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So, What Does the Biomedical Research Workforce Look Like?

Posted on June 22, 2012 by Sally Rockey

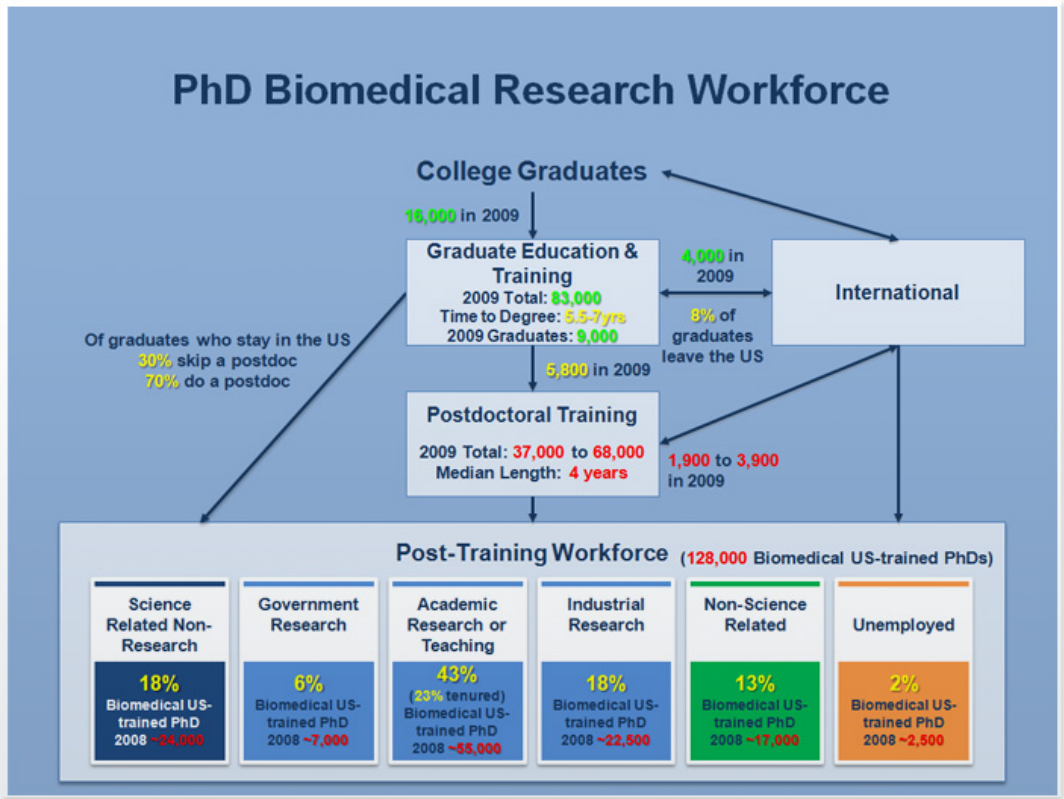
As I blogged last week, and most of you have heard by now, a working group of the Advisory Committee to the NIH Director (ACD) that I co-chaired with Shirley Tilghman from Princeton just completed a study of the biomedical research workforce. We reported our findings to the ACD last Thursday (you can find a link to the videocast here).

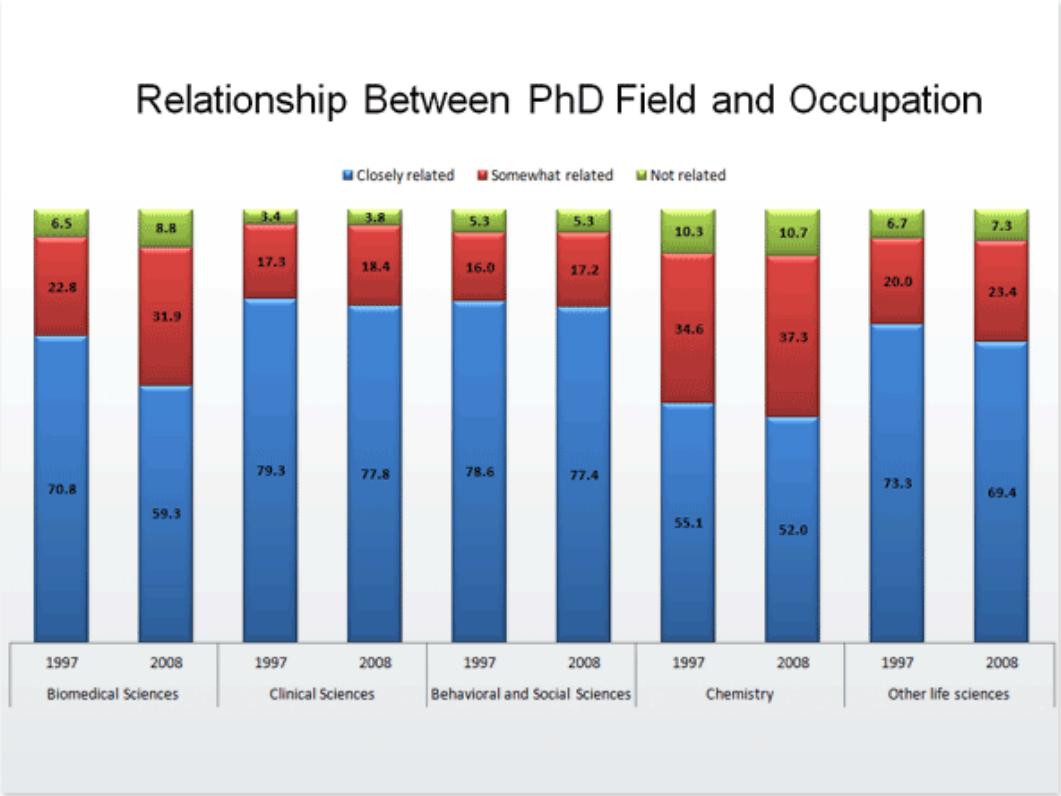
We gathered a lot of data during this study, which are included in the report (see the ACD site for the executive summary and instructions for obtaining a copy of the full report). The data also are posted on an accompanying website. I plan to highlight some of the specific data in future posts, but first, I'd like to discuss the outcome—the conceptual framework that presents a snapshot of the biomedical research workforce, incorporating the latest available data. The framework of the PhD workforce is presented below, and a companion framework for MDs and MD/PhDs in the biomedical research workforce can be seen in the report and on the website.

First, 9,000 biomedical PhDs graduated in the US in 2009 (including basic biomedical and clinical sciences), and 70% of these went on to do postdoctoral research. As we conducted our analysis, it became clear that there are few reliable data on the number of biomedical postdoctoral researchers in the US. We lack solid information on foreign-trained postdoctoral researchers, and many postdoctoral researchers change their title as they proceed through their training, complicating the data collection. That's why the estimate of postdoctoral researchers ranges from 37,000 to 68,000.

Looking at the career paths taken by these US-trained biomedical PhDs, we can see that fewer than half end up in academia, either in research or in teaching, and only 23% of the total are in tenured or tenure-track positions. Many other people are conducting research, however, with 18% in industry and 6% in government.

The science related non-research box includes individuals working in industry, government, or other settings who do not conduct research but are part of the scientific enterprise. Many of the career paths represented by this box contribute to the scientific research enterprise and require graduate training in biomedical science. For example, program and review officers at NIH and managers in many biotechnology companies would be included in this group. This is my box too. It's interesting to note the 18% included in this group is made up of PhDs employed in industry (13% of the total workforce),





in government (2.5%), and in other settings (2.5%). This means that all individuals working in industry (research plus non-research occupations) represent about 30% of the workforce, and all those working in government represent about 9% (more than 10,000 individuals).

That leaves 13% in non-science related occupations and 2% unemployed (this does not include retirees or those who choose not to work). These are 2008 data, the latest available from the NSF Survey of Doctoral Recipients.

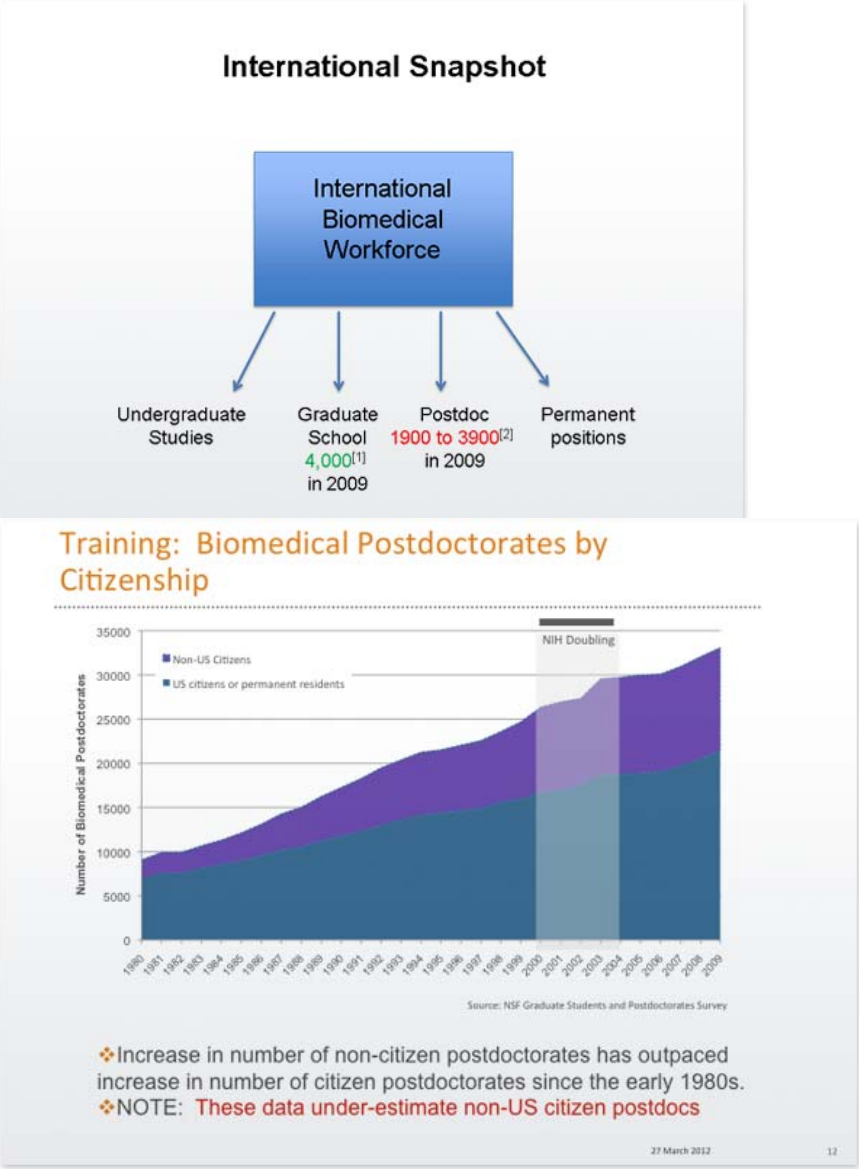
If you're a graduate student or postdoc looking at these numbers, particularly the proportion of people in industry and government settings, it makes sense to learn as much about these career paths as possible. I'm very proud that we were able to develop this framework, as it seems that for the first time we have an idea of where domestically trained biomedical researchers are going. I was quite surprised by the idea that the majority of our trainees do not end up in academia. Did this surprise you?

Notes on the figure

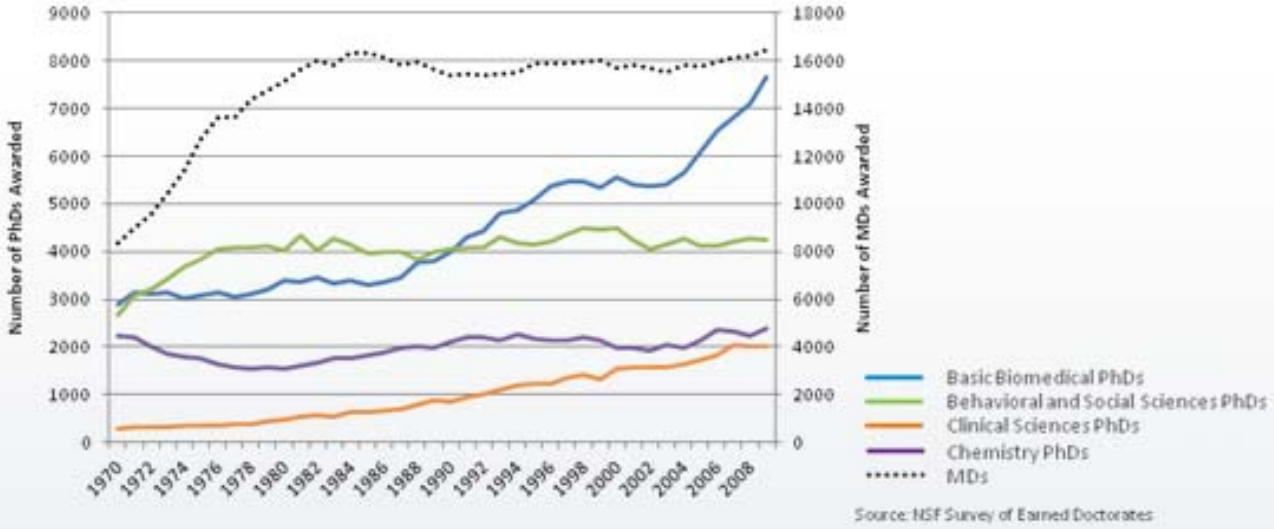
The main sources of the original data, from which the graphs in the report were made and these numbers were derived, come from three NSF surveys: the Survey of Graduate Students and Postdoctorates, the Survey of Earned Doctorates, and the Survey of Doctorate Recipients. You can see the specific sources of each number by clicking on the relevant box on the website.

The color of the numbers reflects our confidence in the accuracy of the data: high (green), medium (yellow), or low (red). For more details see colors. In this case, the red numbers in the post-training workforce box are accurate, but the color reflects the fact that we know almost nothing about the distribution of foreign-trained PhDs in the workforce, so the overall picture is an under-estimate.

The post-training workforce boxes are color coded, with light blue denoting those in research positions and academic teaching positions. The science related non-research box is colored dark blue to indicate that many of the careers represented in this box are closely related to the conduct of biomedical research.

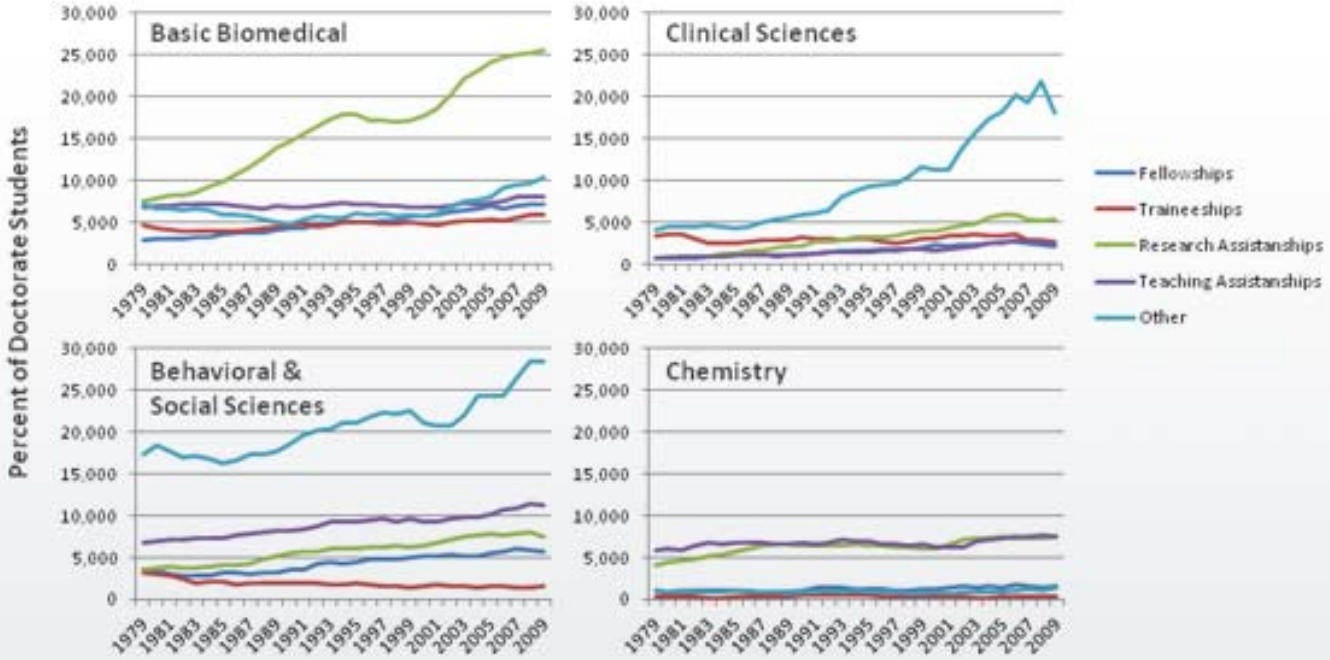


US Graduate Degrees Awarded, by Field



- Stable production of Chemistry PhDs since 1970 and MDs since 1980
- Stable production of Clinical Sciences and Behavioral PhDs since 1998
- Increasing production of Biomedical PhDs that coincides with NIH Doubling

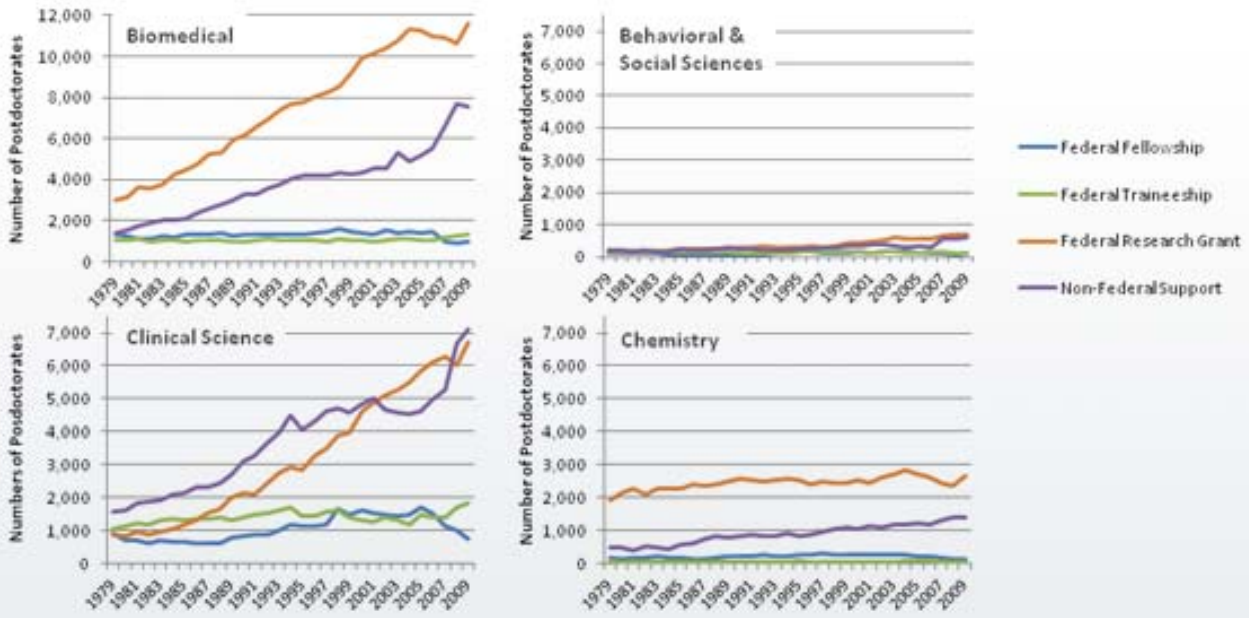
Doctorate Students by Type of Support



- Mix of graduate student support is distinctly different by field.

Source: NSF Graduate Students and Postdoctorates Survey

Postdoctorates, by Field and Type of Support



- Field-specific volume of postdocs; only in Chemistry are numbers stable
- Field-specific mix of federal and non-federal grant support

Rock Talk

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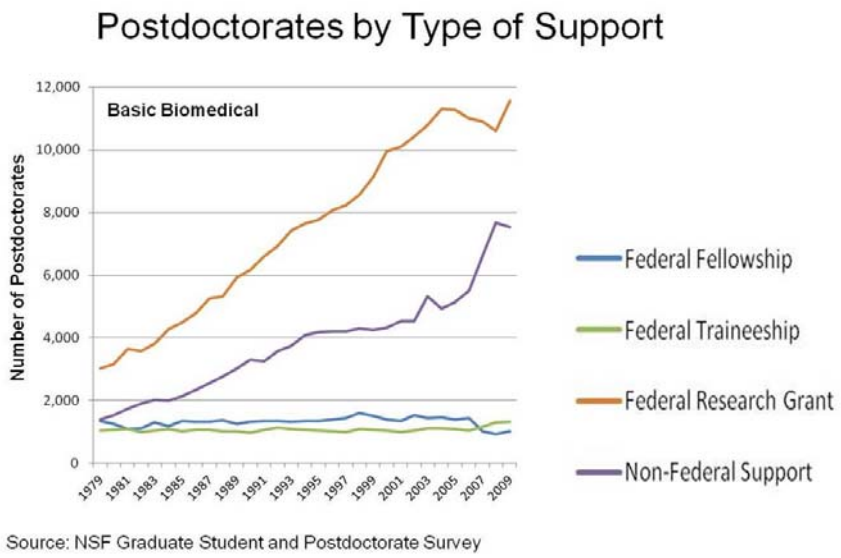
Postdoctoral Researchers—Facts, Trends, and Gaps

Posted on June 29, 2012 by Sally Rockey

The National Postdoctoral Association defines a postdoctoral scholar (or a postdoc) as "an individual holding a doctoral degree who is engaged in a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue a career path of his or her choosing."

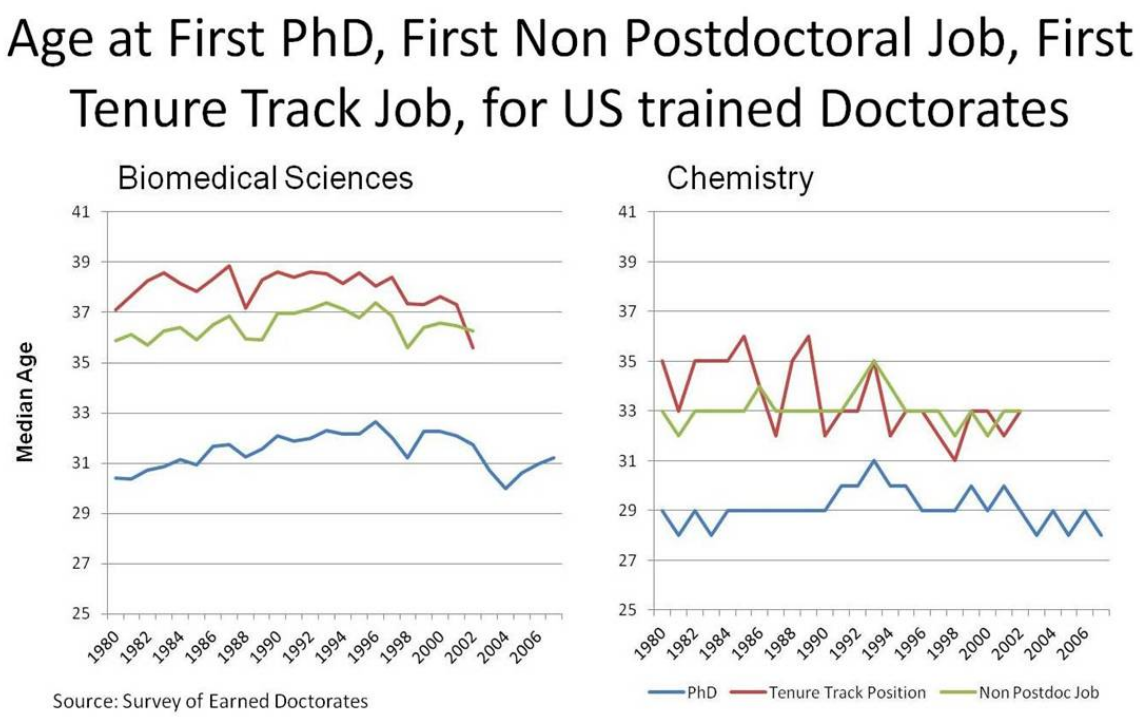
As the data show, postdocs are more prevalent in most of the top fields receiving NIH funding (genetics, biochemistry, developmental biology, and neuroscience) than in those fields that receive less NIH funding (nursing, public health, and pharmaceutical science). In light of this, the experiences and future paths of postdocs obviously are an essential part of any study of the biomedical research workforce.

As we started delving more deeply into the data, however, it became clear that we lack reliable information about the postdoc population in the US. There are many reasons for this. First and foremost, we do not collect much information about foreign-trained PhDs who come to the US to do a postdoc, and we have no idea how long they stay or how many leave after their training. These foreign-trained postdocs comprise about 2/3 of the total postdoc population. In addition, postdocs have many titles, and some institutions require they change their titles after a certain number of years. That is why the PhD snapshot I presented last week includes a range of numbers, and they are colored red, meaning that we have little confidence in their accuracy.



Again, we had heard anecdotal information suggesting that the postdoc training period has lengthened over time. However, data from the NSF Survey of Doctorate Recipients suggest that most US-trained biomedical

PhDs spend fewer than 5 years in postdoctoral positions. Some do remain in postdoc training a lot longer, though. There is some indication those who do the longest postdocs are the ones who go on to tenure-track academic research careers. For example, in the figure below, the age at first non-postdoctoral job (many of which are in industry) has been consistently a year or two lower than the age of obtaining the first tenure-track job. Note that the latest data in this graph (2002-2003) may be underreported due to delays in reporting that result in a lag time bias.



With all that said, what can we glean from the data we have?

First, data in the figure below from the NSF Survey of Graduate Students and Postdoctorates (which includes all sources of support, not just NIH and surveys US degree-granting institutions about their US- and foreign-trained PhDs) show that the vast majority of basic biomedical postdocs are supported on federal research grants, and this number has grown considerably over the past decade. This is perhaps not surprising, as it parallels the growth of basic biomedical graduate students supported on research grants that I showed in the previous post. Similar to the data for graduate students, the numbers of postdocs supported on federal fellowships and traineeships have remained remarkably stable over the same time period. Once again, these data are supported by the NIH-specific data posted on the RePORT website.

As shown below, the other source of postdoc support that has been growing over the last five years is nonfederal support, defined as support from state and local government, institutions, foreign sources, foundations, industry and other private sources.

Combining the average ~6.5 years of PhD training and 4-5 years of postdoctoral research means that it takes approximately 10 years before a person with a biomedical PhD is ready to begin his or her first or post-training job, and even longer if he or she chooses the academic tenure-track research path.

So what does this postdoc have to look forward to?

We looked at earnings potential as one (but by no means the only) attribute of the career path of biomedical PhDs and compared it to other scientific fields and professions. As can be seen in the table below, starting salaries of biomedical PhDs (pooled SDR data in 2008 dollars) are lower than in other fields. However, later in the career stage, 30 years after the PhD, this is no longer the case.

Years Since PhD	BioMed	Comp/ Math	Physical Science	Social Science	Engineer
0	51,594	66,804	57,775	55,532	72,992
10	87,766	99,972	94,180	87,853	113,314
30	123,959	109,277	122,148	107,321	133,292

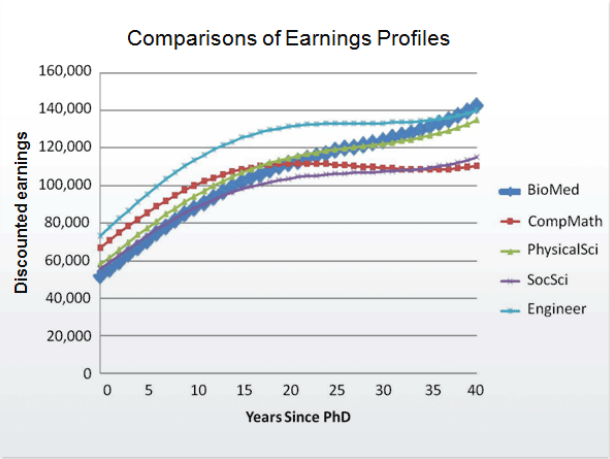


Table 1. Salary Across Broad Fields by Years of Experience

Source: NSF Survey of Doctoral Recipients

A more comprehensive timeline of earnings is shown in the report and on the website, and Paula Stephan, who was on the modeling subcommittee of our working group, has a very interesting discussion of this in her recent book *How Economics Shapes Science*.

The data I've presented in this and my earlier posts, and the information included in the working group report should be of interest to anyone considering a career in the biomedical sciences and those of us responsible for ensuring the availability of a well-trained biomedical research workforce in the future. They are important for making informed decisions about graduate training, sources of federal support, and institutional policies that will attract and retain the best and brightest in biomedical science careers.