Women and the Future of Physics
Howard Georgi
Harvard University
data - and the state of physics education

portrait of a personal journey

recommendations for the future
recent conference put on by WISHR

Women In Science at Harvard-Radcliffe

reminded me of some familiar but puzzling
data on the percentage of women receiving
degrees in various fields
% of women getting physics degrees

% of women getting BAs by field

Source: AIP Statistical Research Center, Data from Mulvey & Nicholson, Enrollments and Degrees Report, and the National Center for Education Statistics.
% of women getting PhDs by field

Worse than Math and Chemistry???

SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; data from Department of Education /National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Survey of Earned Doctorates
BAs in Physics

![Graph showing BAs in Physics](image-url)

**Total**

- 1966
- 1968
- 1970
- 1972
- 1974
- ...
- 1980
- 1982
- 1984
- 1986
- 1988
- 1990
- 1992
- 1994
- 1996
- 1998

**Women**

- 1966
- 1968
- 1970
- 1972
- 1974
- ...
- 1980
- 1982
- 1984
- 1986
- 1988
- 1990
- 1992
- 1994
- 1996
- 1998
BAIs in Physics

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Total women
there is a lot of structure - probably many things are going on - but three things stand out about physics
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1: it is MALE - there are very few women
there is a lot of structure - probably many things are going on - but three things stand out about physics

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2: it is SPARSE - there are very few people period - particularly at the undergraduate level
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3: and it is FOCUSED on advanced degrees
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2: it is SPARSE - there are very few people period - particularly at the undergraduate level

3: and it is FOCUSED on advanced degrees

conclusion — the small number of women in physics doesn’t tell the whole story - it is important to understand how maleness relates to sparseness and focus
attempt to tease out something that isolates a simple gender effect - standard trick in experimental physics and phenomenology - ratio of ratios

\[ P \equiv \frac{\text{Women PhDs/Women BAs}}{\text{Men PhDs/Men BAs}} \]
attempt to tease out something that isolates a simple gender effect - standard trick in experimental physics and phenomenology - ratio of ratios - “Pipeline ratio”

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Why am I here giving this talk?

A brief history of my personal journey from unconsciousness to activism—in the hopes that it may encourage others to examine more closely their own beliefs about the issue of women in science.
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Harvard physics

70s

80s

90s

00s
Harvard physics

70s
male enclave

80s
beginnings
of integration

90s
significant
group of women
with real diversity

00s
Harvard physics women in graduate program

70s
male enclave

80s
beginnings of integration

90s
significant group of women with real diversity

00s
Harvard physics me

70s
male enclave
an oblivious nerd

80s
beginnings of integration
a strong supporter of women in science

90s
significant group of women with real diversity
an activist

00s
Women and the Future of Physics
Howard Georgi
Harvard University
the 70s
Office of the Dean
Harvard College
2002-2003
Responding to Sexual Harassment,
Sexual Assault and Rape
the 80s
Harvard
←
LEFT
Admissions Information for Prospective Graduate Students

The Graduate School seeks applications from students whose background and promise suggest the potential for scholarly achievement.

In general, only applicants holding the A.B. or equivalent, with distinguished undergraduate records, are admitted. Careful academic preparation, preferably in the major field, is essential. The GRE General Test is required; the GRE subject test may be required or recommended for some programs. Letters of recommendation should be submitted with the application. Transcripts, research papers, publications, and other original works may also be considered for the admissions committee during their evaluation.

Students holding a B.A. or B.S. equivalent, or who have completed most of the coursework for a B.A. degree, may apply to a Ph.D. program in the...
Students flocked to Harvard to work with Nobel Prize Winners Shelly Glashow and Steven Weinberg.
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Working with me was easier!
the 90s
Chair of the Physics Department
Lots of responsibility - no power
Deluged with statistics
Chair of the Physics Department
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course grading index = average grade in a course
- average grade of the students in all their other courses

almost always negative for physics courses!
broken down by gender - women were much more negative
I had other data broken down -
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I had other data broken down -
data from senior surveys broken down by gender showed that our women physics concentrators had a miserable experience. Many of our women physics concentrators were trapped in an emotionally abusive relationship with the Harvard Physics Department!!!
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data from senior surveys broken down by gender showed that our women physics concentrators had a miserable experience. Many of our women physics concentrators were trapped in an emotionally abusive relationship with the Harvard Physics Department!!!
This turned me into an activist for Women in Physics!
Failing at Fairness
How Our Schools Cheat Girls

"Failing at Fairness is no one's career for any parent or teacher truly interested in equality. This book provides parents who care about girls with the solid factual evidence to make a difference." — Elizabeth H. Boder, The San Francisco Chronicle, author of Mapping America's Disappearance

MYRA and DAVID SADKER
from Brown College Dean’s Office

- Observe Classroom Dynamics
- Personalize Large Classes
- Shift from a Competitive to a Cooperative Educational Model
- Consider a Variety of Examination Options
- Encourage Active Participation in Labs
- Fight Narrow Stereotypes of Science
- Provide Diverse Role Models
- Make Yourself Available
- Foster Self-Confidence
from Brown College Dean’s Office

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Similar steps needed at the Department level —
from Brown College Dean’s Office

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- Personalize Large Classes
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- Encourage Active Participation in Labs
- Fight Narrow Stereotypes of Science
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- Make Yourself Available
- Foster Self-Confidence

Similar steps needed at the Department level — treat students as individuals
Lots of little things!
Talking to the women concentrators and graduate students
Women in Physics Dinners
Site Visit by CSWP
Improved advising
Biannual picnics
Physics Department Holiday Caroling
most important - tenured women faculty
\[ v \]
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<tr>
<td></td>
<td>2003</td>
<td>16</td>
<td>63</td>
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emphasize that it is hard but humane
have explicit rules of coherence and
readability for problem sets
give students several ways to do well
talk very explicitly about whether to take
the course
PRS, take-home/in-class exam system ...
attract study groups to my office and the
House dining hall with food
hang out to see how they work
Life, love, and physics meet head on
in the brand new musical
that everyone is talking about!

Les Phys
Written and composed by Peter Dong
May 9, 10, 11 at 8pm and May 11 at 2pm
in the Agassiz theater
IF I WERE A SCIENTIST WORKING IN A BIG LAB,
I'D SHOUT "EUREKA!"
EVERY SO OFTEN JUST TO BOOST MORALE.
CONCLUSIONS

Why were our women concentrators so unhappy?

SPARSENESS and FOCUS of physics magnifies the problems of the women in the field. Conversely, efforts to encourage women in physics will help broaden the field for both genders. And a broader program is more fun!
CONCLUSIONS

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And a broader program is more fun!
past time to outgrow the hypermacho lone-ranger approach to physics that leads to sparseness and focus

Physics
The few. The proud.

lingers in our mythology, in our faculty meetings, in our selection committees and in our classes
Recommendations:

NO-BRAINERS
Treat women colleagues as colleagues.
And if one of your other colleagues
doesn’t do this, call him (or her) on it.
Strongly and openly support rules and guidelines designed to protect women students from harassment or intimidation. Make it clear that you care.
Not only protect but actually encourage and cultivate the complainers and the whistleblowers. Many times, the problems are not obvious, and if you drive them underground things will get worse rather than better.
Maintain an ombudscommittee of people who are willing to have their shoulders cried on. NOT THE CHAIR or THE DEAN! And reporting to the chair or dean only if necessary and with the permission of the crier.
Don’t ever compromise quality or adopt quotas. Don’t look for a woman because you have to have a woman. But don’t measure quality in a naive, superficial and one-dimensional way.
Searches - junior faculty as well as senior faculty, should be broad based, not very narrowly defined, and should involve the whole department - not a group.
Searches should not be done precipitously - it is important to give people adequate time to get past first impressions, because these may be strongly affected by subconscious biases.
Pay as much attention to HOW we teach as to WHAT we teach. Treat students as people and as individuals.
Encourage study groups and cooperative behavior in the classroom. Students learn better from other students than they do from you and they learn best by doing the teaching themselves.
Be aware of gender differences in classrooms. Treat women fairly without singling them out. Use relevant examples (*ie.* relativistic chocolate chip cookies rather than space war).
BARELY-BRAINERS
RECRUITMENT AND HIRING
Encourage faculty based initiatives to promote diversity. These should be slightly subversive.
Choose Department Chairs who have a clue.
Prospective chairs should take Mahzarin Banaji’s implicit association test for subconscious prejudice.

They need to be shocked out of the comfortable belief that they know what they are doing in evaluating people.
Pay special attention to search practices that perpetuate the old-boy network — such as “targets of opportunity” — focusing a search much more narrowly than one should - is a good recipe for failing to find women and minorities
TEACHING AND CLIMATE
Ask to get statistics broken down by gender, race, and whatever else you can think of. Sure, the results won’t be statistically significant. But who cares? You should be trying to understand what is going on - not prove it.
For the next generation of scientists it is important to emphasize that science is a team activity in which many different skills are needed, and that one of the most important skills in making a scientific collaboration work is the ability to communicate with, to teach and to learn from others.
Require the nerds to use complete sentences (rules of coherence).
When you encourage study groups, you need to make sure that less self-confident students can find study groups they are comfortable with and can contribute to.
Competition is fine - but “hitting a homerun” is not the right metaphor - the team also needs a pitcher “Touchdown” would be better
Help and encourage the nerds (students and faculty) who perpetuate hypermacho behavior to grow up by complimenting good behavior and calling attention to and whenever possible punishing bad behavior, from showing off in section to making snide remarks in faculty meetings.
BRAINERS

hard issues to which I don’t have good solutions
Life-style issues — this one is really hard, but there are ways of making a difference — example of women in physics in France — women are expected to work so there is good child care and there are more women physicists - even though the culture is not particularly conducive to treating women as colleagues
No good deed goes unpunished! We need sensible reward structures in a research university for teaching, mentoring, and other good citizenship.
More women at the top can help
Female Dean → time change in faculty meetings
sure - it is not all our fault
we are fighting difficult societal and
cultural stereotypes
but we can make a difference!
Physicists are good, intelligent, committed people. We should set an example for the society at large, not be dragged kicking and screaming into compliance with rules.
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Dealing with the issue of women in physics is a special opportunity to make the field more welcoming in general.
All science is either physics or stamp collecting.
—Ernest Rutherford.
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