The APS Bridge Program: Changing the Face of Graduate Education

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Percentage of Women in Physics

Enhancing Diversity in Graduate Education

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Percentage of Women in Physics

Sources: NCES/IPEDS, AIP-SRC, HERI
Underrepresented Minority (URM) Physics degrees

Only ~30 students!

Source: National Center for Education Statistics, US Census, and APS
URM Bachelor and PhD STEM Degrees

Percentage of URM

- Computer Science: 78, 63
- Biological Sciences: 639, 161
- Chemistry: 161, 386
- Engineering: 386, 61
- Mathematics and Statistics: 61, 63
- Physics: 63, 6
- Astronomy: 6, 5

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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)
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• Ritchie Patterson (Cornell)

Architect’s Council
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• Cagliyan Kurdak (Michigan)
• Garrett Matthews (USF)
• Jon Pelz (Ohio State)
• Talat Rahman (UCF)
• Jon Urheim (Indiana)

Research / Assessment
• Deepa Chari (FIU-Postdoctoral Assoc.)
• Geoff Potvin (FIU-Research advisor)
• Rachel Scherr (SPU-Project evaluator)

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Bridge Program Design: Underlying Themes

- Focus on underrepresented racial/ethnic minorities (Hispanic American, African American, Native American)
- Based on published scholarship and operational successes of similar programs
- Avoid “rearranging the deck chairs”
- Measurable outcomes, easily recognizable by an APS member as having significant value
- Significant national impact
APS Bridge Program: Key Features

• **Recruit** students through graduate programs (unaccepted), undergrad programs (promising but uncompetitive, or unsure)

• **Establish** Bridge Sites (6):
  • Year 1: Grad or advanced undergraduate coursework, introduction to grad-level research, active mentoring, progress monitoring, social integration into grad school *(Project funds)*
  • Year 2: Take 1st year grad courses, apply to PhD program, research underway *(Department funds)*

• **Place** additional students at Partnership Institutions:
  • 65 graduate programs looked at “other” applications (2017), recruited additional students; No direct support, some travel
  • “APS Committee on Minorities approved” Partnership Institutions; national recognition of program

• **Monitor** student/site progress
• **Research**
• **Disseminate / Advocate**
Student Eligibility

• Bachelor’s degree in physics or closely related discipline
• US citizen or permanent resident
• Either:
  • Applied but was not accepted
  • Did not apply to graduate program this year
• Be committed to improving diversity in physics
• Meet individual requirements of the institution
• Students may not be currently enrolled in a graduate program

We review applications AFTER April 15
Institution Involvement

**Member Institution** (any institution, 134)
Free; receive information / updates; reduced fees for APS-BP conferences

**Partnership Site** (graduate only, 31)
APS COM approval process; recommended site for Bridge Fellows (and others) to attend; demonstrate effective practices in graduate student support

**Bridge Site** (graduate only, 6)
Receive significant funding from APS; build sustainable program; prepare 2+ students each year for graduate study; significant institutional commitment

**APS Bridge Partnership Sites**
*Bowling Green State University
*California State University Long Beach
*California State University, Los Angeles
Columbia University
Delaware State University
*DePaul University
Embry-Riddle Aeronautical University
Fisk-Vanderbilt
Florida International University
Florida State University
Illinois Institute of Technology
Indiana University
MIT
North Dakota State University
Ohio State University
Princeton University
*Texas State University
University of Central Florida
University of Chicago
University of Cincinnati
University of Connecticut
University of Hawai‘i at Manoa
*University of Houston Clear Lake
University of Michigan
University of North Carolina at Chapel Hill
University of Rochester
University of South Florida
University of Texas at Arlington
University of Texas, San Antonio
University of Virginia
*Wright State University
Member Institutions
• 134 in 38 states

Partnership Institutions
• 31 in 18 states
  ▪ 24 PhD
  ▪ 7 MS
Principles for Bridge and Partnership Institutions

• Admission decisions ("holistic" criteria)
• Financial support (timing)
• Coursework (induction advising critical, allow advanced undergrad courses, alternative plan)
• Progress monitoring (timing, tutors if needed)
• Multiple mentors (intervention, peer involvement)
• Research (appropriate match)
Bridge Program Achievements

Bridge Program Physics PhDs

- 23% Women (20%)
- 93% URM (6%)
  - 64% Hispanic
  - 24% African American
  - 5% Native
- 88% Retention (60%)

137 Students making progress toward PhDs
- All traditionally excluded

URM PhDs reach same fraction as undergrad degrees

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Where did the 46 students go (2017)?

- Bowling Green State University
- CSU Long Beach (2)
- CSU Los Angeles (4)
- Delaware State University (2)
- DePaul University
- Fisk-Vanderbilt University (3)
- Florida State University (6)
- Indiana University (2)
- Ohio State University (3)
- Texas A&M University, Commerce
- Texas State University
- University of Central Florida (4)
- University of Cincinnati (3)
- University of Connecticut
- University of Houston, Clear Lake (3)
- University of Kansas (2)
- University of Massachusetts Dartmouth
- University of Minnesota Duluth
- University of North Carolina, Chapel Hill
- University of Rochester
- University of South Florida (2)
- University of Virginia
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
Some reasons students are not admitted

Students:
• Low physics GRE score
• Apply to too few or wrong places
• “Feel” unprepared (self-esteem)
• Inadequate preparation: will fail in grad courses
• Application materials do not tell a predictive story
• Life intervenes

Admissions Committees:
• Members overwhelmed
• Members unaware of admissions research findings
Research Efforts

• **Graduate admissions**
  • Doctoral institutions (Phys. Rev. PER 13, 020142 (2017))
  • Master’s institutions (in preparation)

• **Admissions data (GRE, GPA, etc.):**
  • Correlations with student success; impact on diversity (submitted)

• **Holistic admissions practices:**
  • Use of non-cognitive measures and other techniques by physics graduate admissions faculty (parallel effort by CGS) (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)
Three studies

- Doctoral institutions (current practices):
  - 170 responses from 199 queries
  - Represents 85% of all functioning PhD departments

- Masters institutions (current practices):
  - 45 responses from ~50% of all MS programs

- Undergraduate students (perceptions on admissions):
  - 1031 responses (roughly 8000 BS graduates)
  - 25% women; 4% African American; 12% Hispanic
How important do you think the following criteria are for a successful graduate school application?

7-point scale running from “Least important” to “Most important”

- GPA/grades - general
- GPA/grades - physics/math
- Undergraduate courses taken
- Undergraduate institution type/reputation
- GRE quantitative scores
- GRE verbal scores
- GRE written scores
- GRE physics subject scores
- Letters of recommendation
- Reputation of recommenders
- Proximity/familiarity to department
- Personal statements
- Prior research experiences
- Prior publications
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.”
Admissions Scores Fail to Predict Success

- Study of 25 of the largest physics graduate programs
- Data from 42% of all programs >10 PhDs/year
- Data for all students matriculating between 2000 and 2010
- Records from ~13% of all PhD students (3962 students)
- Data includes GRE-P, GRE-V, GRE-Q, UG-GPA, Grad-GPS, demographics, ultimate disposition
- Looking for correlations between admissions measures and success
Physics GRE:
Impact of Cutoff Scores

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

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

Source: ETS

Fraction (F) vs. Fraction (M)

- 0.25 (F)
- 0.46 (M)

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Importance of shared physical space to student success (and building community):

[Student 1:] So, we have a floor where everybody taking the core courses sit, and everybody keeps their door open when they are in their office. So, I can just pop in and ask, “Hey, are you working on this?” So, yeah, it makes it a lot easier to interact with people in my class. And, I know there are few others who have changed their floor (laughs) and moved with us ...they were taking these core courses last semester and they did not do so well. So, those were kind of isolated earlier because nobody kind of goes down on that floor to meet with them.

The Bridge Program as a critical opportunity:

[Student 2:] Honestly, the best moment of being a bridge student was when I became one. I had applied to many schools, and I was rejected from every single one. Someone reminded me about this program; I had seen it a long time ago and I was like, yeah, I have this in my back pocket in case I need it. But, you know, I was so delusional when it came to graduate admissions because, you know, you forget that you are competing with students globally ...So, it was the most exciting time [when] ...I was selected.
Next Steps…

• Re-create process in chemistry, math, material science, astronomy, geosciences using collective impact
• Mentoring / tracking students into careers / postdoc positions
• In talks with ETS to change how they report GRE Scores
• Broader implementation of advances made by Bridge Program (admissions, induction, 1\textsuperscript{st} year support, peer and faculty mentoring)
• Spawning related research efforts in graduate education
• Interface with APS National Mentoring Community (www.aps.org/nmc)
• Planning joint Bridge Program / National Mentoring Community Meeting: 16-18 November 2018: Stanford/Google

Happy Physicists ⇒ Great Physics
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