

***Advancing Women and Minorities in
Science and Engineering***

***University of Washington-Seattle
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Outline

- **Science and engineering need women and minorities**
- **The situation from college to workforce**
- **The situation in the Department of Energy**
- **Ideas for advancing women and minorities in science and engineering: something for everyone**
- **Questions and discussion**

Science and Engineering Need Minorities and Women

- **Science and engineering are about...**
 - Questions
 - Ideas
 - Extrapolation and prediction
 - Systematic observation
 - Communication
 - Interpretation, deduction, and understanding
- **Women & minorities strengthen
and enrich the enterprise**
- ! **But they are too scarce in most fields**

Women and Minorities need Science and Engineering

Science and Engineering provide valuable skills and capabilities, in demand by employers and a great way to contribute to society

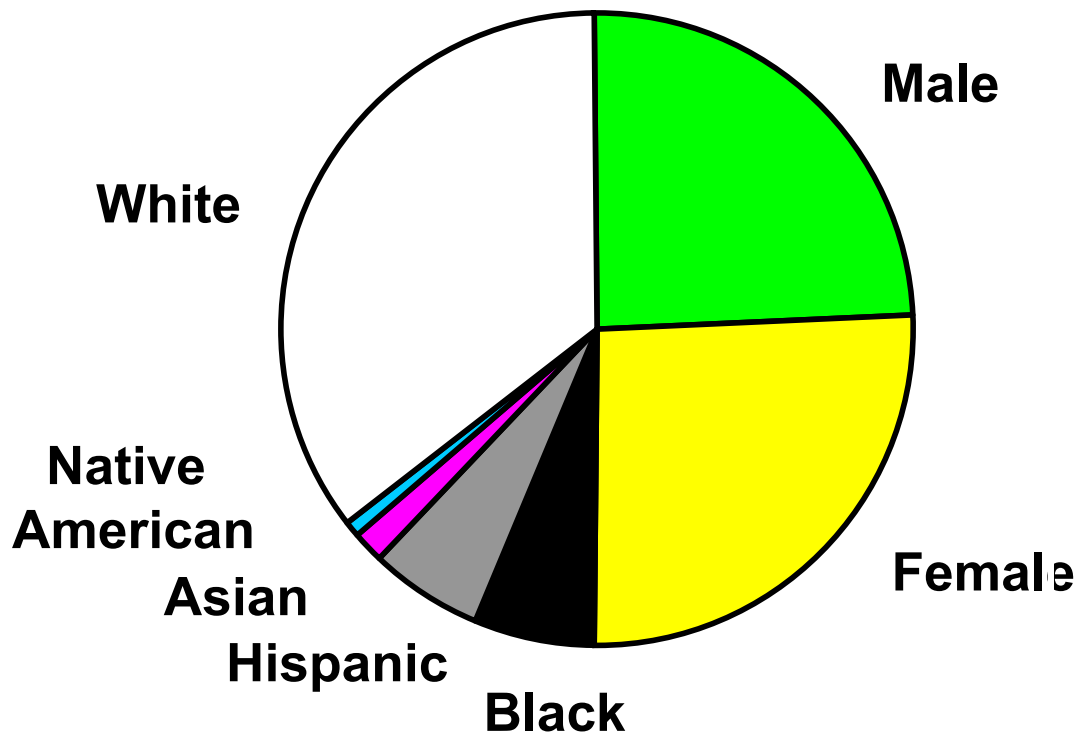
- Questioning
- Hypothesizing
- Experimenting
- Analyzing
- Synthesizing
- Inventing
- Predicting
- Testing
- Modeling
- Teaching
- Problem-solving
- Computing
- Discovering
- . . . And More . . .

1999 Diversity of US Population and Science/Engineering Workforce

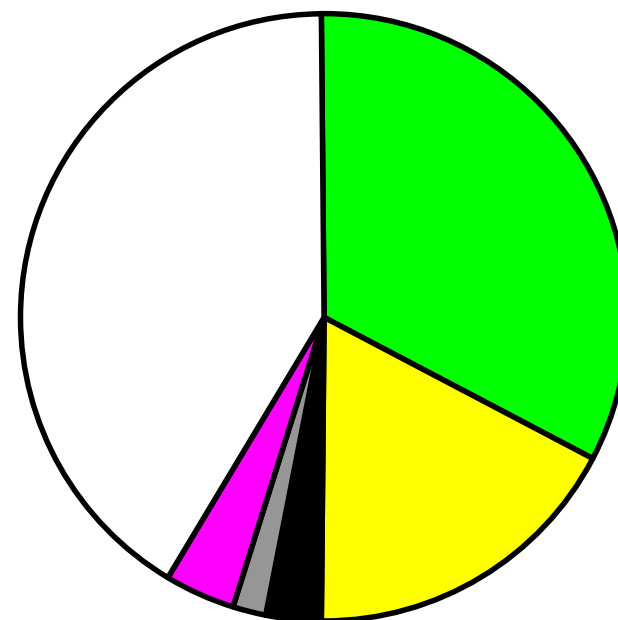
US Population
(273 M)

Ethnicity

Gender

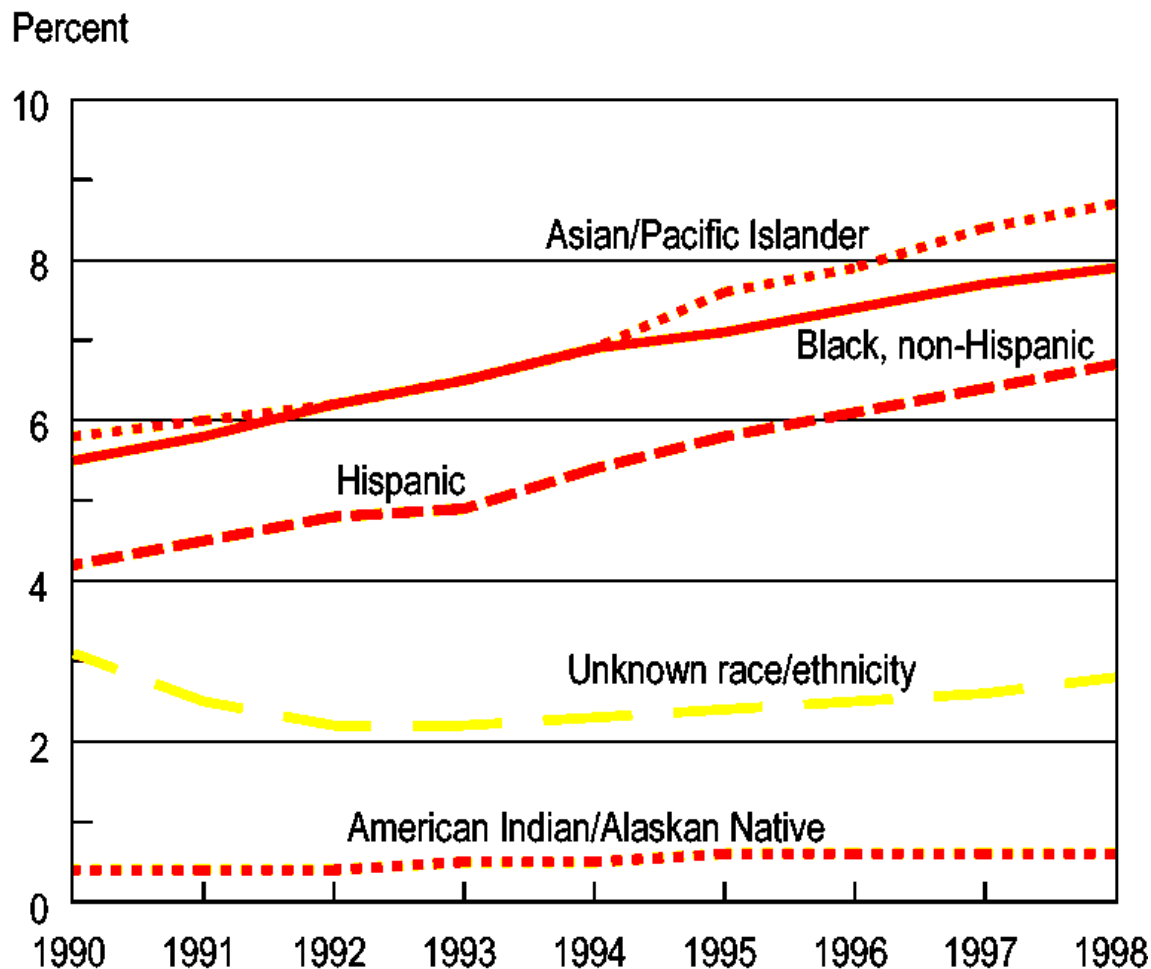


US Sci/Eng Workforce
(11 M)



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

Underrepresented Minorities Earn a Tiny, but Increasing Percentage of S&E Bachelor's Degrees (1990-98)



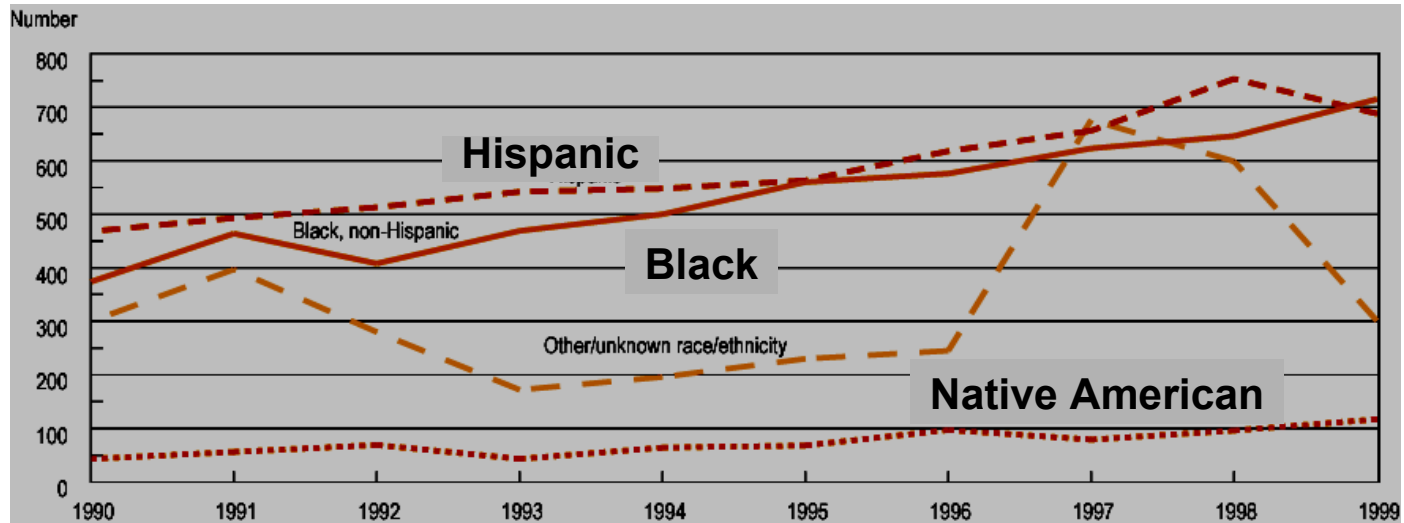
Source:
NSF 7/03

Persistence in Bachelors Degree Completion

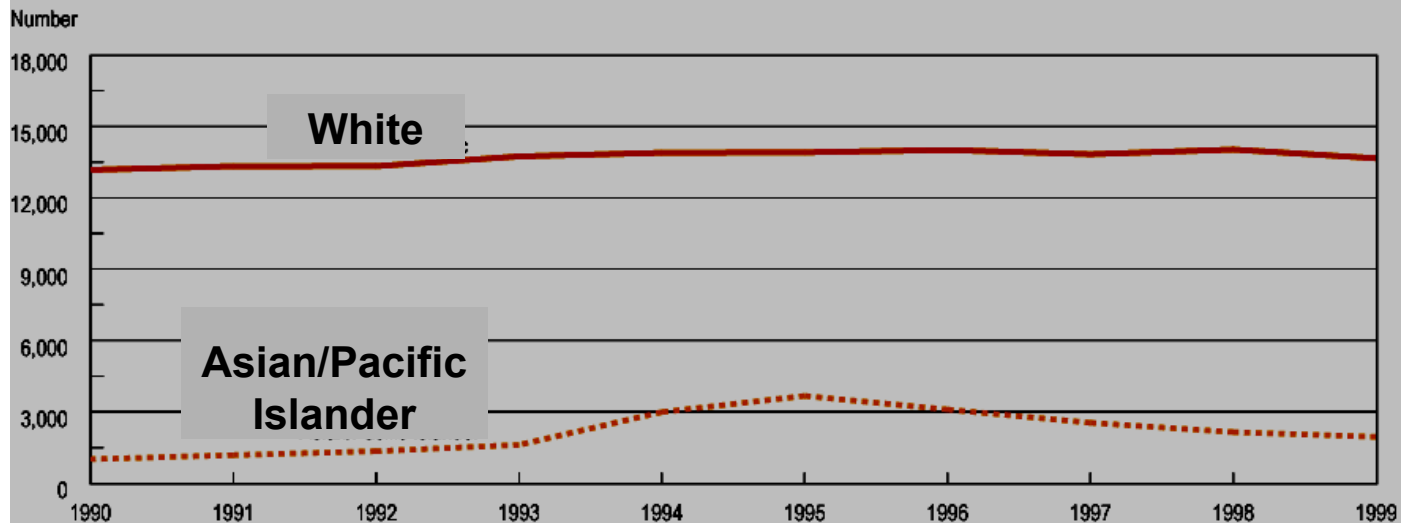
- A **higher** proportion of **Native American** and **Asian** undergraduates get S&E degrees than intend to as Freshmen
- A **lower** proportion of **Black** and **Hispanic** undergraduates get S&E degrees than intend to
- A **higher** proportion of **white female** undergraduates get S&E degrees than intend to
- A **lower** proportion of **white male** undergraduates get S&E degrees than intend to
- **Source:** *Women, Minorities, & Persons with Disabilities in Science and Engineering: 2002* (NSF 7/03)

Number of S&E PhDs Earned by Minorities is Increasing (1990-99)

800

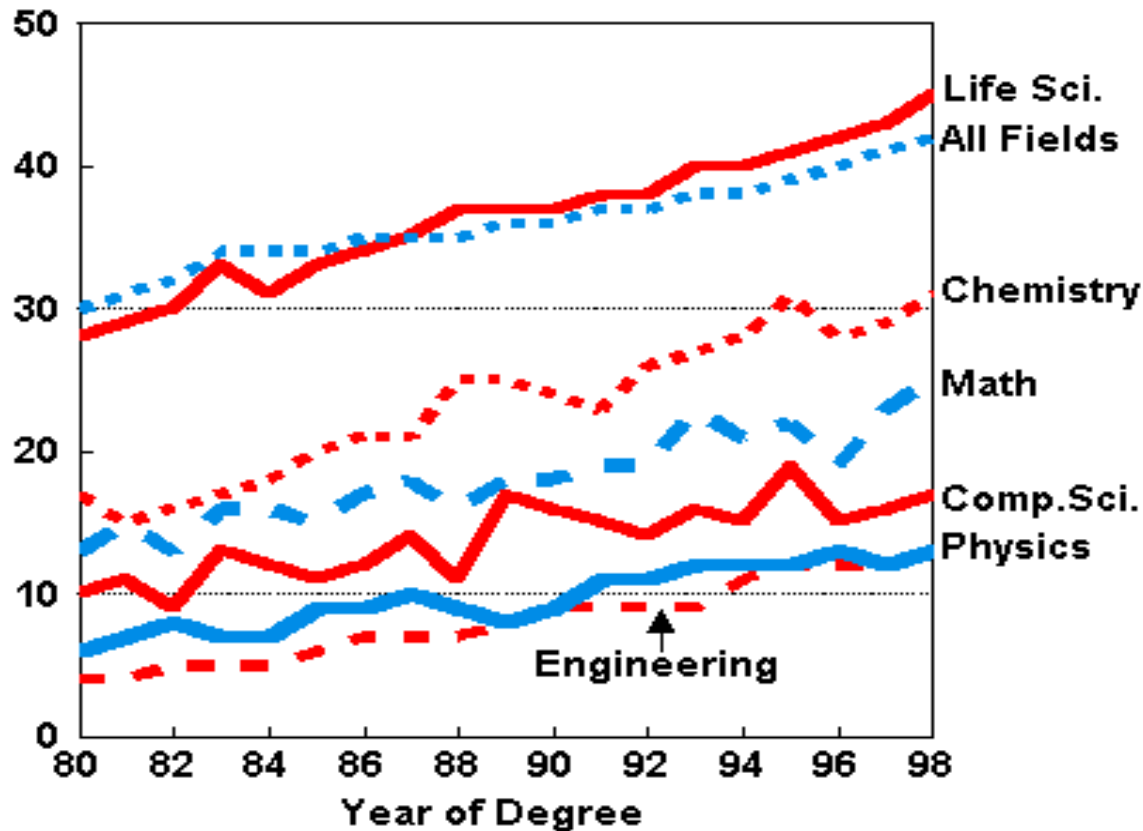


18,000



Source:
NSF 7/03

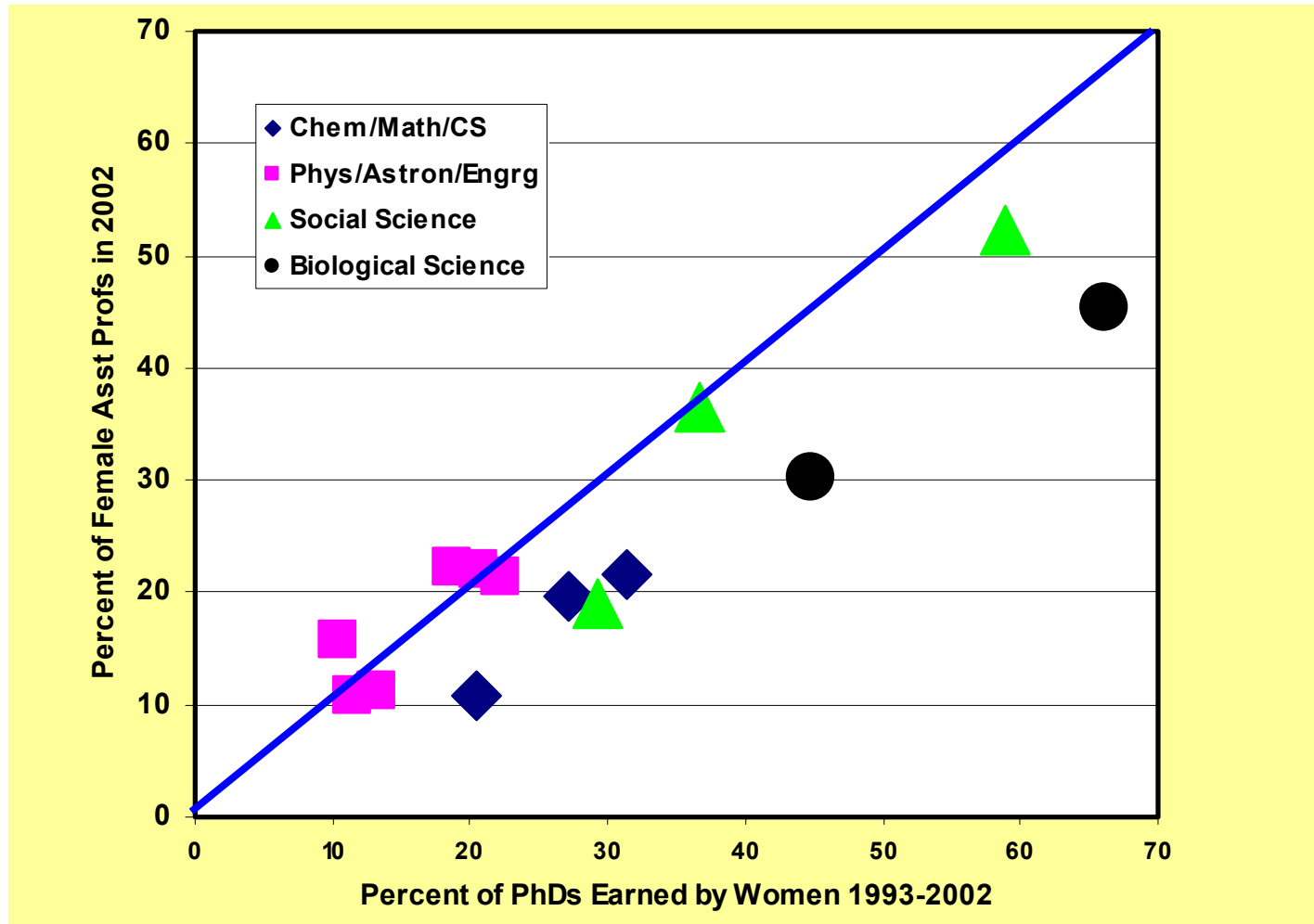
Percent of S&E PhDs Earned by Women is Increasing (1980–1998)



Source: Statistical Research Center, American Institute of Physics.

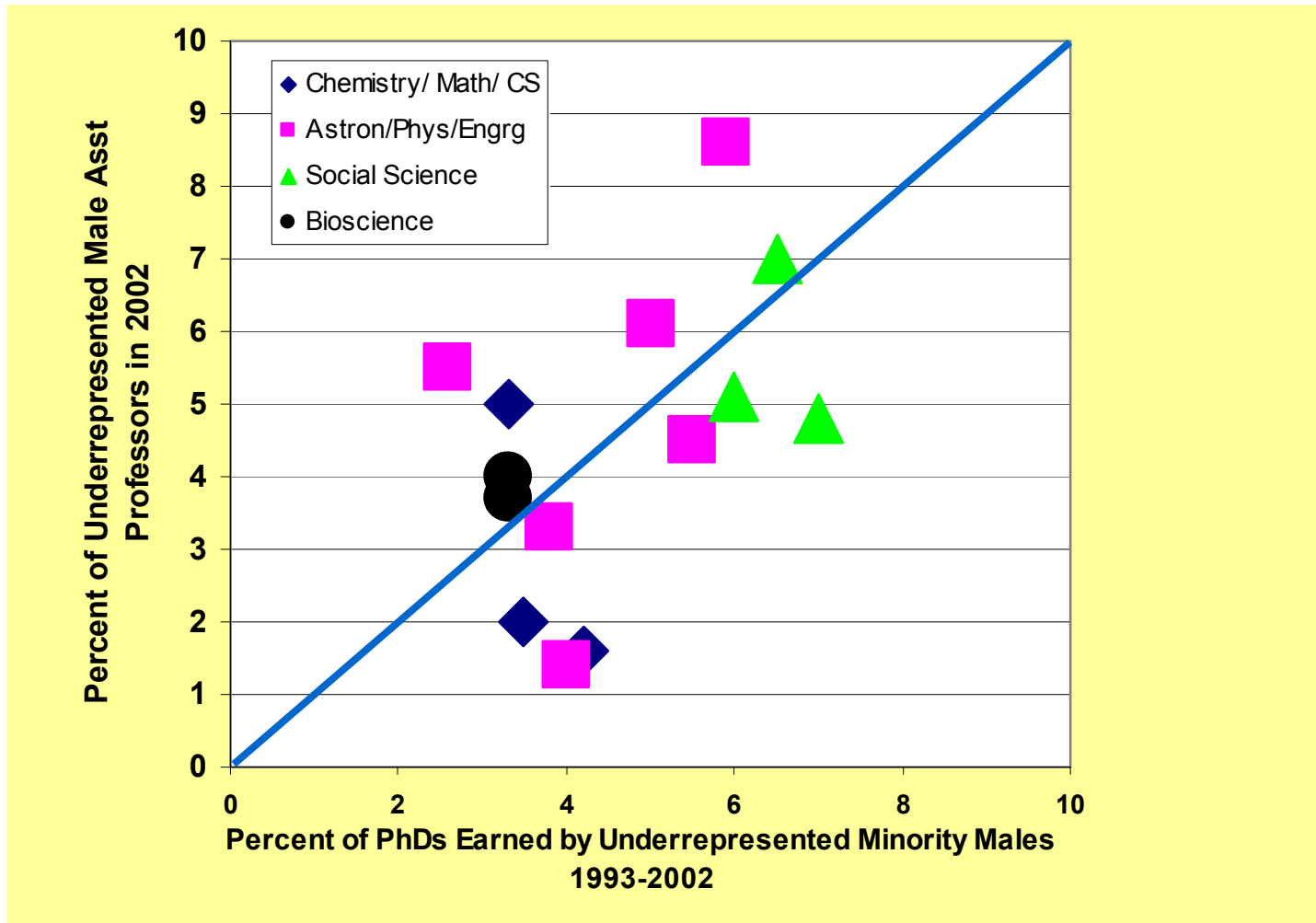
Data from Mulvey & Nicholson, *Enrollments and Degrees Report*, National Research Council, and National Opinion Research Center.

Higher Ed: Female PhDs Not Getting Tenure-Track Positions in **MOST** S&E Fields at R1s



Data source: "Diversity in S&E Faculty at Research Universities," Nelson & Rogers, 2004

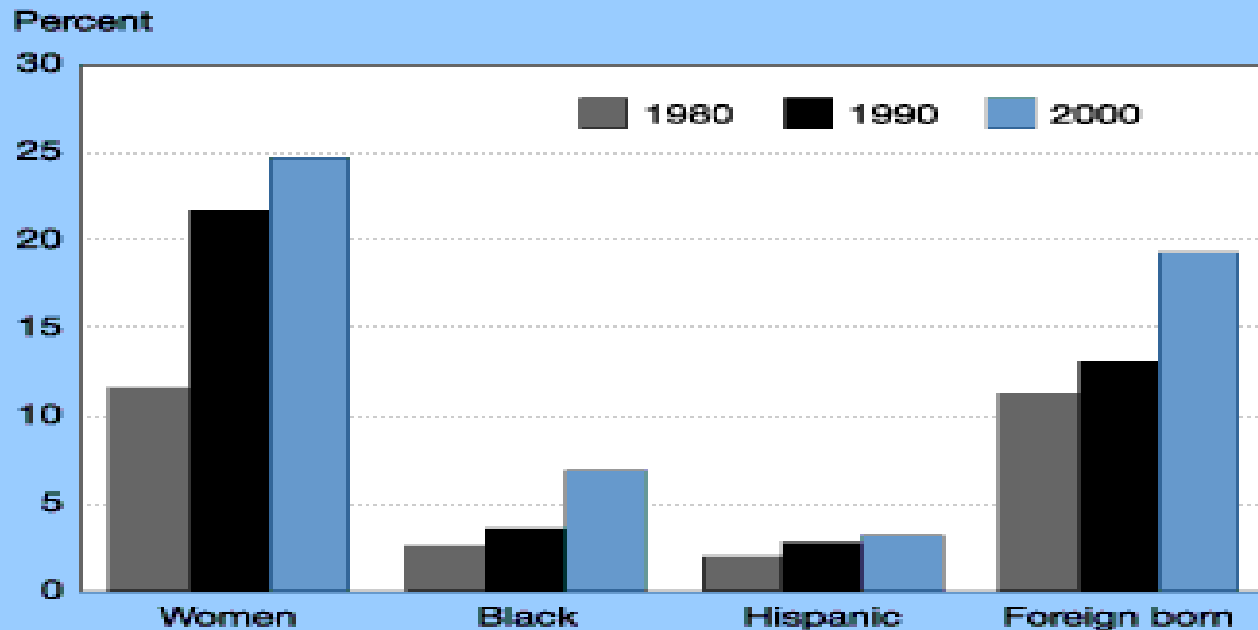
Underrepresented Minority S&E PhDs are getting Tenure-track Positions in Some Fields



Data source: Nelson & Rogers, 2004

Women and Minorities Are Increasing in S&E Occupations Outside Academia

Figure 3-13.
College graduates in nonacademic S&E occupations: women and minorities

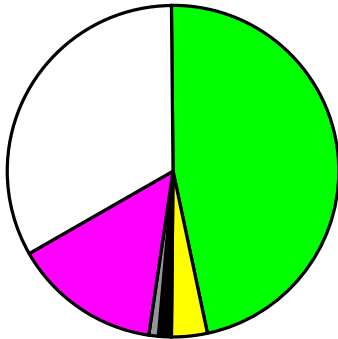


SOURCE: U.S. Department of Commerce, Bureau of the Census, 1980 and 1990 U.S. Decennial Census Public Use Microdata Sample, and March 2000 Current Population Survey.

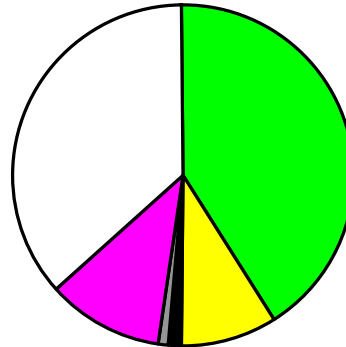
Science & Engineering Indicators – 2002

S&E PhDs in 1999 Workforce: **Variable Women & Asians; Minorities Still Scarce**

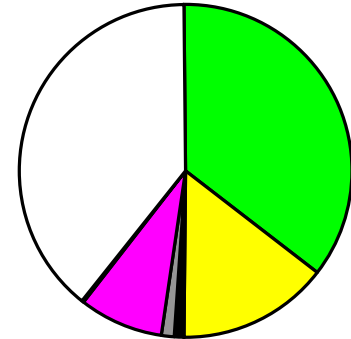
Engineering
(84 K)



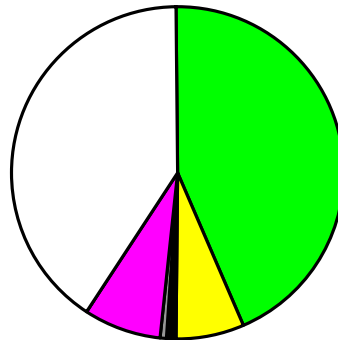
Computer Sci/Math
(67 K)



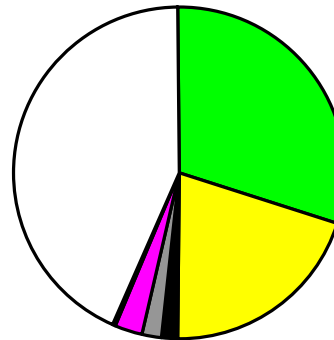
Life Science
(121 K)



Physical Science
(85 K)



Social Science
(127 K)



Source: NSF 7/03)

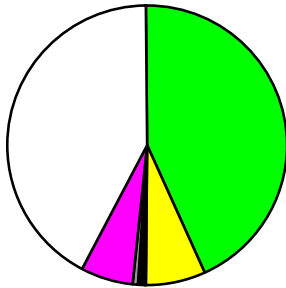
Department of Energy's Laboratories



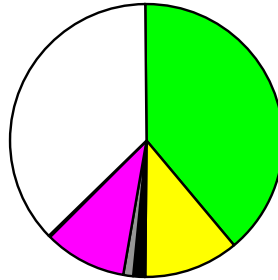
~\$8 Billion/year S&E enterprise

DOE Lab S&E Workforce* Still Overwhelmingly Male and White or Asian

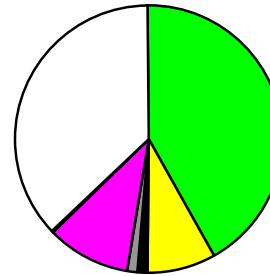
Argonne S&E
1300; 35%



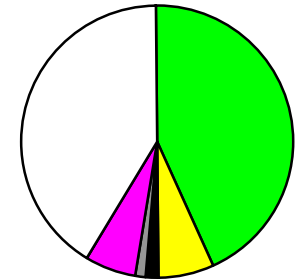
Berkeley S&E
1200; 45%



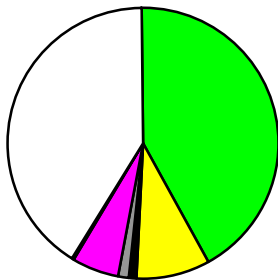
Brookhaven S&E
1100; 40%



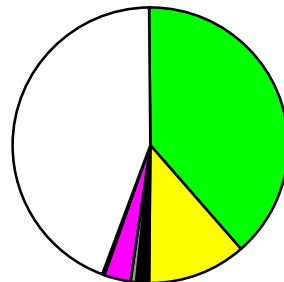
Fermilab S&E
1100; 50%



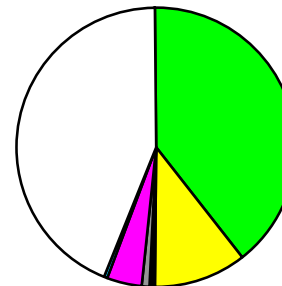
Livermore S&E
2100; 30%



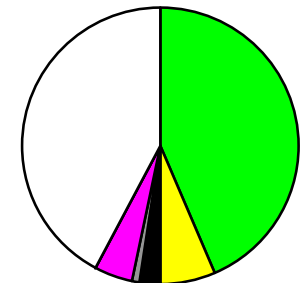
Oak Ridge Professionals
1900; 50%



Pacific Northwest S&E
1400; 35%



Jefferson Lab S&E
260; 45%

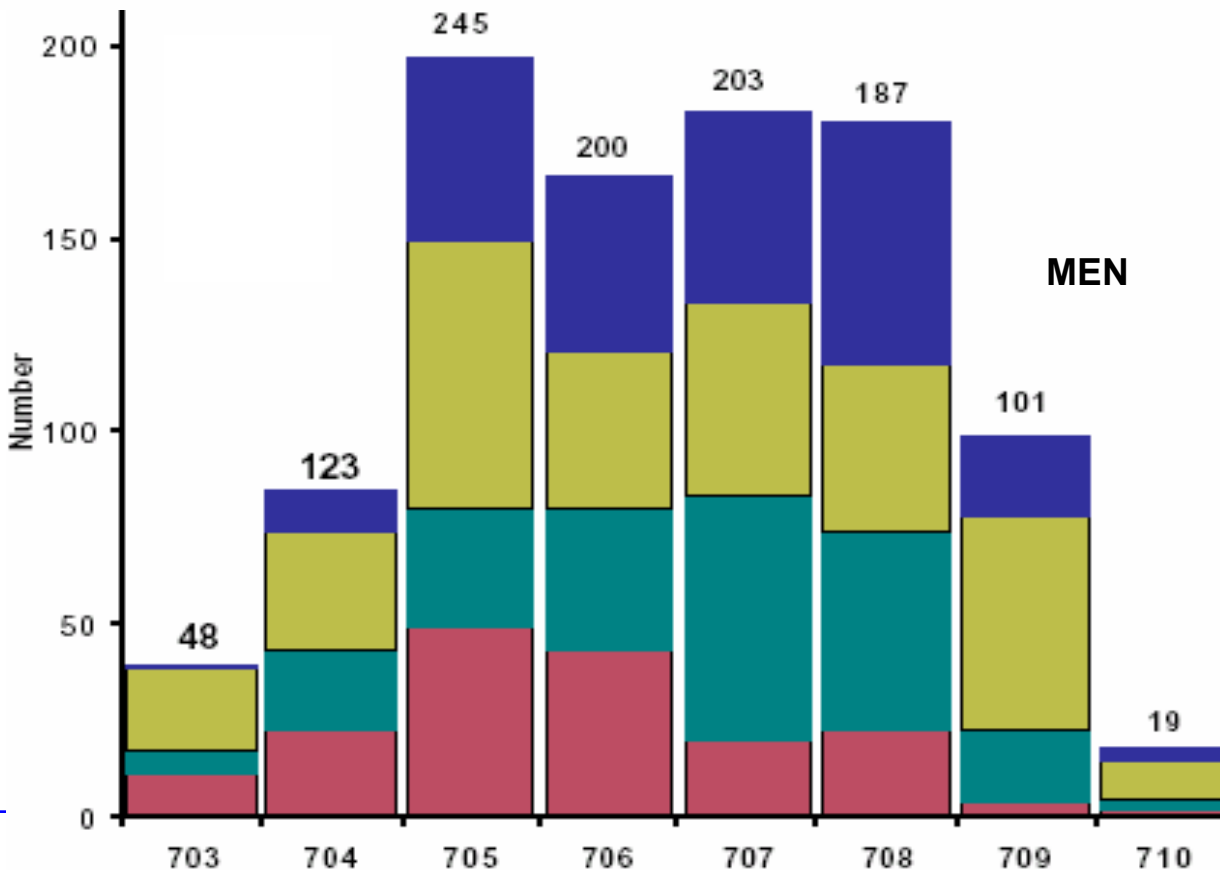
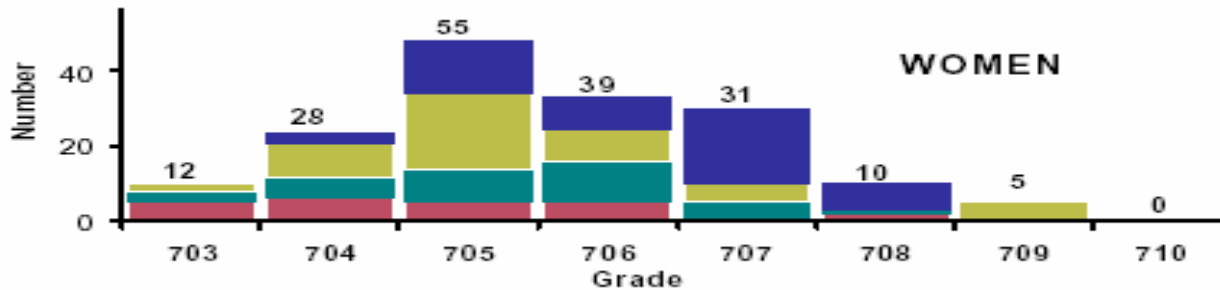


• Few women; very few under-represented minorities

* Definition varies by lab

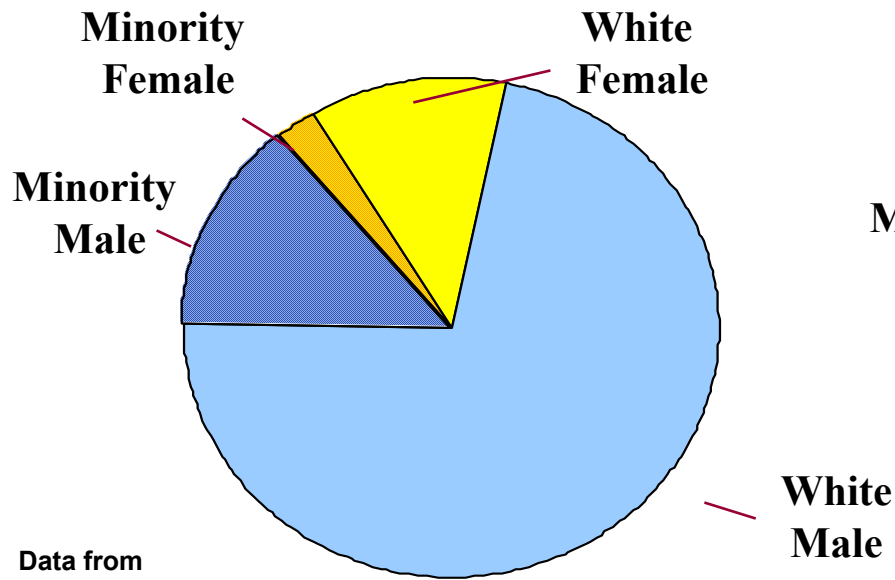
Year ~2001; Source: Lab *Institutional Plans*)

S&E Women at a DOE Lab Peak at Lower Levels than Men (Sept. 2002)



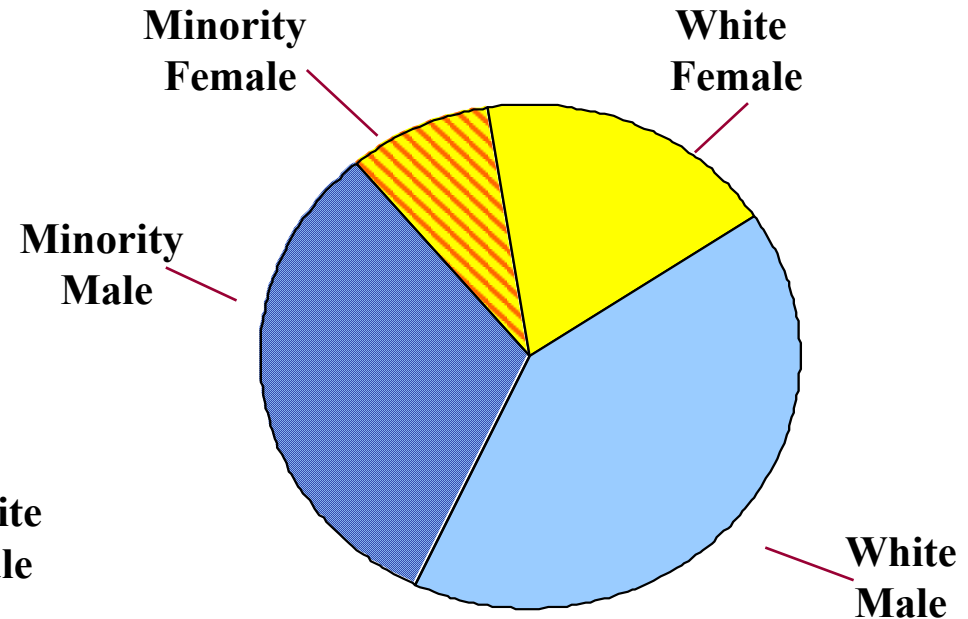
Labs Improve Workforce Diversity via new Hires and Postdocs/students

Science & Engineering Workforce
(1180)



Data from
June 30, 2002

Postdocs and Grad Students
(171)



Recent hires were 22% Female, 22% Minority (mostly Asian)

The Situation for Women and Underrepresented Minorities in S&E

- More are earning degrees in science and engineering than previously—in numbers and percentage
- As one goes up the career ladder, their presence drops systematically
- Many science/engineering departments in many U.S. colleges and universities—especially the top research universities—have **zero** women or minority faculty; most have at most a few
- For women, this situation exists around the world
- Most people and institutions are well intentioned, but **do not understand** 'the problem'
- Challenges are greater for minorities than for women

The Situation for S&E Women and Underrepresented Minorities in DOE

- **DOE and its Labs are aware that women and minorities are scarce in their workforces, especially in S&E**
- **DOE's numbers have increased in the past ~10 years**
- **Some Labs are more enlightened than others: the views of top management make a big difference**
- **Some Labs have significant presence of S&E women and minorities in management (>25%)**
- **Many S&E divisions within Labs have no to few women and underrepresented minorities**
- **The environment and culture at DOE Labs is variable and challenging for minorities and women**

Women & Minorities in Science and Engineering?

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)

Women & Minorities in Science and Engineering?

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*Sometimes it feels this way, trying to advance
women & minorities in science and engineering.
But that's no reason to give up*

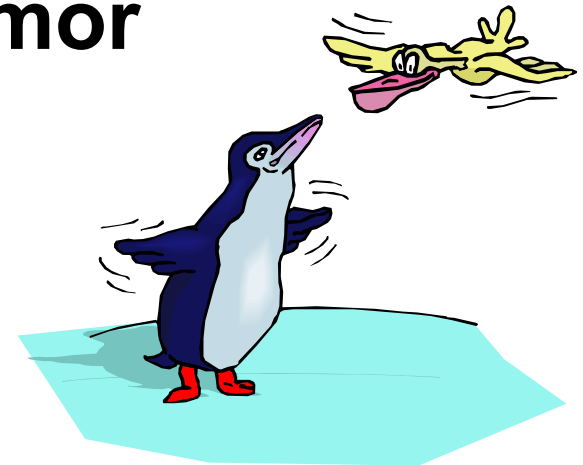
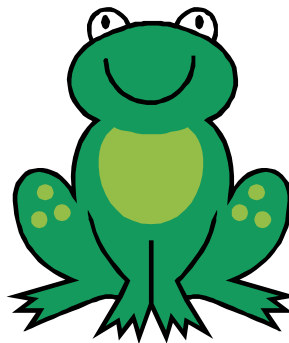
It Really Helps to be



Optimistic
and have a



Sense of Humor



Barriers to Advancement of Women and Minorities in Science and Engineering

- **Two key concepts help explain the slow pace of women's advancement in science and engineering (from Dr. Virginia Valian, *Why So Slow?*)**
 - **“Gender schema” (stereotypes)**: widely held beliefs about the traits of men and women that lead us to overrate men and underrate women with respect to competence and leadership ability.
 - **Accumulation of advantage**: the cumulative long-term effect of small differences in the way males and females are treated throughout their lives.
- **Similar concepts are likely to apply to the situation facing underrepresented minorities, as well**
- **Recognize them and consciously counteract them**

Tensions for Women and Minorities in S&E

- **Being oneself *versus* fitting into the culture**
- **Making connections: political relationships *versus* meaningful relationships and performance**
- **Acting agentially: controlling one's destiny *versus* conforming to expectations**
 - Moreover, expectations of women/minorities conflict with expectations of scientists/engineers
- **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

Advancing Women & Minorities in S&E

- **Catalyzing "epiphanies:" one by one getting people to recognize there is a Problem**
 - Difficult experiences of family members
 - Convincing, paradigm-changing data
 - Unflattering comparisons with other fields/campuses
- **Interesting and attracting female & minority students**
- **Recruiting and retaining undergraduates and graduate students**
- **Enabling career success and advancement via improved climate and expanded opportunity**
- **Supporting family and career needs**
- Adapted and expanded from ideas generated at the International Conference for Women in Physics, Paris 2002

Ways to Attract Female & Minority Students

- **Feature scientists and engineers as diverse, interesting people, not just 'nerdy' white males**
- **Show the value of S&E in daily life**
- **Use examples and problems in science & math teaching and textbooks that intrigue girls & minorities**
- **Use collaborative learning approaches**
- **Solve social/cultural problems that track girls and minorities away from challenging science and math**
- **Tell them they are smart & good at math and science**
- **Publicize and spread successful teaching approaches practiced in some schools and communities**
- **Change the expectations of their peers**
- **....**

Recruiting/Retaining Women and Minority Students in S&E

- **Precollege math and science with great teachers**
- **Intro courses that intrigue, challenge, and invite**
- **Opportunity to do research: experience the challenge of inquiry and joy of discovery**
- **Capable advising, mentoring and career exposure**
- **Students respected as colleagues & team members**
- **A welcoming climate with opportunities to 'belong'**
 - An academic club for majors
 - A room for undergrads to meet, study, interact, relax
 - Departmental social events
- **Diverse faculty & visitors, who take an interest in them as individuals**

Improving the Inclusiveness of Colleges and Universities

- **Ensure that policies and procedures give all students rich opportunities for success**
- **Provide diverse "role models" as faculty, colloquium speakers, and leaders, who interact with students**
- **Ensure policies and procedures for faculty and staff are inclusive and equitable with respect to**
 - Recruitment, promotion, and roles in governance
 - Teaching assignments, space, and research facilities
- **Provide solutions for family/career issues**
- **Investigate disparities in student satisfaction, retention, graduation, or happiness correlated with gender, ethnicity, etc; then remedy root causes**
- **Investigate disparities in faculty/staff satisfaction correlated with gender, ethnicity, etc; & remedy causes**

Ways to Improve Institutional Climate

- **Visiting teams to assess and advise on the climate for women and/or minorities**
- **Equity policies and transparent decision-making processes**
- **Women, minorities, and enlightened others in leadership positions and on important committees**
- **Active networking: horizontally & vertically**
- **Training**
 - On how to treat women/minorities as respected colleagues and how to improve the climate
 - For women and minorities on skills for success
- **Engagement of the powerful to champion this issue**
- **Innovative concepts, such as shared leadership**

Argonne's Workshop on "Survival Skills for Successful Women Scientists and Engineers"

- **Grass-roots initiated and organized**
- **Six 2-hour monthly sessions**
 - “Advancing Professionally to Achieve Your Ambitions”
 - “Establishing Your Professional Identity”
 - “Identifying Your Personal Leadership Style and Applying It in the Workplace”
 - “Communication, Coping Skills, and Conflict Management”
 - “Where the \$\$ Is and How to Get It”
 - “Strategies for Overcoming Hidden Barriers”
- **Highly valued by participants**
- **Stimulated networking across fields and career stages, and won a DOE Best Practices Award**

Everyone Can Help

- **Leaders should take ownership of 'the problem' and create an inclusive climate for all**
- **Criteria and processes for hiring, promotion, salary, and resources must be transparent and inclusive**
- **Women and minorities should be mentors, positive and visible role models, and assertive agents for change**
- **Colleagues should support and advocate each other**
- **Supervisors should give women and minorities assignments where they can gain leadership skills**
- **Scientific/engineering societies should involve more women and minorities in their leadership**
- **Everyone should consciously counter "gender schemas," "ethnic schemas," and disadvantage**

Facilitating Family/Career Balance

- **Value "family service" as much as military service**
- **Pause "career clock" for child bearing or dependent care**
- **Implement family-friendly work conditions – flexible leaves and working hours, part-time jobs, shared jobs**
- **Provide high-quality child care near workplace and at conferences**
- **Help dual-career couples find two nearby positions**
 - 82% of married S&E women have spouses working full time, compared with 43% of married S&E men
- **Feature role models with a successful career in science/engineering and a wonderful family life to show students that it is possible (even normal)**
- **Have men and women share family duties and pleasures**

Simple Strategies

- **Consciously override stereotypes**
 - **Don't assume others behave or think similarly to you**
 - **Invite everyone to contribute/question/talk**
 - **Positively reinforce and credit contributions**
 - **Advertise open positions & avoid screening/selection criteria that disadvantage women/minorities**
 - **Think of all the possible candidates, including some women/minorities, for important assignments**
 - **Help people network: within the group, department, institution, nationally and internationally**
 - **Expand professional peer groups until they include significant numbers of women and minorities**
 - **Encourage and reward good mentoring**
-

References & Recommended Reading

- **CAWMSET: Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering & Technology, 2000**
- **Committee on Equal Opportunity in Science and Engineering (CEOSE), Biannual Reports**
- **B. Hartline & D. Li, eds: Women in Physics, AIP Conf Proceedings 628, 2002**
- **K. Laurin-Kovitz *et al*: "Survival Skills for Successful Scientists and Engineers," Proceedings WEPAN Natl Conf 2003**
- **D. Nelson & D. Rogers: "A National Analysis of Diversity in Science & Engineering Faculty at Research Universities," 2004**
- **NSF 03-312: Women, Minorities, and Persons with Disabilities in Science and Engineering, July 2003**
- **M. Ruderman & P. Ohlott: Standing at the Crossroads: Next Steps for High-Achieving Women, 2002**