Panel on Federal Investment in Science and Technology and its National Benefits

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President's Council of Advisors
on Science and Technology

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Federal investment in R&D

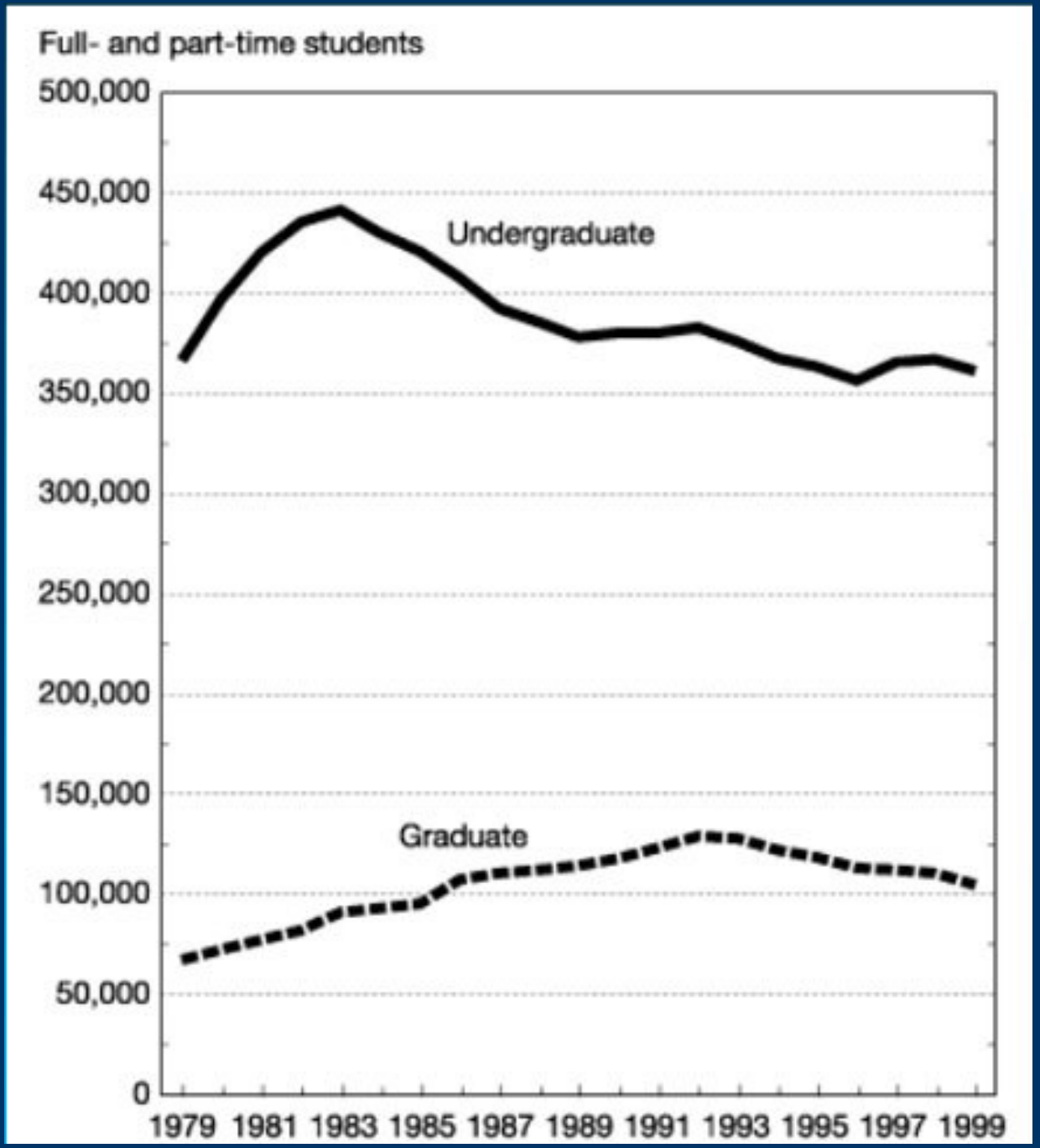
Panel identified five areas for action:

- Shifting R&D allocations
- Science and engineering human resources
- Organizational issues
- R&D investments, priorities and effectiveness
- Competition and cooperation

Human Resources

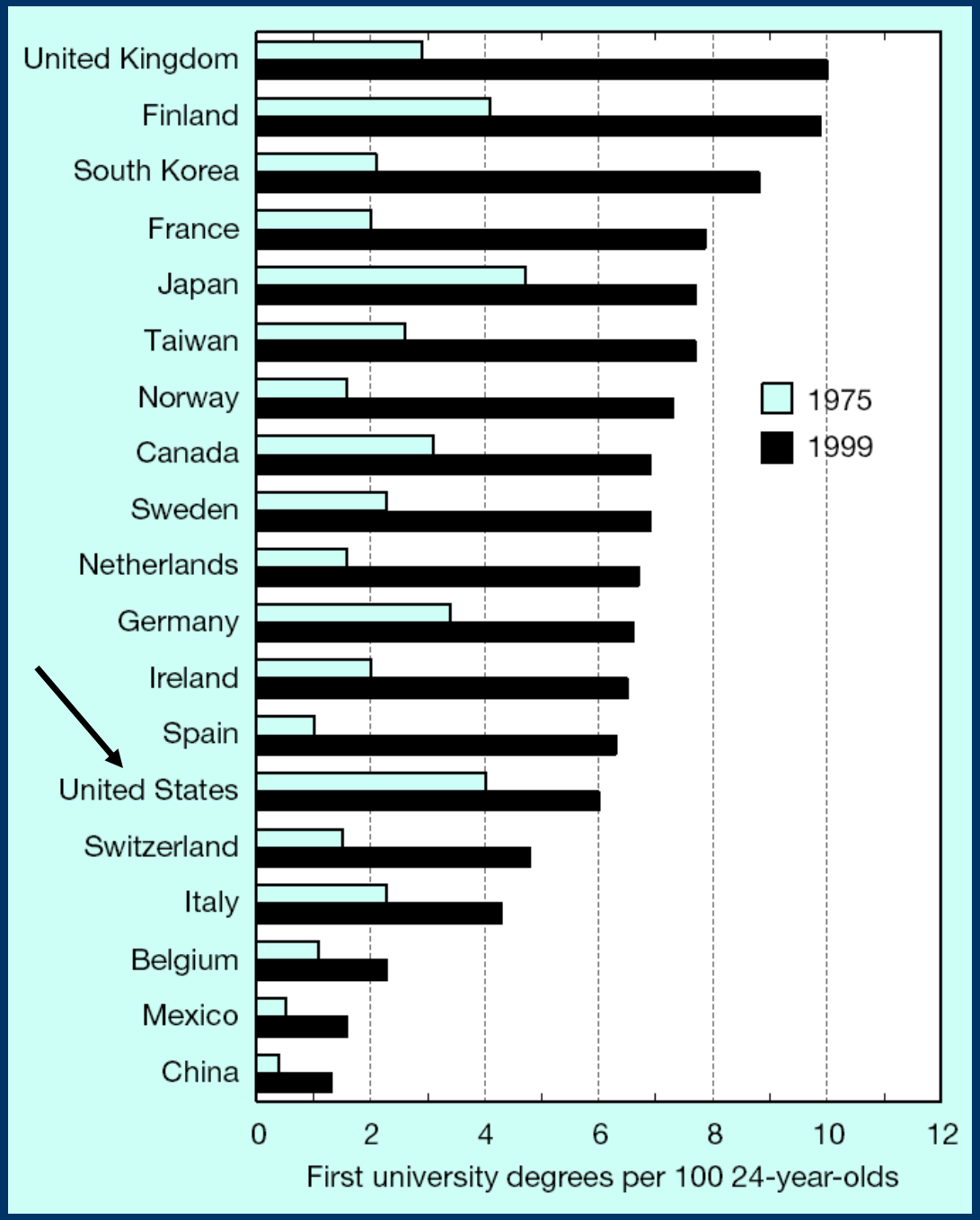
- Number of full-time graduate students has stagnated or declined.
- Women and minorities, who make up an increasing part of the workforce, are under-represented in science and engineering.
- The increase in science and engineering doctorates since 1985 is largely due to an influx of international students.
- This increase is beginning to level off as other countries develop their own graduate programs in science and engineering.

U.S. engineering enrollment



NSF Science & Engineering Indicators 2002

First university degrees in science and engineering per 100 24-year-olds



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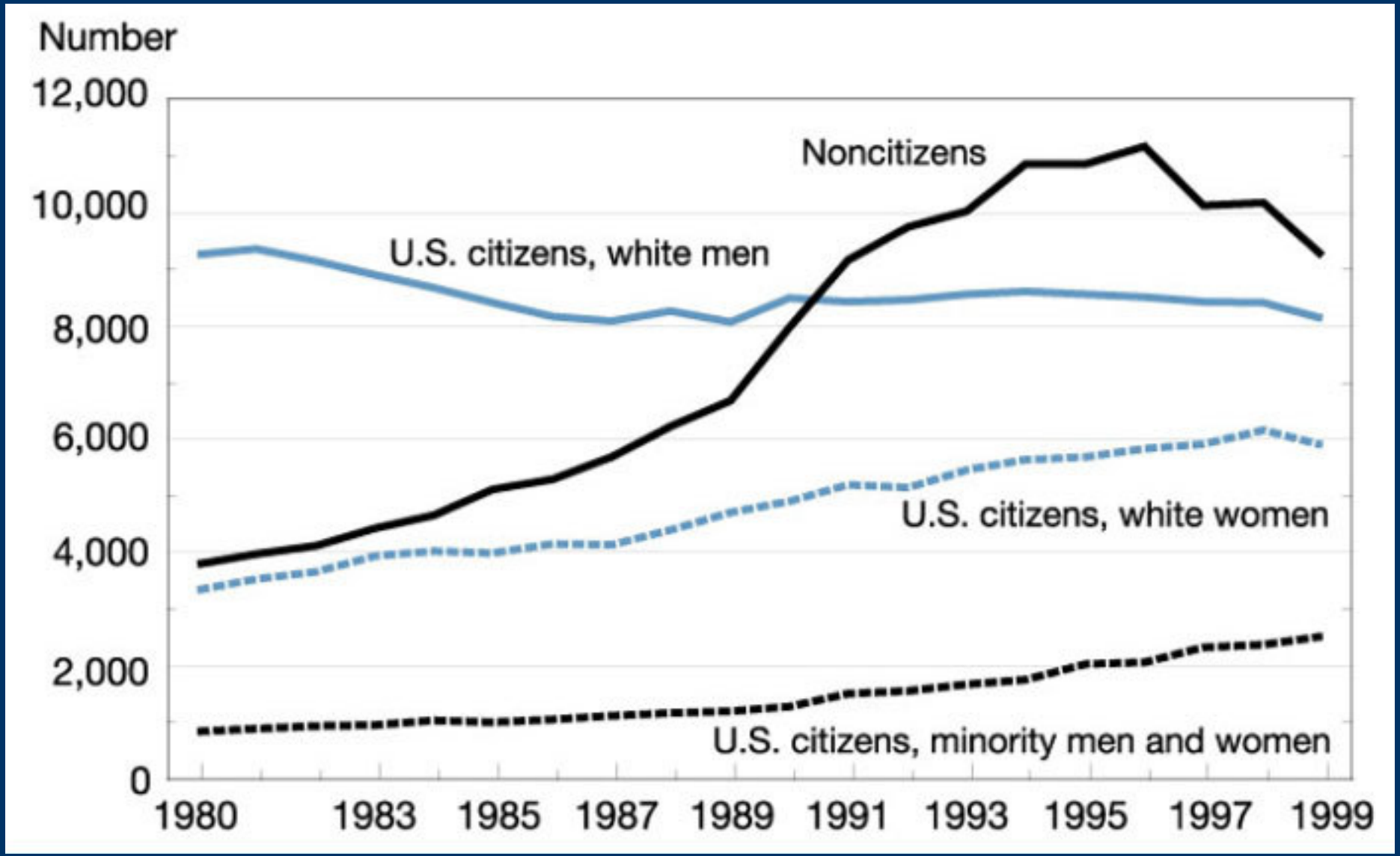
Science and engineering doctorates



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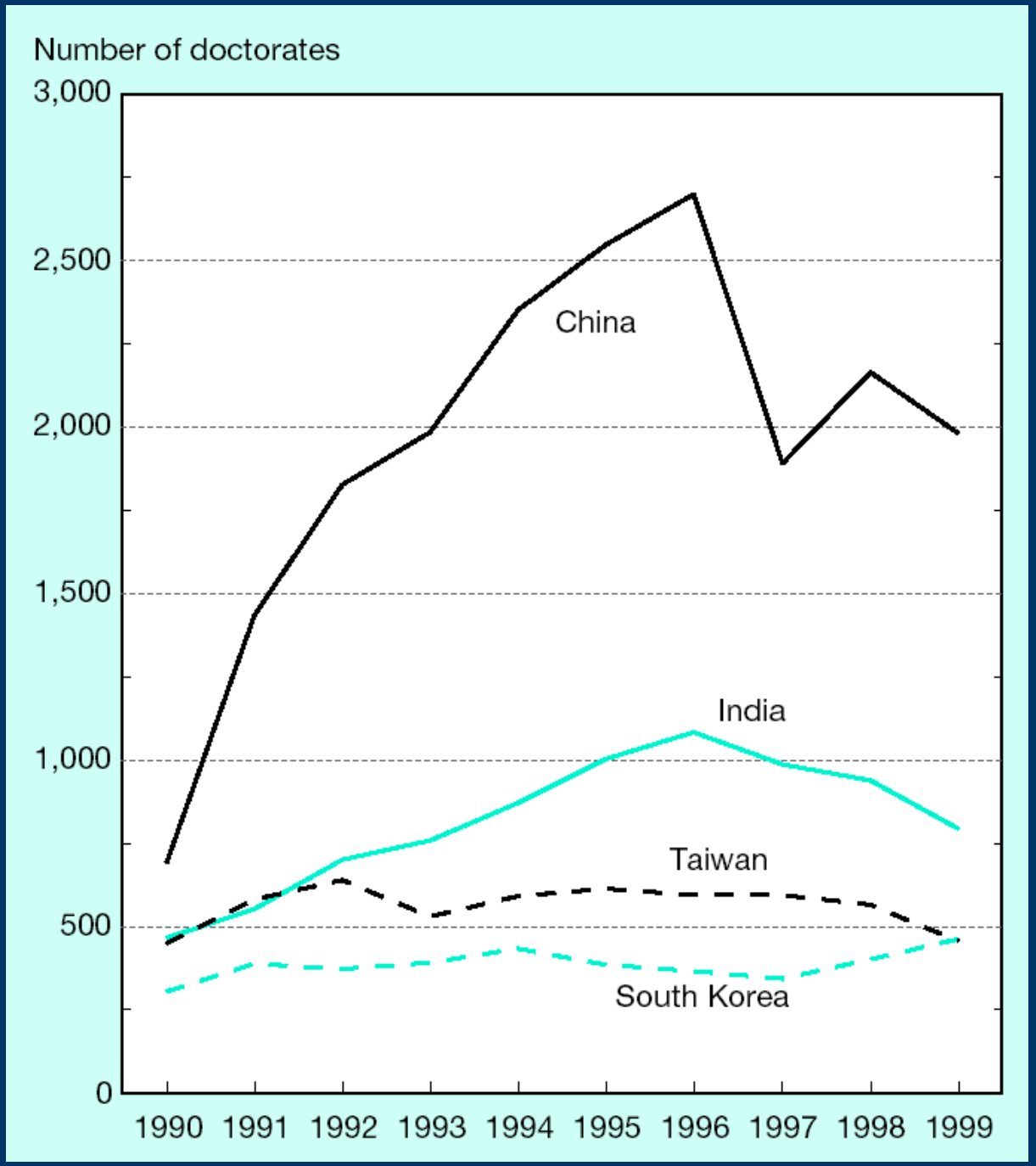


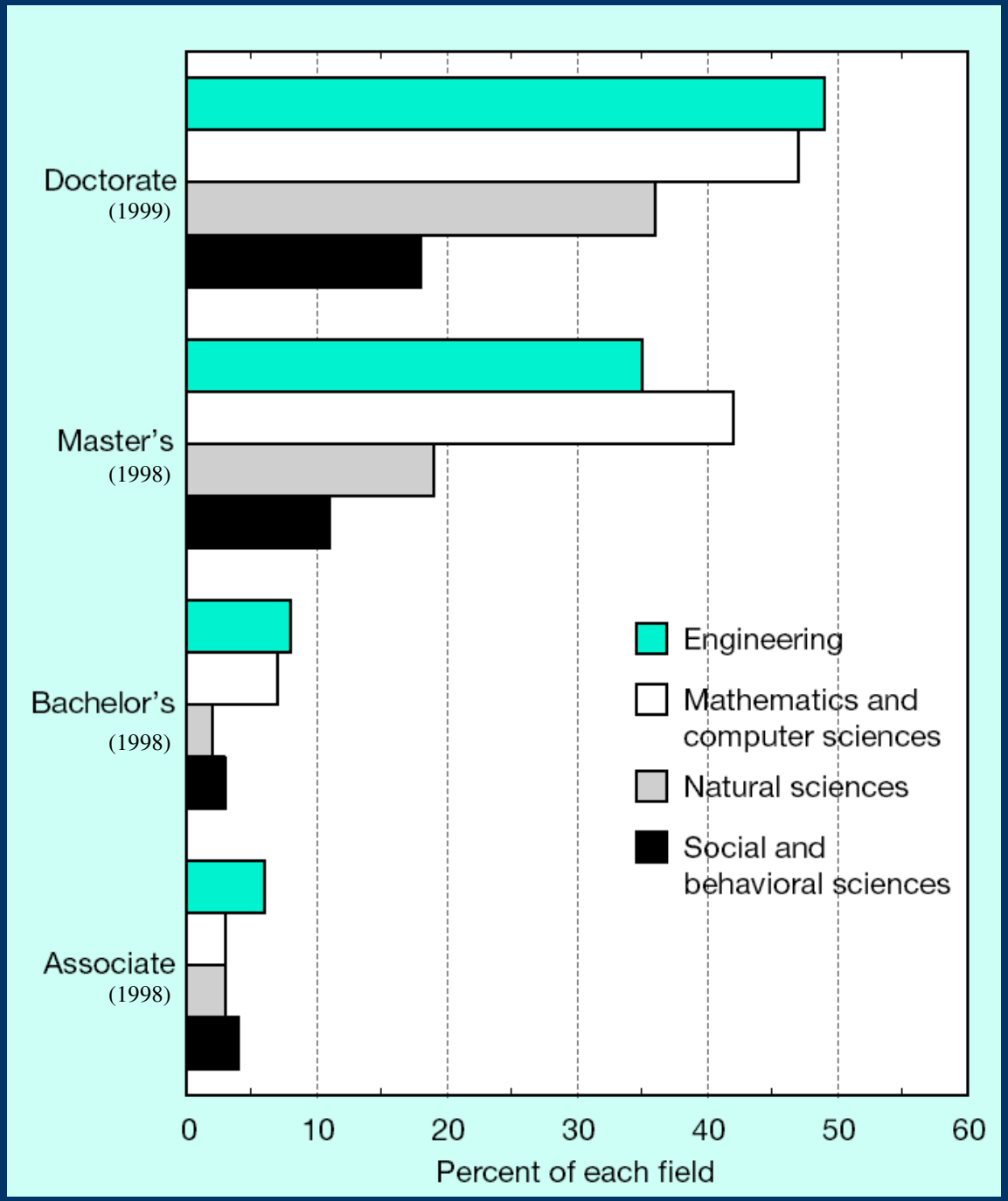
Doctoral students in science & engineering with plans to remain in the U.S.

NSF Science & Engineering Indicators 2002

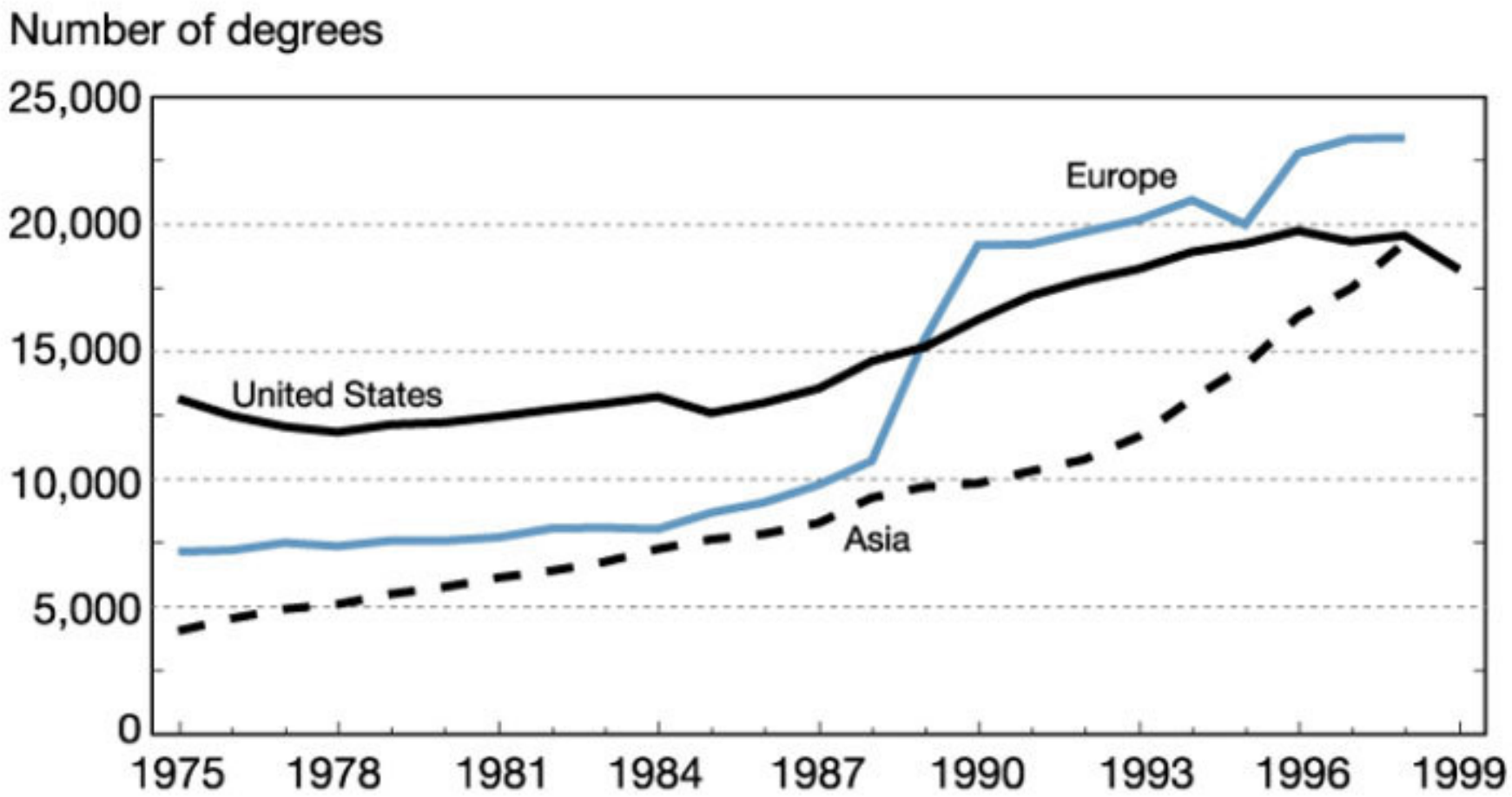
Science and engineering degrees earned by foreign students

By percent of degrees awarded

NSF Science & Engineering Indicators 2002



Doctorates in natural sciences & engineering



NOTE: Europe includes France, Germany, and the United Kingdom. Asia includes China, India, Japan, South Korea, and Taiwan.

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Human resource recommendations

- Establish a graduate fellowship program to attract more students to science and engineering.
- Assess the adequacy of the science and engineering workforce in light of shifting national priorities.

Organizational issues

- Responsibility for research appropriations is divided among 10 Congressional sub-committees.
- Responsibility for research expenditures is distributed among many federal agencies.
- In an increasingly interdisciplinary world, “stove-piping” becomes less and less effective.

Cross-cutting issues and budgets

- Research programs that already cross-cut many agencies:
  - Nanotechnology
  - Information technology
- Cross-cutting issues for the FY 04 budget:
  - Disciplinary allocation of R&D funds
  - Goal-oriented human resource programs

Organizational recommendations

- Assess patterns of federal investment in R&D against ability to meet national needs.
- OSTP and OMB put forth to Congress cross-cutting issues and associated budgets.
- Establish goal-oriented human resources programs across all R&D agencies.

R&D investments, priorities, effectiveness

- Assess the R&D investment:
  - Economic impact
  - Infrastructure needed to pursue R&D
  - Human resources
  - Anti-terrorism and defense
  - Improvements to society
  - Knowledge generation

R&D investments, priorities, effectiveness (cont.)

- Assess effectiveness:
  - Intellectual patents generated
  - Students educated and degree production
  - CRADAs and joint studies
  - Trade balance of intellectual property
  - High technology exports

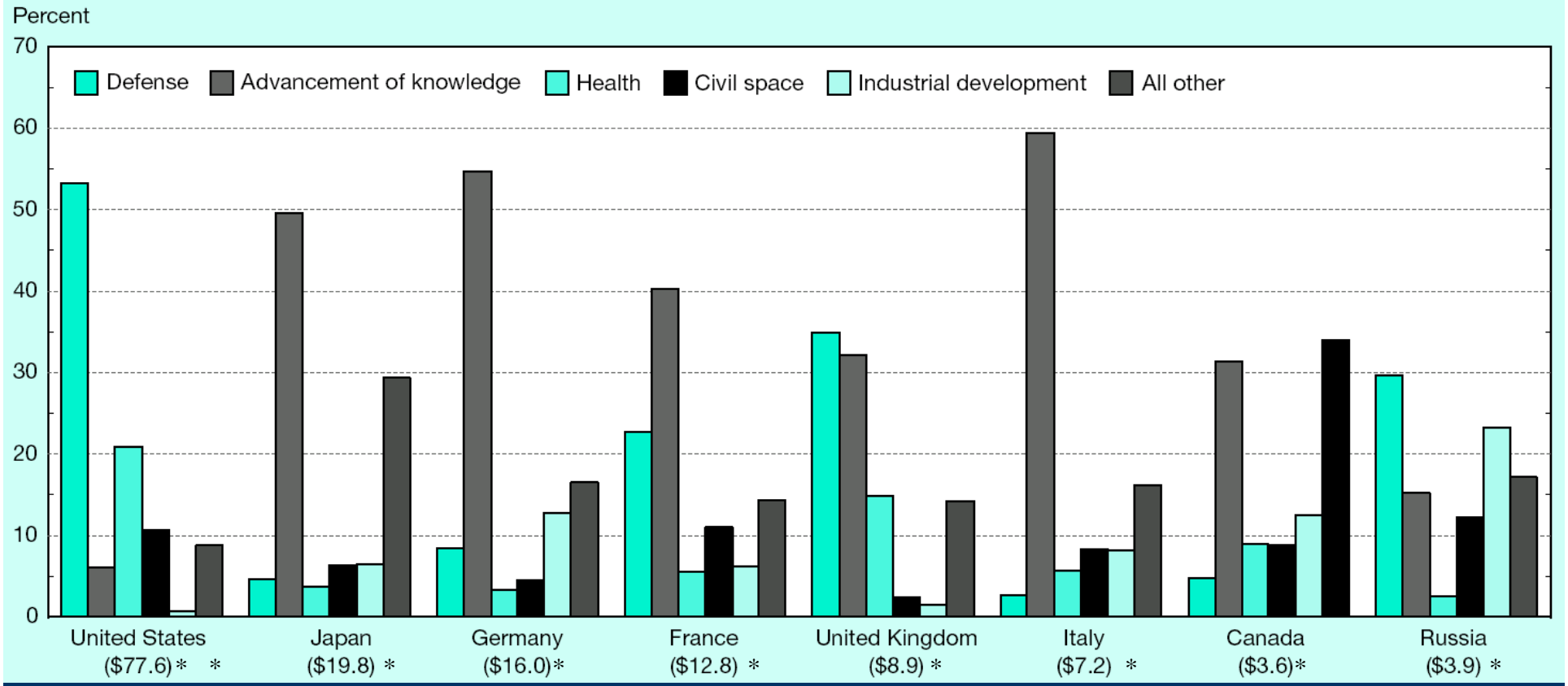
Assessing R&D investment recommendations

- Set priorities in the areas mentioned based on assessments.
- Summarize the general studies on R&D effectiveness, critique the approaches, and derive a set of macro output parameters that should be tracked.

International competition

- Focus of expenditure: U.S. R&D - defense and health; Japan, Germany and Italy R&D - knowledge advancement.
- Ratio of R&D expenditure to gross national product in U.S. now less than other competitors, but recent trends positive.
- Concentrating expenditure in a particular area can give a country the edge: India in software development; Switzerland in pharmaceuticals; Israel in chip design.

Comparing international R&D by type of expenditure



*** Total government R&D support in billions, 1999**

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International competition recommendation

- Closely monitor research investments of other nations and regularly report scientific and technological developments with recommendations to address U.S. global competitiveness.

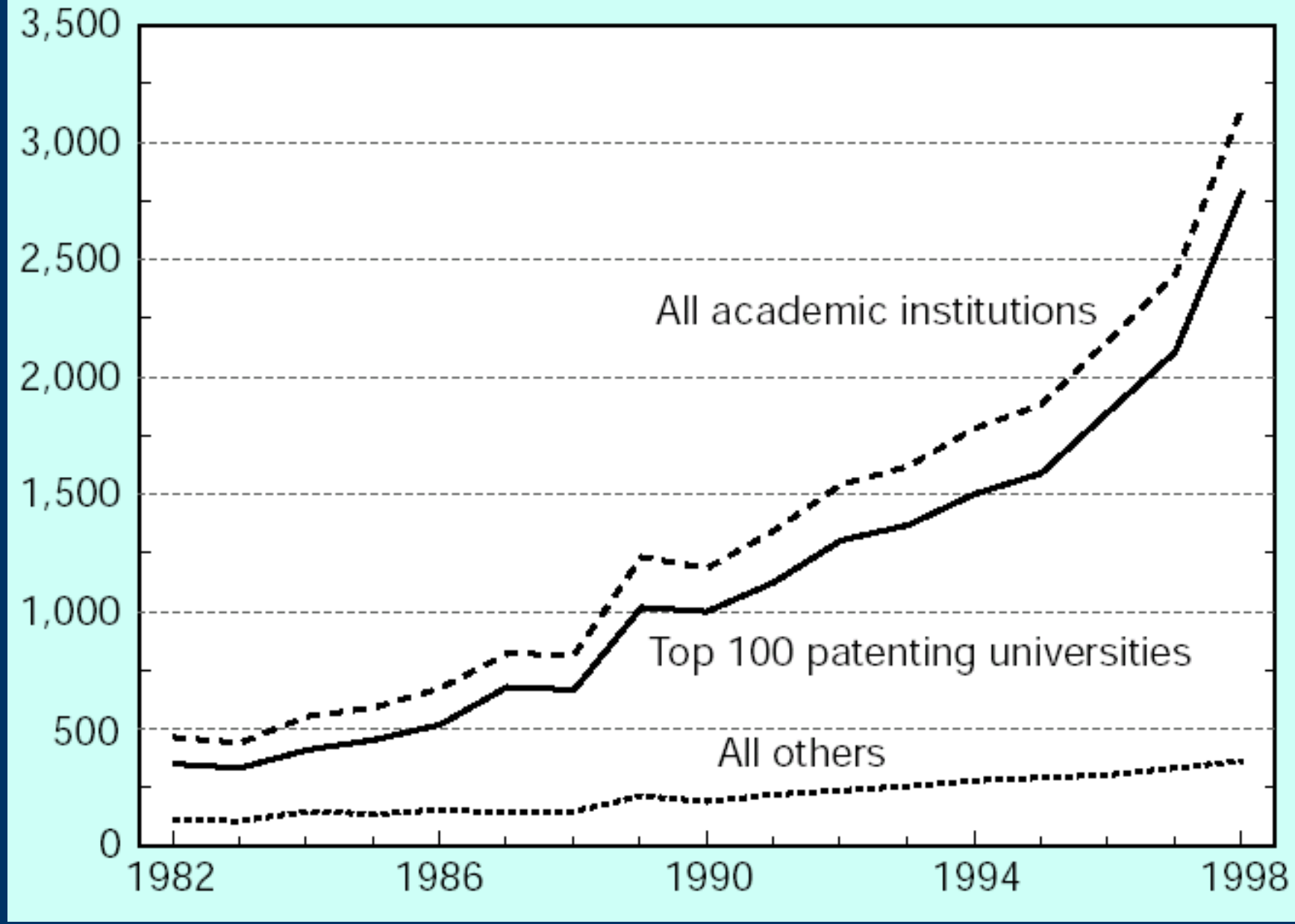
International cooperation

- In the past U.S. failed to take full advantage of opportunities for cooperation:
  - Late to get involved
  - Not a dependable partner
  - Not forthright or transparent in our intent

Technology transfer

- Preliminary report on the Bayh-Dole Act to the Council in June.
- Since June, surveyed venture capitalists and confirmed previous findings that Bayh-Dole works; pharma-bio especially positive.
- Broaden focus of efforts to larger aspects of tech transfer, including impact of public access to publications, impact of incubators, and new company creation.

Granted academic patents: 1982–98



Technology transfer issues

- Semiconductor industry expresses concerns about conflicting interpretations of Bayh-Dole.
- Many universities involved with IP development but small number have sophistication needed.
- Issues in jointly funded projects, where PI's have joint appointments, and with different interpretations by different agencies.
- Federal tech transfer policy embedded in Bayh-Dole, but in other laws and regulations; patchwork is challenge to understand.

Closure Process

- Review and comment on Rand Report on technology transfer.
- Hold an open forum on technology transfer and Bayh-Dole in November.
- Develop a set of recommendations on technology transfer by December.