“I never am really satisfied that I understand anything; because understand it well as I may, my comprehension can only be an infinitesimal fraction of all I want to understand”

Ada Lovelace
Generalizations...

xkcd.com
Generalizations...

Promote awareness, not blame!
Outline

- Why should everyone care about imbalanced gender ratios in science?
- Historical perspective
- Examples of gender bias
- Video talks
- Special topics and Studies
  - Leaky pipeline
  - Stereotype threat
  - Gender Bias
Questions...

• Do you know the percentage of women receiving engineering degrees?

• Why don’t more women enter the physical sciences, engineering and computing-related fields? and why is this weird?

• Why is it important to have a 50/50 ratio of women/men in STEM fields?
Questions...

• Why don’t more women enter the physical sciences, engineering and computing-related fields? and why is this weird?

• Why is it important to have a 50/50 ratio of women in STEM fields?

  • Diversity for the workforce

  • Gender-balanced teams do a better job
    • consider airbag safety for children and small adults

• If the field doesn’t reflect the demographics in the population, the field isn’t drawing from the full talent pool that it can
Things we hear...

• “Science is a meritocracy – the best scientists naturally rise to the top.”
Things we hear...

• “Science is a meritocracy – the best scientists naturally rise to the top.”
  – If this were the case, wouldn’t there already be fair representation of all backgrounds?
  – This assumption ignores factors that disproportionately affect students of some backgrounds (e.g., stereotype threat)
Things we hear...

• “Biases against women and minorities in STEM are a thing of the past. The reason why women and minorities are not well-represented at the faculty level is that it takes a while for them to progress through their careers. In time, the numbers will catch up.”

Institute for Scientist & Engineer Educators, 2013
Things we hear...

• “Biases against women and minorities in STEM are a thing of the past. The reason why women and minorities are not well-represented at the faculty level is that it takes a while for them to progress through their careers. In time, the numbers will catch up.”
  – True that as we reduce biases, it will take time for numbers to catch up, however
  – Biases do still exist (see supplementary reading)
Scientist and Engineering Stereotypes in the Media

Pacific Rim

Thor
Historical Perspective - Rima Apple

- Agnes Fay Morgan
  - BS 1904, MS 1905 - Chemistry from Univ of Chicago
  - PhD 1914 - Organic Chemistry from Univ of Chicago

- 1915 - Assistant professorship at UC Berkeley in home economics
- Conducted nutrition research, despite being in home economics, difficulties with funding
  - feminized department: as a home ec department, called upon to do aspects of nutrition that were closely connected with the home-front, not research.
  - in 1965: Morgan “My first troubles were budgetary. A tight-fisted board of research gave us $600 one year for research for the department and I considered this a remarkable windfall. However, I found later that they had given the Chemistry Department $13,000 for their research. This I considered obviously unfair. I think on one would agree with me then or now.”
- Home Ec could not grant PhDs, despite Morgan’s national reputation and numerous awards
  - Nutritionists trained by Morgan received degrees through interdepartmental group.
Historian of the Family and Gender

- Male breadwinner - mid 20th century “aberration”
- Rebalancing when women entered paid workforce
  - 1970s in America
  - 1960s ads - “you must be really beautiful”
  - 1993 - sexual harassment becomes illegal
- Current state of affairs
  - No national childcare standards
  - No subsidized leave to take care of babies
- Thoughts
  - Second class in the workplace or in the home?
  - Worker’s right to the family life

http://poptech.org/popcasts/stephanie_coontz_gender_gaps
Anecdotes on Gender Bias

• 2005 Larry Summers - President of Harvard
  • Comment: innate differences account for why there are fewer women in science
  • http://www.boston.com/news/education/higher/articles/2005/01/17/summers_remarks_on_women_draw_fire/?page=full

• 2013 - I Fucking Love Science!
  • People were surprised that the person who runs the “I Fucking Love Science” facebook page was a woman
  • Sample comments:
    • "You're beautiful."
    • "you mean you're a girl, AND you're beautiful? wow, i just liked science a lil bit more today ^^"
    • "You're...a woman...?"
    • "OMFG! You are a beautiful GIRL!!! I admit I never expected you to be a girl and on top of that a beautiful one. My sincere apologies."
    • *points, mouth open* GIRL!!!
    • "Holy crap I pictured. A 30 sumthin harvard geek lmfao thanks for makin science more enticing ;)
    • "wow who would've thought!! you're a girl and kindda pretty! LOL"
  • http://www.dailydot.com/society/facebook-fcking-love-science-elise-andrew/
“Leaky Pipeline” and “Glass Ceiling

• Miss Representation: http://www.missrepresentation.org

• Sheryl Sandberg
  • Ted: http://www.youtube.com/watch?v=18uDutylDa4
  • At Grace Hopper: http://www.youtube.com/watch?v=rMVCSrm65kg
    • 9.20 (numbers), 19.00, 23(ambition gap), 25(stereotype threat), 31:20

• Nora Denzel
  • http://www.youtube.com/watch?v=242Z5BhJAC8
Mary Ann Mason: “Do Babies Matter?”


Leaks in the Academic Pipeline for Women*

Graduate School Entry → PhD Receipt → Assistant Professor (Tenure Track) → Associate Professor (Tenured) → Full Professor (Tenured)

- Leak!!
- Leak!!
- Leak!!
- Leak!!

Women with Babies
(28% less likely than women without babies to enter a tenure-track position)

Women, Married
(21% less likely than single women to enter a tenure-track position)

Women
(27% less likely than men to become an Associate Professor)

Women
(20% less likely than men to become a Full Professor within a maximum of 16 years)

* Preliminary results based on Survival Analysis of the Survey of Doctorate Recipients (a national biennial longitudinal data set funded by the National Science Foundation and others, 1979 to 1995). Percentages take into account disciplinary, age, ethnicity, PhD calendar year, time-to-PhD degree, and National Research Council academic reputation rankings of PhD program effects. For each event (PhD to TT job procurement, or Associate to Full Professor), data is limited to a maximum of 16 years. The waterline is an artistic rendering of the statistical effects of family and gender.
Mary Ann Mason: “Do Babies Matter?”


### Reasons Most Commonly Cited by UCB PhD Students for Shifting Career Goal away from Professor with Research Emphasis

<table>
<thead>
<tr>
<th>% citing factor as &quot;Very Important&quot; in career goal shift</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Negative experience as PhD student</td>
<td>48%</td>
<td>50%</td>
<td>46%</td>
</tr>
<tr>
<td>2 Other life interests</td>
<td>41%</td>
<td>39%</td>
<td>41%</td>
</tr>
<tr>
<td>3 Feelings of isolation/alienation as PhD student</td>
<td>37%</td>
<td>35%</td>
<td>39%</td>
</tr>
<tr>
<td>4 Professional activ. too time consuming</td>
<td>37%</td>
<td>31%</td>
<td>41%</td>
</tr>
<tr>
<td>5 Issues related to children</td>
<td>31%</td>
<td>16%</td>
<td>42%</td>
</tr>
<tr>
<td>6 Geographic location Issues</td>
<td>29%</td>
<td>24%</td>
<td>32%</td>
</tr>
<tr>
<td>7 Issues related to spouse/partner</td>
<td>27%</td>
<td>19%</td>
<td>32%</td>
</tr>
<tr>
<td>8 Lack of encouragement/mentor</td>
<td>25%</td>
<td>28%</td>
<td>22%</td>
</tr>
<tr>
<td>9 Job security</td>
<td>24%</td>
<td>28%</td>
<td>21%</td>
</tr>
<tr>
<td>10 Bad job market</td>
<td>23%</td>
<td>25%</td>
<td>22%</td>
</tr>
<tr>
<td>11 Career advancement issues</td>
<td>23%</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>12 Other career interests</td>
<td>22%</td>
<td>27%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Yellow shading indicates the group’s response is significantly higher than the other group’s response (P<.05).


N=262 to 313   107 to 134   154 to 177
C-MORE work-life balance seminar

• Center for Microbial Oceanography Research and Education

• Information about your legal rights to raise a family while having a career in higher education (grads, postdocs, professors)

• Studies about the issue

• Suggestions on strategies
Stereotype threat

- Stereotype threat: experience of anxiety or concern in a situation where a person has the potential to confirm a negative stereotype about their social group

- Claude Steele

- Reducing the Gender Achievement Gap in College Science: A Classroom Study of Values Affirmation
  - http://www.sciencemag.org/content/330/6008/1234.abstract

- Values affirmation improves physics test scores for women
Study: Why fewer women in physical sciences?

- “Gender Segregation in Elite Academic Science”
  - Ecklund et al. 2012 Gender and Society
  - [http://gas.sagepub.com/content/26/5/693.abstract](http://gas.sagepub.com/content/26/5/693.abstract)
  - “Why are women more likely to biology than physics?”
  - Women were more likely to cite discrimination
  - Men were more likely to cite brain differences or “problems” in math
Study: Why fewer women in physical sciences?

• “Gender Segregation in Elite Academic Science”

• Ecklund et al. 2012 Gender and Society

-Gender & Society / October 2012

Students and postdoctoral fellows in physics who are men are particularly less likely to agree with the mentoring argument. Where career stage is most salient is the "women's natural ability for biology" explanation, which men and women graduate students and postdoctoral fellows in both disciplines are significantly more likely to support. Women assistant professors in physics all disagreed, and those cases dropped out of the model. Conversely, the demand-side argument that women face more discrimination in physics is least supported by graduate students and postdoctoral fellows but gradually gains traction among faculty, particularly with women (see Figure 1). Given attrition from science careers, it is possible that those who remain are more likely to hold demand-side explanations than those who leave (selection), or that experiences change perceptions over time. Alternatively, it is possible that more senior women scientists' perceptions...
Study: Gender Bias

• “Science faculty’s subtle gender biases favor male students”
  • Moss-Racusin et al 2012 PNAS
  • http://www.pnas.org/content/early/2012/09/14/1211286109
  • Faculty participants rated male applicants as significantly more competent than the (identical) female applicant
  • Equally strong among female and male scientists, no variation by age, race, or discipline
  • http://www.sciencemag.org/content/337/6102/1592.full?sid=4c0653a6-38c9-4852-bf47-c48a2969bf7b
Study: Gender Bias

- “Science faculty’s subtle gender biases favor male students”
- Moss-Racusin et al 2012 PNAS
Study: Gender Bias

- Women need to publish more to receive the same peer-review rating as a man
  - 3 more papers in major journals or 20 more in minor journals
Ways to keep women in science and engineering

• Recruitment
  • Encourage more women to enter STEM fields
  • Project Awesome (http://awesome.soe.ucsc.edu/)

• Retention
  • Mentoring
  • “Stop the clock on tenure”
  • test for unconscious bias

• Realize myths
  • http://www.livescience.com/7349-top-5-myths-girls-math-science.html