
Diverse approaches for diverse thinkers


Biases, conscious or unconscious, are learned social stereotypes that have real effects in the workplace. This series explores individual, organizational and societal factors that influence the intersection of diversity, equity and inclusion. Participants will be challenged to examine their assumptions, increase their awareness, and consider the impact of their actions and inactions. This series is designed to provide practical tools and resources that interrupt bias and promote workplace inclusion.

Fermilab U.S. Department of Energy Office of Science
APS Bridge Program: Changing the Face of Physics / IGEN: Bridge Program – TNG

Theodore Hodapp
IGEN Director
APS Director of Project Development
8.2 JOINT DIVERSITY STATEMENT
(Adopted by Council on November 16, 2008)
To ensure a productive future for science and technology in the United States, we must make physics more inclusive. The health of physics requires talent from the broadest demographic pool. Underrepresented groups constitute a largely untapped intellectual resource and a growing segment of the U.S. population.

Therefore, we charge our membership with increasing the numbers of underrepresented minorities in physics in the pipeline and in all professional ranks, with becoming aware of barriers to implementing this change, and with taking an active role in organizational and institutional efforts to bring about such change. We call upon legislators, administrators, and managers at all levels to enact policies and promote budgets that will foster greater diversity in physics. We call upon employers to pursue recruitment, retention, and promotion of underrepresented minority physicists at all ranks and to create a work environment that encourages inclusion. We call upon the physics community as a whole to work collectively to bring greater diversity wherever physicists are educated or employed.
Hispanic American Bachelor Degrees

US College-Age Hispanic Population

- Biology
- Chemistry
- Engineering
- Earth Science
- Physics
- Math and Stats

Source: IPEDS, US Census, and APS
African American Bachelor Degrees

US College-Age Black Population

- Biology
- Chemistry
- Engineering
- Math & Stats
- Physics
- Earth Sciences

Source: IPEDS, US Census, and APS

©2019, American Physical Society; Email: hodapp@aps.org
Underrepresented Minority (URM) Physics degrees

Only ~35 students!

Source: IPEDS, US Census, and APS
Problem in all Disciplines
Bridge Components can Solve

- **Comp. Sci.**
  - BS: 91
  - PhD: 374
  - Problem: 10%

- **Bio. Sci.**
  - BS: 112
  - PhD: 203
  - Problem: 14%

- **Chem.**
  - BS: 203
  - PhD: 63
  - Problem: 12%

- **Eng.**
  - BS: 63
  - PhD: 36
  - Problem: 16%

- **Math/Stat.**
  - BS: 36
  - PhD: 6
  - Problem: 6%

- **Phys.**
  - BS: 6
  - PhD: 16
  - Problem: 2%

- **Astro.**
  - BS: 16
  - PhD: 6
  - Problem: 0%

- **Geosci.**
  - BS: 6
  - PhD: 16
  - Problem: 20%
Leadership / Oversight

National Advisory Committee
- Emilio Codecido (OSU, Grad student)
- J.D. Garcia (Arizona)
- Yolanda George (AAAS)
- Wendell Hill (UMCP)
- Renee Horton (NSBP)
- Anthony Johnson (Chair, UMBC)
- Ramon Lopez (UT Arlington)
- James Mathis (UM, Grad student)
- Steve McGuire (Southern University)
- Jesús Pando (NSHP)
- Ritchie Patterson (Cornell)

Funding
- NSF
- APS
- Bridge sites

Architect’s Council
- Marcel Agüeros (Columbia)
- Ed Bertschinger (MIT)
- Andreas Bill (CSU Long Beach)
- Simon Capstick (Florida State)
- Kelly Holley-Bockelmann (Fisk/Vanderbilt)
- Cagliyan Kurdak (Michigan)
- Maria Womack (USF)
- Jon Pelz (Ohio State)
- Talat Rahman (UCF)
- Jon Urheim (Indiana)

Research / Assessment
- Deepa Chari (FIU-Postdoc)
- Geoff Potvin (FIU-Research advisor)
- Rachel Scherr (SPU-Project evaluator)
- Geraldine Cochran (Rutgers-Researcher)

This material is based upon work supported by the National Science Foundation under Grant No. 1143070. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Bridge Program: Key Features

• **Recruit** students from entire country (application aggregation)

• **Establish** Bridge Sites (6):
  • Identified first universities that would commit to close attention to Bridge students through:
    • Induction into graduate student community / life / expectations
    • Constellation mentoring
    • Flexible curricula to prepare student for graduate coursework
    • Progress monitoring
    • Financial support.

• **Certify** Partnership Institutions (39):
  • APS Committee on Minorities reviews applications from physics graduate programs to ensure proper support for Bridge Students
  • Approved Partnership Institutions gain access to Bridge Student applications

• **Monitor** student / site progress

• **Research**

• **Disseminate / Advocate**
APS Bridge Program
Member and Partner Institutions

Member Institutions
• 143 in 38 states

Partnership Institutions
• 39 in 18 states
  ▪ 32 PhD
  ▪ 7 MS

[Map showing APS Bridge Sites, APS Partnership Institutions & Previous Bridge Sites, and APS Member Institutions]
Bridge Program Achievements

**Bridge Program**

**All Physics PhDs**
- 23% Women (20%)
- 93% URM (6%)
  - 64% Hispanic
  - 24% African American
  - 5% Native
- 87% Retention (60%)

**168 Students making progress toward PhDs**

- All traditionally excluded
| Institution                | Students | | Institution      | Students |
|---------------------------|----------|----------------|-------------|
| Central Florida           | 24       | Auburn         | 2           |
| Ohio State                | 18       | Connecticut    | 2           |
| Florida State             | 17       | DePaul         | 2           |
| Fisk-Vanderbilt           | 14       | Duluth         | 2           |
| **CSULB**                 | **13**   | Embry-Riddle   | **2**       |
| South Florida             | 12       | IIT            | 2           |
| Houston Clear Lake        | 11       | TAMU-Commerce  | 2           |
| **Indiana**               | **10**   | UNC-Chapel Hill| 2           |
| Cincinnati                | 8        | UCLA           | 2           |
| CSULA                     | 7        | UIUC           | 2           |
| Virginia                  | 6        | Bryn Mawr      | 1           |
| Alabama                   | 3        | **Central Michigan** | 1 |
| Bowling Green             | 3        | Columbia       | 1           |
| Chicago                   | 3        | Dartmouth      | 1           |
| Princeton                 | 3        | Delaware State | 1           |
| Rochester                 | 3        | Harvard        | 1           |

**Bridge Sites**

MS-Granting
1. Aggregating applications is a powerful tool
2. Admissions data are not what they seem
   a. GRE is a big factor
   b. Students’ perceptions are different than faculty
3. Applications are expensive
4. Importance of graduate student groups
Physics GRE: Impact of Cutoff Scores

- Fraction (White)
- Fraction (Hispanic)
- Fraction (Black)
- Fraction (Asian)

- 0.61 (Asian)
- 0.44 (White)
- 0.34 (Hispanic)
- 0.09 (Black)
Physics GRE:
Impact of Cutoff Scores

Source: ETS

- Fraction (F): 0.25
- Fraction (M): 0.46

Score: 650
Physics GRE "Correlation" with Grad GPA

$r = 0.24; N = 1686$

“Weak” Correlation
Use of Graduate Record Exam

Are GRE scores (quantitative, verbal, written, or physics subject) used as a minimum cutoff in admissions decisions?
• 32% indicate yes

How are GRE scores (quantitative, verbal, written, and physics subject in particular) being used in the admissions process?
• There is widespread (but not universal) use of GRE cutoffs:
  • “a rough cutoff”
  • “preferable score”
  • “as a first cutoff”
  • “No fixed cutoff, but GRE quantitative should be about 90 percentile or higher.”
  • “No hard cutoff, but used as a first cut in going through applications and GRE scores trump GPA scores in assessing students.”
• Lower NRC-ranked departments were more likely to use cutoff scores
Issues Facing Diversification

How are considerations of diversity (race/ethnicity, gender) accounted for in admissions decisions, if at all?

• Many programs report little success towards dealing with underrepresentation:

  • “Unlike the male/female situation, we are not very successful in recruiting underrepresented minorities. If we find a candidate, we find a fellowship. The numbers are just not there in our pool.”
Research Efforts

• Graduate admissions
  • Doctoral institutions (Phys. Rev. PER 13, 020142 (2017))
  • Master’s institutions (Phys. Rev. PER 15, 010104 (2019))

• Admissions data (GRE, GPA, etc.):
  • Correlations with success; diversity impact (Science Advances 5, 10.1126 (2019))

• Holistic admissions practices:
  • Use of non-cognitive measures and other techniques by physics graduate admissions faculty (Phys. Rev. PER 13, 020133 (2017))

• Student perspectives
  • Barriers to admissions (PERC, 10.1119/perc.2017.pr.018)
  • On admissions (in preparation)
  • In bridge programs (in preparation)
Michelle Lollie is an American Physical Society Bridge Fellow at Indiana University in Bloomington.

African Americans, Hispanic Americans and Native Americans make up about one-third of university-age citizens in the United States. Yet less than 1% of bachelor’s degrees in physics are awarded to people from these groups. At the doctoral level it is even worse, with only about 7% of physics PhDs granted to US citizens from racial and ethnic minority groups—just 60–70 students each year. This is one of the lowest rates in the sciences. Chemistry, by comparison, awards 17% of bachelor’s and 11% of doctoral degrees to these groups (see ‘Doctoral dearth’). The proportion in physics has barely risen over the past 15 years, while the percentage of US university-age students from minorities has grown by 16%.

This is morally questionable and dangerous from a practical point of view. The discipline of physics, and society as a whole, are missing out on talent. Students are often judged on the prestige of their undergraduate institution or the preparation they received at school, rather than on what really matters: their aptitude, drive and ingenuity.

Physicists cannot fix all of society’s ills, but the community can and must provide more equitable pathways into research. This does not mean lowering the bar, but showing students where it is and helping them to find their way over it.

For the past five years, the American Physical Society (APS) has been taking the first steps by working with physics departments across the United States to balance the doctoral and bachelor’s graduation rates for under-represented students. Given that the numbers of students are small, interventions at a limited number of universities can drastically change the landscape. To effect this change, the APS has directed resources to overcoming admissions barriers and ensuring that graduate programmes where students are admitted have adequate support to help them remain on track. These support structures benefit all students.

The APS Bridge Program (funded in part by the US National Science Foundation) also provides faculty members to consider and recruit graduate students from under-represented minorities whom they think would do well in a doctoral programme but who, for whatever reasons, have not been able to remain on track. The APS Bridge Program is helping to recruit and retain PhD students from under-represented minorities.

The APS Bridge Program is enhancing diversity in graduate education. Making physics more inclusive: Theodore Hodapp and Erika Brown explain how the American Physical Society is helping to recruit and retain PhD students from under-represented minorities.

More Info

Nature Comment published May 2018

• Recommendations:
  • Re-think admissions
  • Provide a supportive culture
  • ACS, AGU, AAS, MRS should also do this

House Resolution

• Supporting APS Bridge Program
NSF INCLUDES

- Future of Work
- Growing Convergence Research
- Harnessing the Data Revolution
- Mid-scale Research Infrastructure
- Navigating the New Arctic
- NSF 2026
- NSF INCLUDES
  - Quantum Leap
  - Understanding the Rules of Life
  - Windows on the Universe
Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science

Broadening Participation in STEM at scale

- National Alliances (5, up to $10M) (2018)
- Coordination Hub (1) (2018)

INCLUDES RFP example of national objectives that have potential for scaling: “a disciplinary organization launches a major initiative designed to significantly improve the diversity of PhD graduates in that discipline”
• **Bridge**: Increase the fraction of students from underrepresented groups who complete doctoral degrees in the physical sciences to match the levels of undergraduate degrees awarded.

• **Inclusive Practices**: Catalyze the adoption of evidence-based inclusive practices, especially in graduate education, that reduce inequities in doctoral completion for underrepresented groups and benefit all students.

• **Research**: Conduct research and propagate results that distill scalable, effective practices in inclusive graduate education and institutional change within the physical sciences.

• **Transitions**: Establish sustained, cross-sector partnerships within and among critical stakeholders that support the advancement of underrepresented students from undergraduate through professional employment.
### IGEN: Project Partners

#### Major Partners
- American Physical Society
- American Chemical Society
- American Geophysical Union
- American Astronomical Society
- Materials Research Society

#### Cross-Cutting Hubs
- Inclusive Practices Hub (workshops, training local champions, national facilitators; RIT)
- Research Hub (graduate education; USC)

#### National Laboratories (CIMER)
- Los Alamos
- Argonne

#### Private Sector Corporations
- General Atomics
- IBM
- Intel Corporation
- Google
- Adding: Corning, ExxonMobil, …

- Lawrence Livermore
- Brookhaven
- FRIB
- Sandia
- Lawrence Berkeley
- MagLab
- NIST
- JPL
- Adding: FermiLab, INL, …
IGEN: Components

• Application aggregation expanded to all disciplines (chemistry in 2019, rest in 2020)
• Bridge Sites established in chemistry (starting 2019)
• Partnership Institutions established in other disciplines
• Establish and propagate resources and advocates to impact admissions and retention practices
• **Developing mentoring materials focused on National Lab environment, but applicable in other areas**
• Partnering with CIRTL for faculty development resources
• Research into critical factors impacting success
• **Establishing pathways to make professional opportunities available to graduates at National Labs and industry**
• Enhancing mentoring of undergraduates into graduate studies
• National advocacy through annual meetings (and other channels)
National Meeting: 25-27 Oct 2019, Orlando, FL

Questions

This material is based upon work supported by the National Science Foundation under Grant Nos. 1143070, 1641764, 1834540. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.