Biomedical Research Workforce Working Group

INTERIM REPORT

Shirley Tilghman, PhD
President
Princeton University

Sally Rockey, PhD
Deputy Director for Extramural Research
NIH

Charge

1. Develop a model for a sustainable and diverse U.S. biomedical research workforce that can inform decisions about training of the optimal number of people for the appropriate types of positions that will advance science and promote health.

   Developing the model will include an analysis of the current composition and size of the workforce to understand the consequences of current funding policies on the research framework.

   The model should include:

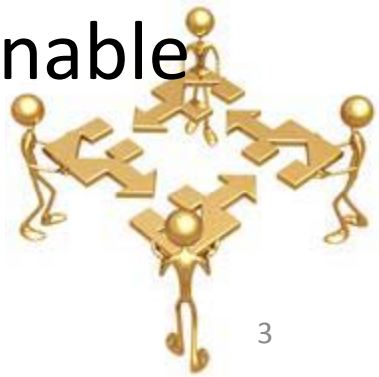
   - An assessment of present and future needs in the academic research arena, but also
   - Current and future needs in industry, science policy, education, communication, and other pathways.

   The model will also require an assessment of current and future availability of trainees from the domestic and international communities.

http://acd.od.nih.gov/bwf.asp

Charge cont.

2. Based on this analysis and input from the extramural community, using appropriate expertise from NIH and external sources, and recognizing that there are limits to NIH's ability to control many aspects of the training pipeline, the committee will **make recommendations for actions that NIH should take** to support a future sustainable biomedical infrastructure.



Roster

- **Shirley Tilghman,** PhD, President, Princeton University, *co-Chair*
- **Sally Rockey,** PhD, NIH Deputy Director for Extramural Research, NIH, *co-Chair*
- **Sandra Degen**, PhD, Interim Chair, Dept of Molecular Genetics, Biochemistry & Microbiology, Associate Chair for Academic Affairs, Dept of Pediatrics, University of Cincinnati and Cincinnati Children's Hospital, University of Cincinnati
- **Laura Forese**, MD, COO, Chief Medical Officer, and Senior Vice President, NY-Presbyterian Hospital/Weill Cornell Medical Center
- **Donna Ginther, Ph.D.,** Professor, Professor of Economics and Director, Center for Economic and Business Analysis, University of Kansas
- **Arthur Gutierrez-Hartmann**, M.D., Professor, Department of Medicine and Department of Biochemistry and Molecular Genetics; and Director, Medical Scientist Training Program, University of Colorado Denver
- **Freeman Hrabowski**, PhD, President, University of Maryland, Baltimore County
- **James Jackson**, PhD, Professor of Psychology and Director, Institute for Social Research, University of Michigan
- **Leemor Joshua-Tor**, PhD, Professor and Dean, Watson School of Biological Sciences, HHMI Investigator, Cold Spring Harbor Laboratory
- **Richard Lifton**, MD, PhD, HHMI Investigator, Yale School of Medicine
- **Garry Neil**, MD, Corporate Vice President, Corporate Office of Science and Technology, Johnson & Johnson
- **Naomi Rosenberg**, PhD, Dean, Sackler School of Graduate Biomedical Sciences, Tufts University School of Medicine
- **Bruce A. Weinberg**, PhD, Ohio State University
- **Keith Yamamoto**, PhD, Executive Vice Dean, School of Medicine, University of California San Francisco

Modeling sub-Committee

- **Bruce Weinberg, Ph.D.**, Professor of Economics, Ohio State University, *co-chair*
- **Donna Ginther, Ph.D**., Professor of Economics & Director, Center for Economic and Business Analysis, University of Kansas , *co-chair*
- **David Blau, Ph.D.,** Professor of Economics, Ohio State University
- **Stephen Eubank, Ph.D.** Professor of Physics, Virginia Bioinformatics Institute & deputy director, Network Dynamics and Simulation Science Laboratory, Virginia Tech
- **Richard B. Freeman, Ph.D.** Herbert Ascherman Chair of Economics, Harvard University & director of the National Bureau of Economic Research/Sloan Science Engineering Workforce Project
- **Peter K. Sorger, Ph.D.** Professor of Systems Biology, Harvard Medical School
- **Paula Stephan, Ph.D.** Professor of Economics, Georgia State University
- **Michael Teitelbaum, Ph.D.** Senior Advisor, The Alfred P. Sloan Foundation

NIH Activities

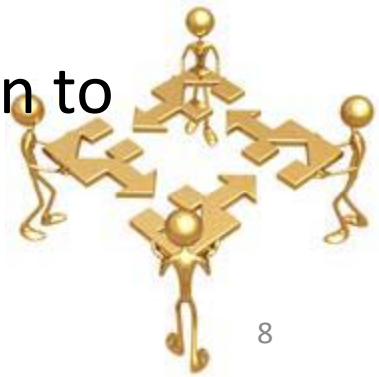
- NIH Training/Workforce Committee
  - Trans-NIH group of staff experts in training and workforce issues
  - Led by Rod Ulane and Richard Baird, co-chairs of the NIH Training Advisory Committee
  - Developing scenarios for possible NIH policy changes for supporting:
    - Graduate students
    - Postdoctoral Fellows
    - Early career scientists
    - Clinician-scientists
- Support
  - OER and other NIH staff
  - Discovery Logic – data analyses
  - Ripple Effects – RFI analyses

Activities

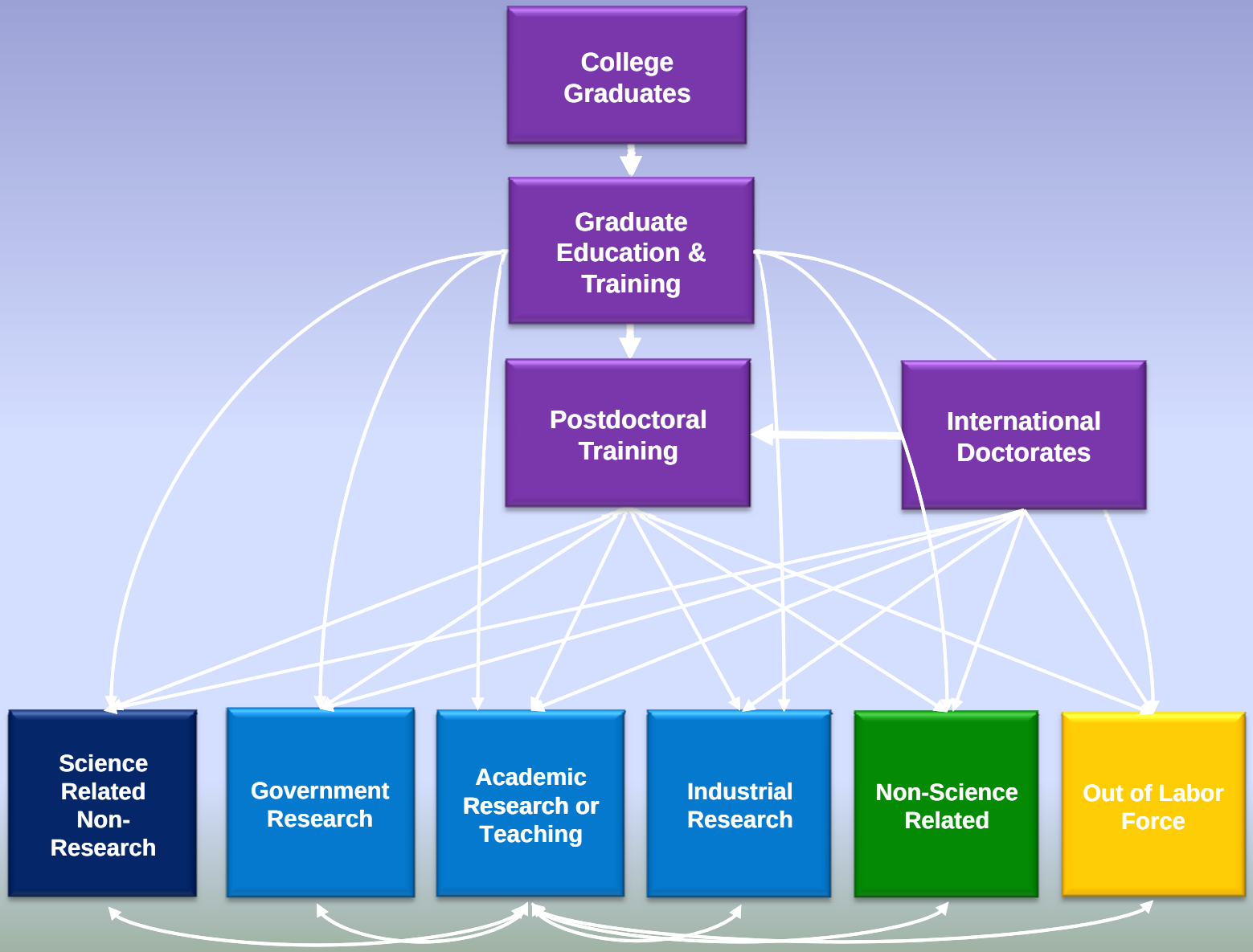
- May 10, 2011 – first working group call
- May 23, 2011 – first modeling sub-committee call
- June 21, 2011 – one day working group meeting on NIH campus
  - Working group meeting
  - Presentations from stakeholders
- August 5, 2011 – one day meeting of modeling sub-committee in Cambridge, MA
  - Definition of a conceptual framework for a model
  - Developed a list of analyses to provide data to the working group (analyses ongoing)
- Request for Information http://grants.nih.gov/grants/guide/notice-files/NOT-OD-11-106.html - published August 17, 2011 (closed October 7, 2011)
- September 14, 2011 – working group call to refine major issues
- October 12, 2011 – working group call on staff scientists
- October 25, 2011 – one day meeting on NIH campus
  - Initial presentation of data
  - Discussion of unintended consequences of NIH policies
  - First outline of report
- October-November, 2011 – NIH staff group deliberations

Approach

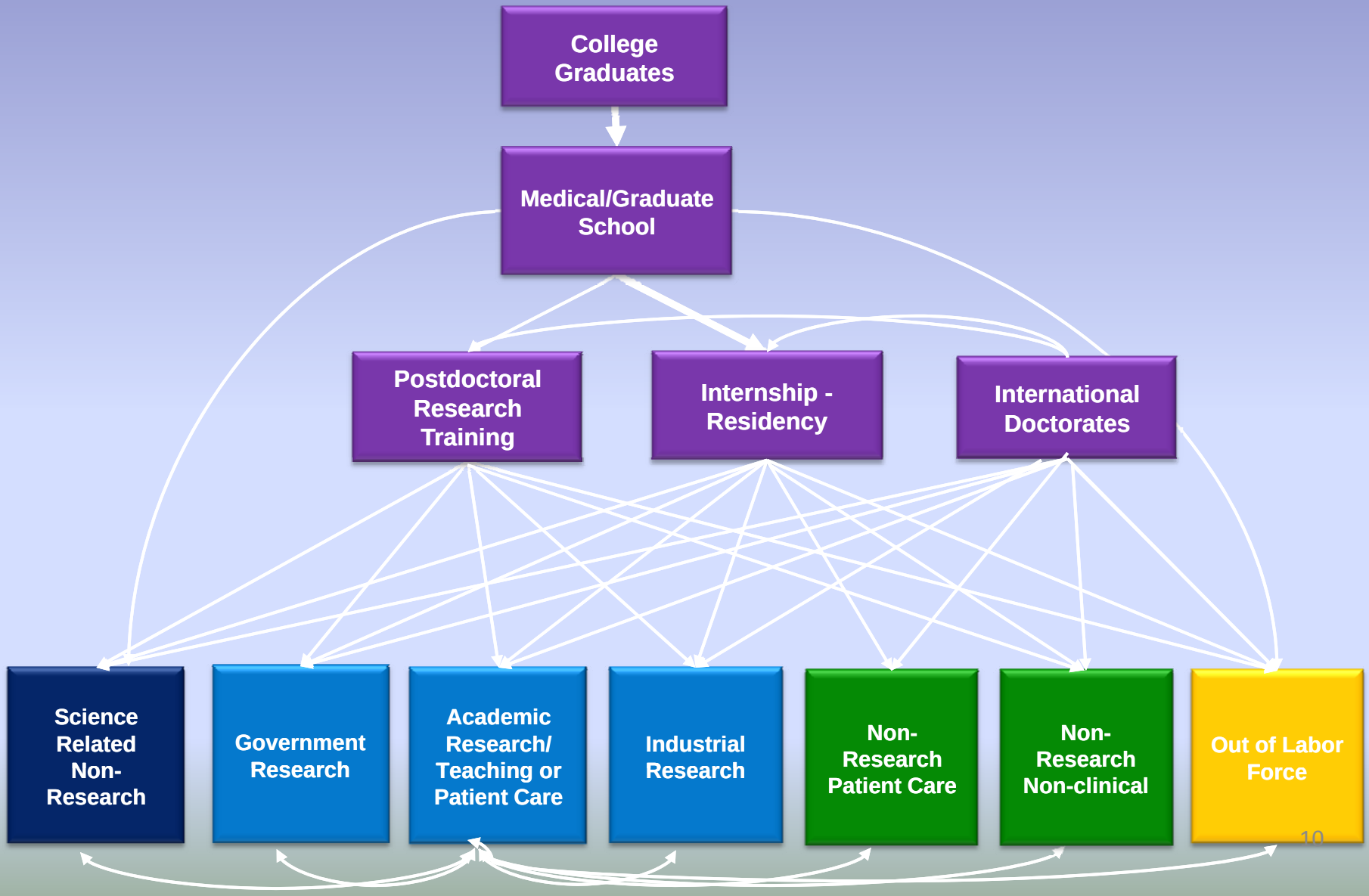
- A two-tiered approach that includes descriptive analyses and a conceptual framework (model):
  - Perform a number of descriptive analyses of key aspects of the workforce
  - Develop a conceptual framework to organize the analyses (see next slides), could be developed into a full dynamic model
- Populate conceptual framework with information on each career stage and transition
- Augment with descriptive analyses that drill into key points
- Link to data on each career stage and transition to build a comprehensive resource upon which recommendations will be based.



Conceptual Framework: PhD Biomedical Research Workforce



Conceptual Framework:
MD & MD/PhD Biomedical Research Workforce



Issues and Analyses: Graduate Students

- Issues:
  - The balance between supply, including the number of domestic and foreign trained PhD students, and demand, i.e. post-training career opportunities.
  - Characteristics of PhD training in biomedical research, including issues such as
    - The length of the PhD training period.
    - Recommendations for changes to the PhD curriculum.
    - Training for multiple career paths (including bench and non-bench science).
  - The ratio of PhD students on training grants to those supported by research grants.
- Analyses:
  - PhD training, analyzing doctoral-level degrees conferred by US institutions.
    - Includes information on numbers of students, time to degree, and degrees awarded
    - Broken out by citizenship/visa status, race and ethnicity, and gender
  - NIH support for students

Issues and Analyses: Postdoctoral Fellows

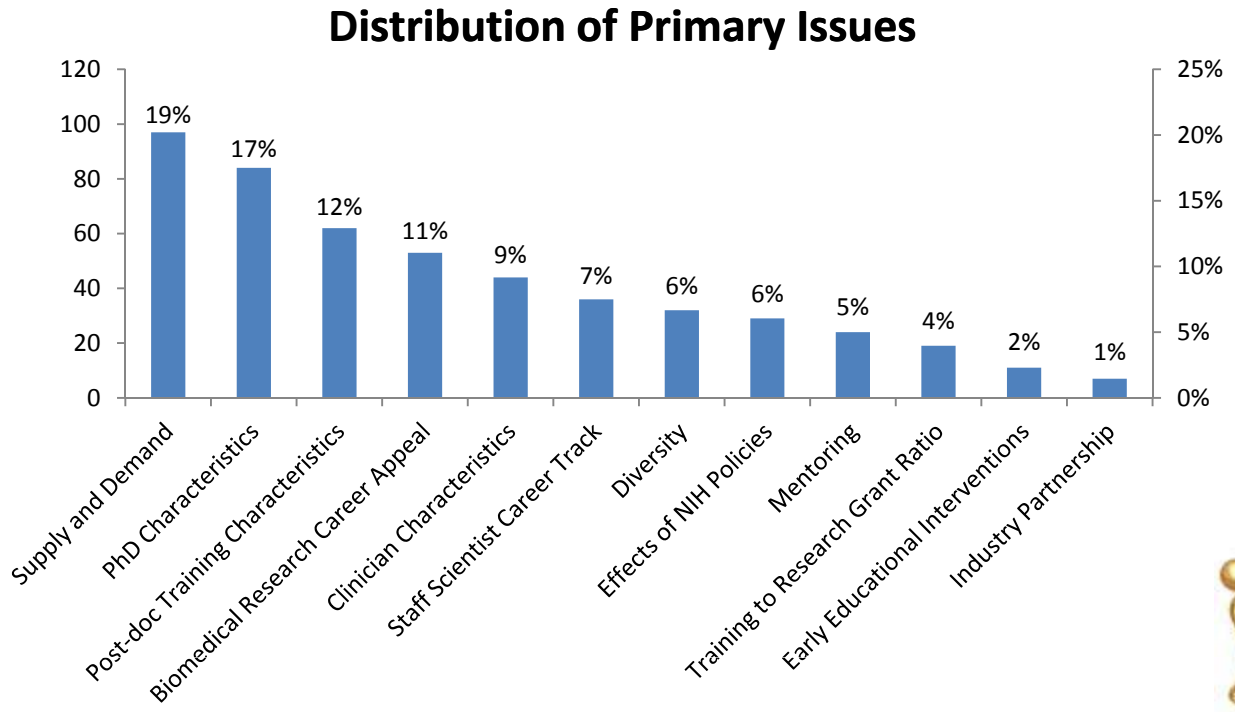
- Issues:
  - The balance between supply, including the number of domestic and foreign trained postdoctoral fellows, and demand, i.e. post-training career opportunities.
  - The ratio of postdoctoral fellows on training grants to those supported by research grants.
  - Length of Post-doctoral training.
  - Number and fate of foreign postdoctoral fellows and how that affects the size of the workforce and career prospects of trainees.
- Analyses:
  - PhD students planning to do a postdoctoral work
  - Numbers of postdoctoral fellows by citizenship/visa status and by source of support
  - Numbers of US PhDs and MDs in postdoctoral positions at various times after their degree
  - NIH support for postdoctoral fellows
  - Information about foreign postdoctoral fellows derived from visa data

Issues and Analyses: Career Paths

- Issues
  - Possibilities for professional/staff scientist positions and the level of training required for such positions (e.g. PhD or MSc degrees).
  - Issues related to the attractiveness of biomedical research careers (e.g. salary, working conditions, availability of research funding)
  - The effect of changes in NIH policies on investigators, grantee institutions and the broader research enterprise.
  - Diversity of the workforce
  - The multiple career paths taken by the biomedically-trained workforce and the decision points leading to those careers.
- Analyses
  - NIH support for new investigators
  - Employment trends of biomedical workforce, mainly in academic and medical school settings, with some information about industry and government
    - Age, tenure status, race/ethnicity, and gender of US-trained faculty
    - US-trained and foreign PhDs by major field
    - Salary data
    - Trends in workforce entrants by citizenship/visa status
    - Stay rates for US-trained biomedical PhDs
    - Staff scientists by organization type, gender, and nativity
    - US-trained PhDs in fields closely, somewhat, or unrelated to their degree
  - Additional analysis of recent industry trends
  - Aging of the workforce – retirement rates
  - Unintended consequences of current NIH policies
  - Salary sources (the “soft money” question)

RFI Responses: Basic Statistics

- 219 unique comments received
- 170 (80%) on behalf of self and 44 (20%) on behalf of an organization
- In addition to the 8 issues in the RFI, 4 additional issues raised in the comments: mentoring, early education interventions, industry partnership, and diversity



http://grants.nih.gov/grants/guide/notice-files/NOT-OD-11-106.html

RFI Responses: Self vs Organization

Commenters were asked to indicate the most important issue(s) for the working group to address. Following are the issues indicated by individual and organizational commenters in order of priority

Self	Organization
Supply and Demand	PhD Characteristics
PhD Characteristics	Clinician Characteristics
Biomedical Research Career Appeal	Post-doc Training Characteristics
Post-doc Training Characteristics	Supply and Demand
Clinician Characteristics	Biomedical Research Career Appeal
Effects of NIH Policies	Staff Scientist Career Track
Diversity	Diversity
Mentoring	Effects of NIH Policies
Staff Scientist Career Track	Training to Research Grant Ratio
Industry Partnership	Early Educational Interventions
Early Educational Interventions	Mentoring
Training to Research Grant Ratio	Industry Partnership

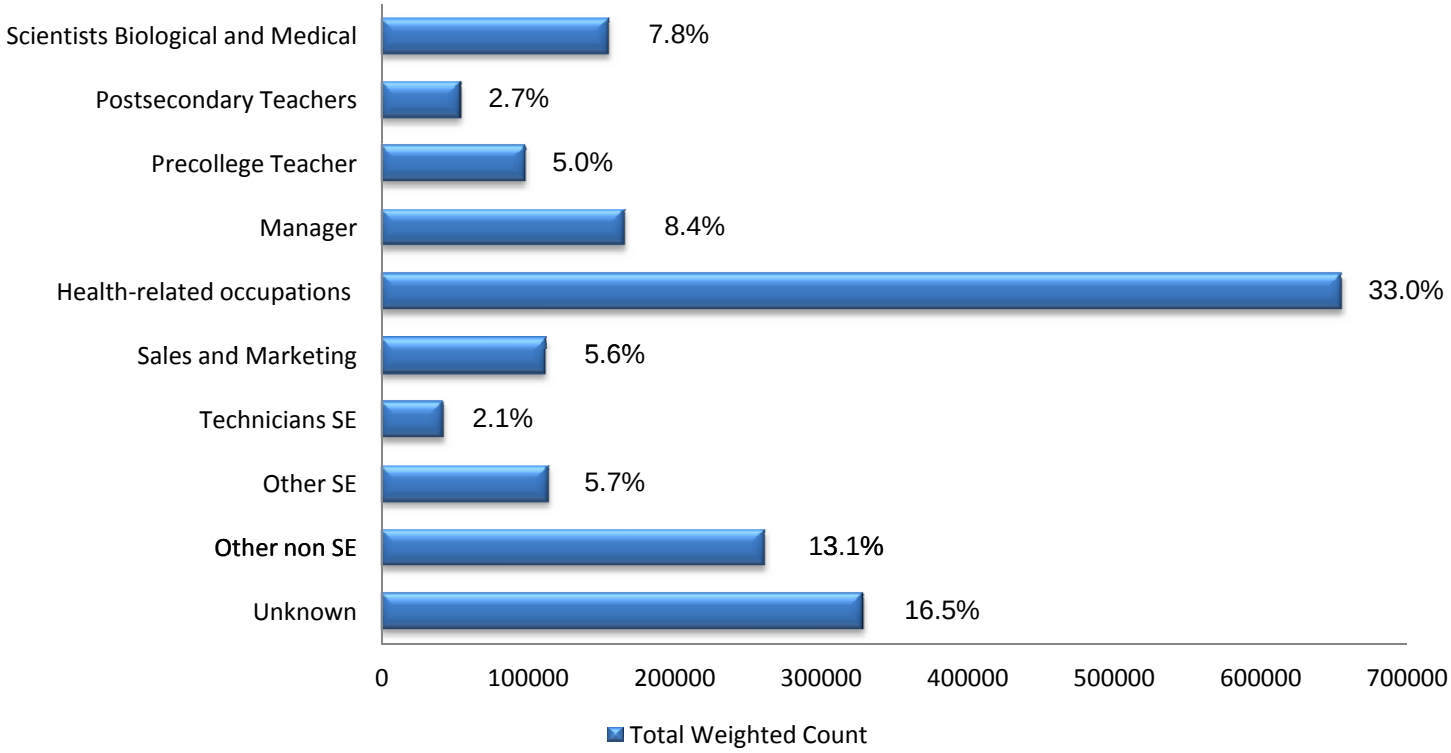
RFI Responses: Selected Recommendations

- Encourage career development programs that integrate multiple career pathways.
- Revise training grant review policies so that non-academic career choices for former trainees are not considered training failures.
- Provide mechanisms to support protected time for clinician research.
- Provide grant mechanisms and change the funding policy to increase project budgets to support the costs associated with permanent staff (i.e. staff scientists).
- Review and modify family friendly policies, such as family leave for trainees, and funding restrictions/preferences based on career pacing.
- Encourage more structured mentoring experiences and develop career/mentorship plans and guidelines.
- Increase training mandates and trainee monitoring on research grants.
- Promote partnership programs for post-doctoral fellows to provide them with a better understanding of how science is carried out in industry, which would help prepare them for career paths outside of academia.

PRELIMINARY DATA

Employment for College Graduates with a Bachelor's in a Biology Field (n=1,989,383)

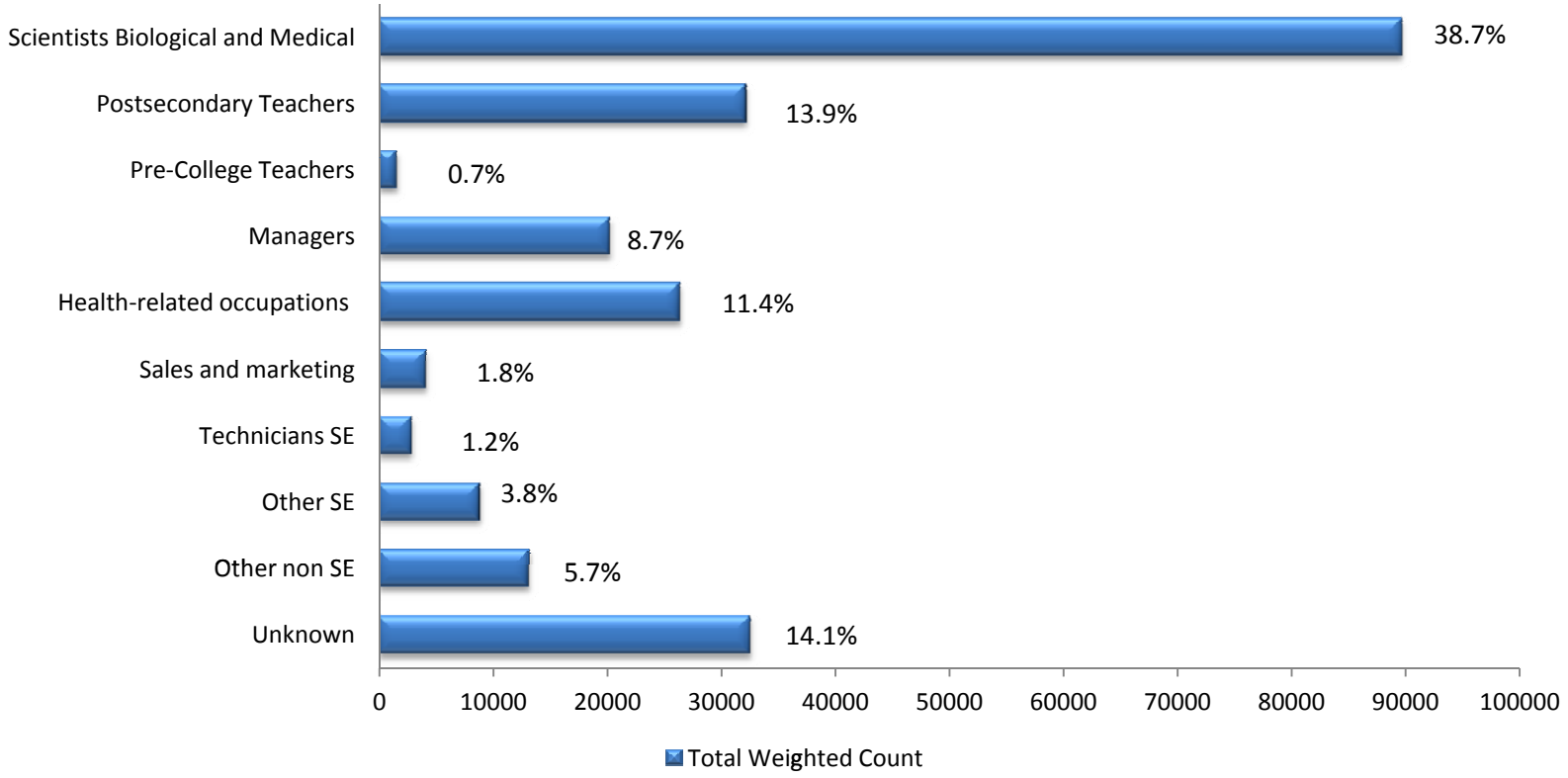
One-third of biology college graduates are employed in health-related occupations.



Source: NSF SESTAT, 2003 National Survey of College Graduates

Employment for Doctorates in Biology Field (n=231,350)

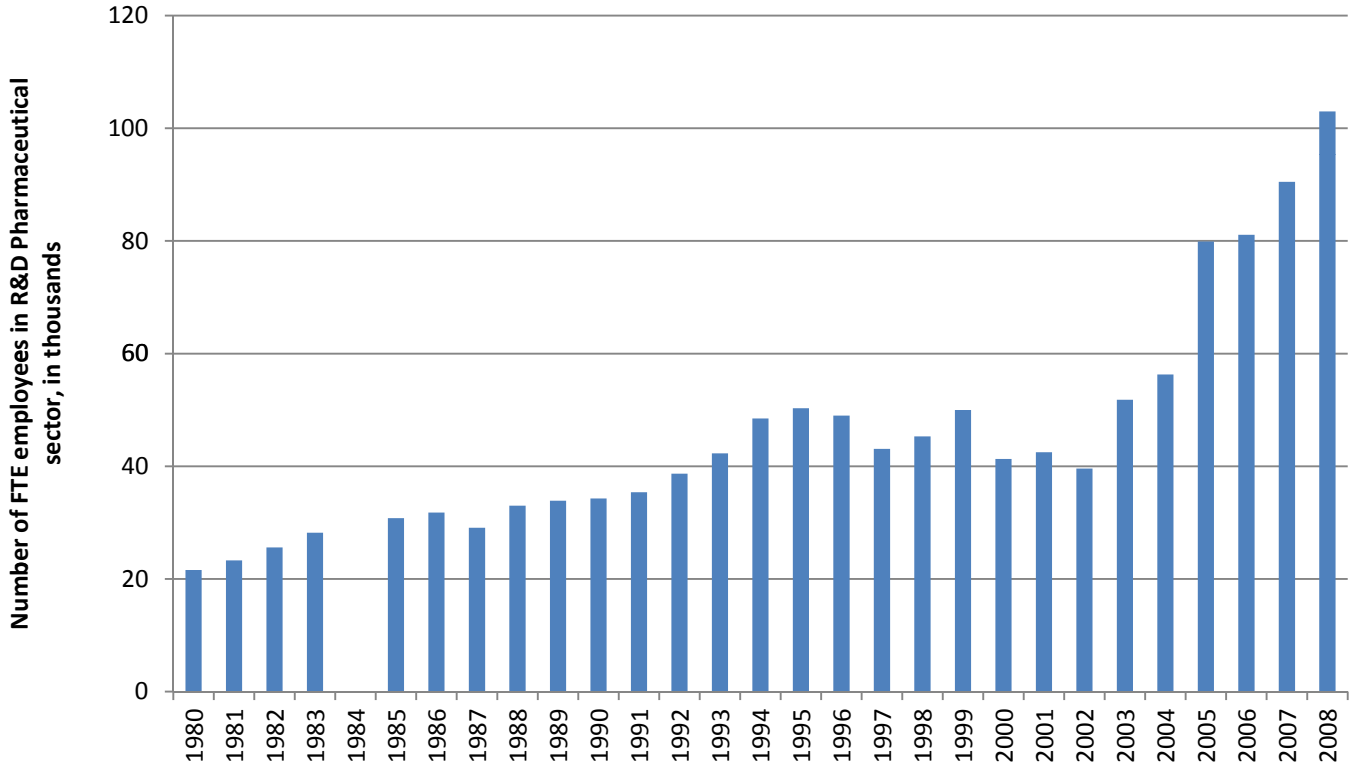
Based on a survey of all college graduates residing in the US, one-third of biology doctorates are employed in research occupations.



Source: NSF SESTAT, 2003 National Survey of College Graduates

Pharmaceutical Industry R&D Employment

Employment in the US Pharmaceutical sector has risen over two-fold since 2002. However R&D Employees include more than PhDs.



Source: NSF Industrial Research and Development Information System

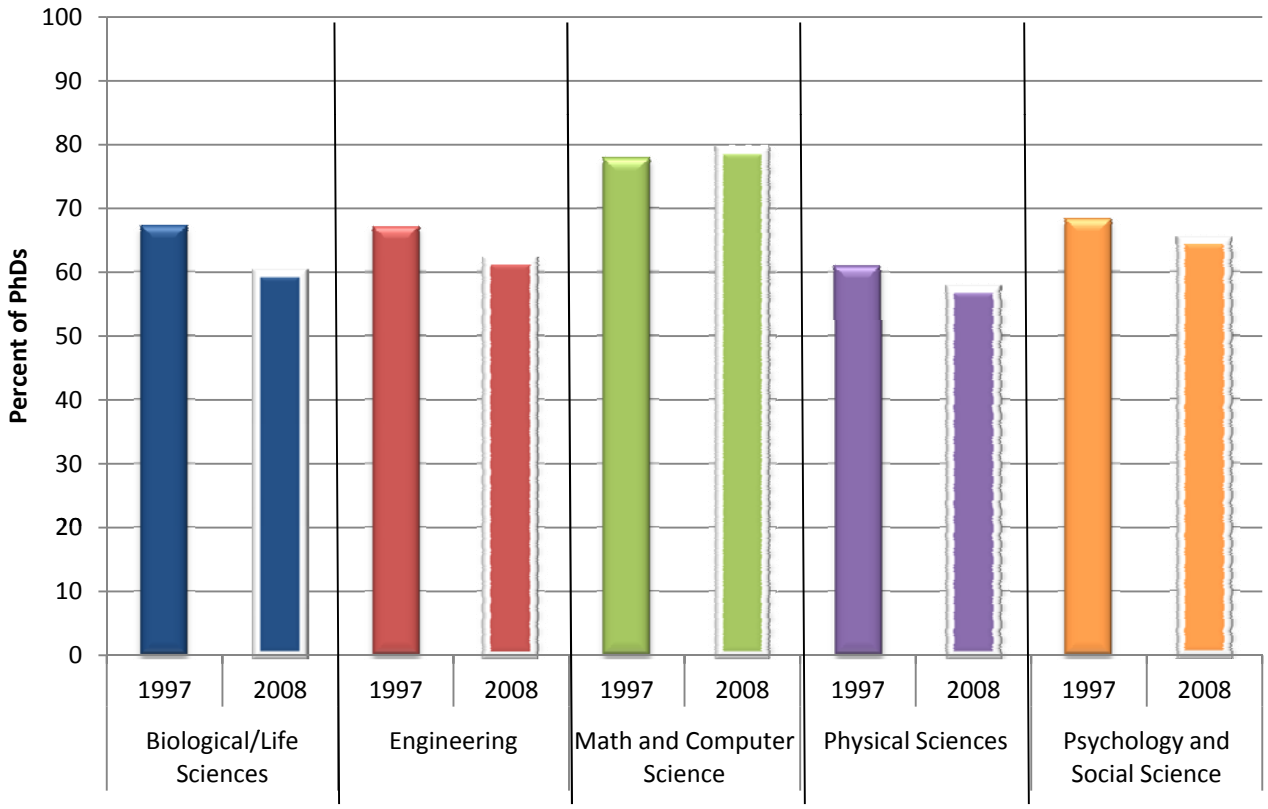
Note: NSF data until 2008. Analysis of more recent data is ongoing.

In the Following Slides:
Analysis of U.S. Trained PhDs

- From the 1993 – 2008 Survey of Doctorate Recipients
- These data are for U.S. Trained PhDs only
- Biomedical Fields exclude: Clinical, Psychology and Social Science Fields

Relationship Between Science and Engineering PhD Field and Occupation

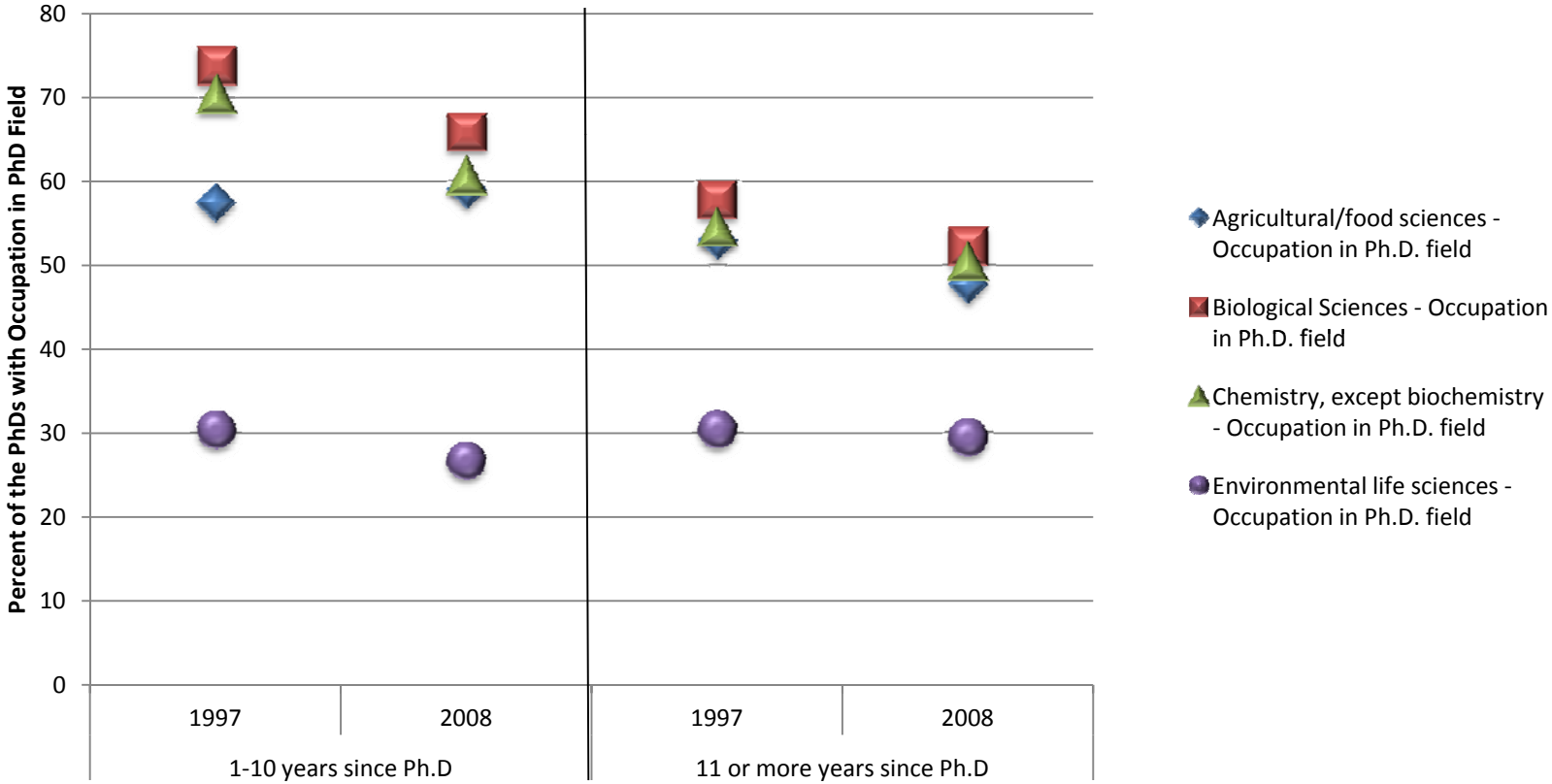
Across S&E PhD fields, 50-80% of graduates are employed in occupations that closely match their PhD field.



Source: NSF Survey of Doctoral Recipients

Relationship Between Life Sciences PhD Field and Occupation

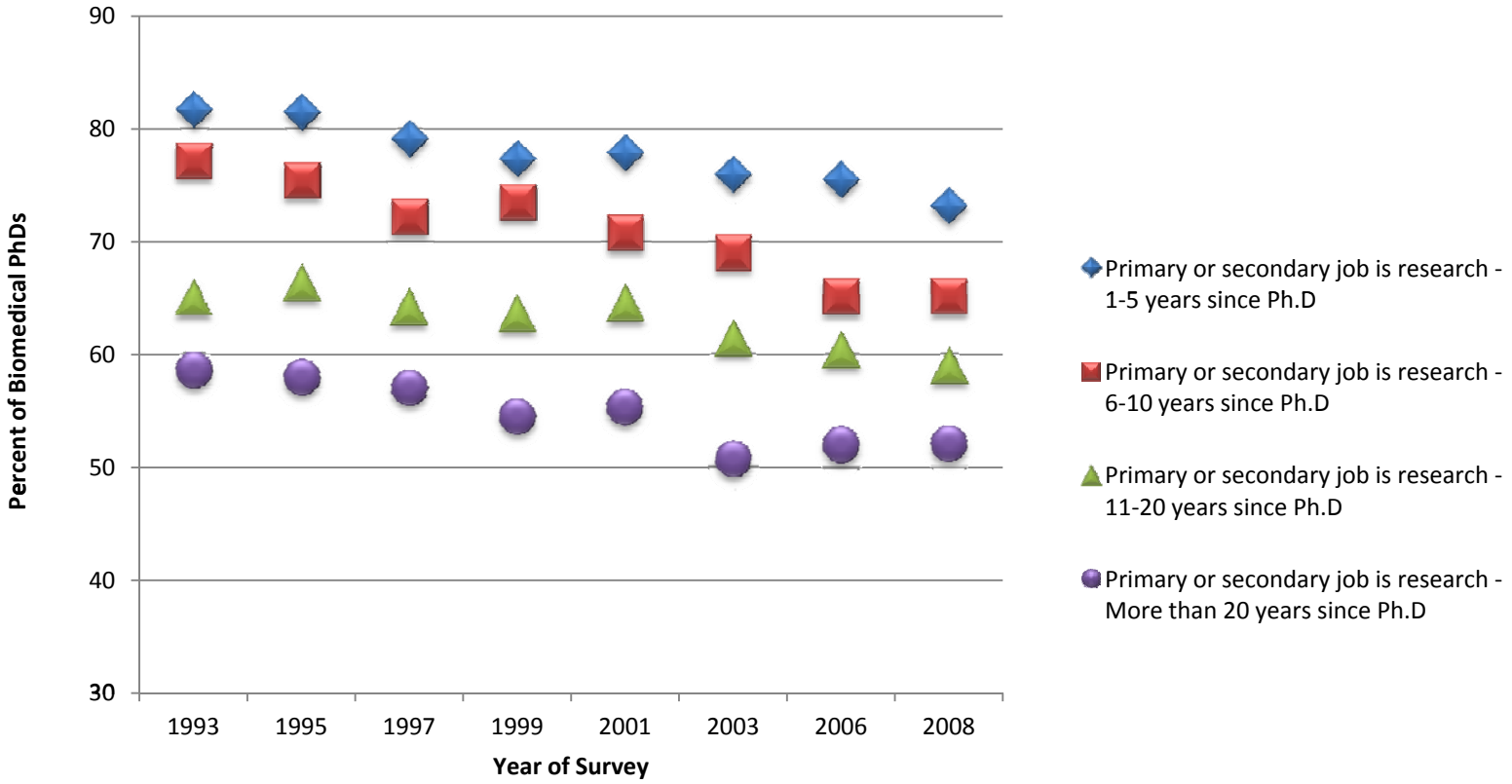
Within Life Sciences, Biological Sciences fields have the highest number of PhDs working in a related occupation.



Source: NSF Survey of Doctoral Recipients

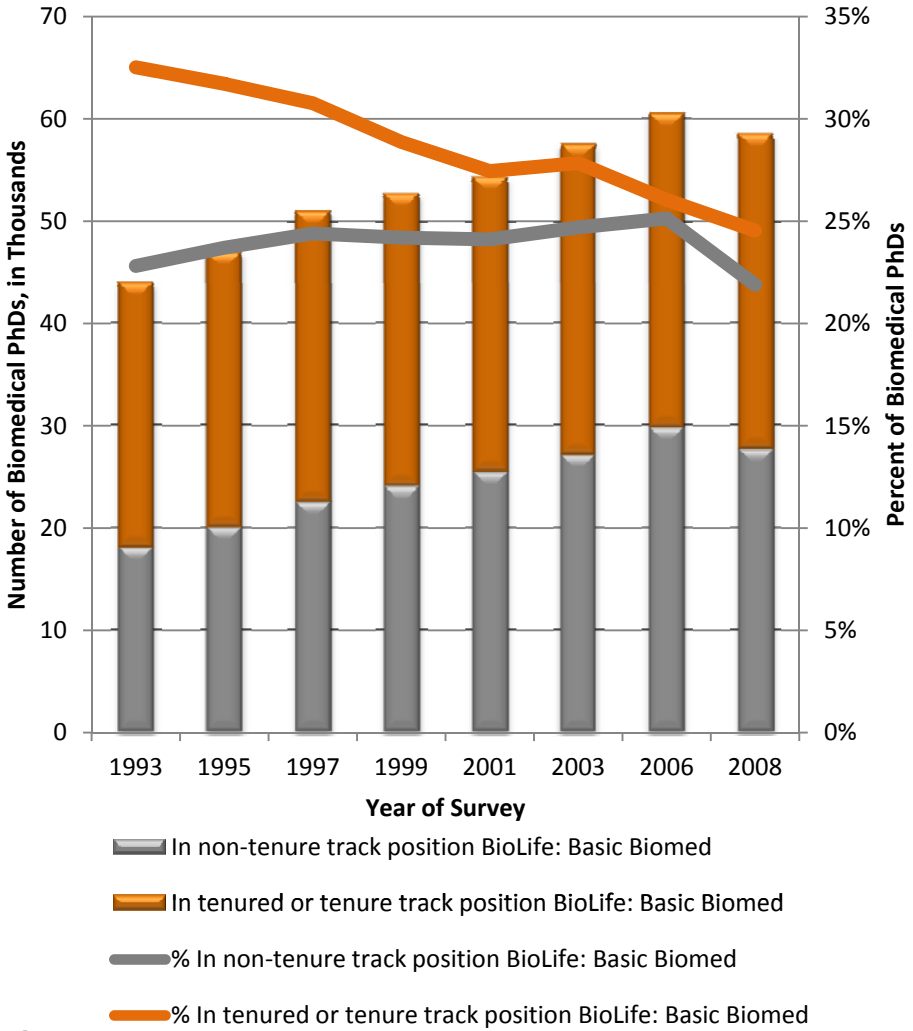
U.S. Trained Biomedical PhDs in Research Occupations, by Years Since Degree

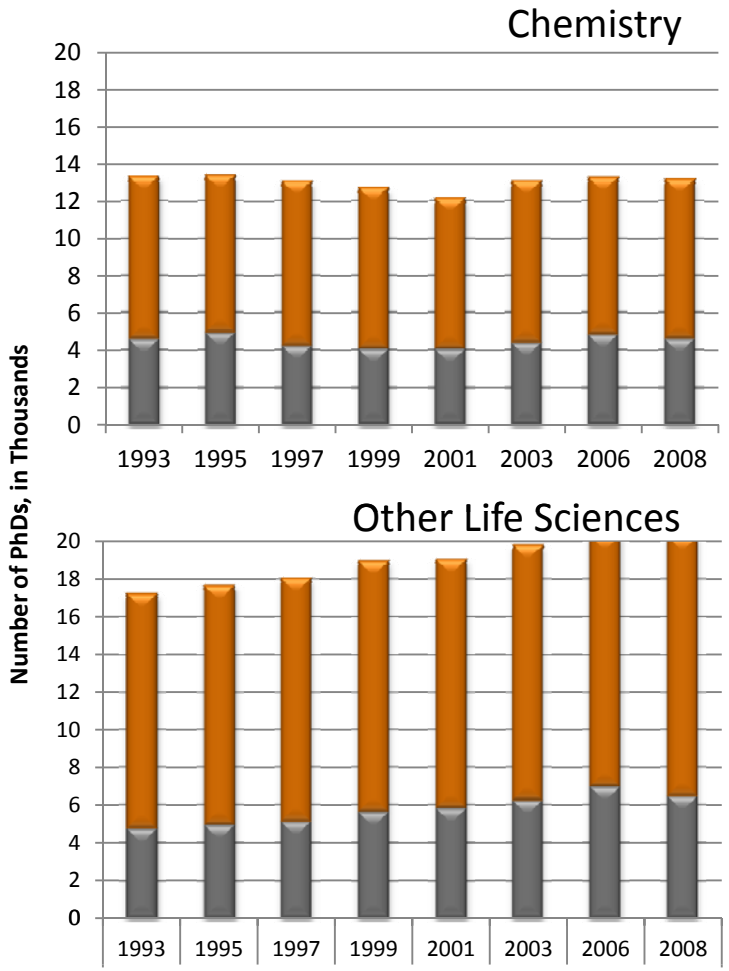
Over 70% of biomedical PhDs begin working in research occupations out of graduate school; by 11 YSD 60% still work in a research occupation.



U.S. Trained PhDs in Academic Employment, by Tenure Track Status

Biomedical





Source: NSF Survey of Doctoral Recipients