IGEN: Erasing Achievement Gaps in Doctoral Education

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Hispanic American Bachelor Degrees

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

Source: IPEDS, US Census, and APS
Underrepresented Minority (URM) Physics degrees

US Graduate-Age URM population

Source: IPEDS, US Census, and APS

Only ~35 students!
Problem in all Disciplines Bridge Components can Solve

- Comp. Sci.: 91 BS, 374 PhD
- Bio. Sci.: 112 BS, 112 PhD
- Chem.: 203 BS, 63 PhD
- Eng.: 63 BS, 36 PhD
- Math/Stat.: 36 BS, 6 PhD
- Phys.: 16 BS, 6 PhD
- Astro.: 6 BS, 6 PhD
- Geosci.: 16 BS, 6 PhD
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

• Design and Development Launch Pilots (~68, $300k) (2016, 2017)
• 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”
**Member Institutions**
- 143 in 38 states

**Partnership Institutions**
- 38 in 18 states
  - 31 PhD
  - 7 MS

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**APS Bridge Program**

**Member and Partner Institutions**

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[Map showing the locations of Member and Partnership Institutions across the United States]
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

URM PhDs reach same fraction as undergrad degrees

Students

2013 2014 2015 2016 2017 2018

No Longer Pursuing Physics PhD
Placed/Retained
Project Funded

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Physics GRE: Impact of Cutoff Scores

The graph shows the fraction of different ethnicities for various cutoff scores. The y-axis represents the fraction, and the x-axis represents the score range from 400 to 1000.

- **Fraction (White)**
  - 0.09 (Black)
  - 0.44 (White)
  - 0.61 (Asian)
  - 0.34 (Hispanic)

The graph indicates that the fraction of Black and Hispanic students decreases significantly below the cutoff scores of 650.
Physics GRE: Impact of Cutoff Scores

Source: ETS

- Fraction (F) at 650: 0.25 (F)
- Fraction (M) at 650: 0.46 (M)

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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
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.”
• **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
- Lawrence Livermore
- Brookhaven
- FRIB
- Sandia
- Lawrence Berkeley
- MagLab
- NIST
- JPL
- Adding: FermiLab, INL, …

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

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