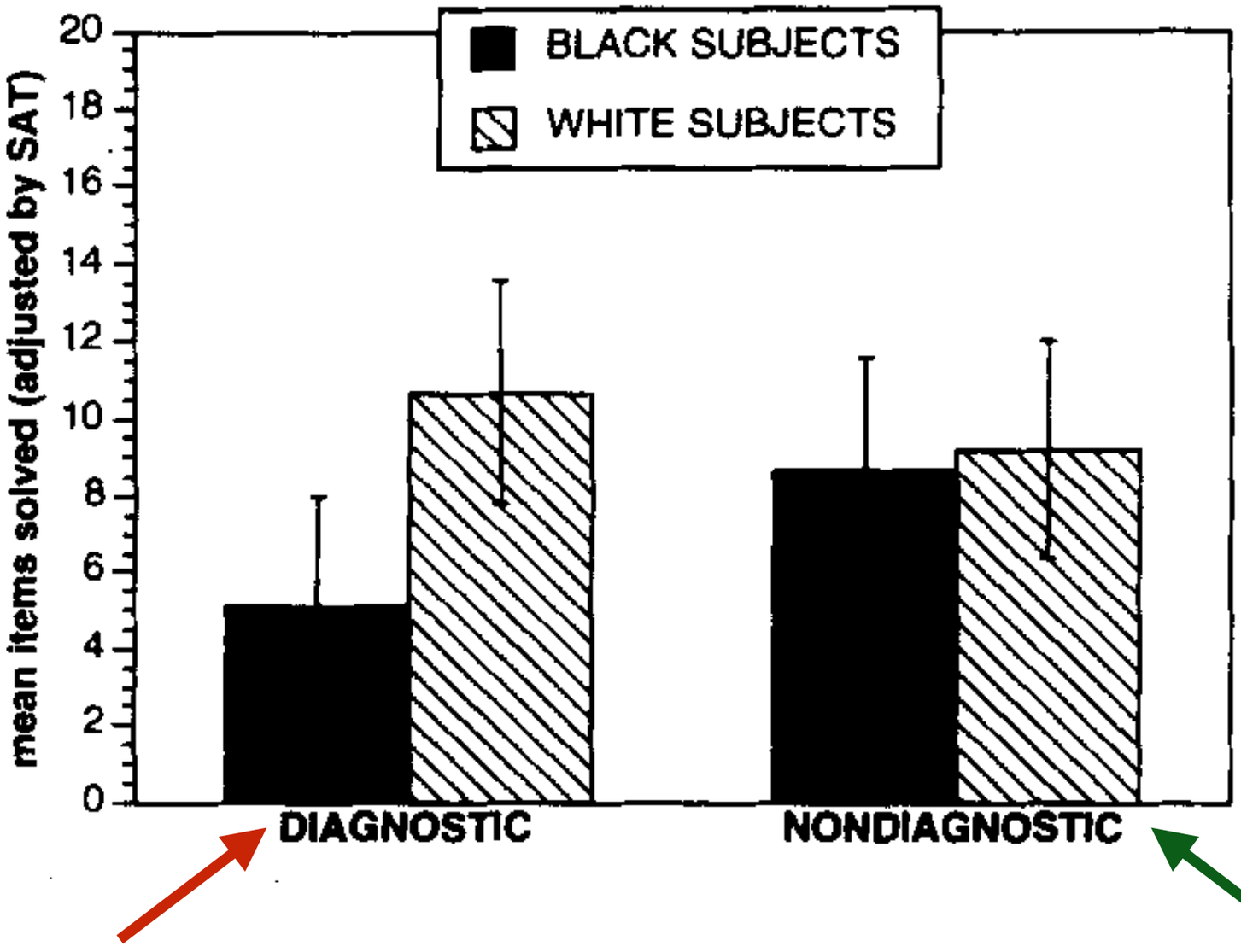
Systemic Factors Contributing to Failure to Achieve Equity

Stereotype Threat

Stereotype threat is the social-psychological predicament in which one fears their actions may reinforce widely-known negative stereotypes about one's group

(paraphrased from Steele & Aronson 1995)

Stereotype Threat



Steele & Aronson 1995

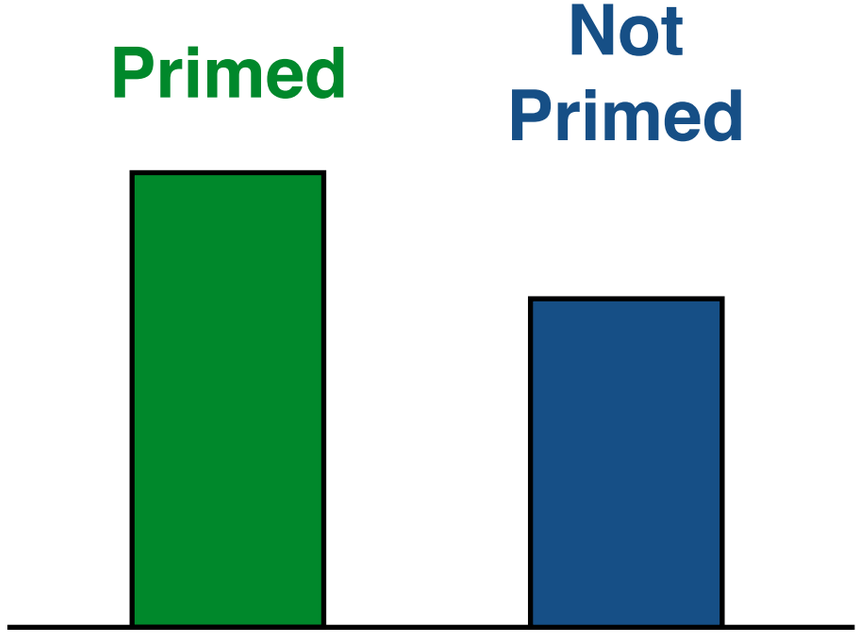
Tell students: "We're testing how smart you are."

Tell students: "We're testing how students solve problems."

Stereotype Threat

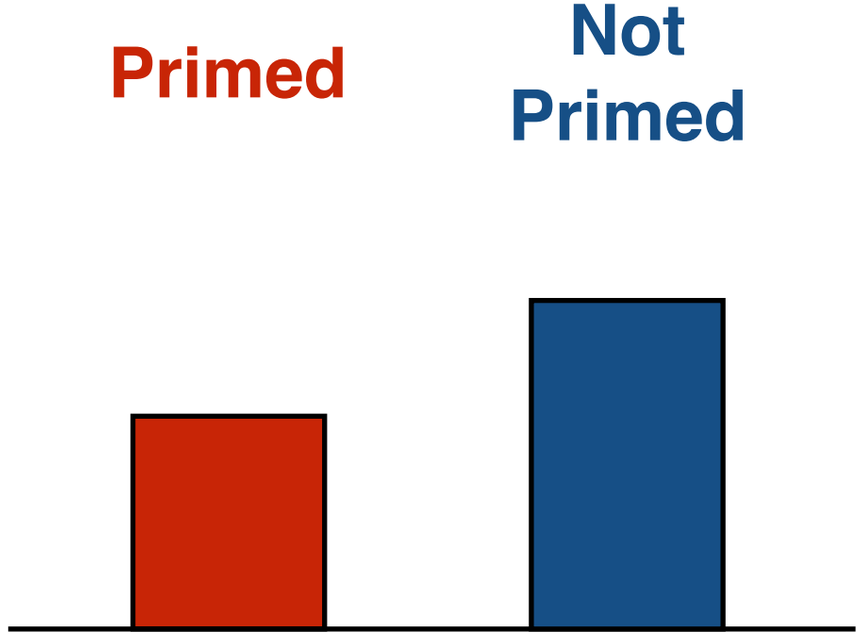
Groups of Asian-American female students were:

(a) reminded of their **Asian heritage**



performance ***boost***

(b) reminded of their **female gender**



performance ***drop***

Shih, Pittinsky, & Amady 1999

Stereotype Threat

Stereotype threat (or boost) is most effective when acting on a subconscious level

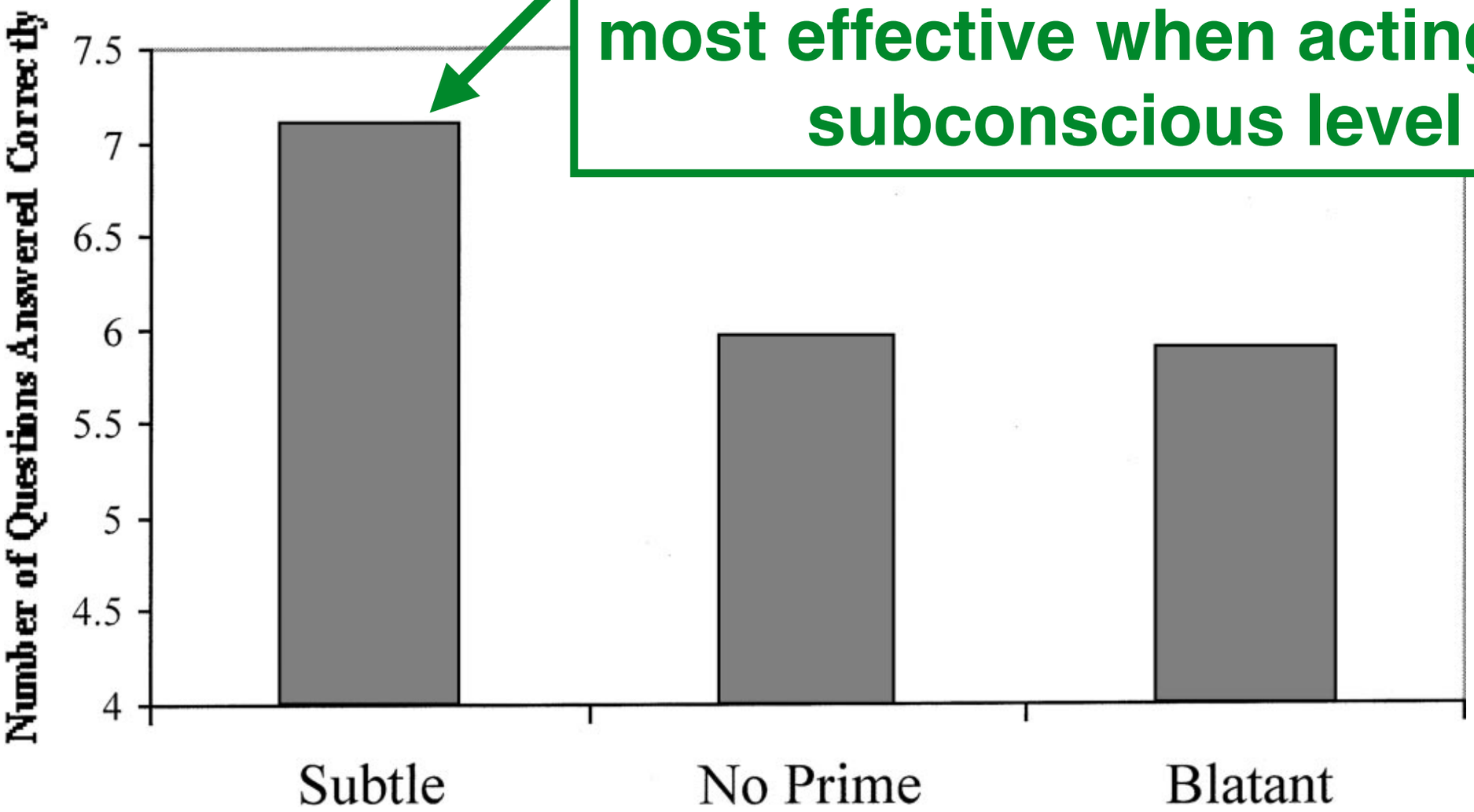
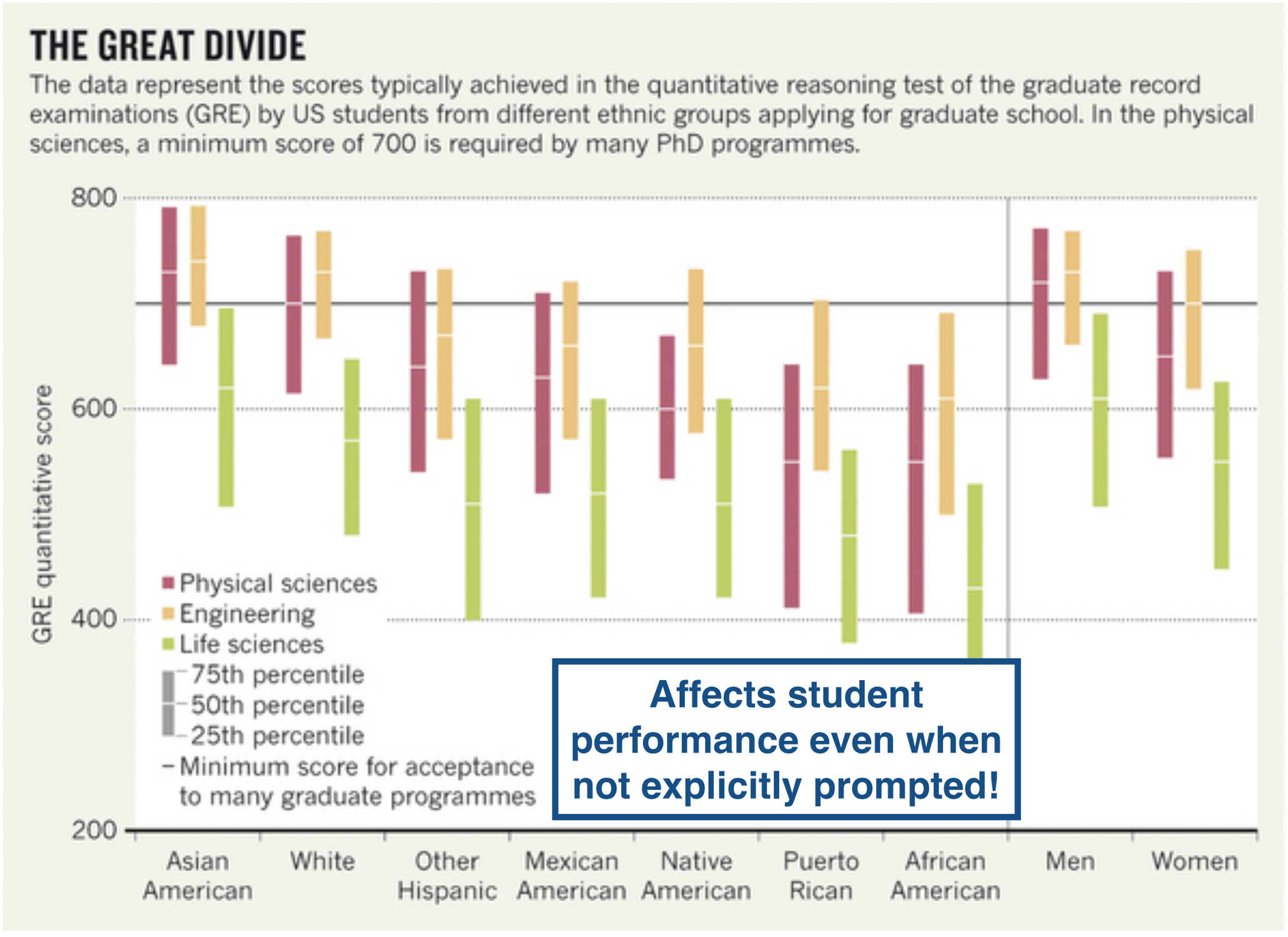


Figure 1. Study 1: Asian American's math test performance following stereotype activation.

Shih+ 2002

Stereotype Threat



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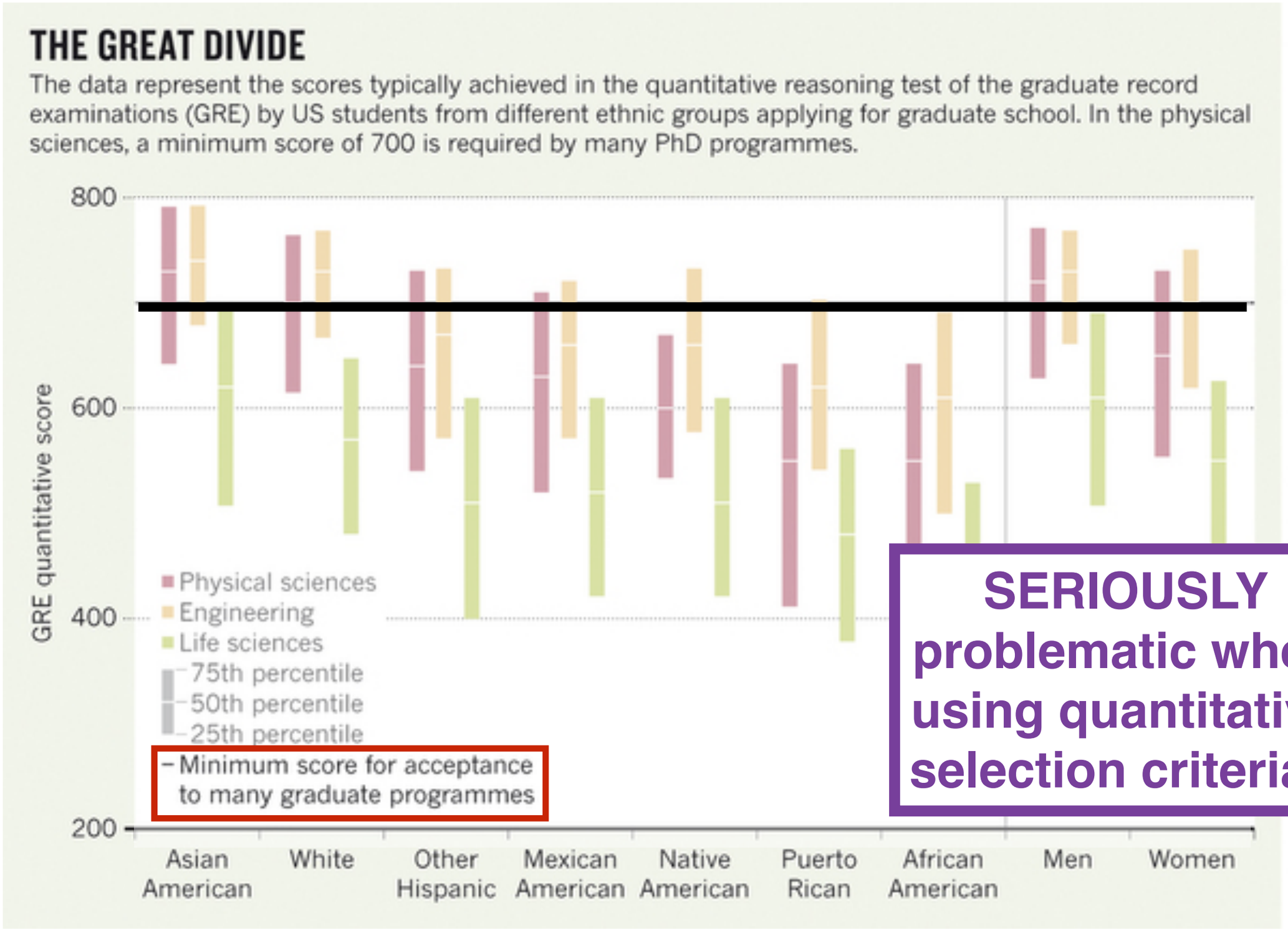


Brief Summaries:

Privilege

Micro-aggressions

Mansplaining

Gaslighting

(White / Male / Cis / Hetero / Ableist) **Privilege**

Privilege, at its core, is the advantages that people benefit from based solely on their social status.

It is a status that is conferred by society to certain groups, not seized by individuals, which is why it can be difficult sometimes to see one's own privilege.

(from Feminism 101 Blog)

(White / Male / Cis / Hetero / Ableist) **Privilege**

"Privilege is like an ***invisible backpack*** full of unearned assets that I can count on cashing in each day, but about which I was meant to remain oblivious." — Dr. Peggy McIntosh

Which backpack gets handed to you will determine how easy the journey is for you!

(thanks to Dr. Katie Schlesinger for sharing this analogy)

Micro-Aggressions

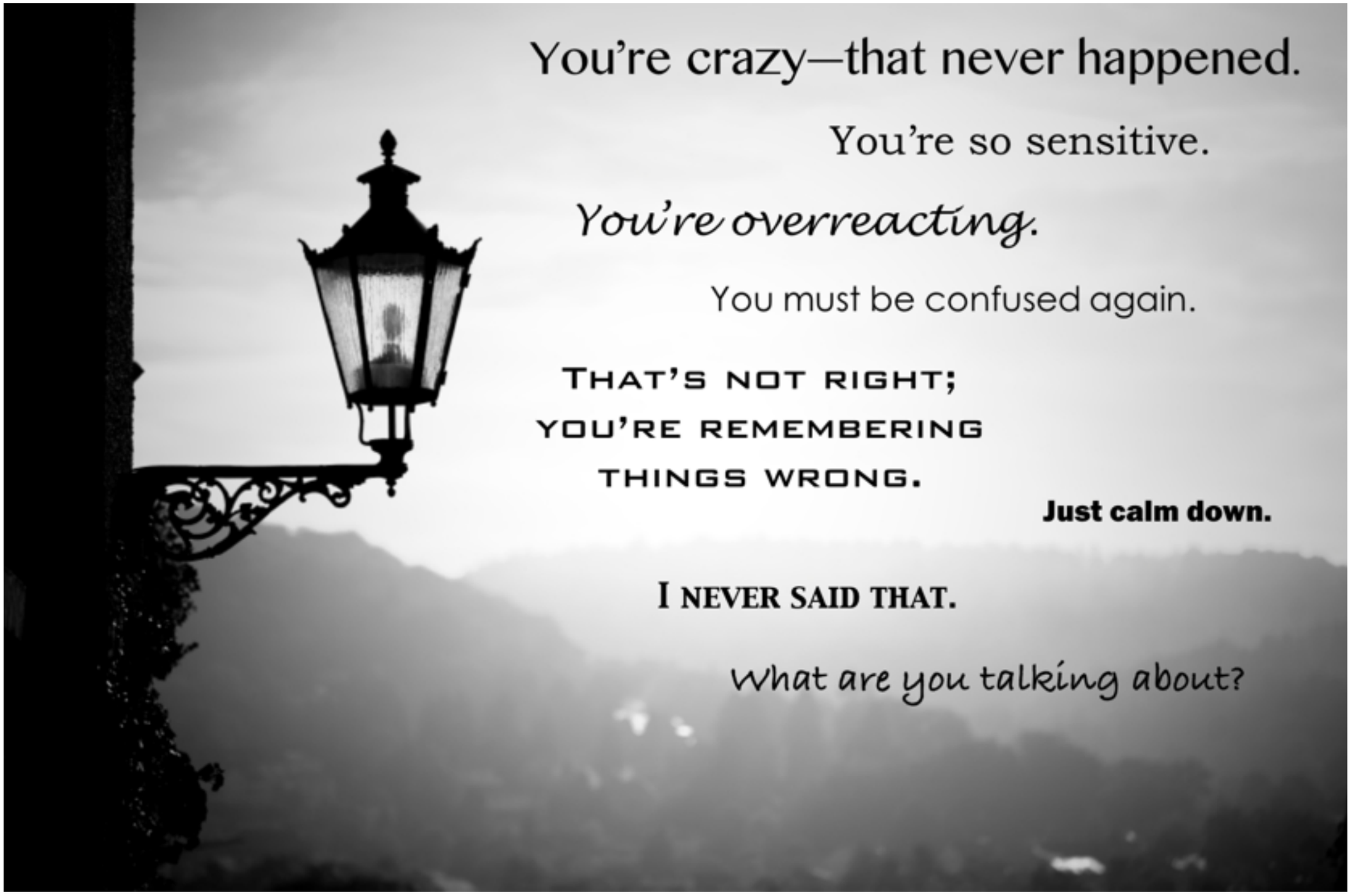
Microaggression:
"social exchanges in which a member of a dominant culture says or does something, often accidentally, and without intended malice, that belittles and alienates a member of a marginalized group."

Mansplaining

"I said, 'I wonder what it means,' not 'Tell me what it means.'"

Gaslighting

(a.k.a. blame the victim)



Unconscious Bias

Unconscious bias (or "implicit bias") is a positive or negative mental attitude towards a person, thing, or group that a person holds at an subconscious level.

(definition from Stanford Medical School)

Mary and Jeff: an unconscious bias case study

Mary and Jeff are both PhD students, and both recently published a paper on the high-profile object Star X

Mary

Jeff

Mary and Jeff give back-to-back contributed talks about Star X at a popular conference

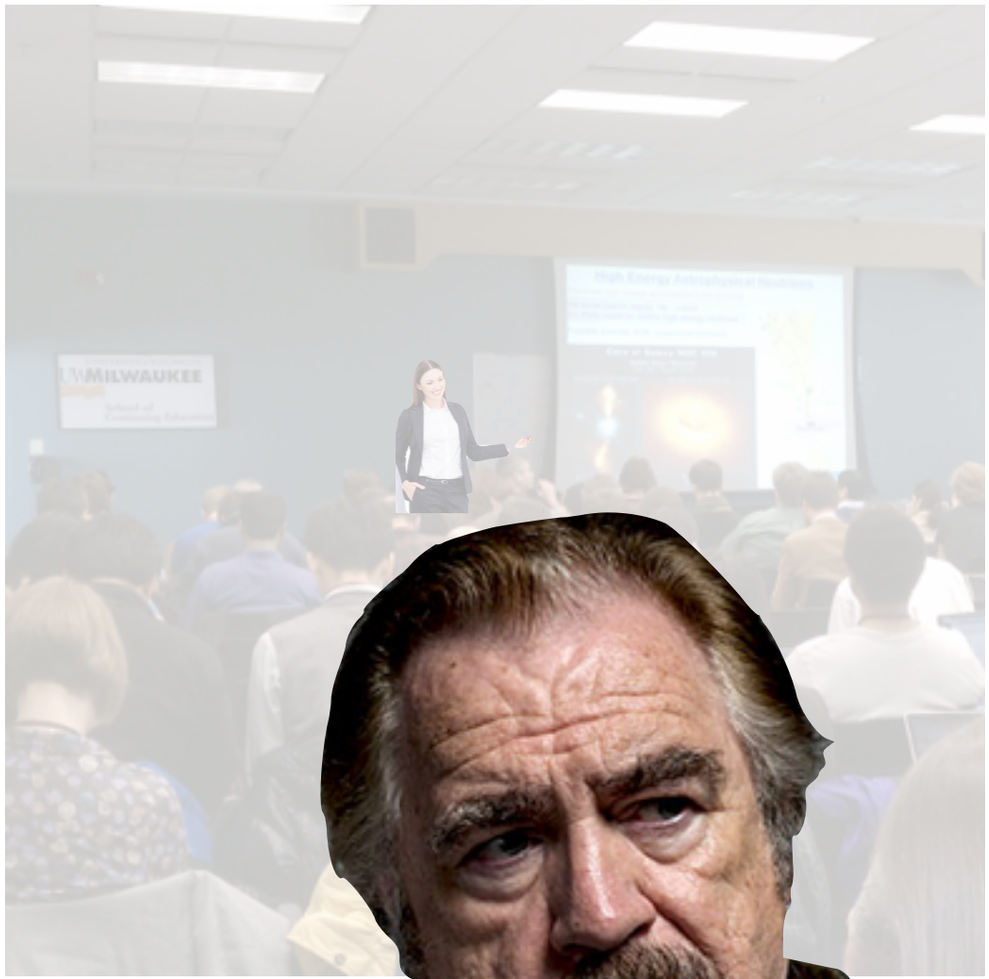
In the audience for Mary and Jeff's talks is Professor Nigel, a prestigious prize-winning senior scientist

Mary

Jeff

Professor Nigel has never realised it, but he has a subtle unconscious bias against women scientists

Professor Nigel leaves the conference thinking “Wow that Star X sure is interesting, and Jeff gave a great talk about it”



Professor Nigel leaves the conference thinking "Wow that Star X sure is interesting, and Jeff gave a great talk about it"

In his next invited review paper, Professor Nigel cites Jeff's paper about Star X, but not Mary's

nature

www.nature.com/nature

Vol 623 | Issue no. 9523 | 31 Nov 2018

Amazing Stars!!!

by Prof. Nigel

Geneticists spent more than a decade getting their first complete reading of the 3 billion base pairs of the human genome, which they finally published in 2003. But today's rapid sequencing machines can run through that much DNA in a week, and are busily churning out multiple sequences from an ever-expanding list of species. Meanwhile, astronomers working with the Sloan Digital Sky Survey telescope in New Mexico have mapped some 25% of the sky since 2000, obtaining data on more than 200 million objects. The Large Synoptic Survey Telescope, scheduled for completion atop Chile's Cerro Pachón in 2015, will gather that much data in one night.

Statistics tell a similar story in many scientific fields. This is great news for research: data glut is always better than data famine. But it is also cause for concern, because investigators' ability to amass huge quantities of data has accelerated much faster than have policies and

their fields, and institutions should ensure that training is in place to make this possible.

The access principle asserts the value of openness: only if results are shared can other researchers check the data's accuracy, verify analyses and build on previous work. So unless there are very good reasons for researchers to withhold data — reasons that should be publicly posted and available for comment by other researchers — they should make provisions to supply public access in a timely manner, possibly as early as their grant proposals.

"Each researcher is ultimately responsible for ensuring the truth and accuracy of the data he or she produces."

Finally, the stewardship principle addresses the need for long-term preservation. Scientific societies and communities need to provide guidelines on which data are worth retaining for future analysis; institutions and funding agencies need to address and support these needs. Journals can

References:

Jeff et al.

Professor Nigel leaves the conference thinking "Wow that Star X sure is interesting, and Jeff gave a great talk about it"

When Professor Nigel gives invited review talks around the world, he adds a new slide about Star X with a figure from Jeff's paper (not Mary's)

3 years later…

Jeff and Mary have finished their PhDs and are both applying for a prestigious fellowship at Y University

The fellowship selection committees looks at their CVs and the following comments are heard:

“Well Mary seems nice but her paper only has 20 citations, while Jeff’s paper on the same object has 50 citations.”

“Ah yes I remember hearing about Jeff’s work on Star X during a talk by Professor Nigel.”

Jeff is awarded the fellowship

5 more years later…

Jeff and Mary are now both applying
for permanent academic positions

Jeff has had 5 years of self-driven research afforded by having his fellowship. He has written 8 papers and has travelled to every major conference on his research topic. Jeff now has an h-index of 25.

Mary has had two different postdoc positions in the same time, both of which have required her to move to a different continent. These positions also have had a heavy “service” load to support an existing project, leaving less time for science or conference travel. Mary has written 3 papers and has an h-index of 15.

You can guess the hiring outcomes that follow…

"Surely Professor Nigel can't be the sole cause of Mary's lesser success."

Mary

Jeff

"Surely Professor Nigel can't be the sole cause of Mary's lesser success."

Mary

Jeff

No … but conferences full of Professor Nigels…
group meetings, journal clubs full of Nigels…
time allocation committees with Nigels…

Unconscious Bias

What can you do?

Start by understanding your own implicit biases:

Good way to check yourself:

Harvard's implicit assumptions tests

implicit.harvard.edu

Unconscious Bias

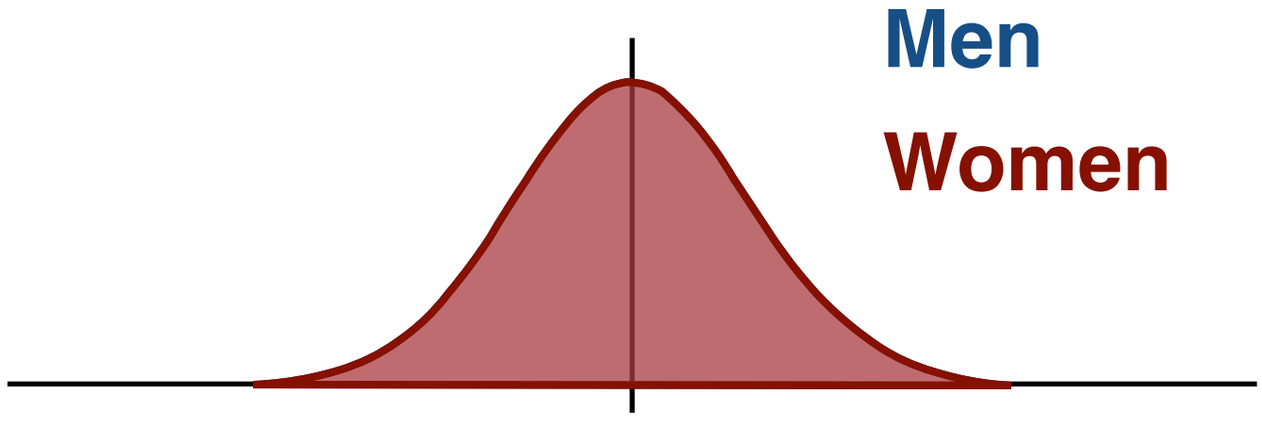
Your unconscious biases are *NOT* a reflection on your chosen values!!!

This just tells you how your **animal brain** is programmed to respond to people who appear different than you!

The best way to apply corrective measures is to first *be informed!*

What is the net outcome on our demographics?

Intrinsic Aptitude



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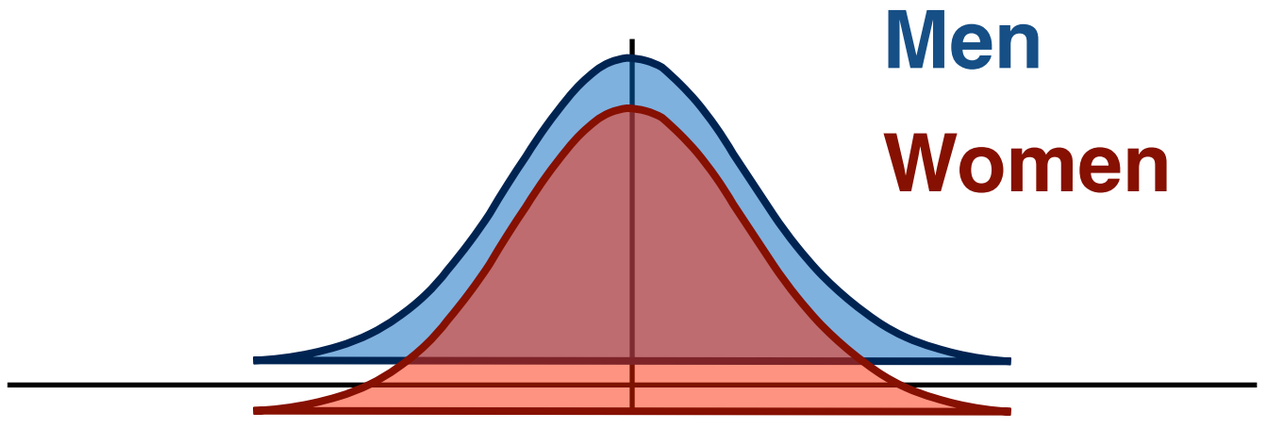
Intrinsic Aptitude



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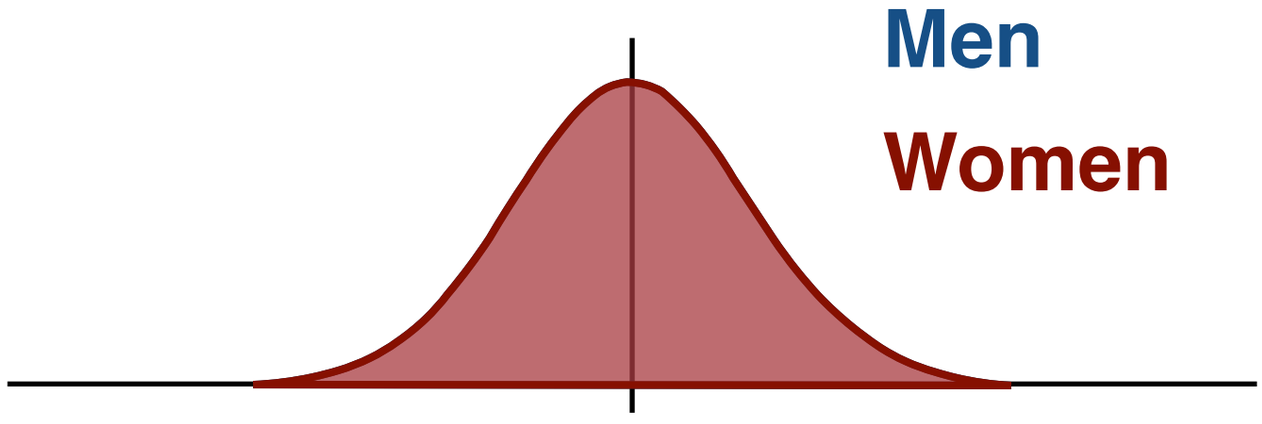
Intrinsic Aptitude



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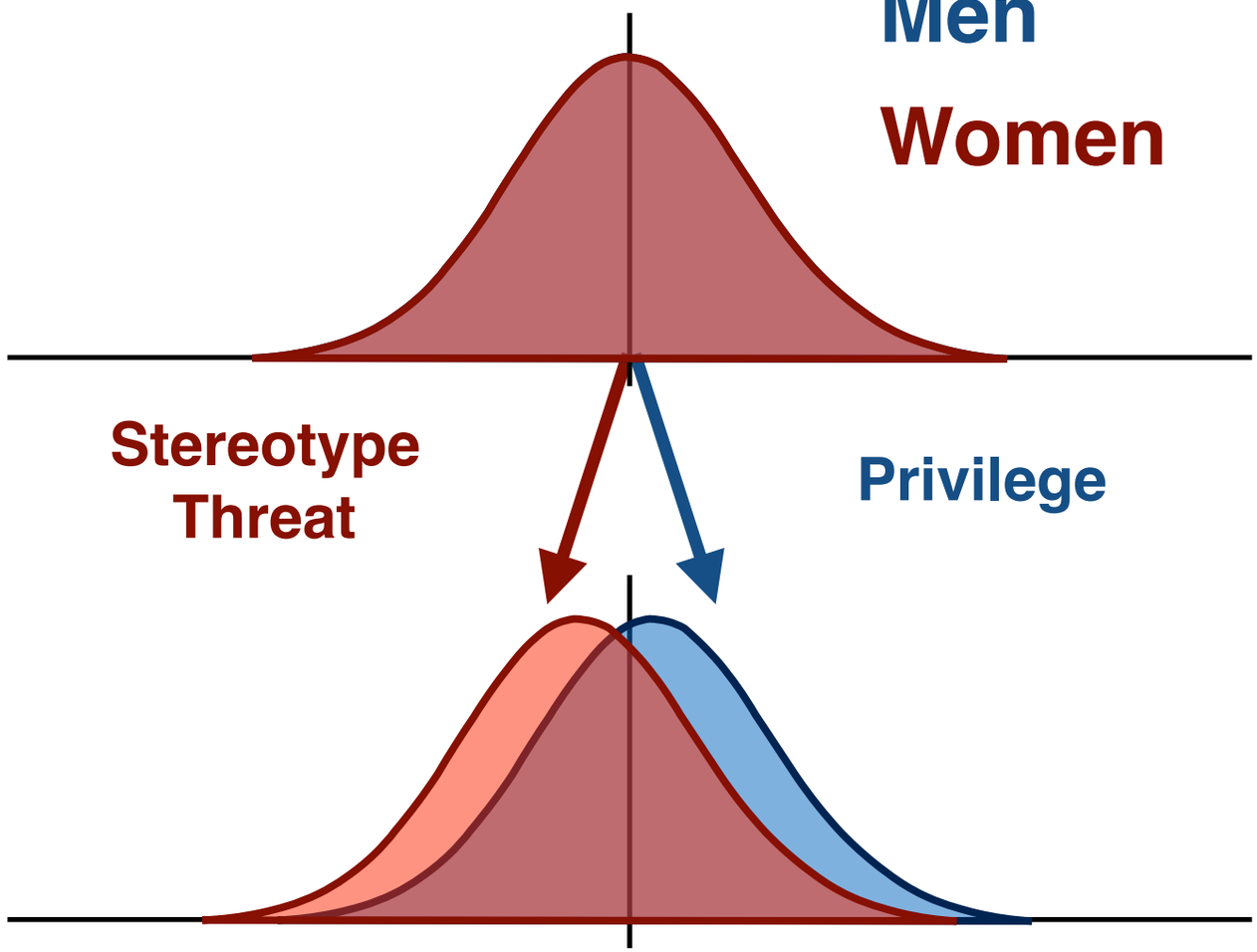


Performance Outcomes

(e.g. # papers)

(*or performance on standardised tests*)

What is the net outcome on our demographics?

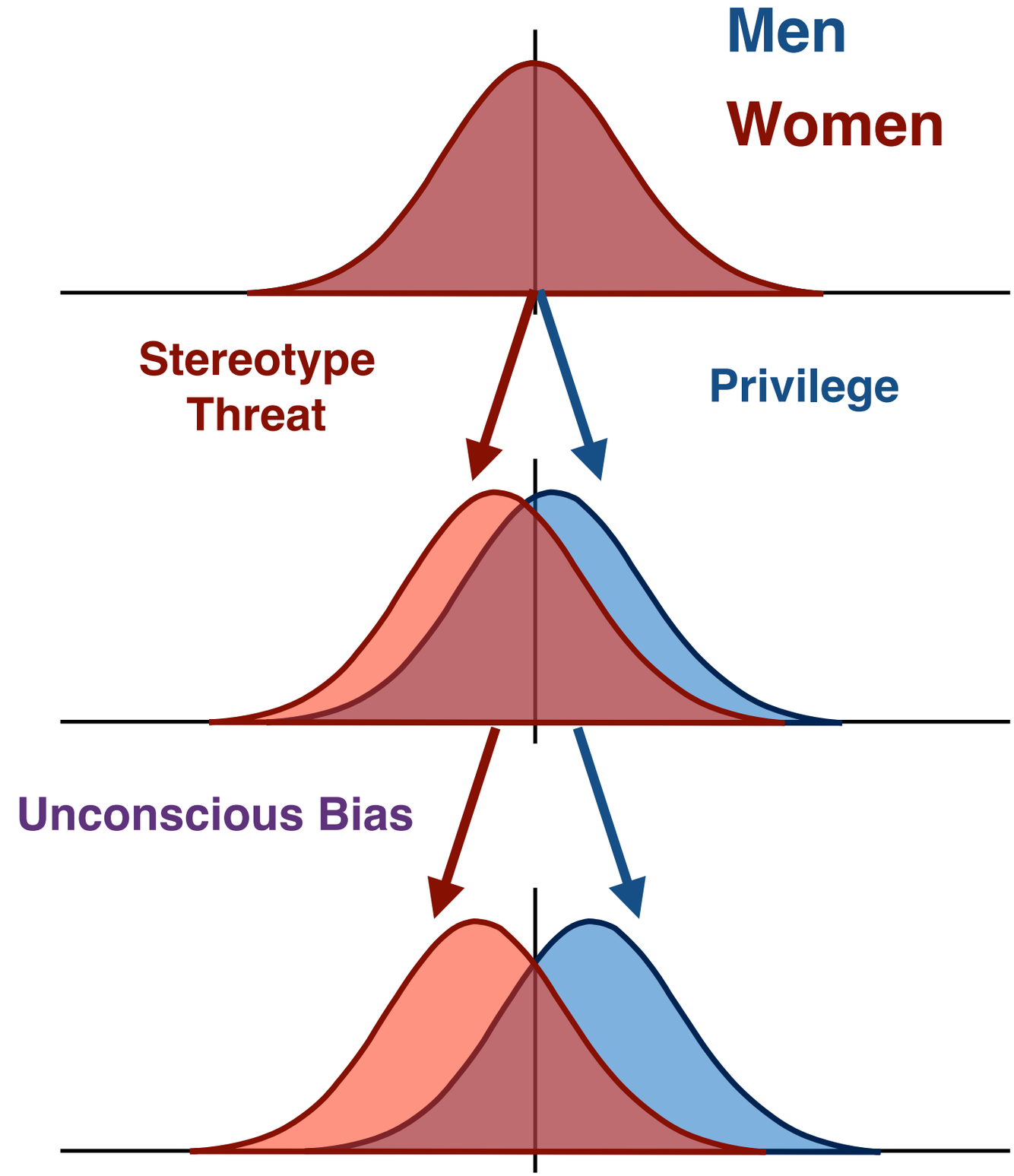
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



What is the net outcome on our demographics?

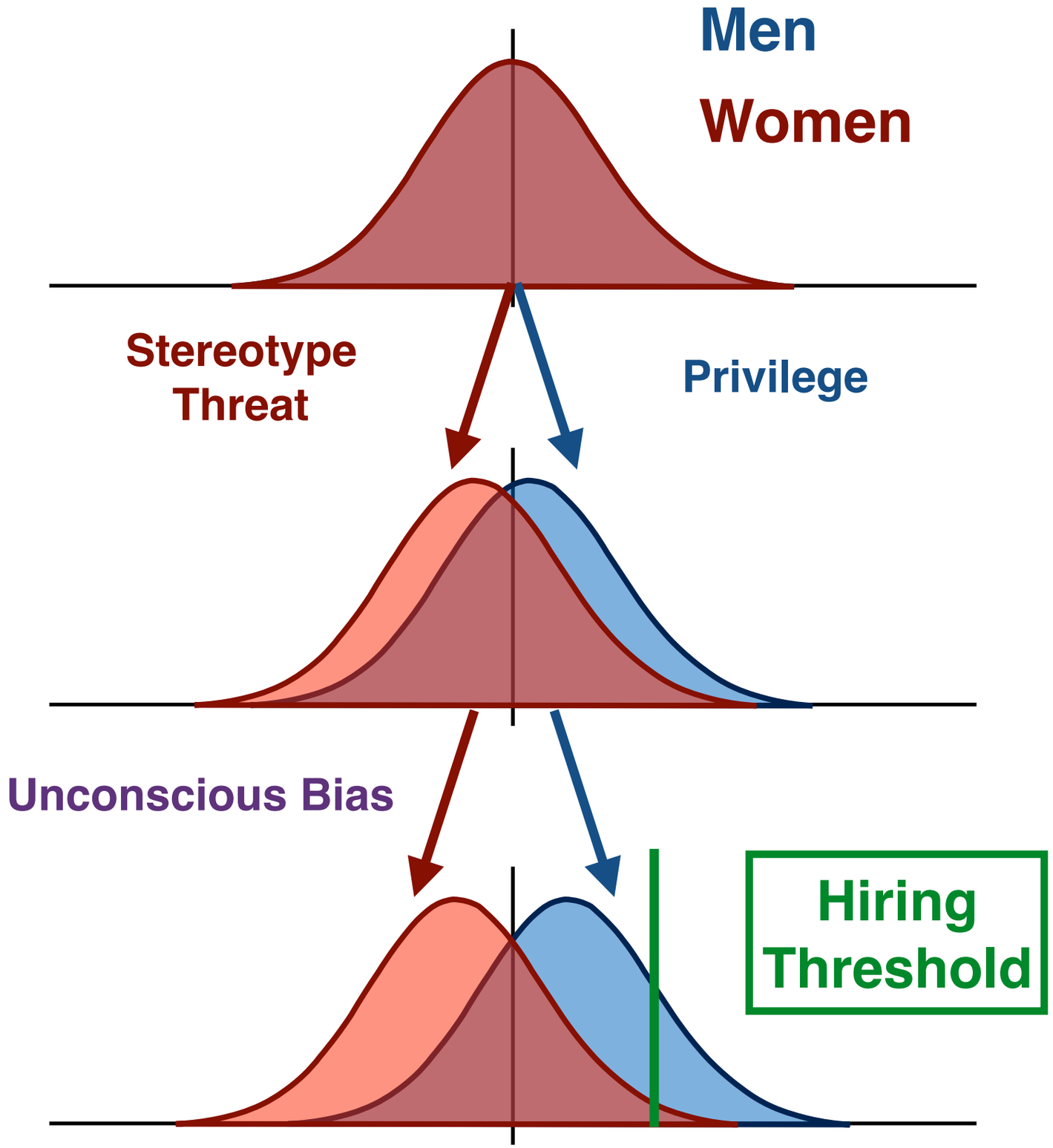
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



What can you do to make things better?

Unconscious bias awareness can decrease its impact!

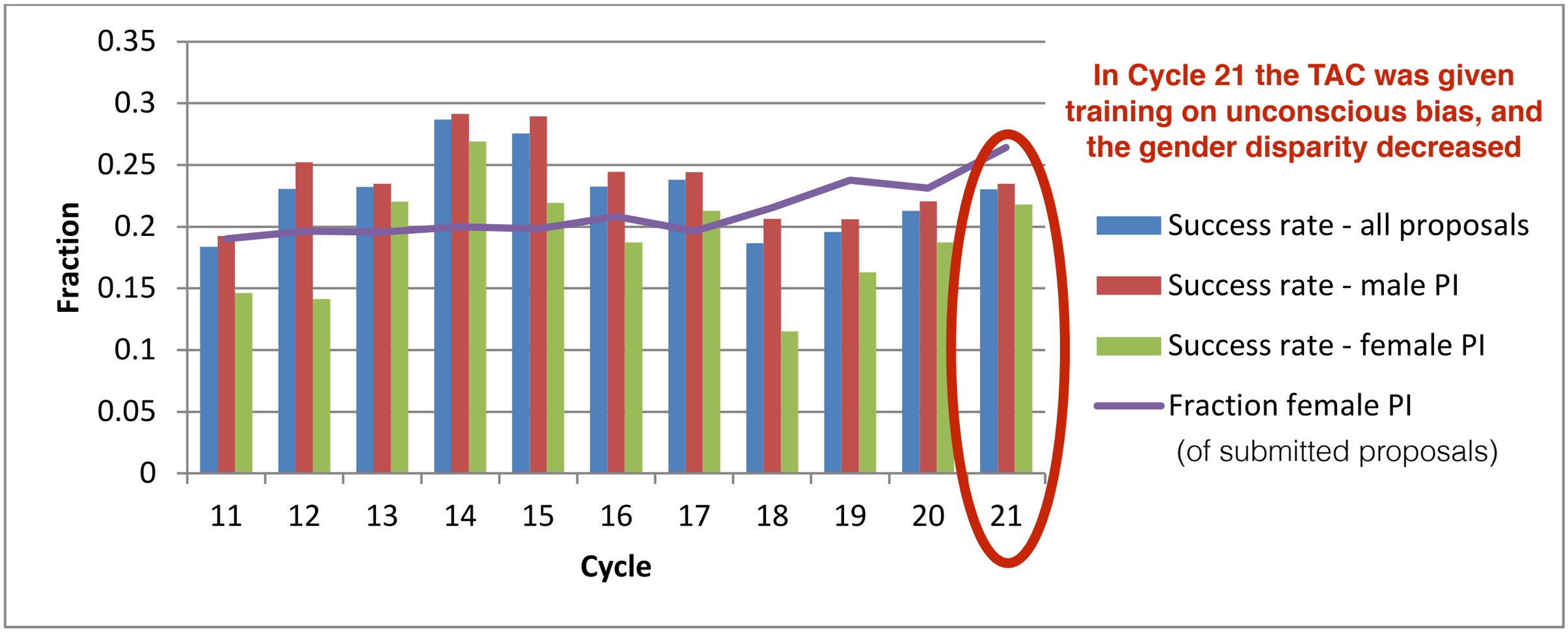
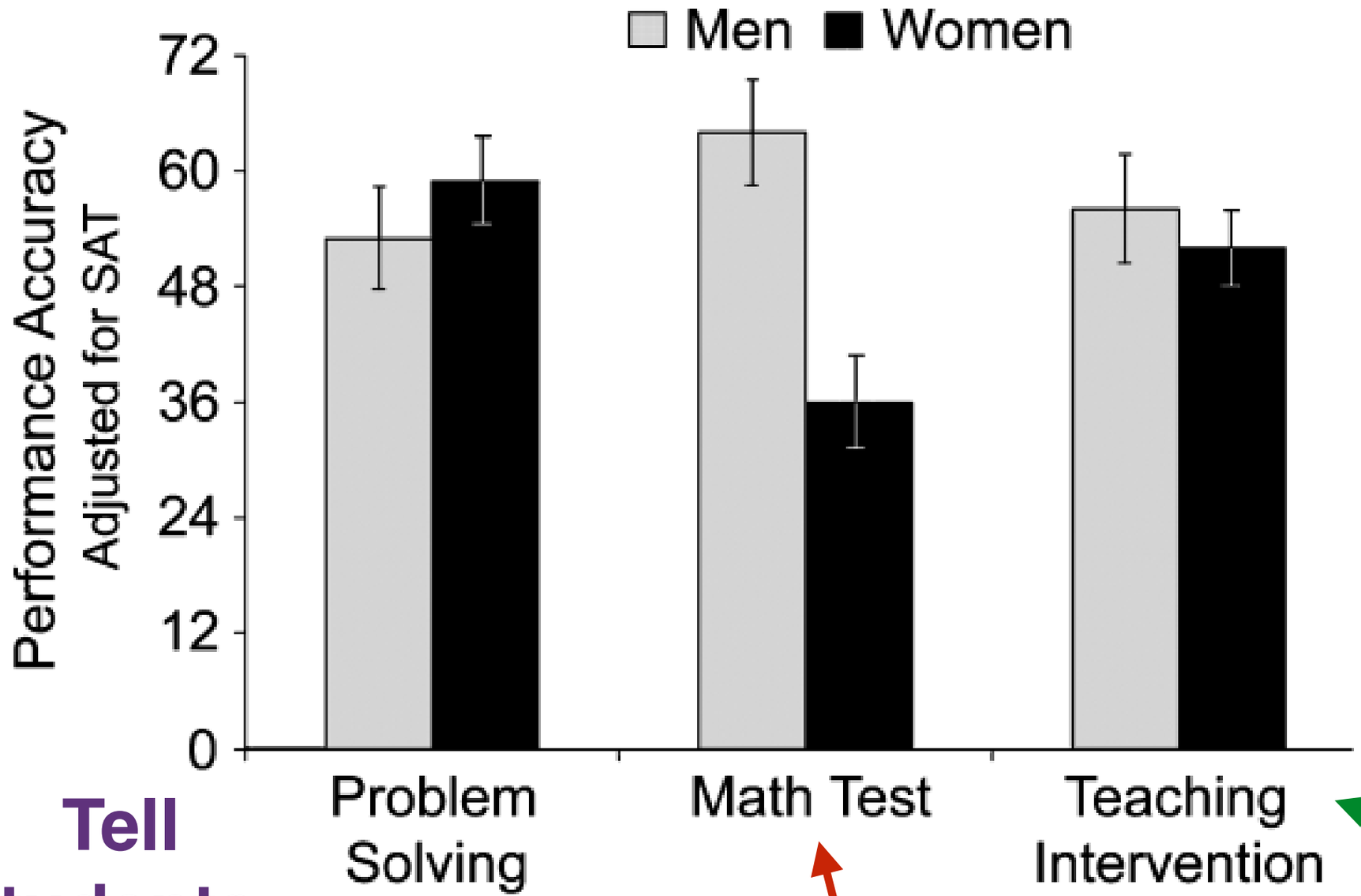


Figure 1: Statistics on the success rate of HST proposals for Cycles 11 through 21. The histograms show the success rates for all proposals, proposals with a male PI and proposals with a female PI; in each case, the statistics encompass all types of proposal (GO, SNAP, AR). The line shows the fraction of submitted proposals with female PIs in each cycle.

Reid et al. 2014, PASP, 126, 923

What can you do to make things better?

Stereotype threat awareness can decrease its impact!



Johns et al. 2005

Tell students:

"We're testing problem-solving techniques."

"We're testing gender differences in math ability."

"We're testing gender differences, but hey there's this thing called stereotype threat…"

What is the net outcome on our demographics?

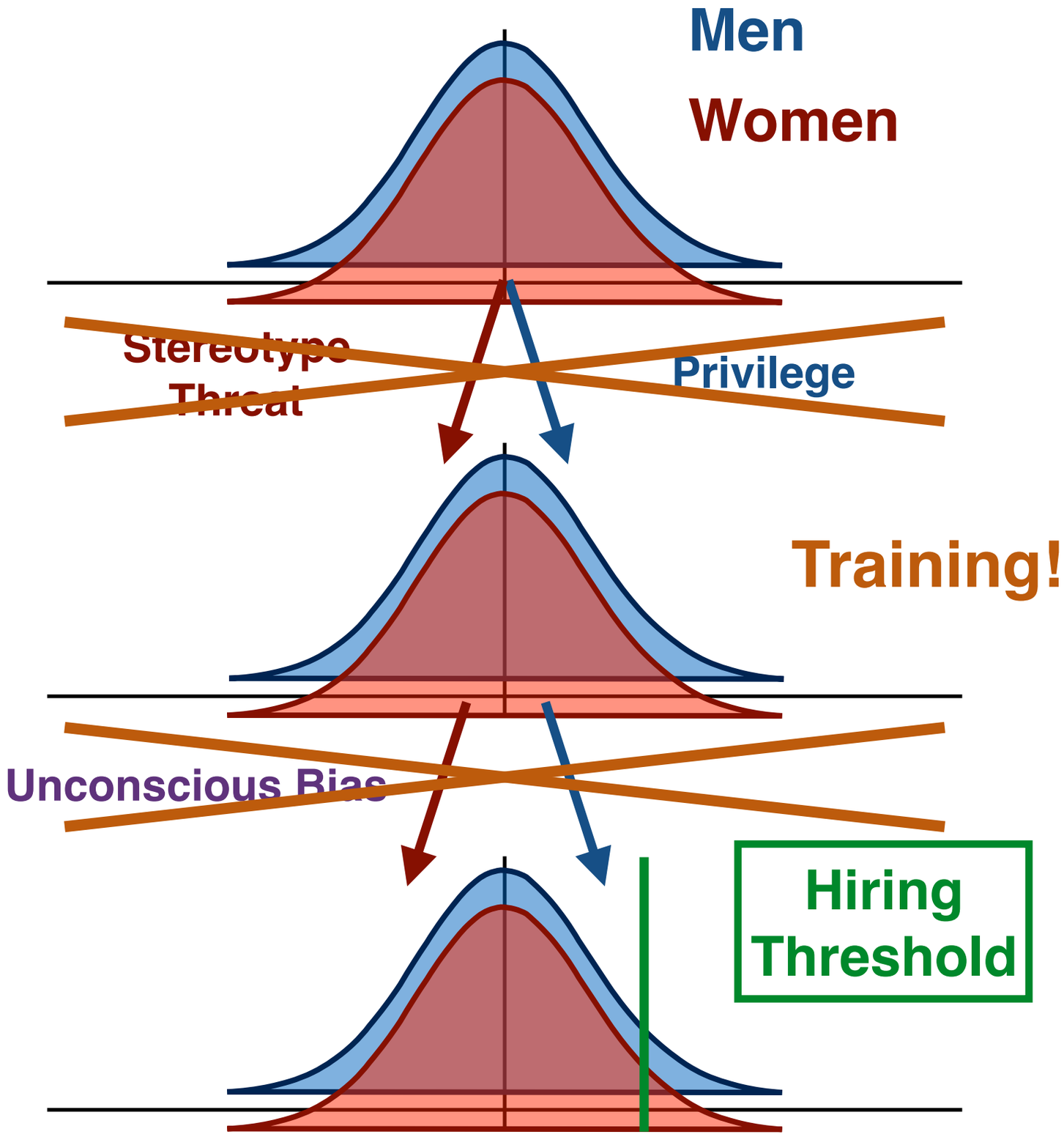
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



Ideal Version!!

New Flash: this will NEVER happen perfectly!!

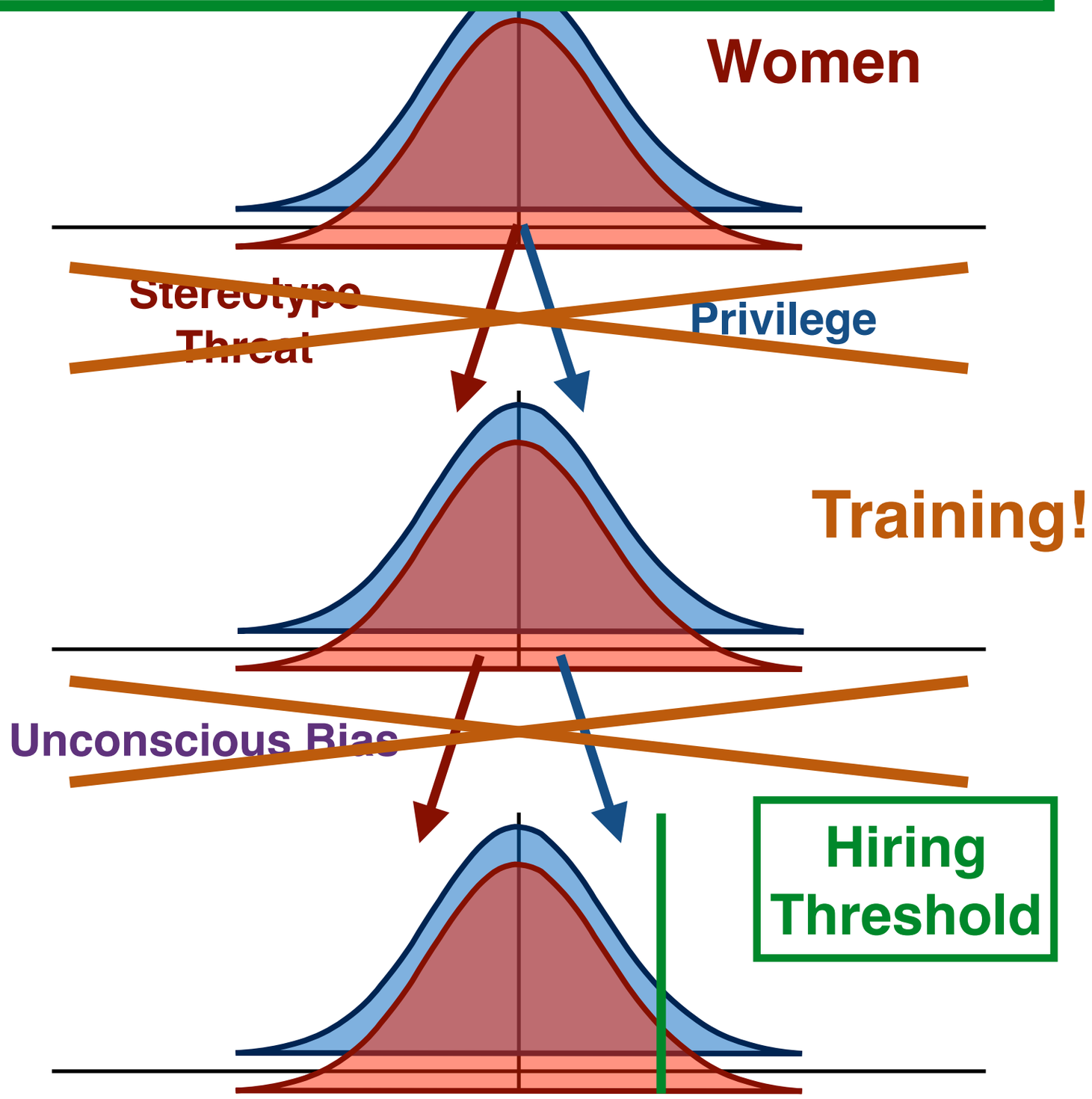
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



A more realistic hope:

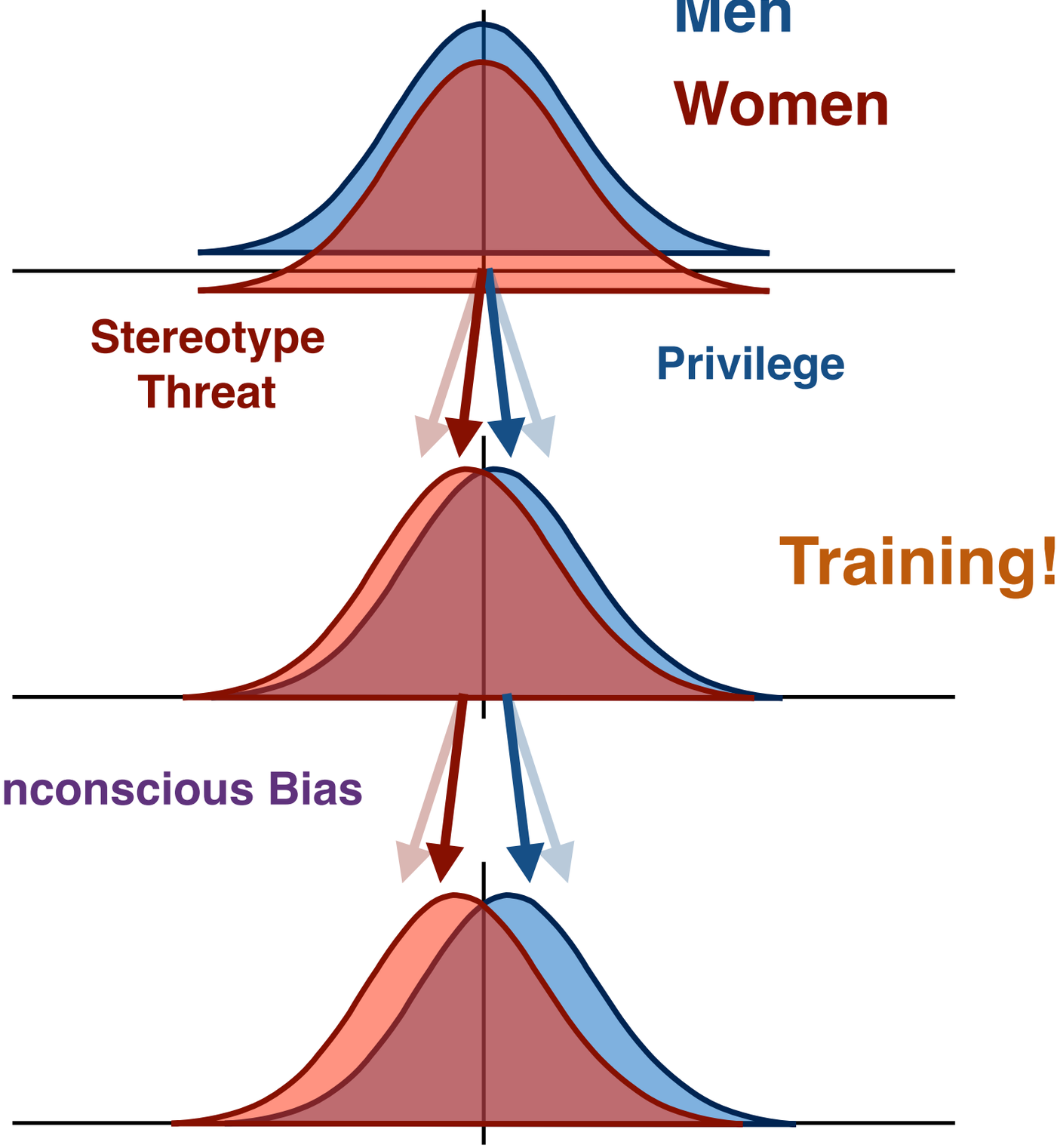
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



A more realistic hope:

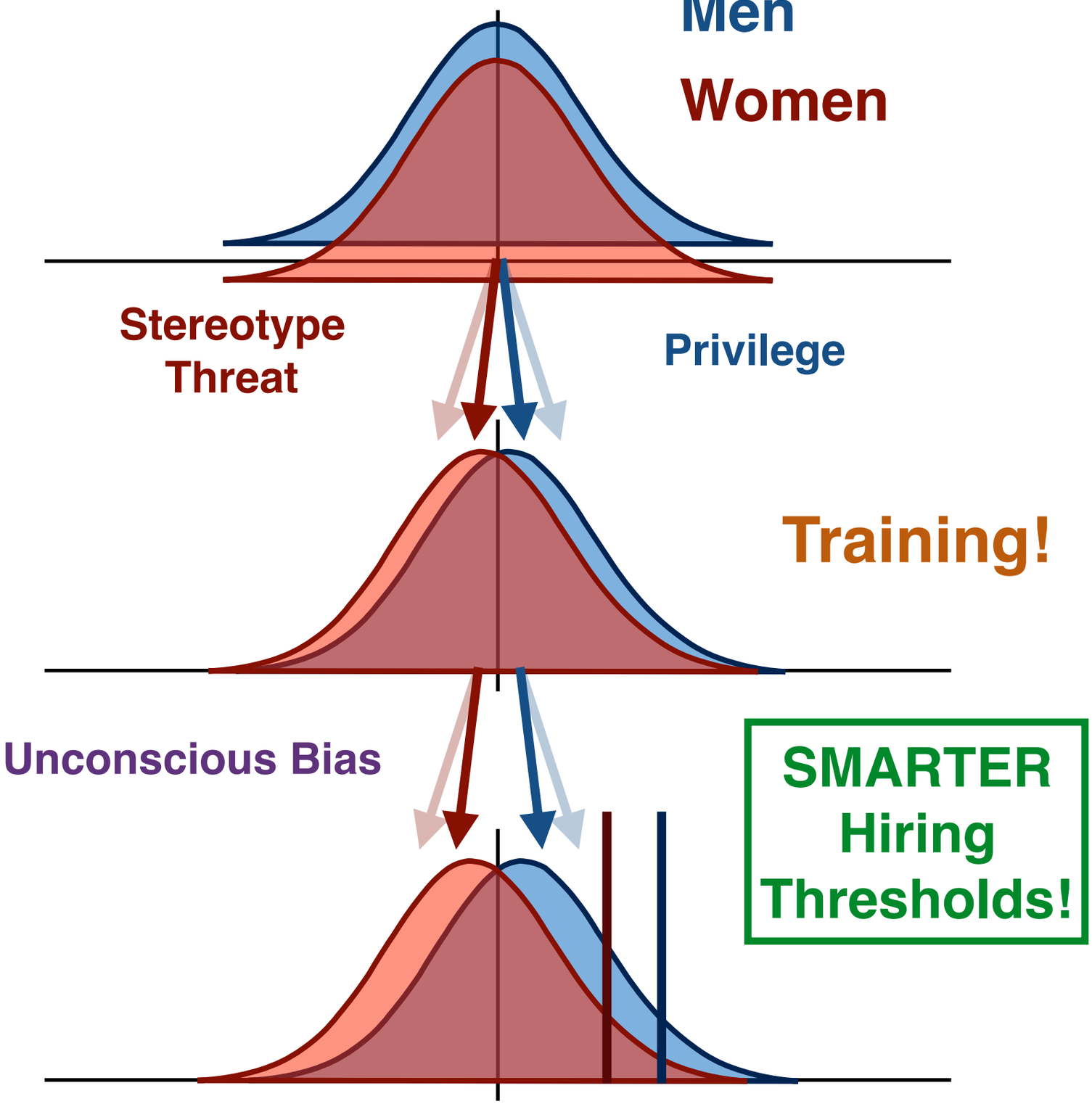
Intrinsic Aptitude

Performance Outcomes

(e.g. # papers)

Esteem Metrics

(e.g. # citations)



Harassment

Higher education

Sexual harassment 'at epidemic levels' in UK universities

Exclusive: Almost 300 claims against staff have been made in six years, but victims and lawyers say those are just tip of iceberg

Oxford University reported the highest number of staff-on-student and staff-on-staff allegations. Photograph: Pete Lusabia/Alamy Stock Photo

439

David Batty, Sally Weale and Caroline Bannock

Sunday 5 March 2017
18.00 GMT

https://www.theguardian.com/education/2017/mar/05/students-staff-uk-universities-sexual-harassment-epidemic

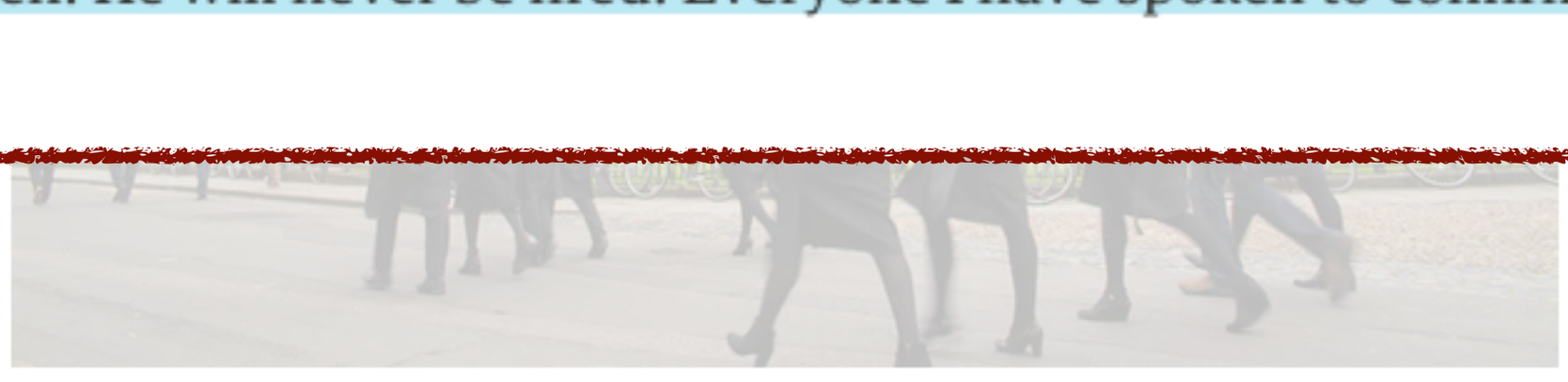
Harassment

Higher education

Sexual harassment 'at epidemic levels' in UK universities

Exclusive: Almost 300 claims against staff have been made in six years, but victims and lawyers say those are just tip of iceberg

A junior female member of staff at a university in southern England told the [illegible] she had tried to raise concerns about sexual harassment in her department for five years, but no manager she contacted had taken action. "The worst thing is that there are many people who are suffering under this professor. Simply putting in a formal complaint will not do anything but make life hell for me and other women. He will never be fired. Everyone I have spoken to confirms this."



Oxford University reported the highest number of staff-on-student and staff-on-staff allegations. Photograph: Pete Lusabia/Alamy Stock Photo

Harassment

Higher education

'We felt inferior and degraded': reporting sexual harassment at university

Readers describe their experiences of misconduct, what happened when they complained – or why they chose not to

72

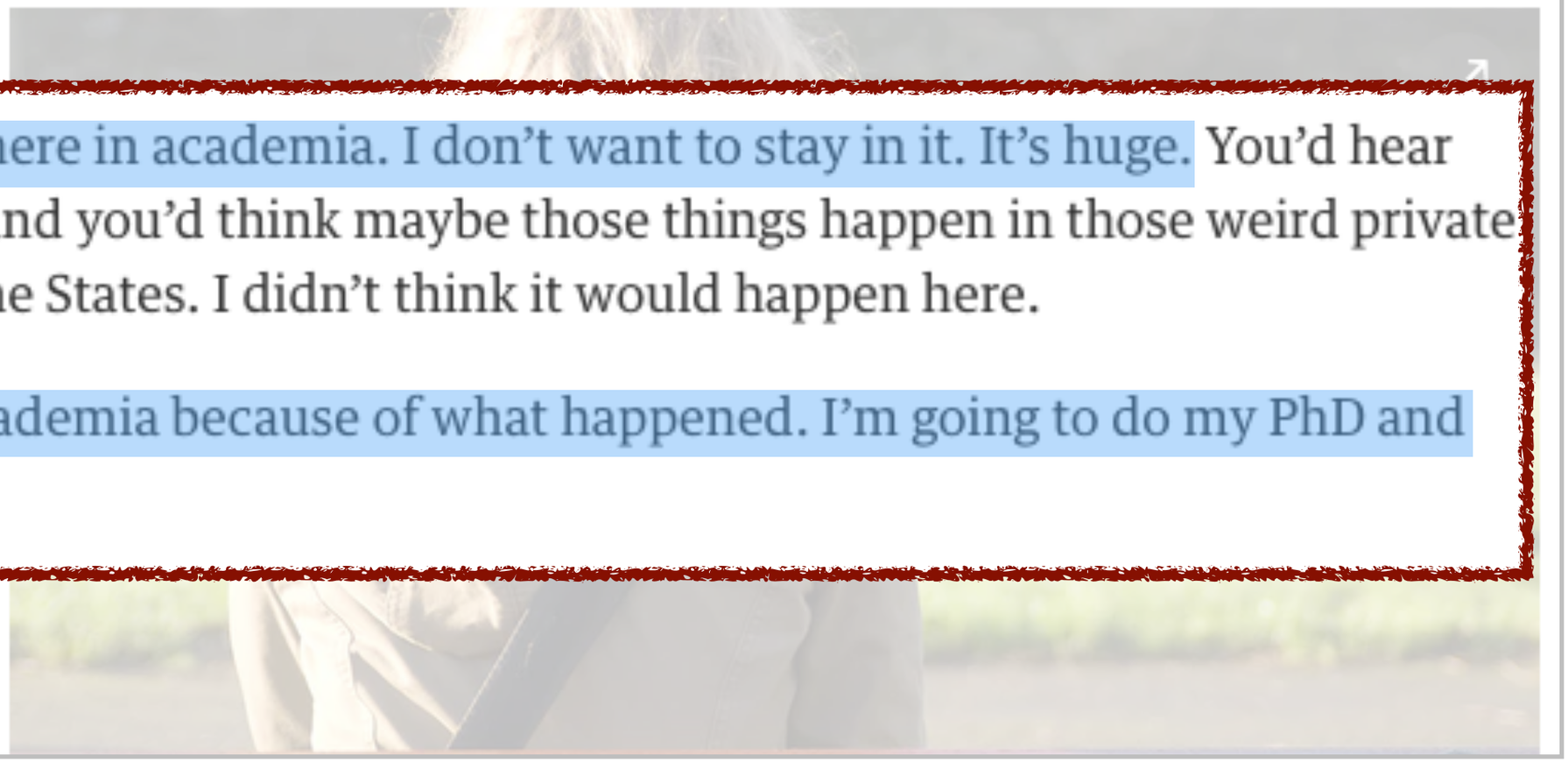
Sally Weale and Caroline Bannock

Sunday 5 March 2017
18.00 GMT

https://www.theguardian.com/education/2017/mar/05/we-felt-inferior-and-degraded-reporting-sexual-harassment-at-university

Harassment

"On paper, my university has proactive, supportive and committed policies and procedures to address sexual violence, sexual harassment and sexual discrimination. I now know that if it is the word of a student against a senior member of staff, that commitment quickly evaporates and they close ranks to protect their own."



"This is everywhere in academia. I don't want to stay in it. It's huge. You'd hear these stories ... and you'd think maybe those things happen in those weird private universities in the States. I didn't think it would happen here.

"I am leaving academia because of what happened. I'm going to do my PhD and then that's it."

Harassment

<u>This is a huge problem in academia</u>

Universities generally pay lip service to protecting victims of harassment — but most of the time they will protect themselves, their reputations, and their financial interests first

The CULTURE of response to harassment has to change — we need (at a minimum) for EVERYONE to respond vocally and demand action be taken to punish harassers

(I'm still not sure how to ensure a lasting solution…)

End Note:

How can we (as a science / HE community) drive *lasting* change??