



Women Engineers of Color: How Research Supports Them

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Issues of Invisibility

- Fragmented literature:
 - By race/ethnicity
 - By women and race/ethnicity
 - By discipline
 - By exclusion from U.S story
 - By data source
 - U.S. citizens and permanent residents
 - Blanket ethnic categories



Overview of Talk: How Research Can Assist them. . .

- Distribution and number of degrees
- Where Women Scientists of Color work
- What are their individual issues?
- Institutional and social issues
- What can be done to address these?

Women Ph.D.s, U.S. Citizens, All Engineering 1996-2005

Women Ph.D.s, U.S. Citizens, All Engineering 1996-2005

	1996	1998	2000	2002	2004	2005
Asian Amer	51	51	57	49	51	55
Black	19	21	24	26	33	23
Nat. Amer	2	4	4	0	2	1
Hispanic	14	13	10	23	17	21
Mex.Amer	3	3	3	6	5	8
Puerto Rican	5	1	4	11	2	5
Other Hisp.	6	9	3	6	10	8
White	325	279	319	257	296	272
Unknown	7	7	7	12	14	24
All Women	418	375	421	367	413	396
All Men	2,178	2,193	1,802	1,526	1,532	1,602
All U.S Citizens	2,596	2,569	2,223	1,893	1,945	1,999

Source: National Science Foundation, SRB. 2007. *Doctorates in Science and Engineering 2005*.
Susan Hill, Program Officer, NSF 07-305

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Ph.D.s earned in 2004 in Science and Engineering U.S. Citizens only

All Science minus psychology and social sciences

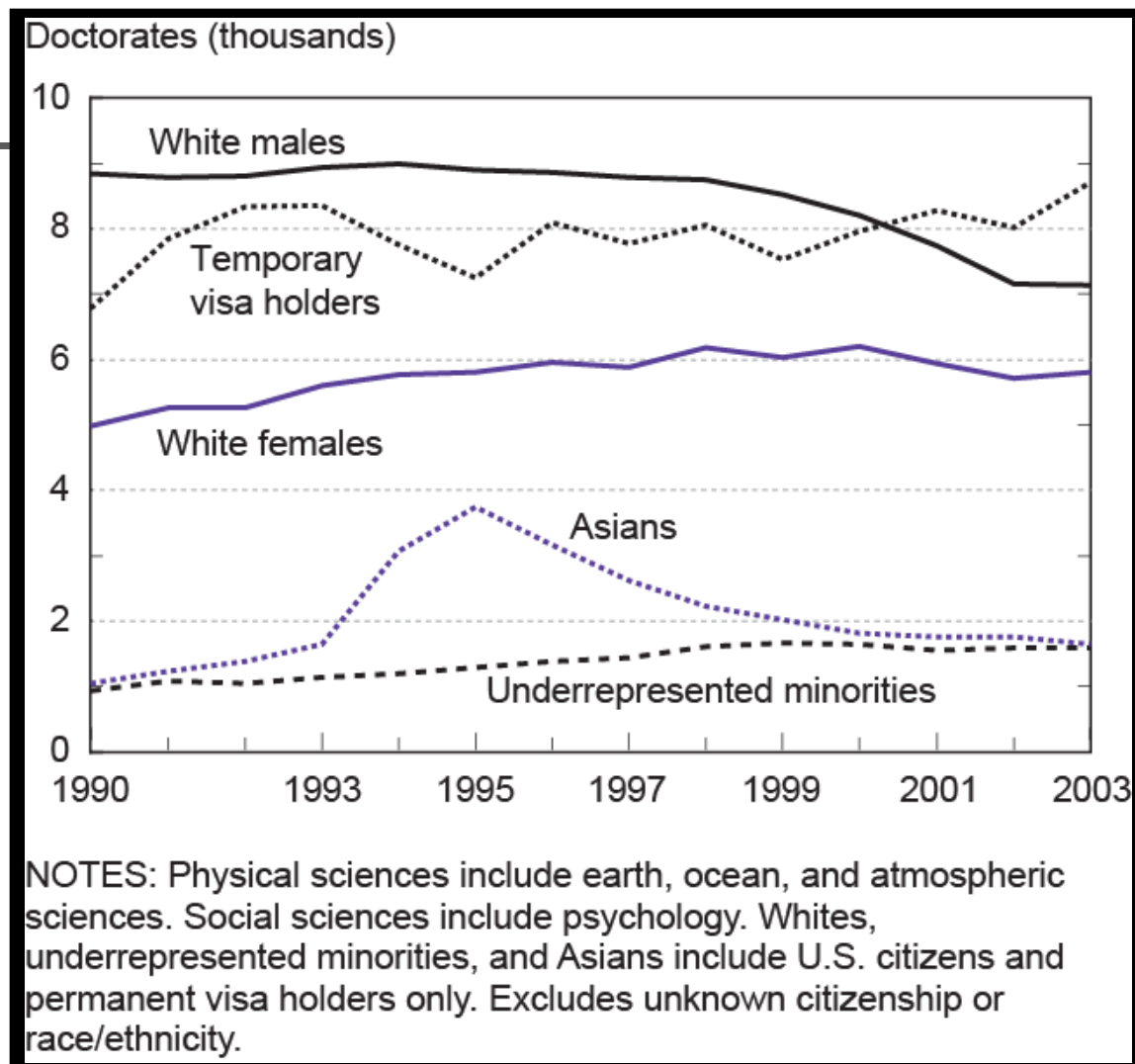
Total all ethnicities:		Nat. Amer.		Afr. Amer		Asian		Mexican Amer	
Women	Men	Wm	Men	Wm	Men	Wm	Men	Wm	Men
2,911	6,104	6	22	124	107	254	340	41	52
% wm	48%	27%		116%		75%		79%	
All Engineering:									
Women	Men								
412	1,529	2	3	32	52	51	178	5	17
27%		67%		62%		29%		29%	

Total U.S. citizens (women and men) all ethnicities in natural and physical science: **9,015**

Total URM women (Nat. Amer., Afr. Amer., Mex. Amer.) 171 = 1.89%

Source: Susan Hill, National Science Foundation, *Doctorates in Science and Engineering 2004*, March 2006

S&E doctorates conferred by citizenship status and race/ethnicity: 1990–2003



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UCB Science and Engineering Ph.D.s 1980-1990 By Gender and Ethnicity

**Table 17c: UCB Science and Engineering Ph.D.s 1980-1990
By Gender and Ethnicity**

Ethnicity	Total	Women	% Women	Men	% Men
African American	54	15	27.8%	39	72.2%
Asian American	347	65	18.7%	282	81.3%
Chicano	24	5	20.8%	19	79.2%
Filipino	5	2	40.0%	3	60.0%
Hispanic	57	14	24.6%	43	75.4%
Native American	9	3	33.3%	6	66.7%
White	2,464	555	22.5%	1,909	77.5%
Foreign	1,036	95	9.2%	941	90.8%
Others/Unknown	142	17	12.0%	125	88.0%
Total	4,138	771	18.6%	3,367	81.4%

Source: UCB Graduate Division Database / A.J. MacLachlan, *Progress and Outcomes*, 12/2002



Detailed Employment of Study Participants by Gender

Table E 3: Detailed Academic Employment of Study Participants By Gender

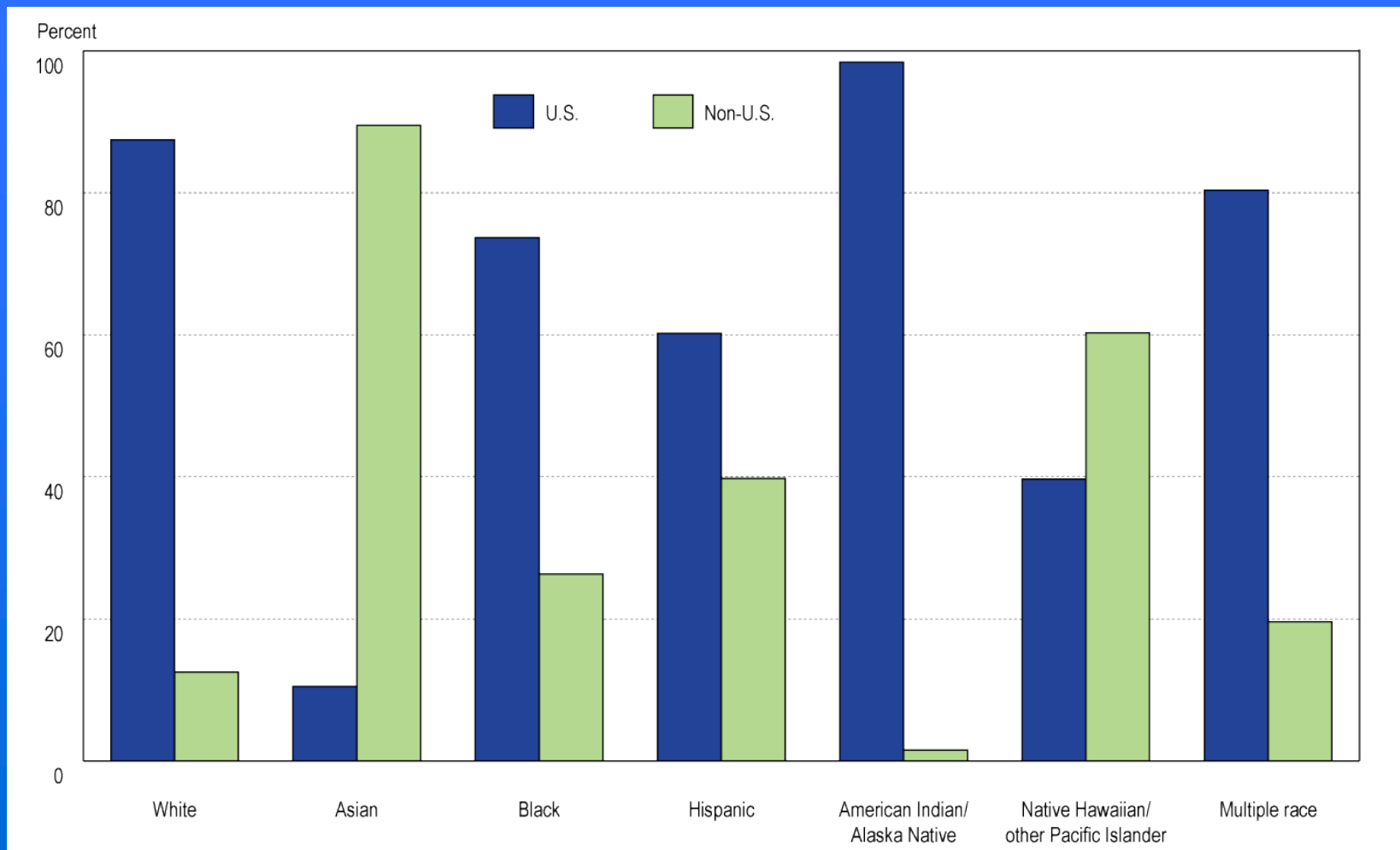
	Women	% Women	Men	% Men	Total	% Total
Academic	42	66.7%	56	57.7%	98	61.3%
Industry	8	12.7%	23	23.7%	31	19.4%
Government	7	11.1%	12	12.4%	19	11.9%
Non-Profit	3	4.8%	1	1.0%	4	2.5%
Other	3	4.8%	5	5.2%	8	5.0%
Subtotal Non-Academic	21	33.3%	41	42.3%	62	38.8%
Total	63	100.0%	97	100.0%	160	100.0%



Relationship between Population and Degree Attainment

- U.S. Population:
 - white 73.9%, black 12.4%, Asian 4.4%
 - Hispanic or Latino 14.8% (U.S. Census 2000)
- All Women 25.8% w/degrees in S&E workforce, 47.2% of total college educated workforce
- All Blacks 5.1% of S&E, 7.5% ed.wkfce
- Hispanics 5.2% S&E, 5.8% ed.wkforce
(NSF Science and Engineering Indicators, 2008)

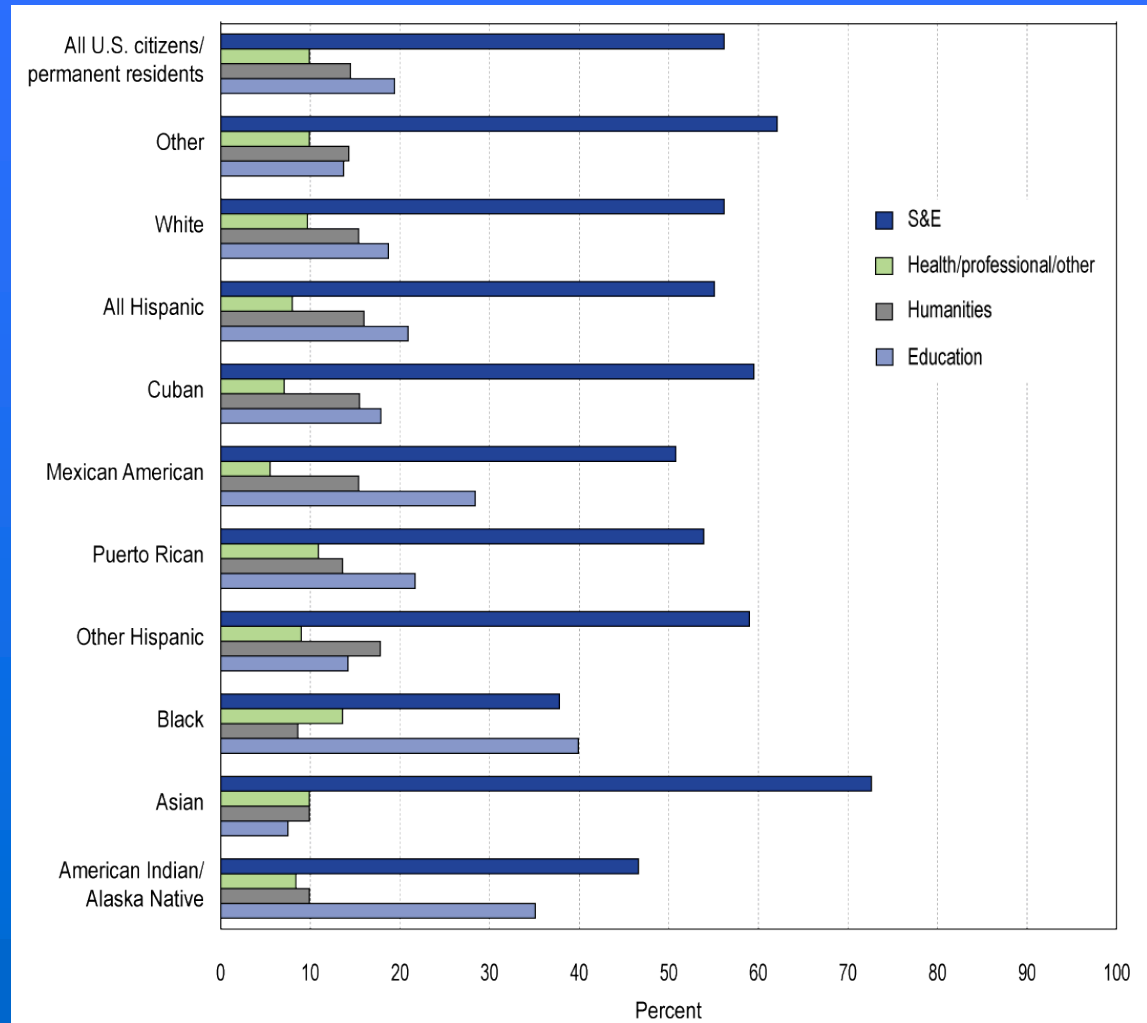
Doctoral science and engineering faculty, by race/ethnicity and country of birth: 2003



SOURCE: *Women, Minorities and Persons With Disabilities in Science and Engineering (December 2006)*



Field distribution of S&E and non-S&E doctoral degrees awarded to U.S. citizens and permanent residents, by race/ethnicity: 2004



SOURCE: *Women, Minorities and Persons With Disabilities in Science and Engineering (December 2006)*



What Issues Contribute to Sense of Invisibility?

~~Isolation—solo status~~

- Micro aggressions
- Lack of respect
- Expectation that ethnicity not important
- White “liberalism”—implicit bias
- Campus & working climate for women and minorities

Working Conditions of Women of Color



- Against white men's median income
 - Asian-Amer women earn 78%
 - Black women 63%
 - Hispanic 52%
- In 2007 in top 500 companies
 - All women corporate officers 15.4%
 - Women of color 2%

(Carol Hymowitz, "On Diversity, America isn't Putting its Money Where its Mouth is."
Wall Street Journal, 27 February, 2008)



Sources of Individual Conflict for Women of Color

- service to their community vs career
- dealing with lack of respect
- conflict between training and teaching
- own focus on science and research
- over use in diversity matters of any kind
- expectation that there to mentor SOC
- misunderstanding by birth families
- dissonance with potential partners



How Isolation is Preserved

- Your ethnicity is from society, it affects virtually all your experiences. It is part of American society, it is part of the consciousness of Americans. It influences the nature of your experience in graduate school, how you are perceived. It is impossible for me to separate this from graduate education.
African American Professor, 2004




The Academic and Scientific Environment

- Colleges and Universities are in the middle of an enormous paradigm shift without a sense of where this shift is taking them.
- From public to private funding
- Real rising costs/expectations
- Clamor for accountability
- Science very expensive
- Faculty and scientific work life changing



Attributes of this system:

- Fosters competition
- Based on unchallenged white male assumptions about what constitutes “good science” and “excellence”
- Operated on largely good old boy networks affecting hiring and promotion
- Self contained “The military industrial complex” [Eisenhower]



Paradigm of the successful scientific enterprise started to fray in the 1970s and into the 1990s. Why?

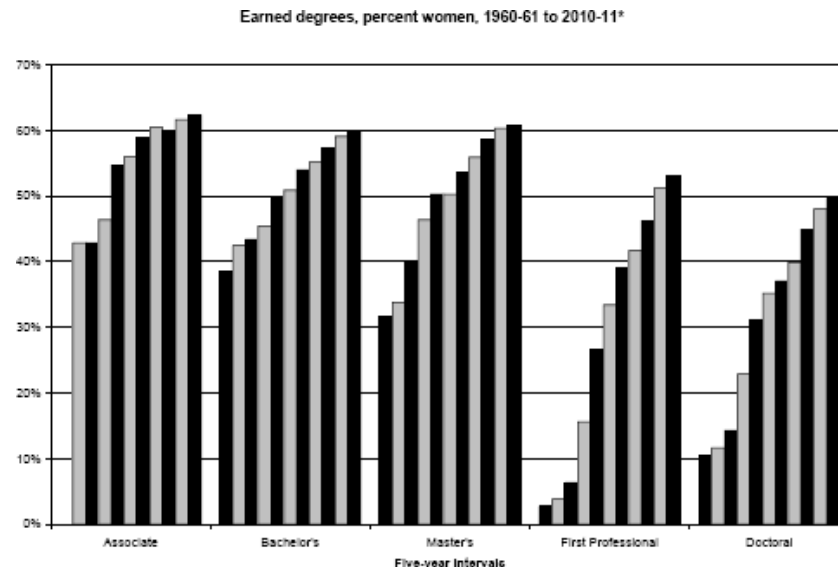
- Great expansion without the interior social system of how academic science is practiced noticing the enormous social changes taking place in the U.S.
- Belief in the “objectivity” of science



Elements of Social Change:

- End of segregation, Civil Rights Movement
- Higher Education Act + amendments
- Women's movement
- Anti-war, anti-nuclear movements
- Environmental movements

Earned degrees, percent women, 1960-61 to 2010-11



Source: U.S. Department of Education, Digest of Education Statistics 2005 (Table 246)



Why is Increasing Underrepresented Groups in STEM so slow?

1. Domination of the Pipeline model
2. General unwillingness to address spectrum of issues affecting African Americans, Native Americans and Chicanos/as—especially women
3. Social Organization of science still following post WW II model based on white male networks, myths about science



Slowly, slowly

4. Close to 40 years of programs:

Are they worth the money?

Have they changed postsecondary STEM achievement substantially for URM's?

Do we think we know what we are doing?

Are barriers openly discussed?

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Recognition of Bias and Discrimination against Women in STEM

- Ongoing studies--Research
- Increasing militancy of women
- National recognition of the problems and barriers
- ADVANCE Program
- State audits of women faculty looking at salary inequities, tenure and promotion



Making the Unnamed Visible

- *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* (2006) NAS Press
- *AAUP Faculty Gender Equity Indicators 2006*. Martha S. West and John W. Curtis. AAUP
- *Challenging Racism in Higher Education, Promoting Justice*. Mark Chesler, Amanda Lewis and James Crowfoot, 2005



NAS Summary:

- “the panel blamed environments that favor men, continuous questioning of women’s abilities and commitment to an academic career, and a system that claims to reward based on merit, but instead rewards traits such as assertiveness that are socially less acceptable for women to possess.”
- Source: Chronicle of Higher Education, September 19, 2006



Sources of Racism in Higher Education

- In the complicit silence of most college and university personnel, including leadership about poor treatment of women and faculty of color based on ignorance, prejudice, hostility, jealousy, fear of competition, and unexamined inherited attitudes and behaviors.
- In the unwillingness to identify problems related to race/ethnicity and culture.
- Negative impact of white liberalism and political correctness



More Sources ...

- Use of “minority” as an identifier of members of culturally diverse groups and treating individuals as if they are all the same
- Lack of acknowledgement that groups are internally stratified with class playing a critical role in individual life chances



Role of Leadership

- Senior leaders should set guidelines and adhere to these themselves
- Managers at all levels should pay attention to social dynamics in the workplace and end poor behavior
- Cooperation and mutual support among women should be institutionally encouraged and supported.
- Words like “excellence” and “collegiality” need to be defined so not used as a tool of exclusion
- New women leaders (department chair, manager) should be adequately trained and supported
- Collegiality should not be used as an excuse for inaction



More Leadership:

- Create mechanisms with teeth to end bad behavior
- Do not assume that women will themselves be fair so ...
- Clearly define expectations for behavior in any organizational unit academic or otherwise
- Make adherence to defined organizational values a factor in promotion, thereby
- Making every individual in the organization responsible for his or her own conduct



What Can Individuals Do?

- Advocate for institutional self-analysis involving individuals from underrepresented groups
- Catalogue the behaviors and language which alienate—“You are very eloquent [for an Indian]”
- Circulate, dramatize these for faculty, administrators, and students
- Examine the Darwinian culture of graduate school, postdocs and non-tenured employment with the goal of making more supportive



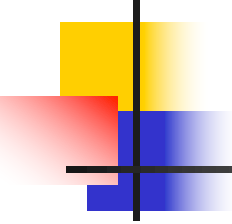
What Can Individuals Do?

- Get Tenure
 - Remember it is Research ad ...
 - Student work is not much valued
 - Good teaching is a plus
- Build Networks
- Acquire famous external mentors
- Know your limits and act



What we can do

- Reconsider the undergraduate curriculum in STEM fields to include social science studies of science, establish the legitimacy of concepts such as discrimination, bias, culture
- Support students of color by organizing seminars, meetings, etc. with faculty of color, alumni
- Train white faculty to mentor fairly and in a culturally sensitive way



What women scientists of color can do for themselves

- Organize locally with other women faculty
- Meet with Black, Hispanic, etc. campus groups
- Network with other women scientists
- Seek mentoring, mentor a younger scientist
- Consider a national organization such as AWIS
- Attend conferences for women scientists of color
- Speak out, overcome passivity



Further Considerations

- Some progress has been made in increasing the participation of persons of color in postsecondary education since the 1970
- Realize that African Americans do not constitute the entirety of under representation
- Pay attention to what is going on in your environment, scrutinize your and others' behavior for bias, inquire into the origin of prejudice in yourself



Factors of Invisibility

- Late appearance in higher ed
- Culture of science
- Actual small numbers
- Double bind—both female and minority
- Implicit bias of colleagues >>
- Discrimination in hiring and promotion