Female Scientists and Engineers in the U.S.:
A Story of Change and Revitalization

Grace Series Lecture
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This is Me

My position
• A senior executive in the federal government – 1 of 7,500
• National Science Foundation (NSF)
• Division of Graduate Education (DGE)

My job
• Support innovation and transformation in STEM graduate education
  • Institutional change
  • Direct support of graduate students in STEM
  • *SFS at UT-Dallas since 2010; Graduate Research Fellows (7)*

My background
• Trained in civil engineering and science policy
• Career in statistics, survey methodology and science policy analysis
Barrier, Catalyst, Opportunity

**Barrier:**
a circumstance or obstacle that keeps people or things apart or prevents communication or progress

**Catalyst:**
a person or thing that precipitates an event

a substance that modifies and increases the rate of reaction without being consumed in the process

**Opportunity:**
A set of circumstances that makes it possible to do something
My Life in a Chart
Changes in the Scientific Workforce

1970s
- Disciplinary focus, work as an individual
- U.S. a world leader in higher education and attracting talent
- Predominantly U.S. citizen students and postdocs
- Public and private non-profit campus-based degree programs
- Mobility is limited (across disciplines, sectors, economies)
- Students predominantly white and majority male

2000s
- Greater interdisciplinary and team focus
- Growth in higher education abroad and increasing competition from other nations
- Increase in foreign students and foreign postdocs
- Growth of for-profit institutions and online programs
- Students move across disciplines, countries and institutions
- Greater racial/ethnic diversity and higher proportion of female students
## Women as a Percentage of the U.S. Population

<table>
<thead>
<tr>
<th>Category</th>
<th>1980/81</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women as a percentage of the U.S. Population</td>
<td>51%</td>
<td>51%</td>
</tr>
<tr>
<td>% of Women with bachelor’s degrees</td>
<td>50%</td>
<td>57%</td>
</tr>
<tr>
<td>(out of 935,000 degrees)</td>
<td></td>
<td>(out of 1,893,000 degrees)</td>
</tr>
<tr>
<td>% of Science and engineering bachelor’s degrees</td>
<td>45%</td>
<td>57%</td>
</tr>
<tr>
<td>(out of 438,000 degrees)</td>
<td></td>
<td>(out of 859,000 degrees)</td>
</tr>
<tr>
<td>% of <strong>Computer science bachelor’s</strong> degrees</td>
<td>33%</td>
<td>18%</td>
</tr>
<tr>
<td>(out of 15,000 degrees)</td>
<td></td>
<td>(out of 49,000 degrees)</td>
</tr>
<tr>
<td>% of <strong>Computer science master’s</strong> degrees</td>
<td>23%</td>
<td>30%</td>
</tr>
<tr>
<td>(out of 4,200 degrees)</td>
<td></td>
<td>(out of 29,000 degrees)</td>
</tr>
<tr>
<td>% of <strong>Computer science doctoral</strong> degrees</td>
<td>10%</td>
<td>22%</td>
</tr>
<tr>
<td>(out of 250 degrees)</td>
<td></td>
<td>(out of 1,900 degrees)</td>
</tr>
</tbody>
</table>

- All S&E occupations
- Computer and mathematical scientists
- Biological, agricultural, and environmental life scientists
- Physical scientists
- Social scientists
- Engineers
### US S&E Workforce: 25 M (degree or job in an S&E field)

Table 3-4
Educational background of college graduates employed in S&E occupations, by broad S&E occupational category: 2015
(Percent)

<table>
<thead>
<tr>
<th>Educational background</th>
<th>All S&amp;E occupations</th>
<th>Bio/agri/enviro life scientists</th>
<th>Computer and mathematical scientists</th>
<th>Physical scientists</th>
<th>Social scientists</th>
<th>Engineers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (number)</td>
<td>6,407,000</td>
<td>631,000</td>
<td>3,156,000</td>
<td>331,000</td>
<td>570,000</td>
<td>1,719,000</td>
</tr>
<tr>
<td>At least one S&amp;E degree</td>
<td>82.8</td>
<td>88.6</td>
<td>75.0</td>
<td>97.6</td>
<td>86.5</td>
<td>91.1</td>
</tr>
<tr>
<td>At least one S&amp;E degree in field</td>
<td>62.4</td>
<td>76.1</td>
<td><strong>44.8</strong></td>
<td>75.5</td>
<td>80.9</td>
<td>81.0</td>
</tr>
<tr>
<td>Highest degree in field</td>
<td>75.8</td>
<td>66.9</td>
<td><strong>40.6</strong></td>
<td>70.1</td>
<td>70.2</td>
<td>74.5</td>
</tr>
<tr>
<td>All degrees in S&amp;E</td>
<td>71.0</td>
<td>71.5</td>
<td>65.0</td>
<td>90.3</td>
<td>58.6</td>
<td>82.4</td>
</tr>
<tr>
<td>No S&amp;E degrees but at least one S&amp;E-related degree</td>
<td>4.3</td>
<td>5.7</td>
<td>4.4</td>
<td>1.5</td>
<td>2.5</td>
<td>4.6</td>
</tr>
<tr>
<td>No S&amp;E or S&amp;E-related degree but at least one non-S&amp;E degree</td>
<td>12.9</td>
<td>5.7</td>
<td><strong>20.6</strong></td>
<td>0.9</td>
<td>11.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>

25M – 6.4M – where are the rest of the S&E trained people?

Science and Engineering Indicators 2018
## Degree vs. Occupation

<table>
<thead>
<tr>
<th>Population</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed scientists and engineers <em>(Working in an S&amp;E occupation)</em></td>
<td>25.0 M</td>
</tr>
<tr>
<td></td>
<td><em>(6.4 M)</em></td>
</tr>
<tr>
<td>Job requires S&amp;E technical expertise</td>
<td>19.4 M</td>
</tr>
<tr>
<td>Job requires S&amp;E technical expertise in engineering, computer science, math or natural sciences</td>
<td>14.1 M</td>
</tr>
</tbody>
</table>

*Science and Engineering Indicators 2018*

**Opportunity**
Estimated salary differences between women and men with highest degree in S&E employed full time, controlling for selected characteristics, by degree level: 2015

- Total difference in full-time salary
- Controlling for education and employment
- Plus demographics and other characteristics

Barrier
Catalyst
Opportunity
The $\pi$-shaped Scientist/Engineer

Teamwork  Communication  Teaching  Leadership  Entrepreneurship

Interdisciplinary Training

Deep Disciplinary Knowledge

Computational Skills
Integration Across Domains
What characteristics define high-performing teams?

• Demographics?
  That’s a part of it

• Variety/Range
  • Perspectives
  • Skills
  • Abilities

Opportunity
My Life in a Chart

Barrier, Catalyst, Opportunity

O*NET

https://www.onetonline.org/