



*Increasing Diversity in
STEM Research and
Education: Defining the Issues*

*Building Diversity in Higher Education
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Goals

- **Explore the mandate for and benefits of broadening participation in STEM**
- **Introduce CEOSE**
- **Identify issues, trends, challenges, barriers, and opportunities for increasing faculty diversity**
- **Set the stage for the panel following**



What Do We Mean by Broadening Participation in STEM?

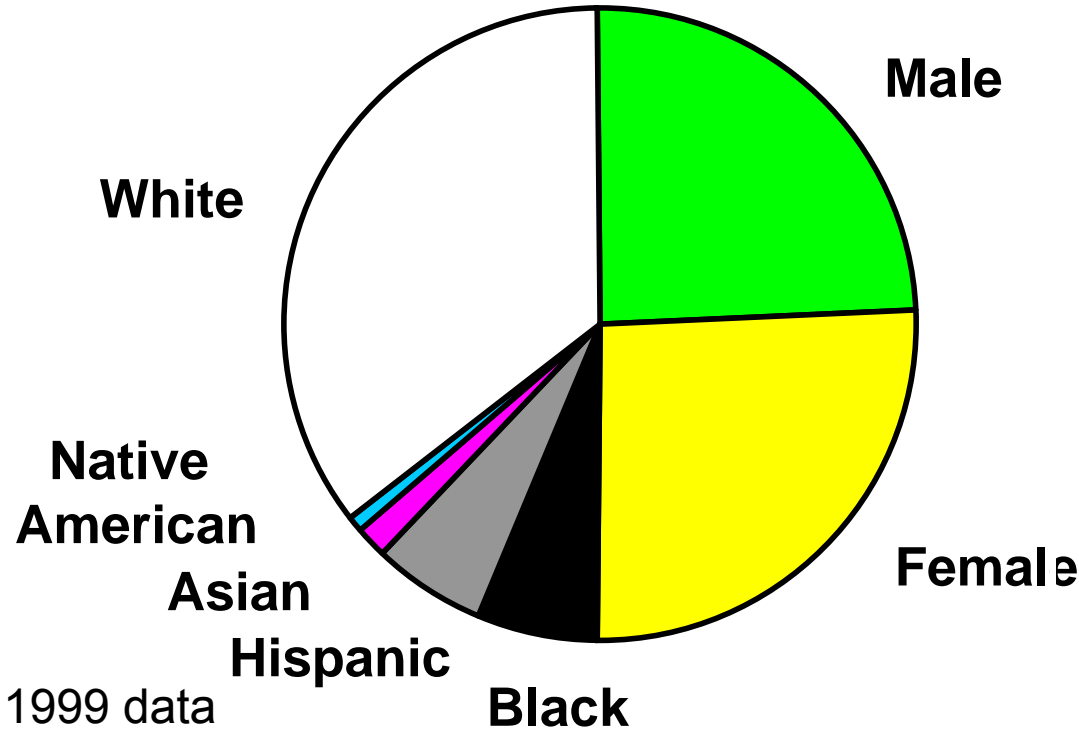
- **Increasing the number and percentage of STEM performers and leaders who are:**
 - Underrepresented minorities
 - Persons with disabilities
 - Women
 - Economically disadvantaged persons
 - Institutions serving significant numbers of underrepresented persons
 - Located throughout the USA and territories



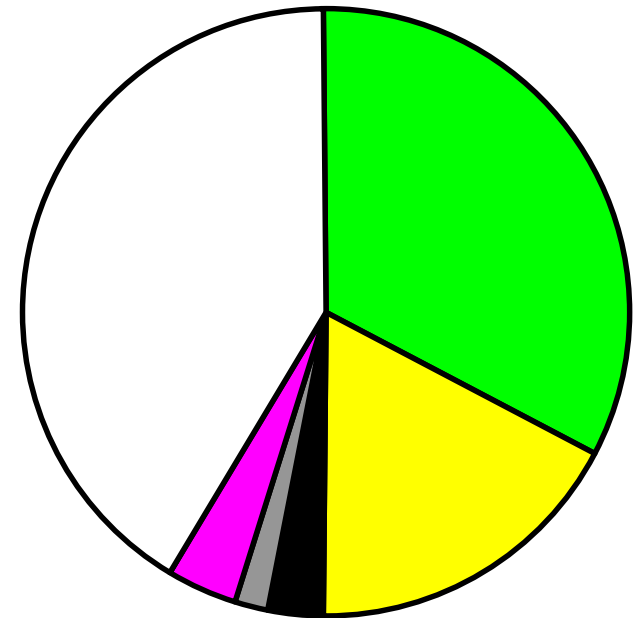
Compared with the US Population, the STEM Workforce is Overwhelmingly Male, White, & Asian

US Population
(273 M)

Ethnicity **Gender**



US Sci/Eng Workforce
(11 M)



1999 data

Women, Minorities, and Persons with Disabilities in Science and Engineering: 2002 (NSF 7/03)

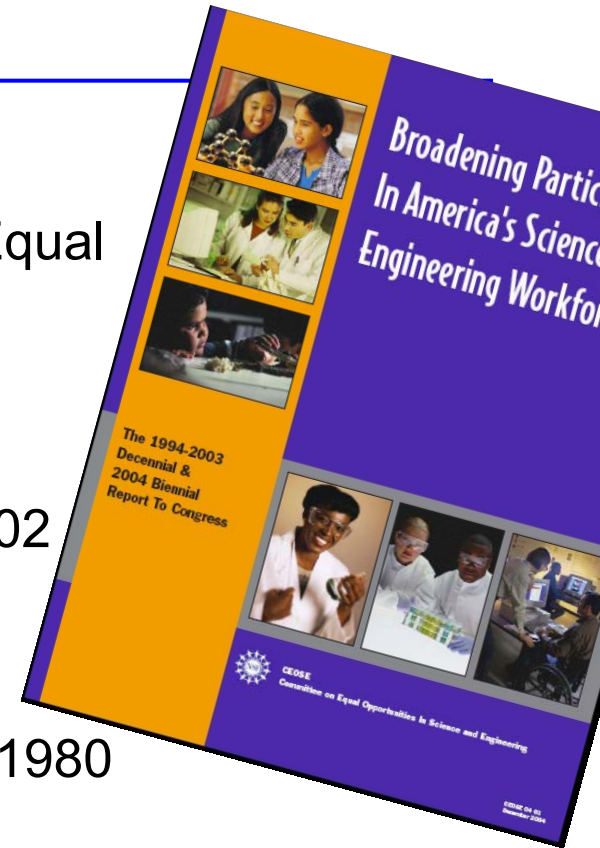
Introducing CEOSE

- **The Committee on Equal Opportunities in Science and Engineering**
- **Established by Congress in 1980**
 - Reviews and provides advice to NSF on policies, programs, and activities within and outside NSF that
 - Promote the **full participation of women, minorities, and persons with disabilities** in America's scientific, technological, engineering, and mathematics (STEM) enterprise
- **Meets 3 times per year and submits a report to Congress every two years**
- **A resource and champion for broadening participation**



CEOSE Reports to Congress

- **Biennial Reports**
 - Required by the Science and Engineering Equal Opportunities Act of 1980
 - Next one due in January 2009
- **Decennial Report submitted in 2005**
 - Required by NSF Reauthorization Act of 2002
 - Summary of CEOSE findings since 1980
 - Description of NSF policies
 - Assessment of trends in participation since 1980
 - Recommendations for action
- **Latest Biennial Report submitted in 2007, next one in 2009**
- **CEOSE membership, reports, & minutes available at <http://www.nsf.gov/od/oia/activities/ceose>**



CEOSE Members

- **Volunteers**
- **Demographically diverse**
- **Scientifically diverse**
- **Geographically diverse**
- **Institutionally diverse**
- **Serve 3-year terms, appointed by NSF Director**
- **Share a passion for excellence in STEM and for broadening participation**

- **Margaret Tolbert, Senior Advisor in OIA, is CEOSE's federal liaison official**



Facts about STEM

- **Science and engineering are about...**
 - Questions and Ideas
 - Extrapolation and prediction
 - Systematic observation
 - Communication
 - Interpretation, deduction, and understanding
- **Women, UR minorities, & persons with disabilities strengthen and enrich the STEM enterprise and EPSCoR jurisdictions**
- ! **But they seem to be all but invisible in many EPSCoR RII Projects**



Science & Engineering Need **MORE** Women, Minorities, & Persons with Disabilities

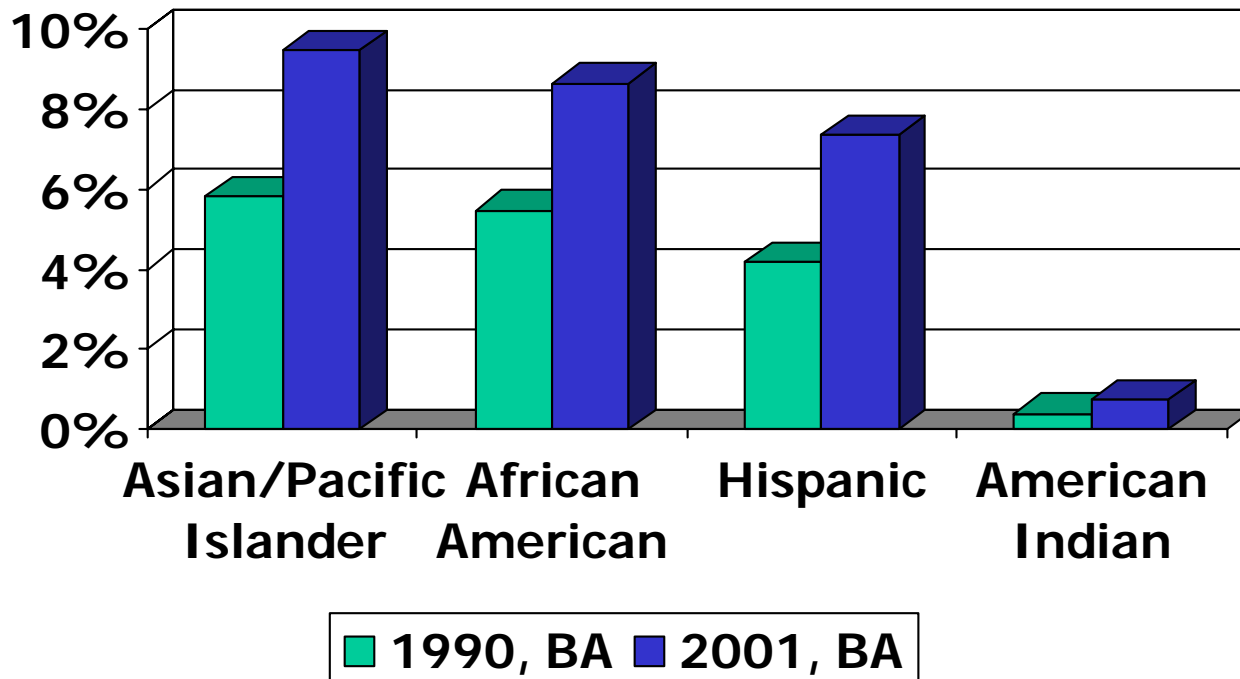
- Minorities, women, and persons with disabilities bring ideas and approaches that enrich and advance STEM. Yet . . .
 - They are **SCARCE**.
 - Minority faculty are **VERY SCARCE**, especially at the leading research universities.
- Even today, in many departments, subfields, program committees, directorships, *etc.* *there has never been a minority or female scientist/engineer, leaving the opportunity and the challenge for someone to be the FIRST ONE.*

National Trends

- **A growing share of STEM B.S., M.S., and Ph.D. degrees are being earned by persons from underrepresented groups**
 - However, participation is nowhere close to population demographics!
 - **There has only been a small change in the "face" of the professoriate and STEM leadership**
 - Especially at leading research universities and state "flagship" institutions
- ❖ **The sign is right, but the magnitude is disappointing after more than 25 years**

Growth in Share of Minority Bachelor's Degrees

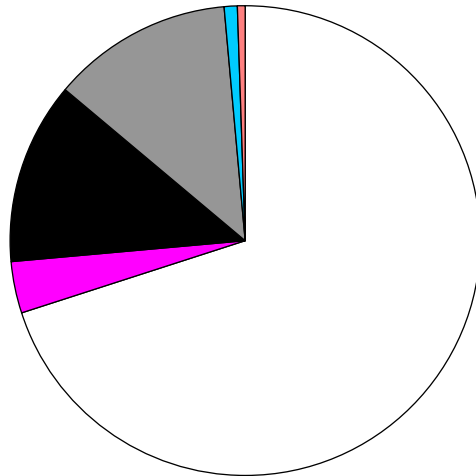
Share of Bachelor's Degrees Awarded in STEM Disciplines



From S.L. Myers. Data from Myers & Turner, *Amer. Econ. Review*, 94 (2), May 2004

STEM Bachelors Degrees Awarded by Race/Ethnicity: 1990 and 2001

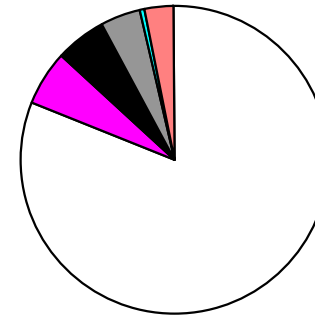
Ethnicity of US Population 2000



284 Million

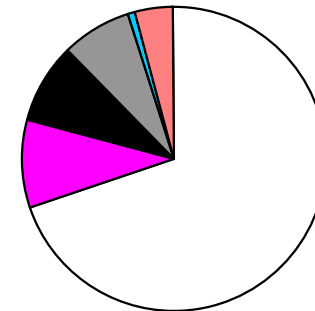
Ethnicity of US S&E Bachelors Recipients 1990

333,475



Ethnicity of US S&E Bachelors Recipients 2001

384,492



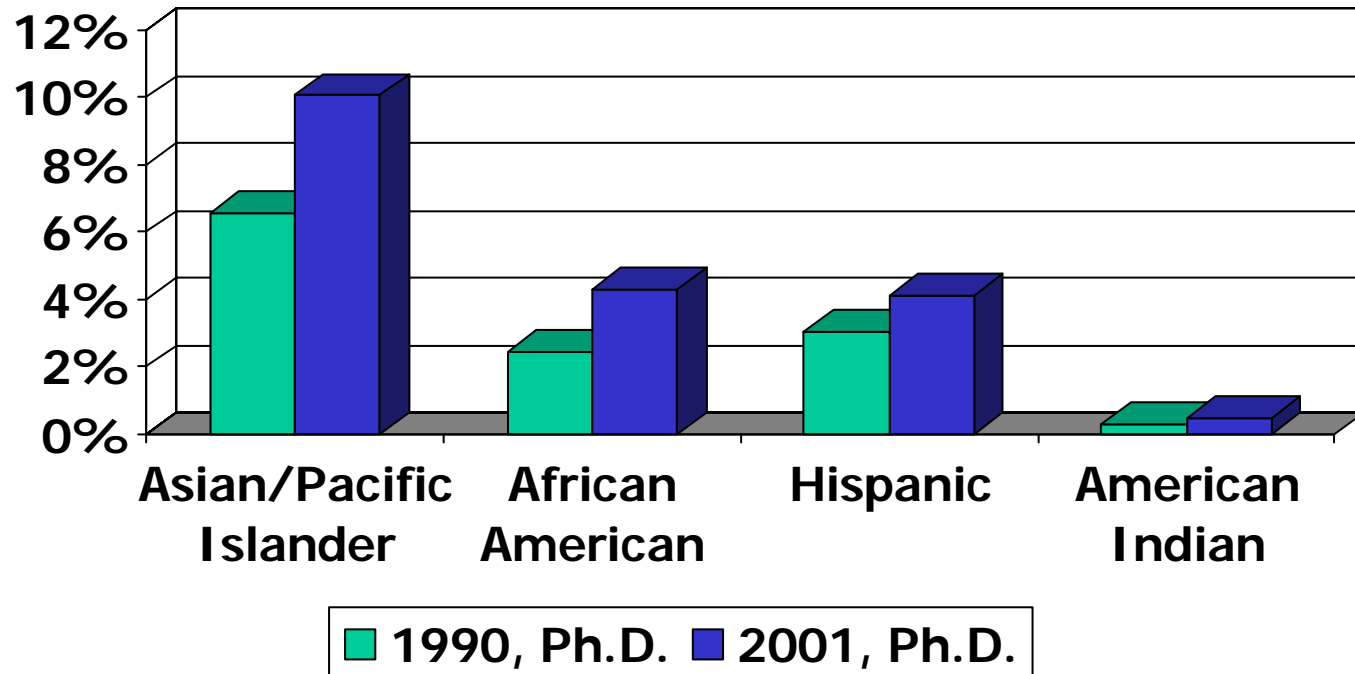
- white
- API
- Black
- Hispanic
- AIAN
- Unknown

Source: NSF 03-312 & NSF 04-317



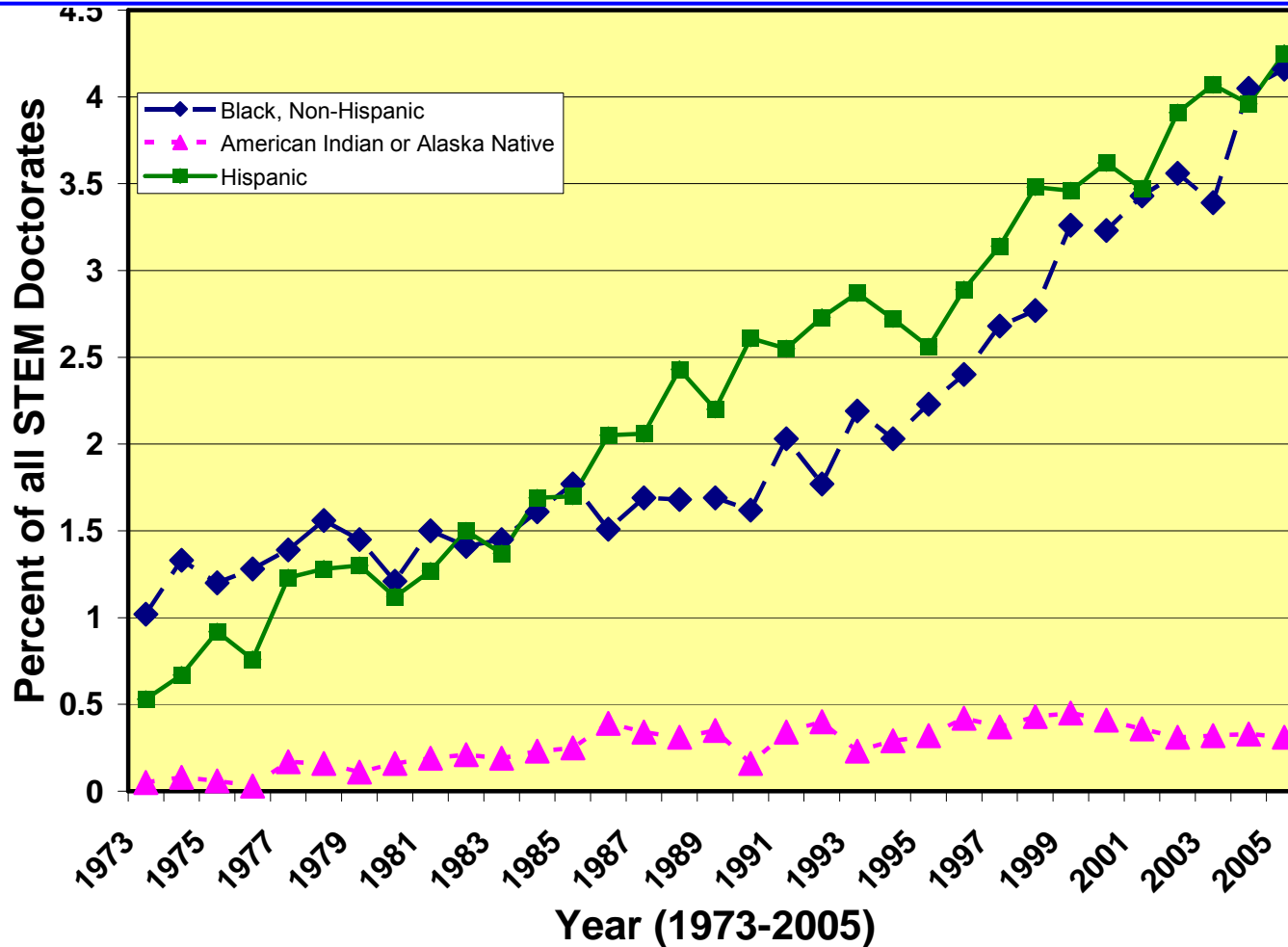
Growth in Share of Minority Ph.D.s

Share of Ph.Ds Awarded in STEM Disciplines



From S.L. Myers. Data from Myers & Turner, Amer. Econ. Review, 94 (2), May 2004

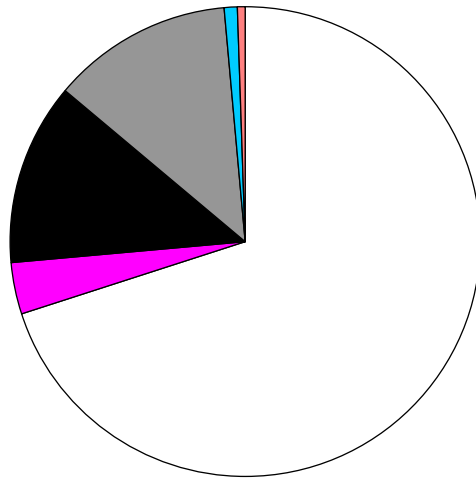
Percentage of STEM Doctorates to URM Rose from 1.5% to almost 10% between 1973 and 2005



Source: NSF SRS: Survey of Earned Doctorates via WebCaspar

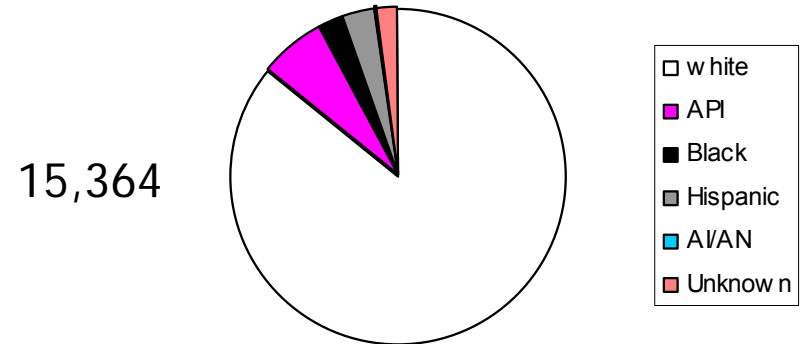
STEM Ph.D. Degrees Awarded by Race/Ethnicity: 1990 and 2001

Ethnicity of US Population 2000

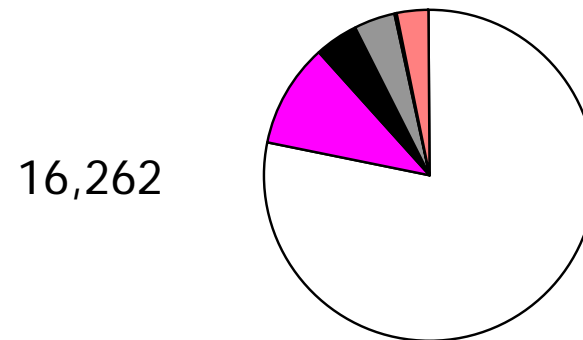


284 Million

Ethnicity of US S&E PhD Recipients 1990



Ethnicity of US S&E PhD Recipients 2001



Source: NSF 03-312 & NSF04-317

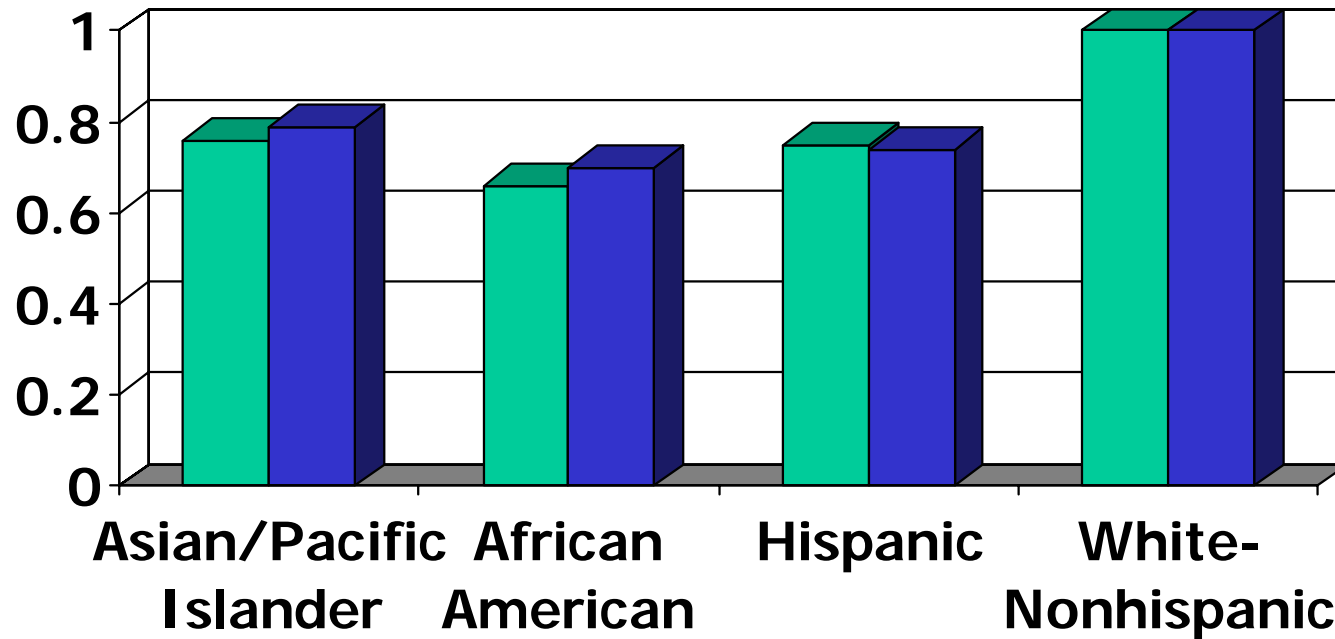
Myths and Facts

- **Myth 1: Underrepresented equals unqualified: "Our only criterion is excellence..."**
- **Myth 2: There are none available**
- **Myth 3: The only useful focus for broadening participation is K-12**
- **Fact 1: Diverse groups are the most innovative and successful in STEM and the business world**
- **Fact 2: Most universities are graduating many more underrepresented STEM PhDs than they hire as tenure-track assistant professors**
- **Fact 3: Diverse leadership can drive jurisdictional competitiveness faster than diverse school children AND accelerate K-12 excellence and diversity**



Continued Underrepresentation of Minority Faculty

Faculty Representation Ratios

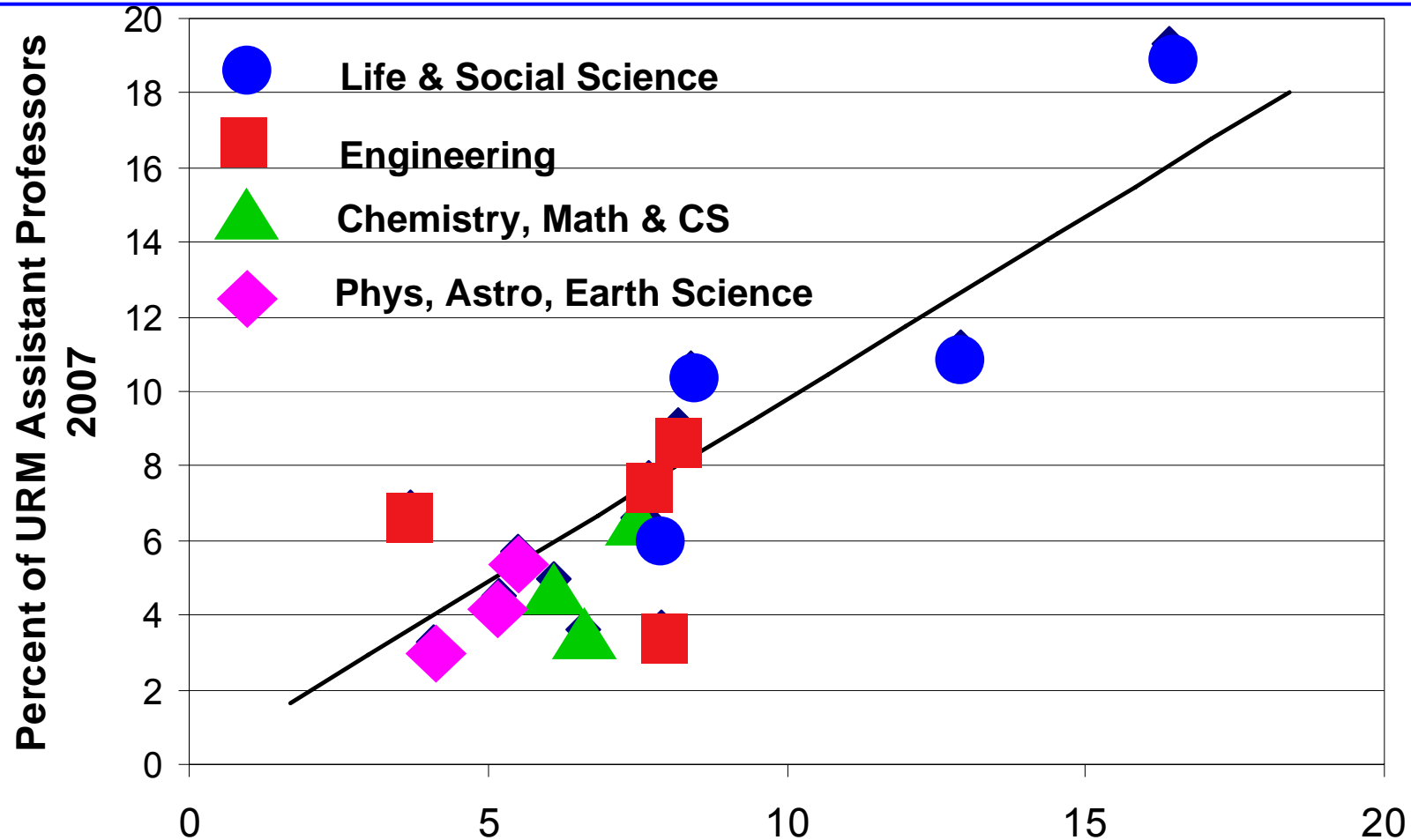


Very few minority women are faculty members

■ 1990 ■ 2000

From S.L. Myers. Data from Myers & Turner, Amer. Econ. Review, 94 (2), May 2004

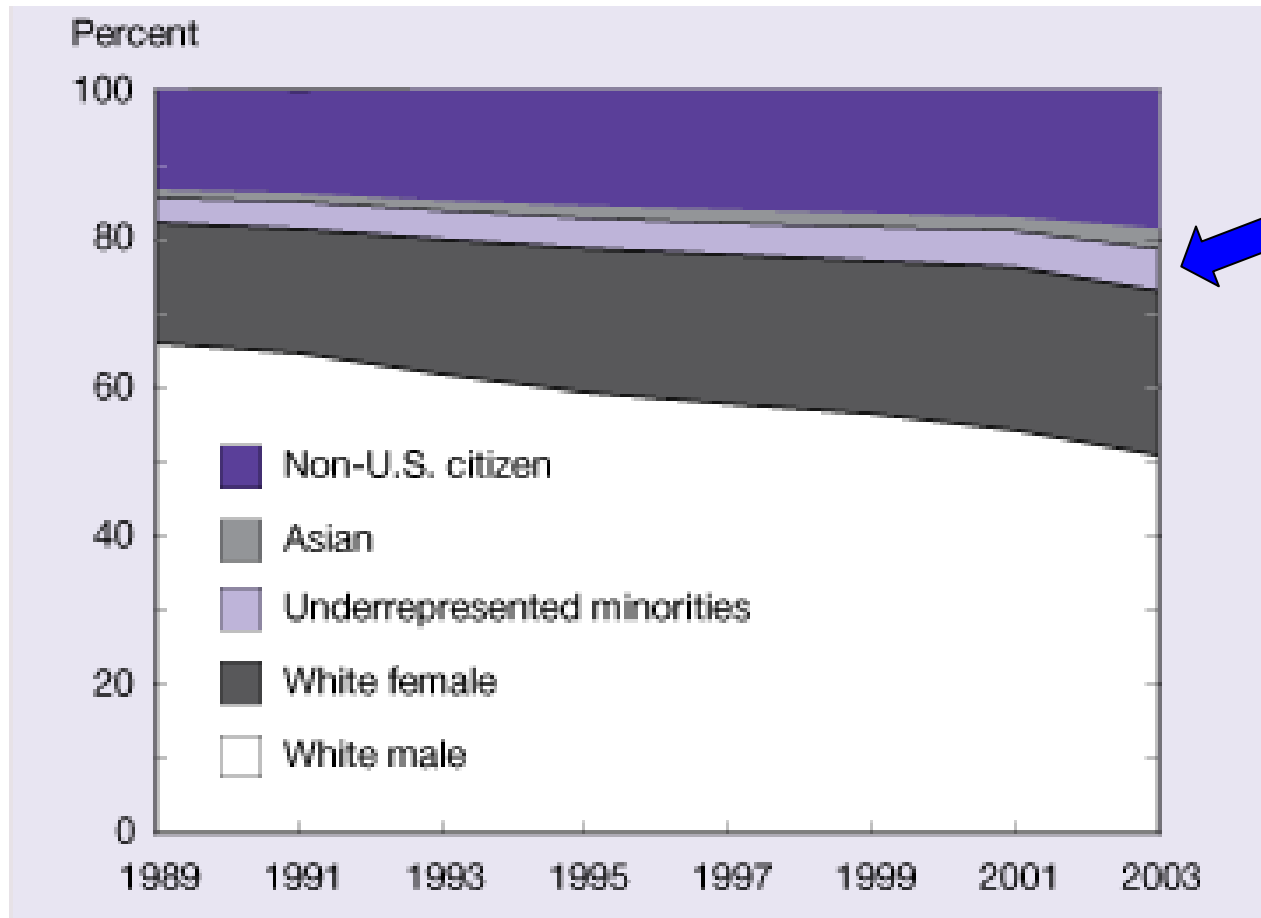
Underrepresented Minorities in Tenure-Track Positions: Top 50



Percent of PhDs Earned by Underrepresented Minorities 1996-2005

Donna Nelson, 2007

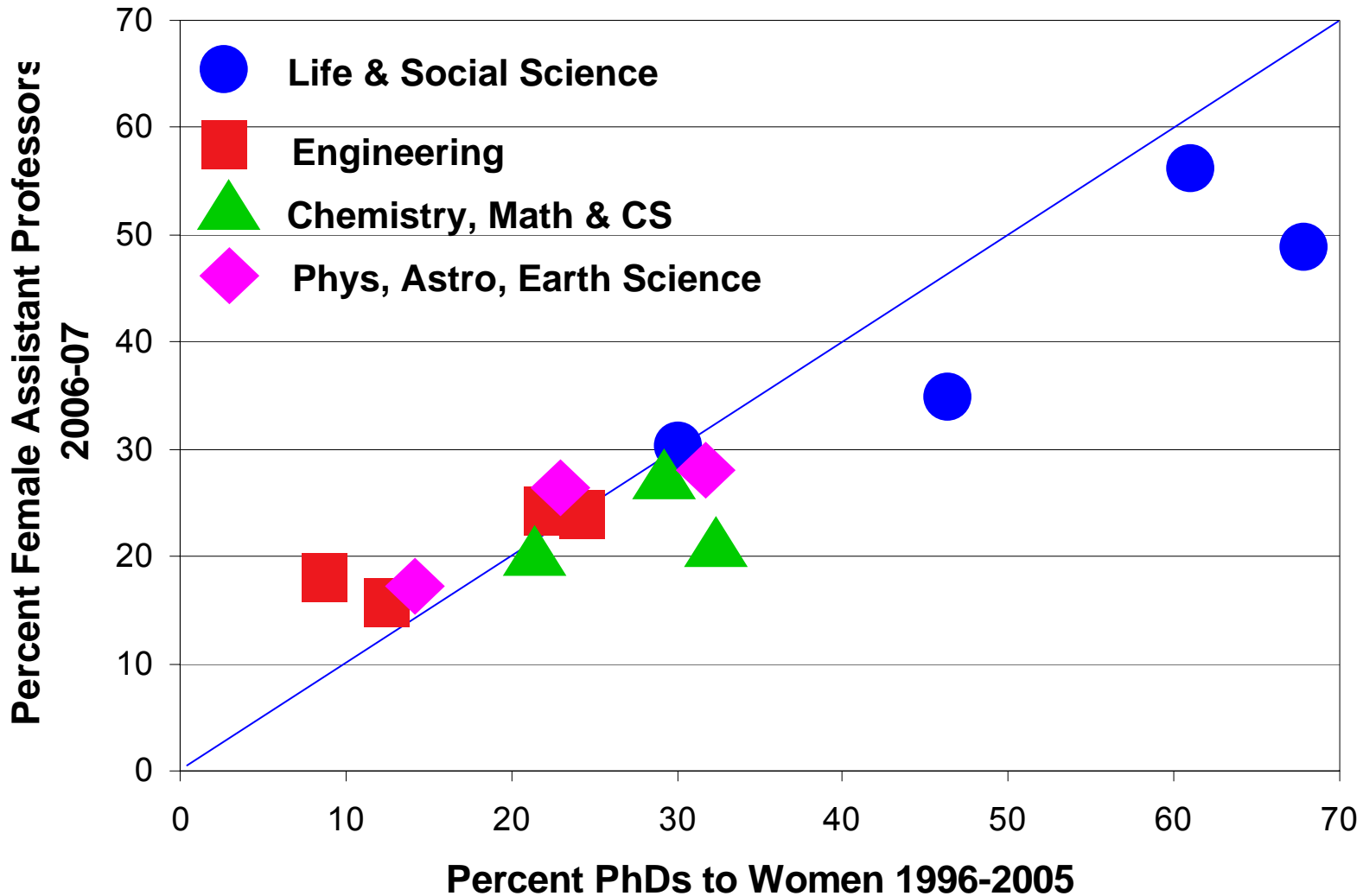
US Minorities Remain a Tiny Fraction of US Doctoral Academic STEM Workforce



Under-represented Minorities

From NSF *Science & Engineering Indicators 2006*. Figure O-42.
(Citizenship at time of degree conferral)

Women in Tenure-Track Positions: Top 50



Donna Nelson, 2007

Women, Minorities & Persons with Disabilities in EPSCoR STEM?

Every public action which is not customary,
either is wrong, or
if it is right,
is a dangerous precedent.

It follows that **nothing**
should **ever** be done for the first time.

--Francis M. Cornford (1908)

Understanding the Challenges Faced by the Underrepresented

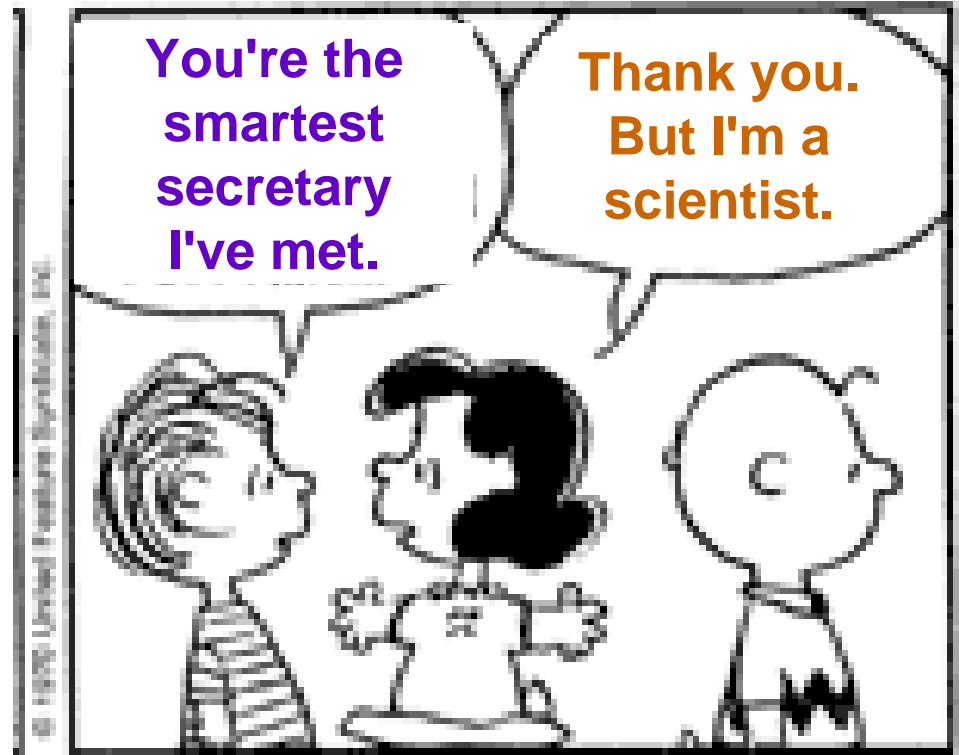
- **Two key concepts help explain the slow pace of inclusion and advancement of women, minorities, and persons with disabilities in science and engineering (adapted from Virginia Valian (*Why So Slow?*)**
 - ❖ **Gender, racial/ethnic, and disability "schema"**
 - ❖ **Accumulation of advantage**

"Schema"

- **"Schema" are widely held beliefs about men, women, people from various racial and ethnic groups, people with visible disabilities, and people from economically distressed locales with respect to their competence, career roles/potential, and leadership ability**
 - *Lead us to overrate white men*
 - *Lead us to underrate women, minorities, persons with disabilities, and persons from poor communities*

"Schema"

***Overheard
at the STEM
conference:***



Drawing © UFS, Inc, 3/6/04

Accumulation of Advantage

- **"Accumulation of advantage" refers to the cumulative long-term effect of small differences in the way males and females from different racial/ethnic groups are treated throughout their lives**
 - At home and in school
 - On the sports field
 - In the workplace
 - In restaurants, stores, theatres,...
- **If majority males experience "1.001" and others experience "0.999" the difference accumulates profoundly**
 - Dominant-group males experience $\rightarrow \infty$ ("1400" after 20 years)
 - Others' experience $\rightarrow 0$ ("0.00067" after 20 years)

Other Tensions

for Women and Minorities in STEM

- **Being oneself *versus* fitting into the STEM culture**
- **Making connections: political relationships *versus* meaningful relationships and performance**
- **Controlling one's destiny *versus* conforming to expectations**
 - Moreover, expectations of women/minorities conflict with expectations of scientists/engineers/leaders
- **Achieving wholeness: freedom to align ideas, personality, and passions while being and being perceived as professionally successful**
- **Gaining self clarity: knowing what you need to do and be**
- **Adapted from Ruderman and Ohlott: Standing at the Crossroads**



EPSCoR Mandates

- **EPSCoR jurisdictions need more STEM and R&D to be competitive**
 - **EPSCoR & RII**
- **STEM & EPSCoR need more participation by traditionally underrepresented people to be competitive**

EPSCoR Jurisdictions

- **Only 18% of the US population**
- **BUT**
 - 51 of the nation's 103 HBCUs
 - 48 of the nation's 139 HSIs
 - 22 of the nation's 32 Tribal Colleges
- **Large opportunity for involving and partnering with minority serving institutions of higher education**

The Opportunity for EPSCoR

- **EPSCoR jurisdictions have an opportunity to broaden participation, become models of inclusiveness and diversity, and enhance their competitiveness in STEM**
 - From K-12 to leadership levels
 - Across all STEM disciplines
- **The challenge is to figure out HOW, not just accept, explain. or justify the *status quo***
- **Need to understand and navigate the change process**



Stages of Change for Smoking Cessation

Stage	Smoker	IT - Individual	IT - Institution
Pre-contemplation	"Smoking is not a problem and I enjoy it!"	"We've always done it this way, and it seems to work just fine."	No resources committed to solutions
Contemplation	"I am worried that smoking is bad for my health and I want to quit."	"If we want the best and brightest, we must figure out a way to attract women and minorities and keep them from leaving."	Task force charged with reviewing local data
Preparation	"I am going to buy a nicotine patch and quit on my birthday."	"I am reading CEOSE reports"	A strategic plan for diversity is developed
Action	"I quit!"	"I called the program chair and complained that there were no women or minority speakers"	Underrepresented faculty hired. Diverse EPSCoR leadership and "Board"
Maintenance	"I enjoy being able to breathe more than I enjoyed smoking."	"I am proud of the advances we have made hiring and promoting women & minorities."	Institutional and jurisdictional data are monitored and made public

Adapted from Molly Carnes et al., 2005³⁰

Example Strategies and Actions

- **Seek first to understand—underrepresented individuals and institutions/programs that do well**
- **Look for successful models and adapt or steal...**
- **Form true partnerships & alliances**
 - Significant roles, including leadership, for under-represented persons & minority-serving institutions
 - Leadership Alliance model
- **Provide supportive mentoring**
 - Accept people where they are and have very high expectations
 - Offer research experiences: early and often for all
 - Imminent CUR book: *Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact*, edited by Mary K. Boyd and Jodi L. Wesemann

Learn from Our Next Panel

- **Kellina Craig Henderson, *Program Director, National Science Foundation***
- **Ed Galindo, *National Resources Tribal Cooperative Aquaculture Research Institute, University of Idaho***
- **Sue Rosser, *Dean, Ivan Allen College of Liberal Arts, Georgia Institute of Technology***
- **Laureen Summers, *Program Associate, Project on Science, Technology, and Disability, AAAS***

