OXIDE

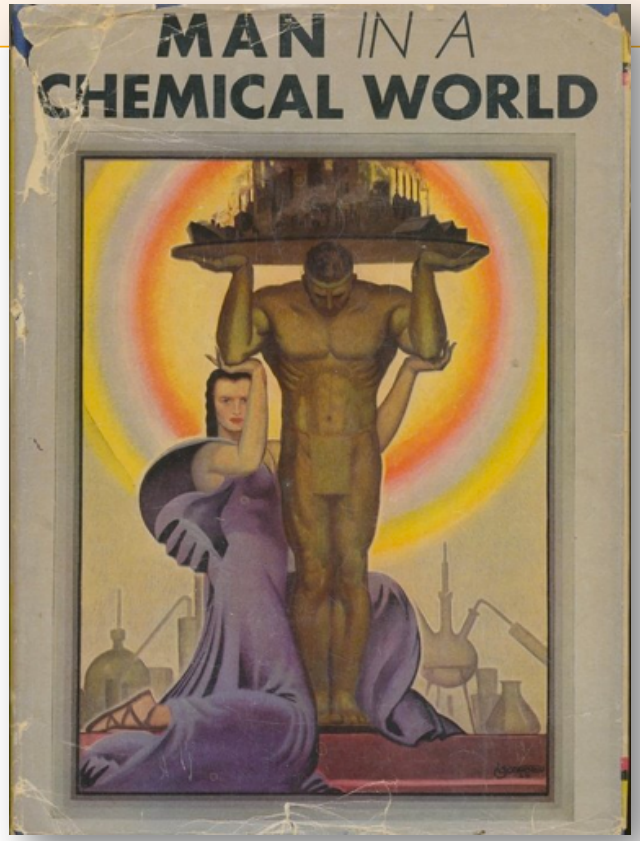
Open Chemistry Collaborative in Diversity Equity

NDEW 2015
Focus Session #1

to render the extraordinary, ordinary: acknowleging bias and barriers

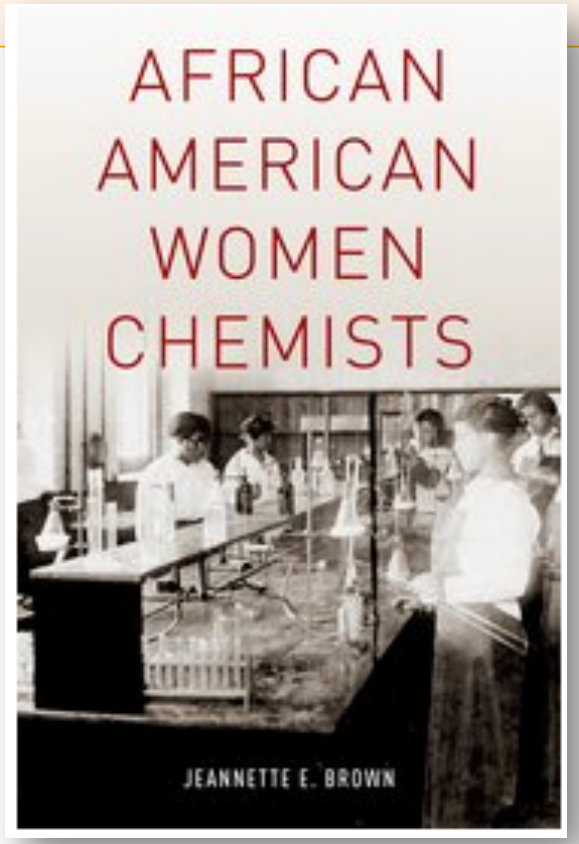
Amy Lisa Graves
Professor of Physics
Swarthmore College

then ...



1937

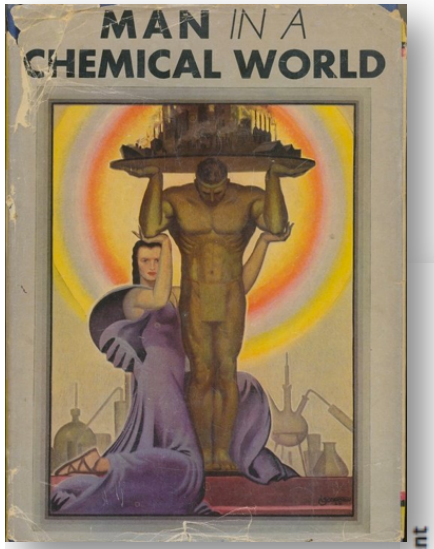
now ...



2012

then ... now ...

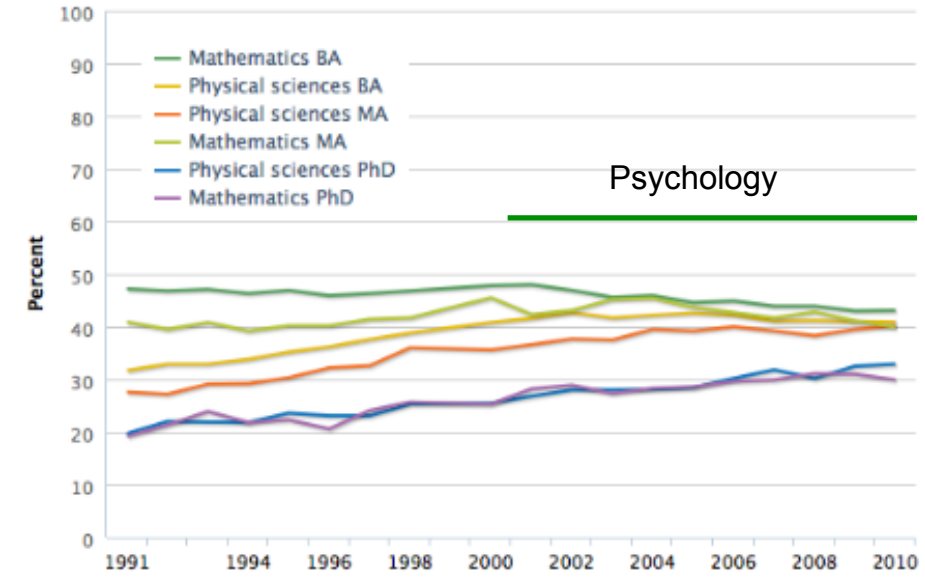
Women, Minorities, and Persons with Disabilities in Science and Engineering

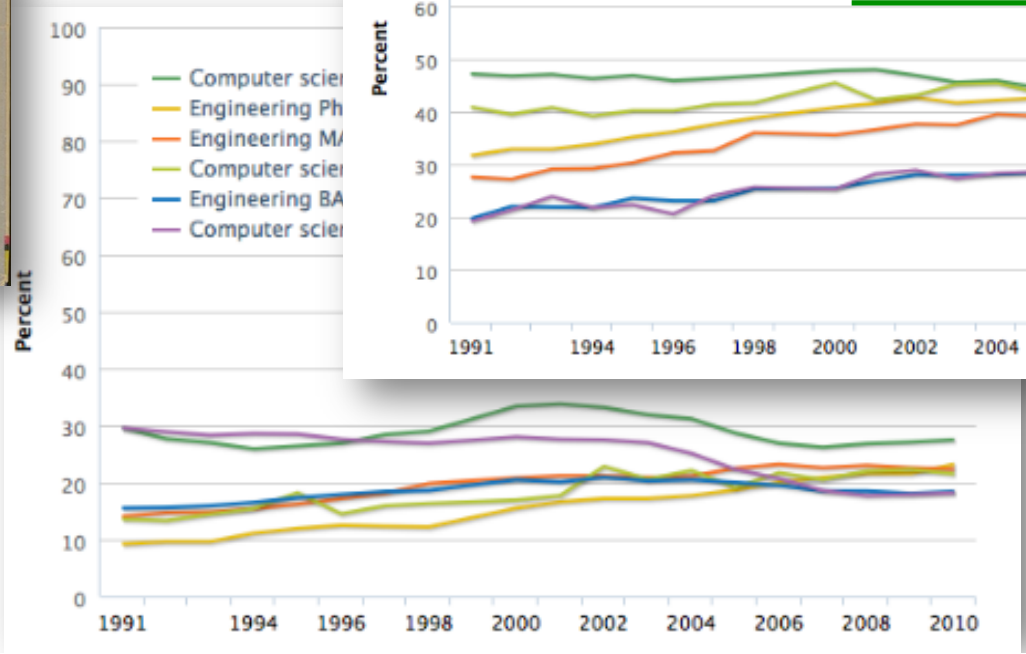


1937

Medium-low participation fields for women: Physical sciences and mathematics, 1991–2010

View: Chart | Table





then ... now ...

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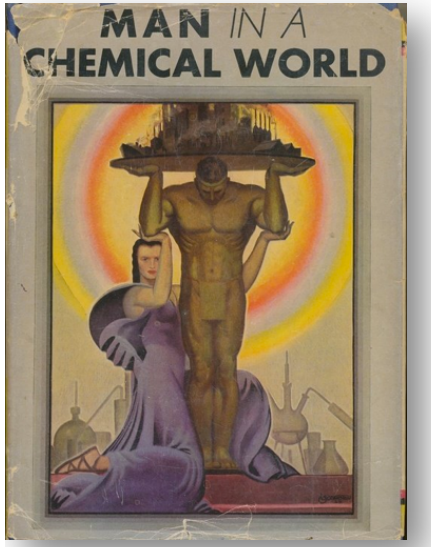
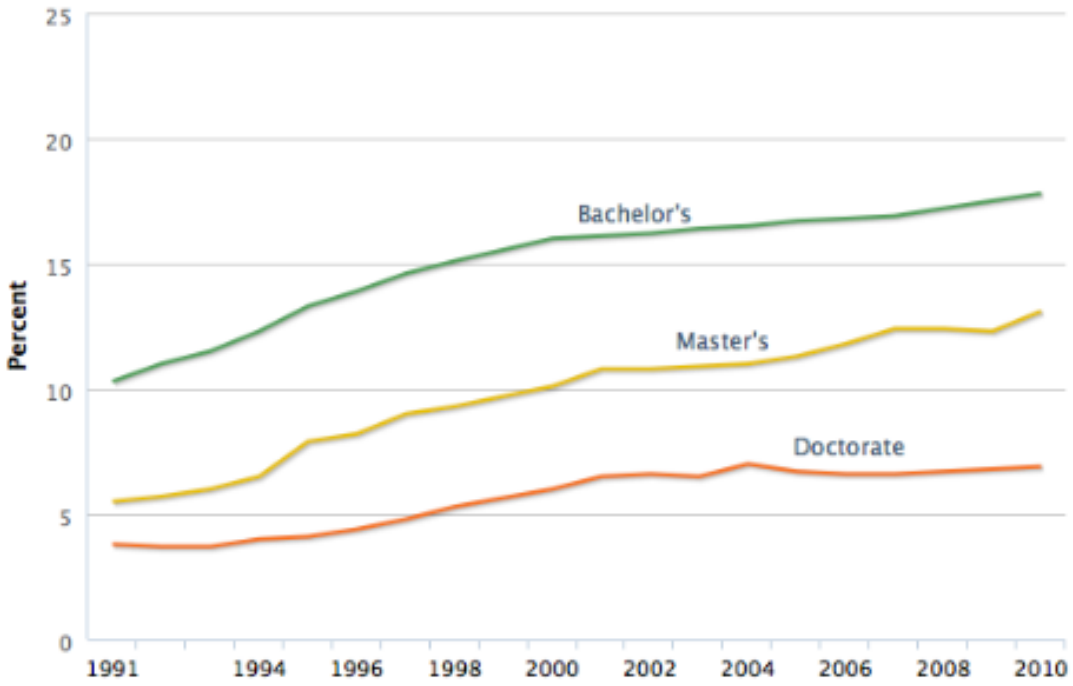


1937

Science and engineering degrees earned by underrepresented minorities: 1991–2010

View: Chart | Table



then ... now ...

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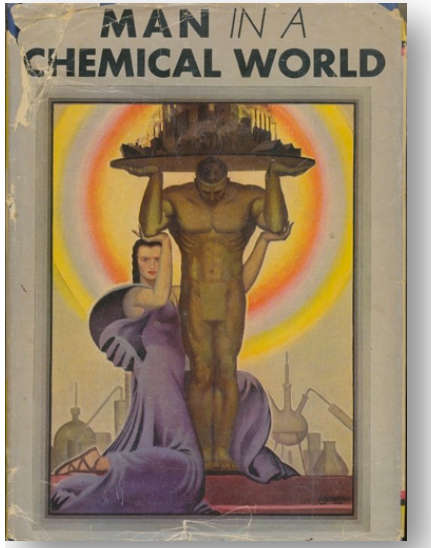
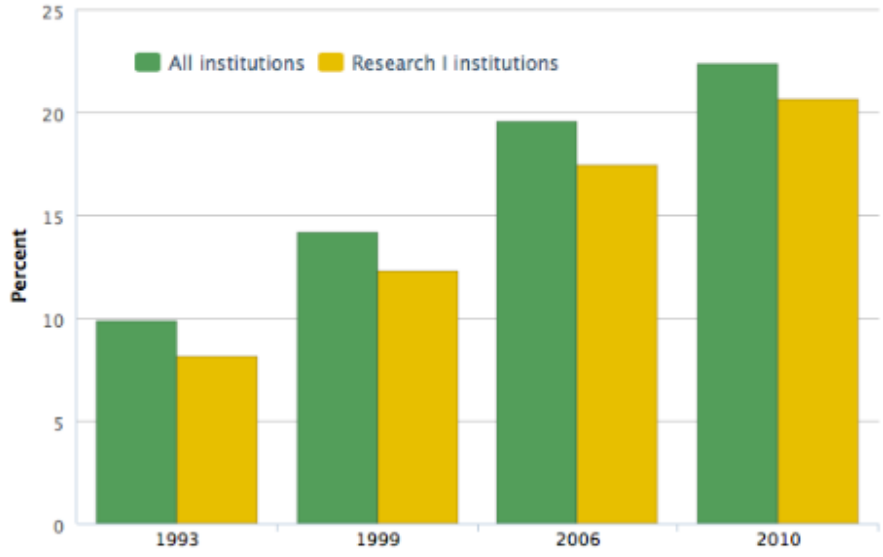


1937

Women as a percentage of full-time, full professors with science, engineering, and health doctorates, by institution of employment: 1993–2010

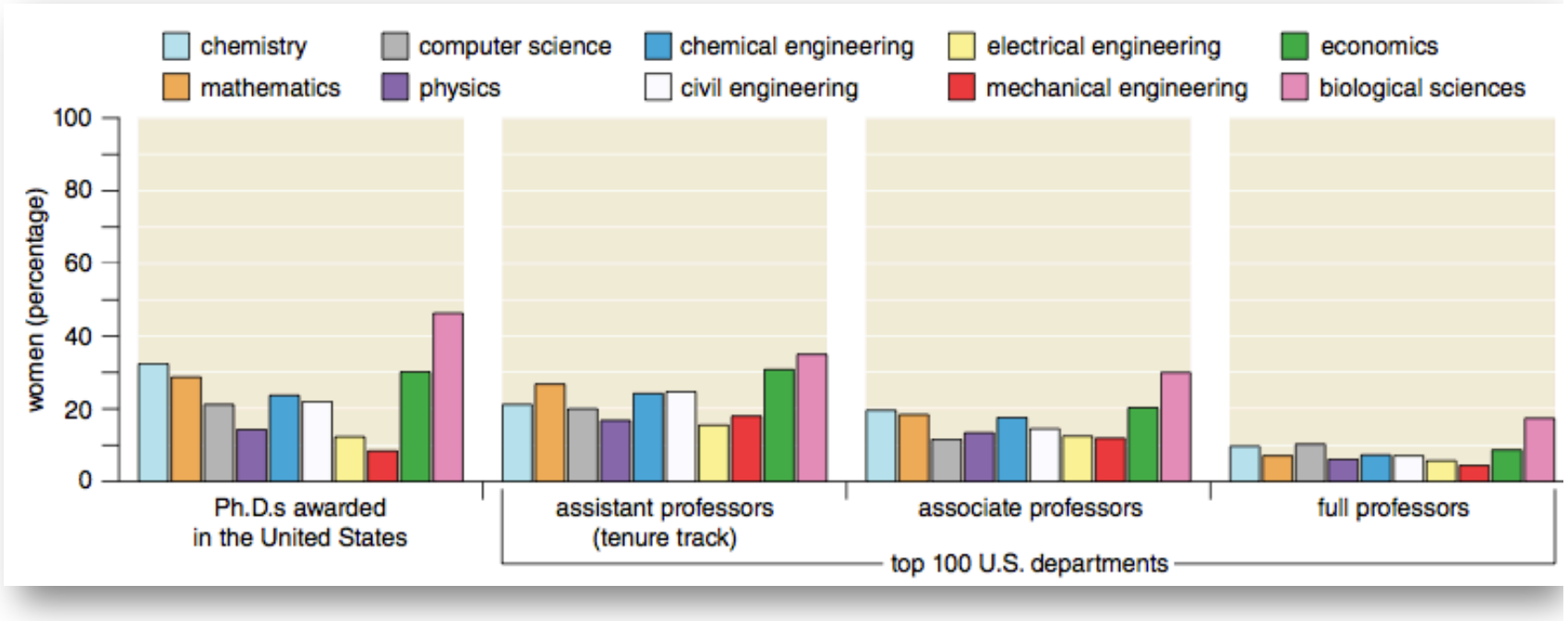
View: Chart | Table



Note: OXIDE Faculty Demographics Data

In partnership with Chemical & Engineering News (C&EN), OXIDE surveys the chairs of leading Ph.D.-granting chemistry departments to track the demographics of the departments' research-active tenured / tenure-track faculty on an annual basis. Longitudinally, these data reflect the progress made by departments—both individually and collectively—in building more diverse faculties.

Numbers are a problem:
Across fields and within hierarchy of any field

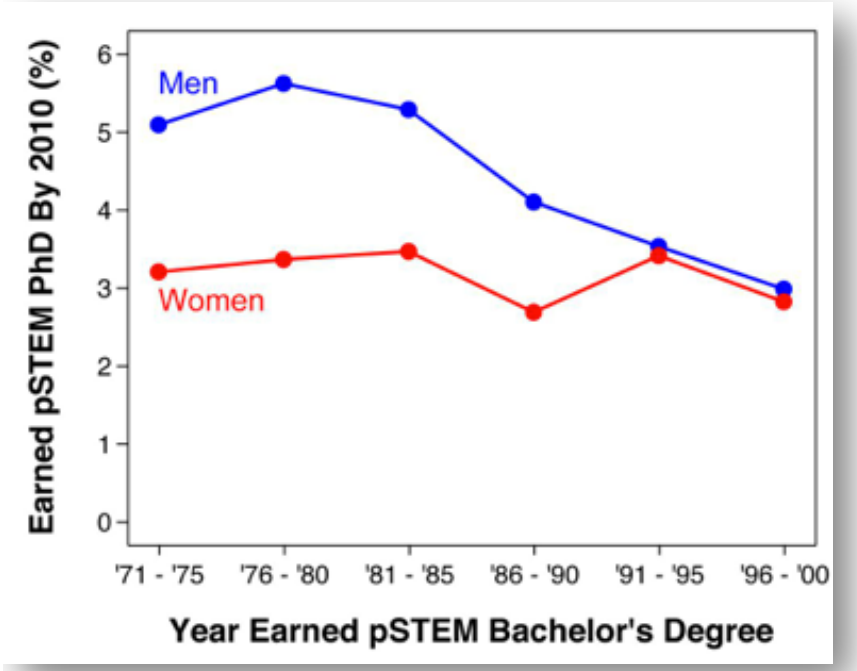


2007 figures

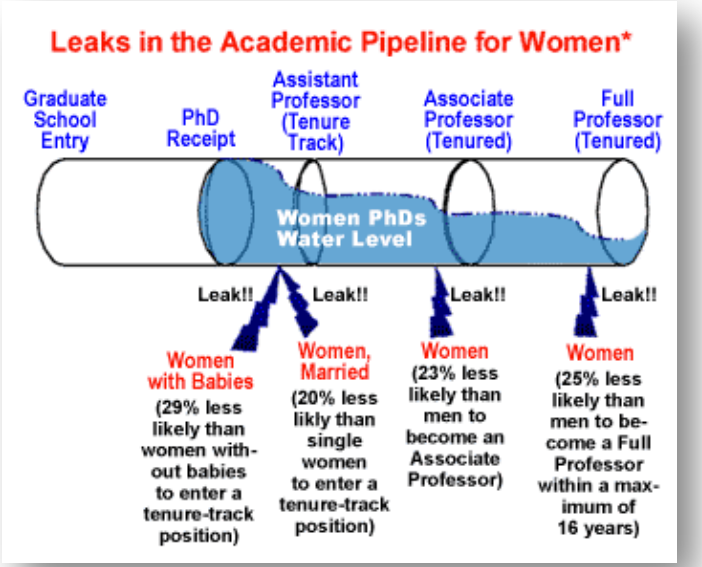
-Ceci and Williams, 2012

Different educational and job trajectories?

Pipeline issues: *are controversial.*
Even this nomenclature has been problemetized.



David Miller and Jonathan Wai using national studies with longitudinal data (Frontiers in Psychology, 2015)



Also using longitudinal data set (UC Berkeley Family friendly page, 2003)

Different educational and job trajectories

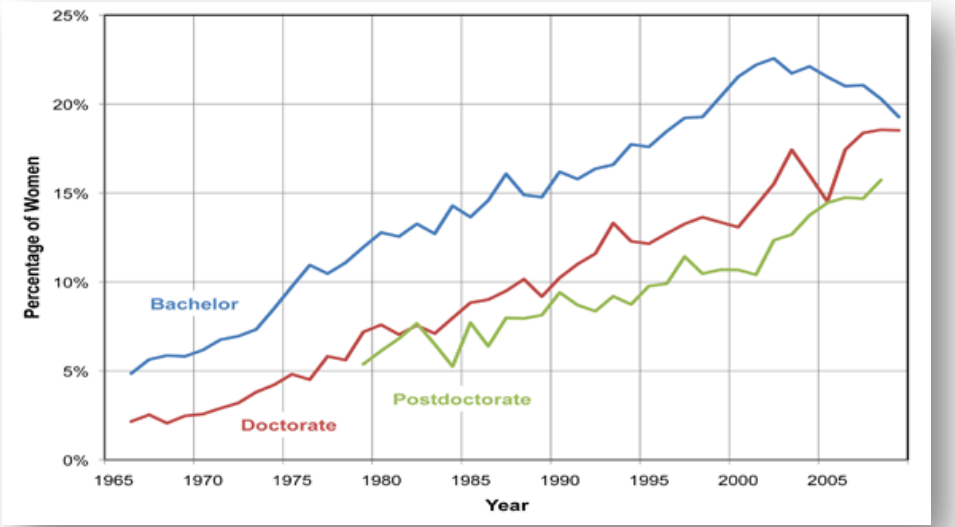
Pipeline issues: *Women are*
50% of High School physics students

25% of College physics majors

one leak that all can agree on

4% are Hispanic Americans, 3% are African Americans ...

-Rachel Ivie (2005, 2010) ; Toni Feder (2007); Gender Equity Report of APS (2007)



Different experiences in the workplace

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Workplace issues: *The most up-to-date data suggest, women have*
equivalent tenure and promotion rates to men's
lower retention rates
lower job satisfaction
-NRC of National Academies (2009)

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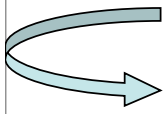
Workplace issues:



equivalent tenure and promotion rates
lower retention rates
lower job satisfaction

- NRC of National Academies (2009)

"pushed out by the chilly climate" -Meg Urry(2008)

"a built in headwind" -Beyond Bias and Barriers NAS, NAE, I of M (2007)

"swimming against the tide" - Ben Barres, (2010)

Different experiences in workplace

Data from women worldwide

Women in physics: A tale of limits

Rachel Ivie and Casey Langer Tesfaye

February 2012, page 47

DIGITAL OBJECT IDENTIFIER

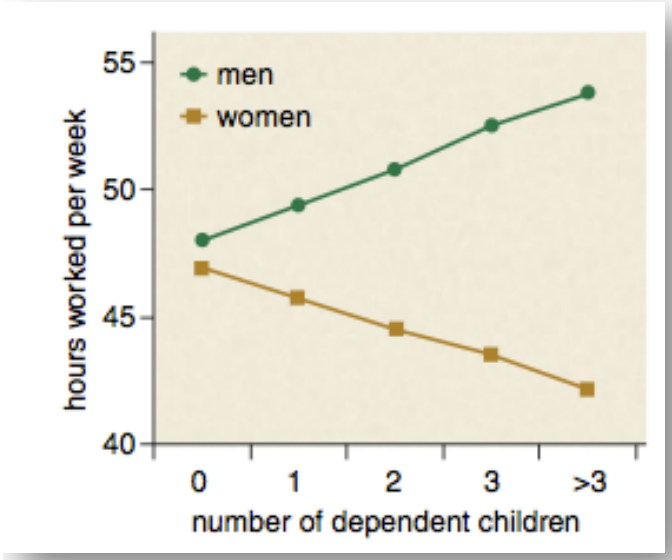
http://dx.doi.org/10.1063/PT.3.1439

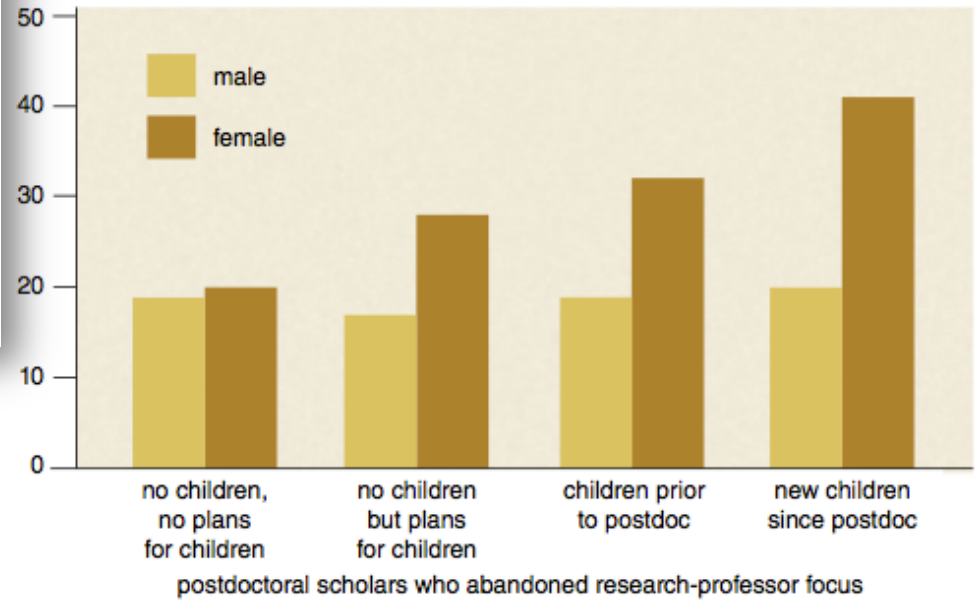
A newly completed survey of 15 000 physicists worldwide reveals that women physicists still do not have equal access to the career-advancing resources and opportunities enjoyed by their male colleagues.

Three IUPAP conferences were accompanied by surveys conducted by the Statistical Research Center of the American Institute of Physics (AIP). This article reports on the third survey. (2009-2011)

Recently-recognized obstacle to career progress:

*Marital status is slightly important, but **parenting status is crucial***
-NSF (2008), Sloan Foundation (2010), Ceci and Williams (2012)





The issue of fame and visibility ...

Prizewinners at March 2012 meeting of Amer. Phys. Soc.

The issue of fame and visibility ...

2013-2014 update: At major meetings, ~ **50 awards** not designated for underrepresented minorities: **~ 3 women won**
In 21 years of Bouchet award: 2 Latina women, 0 African American women

What problems does gender cause for the sciences ?

*Gender of **subjects** is a central issue in life and social sciences and medicine …*

"The study took 208 people in their 20s … found overlapping curves, with a significant tendency for men to prefer blue, and female subjects showing a preference for redder, pinker tones. This, the authors speculated (to international excitement and approval) may be because men go out hunting, but women need to be good at interpreting flushed emotional faces, and identifying berries whilst out gathering … "

–B. Goldacre, Christian Science Monitor (2007)

What problems does gender cause for the sciences ?

*Gender of **subjects** is a central issue in life and social sciences and medicine …*

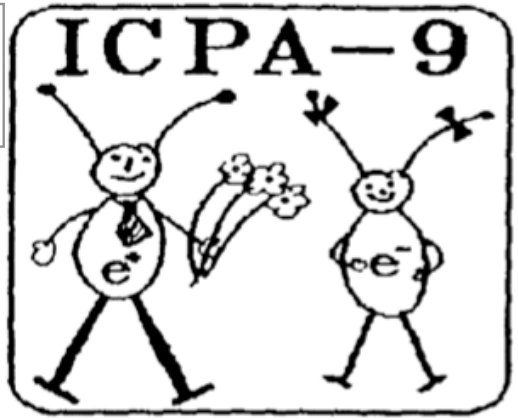
*… biases can result **in manifestly bad science***

*"The study took 208 people in their 20s … found overlapping curves, with a significant tendency for men to prefer blue, and female subjects showing a preference for redder, pinker tones. This, the authors speculated (to international excitement and approval) may be because men go out hunting, but women need to be good at interpreting flushed emotional faces, and identifying berries whilst out gathering … " **However, pre-1940, blue was viewed as the more feminine color, and appropriate for girls, while pink was for boys***

–B. Goldacre, Christian Science Monitor (2007)

What is problematic (and what is not) about gender and race in the **physical** sciences ?

Electrons don't have a race, gender, sexual orientation ...



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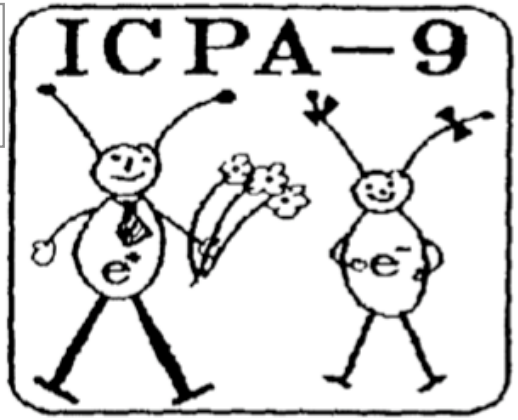

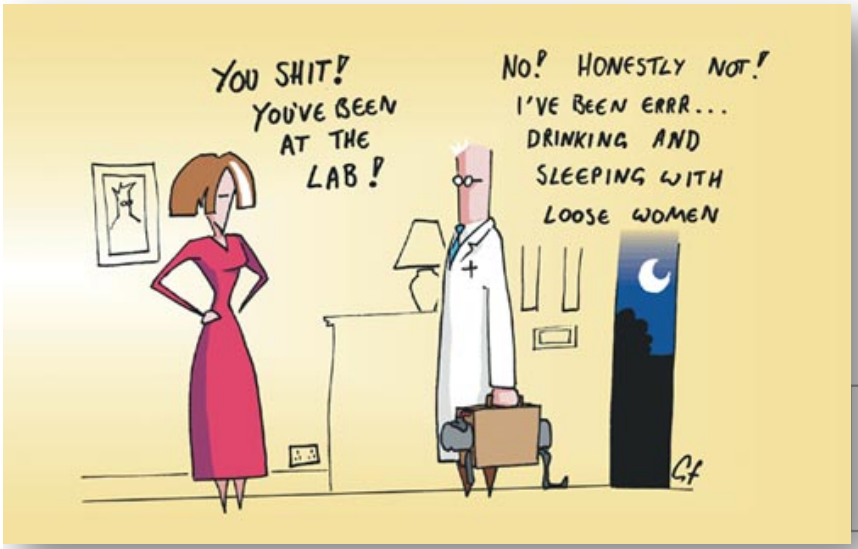

... but the scientists who study them do.

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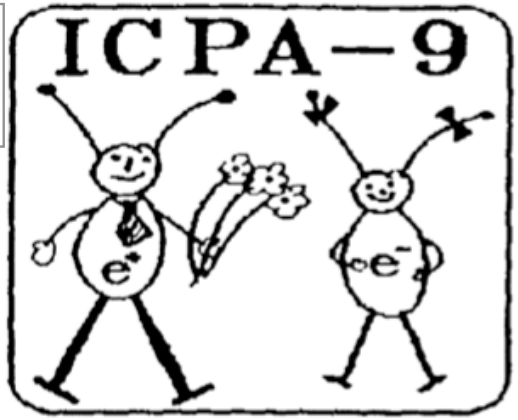

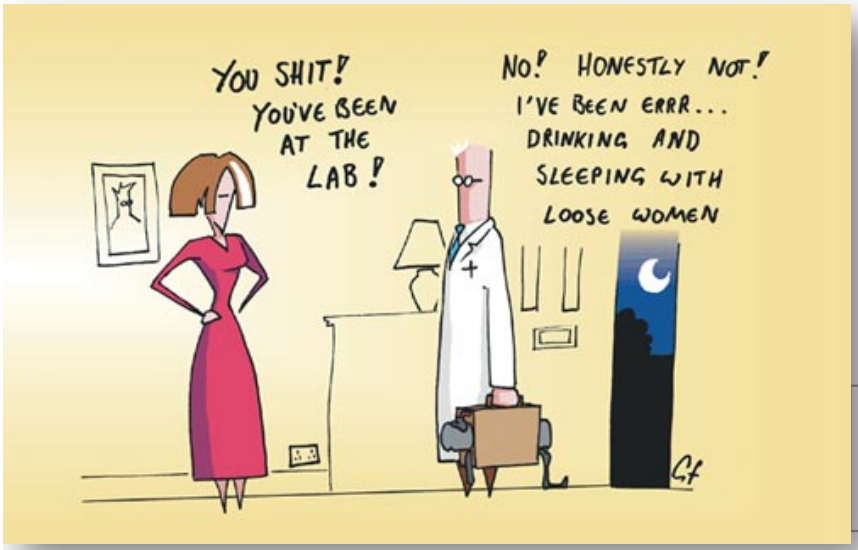

... but the scientists who study them do.

"The computer supports epistemological pluralism, but the computer culture does not" - Turkle and Papert, 1990

A person's gender might affect whether they become a successful scientist because of …

Structural obstacles e.g. bias (formerly overt; now **innate**)
Biological obstacles e.g. brain dimorphism
Sociobiological obstacles e.g. lifestyle/workstyle choices

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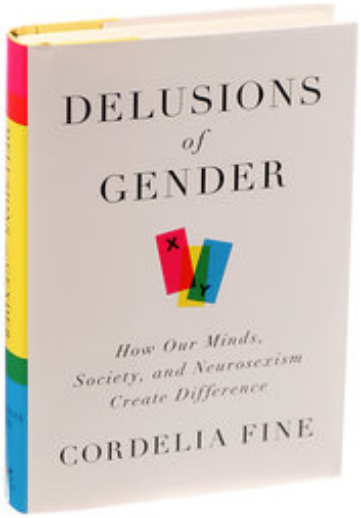
A person's gender might affect whether they become a scientist but *not* because of innate inability to think a certain way …

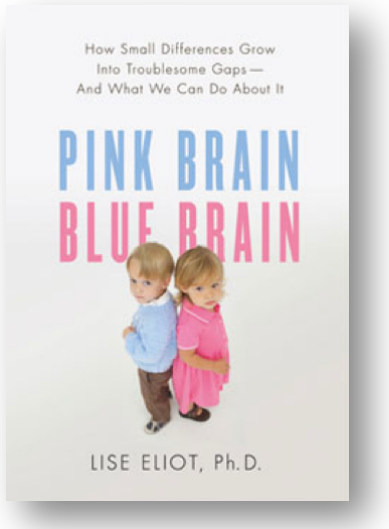
From ScienceDaily

Few Gender Differences in Math Abilities, Worldwide Study Finds (Jan. 5, 2010) — Girls than confident in countries wh more likely t

Study Debunks Myths About Gender and Math Performance

December 12, 2011 — A major study of recent international data on school mathematics performance casts doubt on some common assumptions about gender and math achievement -- in particular, the idea that girls and women ... > *full story*





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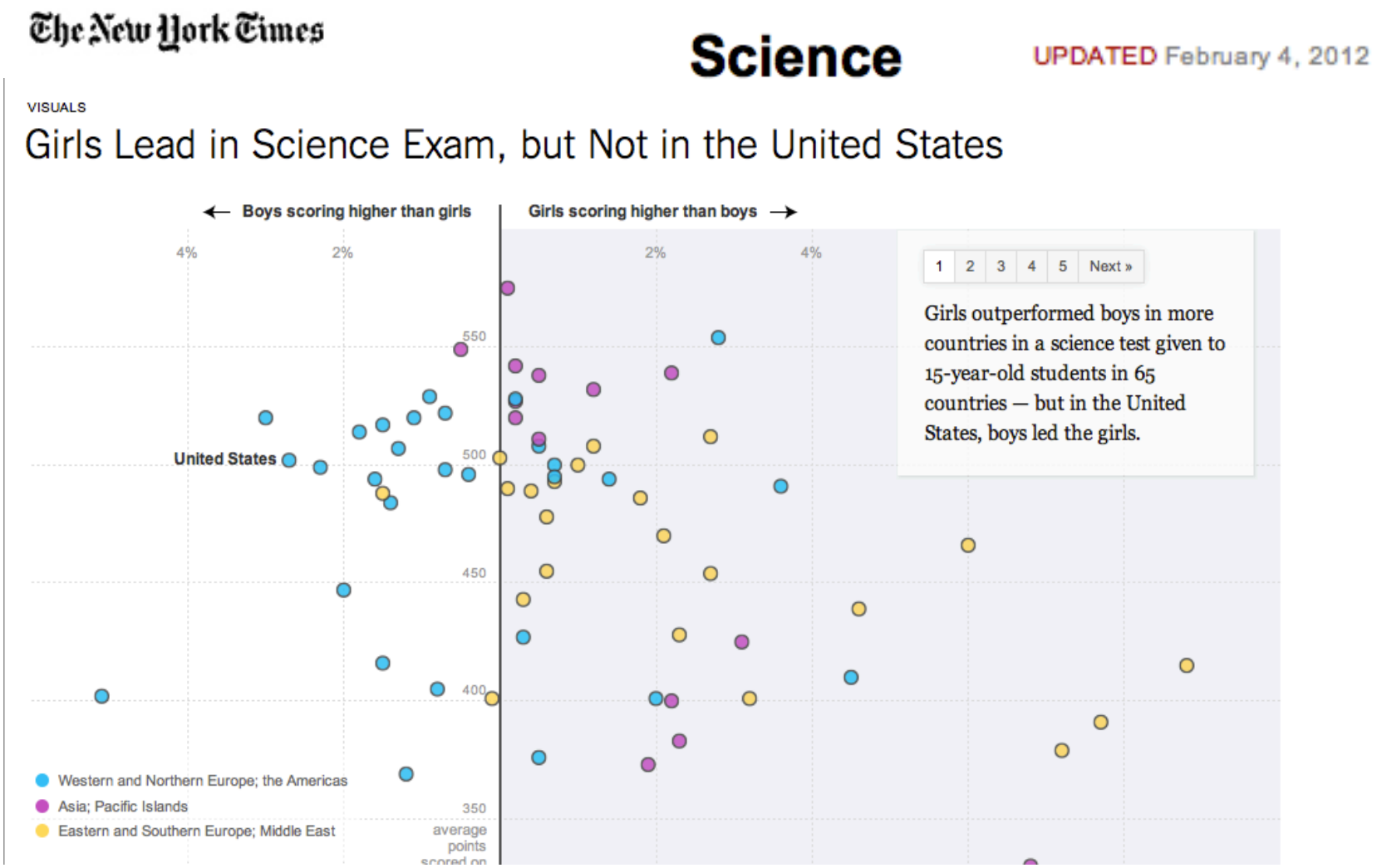
Women's Math Performance Affected By Theories On Sex Differences

October 20, 2006 — Women perform differently on math tests depending on whether they believe math-related gender differences are determined by genetic or social differences, according to University of British Columbia ... > *full story*

e.g. **Is Math a Gift?** – C. Dweck
(Ceci and Williams' Why aren't more women in science?, 2007)

Education and expectation depend on culture and nation



Identity safety, role congruence … affect
how we value ourselves
how we are evaluated by others

Differential ways that men and women are evaluated

Gender schema theory, Bem (1981) ; "Why so slow?" Valian (1998)

Gender schemas are expectations or ideas, more neutral than stereotypes, that permeate a culture and are carried by both men and women.

"The effect of schemas in professional life is to cause us to slightly, systematically overrate men and underrate women," (Valian) said.

... two key concepts--gender schemas and the accumulation of advantage ... make sense of a "bewildering difference" between men's and women's career trajectories.

-MIT Tech talk (2002)

Gender enters into the way
men and women are evaluated?
Much formal and informal evidence says "yes".

Syllabus studies: *race/gender of professor affects evaluation outcomes*
-Kasehak (1979); Moore and Trahan (1997); Anderson and Smith (2005)

CVs: *Gender affects likelihood of awards (postdoc fellowship; prizes)*
-Wenneras and Wold (1997); Lincoln et al, APS News (2009)

CV studies: *Gender on CV affects hiring; race/gender affects student rating*
- Steinpreis et al (1999), -Hebl et al (2010)

Teaching evaluations: *gender of student and race/gender of professor affect rating - Basow (1998); Sprague and Massoni (2005)*

Online education evaluation: *male vs. female instructor name affects student rating -MacNeil et al (2014)*

Blind auditions*: increases fraction of women hired in symphony orchestras*
- Goldin and Rouse (2000)

Recommendation letters: *quantifiably differ by gender*
- Watson (1998); Trix and Pensca (2003) ; Madera et al (2009)

Physical attractiveness: *affects evaluation, especially for men*
- Hammermesh and Parker (2003)

Gender enters into the way
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Much formal and informal evidence says “yes”.

Hiring studies

PNAS **September 17, 2012**

Science faculty’s subtle gender biases favor male students

Corinne A. Moss-Racusin[a,b], John F. Dovidio[b], Victoria L. Brescoll[c], Mark J. Graham[a,d], and Jo Handelsman[a,1]

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.

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men and women are evaluated?
Much formal and informal evidence says “yes”.

Hiring studies

PNAS January 31, 2014

How stereotypes impair women’s careers in science

Ernesto Reuben[a], Paola Sapienza[b], and Luigi Zingales[c,1]

Without provision of information about candidates other than their appearance, men are twice more likely to be hired for a mathematical task than women. If ability is self-reported, women still are discriminated against, because employers do not fully account for men’s tendency to boast about performance. Providing full information about candidates’ past performance reduces discrimination but does not eliminate it. We show that implicit stereotypes (as measured by the Implicit Association Test) predict not only the initial bias in beliefs but also the suboptimal updating of gender-related expectations when performance-related information comes from the subjects themselves.

Research done at Swarthmore …

Structural obstacles like bias (formerly overt; now **innate**)

~~Biological obstacles like brain dimorphism~~

~~Sociobiological obstacles like lifestyle choices~~

Swarthmore study

" the purpose of the study ... basically, watching a short video of someone teaching and then evaluating what you saw... you are going to watch a videotape that shows the first few minutes of a college physics lecture. The lecture is at the freshman level. The video will last about 7 minutes."

-oral instructions to students

Swarthmore study

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-oral instructions to students

Actor training and preparation

Male actor

EDUCATION

MFA	1980	Theatre Arts(Directing) Memphis University
B ED	1970	Education Major, Drama, Speech Minor,University of Miami

PROFESSIONAL AFFILIATIONS

Unions SSDC, AEA, SAG

Female actor

TRAINING

MFA – Yale School of Drama
BFA – Southern Methodist University

SPECIAL SKILLS

Classically trained pianist, singer, perfect pitch

Shooting script

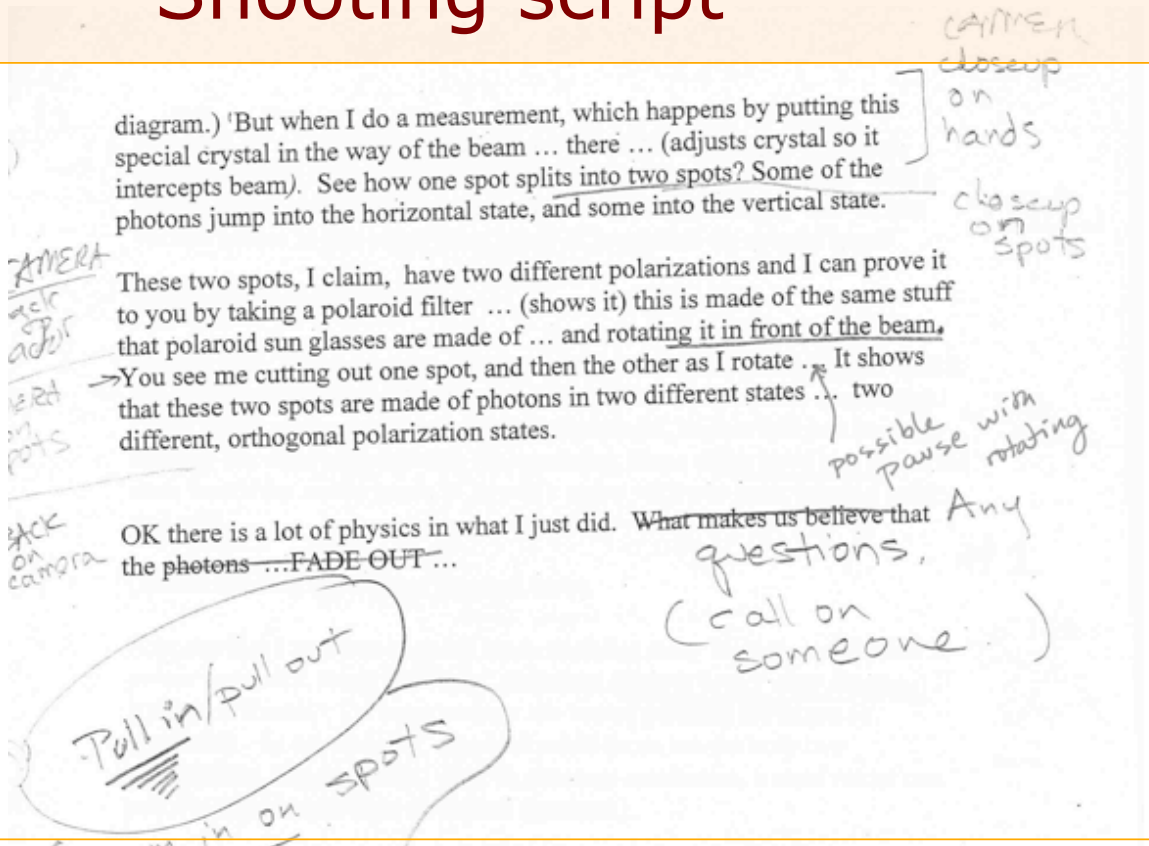


diagram.) 'But when I do a measurement, which happens by putting this special crystal in the way of the beam … there … (adjusts crystal so it intercepts beam). See how one spot splits into two spots? Some of the photons jump into the horizontal state, and some into the vertical state.

These two spots, I claim, have two different polarizations and I can prove it to you by taking a polaroid filter … (shows it) this is made of the same stuff that polaroid sun glasses are made of … and rotating it in front of the beam. →You see me cutting out one spot, and then the other as I rotate … It shows that these two spots are made of photons in two different states … two different, orthogonal polarization states.

OK there is a lot of physics in what I just did. ~~What makes us believe that~~ the ~~photons …FADE OUT…~~

CAMERA closeup on hands

closeup on spots

CAMERA

possible pause with rotating

Any questions, (call on someone)

Pull in/pull out

zoom in on spots

- Script based on
  - Steven Weinberg's 1986 Dirac Memorial Lecture
  - John Boccio's freshman quantum mechanics lectures
- Blocking includes boardwork, demo. questions from "students"

Rehearsal and Filming

Actors:
- discuss motivation: to teach a good physics class
- see good physics teaching: in person (man and woman at Haverford, Swarthmore) (Swarthmore); Goodstein, Weinberg, Feynman (videos)
- receive script, learn lines
- attend rehearsals, learn blocking, receive notes from director
- performances filmed (digital video)

Post-production:
- nonlinear editing of raw footage (Final Cut Pro)
- dub in “stock” footage: students in classroom, laser polarization demo

Clips from four lectures

NB: Each student sees just one lecture

Analysis

N = 126 students **
Independent variables:
Lecturer (4)
Institution (2)
Student sex (2)
Lecturer sex (2)

5-point rating scale
17 questions. For example:
Q2 Teaches so students learn?
Q8 Approachable outside class?
Q9 Lecture went too slow?
Q10 Lecture well organized?
Q13 Good with equipment?
Q14 Didn't like lecturer?
Q15 Lecture quality?
Q16 Lecturer quality?
Q17 Hire them at my school?

Composite score

- Responses to 15 questions are combined to create a **composite variable, E,** representing an **overall evaluation score**.
- Larger E -> more positive evaluation.
- E used as a dependent variable in ANOVA.
- Calculations performed with SPSS.

Individual questions also of interest …

e.g. Hiring decision? A strong positive correlation between E and Q17, recommendation to hire.

Results

"Swimming Against the Tide: Gender Bias in the Physics Classroom"
ALG, Etsuko Hoshino-Browne, and Kris Lui
(submitted to JWMSE, March, 2015)

lecturer sex*: mL (3.78/5.00) > fL (3.54/5.00)

lecturer ID:  Greg > Denise 

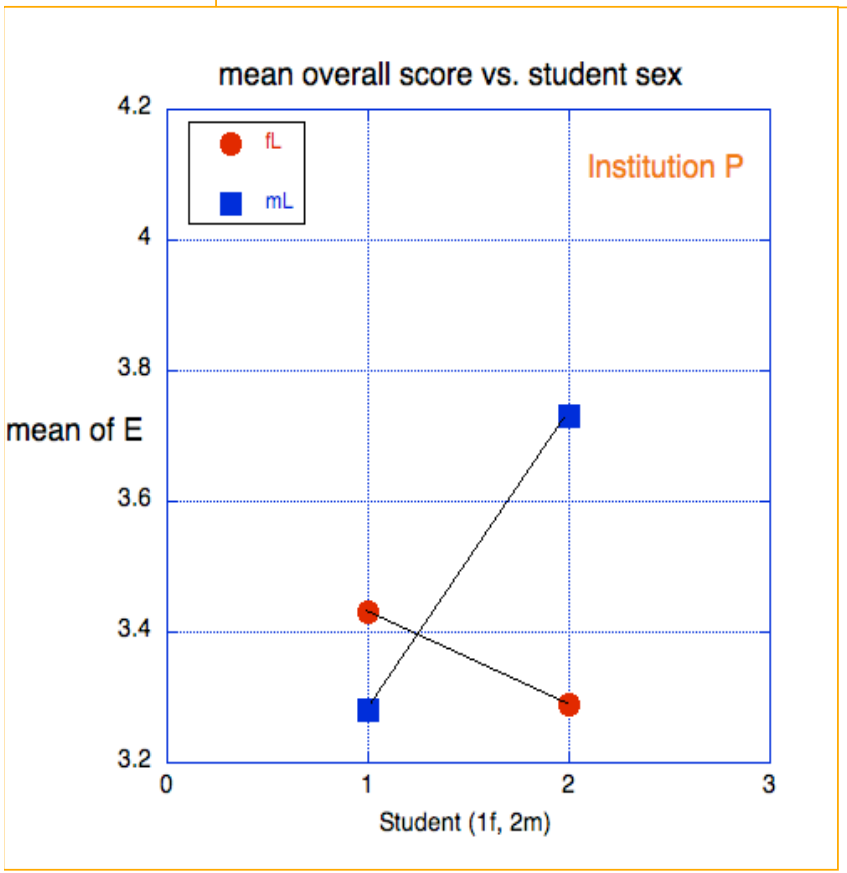
(Greg: 4.01, Suzy: 3.65, Bill: 3.55, Denise: 3.43)

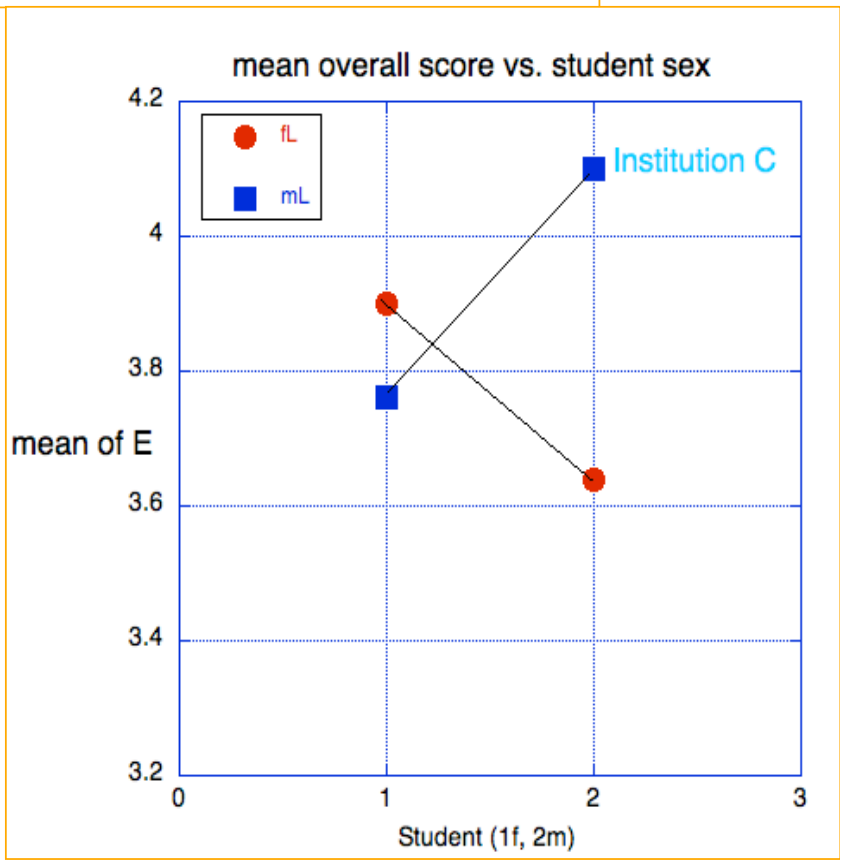
institution ID: C (3.85) > P (3.43)

* *not significant ...*

Result: Interactions

Interaction between lecturer sex and student sex





M students rated M lecturer significantly better than F lecturer.
F students rated both M and F lecturers equally positively.

A way to understand our findings?

Stereotype confirmation

Rater-ratee similarity bias

For male subjects, these *positively reinforce* each other

For female subjects, these *compete*

Results: Specific questions that probe gender-stereotypical attributes

Scientific thinking and hands-on skills:
Q4 Has a solid grasp of the material?
Q7 Is knowledgeable?
Q13 Good with equipment?

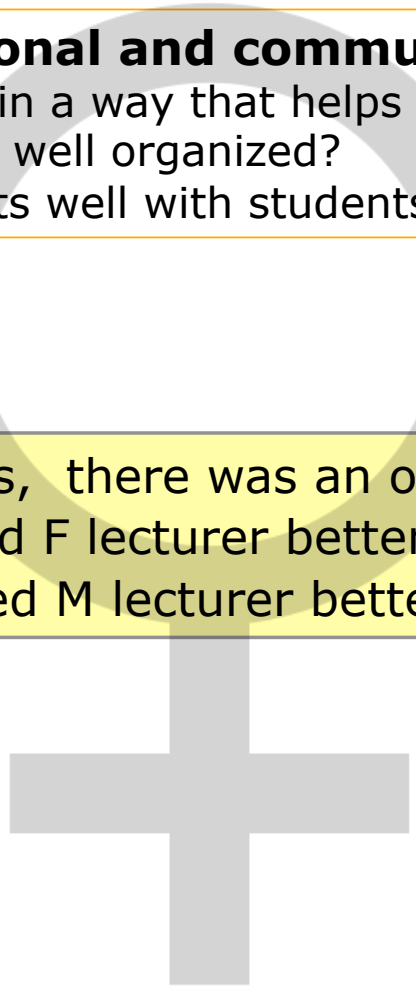
There was a significant main effect of gender:
both F and M students rated M lecturer better than F lecturer.

Disaggregating students by gender:
In the M student condition, M lecturer was deemed significantly better than F lecturer.
In F student condition, difference existed but was not significant.

Results: Specific questions that probe gender-stereotypical attributes

Interpersonal and communication skills:
Q2 Teaches in a way that helps students learn?
Q10 Lecture well organized?
Q14 Interacts well with students in class?

In all conditions, there was an own-sex bias ...
F students rated F lecturer better;
M students rated M lecturer better.



Ongoing work: Coding and statistical analysis of free responses

- Transcribed comments
- Grammar/spelling mistakes kept
- Gendered nouns and pronouns were changed. E.g. "her" becomes "him/her"
- Institutional names hidden
- Final coding categories (e.g. agency) are in development

Some responses:

His/her lecture seemed very organized and I liked how he/she had a brief summary of the last class's notes on the board. He/she seemed to interact with the students well."

"Let him/her teach high school."

What promotes diversity in STEM?

recognition that great progress has been made, even in physical sciences.

- numbers of women
- quality of their careers

-fnal "draw a scientist" before and after

What promotes diversity in STEM?

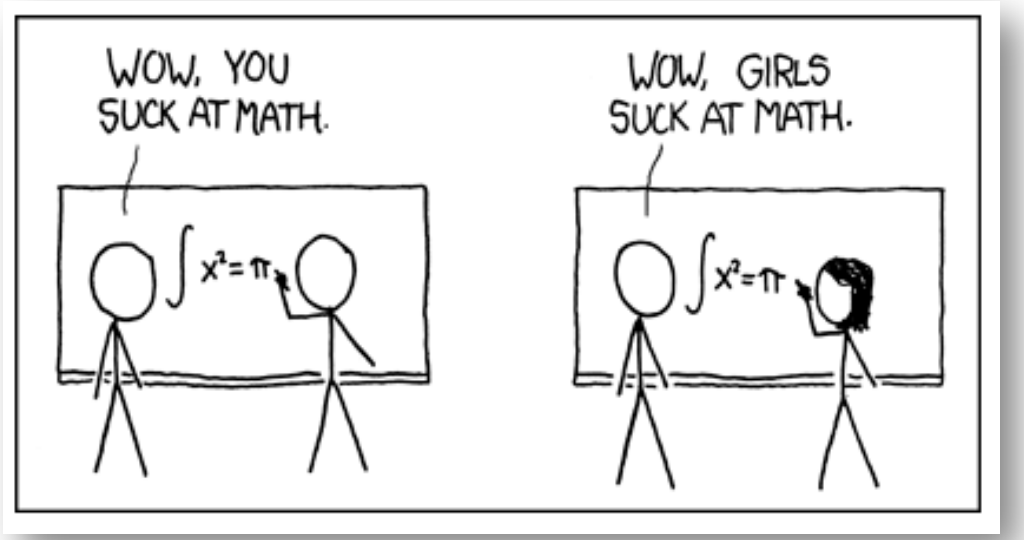
recognition that, despite much progress, biases and barriers still exist

research and funding dedicated to remediation...

- Innate bias *(e.g Duguid and Thomas Hunt, 2014)*
- Race penalty remains dire
- Child rearing effect on mom's career
- Salary gap
- Willingness-to-negotiate gap
- Hard vs. soft sciences: identity issues

What promotes diversity in STEM?

recognition that, despite much progress, biases and barriers still exist



-xkcd

Hard vs. soft sciences: identity issues

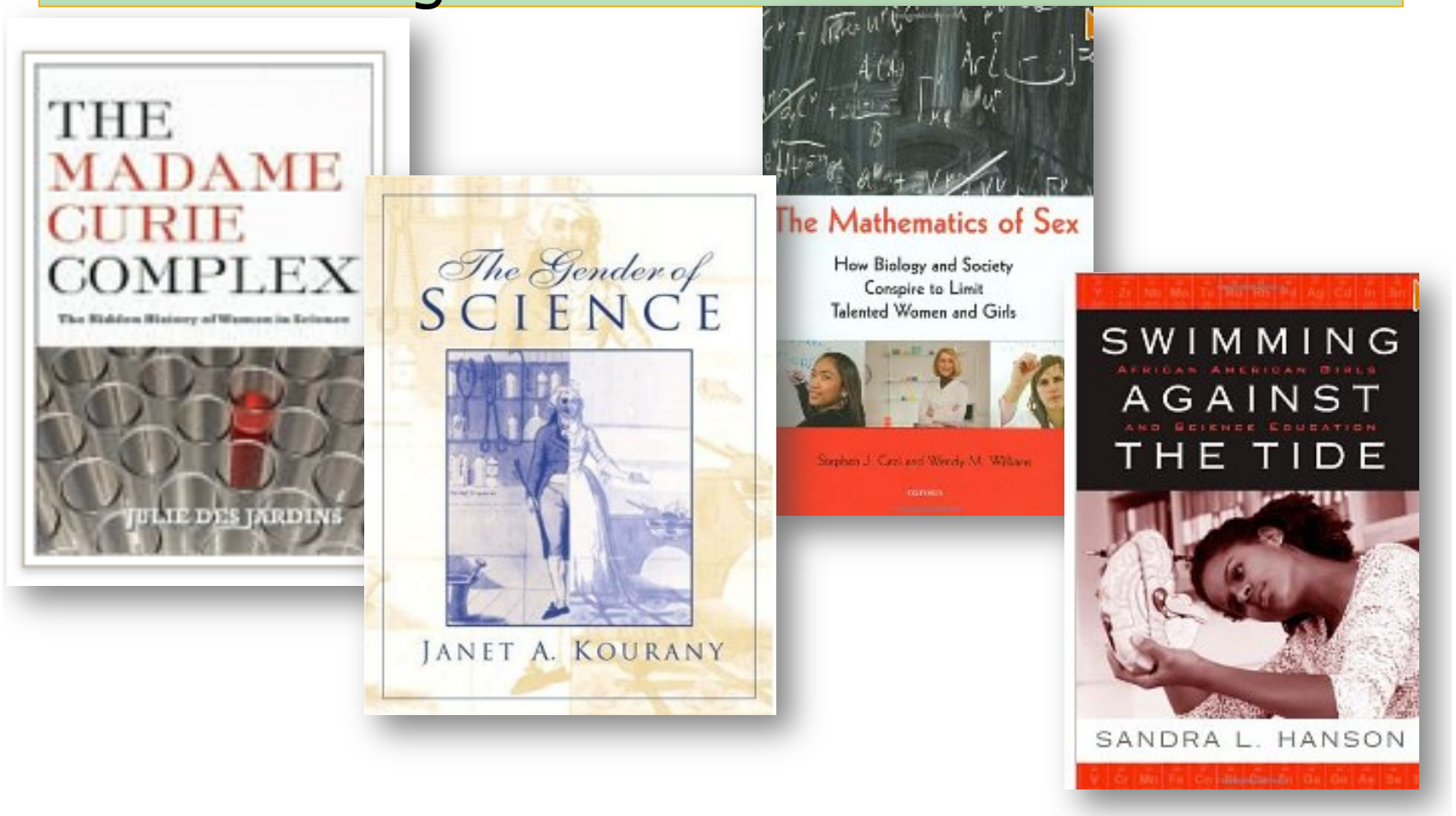
What promotes diversity in STEM?

action by those in power at institutions

Figure 1. Number of women faculty in the School of Science at MIT (1960-2010).
(Revised from Hopkins, MIT Faculty News Letter, no. 4, vol. XVIII, 2006.)

What promotes diversity in STEM?

mainstreaming learning about race, gender and science



What promotes diversity in STEM?

teaching about race, gender and science

Gender and (Physical) Science:

week	topic
1	introducing the issues around gender, race and science
2	who did science? scientific individuals from ancient to modern times
3	mechanism, dualism, and worlds without women
4	sexing the brain: biology of gender, race and knowledge
5	sexing the mind: psychology of gender, race and knowledge
6	gender and science teaching and learning
7	scientific workplace culture: church, combat, or commune?

	ial schedule:
	s Pockels
	s
	attan project to the LHC
10	words and images: old and new narrative and iconic traditions in science
11	philosophy of science and feminist science studies
12	profession, parenthood and family life *DUE: 3-4 page ethnographic study field notes*
13	i) Lab 2: "What stars are made of": the astrophysics of Cecilia Payne-Gaposchkin ii) more philosophy of science and feminist science studies
14	Remedies: what aspects of science are broken? How do we fix them?

What promotes diversity in STEM?

teaching about race, gender and science

Gender and (Physical) Science:

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3	mechanism, dualis
4	sexing the brain:
5	sexing the mind:
6	gender and scienc
7	scientific workplac
8	week of the American Physical Society meeting → special schedule: i) Lab 1: "Physics in her kitchen": the physics of Agnes Pockels ii) Free time: to pursue your ethnographic observations
9	men sweat but women glow: from radium to the Manhattan project to the LHC
10	words and images: old and new narrative and iconic traditions in science
11	philosophy of science and feminist science studies
12	profession, parenthood and family life *DUE: 3-4 page ethnographic study field notes*
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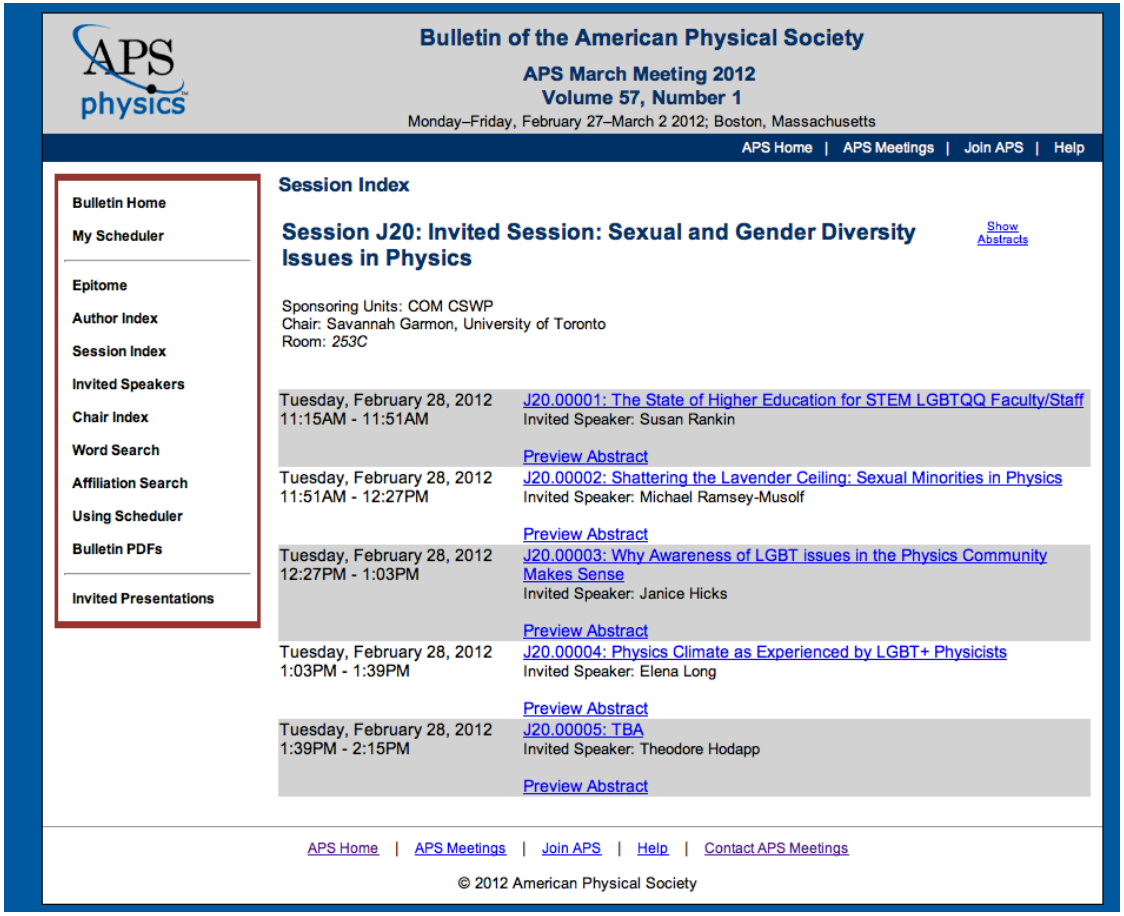
What promotes diversity in STEM?

repurposing old structures



APS physics

Bulletin of the American Physical Society

APS March Meeting 2012
Volume 57, Number 1
Monday–Friday, February 27–March 2 2012; Boston, Massachusetts

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Session J20: Invited Session: Sexual and Gender Diversity Issues in Physics

Show Abstracts

Sponsoring Units: COM CSWP
Chair: Savannah Garmon, University of Toronto
Room: *253C*

Tuesday, February 28, 2012 11:15AM - 11:51AM	J20.00001: The State of Higher Education for STEM LGBTQQ Faculty/Staff Invited Speaker: Susan Rankin Preview Abstract
Tuesday, February 28, 2012 11:51AM - 12:27PM	J20.00002: Shattering the Lavender Ceiling: Sexual Minorities in Physics Invited Speaker: Michael Ramsey-Musolf Preview Abstract
Tuesday, February 28, 2012 12:27PM - 1:03PM	J20.00003: Why Awareness of LGBT issues in the Physics Community Makes Sense Invited Speaker: Janice Hicks Preview Abstract
Tuesday, February 28, 2012 1:03PM - 1:39PM	J20.00004: Physics Climate as Experienced by LGBT+ Physicists Invited Speaker: Elena Long Preview Abstract
Tuesday, February 28, 2012 1:39PM - 2:15PM	J20.00005: TBA Invited Speaker: Theodore Hodapp Preview Abstract

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What promotes diversity in STEM?

creating/utilizing new structures

The Future of Women in Chemistry and Science brought together 60 of today's leading minds to discuss, debate, and define today's major issues and opportunities facing women in chemistry and the sciences, from work-life balance and gender differences, to mentoring young women engineers and executive leadership. The Future of Women in Chemistry and Science inspired, educated, and challenged participants to think in new and innovative ways about women's role in creating the stry—and sciences in general.

The Future We Create

THE FUTURE OF WOMEN IN CHEMISTRY AND SCIENCE

Virtual Conference

What promotes diversity in STEM?

networking

What promotes diversity in STEM?

mentoring

Mentoring Strategies To Facilitate the Advancement of Women Faculty

Editor(s): Kerry K. Karukstis [1], Bridget L. Gourley [2], Miriam Rossi [3], Laura L. Wright [4]

Volume 1057
Publication Date (Web): December 14, 2010

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ISBN13: 9780841225923
eISBN: 9780841225930
DOI: 10.1021/bk-2010-1057

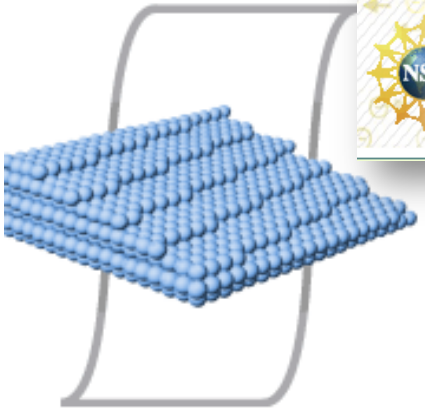
Sponsoring Divisions: ACS Division of Chemical Education

What promotes diversity in STEM?

multidisciplinary research

NATIONAL SCIENCE FOUNDATION MRSEC MATERIALS RESEARCH SCIENCE & ENGINEERING CENTERS

Programs to stimulate interdisciplinary education and the development of human resources (including support for underrepresented groups) through cooperation and collaboration …



National Science Foundation PREM Partnership for Research and Education in Materials

What works for women in STEM?

initiatives like OXIDE

About OXIDE

The Open Chemistry Collaborative in Diversity Equity (OXIDE) is a 5-year, NSF/NIH/DoE-funded initiative to change the academic chemistry infrastructure from the top down by working with the chairs of leading research-active chemistry departments to reduce inequitable policies and practices that have historically led to disproportionate representation on academic faculties with respect to gender, race-ethnicity, disabilities, and sexual orientation.