

Education for a World Based in Science and Technology

Shirley M. Malcom

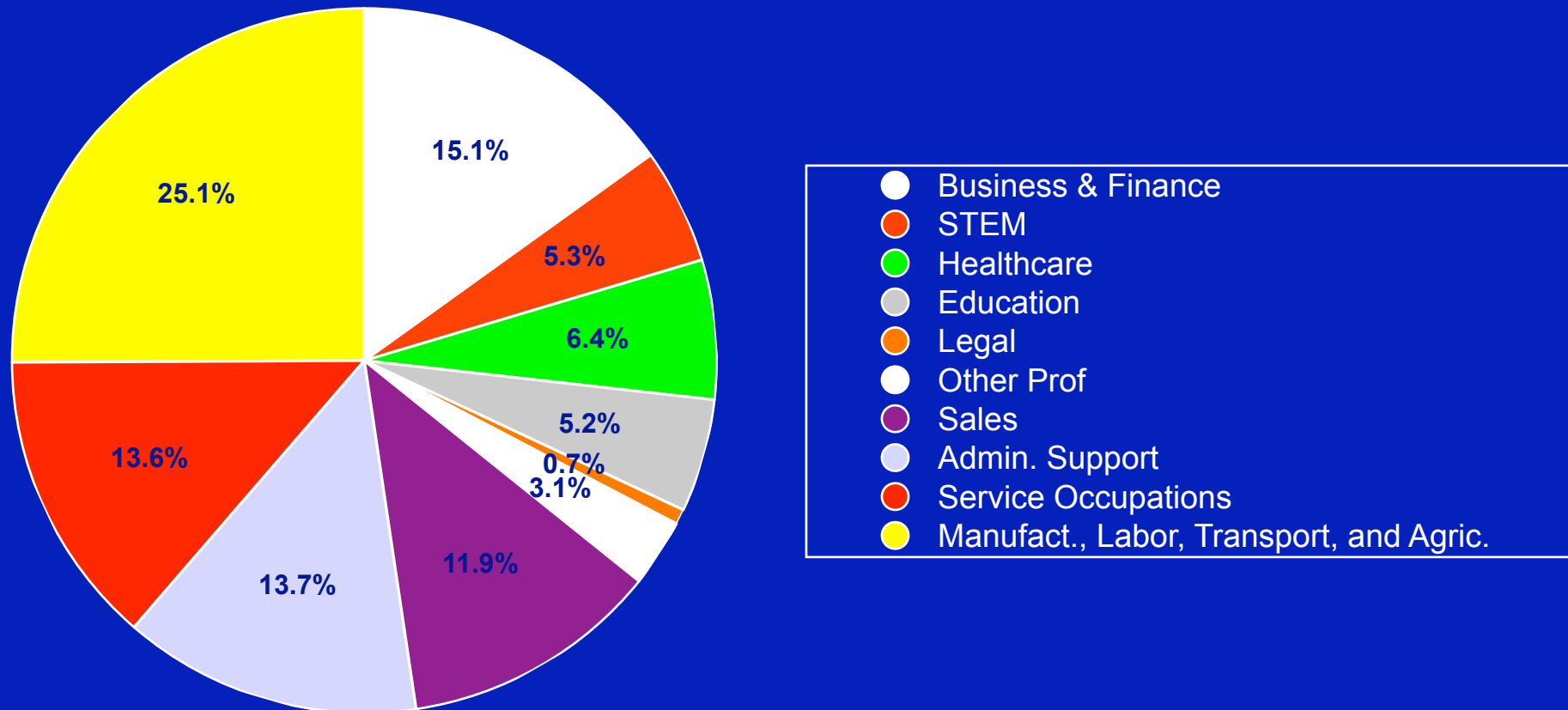


ADVANCING SCIENCE, SERVING SOCIETY

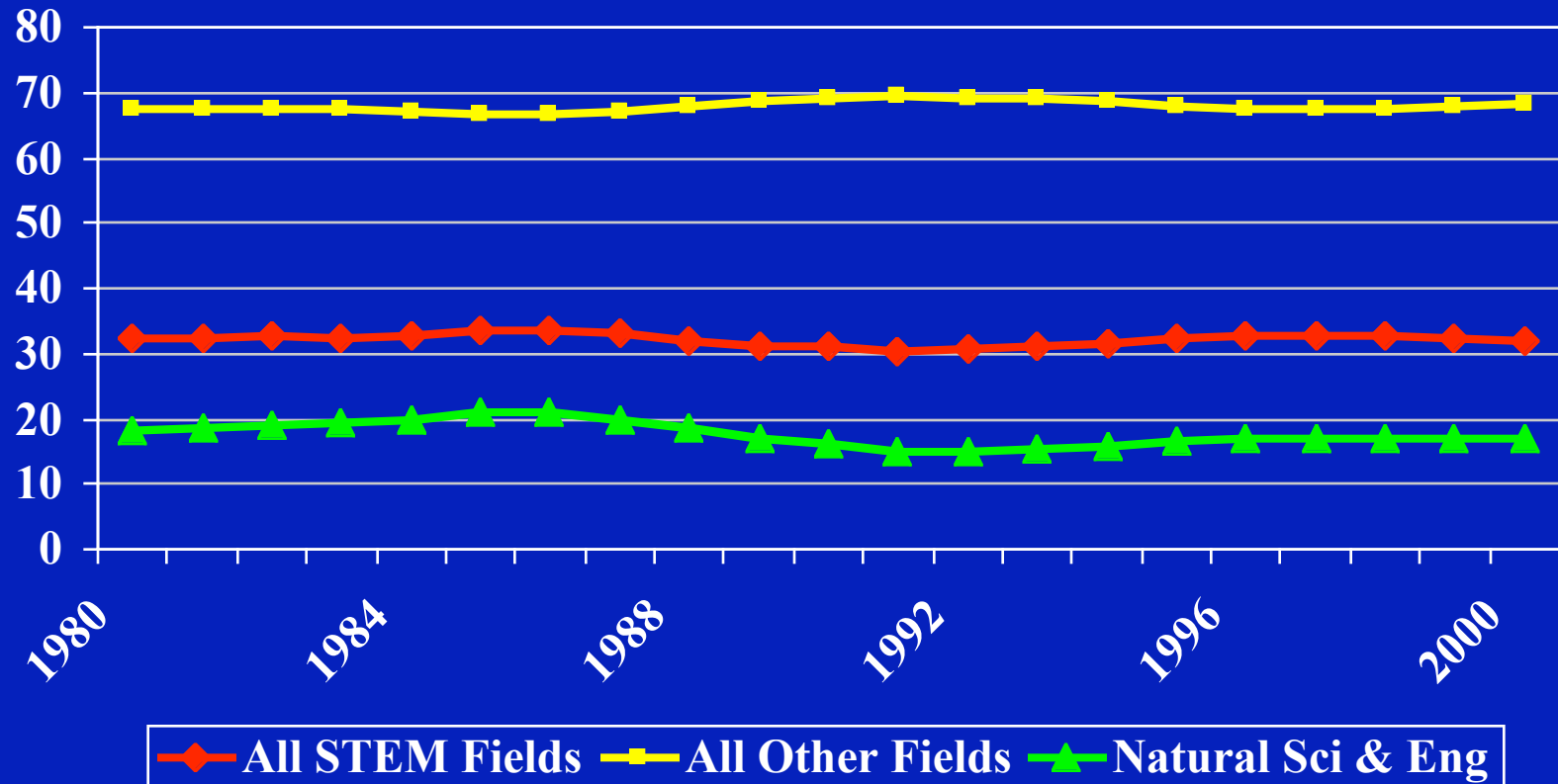
Human Resources Challenges

- An adequate base of scientists, mathematicians, engineers and technicians
- Science and mathematics for related fields (e.g., health care)
- Science and mathematics for the rest of us

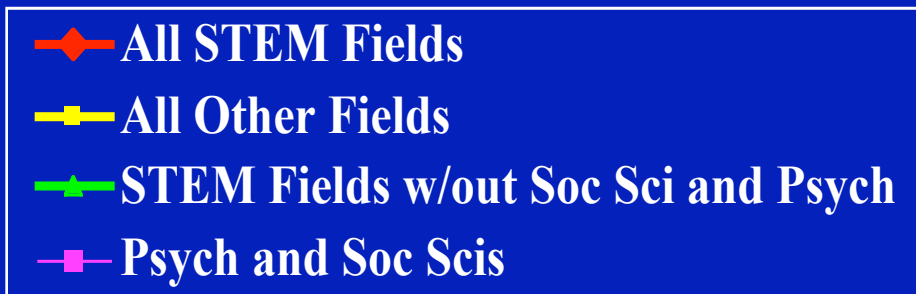
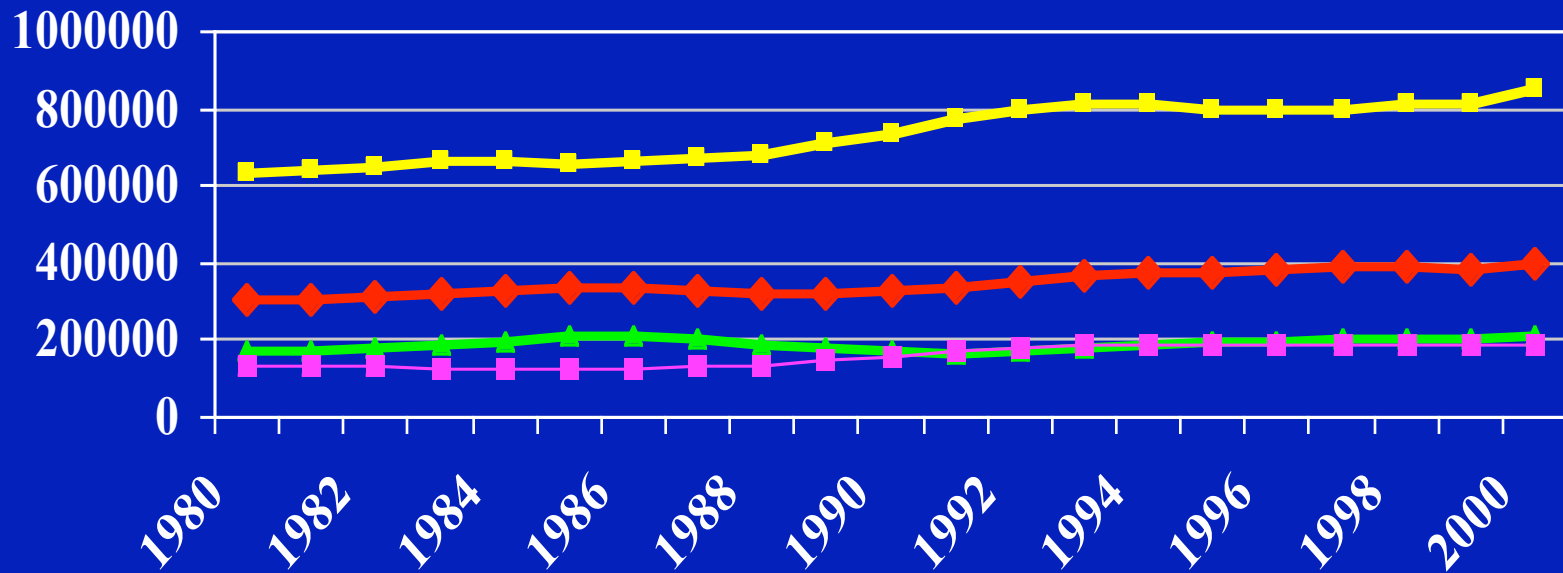
STEM Workforce as a Percentage of the Total Workforce in the U.S., 2001 (Total Workforce = 135,073,000)



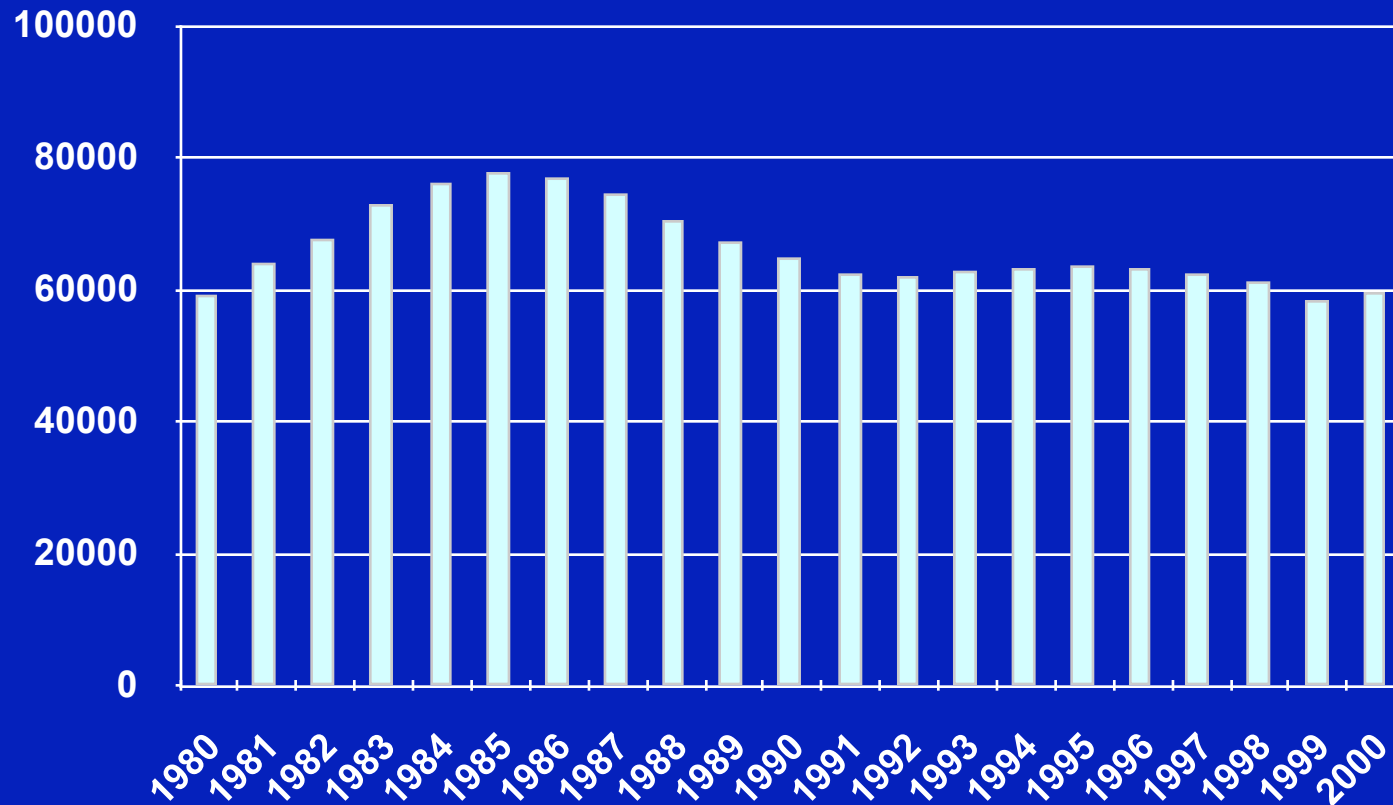
Percentage of Bachelor's Degrees Awarded in STEM and Other Fields, 1980-2000



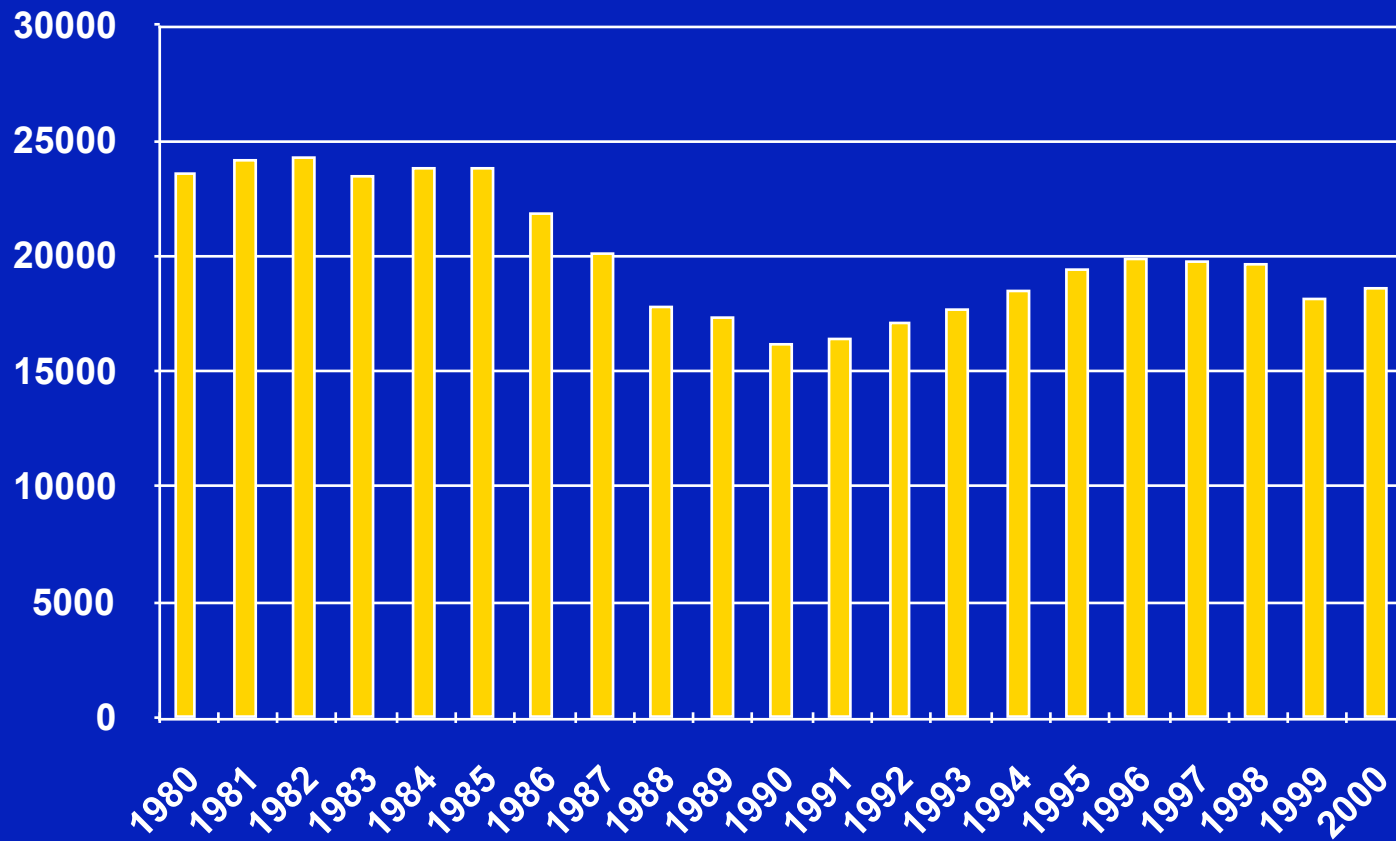
Bachelor's Degrees Awarded in STEM and Non-STEM Fields, 1980-2000



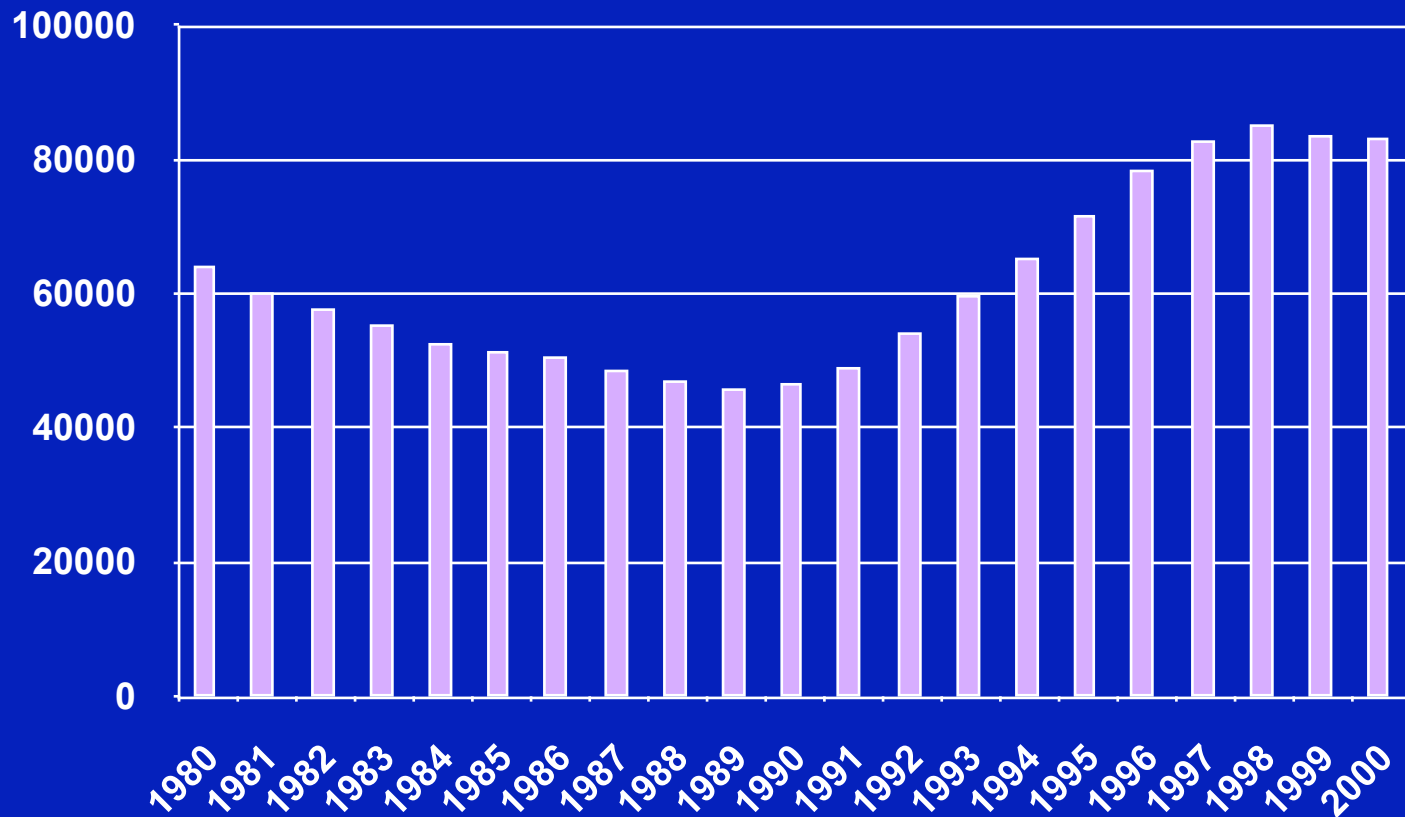
Bachelor's Degrees Awarded in Engineering, 1980-2002



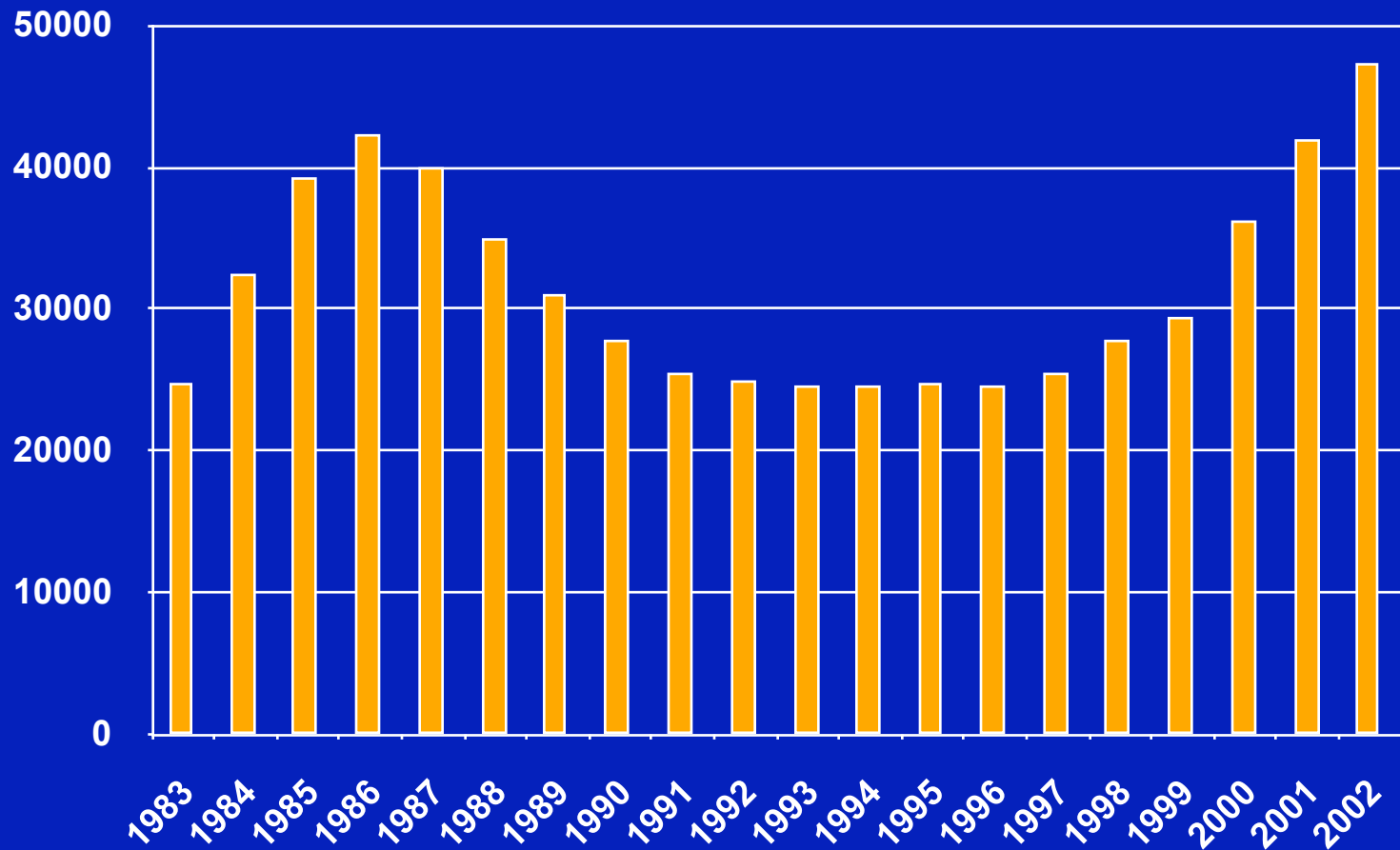
Bachelor's Degrees Awarded in Physical Sciences, 1980-2002



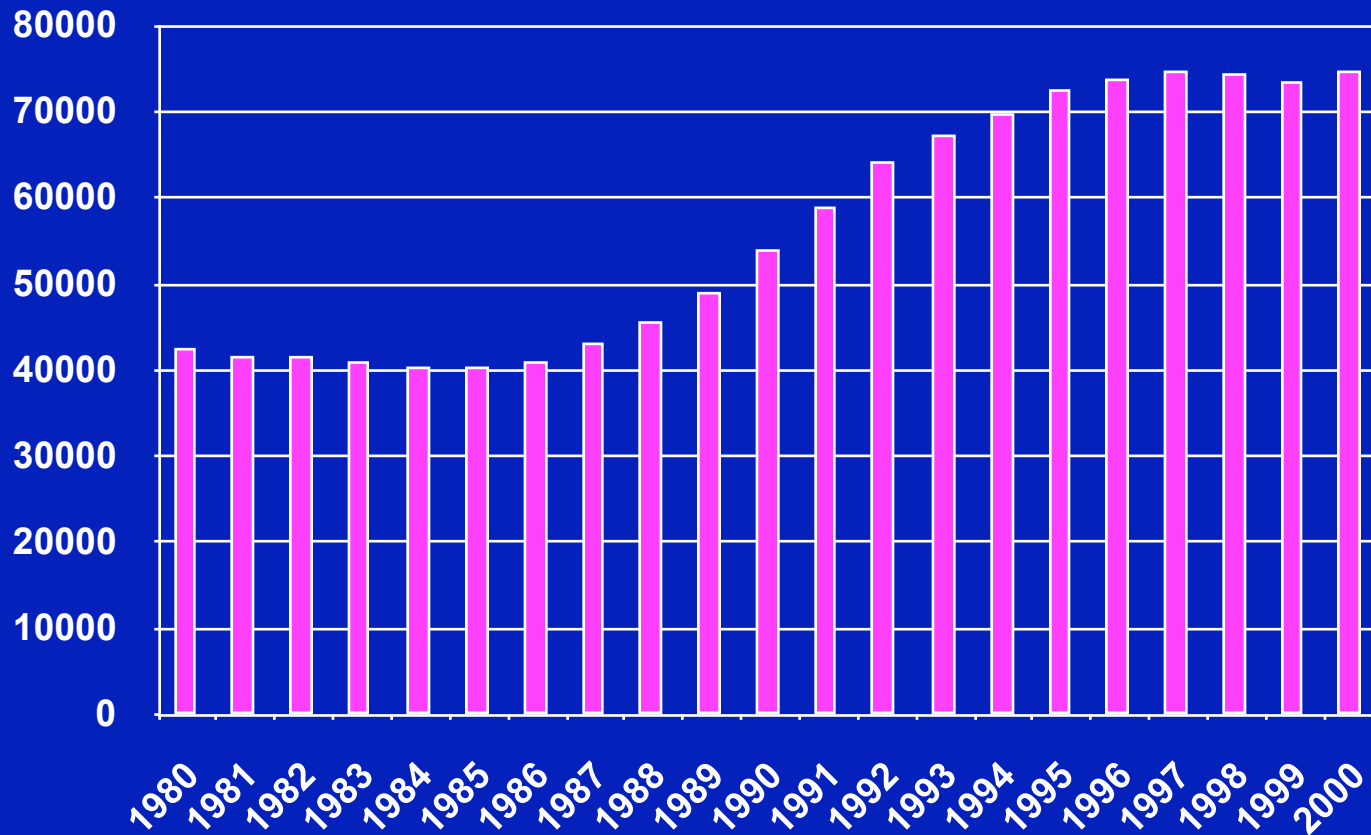
Bachelor's Degrees Awarded in the Biological Sciences, 1980-2002



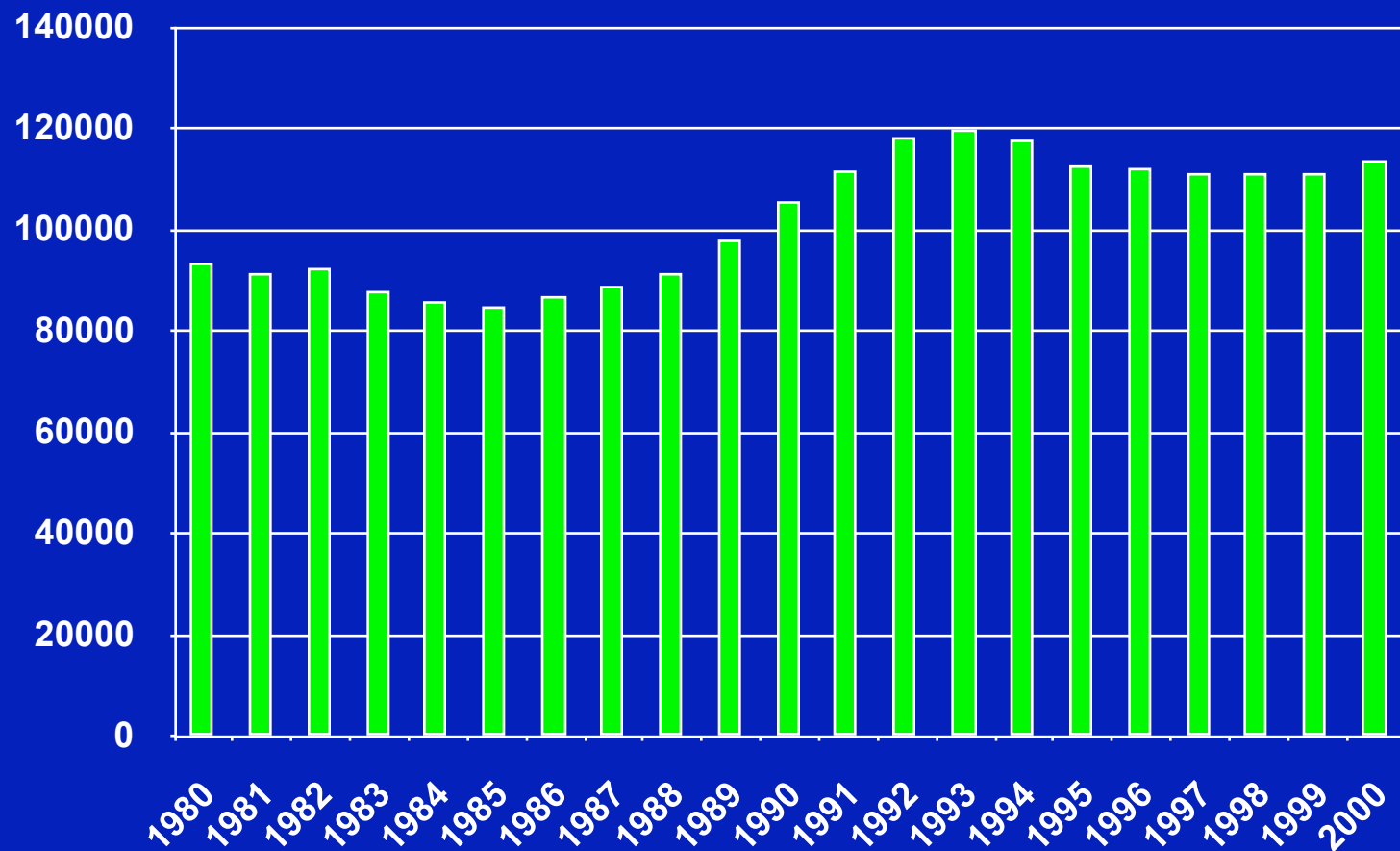
Bachelor's Degrees Awarded in Computer Science, 1983-2002



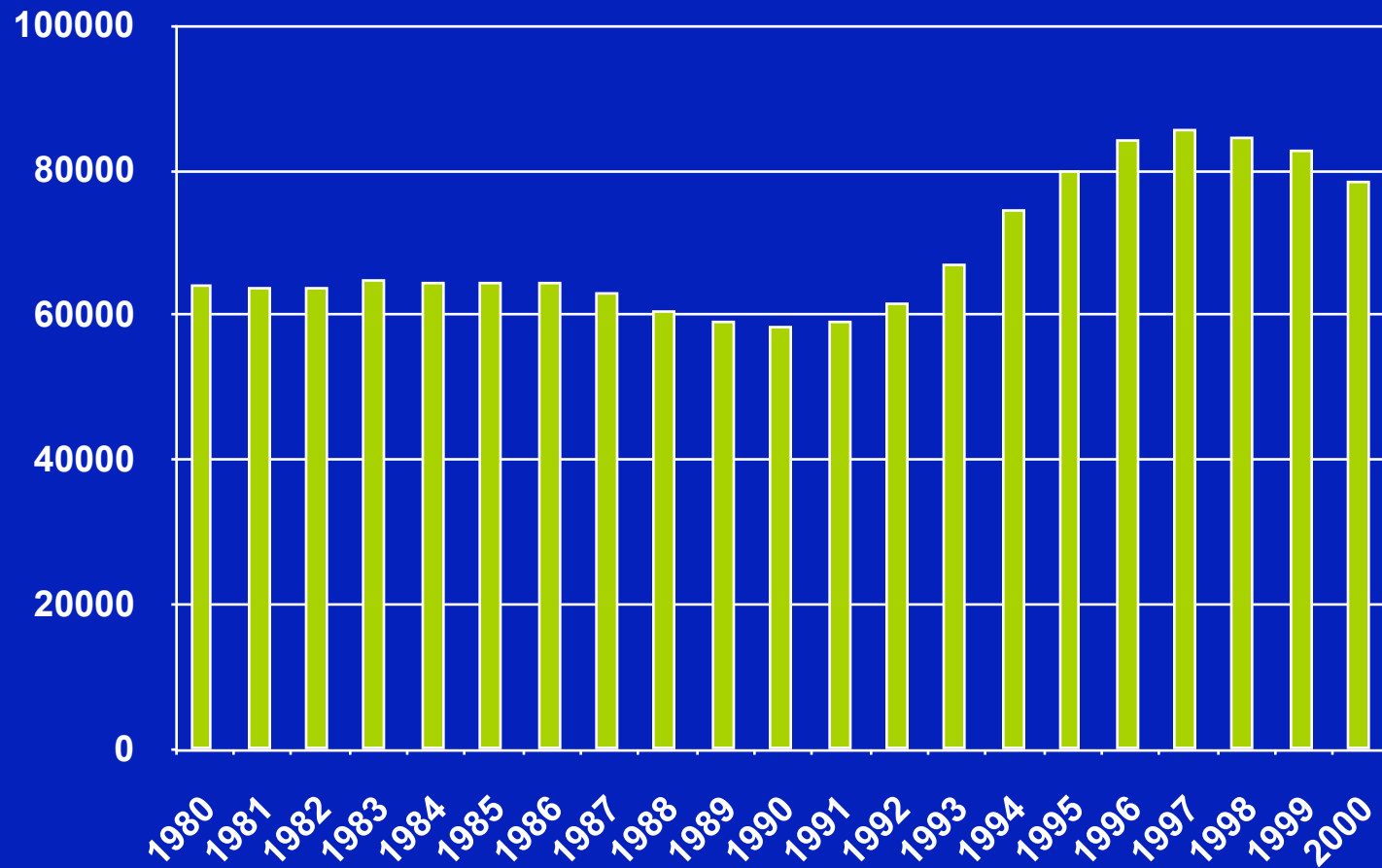
Bachelor's Degrees Awarded in Psychology, 1980-2002



Bachelor's Degrees Awarded in the Social Sciences, 1980-2002



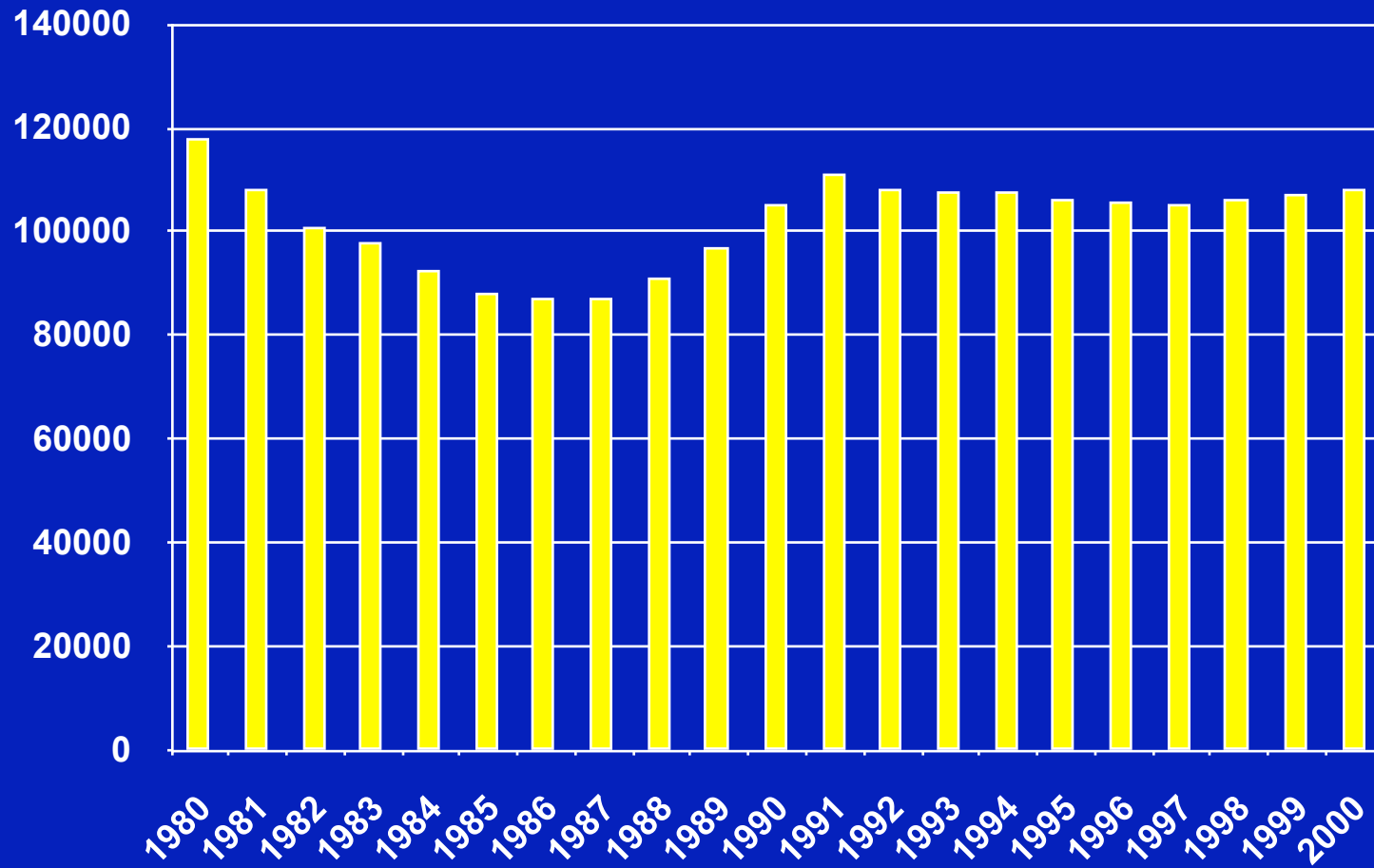
Bachelor's Degrees Awarded in the Health Professions, 1980-2002



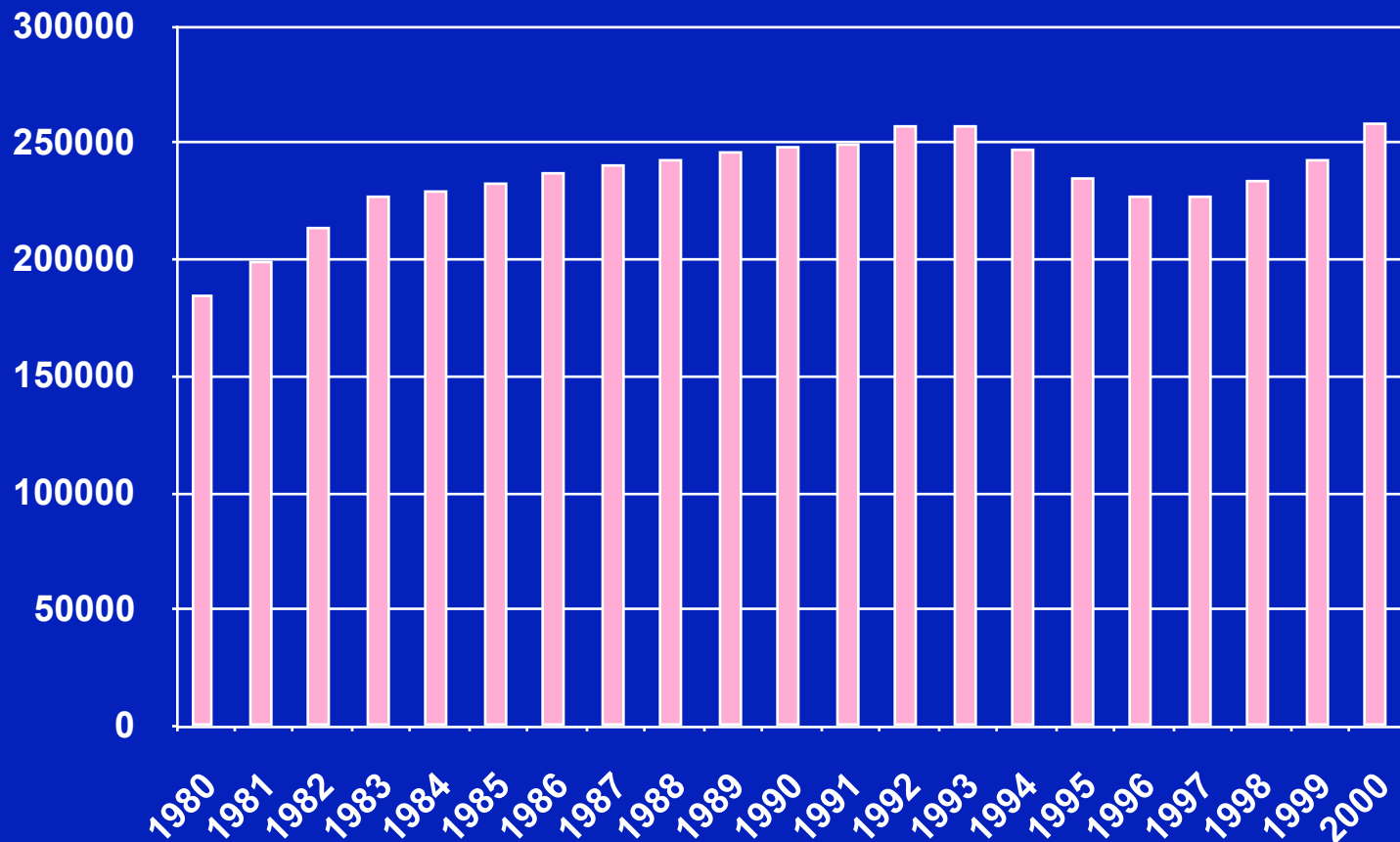
The Rest of Us

- Teachers
- Lawyers
- Policymakers
- Consumers of Science and Technology

Bachelor's Degrees Awarded in Education, 1980-2002



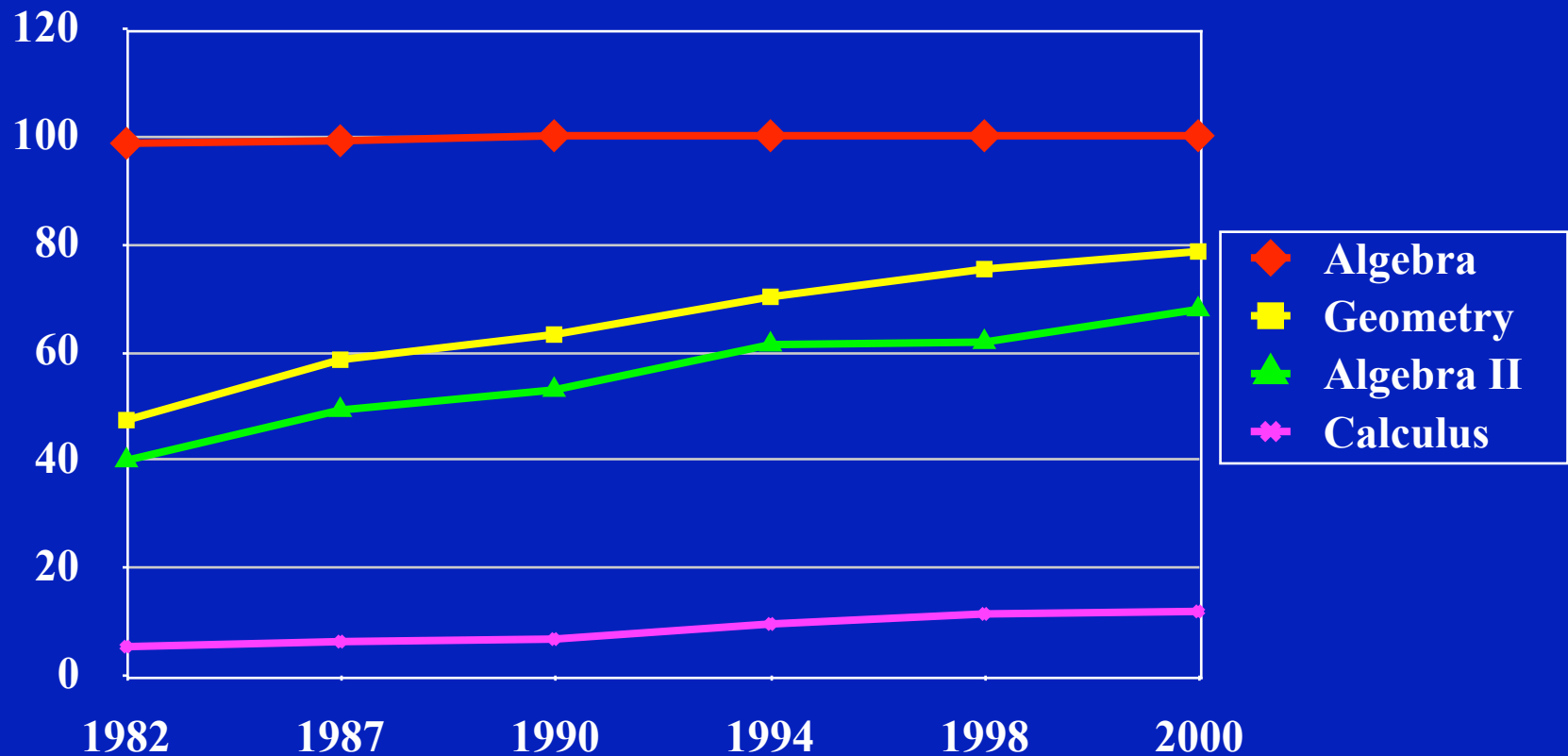
Bachelor's Degrees Awarded in Business, 1980-2002



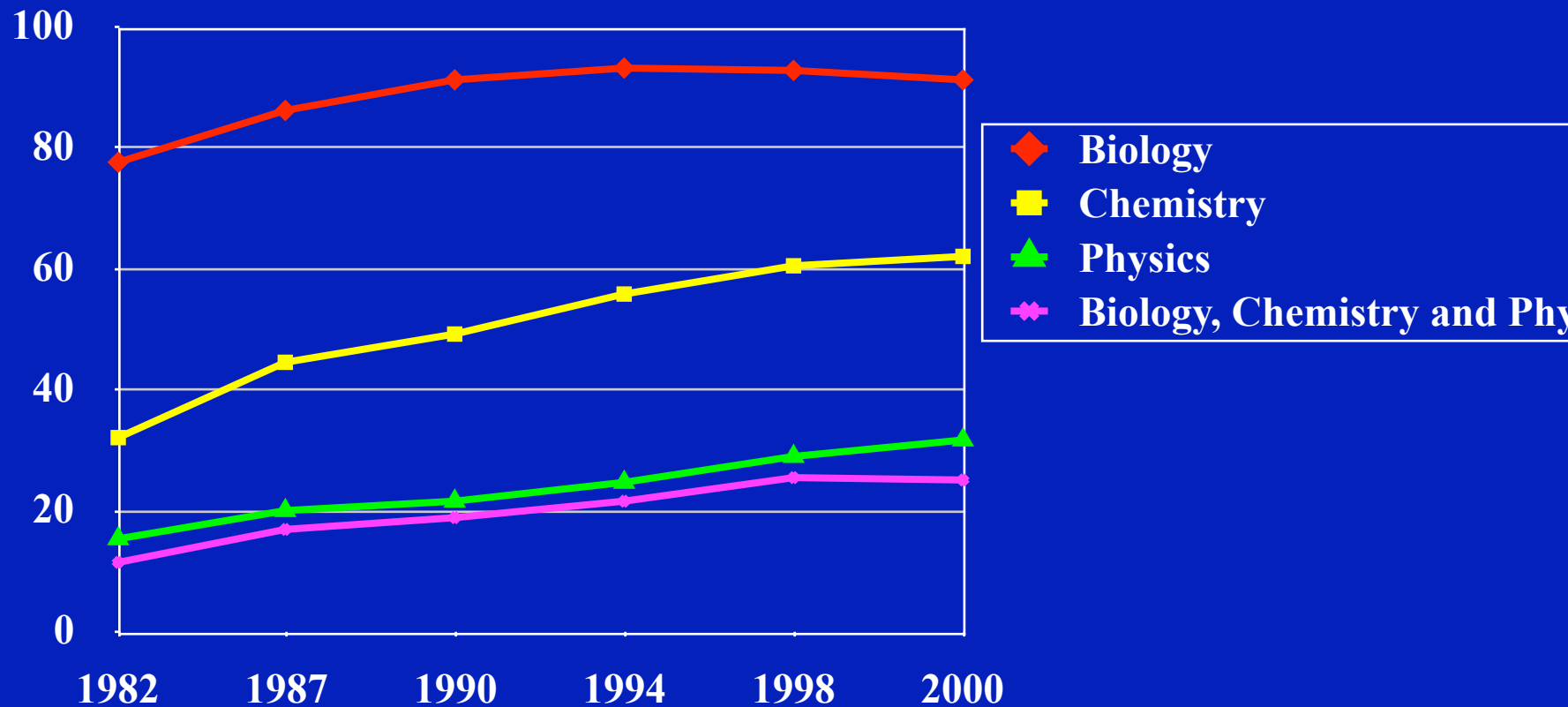
Challenges of Education (K-12)

- The education pathway for citizen and scientist is initially the same
- The size of the talent pool decreases over time, and its composition changes
- The capacity of the system to provide appropriate, high quality education is limited
- The components of the education systems are poorly aligned

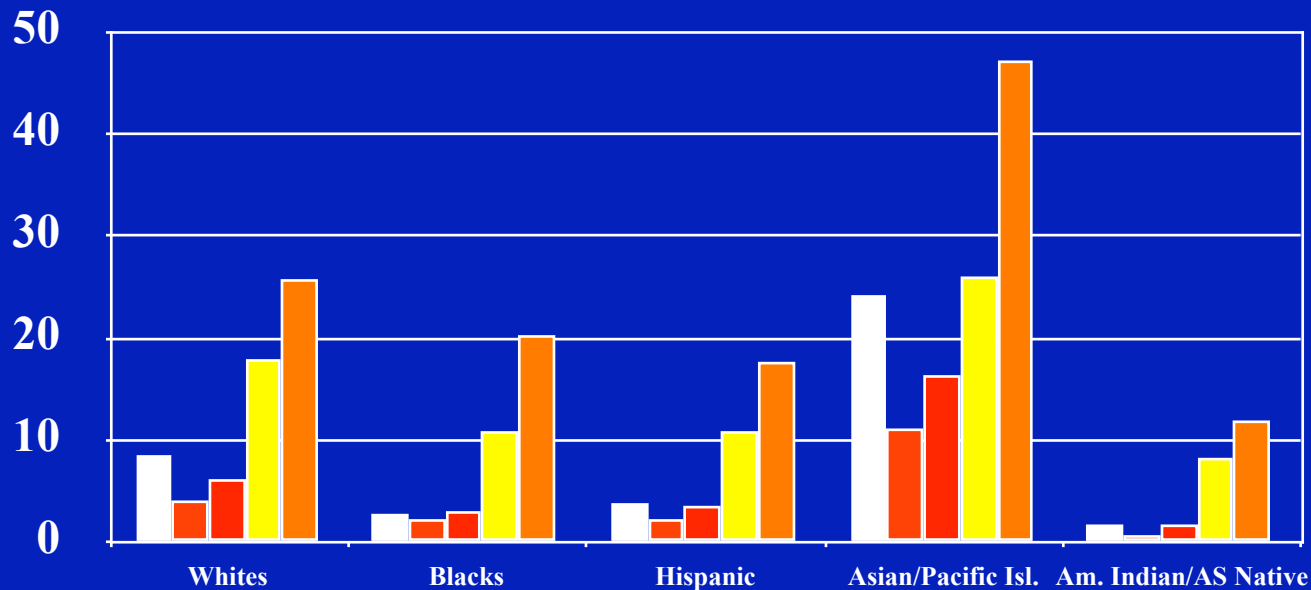
Percent of Public High School Graduates Taking Selected Mathematics Courses in High School, 1982-2000



Percent of Public High School Graduates Taking Selected Science Courses in High School, 1982-2000

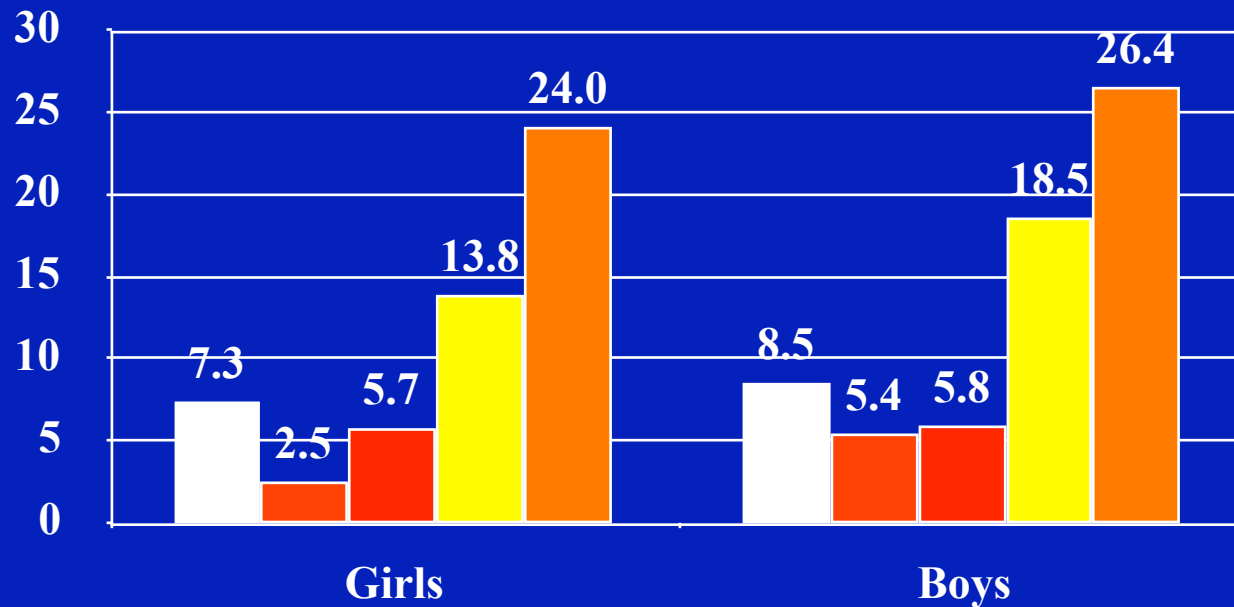


Percent of High School Graduates Taking Selected Math and Science Courses in High School, by Race/Ethnicity, 2000



AP Calculus
 AP Physics
 AP Chemistry
 AP Biology
 Bio, Chem & Phys

Percent of High School Graduates taking Selected Math and Science Courses in High School, by Gender, 2000



■ AP Calculus ■ AP Physics ■ AP Chemistry ■ AP Biology ■ Bio, Chem & Phys

Challenges of Education (Collegiate)

- Articulating a clear set of learning goals in science, mathematics, and technology
- Scientific, technological, and quantitative literacy as a component of liberal education

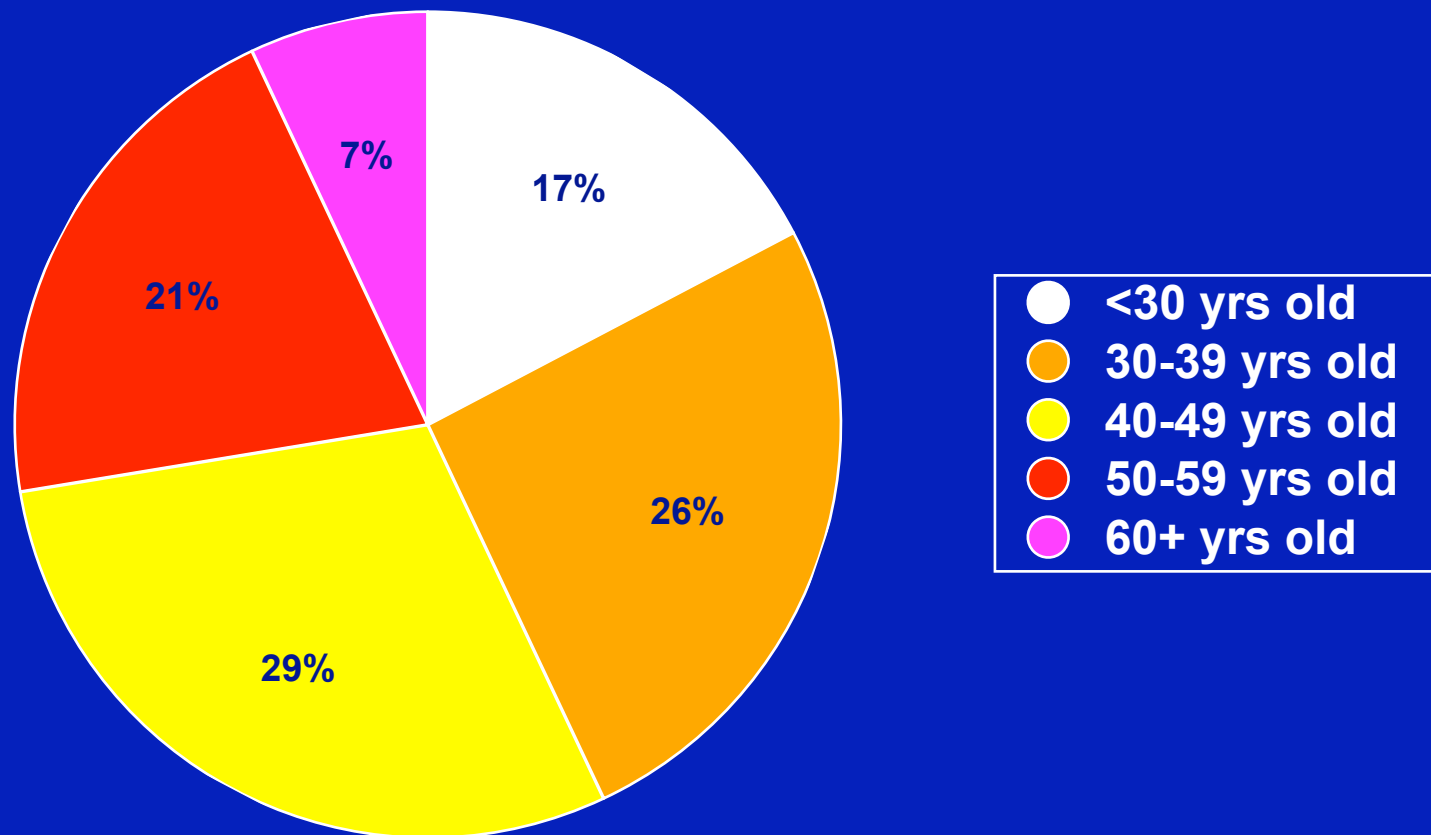
Challenges of Education (Graduate)

- Mismatch between graduate education and career opportunities
- Mismatch between training experiences and skills needed for jobs BEYOND ACADEMIC

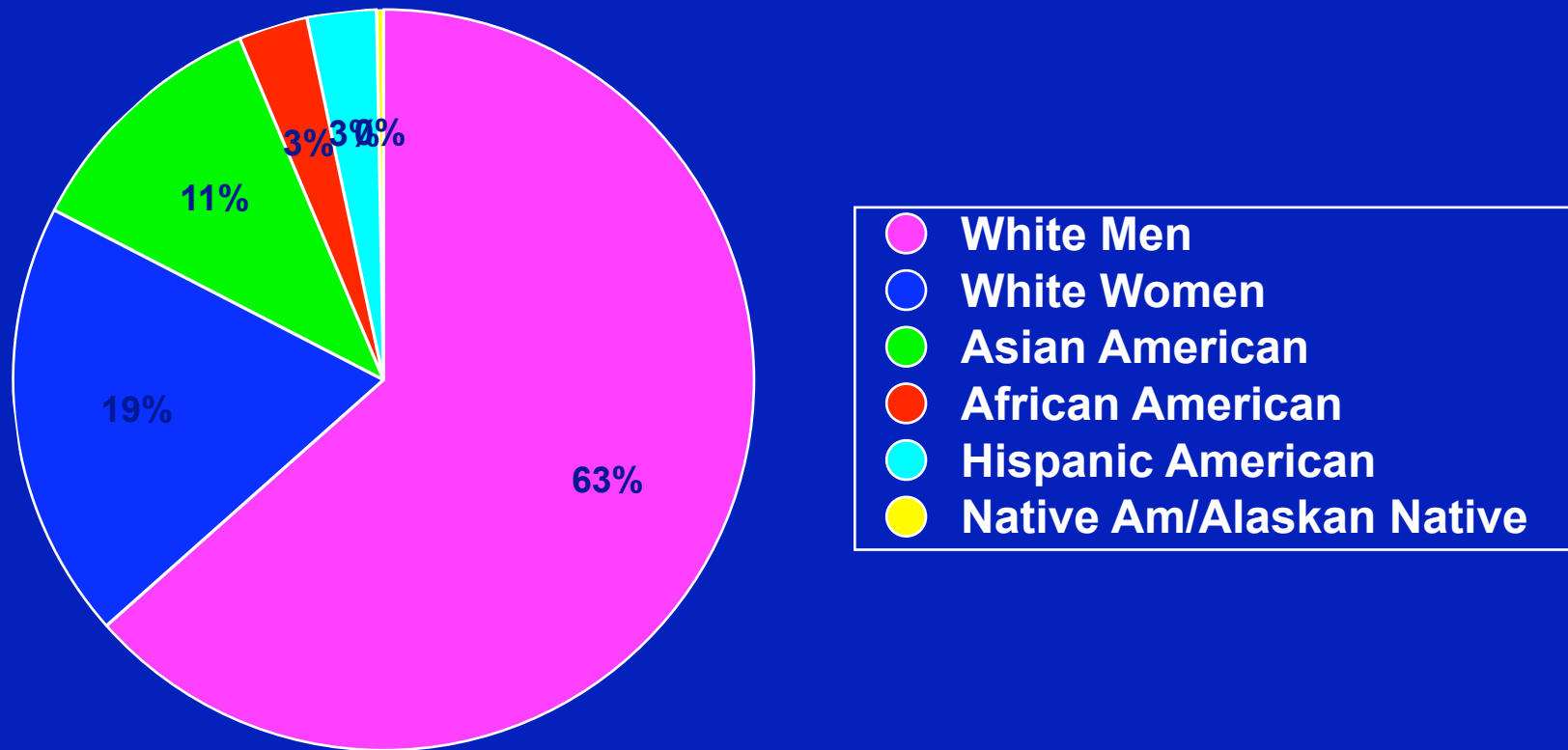
Workforce Development

- “Do we need more scientists?” (Teitelbaum)
- Composition of STEM workforce
- Nature of education and career development

Employed Scientists and Engineers by Age, 1999



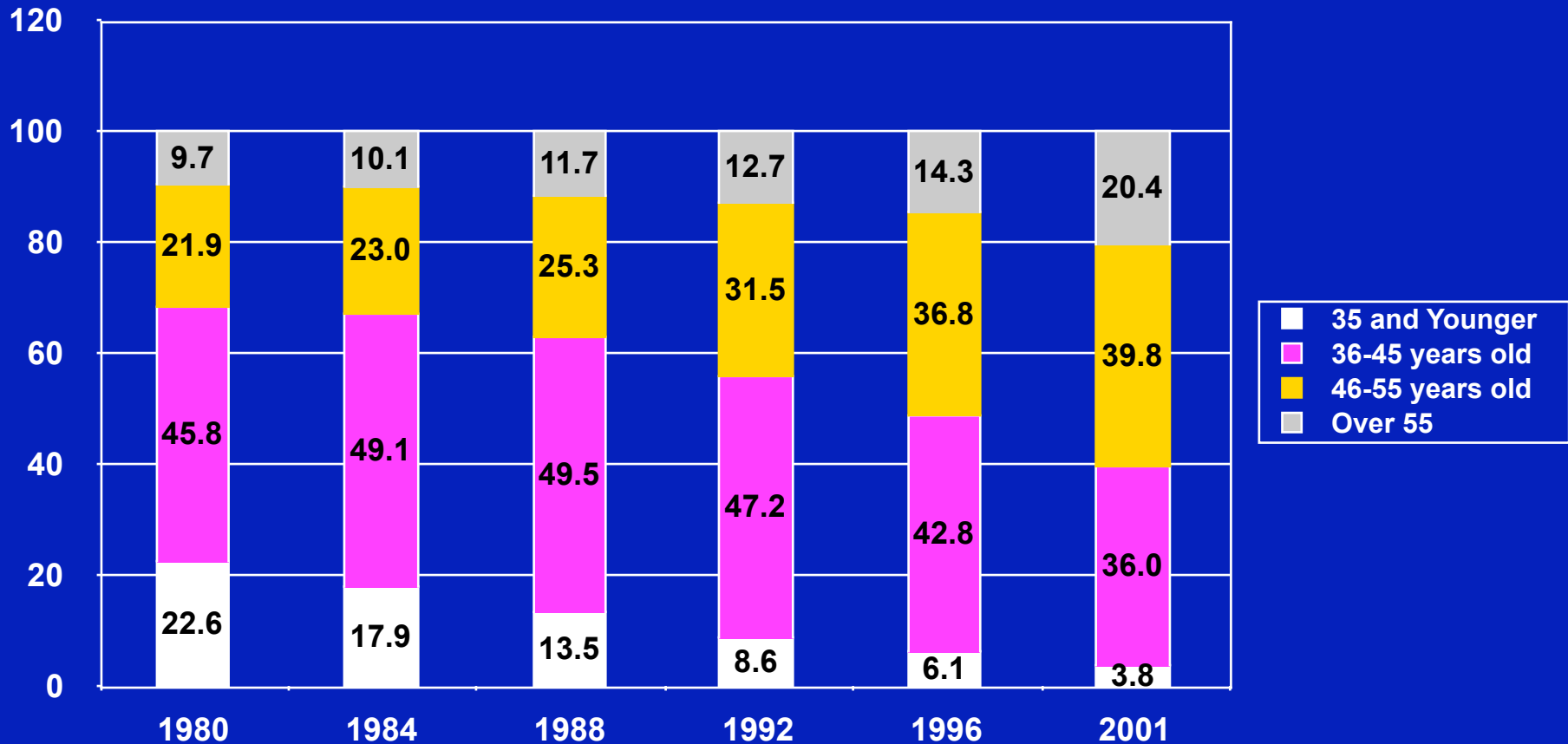
Scientists & Engineers in the Labor Force, by Sex and Race/Ethnicity, 1999



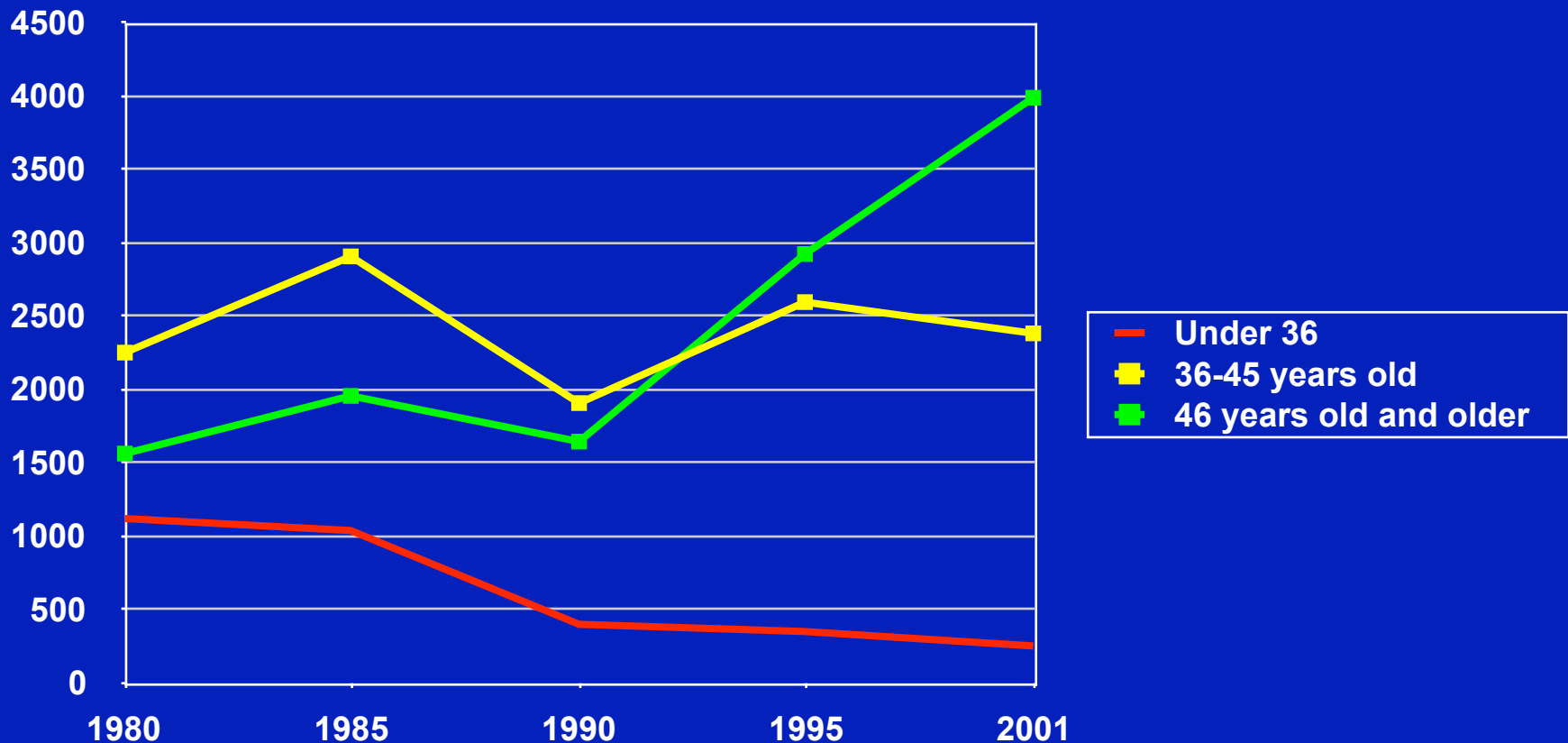
Challenges in Education and Career Development

- Mismatch between education and workplace skills
- Lack of cross-sector experiences
- Lengthening time to independence

Percentage of NIH Traditional Research Project Applications, by Age of Investigator, 1980-2001



NIH Traditional Research Project Awards, by Age of Investigator, 1980-2001



Is There Shortage? Considering the Evidence

- Unemployment rates
- Salaries
- Importing talent – exporting jobs

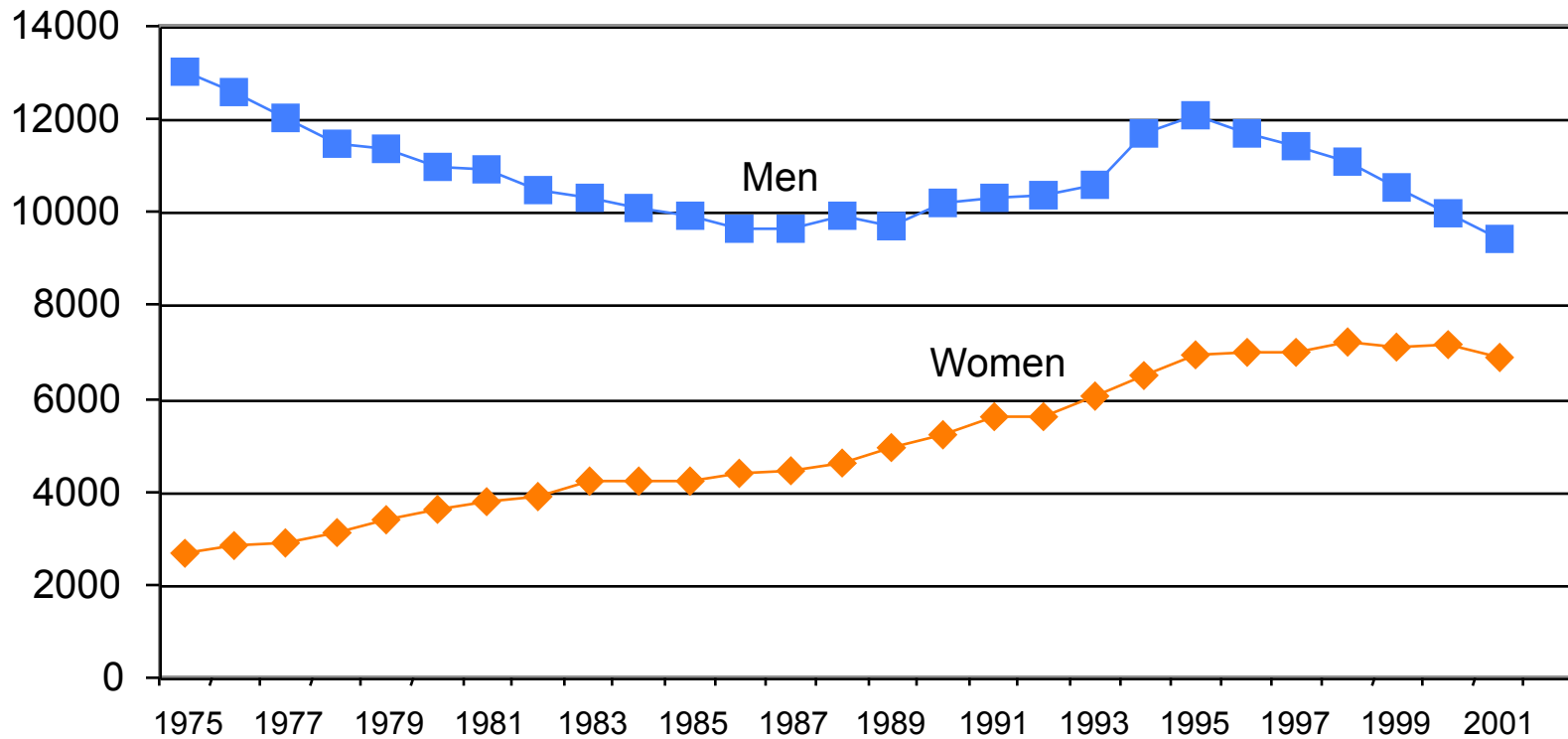
Limits of Supply-Demand Models

- Quality
- Demographics
- Skills and Know How

Composition as the Issue

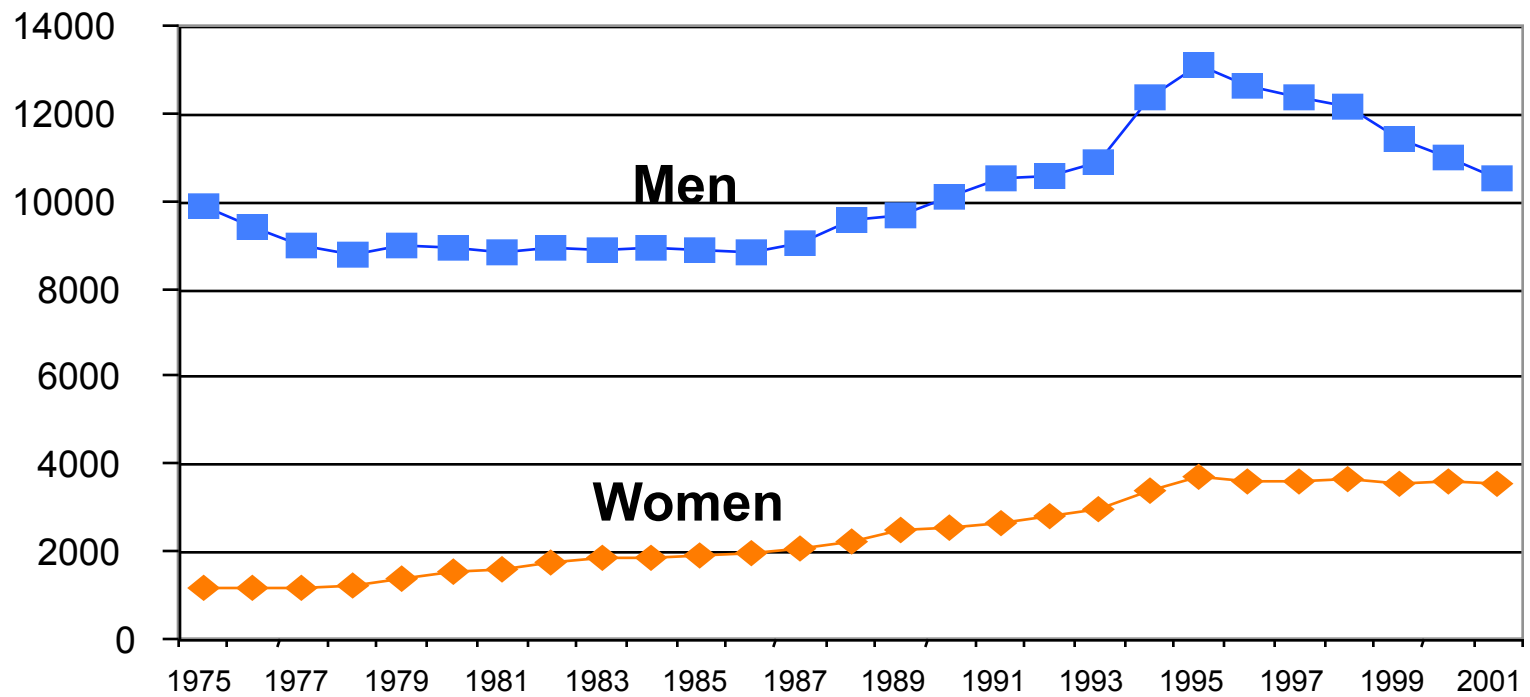
Faculty of the Future The Business Case for Diversity

PhDs in S&E by Gender, 1975-2001 (U.S. Citizens and Permanent Residents Only)



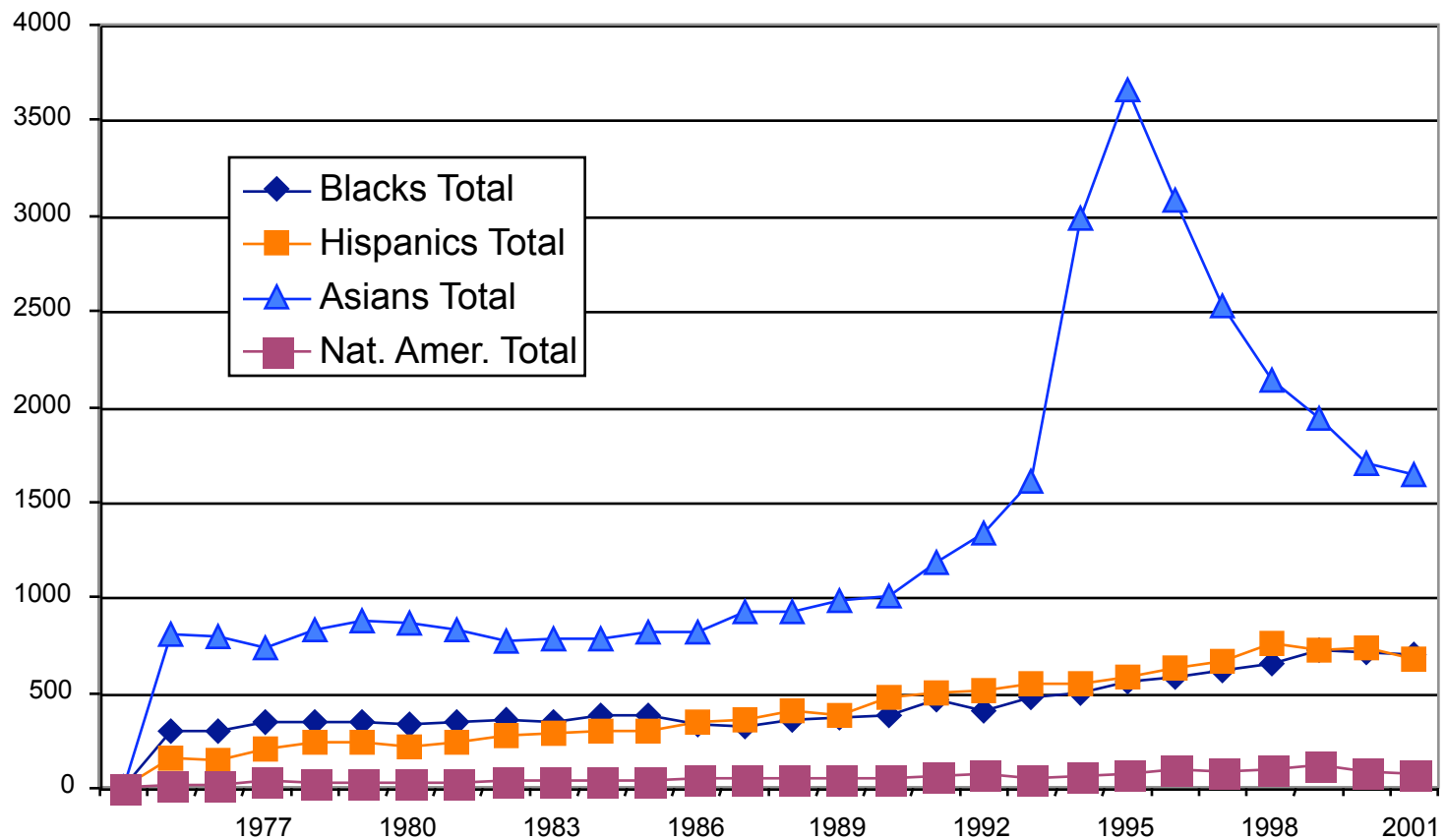
Source: CPST, data derived from National Science Foundation

PhDs in NS&E by Gender, 1975-2001 (U.S. Citizens and Permanent Residents Only)



Source: CPST, data derived from National Science Foundation

PhDs Awarded in S&E by Race/Ethnicity, 1975-2001 (U.S. Citizens & Permanent Residents Only)



Source: CPST, data derived from National Science Foundation

Retention

Not Just Getting Them In, but Keeping Them In

Advancement

Not Just Getting Them In, but Also Keeping Them In
and Getting Them Up

Policy Implications

- K-12
- Collegiate
- Ph.D.
- Postdoctoral

Policy Implications (K-12)

- Meeting national needs for STEM relies on a distributed system of production
- Successful distributed production relies on
 - Shared goals and agreed-upon standards
 - Reliable measurement to determine if these are being met
 - Distributed capacity (SES, geographic, demographic)

Policy Implications (K-12, continued)

- Challenges to capacity building
 - Shortage of quality teachers of STEM
 - Inappropriate science and mathematics curriculum “mile wide and an inch deep”
 - Inadequate funding and/or inefficient use of funds
 - Poor bridging from research to practice
 - Poor assessments
 - Focus of assessment on accountability rather than improvement of instruction
 - Poor articulation across K-21
 - Not everyone gets a fair shake

Policy Implications (Collegiate)

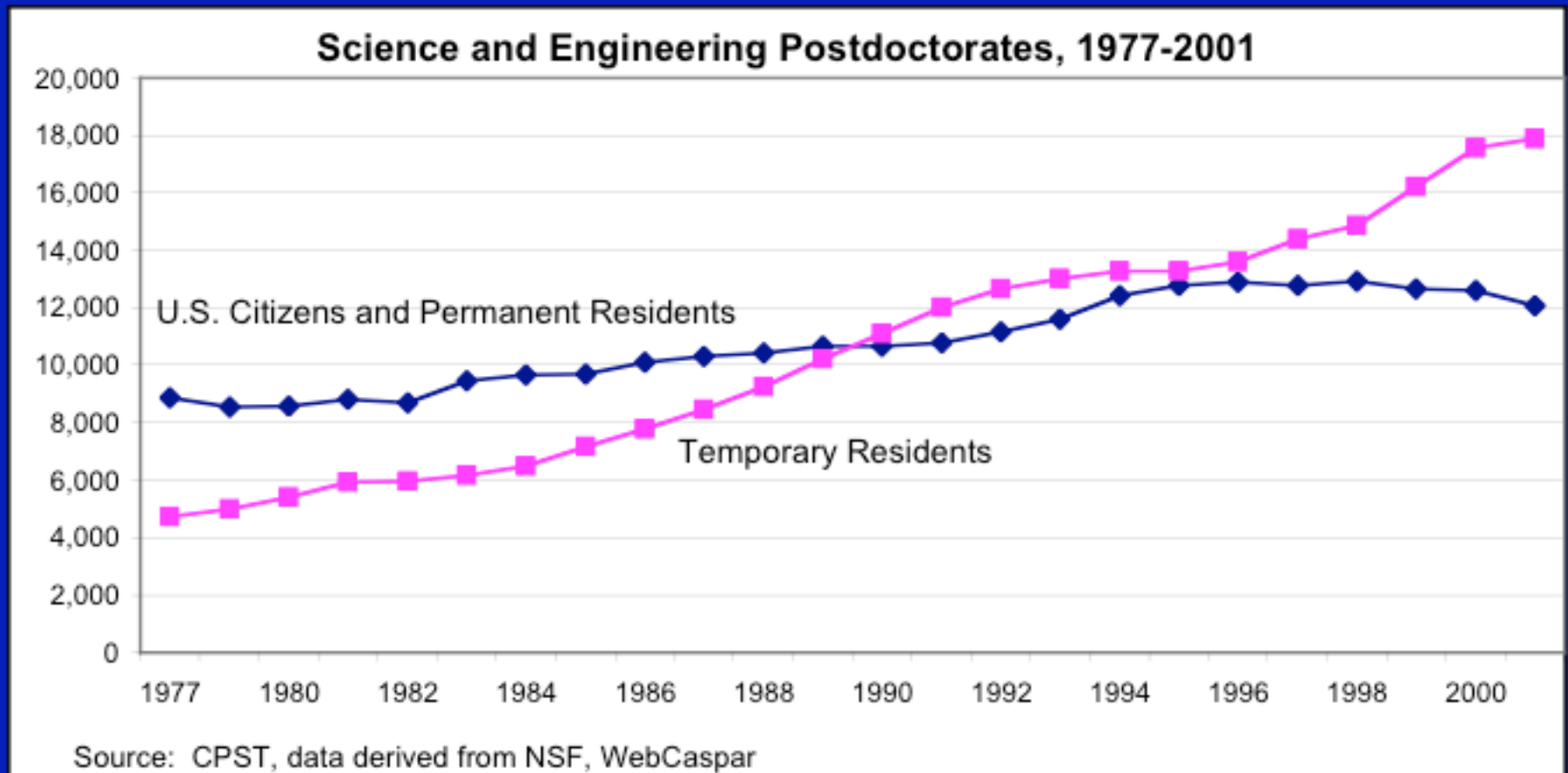
- Policies based on an outdated model of the make up of student populations of colleges and universities
 - Nontraditional students
 - Part-time students
 - Changing demographics
 - The role of community colleges
 - The rise of proprietary schools

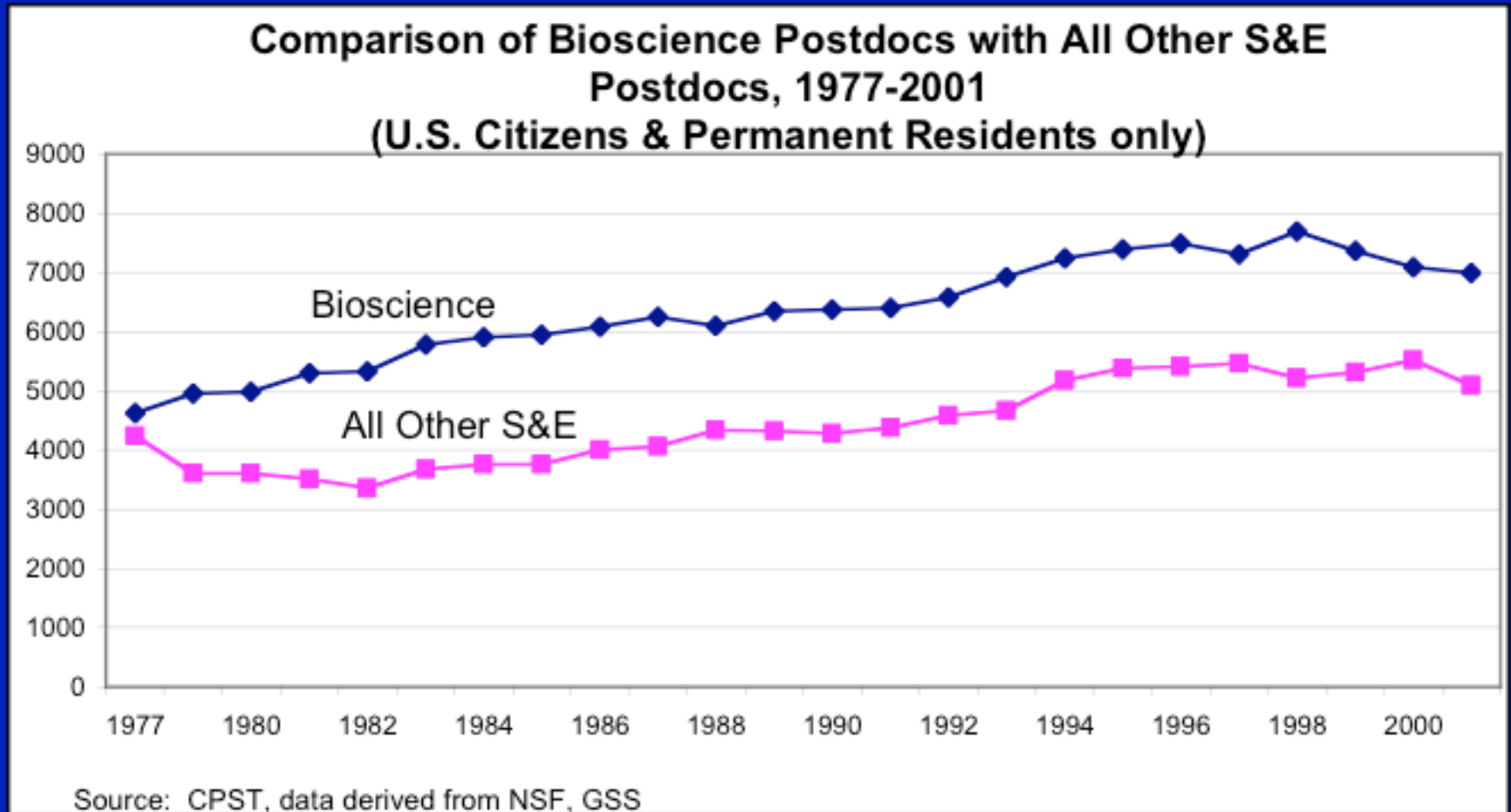
Policy Implications (Ph.D.)

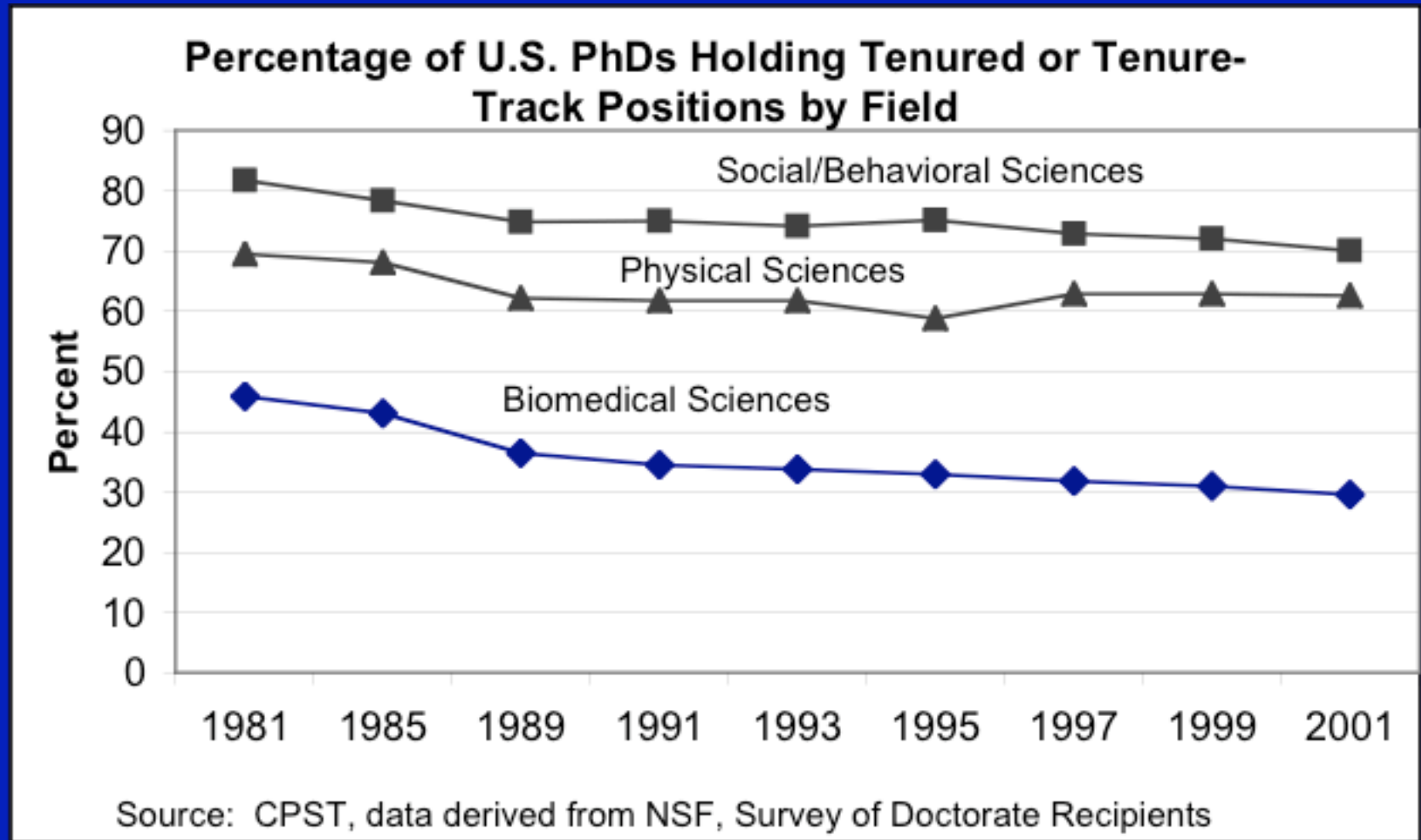
- Appropriate preparation (beyond technical know-how)
- Full disclosure of career opportunities and educational needs
- Integration of research and education
- Diversity

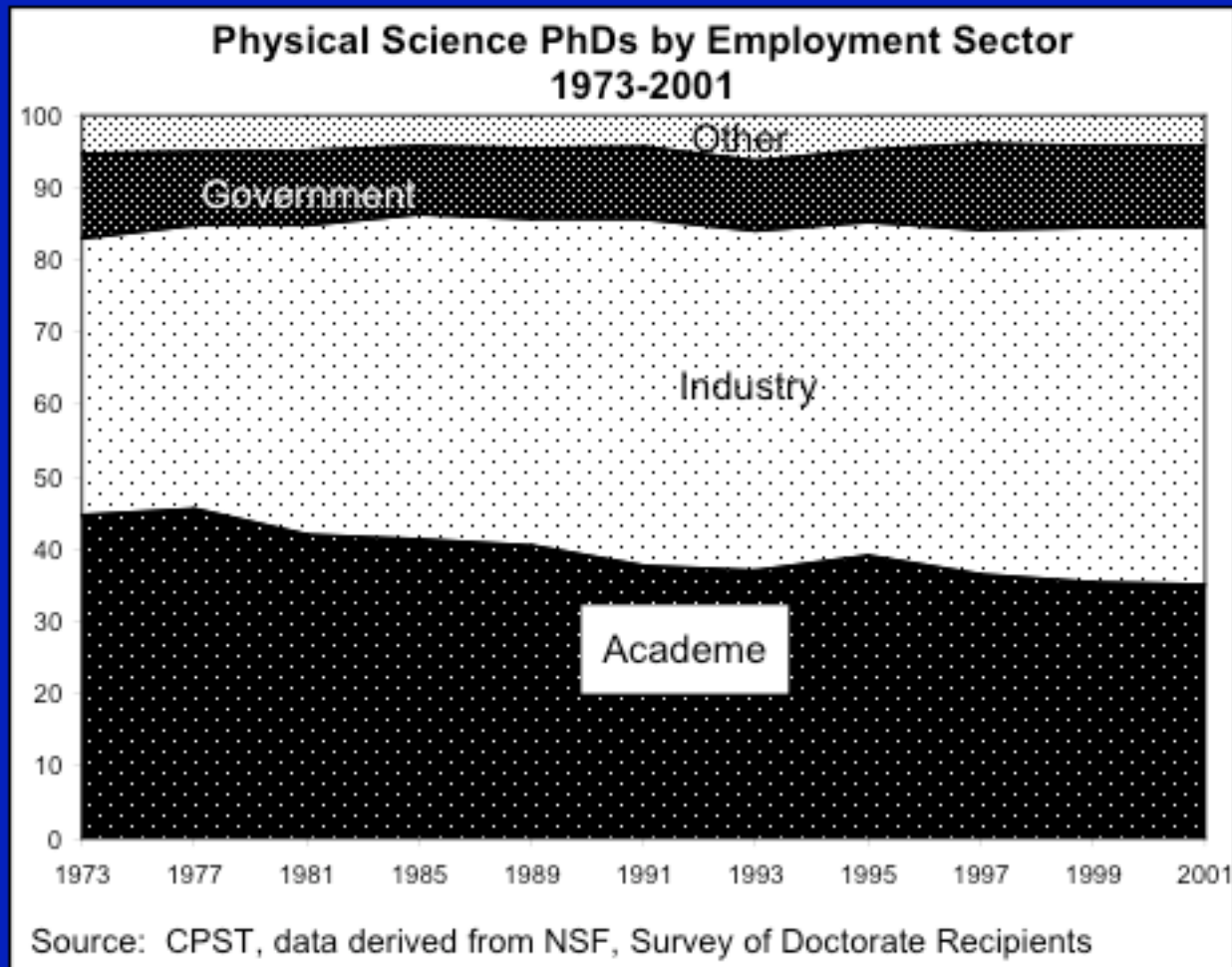
Responses

- Professional science masters
- Science's Next Wave, MiSciNet
- IGERT, CAREER, and GOALI
- ADVANCE & AGEP



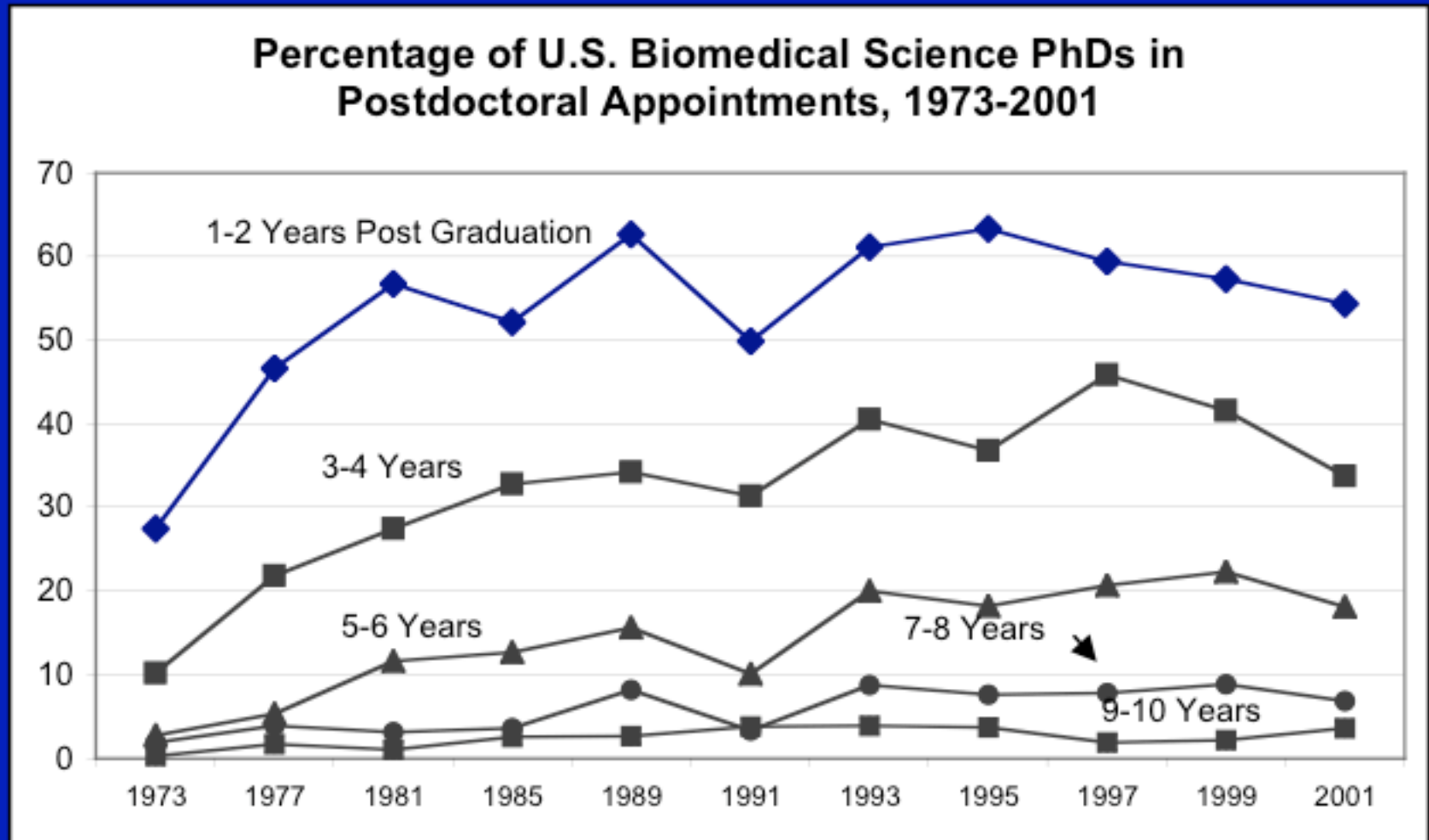


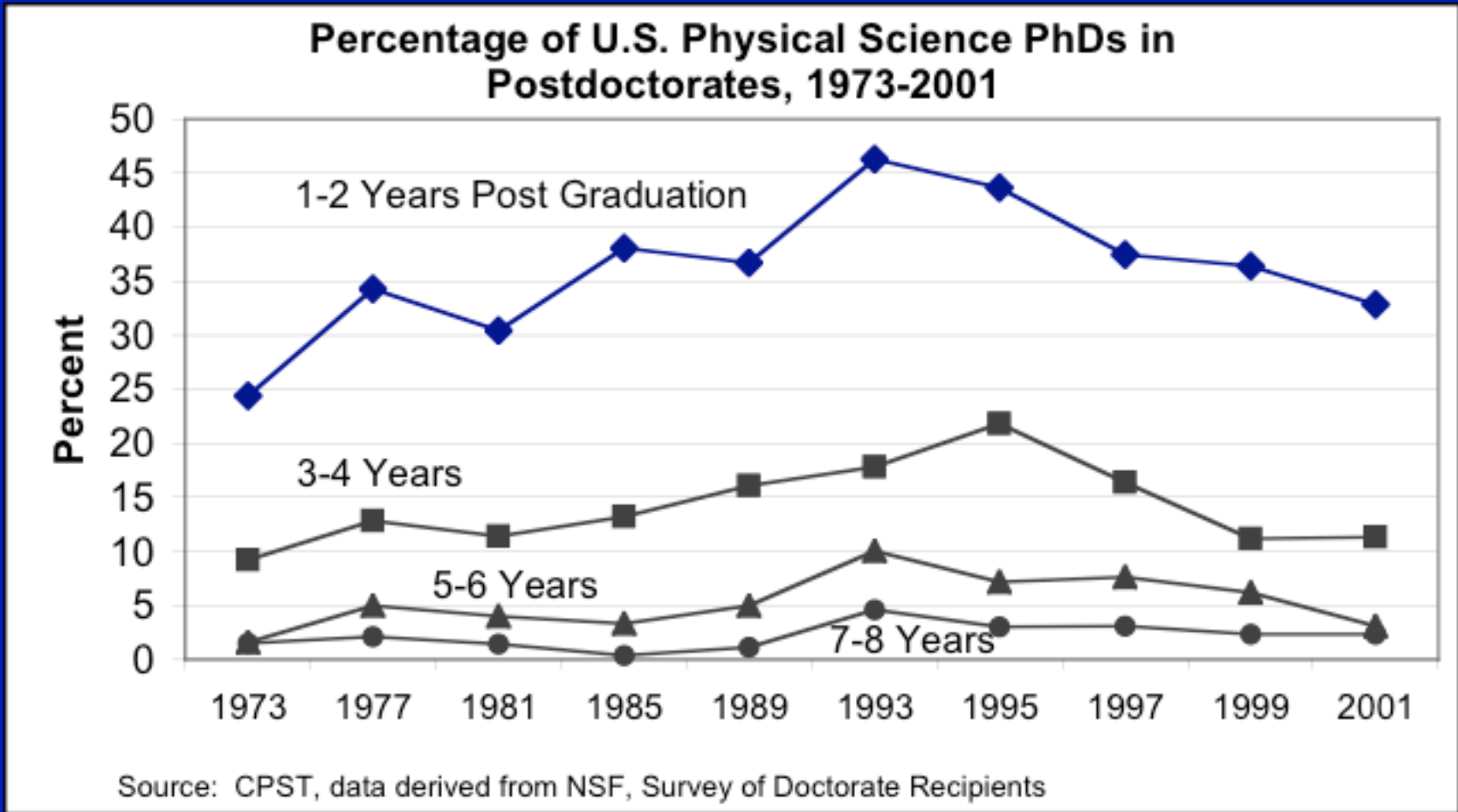




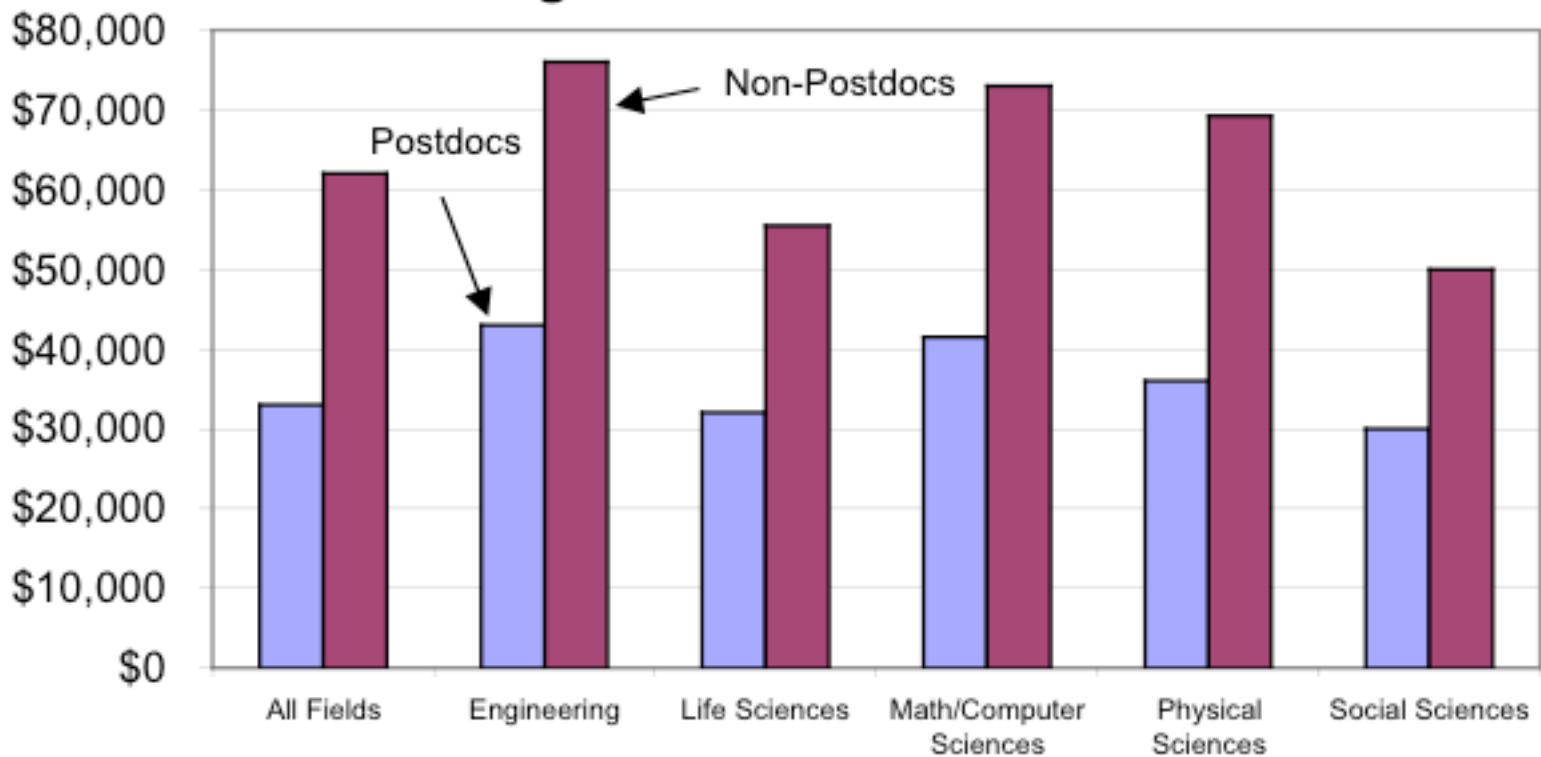
Policy Implications (Postdoctoral)

- “What new skills do you get in the third postdoc, and why didn’t you get them earlier?”





Median Salary in 2001 of U.S. Doctorates 1-3 Years after Degree: Postdoc and Non-Postdoc



Source: CPST, data derived from NSF, Survey of Doctorate Recipients

Students as Product?

Students as “By-Product”?

Acknowledgments

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