

Federal Support for Science in  
the Research University: The  
Social Consequences  
Between 1947 and the present.

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# The Problem:

- Why are the numbers of women and people of color earning Ph.D.s in Science, Technology, Engineering, and Mathematics (STEM) growing so slowly;
- Why are members of this population so under represented as faculty at research universities?

# Why Should We Care?

- Workforce participation circumscribed
- Median income below whites
- Multigenerational poverty
- Health disparities substantial
- Shorter life span than whites
- Complex social problems fostering self-destructive behaviors

# More Reasons to Care

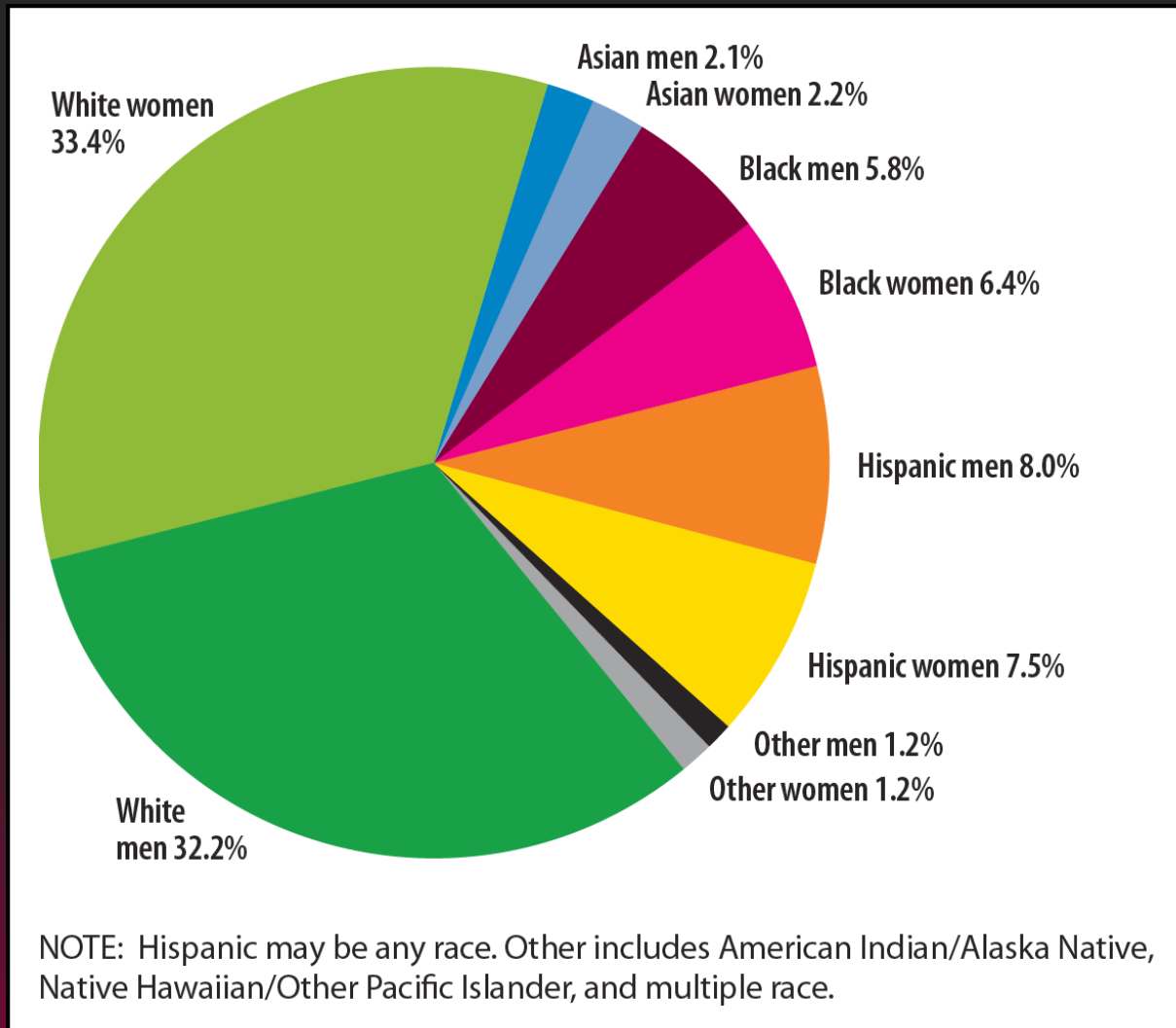
- Perceived decline in U.S. scientific achievements NAS Gathering Storm
- Concern about technology and economic development
- Concern about economic and social costs of populations excluded from the mainstream workforce
- Lack of interest in “building democracy through education” Truman Report 1947

# Science and Engineering Doctoral Degrees Awarded by U.S. Citizenship and Permanent Residents, Field, and Ethnicity: 2007

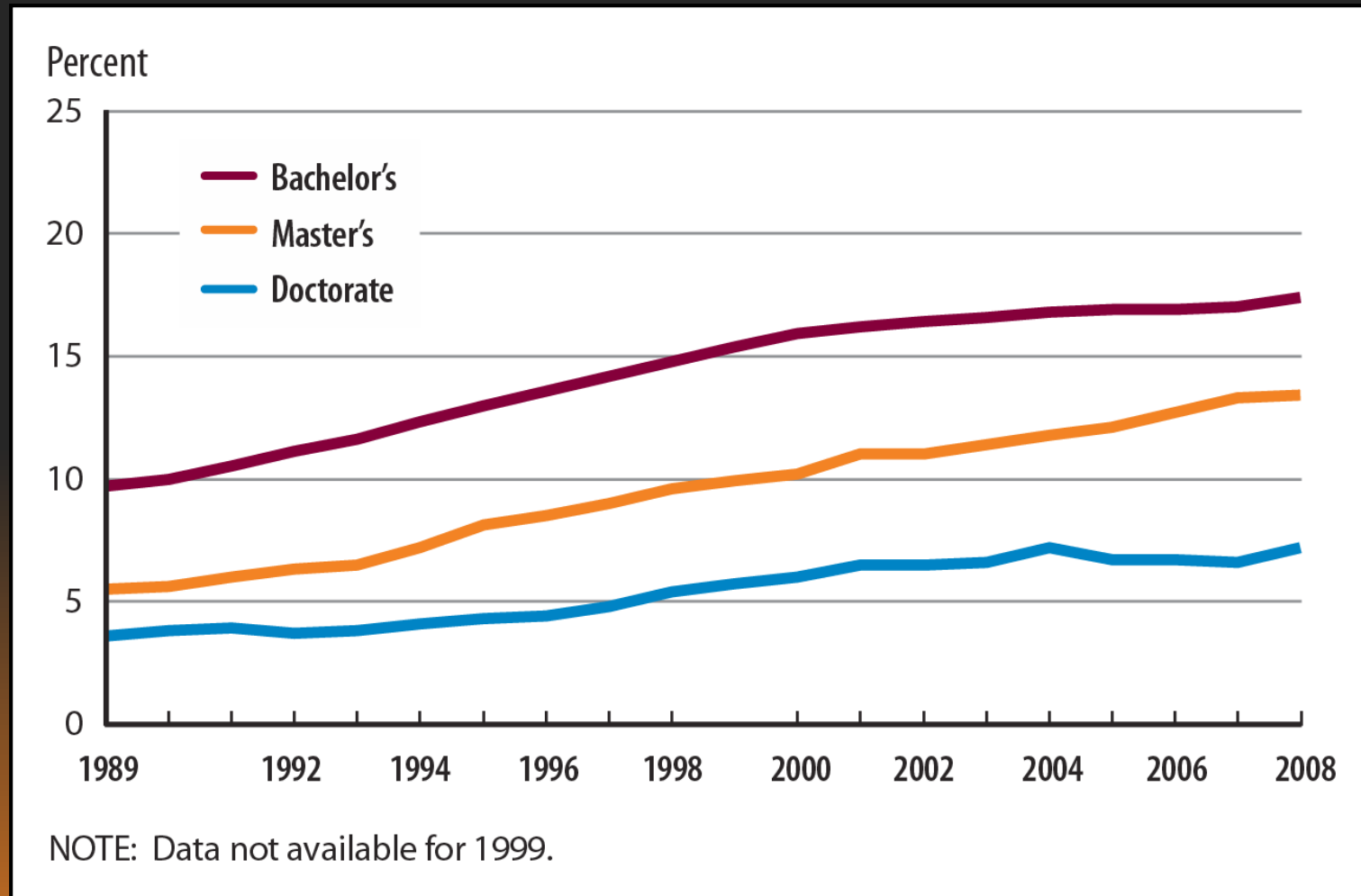
<i>Ethnicity</i>	<i>Male</i>	<i>%</i>	<i>Female</i>	<i>%</i>	<i>Total</i>	<i>%</i>
White	5748	73%	3154	70%	8902	72%
Asian/Pacific Islander	939	12%	579	13%	1518	12%
Black	243	3%	215	5%	458	4%
Hispanic	309	4%	218	5%	527	4%
American Indian/Alaska Native	24	0%	23	1%	47	0%
Other/Unknown Race/Ethnicity	625	8%	345	8%	970	8%
Total	7888	100%	4534	100%	12422	100%

Source: National Science Foundation, SRS. 2007. S&E Doctorates Awarded to U.S. Citizens and Permanent Residents 2007. Web. 2010 Sept. 24.

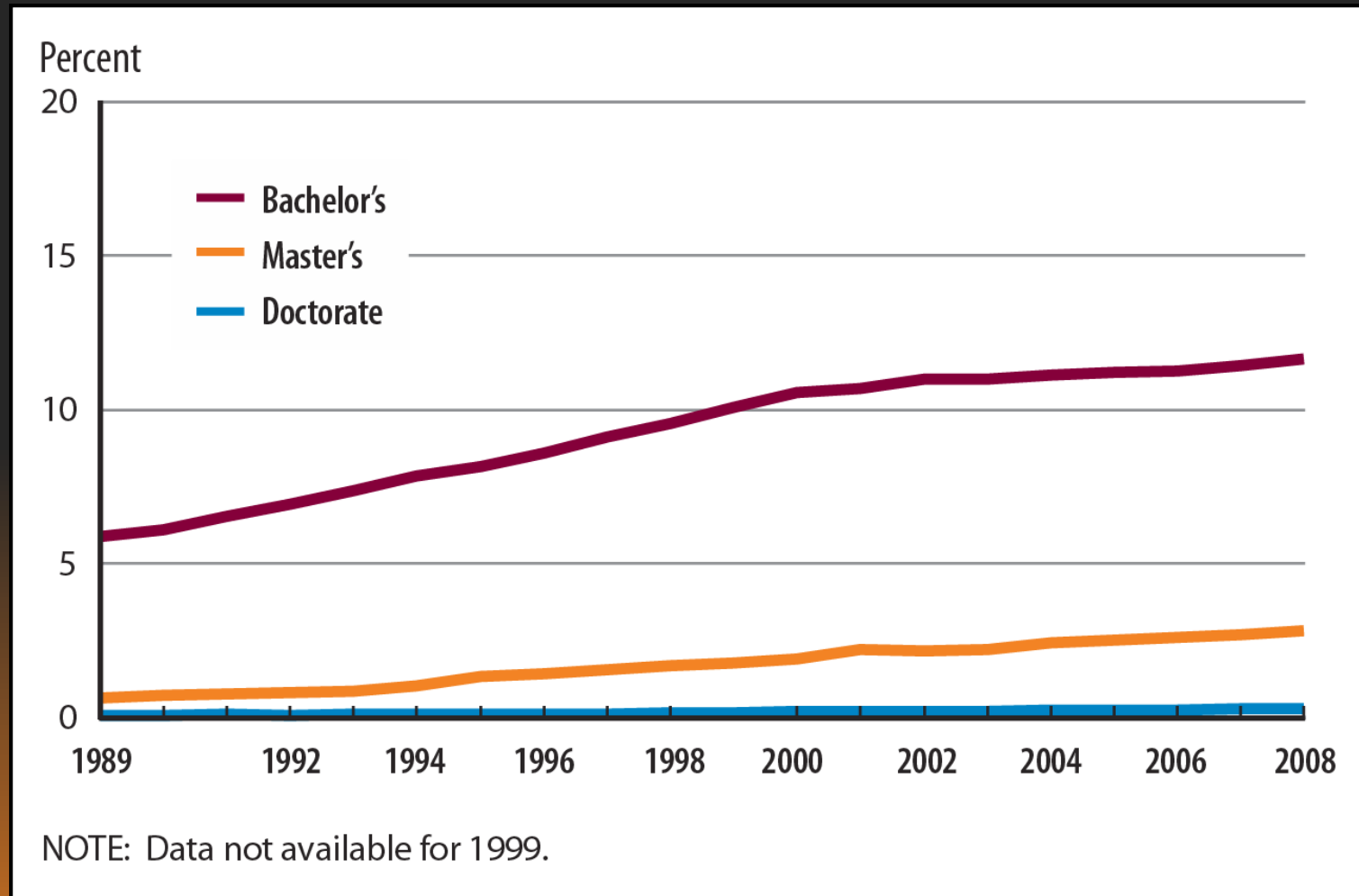
# Resident population of the United States, by sex and race/ethnicity: 2008



# Science and engineering degrees earned by underrepresented minorities: 1989–2008



# Science and engineering degrees earned by underrepresented minority women: 1989–2008





# Seeking a Comprehensive Explanation

- Various current explanations by themselves inadequate to understand problem
- Issues persist—MIT latest report, NAS, etc.
- Broader, systemic explanation more likely—hence my hypotheses about federal policy and its local execution

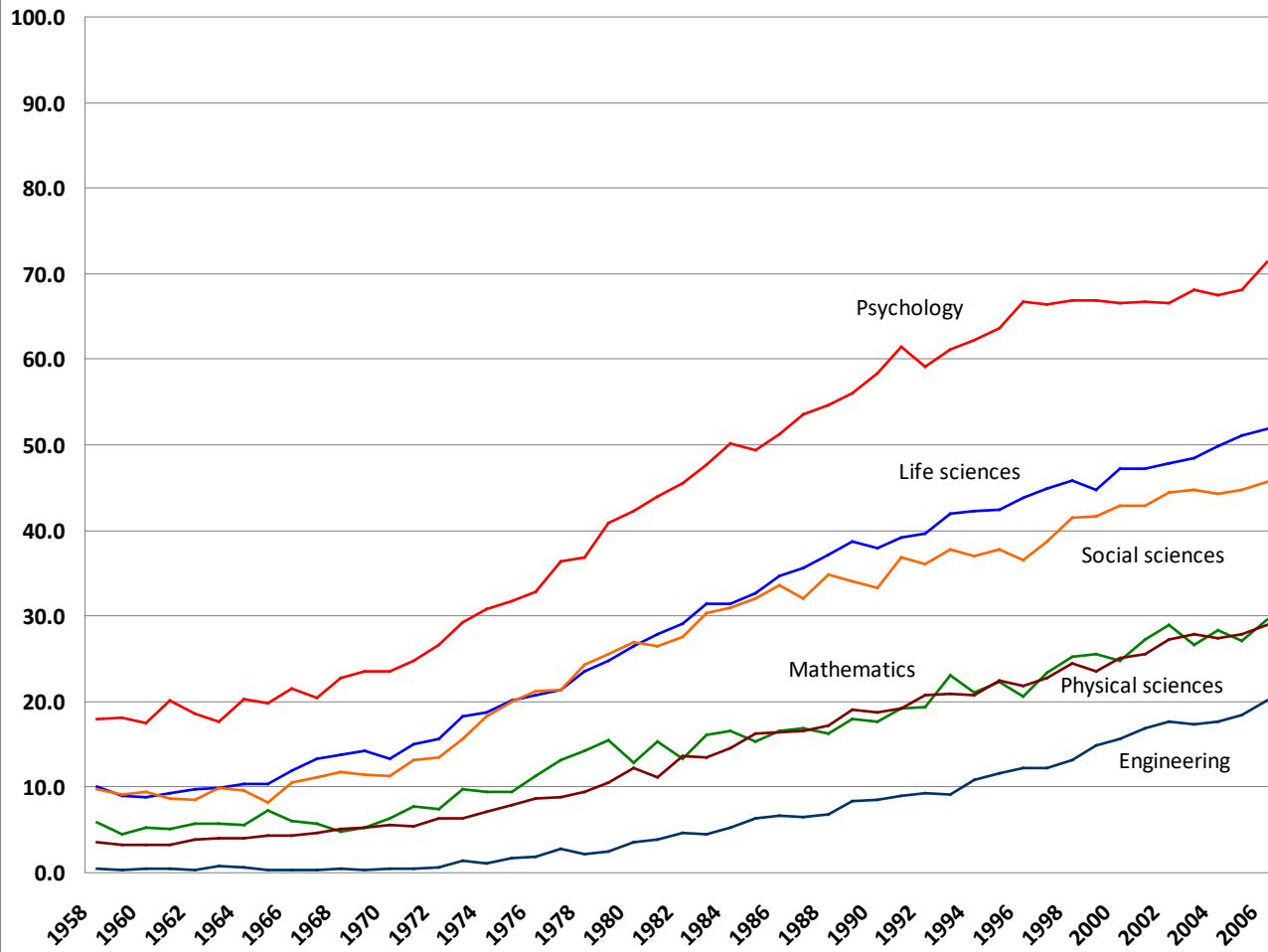
# Current Explanations

- Bias/Stereotyping
  - Not smart enough for math
  - Lack discipline
  - Graduate school in STEM is too demanding
  - Women will choose family over profession
  - Viewed as servants, athletes, criminals

# More Other Explanations

- Pipeline Issues
- Stereotype Threat
- Flagging interest in science careers among U.S. high school pupils and undergraduates

Women's Percentages of PhDs in Selected Fields, 1958–2006



# Education in the United States Prior to World War II (1940)

- 73% of age group in high school, 7 million Presidents Commission on Higher Education, 1947
- Higher ed enrollments 16% of cohort, 1.5 million students Presidents Commission
- Direct cost of higher ed 522 million, .55 GNP ditto
- 3% of “Negros” had completed 1 year of college
- 1.5% earned a degree ditto
- Segregated colleges/life in 17 states and D.C.
- Small numbers of any ethnic group attending college
- Women ca. 40% undergraduate enrollment Thelin

# Post War Social Engineering through the G.I. Bill

- Selective Service Readjustment Act 1944
- Reintegration of 16 million veterans
- Goals: prevent massive unemployment and social unrest, assist veterans to move into the middle class through education, jobs, house acquisition, small business starts
- Reached 8 out of 10 men born in the 1920s Putnam in Katznelson 113

# Populations Assisted 1944-1956

- Half of 16 million veterans utilized
- Far less than 50% of 1 million + black veterans were able to use
  - Administered by Jim Crow state VA offices
- Of 400,000 women veterans, 3.6% utilized educational benefits

# Consequences

- 1947 49% of all college students veterans
- Brought first generation students into H.E.
- Gender consequences: men outnumbered women in college (40% in 1940, 32% 1950)—masculinized postwar campus
  - Men enrolled heavily in STEM and Professional Schools—adding to perception of female disinterest and/or incapacity TheIn
- Greatly expanded public institutional enrollment
- Few blacks in STEM and/or graduate programs outside of the South



# Consequences

- By 1956 the “United States was richer by 450,000 engineers; 238,000 teachers; 91,000 scientists; 67,000 doctors; 22,000 dentists; and more than a million other college-trained men and women, thanks largely to the Servicemen's Readjustment Act of 1944, universally known as ‘the GI Bill.’”  
Haydock, 1999

# Further Shaping of the Future

- *Science—The Last Frontier* Report of Office of Science under Vannevar Bush, 1945-It calls for a permanent federal agency to help support basic research in academia, oversee medical and military research and provide funding for science education at the undergraduate and graduate levels.
- 1947 Congress creates National Science Fdtn, signed in 1950
- *The President's Commission on Higher Education for Democracy*, 1947

# Sputnik and Big Science in U.S.

- Proliferation and expansion of federal scientific oversight and research funding
- 1958 NDEA
- Proliferation of Ph.D. programs in STEM
- Great investment in university facilities
- Expansion of postdoctoral programs

# Growth in R&D Investment in Universities

- Growth in size of individual research universities
- Increase in Ph.D. programs in STEM
- Development of scientific facilities and infrastructure with both universities and national labs or other facilities (SLAC)

# Attitudes Supported by this System of Funding

- War and post-War structuring of research organized by white men who accepted the segregation of the military and society, the low value of women's work and intelligence.
- War-time work had created a familiarity and comfort with working for and with the federal government/military
- Reinforcing scientists' apparent neutrality was/is a belief that science "objective."
- War time scientists trained a largely male succeeding generation in STEM imparting their own values
- This generation in turn educated an even greater number of largely white men in the 1960s and 1970s

# Persistence of Attitudes Inimical to Inclusion in Science

- Until the Civil Rights Movement and the later Women's Rights Movement, little challenged prevailing social paradigm of doing science.
- In 1970s focus of these movements more on increasing general minority and female participation in postsecondary education and creating fields of study related to themselves.
- Women faculty in all fields isolated and discriminated against in salary, research support, daily treatment. FOC treated the same. Members of both groups very small in number.

# Federal Efforts to Address Historical and Current Discrimination

- Supreme Court decision in 1954 *Brown vs the Board of Education*
- U.S. Commission on Civil Rights, Congress 1959
- Southern resistance, passage of the Civil Rights Act 1964, Title VII creates of the Equal Employment Opportunity Commission (Equal Pay Act 1963)
- President Johnson's Executive Order 1969 that employers "take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to race, color, religion, sex, or national origin."
- Reauthorization of Higher Education Act 1972, Title IV forbade gender discrimination in education

# Federal Attempts in STEM Education

- 1930 NIH created from Hygienic Lab
- 1949 under federal security agency, public health service
- NIH National Institute for General Medical Sciences, 1962
- 2011 NIGMS supports over 4,500 [research grants](#)—about 10% of the grants funded by NIH as a whole. NIGMS also supports approximately 25% of the trainees who receive assistance from NIH.
- 1973 NIH NIGMS creates MARC and MBRS Programs for minority biomedically related STEM students



# Aspects of Social Engineering in Higher Education: Financial Aid

- **1958** National Defense Education Act
- Federal financial aid programs, Economic Opportunity Act of **1964**, PL88-452 (established college work-study and authorized Head Start, Upward Bound, and VISTA)
- **1965** Higher Education Act of 1965, PL89-329 (authorized most federal student financial aid programs, including the Educational Opportunity Grant Program and the Guaranteed Student Loan Program).

# Aspects of Federal Social Engineering: STEM from Middle School to Postdoctorate

- Training programs including those targeted at women and students of color:
- NIH
- National Science Foundation
- Department of Energy & National Labs
- Departments of Agriculture, Transportation, Education, Public Health, etc.

# What is Wrong with This?

- Programs created without reference to one another often with overlapping goals
- Usually for a few years—some renewable some not—absence of continuity
- Pedagogical goals mostly set by white male STEM professionals
- Goals for targeted populations set without reference to particular issues of first generation students and the effects of long term discrimination
- No knowledge each program's effectiveness
- No real shared knowledge of what makes programs effective

# Measuring Undergraduate Program Effectiveness

- Most participant populations already at a high standard: usually 3.0 gpa
- Criteria for participation varied beyond gpa
- Run at the institution level by faculty who may or may not be effective with a student from a very different background
- Evaluation of student may be biased

# Who is now Participating and Who Runs?

- Questions today about programs originally for U.S. domestic underrepresented students—increasingly immigrants from Africa or the Caribbean, Hispanics from middle class backgrounds, new Asian populations
- Affirmative Action still federal law—not enforced

# Graduate Programs in STEM

- 2007 S & E total enrollment 516,199
    - U.S. citizens and perm res 365,091 (67% white)
    - Temporary visa holders 151,108 Burns, Einaudi, Green, NSF
- 2007 48,112 total Ph.D.s awarded in U.S.
- Engineering 7,744 total Ph.D.s
- 4,586 temporary visa holders

2009

# Numbers of Faculty in the United States in Fall 2007 all Fields

- Full-time instructional faculty:
- Total 703,463
- Black 37,930      5.4%
- Hispanic 24,975    3.6%
- Questions about these data: Who is counted among ethnic groups; Exclusion of non-teaching faculty; Tenure track vs non

Source: NCES (National Center for Education Statistics) 2009. *Digest of Education Statistics*.

# Summary

- Federal policy since WW II favored the education of white men who dominated in STEM fields. (GI Bill)
- Creation of agencies and funding mechanisms by men used to government direction from War
- Growth of university based research supported by federal monies keeps paradigm alive
- Has resulted in massive increase in postsecondary degree attainment in STEM
- Training of people of color began in 1970s and has not caught up in STEM



# Conclusion

- Current federal support for STEM in post secondary education for student programs is duplicative, uncoordinated, operate in isolation one from another
- Waning interest in affirmative action means increasing numbers of new immigrants populate AA programs
- Faculty at Research Universities often of foreign origin, not sympathetic to training issued of women and student of color, little increase in U.S. faculty of color