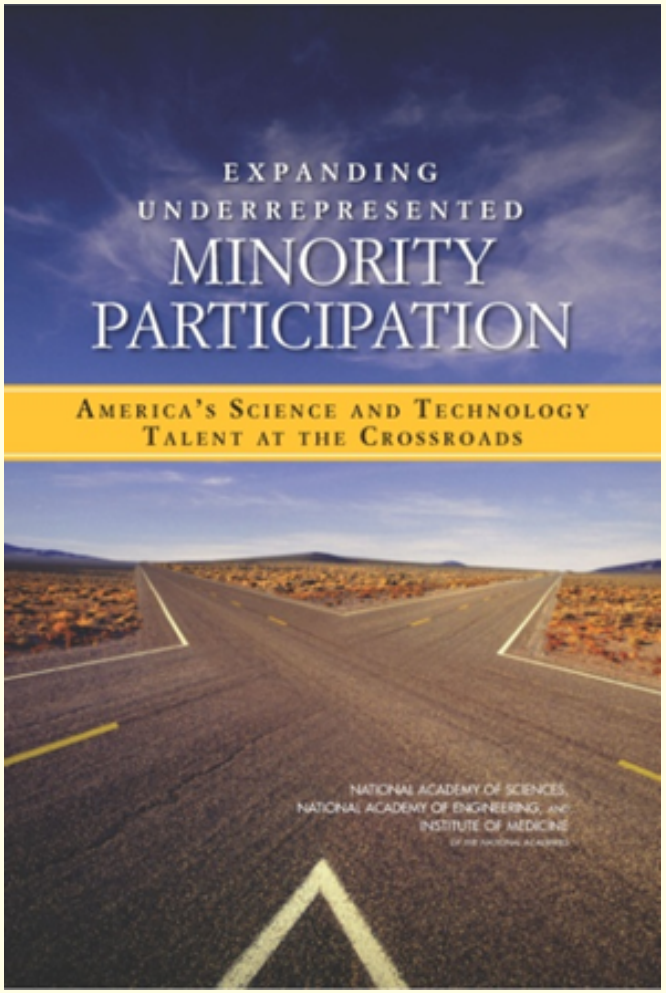
Expanding America's Science and Technology Pipeline: Academic Innovation and Inclusive Excellence

Peter H. Henderson
Senior Advisor to the President
University of Maryland, Baltimore County (UMBC)
June 27, 2013

The Birmingham Children's March

May 2, 1963

National Academies Report



Charge to the Committee

- Examine the role of diversity in the science, technology, engineering, and mathematics workforce and its value in keeping America innovative and competitive.
- Analyze the rate of change and the challenge the nation currently faces in developing a strong and diverse workforce.
- Identify best practices and the characteristics of these practices that make them effective and sustainable.
- Write a consensus report that provides a prioritized list of actionable recommendations across stakeholder groups.

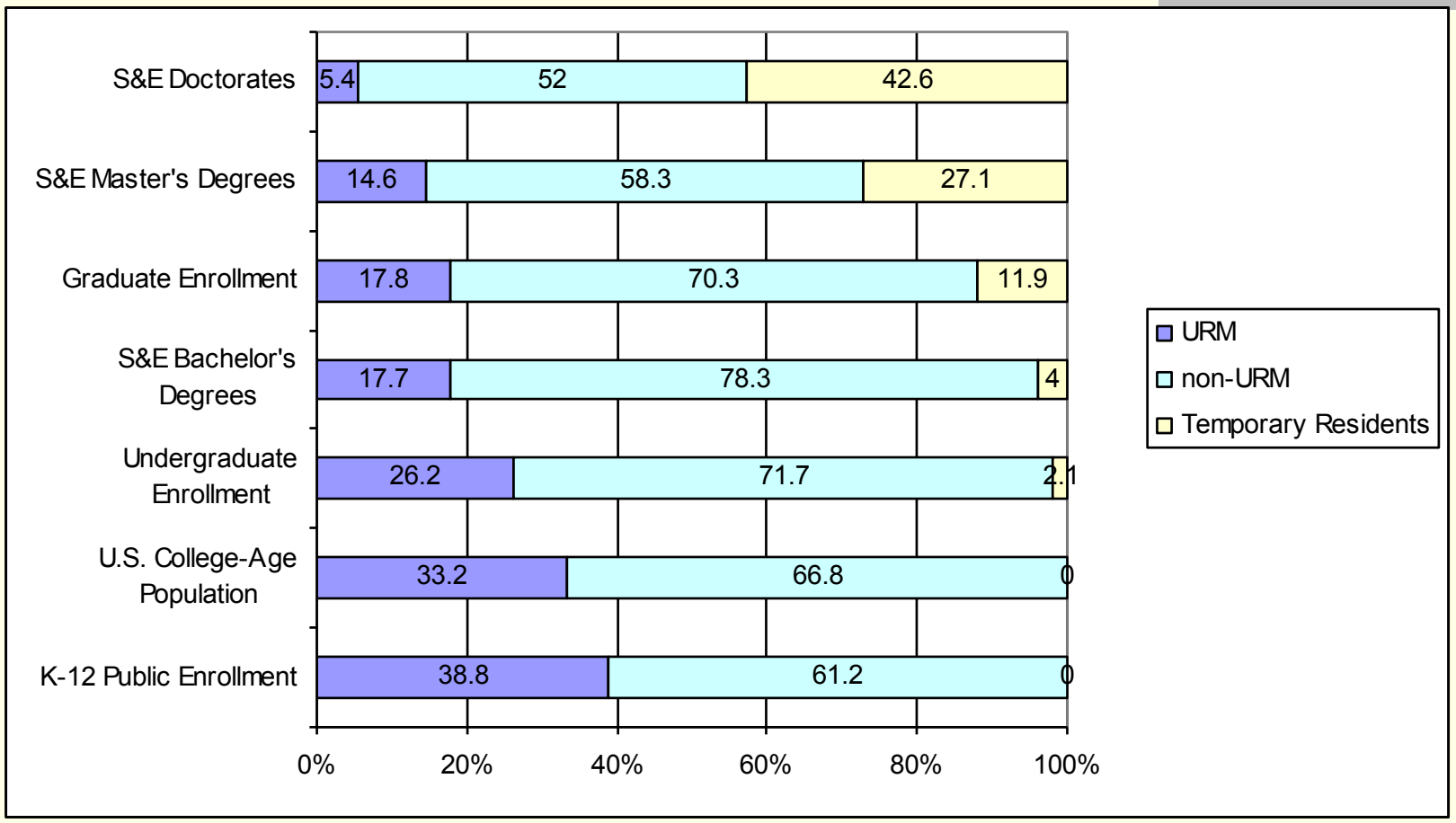
Committee Membership

- **Freeman Hrabowski,** Chair, University of Maryland, Baltimore County
- **James Ammons,** Florida A&M University
- **Sandra Begay-Campbell,** Sandia National Laboratories
- **Beatriz Chu Clewell,** The Urban Institute
- **Nancy Grasmick,** Maryland State Department of Education
- **Carlos Gutierrez,** California State University-Los Angeles
- **Evelyn Hammonds,** Harvard College
- **Wesley Harris** (NAE), Massachusetts Institute of Technology
- **Sylvia Hurtado,** Higher Education Research Institute, University of California Los Angeles
- **James S. Jackson** (IOM), Institute for Social Research, University of Michigan
- **Shirley McBay,** Quality for Minority Education Network
- **Diana Natalicio,** University of Texas El Paso
- **John Nemeth,** Oak Ridge Associated Universities
- **Eduardo Padron,** Miami Dade College
- **Willie Pearson,** Georgia Institute of Technology
- **Sidney Ribeau**, Howard University
- **John Slaughter** (NAE), NACME
- **Richard Tapia** (NAE), Rice University
- **Lydia Villa-Komaroff,** Cytonome, Inc.
- **Linda Sue Warner,** Haskell Indian Nations University

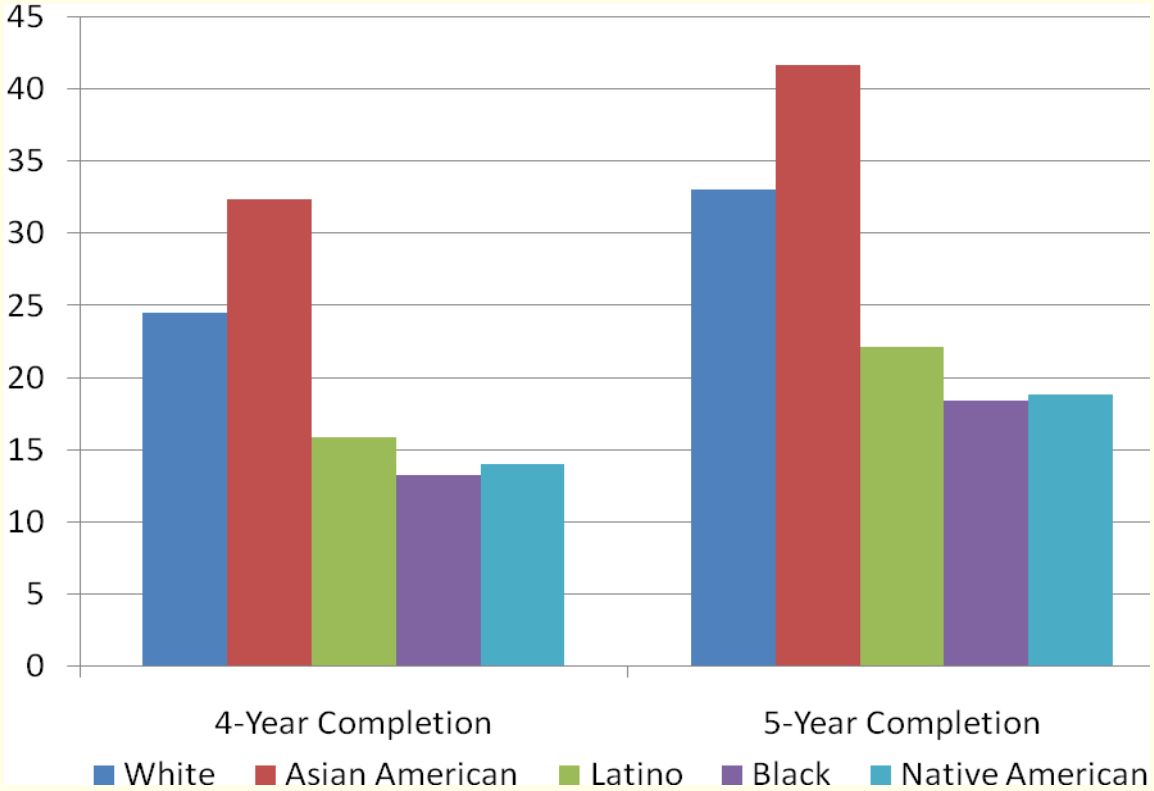
Why Broad Participation Matters

- U.S. sources for the S&E workforce are uncertain.
- The demographics of the U.S. population are shifting dramatically.
- The proportion of underrepresented minorities in S&E was less than a third of their share of the overall population in 2006.
- Underrepresentation of this magnitude in the S&E workforce stems from the underproduction of minorities in S&E at every level of the pathway.

Enrollment and Degrees, by Educational Level and Race/Ethnicity/Citizenship, 2007



Percentage of 2004 STEM Aspirants Who Completed STEM Degrees in Four and Five Years, by Race/Ethnicity



SOURCE: University of California Los Angeles Higher Education Research Institute

Postsecondary Attainment

- Calls to increase U.S. postsecondary completion rate from 39 to 55 or 60 percent. A challenge for minorities. In 2006, percent of 25-34-year old cohort w/ at least AA degree:
  - 26 percent of African Americans
  - 24 percent of Native Americans/Pacific Islanders, and
  - 18 percent of Hispanics … with at least AA degree

STEM Attainment

- Worse news for STEM. Gathering Storm says increase U.S. percentage of 24-year olds who earn a first degree in NS&E from 6 to at least 10 percent. Minorities would need to triple, quadruple, or even quintuple their proportions in order to achieve this 10 percent goal:
  - 2.7 percent of African Americans
  - 3.3 percent of Native Americans
  - 2.2 percent of Hispanics and Latinos

Policy Principles

1. The problem is urgent and will continue to be for the foreseeable future.

2. A successful national effort to address underrepresented minority participation and success in STEM will be sustained.

3. The potential for losing students along all segments of the pathway from pre-school through graduate school necessitates a comprehensive approach that focuses on all segments of the pathway, all stakeholders, and the potential of all programs, targeted or non-targeted.

Policy Principles - 2

4. Students who have not had the same level of exposure to STEM and to postsecondary education require more intensive efforts at each level to provide adequate preparation, financial support, mentoring, social integration, and professional development.

5. A coordinated approach to existing federal STEM programs can leverage resources while supporting programs targeting institutions (esp. MSIs) with demonstrated success in preparing and advancing URMs in STEM.

6. Evaluation of STEM programs and increased research on the many dimensions of underrepresented minorities' experience in STEM help insure that programs are well informed, well designed, and successful.

Recommendations

Preparation

- **1**. Pre-School through Grade 3 Education: *Develop reading readiness, provide early mathematics skills, and introduce concepts of creativity and discovery.*

- **2**. K to 12 Mathematics and Science: *Vastly improve K-12 mathematics and science education for URMs.*

- **3**. K-12 Teacher Preparation and Retention: *Improve the preparedness of K-12 mathematics and science teachers.*

Recommendations

Postsecondary Success

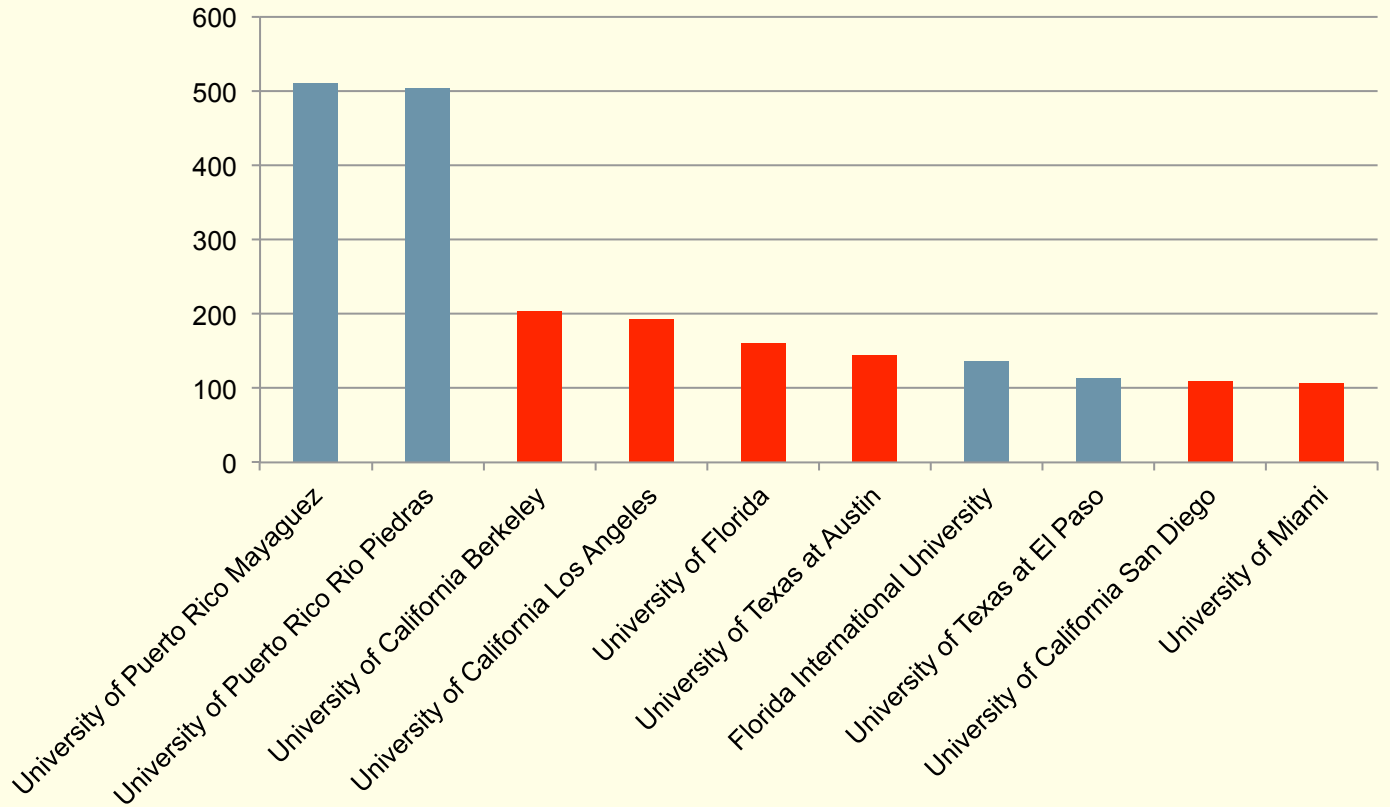
- 4. Access and Motivation: *Improve access to postsecondary education and technical training and increase URM student awareness of and motivation for STEM education and careers.*
- 5. Affordability: *Provide adequate financial support to URM undergraduate and graduate students.*
- 6. Academic and Social Support: *Transform the nation's higher education institutions to increase inclusiveness and college completion and success in STEM for URM students.*

Priority 1

Undergraduate Retention and Completion

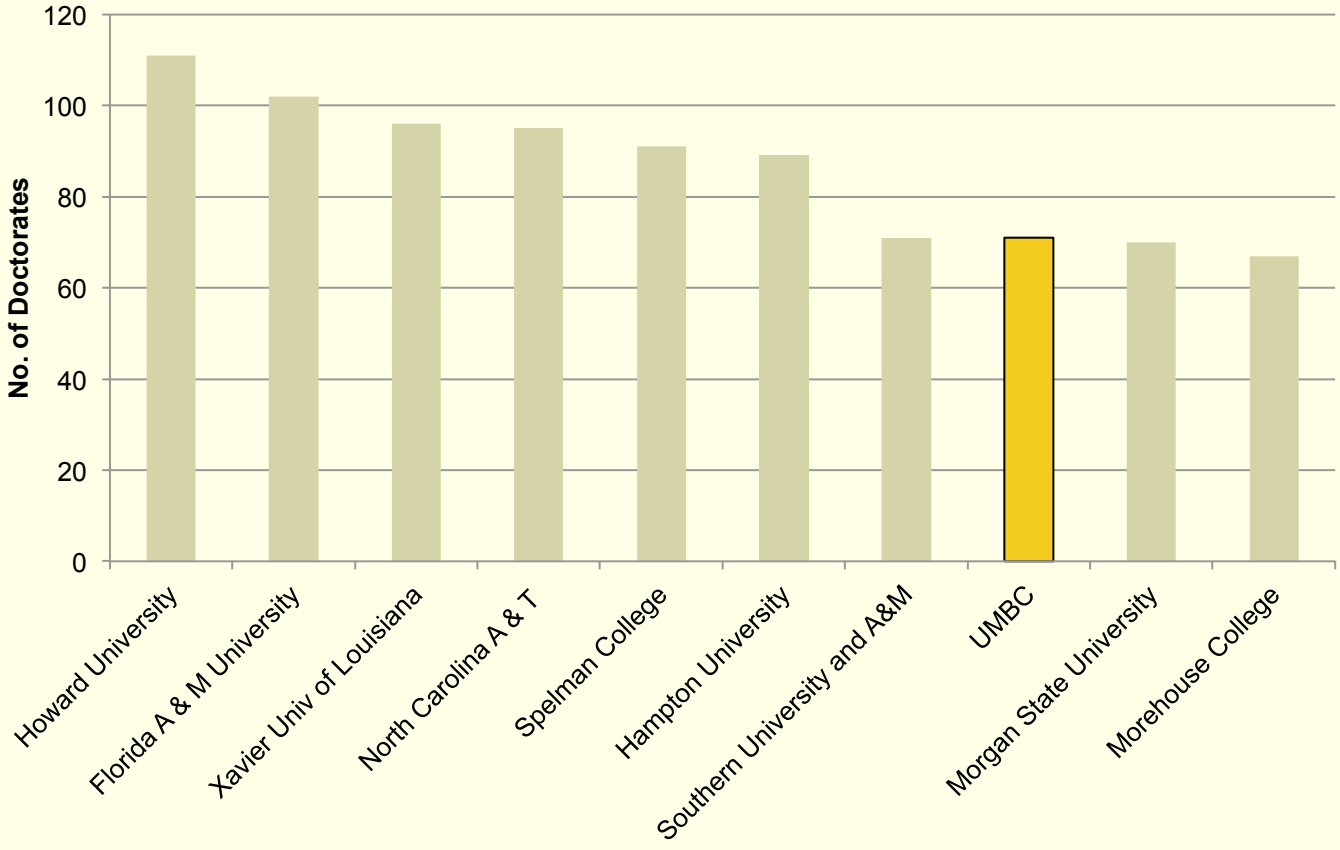
- We propose, as a near-term focus for increasing the participation and success of underrepresented minorities in STEM, programs that increase undergraduate completion through strong academic, social, and financial support.
- Financial support for underrepresented minorities that allows them to focus on and succeed in STEM will increase completion and better prepare them for the path ahead.
- This financial assistance should be provided through higher education institutions along with programs that simultaneously integrate academic, social, and professional development.

Top 10 baccalaureate-origin institutions of 2002–11 Hispanic S&E doctorate recipients



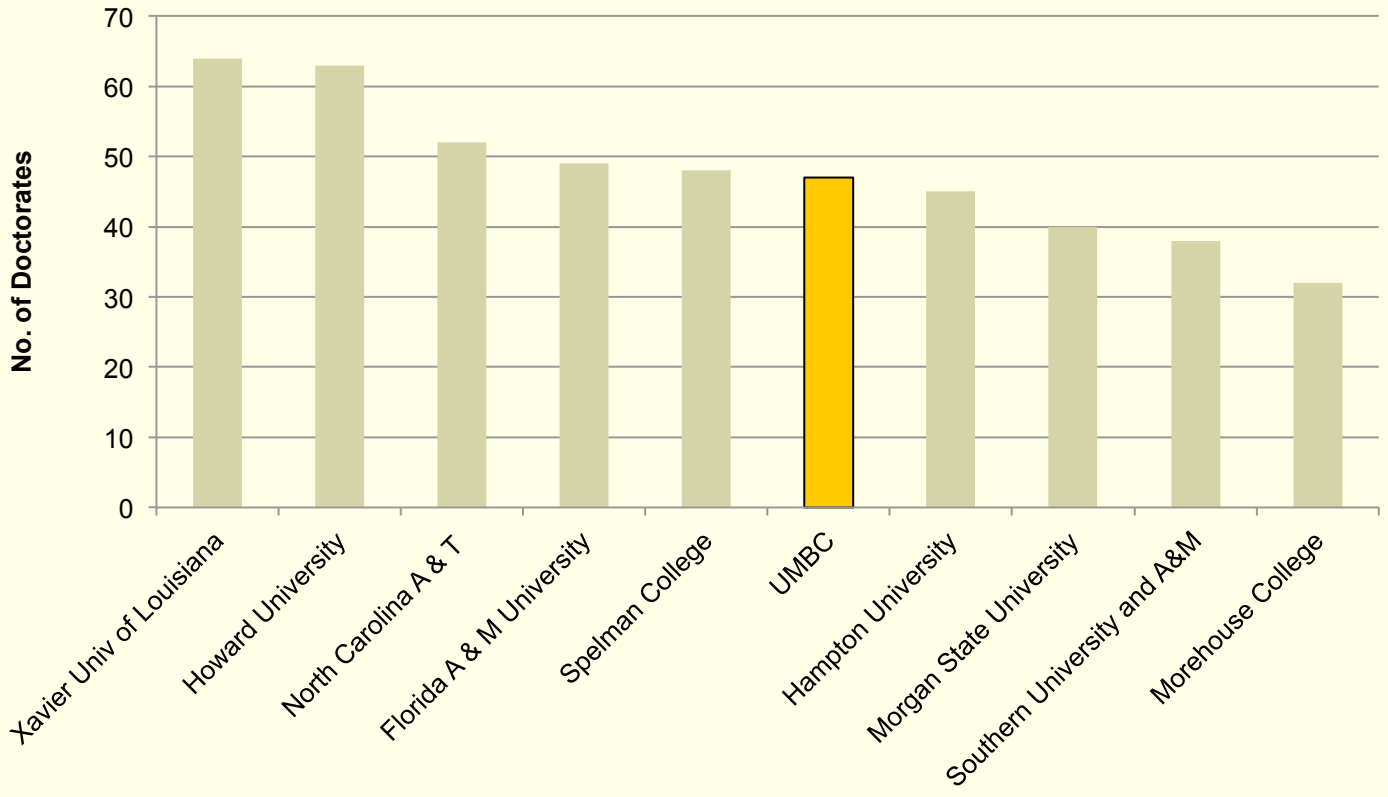
SOURCE: NSF, National Center for Science and Engineering Statistics

Top 10 Baccalaureate-Origin Institutions of 2002-2011
Black Natural Sciences & Engineering Doctorate Recipients



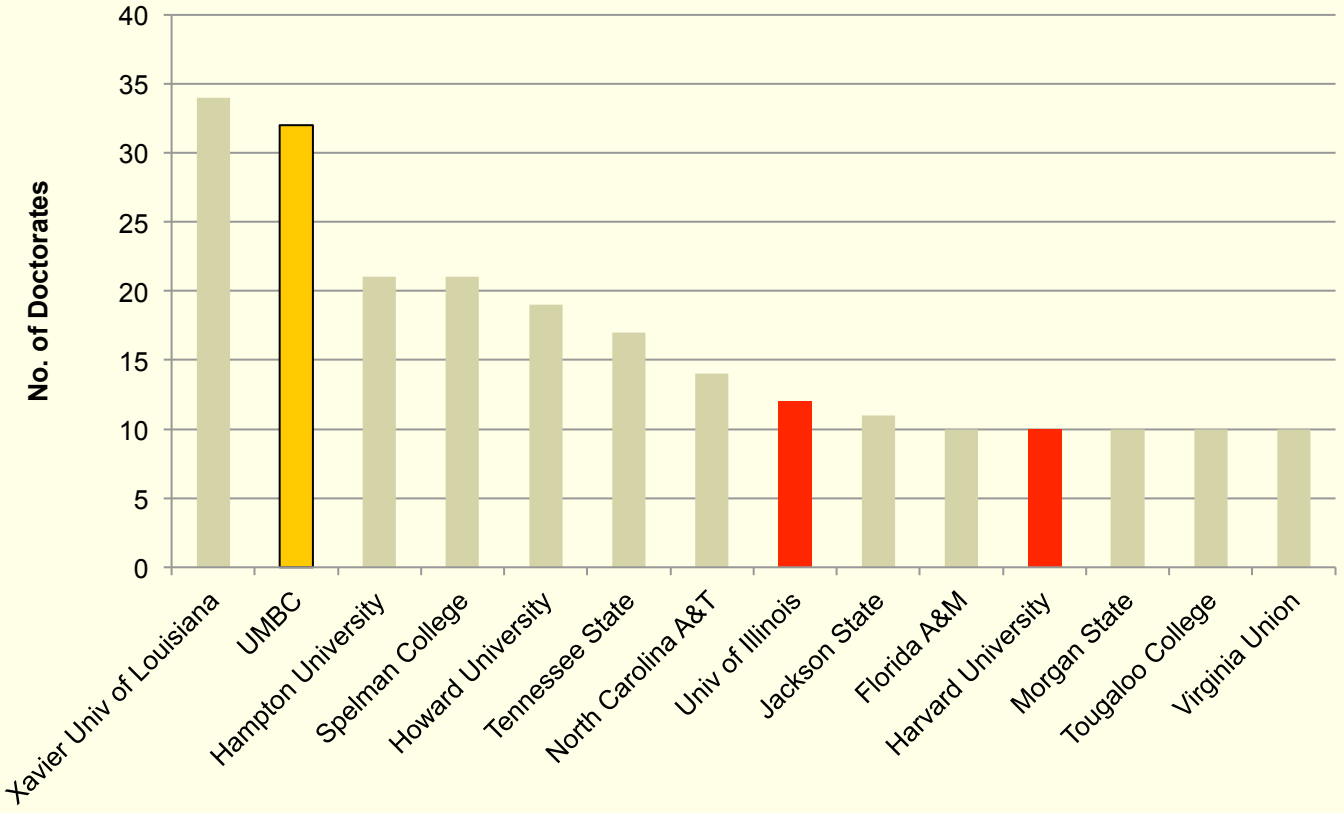
SOURCE: NSF, National Center for Science and Engineering Statistics

Top 10 Baccalaureate-Origin Institutions of 2007-2011 Black Natural Sciences & Engineering Doctorate Recipients



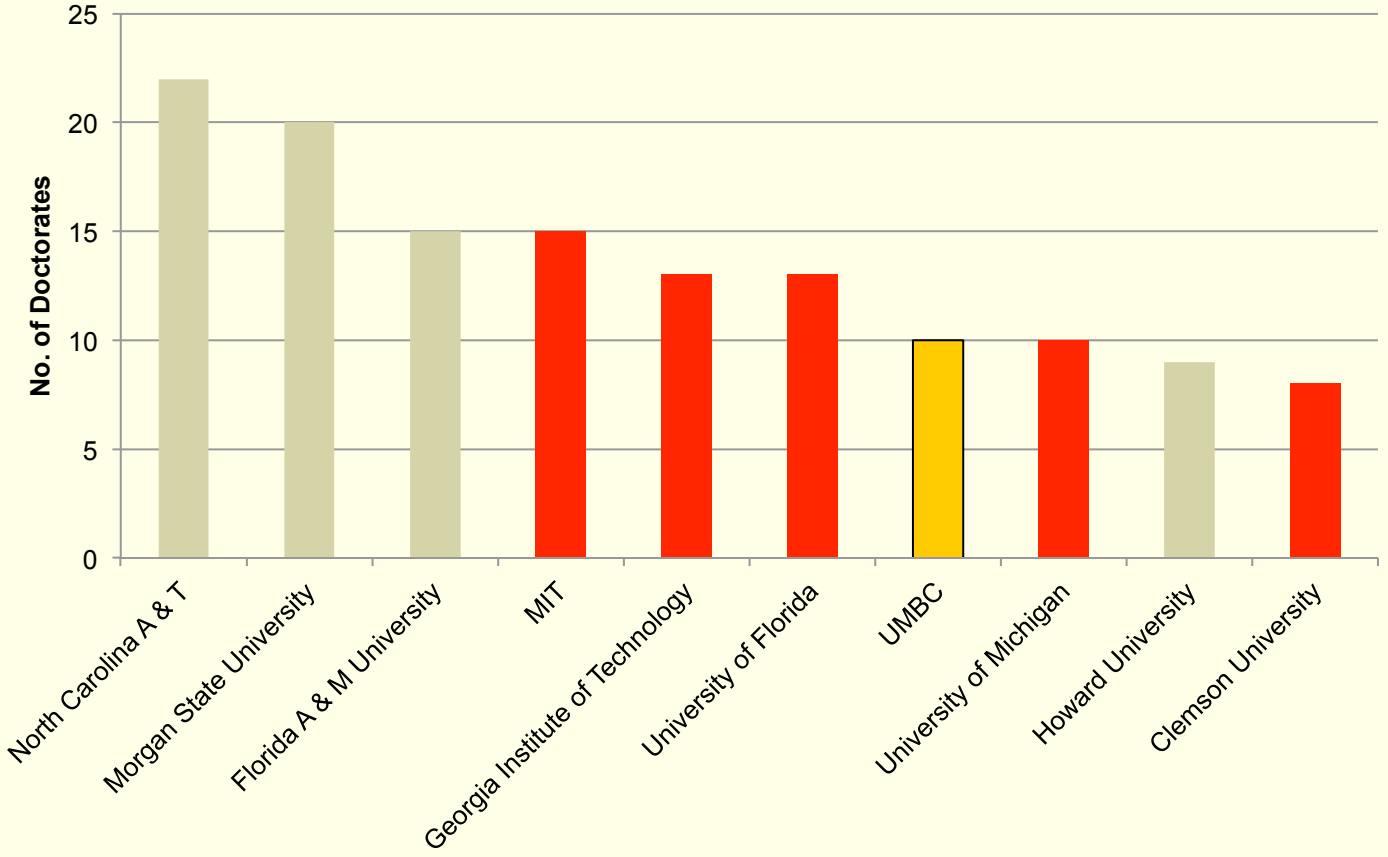
SOURCE: NSF, National Center for Science and Engineering Statistics

Top Baccalaureate-Origin Institutions of 2007-2011 Black Biological Sciences Doctorate Recipients



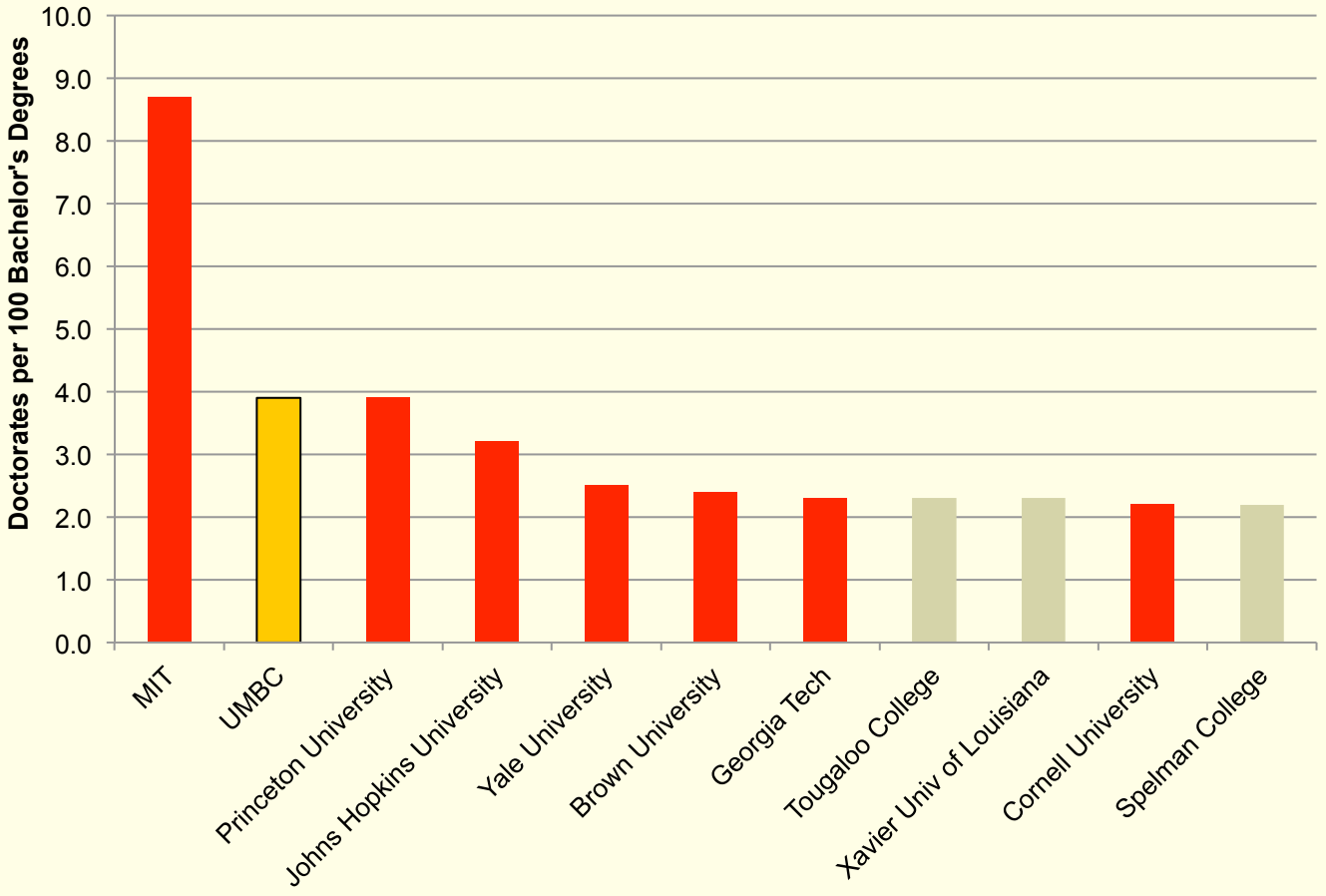
SOURCE: NSF, National Center for Science and Engineering Statistics

Top 10 Baccalaureate-Origin Institutions of 2007-2011 Black Engineering Doctorate Recipients



SOURCE: NSF, National Center for Science and Engineering Statistics

Top Baccalaureate-Origin Institutions of 2002–11 Black NS&E Doctorate Recipients, By Institutional-yield Ratio for black S&E doctorate recipients



SOURCE: NSF, National Center for Science and Engineering Statistics

UMBC: Meyerhoff Program

1. RECRUITMENT OF TOP STUDENTS
2. SCHOLARSHIP SUPPORT
3. SUMMER BRIDGE PROGRAM
4. PROGRAM VALUES & PROGRAM COMMUNITY
5. FACULTY INVOLVEMENT
6. ADMINISTRATIVE INVOLVEMENT & PUBLIC SUPPORT
7. FAMILY INVOLVEMENT
8. MENTORS
9. PERSONAL ADVISING AND COUNSELING
10. STUDY GROUPS
11. TUTORING
12. SUMMER RESEARCH INTERNSHIPS
13. COMMUNITY SERVICE
14. EVALUATION

Outcomes for Students

- Opportunity to compare educational outcomes of Meyerhoff Scholars to those who declined:
  - Significantly higher GPA
  - Twice as likely to persist on graduate in STEM
  - Five times as likely to go on for a Ph.D.
  - Many hold faculty positions in Ivies, Big Ten, and beyond
  - Replication: Duke, Cornell, Michigan, Colby, Morehouse, Winston-Salem, Penn State, UNC

Outcomes for UMBC

- Analytics:
  - Importance of evaluating programs
- Culture Change:
  - Willingness to look in mirror and take risks
- Teaching and learning:
  - Re-think the way courses are taught and students learn
  - Scholars Programs, Course re-design, Chemistry Discovery Center, Retriever Learning Center, and more