Longitudinal Support for Generational Change

Shua Sánchez

NSF Postdoctoral Fellow, Massachusetts Institute of Technology
Strain + X-rays in strongly-correlated quantum materials
DEI: Importance of directly mentoring students

9 Undergrad Lab Mentees:
- Between grad school and postdoc, I have mentored 9 undergraduates in my lab for at least 1 semester/summer and many for over a year.

Research and Mentoring Activities:
- Focus on building real skills, doing real projects.
- Crystal growth & optical characterization of quantum materials, nanofabrication (top picture)
- Group meeting talks, conference attendance, future publications, graduate program applications
- Continued mentoring relationship after our work together ends

Demographics:
- 7 students of color
- 3 male, 5 female, 1 nonbinary

Outcomes:
- 3 Physics PhD students
- 1 Electrical Engineering PhD student
- 2 STEM Masters degree program
- 3 still undergrads
US STEM workforce growing rapidly

From 2021 to 2031, STEM Occupations are Projected to Grow Faster Than Others

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Workers 2014</th>
<th>Number of Workers 2018</th>
<th>2028 Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and Mathematical</td>
<td>3,619,000</td>
<td>4,000,890</td>
<td>4,552,390</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>2,211,560</td>
<td>2,316,240</td>
<td>2,420,840</td>
</tr>
<tr>
<td>Life, Physical and Social Science</td>
<td>968,670</td>
<td>990,800</td>
<td>1,075,200</td>
</tr>
<tr>
<td>All STEM</td>
<td>6,799,230</td>
<td>7,307,930</td>
<td>8,048,430</td>
</tr>
</tbody>
</table>

Source: Bureau of Labor Statistics Employment Projections

smartasset
By 2032, over 50% of all 18 year olds in this country will be nonwhite.

Physics has to become more diverse, or it has to become smaller.

Live births by race/ethnicity, United States, 1965-2017, estimated:

Among newborns, minorities slightly surpass non-Hispanic whites

Note: Minority includes all race and ethnic groups except single-race non-Hispanic white. Data for 2010 are as of April 1; for other years, data are as of July 1. Source: U.S. Census Bureau 2015 population estimates

CDC data aggregate
Racial/Ethnic Disparities in Physics

US pop. vs Physics PhD rates
- 15% vs (2%) Black
- 21% vs (5%) Hispanic
- 72% vs (80%) White

NOT a problem that will fix itself!

Source: IPEDS, US Census, and APS
Minorities vs Whites:
• lower-income background
• More student loan debt
• Primary care-taker of family member
• Less cultural familiarity with academia/research
• Brilliant minority students often pursue engineering and medicine

https://www.brookings.edu/blog/up-front/2020/02/27/examining-the-black-white-wealth-gap/
My success: Hard work + $$$ + Mentoring

• B.S. Physics at University of Wisconsin
  • 4-year academic scholarship
  • 2-year NSF undergraduate research fellowship

• PhD at University of Washington
  • 1-year Clean Energy Institute fellowship
  • 1-year DOE fellowship.

• Postdoc at Massachusetts Institute of Technology
  • 3-year NSF fellowship (MPS-Ascend Fellow)

• Strong mentoring aspects of these fellowships!
Bridge Programs Succeed in Diversifying Physics: Opportunities + $$$ + Mentoring

<table>
<thead>
<tr>
<th>Programme</th>
<th>Year founded</th>
<th>Student entry point</th>
<th>Number of institutions</th>
<th>Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisk-Vanderbilt</td>
<td>2004</td>
<td>Master’s</td>
<td>2</td>
<td>Astronomy, Physics and Material Science, Biology, Chemistry</td>
</tr>
<tr>
<td>Columbia</td>
<td>2008</td>
<td>Post-baccalaureates</td>
<td>1</td>
<td>Multiple science and engineering fields and economics</td>
</tr>
<tr>
<td>APS Bridge</td>
<td>2013</td>
<td>Master’s</td>
<td>6 out of &gt;25*</td>
<td>Physics (including Astronomy in Physics PhD programmes)</td>
</tr>
<tr>
<td>Cal-Bridge</td>
<td>2014</td>
<td>Undergraduate</td>
<td>25</td>
<td>Physics and Astronomy</td>
</tr>
</tbody>
</table>

*Six programmes are APS Bridge Program sites. More than 25 are APS Bridge Program partnership institutions, which do not have the same processes of vetting or expectations of programming as the original bridge sites.

Proposal: Longitudinal support of undergrads

Single-Summer REU/
Single-Semester Lab Position
• Light investment in many students
• Possible limited contact after REU
• Not enough time to build strong skills or strong relationships
• No financial security over multiple years, have to think about funding constantly

Multi-summer REU/
Multi-year Lab Position
• Heavily invest in 1 student
• Support them from undergrad into grad school.
• Build stronger lab skills and mentoring relationships
• Student feels like they belong in STEM, keeps them in the field!
UW Clean Energy Institute: OUR Award

• Clean Energy Bridge to Research (CEBR) Program
• Focus on women and minority students

• Outstanding Undergraduate Research (OUR) Award: New multiyear undergraduate REU award
• Allows a CEBR student to return for multiple summers to continue working in the same lab
• Build stronger skills and relationships with mentors
• Longterm financial support for a single student
What will you do to help the next generation of diverse Physicists?