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Section 4: Funding Trends

A funding profile of the NIH

Matthew Richardson

As the largest source of funding for medical research globally (1), the National Institutes of Health (NIH) in the United States is responsible for distributing more than $30 billion per year to best support biomedical researchers. According to the NIH, "[m]ore than 83 percent [of this budget] goes to more than 300,000 research personnel at over 3,000 universities, medical schools, and other research institutions in every state and throughout the world." (2)

In 2012, the NIH awarded 12,303 Research Grants, including the main Research Project Grants as well as other extramural awards such as those specifically supporting research centers or small businesses; in addition, funding was awarded for training, R&D contracts, and intramural research. In this article we use the NIH's publically-reported (3,4) data to look in more detail at the types of awards they provide, the typical recipient of an award, and at how funding is affecting research in specific areas.

Types of NIH award

The most common type of award provided by the NIH is the R01, which is one of a number of so-called Research Project Grants (RPGs). The R01 grant is the oldest offered by the NIH, which is awarded "to support a discrete, specified, circumscribed project" in an area of the investigator's interest (5). This is offered alongside other RPGs such as the R15 offered to those at "educational institutions that have not been major recipients of NIH research grant funds" (6), and the R21 grant which "is intended to encourage exploratory/developmental research by providing support for the early and conceptual stages of project development." (7)

In addition to RPGs, the NIH offers a variety of awards aimed at research centers, small businesses – including the Small Business Innovation Research (SBIR) grant and the Small Business Technology Transfer (STTR) grant – Research Career Awards (the so-called K grants), and individual and institutional training awards.

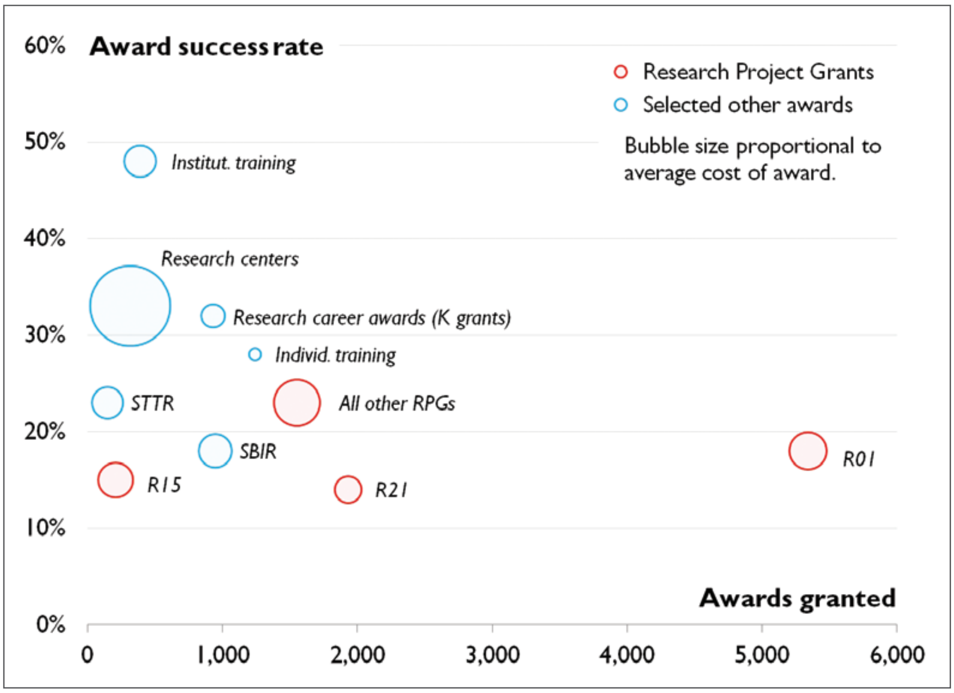

Figure 1: Number of awards granted and success rate per grant type in 2012. Source: NIH Data Book

Major categories of NIH award are shown in Figure 1, p14. Award types towards the right of the chart are those which were most commonly awarded in 2012, with the R01 by far the most numerous. The y-axis shows the success rate of applicants for each award in 2012; this varies from almost 50% for institutional training to 14% for R21 grants. Finally, the bubble size is proportional to the average cost of each award in 2012; the Research Center Awards hold the highest cost per award, followed by the Research Project Grants.

Profile of NIH awardees

Using the data available at the NIH Data Book (3), we can answer many questions about how the available budget is distributed among investigators, and indeed students, in biomedical fields. Here we answer three questions concerning the profile of award recipients: what is the representation of women, in which fields are PhD students supported, and how successful are first-time investigators when applying?

What is the representation of women among NIH-funded investigators? (see Figure 2)

Mirroring the gradual dismantling of cultural and institutional barriers preventing women from advancing in scientific careers, NIH grants have been increasingly awarded to women; however the number of female investigators is still far from reaching parity with men, particularly in some of the types of grant awarded.

Looking at trends from 2000 to 2012, we can see an increase in the representation of women in every type of research grant. Research Project Grants (RPGs) were awarded to female investigators in only 30% of cases in 2012; however this does represent an increase from 22% in 2000. The rate is also much higher than we see for Small Business (SBIR/STTR) and Research Center Awards (20% in 2012).

Research Career Awards stands above the other types with 45% of investigators being female in 2012, however we see no increase in this rate since 2010.

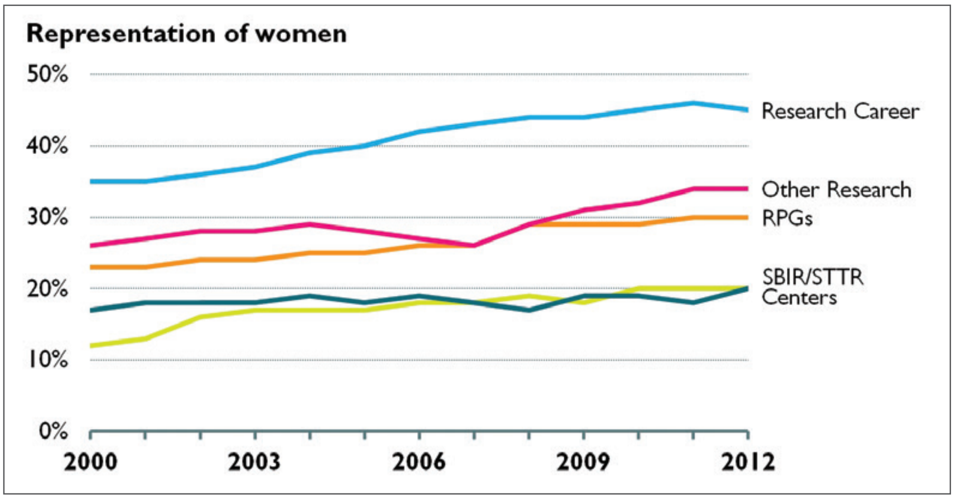

Figure 2: Representation of women among research grant investigators, by type of grant. Note: 2009 and 2010 data points exclude awards made under the 2009 American Recovery and Reinvestment Act. Source: NIH Data Book

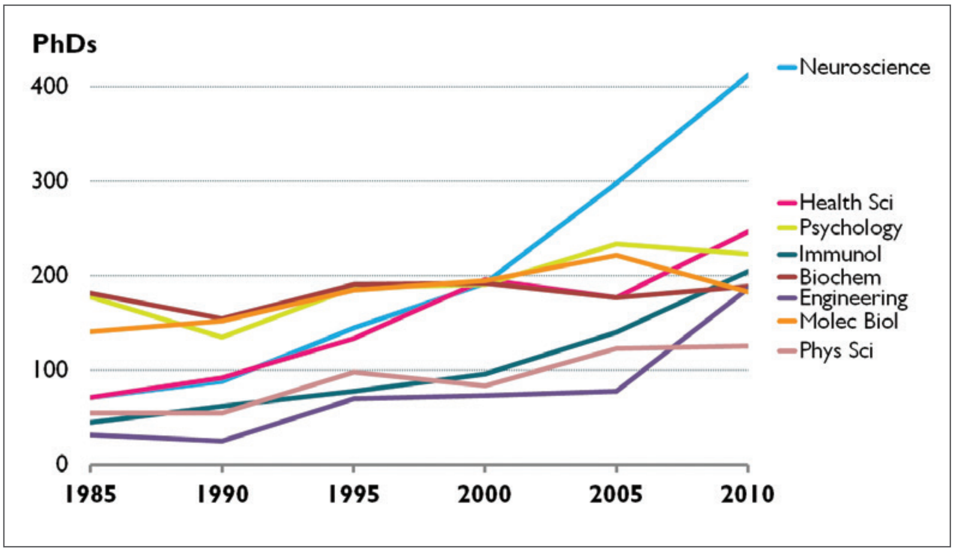

Figure 3: Number of PhDs per field of study with NIH support prior to their PhD. Source: NIH Data Book

In which fields are NIH-supported PhDs recipients? (see Figure 3)

The NIH supports PhD students across numerous fields with fellowships, traineeships, and research assistantships. While the fields in which NIH support is granted are those we would expect (with Biochemistry, Health Sciences, Immunology, Molecular Biology, and Neuroscience featuring prominently), the long-term trends over the past 30 years show that growth in some areas has been much stronger than in others. Neuroscience in particular sees a dramatic increase to become the most common area by a great deal, followed by Health Sciences; another field with strong growth, particularly in the years from 2005 to 2010, is Engineering. This makes the current view very different from the years 1985 to 1995 when the dominant fields (as reported by the PhD recipients themselves) were Biochemistry, Psychology, and Molecular Biology.

How successful are first-time investigators vs. established investigators when applying for NIH grants? (see Figure 4)

The overall success rate for Research Grants has declined from a level of 33% in 2000 to 19% in 2011 and 2012. (In the same time period, applications for grants increased by 72% while the number of grants awarded, which increased steadily until 2004, later declined until it has returned to the same level as in 2000.) For R01 grants, these success rates tend to be slightly lower. But how do the success rates differ between first-time investigators and established investigators?

Until 2007, there was a clear (though narrowing) gap between the success rates of established and first-time investigators; compare the success rates of applicants for R01-equivalent grants in 2000, in which 29% of established investigators were successful while the equivalent rate for first-time investigators was 22%. In recent years these success rates have generally been decreasing, but first-time investigators have received a boost in success rates which led to parity between the two groups in the year 2011. In 2012, we see signs that established investigators may once more have an advantage when applying, with a success rate of 16% vs. 13% for first-time investigators.

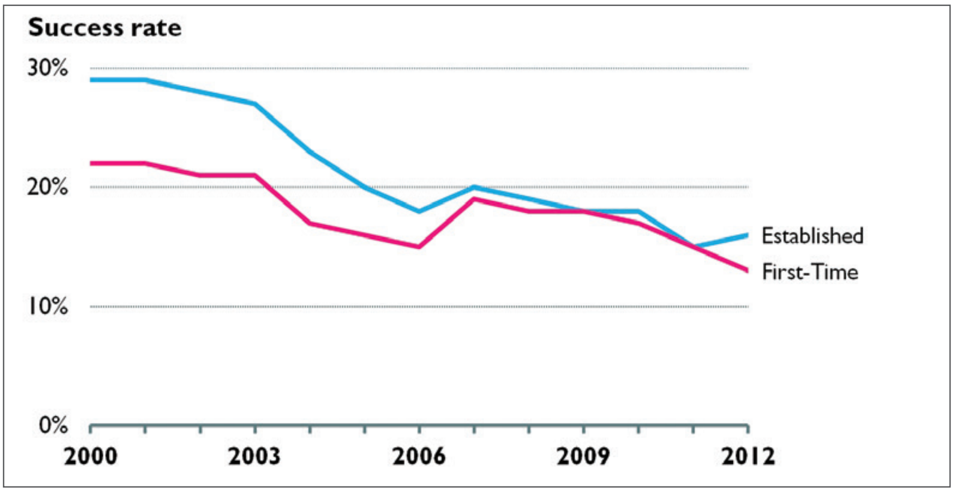

Figure 4: Success rates of applicants for R01-equivalent awards, by career stage of investigator. Note: 2009 and 2010 data points exclude awards made under the 2009 American Recovery and Reinvestment Act. Source: NIH Data Book

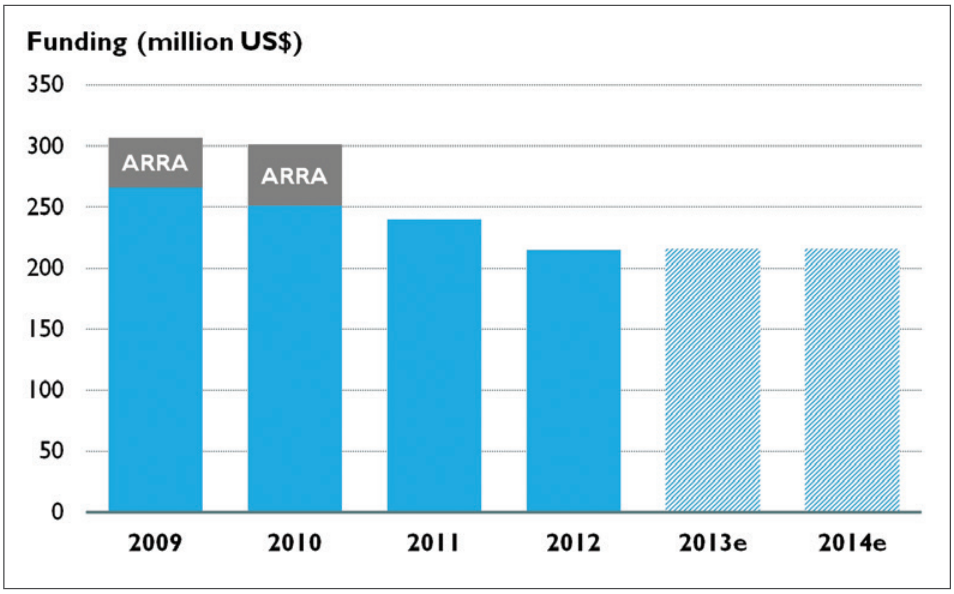

Figure 5: NIH funding per year in hypertension. Note: 'ARRA' in 2009 and 2010 represents funding from the American Recovery and Reinvestment Act. Source: NIH Categorical Spending

Research/Disease Areas	FY 2012 Actual	CAGR 2009-12
Clinical Research	10,951	1.9%
Genetics	7,632	1.6%
Biotechnology	6,089	2.7%
Prevention	5,924	3.6%
Cancer	5,621	0.0%
Neurosciences	5,618	1.8%
Brain Disorders	3,968	3.9%
Infectious Diseases	3,867	2.2%

Table 1: Funding in 2012 per research/disease area, with Compound Annual Growth Rate (CAGR) 2009-12. All funding values million US$. Source: NIH Categorical Spending

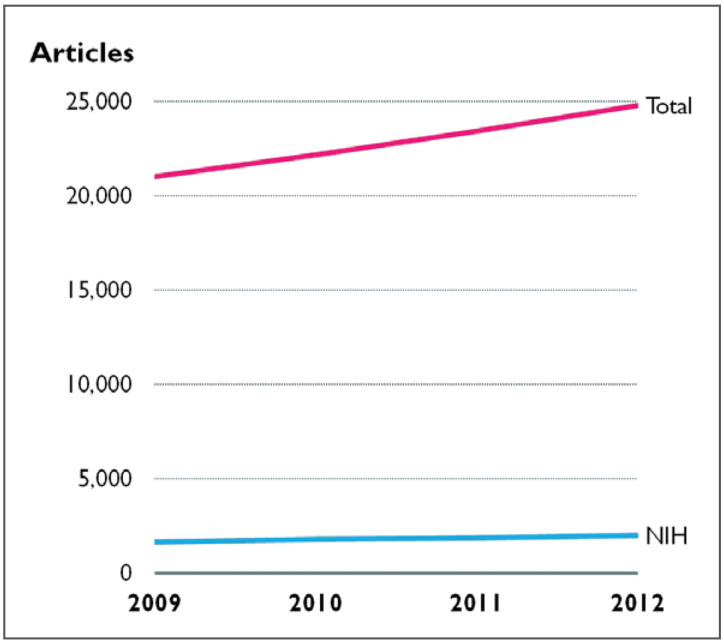

Figure 6: Article output per year in hypertension, overall (source: Scopus) and with NIH funding (source: PubMed)

Research areas

The Research, Condition, and Disease Categories (RCDC) are reported by the NIH to show funding in different areas of research (4). We can use this information to see those areas in which the most money is spent (see Table 1). However, trends over time show that the areas with highest spending have only seen modest increases in funding since 2009: for instance, Cancer has been stable with 0% growth. The area of Brain Disorders has seen the highest growth out of these top 8 areas with growth of 3.9% per year.

Of course, when we see increases in some areas when the overall budget has remained stable, we know that some areas must have lost out. Hypertension is an example of an area in which funding has reduced since 2009. The NIH Categorical Spending data show a picture of regular declines year-on-year, which can be expected to have a serious effect on research in this area (see Figure 5, p.16). Using Scopus we can see that in the same time period, the overall rate of publication on hypertension has been growing at 5.7% per year; PubMed can be used to look at NIH-funded papers in the area, and these have been growing even more rapidly at 6.8% per year (see Figure 6). However, this rate of growth is very unlikely to be sustained given a scenario of reduced funding each year from such a major medical research funding body.

Conclusion

The data made available by the NIH allows us to look in some detail at the types of funding provided each year and where it is assigned. While it is of interest in its own right, it is also a good complement to the wider focus on tracking the impact of funded research: see, for instance, the efforts of FundRef (8) to enable the tracking of funded research after the submission of papers. Alongside the growing ability to track funded work, we have the emergence of ORCID (9) as a unique identifier to track authors with confidence. As these systems are adopted more widely, we are approaching a time when analysis of funding, and the resulting impact of work, can become more rigorous and extensive.

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