THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Broadening Participation and Cultivating Success in STEM: An Ecological Approach

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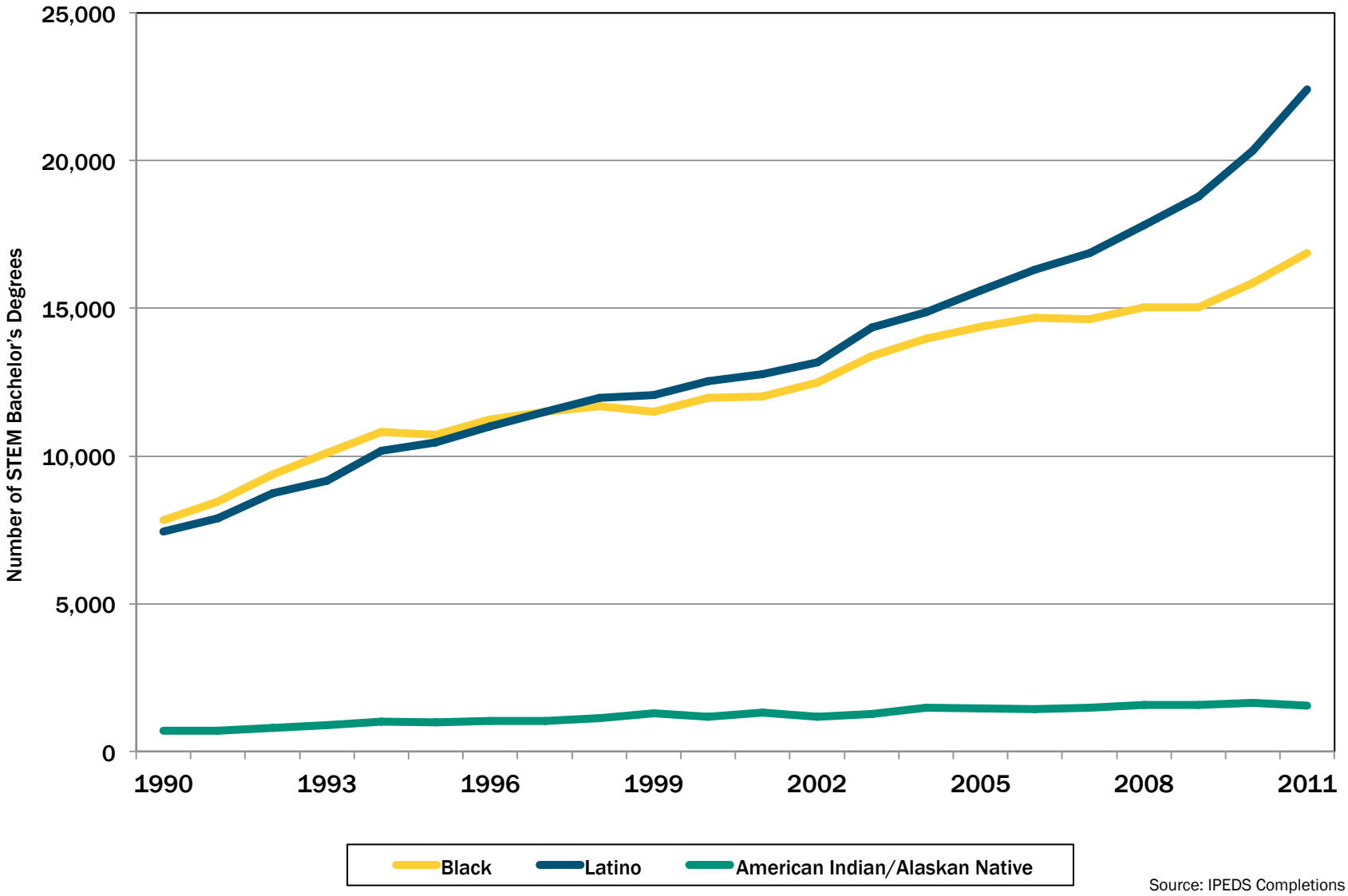
AIR Symposium on Using Research to Inform Policies and Practices in STEM Education

September 26, 2013

Let's start with...

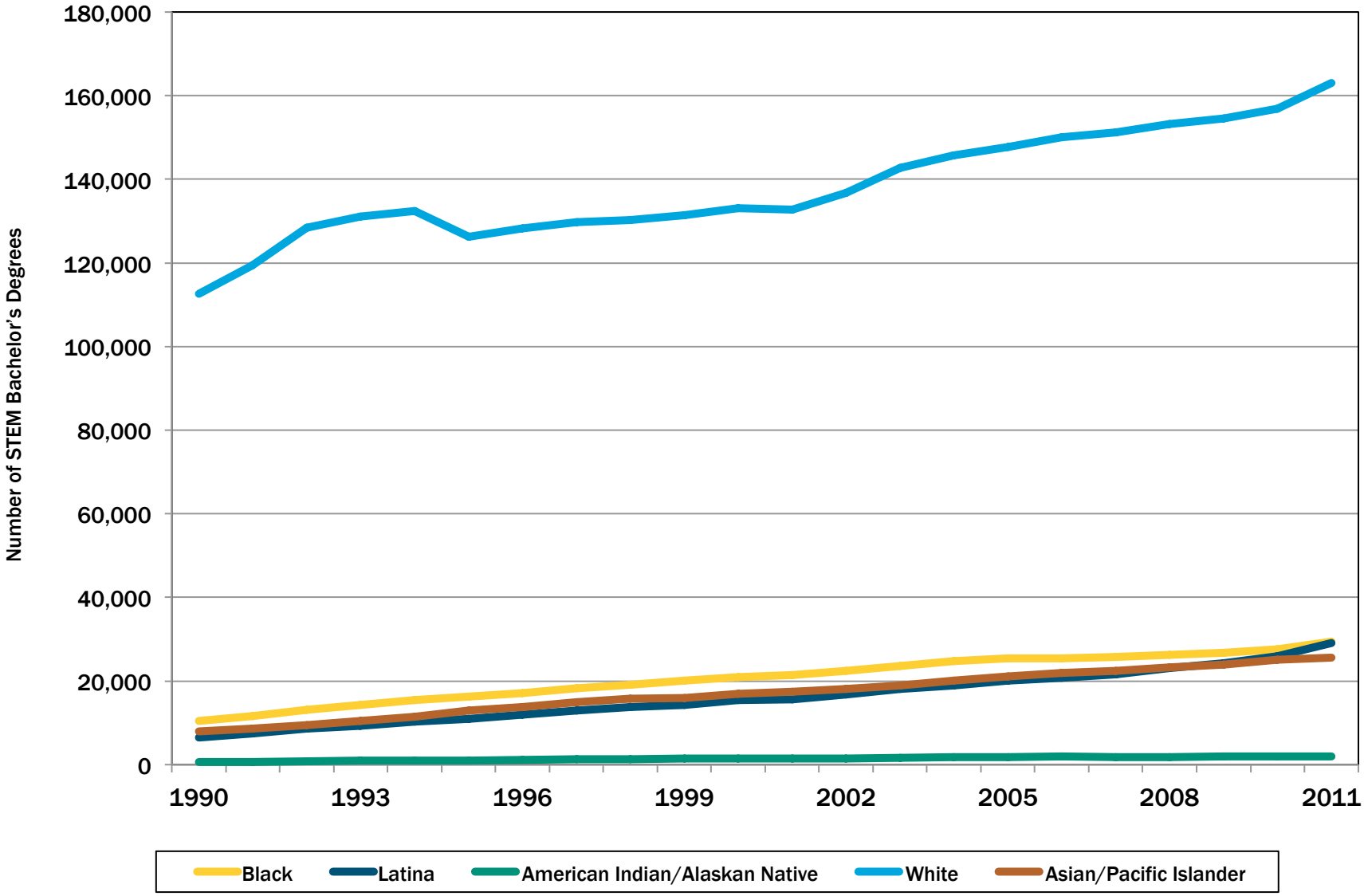
THE GOOD NEWS.

STEM Bachelor's Degrees Awarded to Underrepresented Minority Men, 1990-2011



Source: IPEDS Completions Survey, 1990-2011.

STEM Bachelor's Degrees Awarded to Women by Race/Ethnicity, 1990-2011



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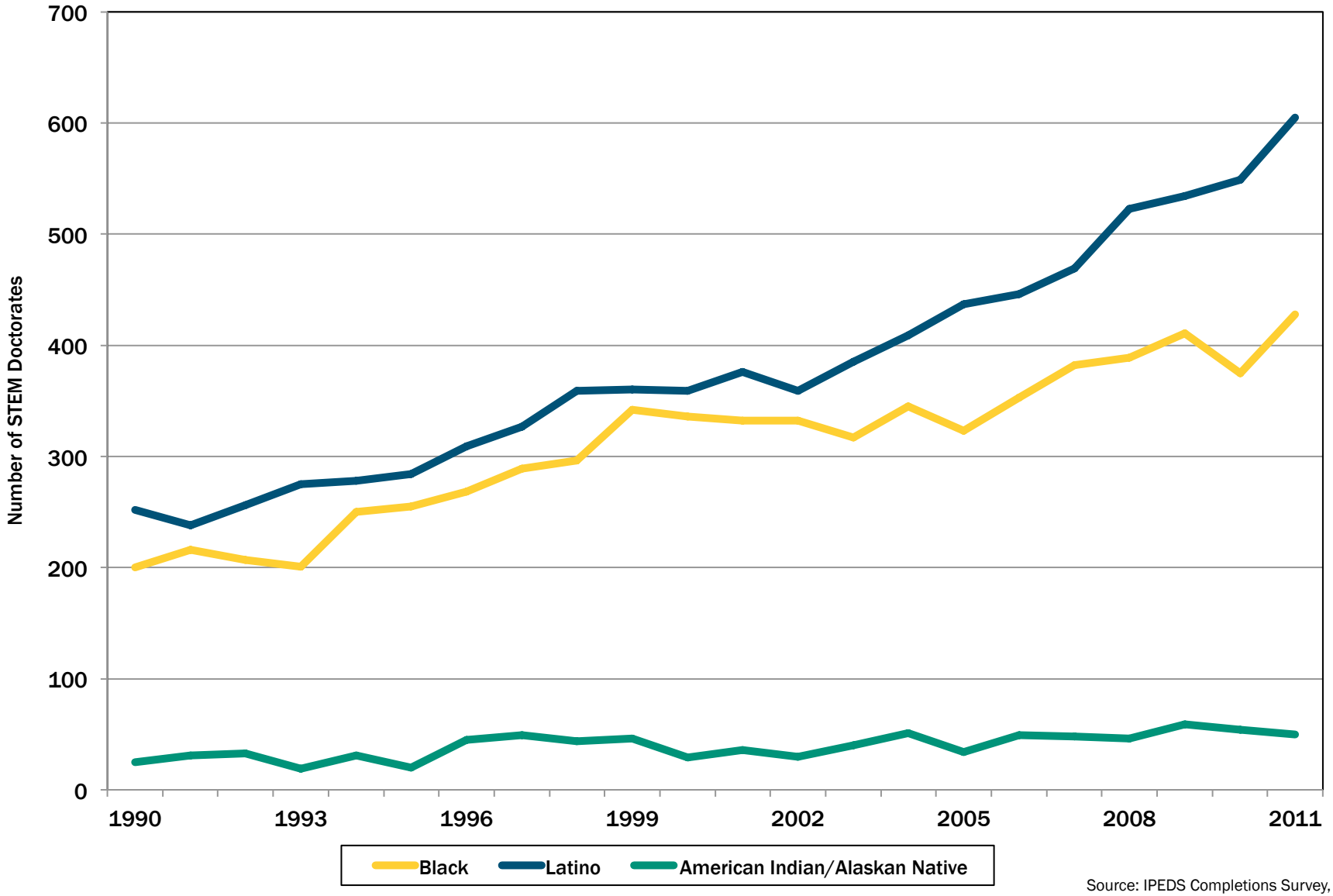
STEM Doctorates Awarded to Underrepresented Minority Men, 1990-2011



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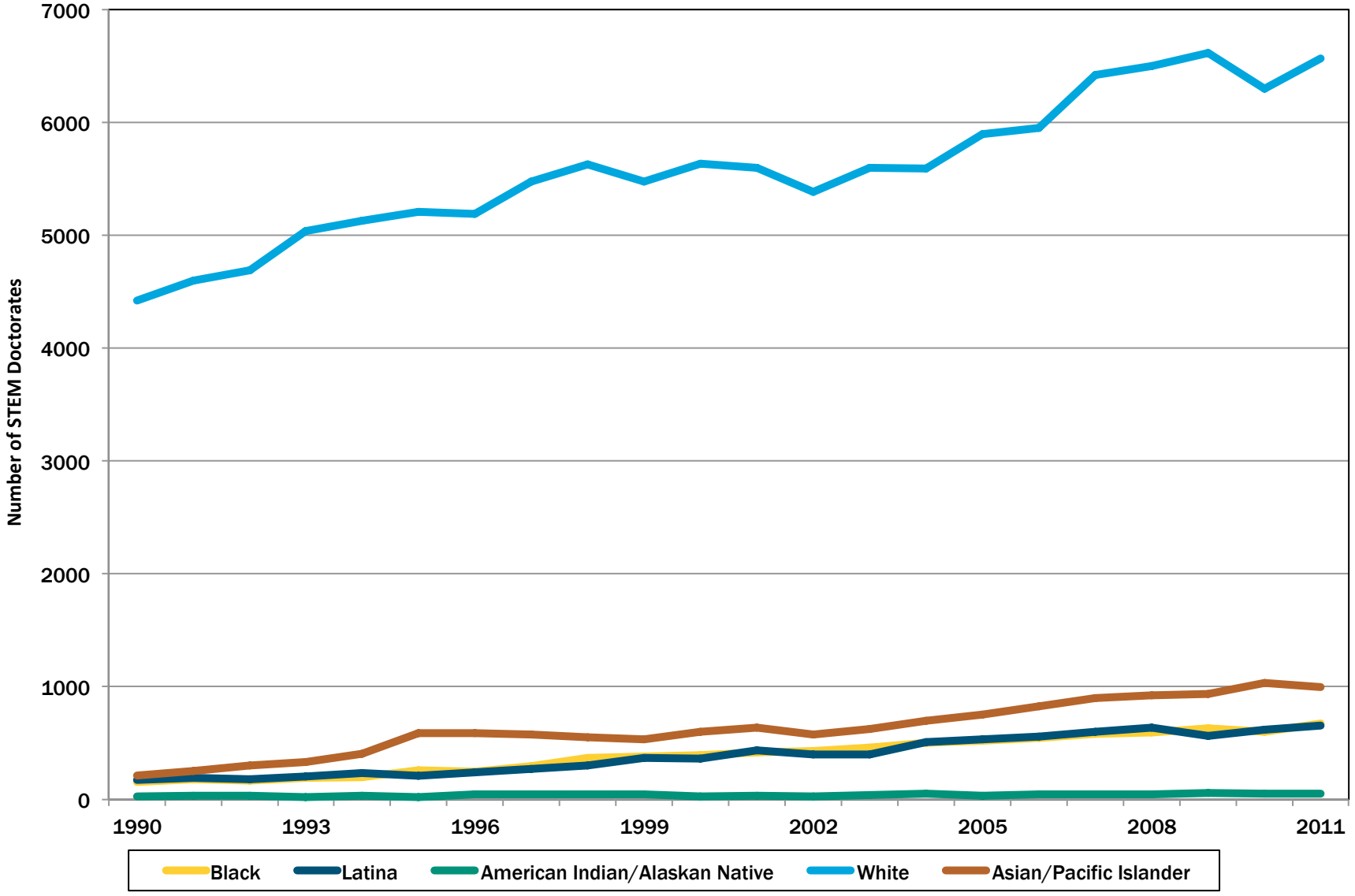
STEM Doctorates Awarded to Women by Race/Ethnicity, 1990-2011

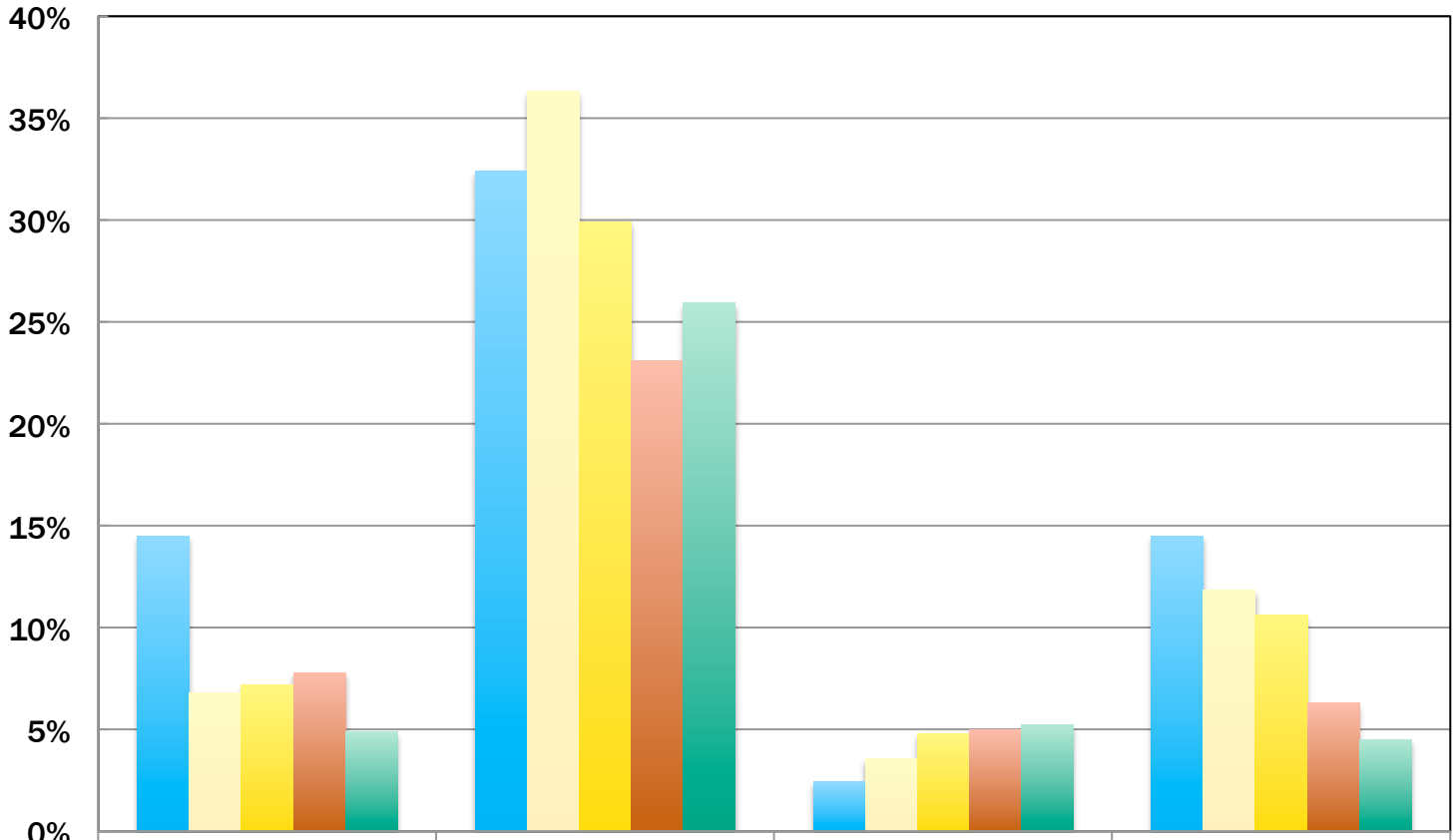


Source: IPEDS Completions Survey, 1990-2011.

However...

UNDEREPRESENTATION REMAINS A PROBLEM.

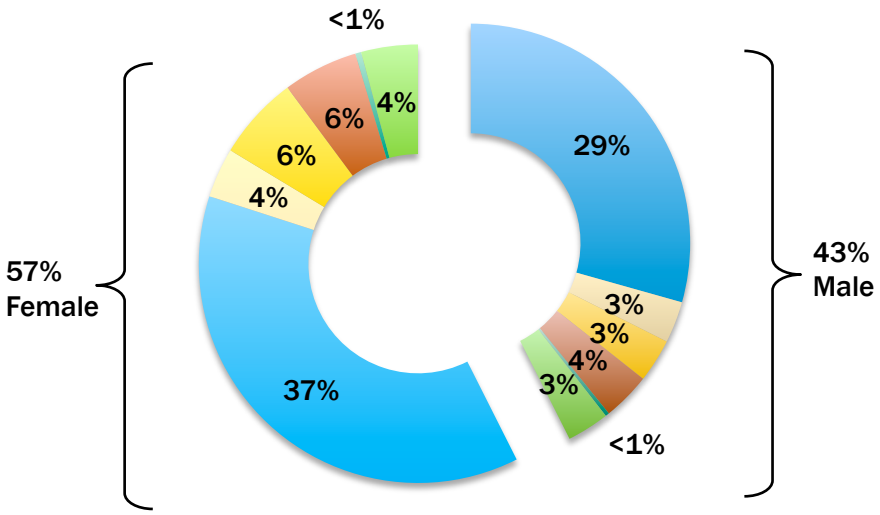
Percent Share of STEM Bachelor's Degrees Earned by Underrepresented Groups, 2010



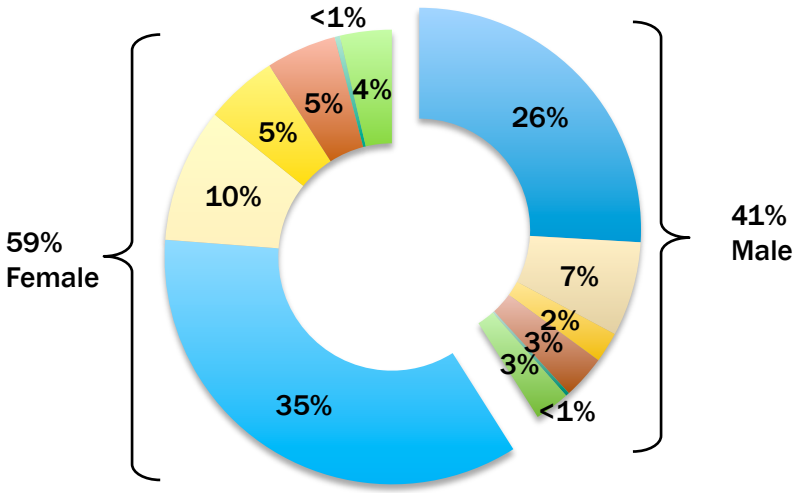
	URM Men	White Women	Asian Women	URM Women
U.S. Population	14.5%	32.4%	2.5%	14.5%
All Bachelor's Degrees	6.8%	36.3%	3.6%	11.8%
STEM B.S. Degrees	7.2%	29.9%	4.8%	10.6%
NS&E B.S. Degrees	7.8%	23.1%	5.0%	6.3%
NS&E Doctorates	4.9%	25.9%	5.2%	4.5%

Source: NSF, 2013.

Percent Share of Bachelor's Degrees by Gender and Race/Ethnicity in All Fields and Biological Sciences, 2010



All Fields

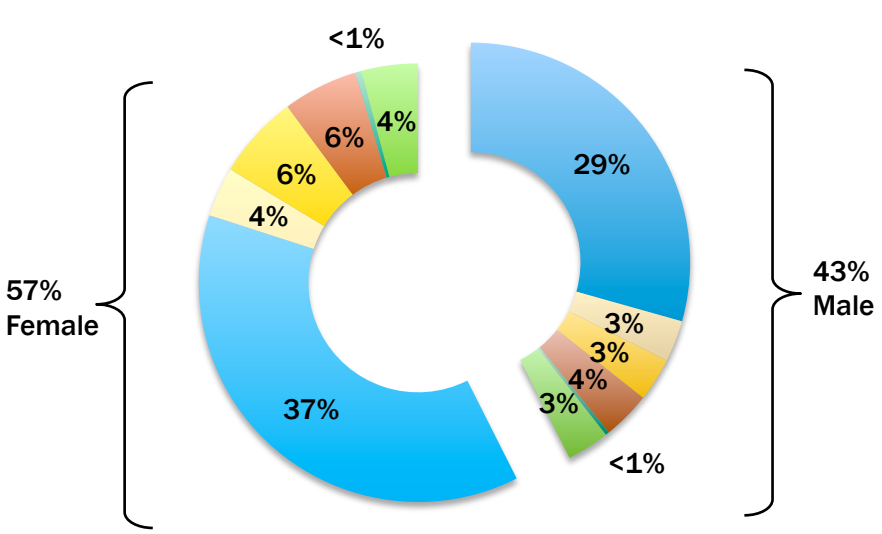


Biological sciences

White Asian/Pacific Islander Black Latina/o American Indian/Alaskan Native Other/Unknown

Source: NSF, 2013.

Percent Share of Bachelor's Degrees by Gender and Race/Ethnicity in All Fields and Chemistry, 2010



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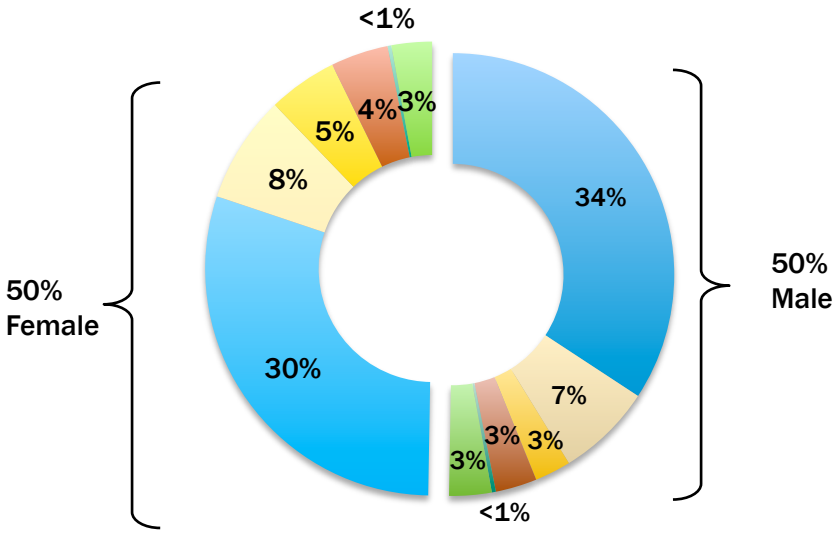
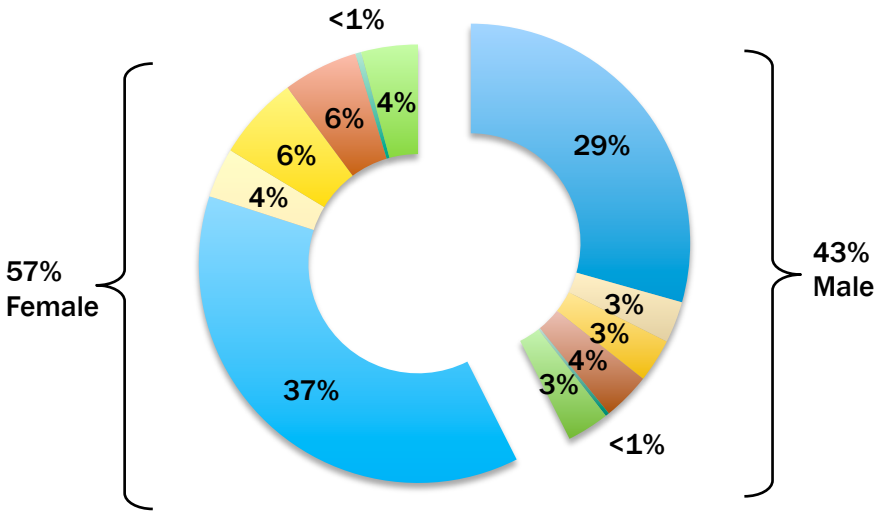


Chemistry

White Asian/Pacific Islander Black Latina/o American Indian/Alaskan Native Other/Unknown

Source: NSF, 2013.

Percent Share of Bachelor's Degrees by Gender and Race/Ethnicity in All Fields and Electrical Engineering, 2010



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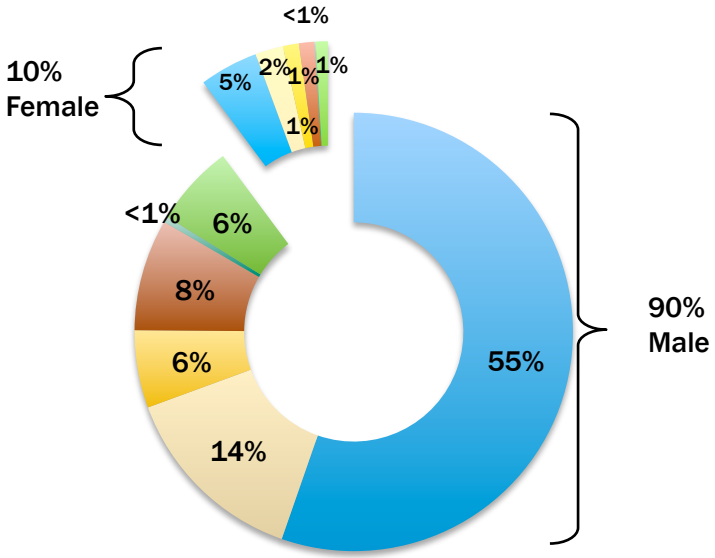
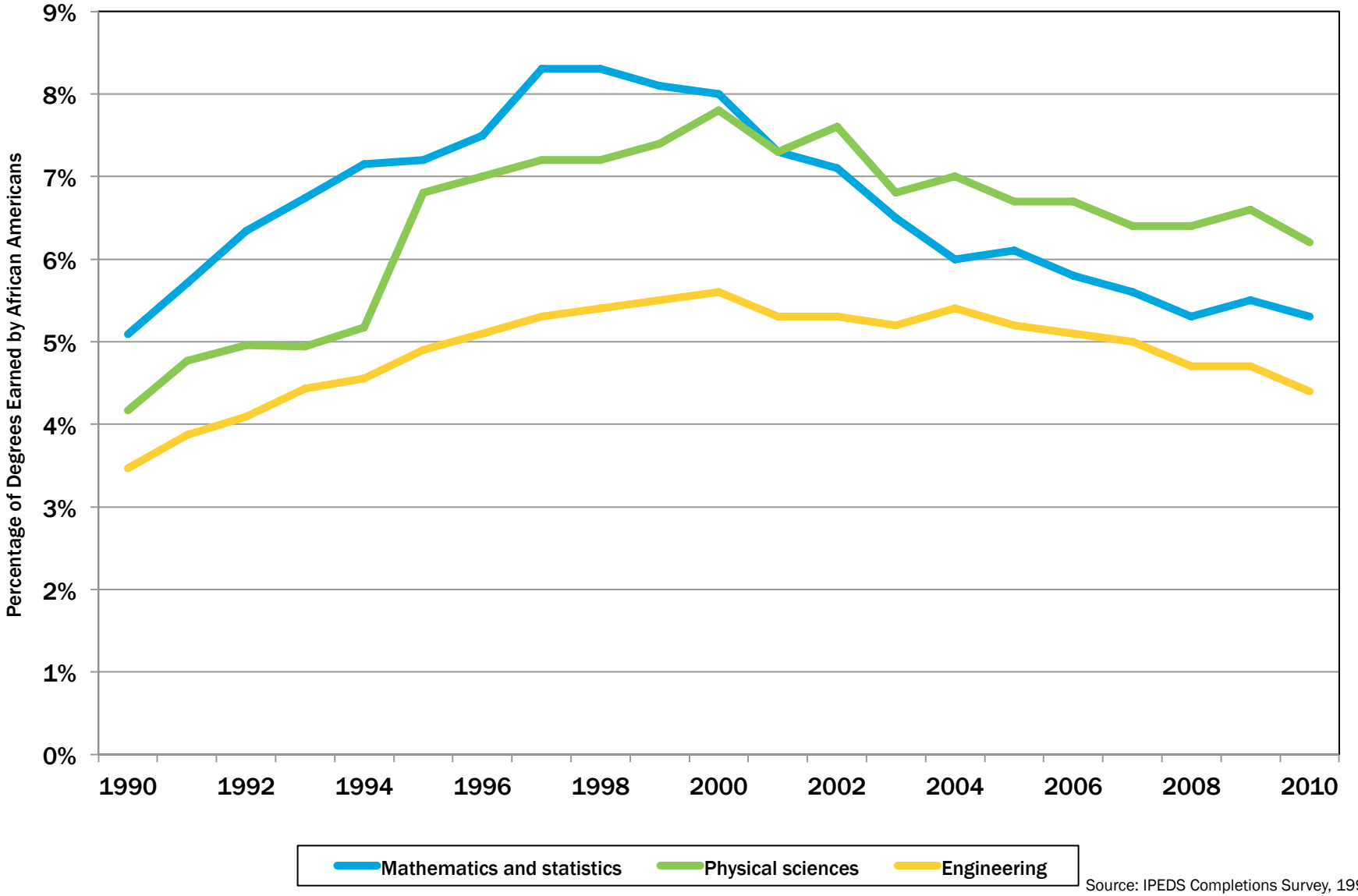


Electrical Engineering

White Asian/Pacific Islander Black Latina/o American Indian/Alaskan Native Other/Unknown

Source: NSF, 2013.

Share of Bachelor's Degrees in Mathematics, Physical Sciences, and Engineering earned by African Americans, 1990-2010



Source: IPEDS Completions Survey, 1990-2010.

Broadening Participation in STEM

- Decades of efforts to broaden participation in STEM have yielded slow, but measurable change.

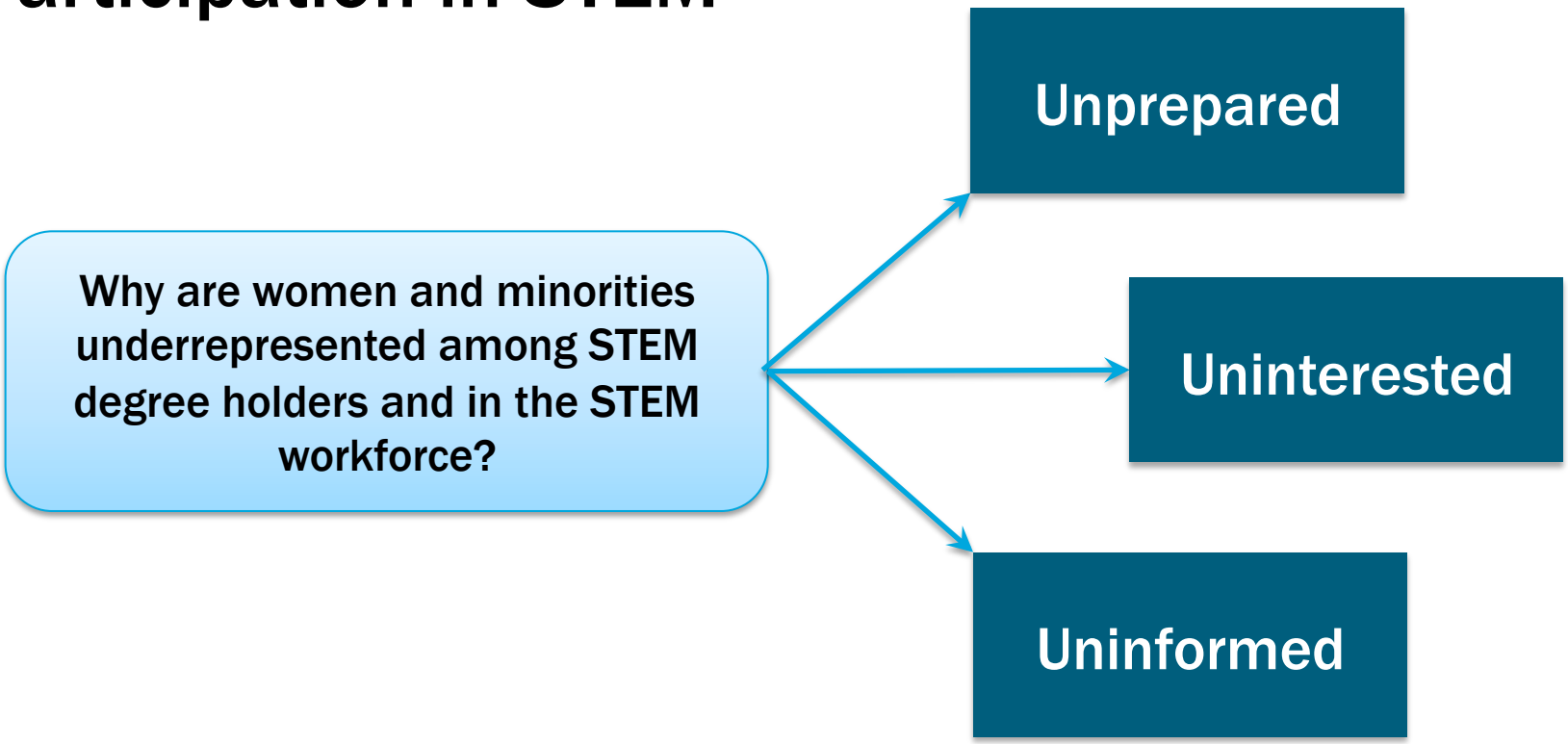
- Progress has been uneven across STEM disciplines and institutions, and for various populations.

- Do we need to alter our approach? If so, how?

Well, what have we tried?

THE APPROACH TO BROADENING PARTICIPATION IN STEM HAS EVOLVED OVER TIME.

Evolving Approaches to Broadening Participation in STEM



"Fix the Student" Perspective

Evolving Approaches to Broadening Participation in STEM

Unprepared	Uninterested	Uninformed
• Remediate "knowledge gaps" in math and science • Close the math and science achievement gap • Complete more advanced STEM coursework • Engage in research and hone research skills	• Develop positive attitudes toward science • Change perceptions of scientists and engineers by finding role models/ mentors • Find connections between science and engineering to daily life	• Become more knowledgeable about STEM career opportunities • Increase awareness of and application to graduate and research funding opportunities

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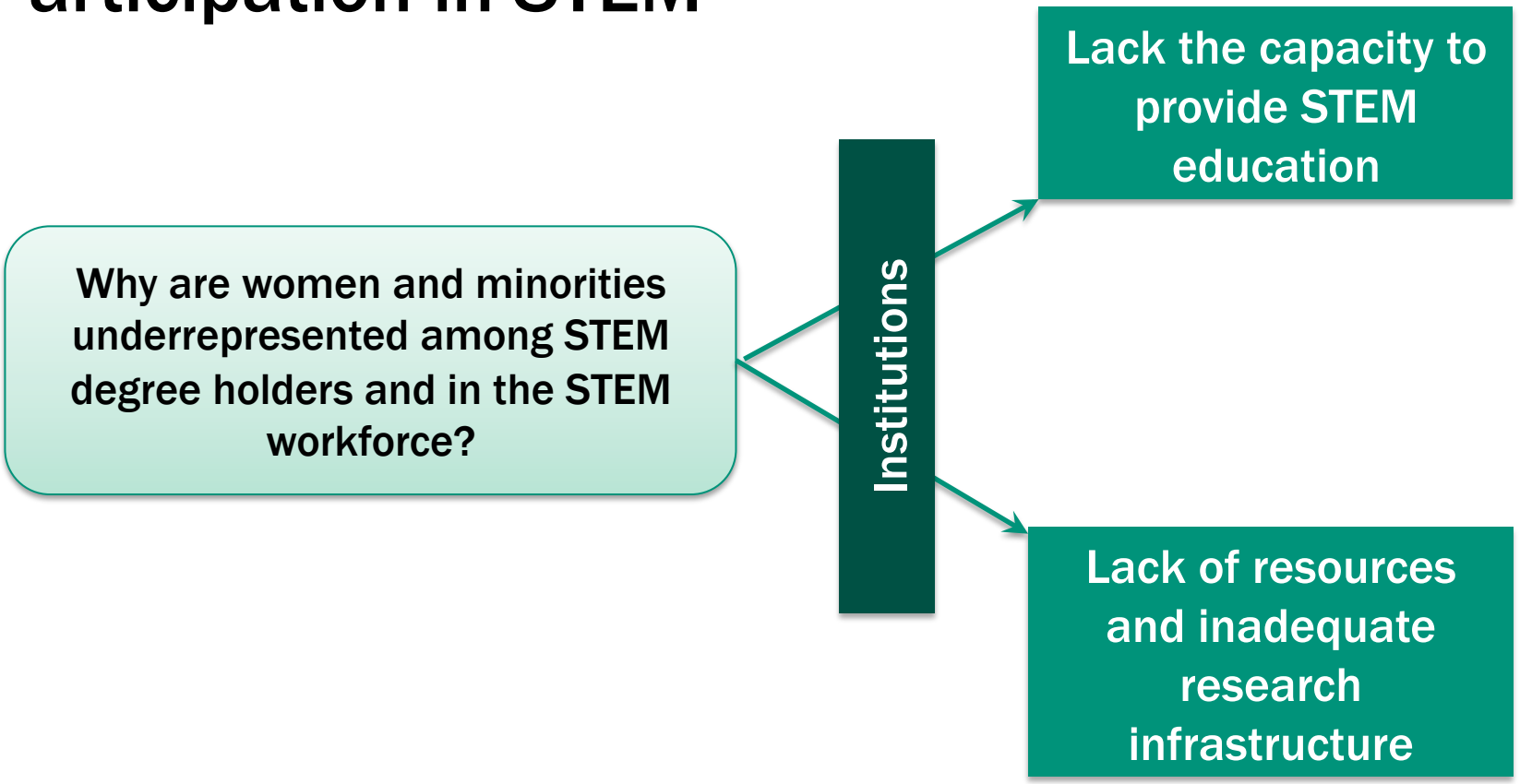

"Strengthen Minority Institutions" Perspective

Evolving Approaches to Broadening Participation in STEM

Lack Capacity to offer STEM Education

- Expand STEM academic program offerings
- Establish dual-degree programs with research institutions
- Improve teaching quality through training and professional development
- Reform STEM curriculum to increase retention

Lack of Resources and Inadequate Research Infrastructure

- Acquire external funding to improve research facilities
- Obtain grants to provide research opportunities for faculty and students
- Form partnerships with research universities
- Partner with industry and research institutions to provide research experiences to students
- Enhance research capabilities of faculty

"Strengthen Minority Institutions" Perspective

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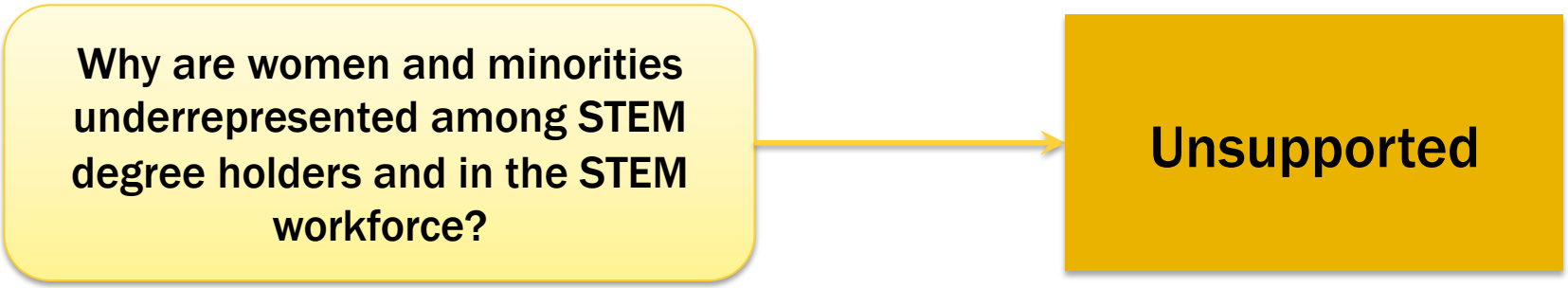


"Supporting Individuals" Perspective

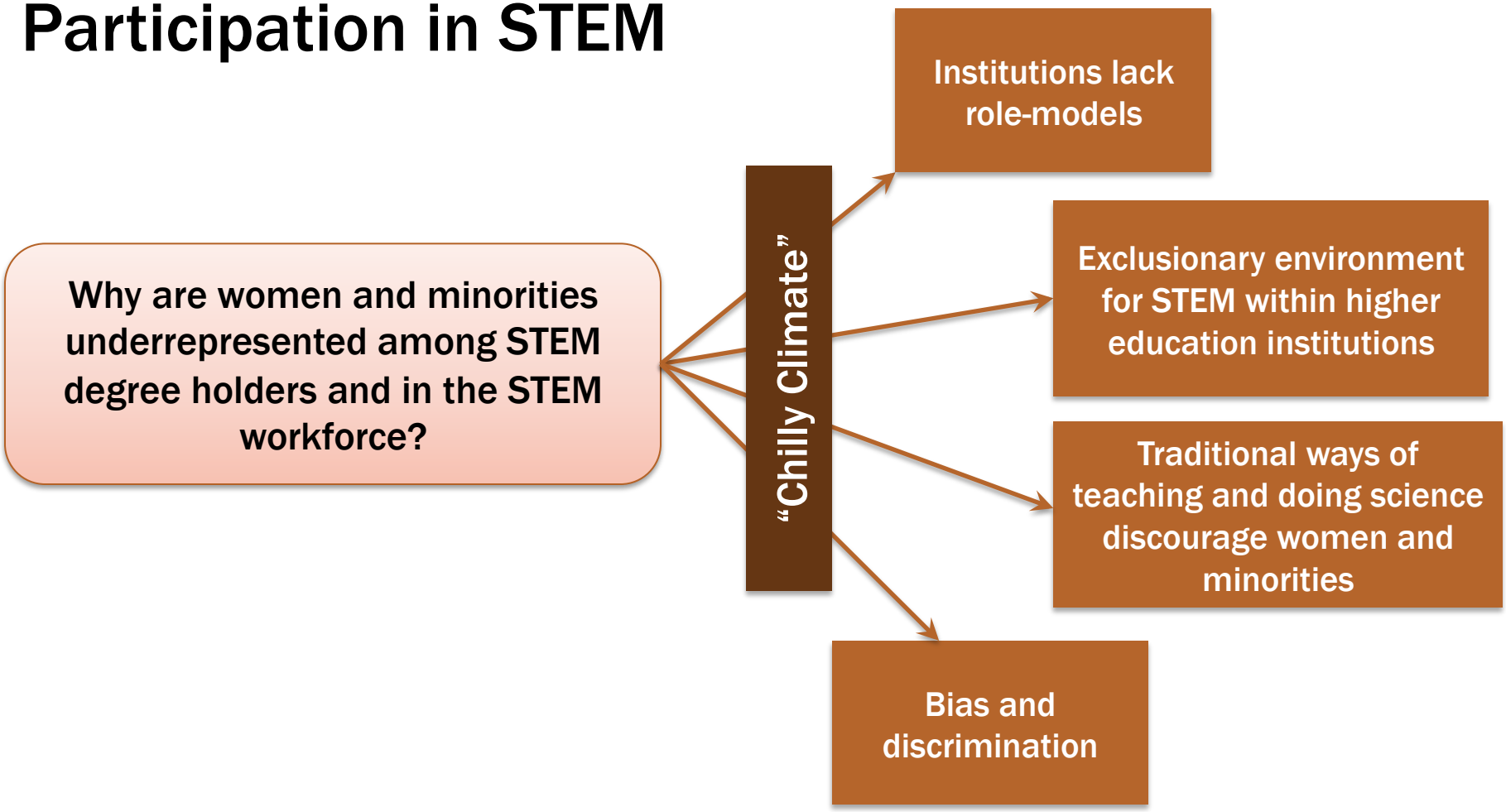
Evolving Approaches to Broadening Participation in STEM

Unsupported

- Encourage women and minorities to pursue STEM
- Provide underrepresented students with academic enhancement and support
- Identify mentors to provide support and guidance with career planning, publishing, and research
- Provide financial support for undergraduate and graduate education
- Encourage and facilitate community-building for underrepresented students in STEM

"Supporting Individuals" Perspective

Evolving Approaches to Broadening Participation in STEM



"Institutional Transformation" Perspective

Evolving Approaches to Broadening Participation in STEM

Warming Up the "Chilly Climate"

- Understand the barriers that prevent women and minorities from pursuing and succeeding in STEM within specific institutional context
- Make diversity, equity, and inclusiveness in STEM a priority among faculty, staff, and administrators
- Alter curriculum and teaching approaches to retain women and minorities
- Aggressively recruit and retain minority and women STEM faculty
- Develop, implement, and enforce policies to lessen role of discrimination and biases in admissions, hiring, and promotion/tenure processes

"Institutional Transformation" Perspective

So, what ought to change?

TOWARD A MORE COMPREHENSIVE APPROACH.

Broadening Participation in STEM: A Slow, Complex Process

~~Fix the Student~~ Create Opportunity

+

Strengthen Minority-Serving Institutions

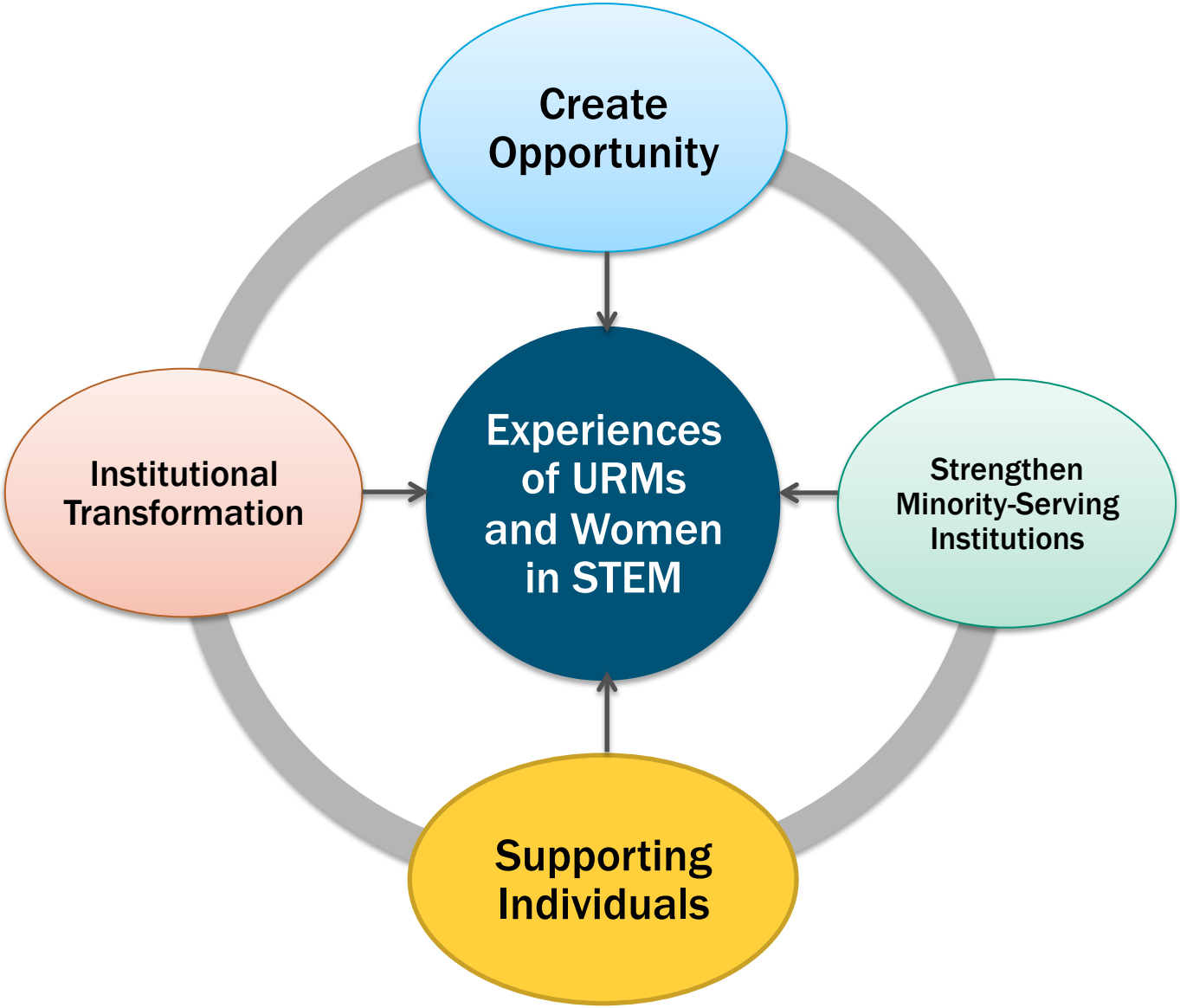
+

Supporting Individuals

+

Institutional Transformation

A More Comprehensive Approach?



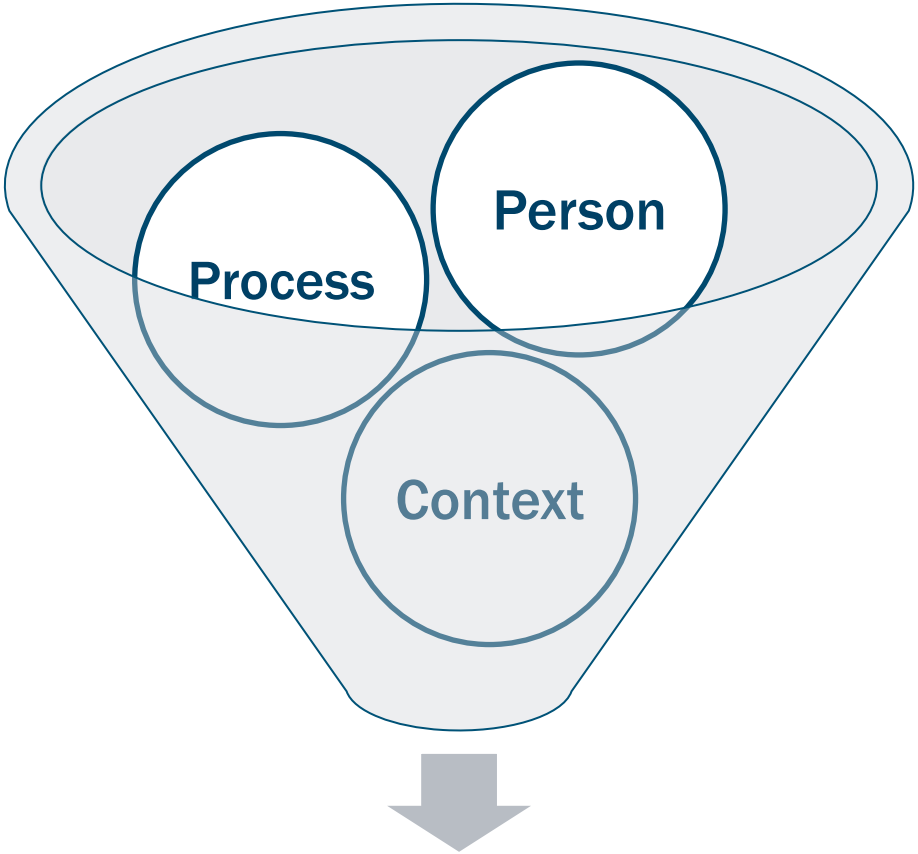
Why take an Ecological Approach?

- Social science research demonstrates that educational environments and the interactions with and within that environment can promote and/or inhibit student learning and development.

Key Questions

- How do students relate to and interact with their environment (e.g., campus, social, cultural, sociopolitical, etc.)?
- What factors impact these interactions?
- And, how do these relationships impact STEM outcomes?

Elements of Ecological Systems Theory



Participation and Outcomes in STEM

Based on Bronfenbrenner & Crouter, 1983

What Accounts for Different STEM-Related Outcomes among Students in Seemingly Similar Environments?

Variability in Outcomes are a Function of Context and the Person:

- Quality, nature, and frequency of interactions with faculty and peers vary for different students.
- Different students elicit particular responses from peers, faculty, and others.
- Students derive different meanings from their environment and their interactions with that environment.
- Students differ in their views of their agency in relation to their environment.

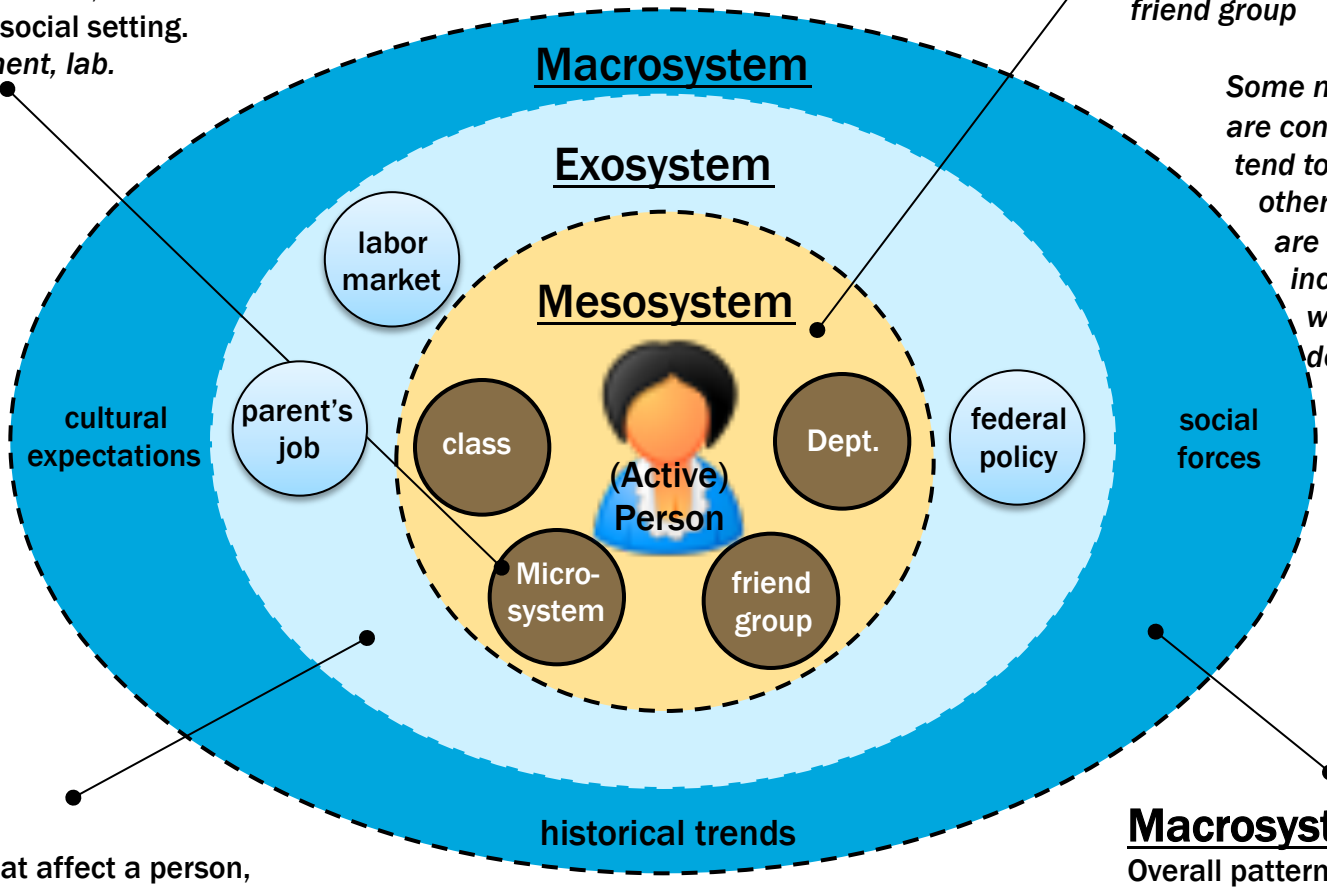
Based on Bronfenbrenner, 1979, 1999, 2005.

Ecological Model of College Student Development (Renn)

Microsystem:
An academic, residential, extracurricular, or social setting.
Ex: Class, department, lab.

Mesosystem:
Web of interconnected microsystems.
Ex: Campus culture, home life, friend group

Some microsystems are are consonant, which tend to favor development; other microsystems are dissonant with inconsistent messages, which don't favor development.



Exosystem:
Web of settings that affect a person, some of which do not contain the person.
Ex: Parents' workplace, federal policies.

Macrosystem:
Overall pattern of systems of a culture.
Ex: Racial/ethnic and gender stereotypes, societal perceptions of science and scientists.

Adapted from (Renn,2004)

Going Forward…

Key Questions

- How do students relate to and interact with their environment (e.g., campus, social, cultural, sociopolitical, etc.)?
- What factors impact these interactions?
- And, how do these relationships impact STEM outcomes?