Professional Science Master's Degrees: Background and Overview

NRC Committee on Enhancing the Master's Degree in the Natural Sciences

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Council of Graduate Schools

Professional Science Master's (PSM) - What is it?

A new kind of degree that:

- Prepares graduates for work—outside academia—involved in active science.
- Combines technical competencies with workforce skills, e.g. management, policy, communications, law – "Science Plus!"
- Leads to a wider variety of career options than provided by traditional graduate programs – jobs in business, government, non-profit ("BGN") sectors.

What else is it? Technical Leadership Development

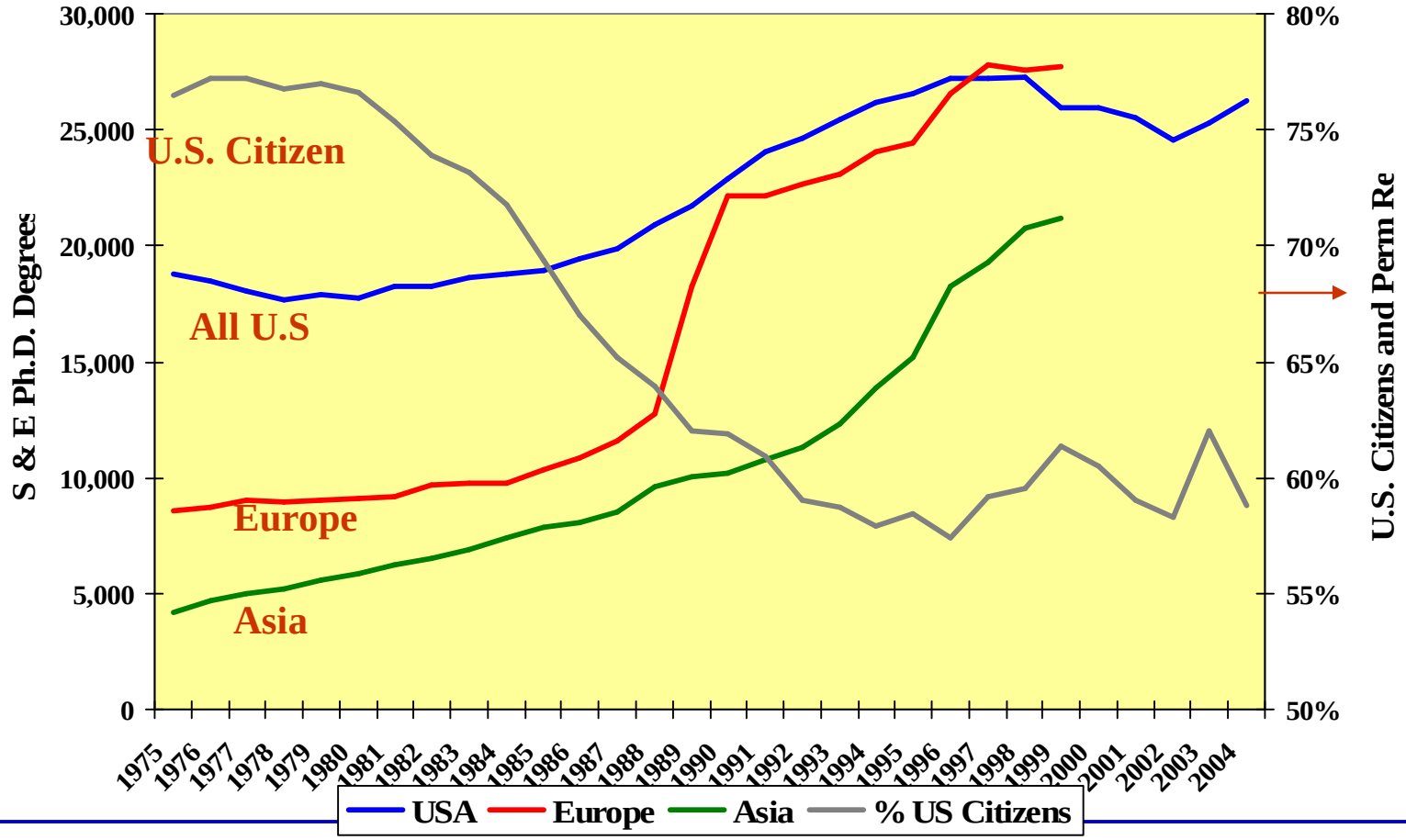
- Technical depth and leadership skills are hard to find in one person, but essential in many employment areas (director/manager in technical and financial fields).
- PSMs produce technically knowledgeable leaders.
- Needs for such people increase with complexity.
- This is vital for US global competitiveness.

Professional Science Master's Degree - Why?

Odd Gap in U.S. Science Graduate Education

- Strong: Bachelors, PhDs in science.
- But BA/BS insufficient for science career.
- Master's considered merely as entry to (or exit from) the PhD.
- But PhD too long, with uncertain prospects.
- Attractiveness of PhD declining among domestic students; < 20% of majors continue in science/math graduate programs.

Doctoral S&E Degrees by World Region



Council of Graduate Schools

Source: National Science Board, Science and Engineering Indicators 2004

PSM – Why?
Employers Views:

- Many need PhDs, but not in large numbers
- Do want advanced science skills,
- PLUS…
  - Interdisciplinary teamwork, flexibility
  - Project management
  - Computational skills
  - Communication ability
  - Basic business skills
  - Ethics
  - Legal and regulatory issues

PSM – Why?
Workforce Projections

- Ramp-ups in competition: China, India
- Many expect demand for graduate skills
- Globalizing, off-shoring, rapid change
- Needed: more flexibility, nimbleness in graduate science education

PSM – Why?
Science Students Ask:

- If I take time to obtain an advanced degree, will I be able to enter my chosen profession?
- Can I aspire to a level of compensation roughly comparable to my peers in other professions?
- Is a career in science compatible with “having a life”?

PSM Programs Are For:

Highly motivated students who want to work in:

- Non-academic sectors
- Interdisciplinary careers
- Team oriented environments
- Managerial or other professional level positions
- Emerging areas of science and scientific discovery

Or who are:

- Seeking career advancement in government, industry, and technology
- Looking to gain a competitive edge in the job market
- Re-entering the workforce looking to refine professional and technical skills
- Seeking career growth

How is the PSM Different?

- More science (or mathematics) than MBA.
- Often more informatics/computation than science degree.
- More professional skills (business, law, communication) than PhD (and students often interact across multiple programs).
- Connections with potential employers.
- Project or team experience vs. thesis: real world experience.

As a result, these programs often require more credits than a traditional master's degree and tend to be more rigorous.

How is the PSM Different?

- Curriculum developed in concert with employers and designed to dovetail into present and future vocational opportunities.
- Based on analysis of demand for graduates, including collection of information from potential employers.

How Do Employers Help?

- Advise PSM faculty
- Mentor PSM students
- Tuition for employees
- Internships
- Prospective employers
- Champions re: regional economic development

Variations in PSM Programs

- A few (increasing) cater to working professionals (all 4 Illinois Institute of Technology programs).
- Some use “cohort” model – students go through program requirements as a group (Keck).
- Some use case studies for teaching (North Carolina State U.).
- Bundled program components, especially the “plus” modules, offered as a certificate (Mich. State U.).
- A few (e.g. Case Western) focus on preparing entrepreneurs.

PSM - A Brief History

- 1997 - Sloan Foundation initiative for research universities. Resulted in about 60 new programs/tracks.
- 1997 - Keck Foundation initiative – $50M grant to start the Keck Graduate Institute. Offers “Master of Bioscience” degree in 5 specialty areas in (coincidentally) PSM model.
- 2000 – Sloan funds “single-track” PSMs in bioinformatics. Resulted in 16 new programs.

History - continued

- 2002 – Sloan/CGS partnership for “master’s-focused” institutions. Two-part feasibility and implementation awards resulted in about 30 new PSM programs/tracks.
- 2005 (and continuing) Sloan “scale-up/sustainability” imitative targeting system-level adoptions of PSM (notably U. North Carolina and California State U.)
- 2006 – Sloan/CGS “institutionalization” initiative.

How many? >100 PSMs, >50 institutions, >20 states

- Math – Financial, Industrial, Computational Sciences, Statistics for Entrepreneurship, or for Environmental Decision Making
- Physics – with Business Applications, Physics of Modeling, Industrial Physics, for Entrepreneurship
- Biological Sciences – Bioinformatics, Biotechnology, Applied BioSciences
- Computational Biology, Computational Chemistry
- Forensics
- Bioanalytical Chemistry, Biomolecular Chemistry
- Geographical Information Systems

Who Hires PSM Graduates?

Applied Biosciences

- Eli Lilly
- 3-Dimension Pharmaceuticals (J&J)
- The Institute for Human Genome Therapy
- Health Sciences, Inc.
- Glaxo SmithKline
- Purdue Pharma
- Novartis
- Blue Cross – Blue Shield
- Johnson & Johnson

Who Hires PSM Graduates?

Financial, Industrial Math & Statistics

- First Federal Bank
- Digital Credit Co.
- Putnam Investments
- Watson-Wyatt
- Chevron
- Lockheed-Martin
- G.E. Capital
- Department of Agriculture
- American Automobile Association

What Is Known from Previous Data Collections

- Number of Institutions and programs with PSMs
  - Currently over 100 programs in over 20 states in about 50 institutions
  - About half in Biosciences; about 1/6th in Mathematics
- Enrollments and Degrees
  - Through Fall 2005 – about 3,400 Enrollees; 1,300 graduates
  - Over 50% are female
  - Over 80% are U.S. citizens
  - About 9% are underrepresented minorities

Starting Salaries for PSM Graduates

- **Private Industry** - $55,000 - $62,000
  - Boeing, Chevron, Novartis, Lockheed-Martin, G.E. Capital, Raytheon, Pfizer, Glaxo Smith-Kline
- **Government** - $45,000 - $55,000
  - NASA, EPA, USDA, National Center for Food Safety, Michigan Council of Governments
- **Nonprofits** - $45,000 - $55,000
  - Mayo Clinic, Institute Human Genome Therapy, IIT Research Institute, Institute for Pollution Control

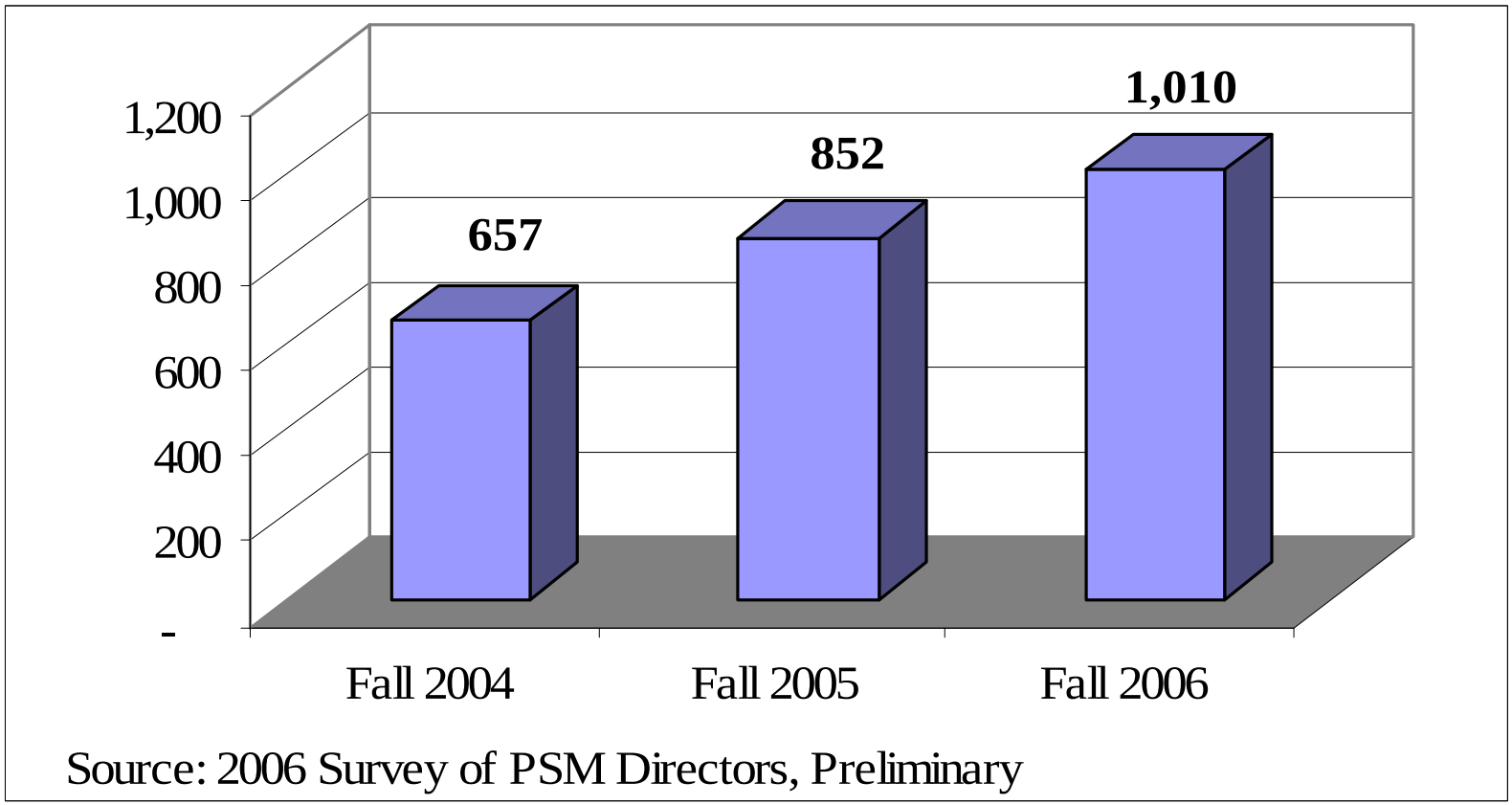
Starting Salaries of Bachelor's & Master's Degree Scientists 2003

	Biological Sci.	Math & Statistics	Physical Sciences
Bachelor's			
Total	$29,000	$36,000	$35,000
Industry	29,000	42,000	35,000
Government	30,000	40,000	38,000
Master's			
Total	40,000	54,000	49,000
Industry	49,000	63,000	54,000
Government	43,000	S	S

Source: NSF, National Survey of Recent College Graduates, 2003

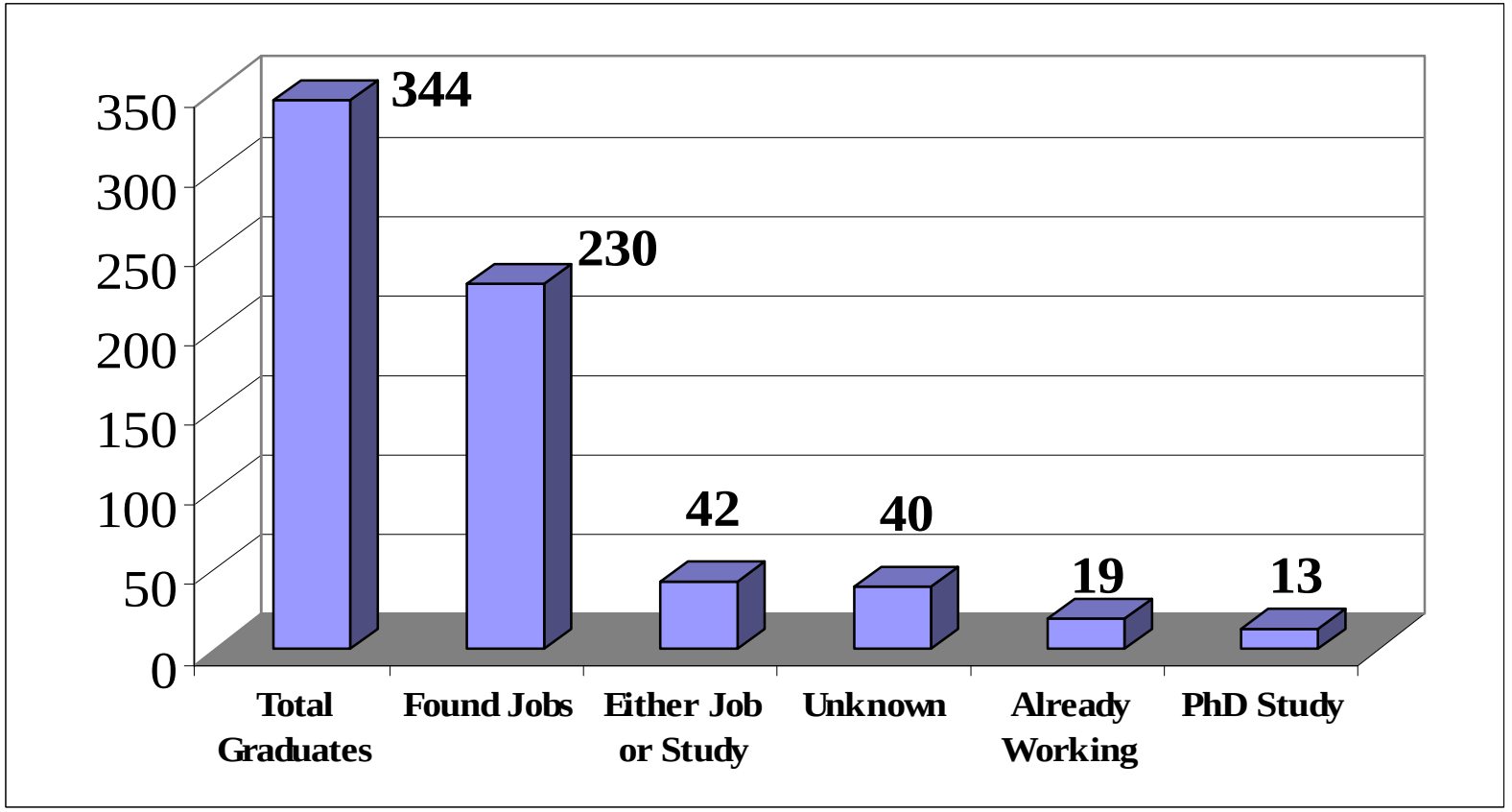
S - data with unweighted values less than 20 are suppressed.

Survey of PSM Program Directors - ENROLLMENTS



Source: 2006 Survey of PSM Directors, Preliminary

Survey of PSM Program Directors – Placement Data



The CGS/Sloan PSM Initiative

- The CGS project consolidates multiple PSM activities under the CGS umbrella.
- Goal: “The institutionalization and promotion of the PSM degree as a regular feature of graduate education.”
- We expect to achieve the following objectives:
  - Continuation and improvement of existing PSM programs.
  - Encourage and assist in the development of new PSM programs.

The CGS/Sloan PSM Initiative

- Significant increase in the number of students enrolled in all PSM programs.
- Expansion of funding by NSF and other agencies to include PSM programs.
- Increase in the number and variety of employment sector champions of the PSM.
- Support of states through work with NCSL and NGA.
- Advocate for PSM in federal legislation.

New Programs Coming Online

- California State, Sacramento – 3
- Middle Tennessee St. U. – 1
- NYU – 4
- Texas A&M – 1
- Towson St. U. – 1
- U. Maryland Baltimore County – 1
- U. North Carolina, Charlotte – 1
- U. Northern Iowa - 3

Institutions in active planning for new or additional programs:

- Appalachian State U.
- Eastern Illinois U.
- Louisiana State. U.
- Roosevelt U.
- Southern Illinois U. Carbondale
- SUNY – several campuses
- U. California Davis
- U. Colorado Boulder
- U. Illinois Urbana-Champaign
- U. Michigan
- U. Pennsylvania
- U. Tampa

The CGS PSM National Advisory Board – 15 Members

- Five PSM Program Directors
- Five Graduate Deans at PSM institutions
- Five Industry/Policy Representatives

(three members of this Board are members of the NRC committee – one from each sector)

PSM in Federal Legislation - Senate

- America COMPETES Act: introduced 3/5/2007 by Senators Reid and McConnell.
- Co-sponsors: 38 - equally split between parties.
- Authorizes funding NSF for program to develop and enhance PSMs.

PSM in Federal Legislation – House

- H.R.363 – Sewing the seeds through science and engineering research act.
- Sponsor: Rep. Bart Gordon, introduced 1/10/07
- Gordon and staff have great interest in PSM but no language in bill yet – expect to be amended or combined with another similar bill.

Why Should Universities Consider Establishing PSM Programs?

- The bulk of the new jobs being created are in the non-academic sector; these programs prepare students for employment in non-academe.
- Most universities have a commitment to outreach. PSM programs fit perfectly as they provide well-educated graduates who will apply their skills to endeavors within the state.

Why Should States Consider Supporting PSM Programs?

- Because master's graduates typically are a less mobile group than PhD recipients.
  - About two-thirds of S&E master's degree graduates were employed in the state in which they earned a degree.
  - About one-fourth of S&E doctorate recipients plan employment in the state in which they earned their PhD.
- PSM programs are more popular with women and domestic students than traditional master's programs in Natural Sciences.

Benefits of the PSM

For the student – alternative way to remain in science without getting a PhD.

For the university - provide students with another career option and help solve community workforce needs.

For the employers – local, regional, state – have a technically trained cadre of workers.

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Council of Graduate Schools www.cgsnet.org

and www.sciencemasters.com

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