The Economics of Postdoctoral Researcher Positions

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Abstract

This chapter examines the dramatic growth and evolving role of postdoctoral researchers in the U.S. scientific workforce from 1979 to 2023, highlighting a fourfold increase in postdoc numbers that outpaced growth in graduate students and faculty. We argue that this expansion reflects the fragmented nature of science funding, particularly the effects of the NIH budget doubling in the early 2000s, which increased both supply and demand for postdocs but ultimately worsened employment conditions. The chapter also explores the career outcomes of postdocs, noting limited economic returns outside academia and declining transitions to faculty roles. With recent declines in postdoc numbers, tightening immigration policies, and rising compensation, it seems likely that the U.S. may have reached "peak postdoc," potentially leading to reduced future research output. The chapter concludes with a call for improved data and further research to better understand postdocs' roles in scientific production and career development.

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Introduction

Postdoctoral researchers are a crucial and growing component of the scientific workforce. In 1979, when the National Science Foundation (NSF) first began to collect data on postdoctoral researchers (postdocs) they counted 18,101. By 2019, that figure had increased roughly four-fold to 65,500, implying an average annual rate of increase of 3.24 percent. Postdoc numbers dipped during the COVID-19 pandemic but have since begun to recover, reaching 65,850 by 2023. Over the same period, the number of graduate students at U.S. universities approximately doubled. Comparable data on faculty numbers are more difficult to obtain, but it seems likely that growth in the number of postdocs has greatly outpaced faculty numbers as well.[1] In many of the physical sciences and in biomedicine, one or more postdoc positions are considered an essential rung on the path to a tenure-track faculty position as an independent researcher, and the number of postdocs in other fields has begun to increase in recent years.

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[1] Counts of postdoctoral appointees and graduate students are from National Center for Science and Engineering Statistics (2021), Table 1-1 [downloaded 4 August 2025]. Data collection on postdocs has improved over time, so some of the growth is likely an artifact of better measurement in recent years. Postdocs are also employed outside universities in national labs and in private industry. Reliable statistics on their numbers are more difficult to obtain, but those that exist suggest they are a relatively small part of the total postdoc population. The graduate student figure includes both M.S. and Ph.D. students. Unfortunately, the survey only began collecting data separately for Ph.D. and Master's students in 2017, so it is not possible to disentangle these two groups in earlier years. In 2019, Ph.D. students accounted for about 40 percent of graduate student enrollment. The Integrated Postsecondary Education Data System (IPEDS) aggregates data on faculty at all degree-granting postsecondary institutions. According to these data, full-time faculty in higher education increased 87 percent (from 450,000 to 832,119) between 1979 and 2018. IPEDS Digest 2019 Table 315.10 < https://nces.ed.gov/programs/digest/d19/tables/dt19_315.10.asp> accessed 9/5/2021. The IPEDS universe is much broader than that covered by the Survey of Graduate Students and Postdoctorates. An alternative is provided by data from the Survey of Doctorate Recipients, which is based on longitudinal samples of individuals who earned doctorates from U.S. universities in science and engineering fields. According to this source, full-time science and engineering faculty numbers grew by 88 percent (from 125,600 to 223,5000) between 1977 and 2017.

The term postdoctoral researcher, taken literally, refers to a career stage for an individual, not to a particular activity or set of job requirements. We follow the guidance of the National Institutes of Health (NIH) and the National Science Foundation, who in 2007 defined a postdoc as "…an individual who has received a doctoral degree (or equivalent) and is engaged in a temporary and defined period of mentored, advanced training to enhance the professional skills and research independence needed to pursue his or her chosen career path" (Bravo and Olsen 2007). As such, postdocs are the career stage immediately following the doctoral degree in some, but not all, fields of science and engineering. While some postdocs are supported on fellowships awarded to the individuals they support or on larger training grants, most postdocs are funded via research grants to a tenure-track faculty researcher. The characteristics of individual postdoc positions vary depending on the supervisor, but it is readily apparent that in many cases postdocs have become relatively low-paid laboratory staff, more senior than doctoral students, but dependent on the Principal Investigator (PI) for support.

Since the late 1990s, the imbalance in biomedicine between the growth in postdoc positions and the number of faculty positions into which they could transition provoked a number of studies documenting the deteriorating conditions of postdoctoral researchers and their diminishing career prospects (NIH 2012, NIH 2018, NIH 2023, NRC 1998, NRC 2005, 2014, NASEM 2018). In its 2014 study of the postdoctoral experience, a National Research Council committee noted that since its last study in 2000, "… the number of postdoctoral researchers in all disciplines has continued to grow sharply," but "the number of independent and especially academic research positions into which they might transition did not" (Institute of Medicine 2014, p. ix). *The Next Generation of Biomedical and Behavioral Sciences Researchers: Breaking Through* (NASEM 2018), found that not only were PhDs in the biomedical sciences less likely to secure faculty positions, but the average age at which they obtained these positions and secured their first independent grant funding was creeping ever higher. As the report observed, the obstacles to success "… have created a career path that is increasingly unattractive, in terms of pay, duration, culture, risk-taking, and future job prospects…" (NASEM 2018, p. 2). The report went so far as to call for a $1,000 tax to be paid by principal investigators who hire postdocs (NASEM 2018). Interestingly, after two decades bemoaning the excess number of postdocs, the dip in postdoc numbers after 2020 has prompted concerns that there may be too few postdocs and led to suggestions to increase salaries and improve benefits (NIH 2023).

For all the ink that has been spilled over the last few decades in describing trends and fluctuations in postdoc numbers, economists and science policy makers have only a limited understanding of the factors that influence entry into and exit from postdoc status. In this chapter, our goal is to summarize and advance understanding of the market for postdocs and their contributions to scientific knowledge. Our starting point is a review and analysis of the historical evolution of postdoctoral research positions. Then we introduce new, disaggregated data that allow us to examine the relationship between R&D funding and the number of postdocs, faculty, and graduate students by discipline and university. We conclude by providing a research agenda that will allow researchers and policymakers to gain a better understanding of the role of the postdoc in the research ecosystem.

2. The Evolving Role of Postdocs in U.S. Science

2.1 Postdoctoral Researchers 1876-1979

The history of postdoctoral appointments, at least in the United States, coincides with that of the modern research university, and in these early years their purpose was primarily the formation of human capital. In 1876, the year of its founding, Johns Hopkins University offered 20 fellowships with the purpose of "… attract[ing] and support[ing] young men starting research careers." While the majority of the fellowships supported doctoral students, four were awarded to men already holding Ph.D.'s (NRC 1969, p. 8).

In the wake of the First World War, which prompted an awareness of the growing importance of science for national security, the National Research Council, with funding from the Rockefeller Foundation, established fellowships in physics and chemistry. In 1922, the Rockefeller Foundation committed additional funding to support fellowships in medical science (NRC 1969, p. 16). These fellowships contributed to the growth of scientific expertise, but numbers remained relatively small, and their presence attracted little attention.

The number of postdocs began to increase more dramatically after World War II, reflecting the growing federal support for science and engineering in the postwar era. The National Institutes of Health established funding specifically to support postdoctoral fellows in medical sciences that greatly increased funds directed to this group. While the first systematic efforts to count postdocs were not undertaken until the early 1960s, the Google N-Gram reproduced in Figure 1 suggests that discussion of this group of scientists began in the early 1940s and followed a rising path until the mid-1960s. After the mid-1960s, references to postdocs slowed for about a decade and then began to accelerate again until the mid-1990s.

Among the earliest efforts to systematically assess the roles and experiences of postdocs was a study by Bernard Berelson (1962) undertaken in the early 1960s at the behest of the American Association of Universities (AAU). Berelson personally visited ten different campuses and sent a survey to all the members of the AAU. Based on this canvas, as well as his examination of data on funding for postdoctoral fellows, Berelson estimated that there were close to 10,000 postdocs in 1960 (of which about 8,000 were employed in higher education) and that the number had clearly been increasing in the years leading up to his study. Summarizing the situation, he observed (p. 128-29): "… postdoctoral work… is substantial, it is established, and it is wanted. It constitutes an invaluable service to the national effort in scientific research. In the arts and sciences, it is an important means to obtaining advanced training in a research specialization. In medicine, it is the major route for research training… In both fields, the universities receive the benefit of a young and well-trained faculty…"

The rapid growth in postdoc numbers noted by Berelson continued throughout the 1960s. A National Research Council study conducted near the end of the 1960s reported that by 1967, the number of postdocs in higher education had doubled to 16,000, implying a growth rate of 9.9 percent per annum. Postdocs in the life sciences accounted for 55.5 percent of this total, and another 32.3 percent were found in the physical sciences, mathematics, and earth sciences. Engineering accounted for only 2.6 percent of the postdocs counted by the National Research Council, and the remaining 10 percent were scattered across the social and behavioral sciences and other fields (National Research Council 1969, p. 54).

Like Berelson, the authors of the National Research Council study viewed the rapid growth in the number of postdocs as a positive reflection of the growth of the nation's scientific enterprise (National Research Council 1969). "If a graduate student is pointing toward a career as a faculty member," the preface of the report summarized, "… a postdoctoral appointment will be almost required to acquire new skills and experience in research and to join the pool from which new appointments are almost always made. The period spent in such an apprentice role is for the most part an enjoyable one…", during which predoctoral pressures and near poverty-level stipends are removed (National Research Council 1969, p. xi). The only significant issue that the report identified was that, despite the rapid expansion of postdoc numbers, the larger academic community remained largely unaware of this segment of the scientific labor force.

Growth in the number of postdocs slowed significantly across the 1970s. When the NSF's National Center for Science and Engineering Statistics (NCSES) began regularly reporting on the number of postdocs in 1979, they found just 18,101, implying an increase of just over 2,000 postdocs in the 12 years between the beginning of the NCSES data collection and the National Research Council study, or an average annual rate of growth of 1 percent.[2] When the National Research Council returned to the topic of postdocs in 1981, not only had growth slowed, but the perception of postdoctoral researchers had shifted considerably, a fact reflected in the title of the report they issued: *Postdoctoral Appointments and Disappointments* (National Research Council 1981). As the National Research Council committee described, obtaining faculty appointments had become more difficult since 1969. Although most postdocs (84 percent) reported taking their appointment to gain additional research experience, to work with a particular group, or to switch fields, close to 1 in 6 (16 percent) said they had taken a postdoc because there was no other employment available (National Research Council 1981, p. 84). Whereas the postdoc had been an important but relatively short route to faculty positions in the 1960s, by the early 1980s an increasing number of postdocs were obliged to wait longer before finding more permanent appointments, or to abandon the search for research faculty positions entirely. Almost 40 percent of chemistry and physics doctorate recipients in Fiscal Year 1972 reported extending their postdoc appointments because of a lack of employment opportunities, as did nearly 30 percent of bioscience doctorate recipients (National Research Council 1981, p. 101).

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[2] For reasons discussed below, the 1979 NSF survey may have been an undercount of the actual number of postdocs.

In addition to these career related concerns, the committee identified two additional problems that perhaps loomed larger because of the growing number of postdocs and the longer time spent by many researchers in these appointments. The first of these was the low pay and lack of recognized status for postdocs within the academic community (National Research Council 1981, pp. 226). The second was the absence of women and minority groups among the postdoc population (p. vii).

During the 1990s, the National Academies' Committee on Science, Engineering, and Public Policy (COSEPUP) returned to the topic of postdoctoral training as part of a larger agenda investigating the education and training of scientists and engineers in the U.S. (Institute of Medicine 2000, p. vii). In contrast to the 1969 and 1981 studies, which had devoted considerable effort to simply documenting the growth in the number of postdocs and trying to better understand the causes and consequences of this growth, the COSEPUP study shifted attention to the training that postdocs received and the conditions under which they worked. Their investigation highlighted many areas in which reality fell short of the ideal, noting that: (1) training opportunities varied substantially, (2) mentoring and career development resources were often limited, (3) postdoc employment status remained poorly defined, and (4) postdoc pay was often quite low. The report concluded with a list of actions that advisors, institutions, funding organizations, and disciplinary societies should undertake to remedy the situation (Institute of Medicine 2000, p. 99). Chief among these were to regularize the institutional status of postdocs, develop clear policies for this group of employees, increase their compensation, provide access to health insurance and other employee benefits, provide substantive career guidance, facilitate postdoc transitions to regular career positions, and improve the collection of data on the numbers and working conditions of the postdoc population.

2.2 Postdoctoral Researchers Since 1979

Despite the NSF's effort to count the number of postdoctoral researchers beginning in 1979, the understanding of this segment of the scientific workforce has been hampered by the heterogeneity of postdoc employment relationships and the limits of data collection by federal agencies (NIH, Biomedical Workforce Group 2012, p. 19; NIH 2023). One important shortcoming of the National Science Foundation's National Center for Science and Engineering Statistics (NCSES) Survey of Graduate Students and Postdoctorates in Science and Engineering (often referred to as the GSS) is that it completely excludes postdocs employed outside of academia at government labs or in industry. A second issue, especially in the early years of the survey, is that it undercounts postdocs in academia. Because some postdocs with their own fellowships were not university employees, and because others were hired by departments or individual faculty with grant funds, previous researchers studying postdocs have accepted that universities were not aware of and did not report all of the postdocs on their campuses (Einaudi, Heuer, and Green 2013). In recent years, most universities have been encouraged to identify a postdoc coordinator to respond to the survey, and a number of other steps have been taken to improve the accuracy and reliability of data collection (Arbeit, Einaudi, Green, and Kang 2016).

The other source of information about postdocs used by some researchers is the Survey of Doctorate Recipients (SDR), which is also managed by the NCSES (see, e.g., Kahn and Ginther 2017). The SDR is a panel survey which follows individuals who earned doctorates from U.S. universities over several years and contains relatively rich data on individual characteristics, as well as capturing employment transitions. The sampling frame of the SDR ensures that it captures postdocs outside the university sector, but because it is limited to graduates of U.S.

universities, it excludes the large number of individuals who earned doctorates outside the country. The effects of this restriction to graduates of U.S. universities are evident in a comparison of aggregate numbers with the GSS. In 2017, for example, the SDR enumerated 18,400 postdocs across all scientific disciplines in academic institutions (SDR, Table S3-7), while the GSS reported a total of 66,733 in Science, Engineering and Health (GSS, Table 1-1).

With these caveats about the data in mind, we now turn to a description of the changing nature of the academic postdoc population since 1979. The pool of potential postdocs is made up of new doctorate recipients. Figure 2 shows the time series of doctoral degrees awarded by field between 1980 and 2023. In the United States, the majority of doctoral degrees were awarded in the fields of biomedical sciences and engineering, followed by social sciences, physical sciences, and psychology. Those awarded in health sciences are comparatively small. Figure 3 shows the primary postdoc fields using data from NSF's GSS. The distribution of postdocs across science fields differs considerably from that of doctoral degrees. Postdocs are concentrated in biomedical and health fields, followed by physical sciences and engineering, although the extent of this concentration has been declining over time. In 1994, 69 percent of postdocs were in biomedical and health fields but by 2023, that share had dropped to 58 percent.

The growth in overall postdoc numbers up to 2019 is also apparent in Figure 3. Prior to about 2006, numbers increased relatively steadily. The rate of growth accelerated between 2006 and 2011, driven primarily by a growth in numbers in health-related areas. After 2011, numbers fell, briefly, again driven by a drop in health-related areas, before beginning to expand again after 2012. Since 2000 the most rapid growth in postdoctoral researchers has occurred in engineering, but this has occurred from a relatively small base. Figure 4 graphs postdoc numbers by field relative to a base of 100 in 2000. Although biomedical and health sciences still account for the largest share of postdocs, their numbers have increased only about 30 percent since 2000, with almost all of that growth concentrated in the first decade of the 2000s. In contrast, the number of postdocs in engineering has increased more than 2.5-fold over the same period, while the number of postdocs in chemistry has declined by 15 percent.

The majority of postdocs today are non-U.S. citizens. Figure 5 compares the growth rate of U.S. citizen and temporary visa holder postdocs since 1994, the first year for which data are available. In 1994, the number of temporary residents and U.S. citizens who were postdocs was the same, but starting in 1999 the shares diverged. The number of U.S. citizen postdocs remained flat through the 2000s but then rapidly increased in the middle of the decade before leveling off at around 30,000 after 2010. The number of temporary resident postdocs fell between 2019 and 2021 only to rebound through 2023. However, the number of U.S. citizen postdocs dropped starting in 2019 and has not recovered. Both the increase in temporary residents and the subsequent growth in U.S. citizen postdocs were likely the result of the doubling of the NIH budget during the early 2000s as we discuss below.

The rise in temporary resident postdocs could reflect either a greater inflow of foreign-trained doctorates or growth in the numbers of international students graduating from U.S. doctoral programs. In Figure 6 we compare the share of temporary visa holders who are doctorates and postdocs from 1994 to 2023 in the fields of biomedical science, physical science, and engineering. The narrowing of the gap between the shares of doctorates and postdocs since 1994 suggests that part of the explanation is indeed due to a growing number of international students in U.S. doctoral programs, but the persistent gap between the postdoc and doctoral shares implies that there is still a persistent flow of foreign trained doctorates into U.S. postdoc positions. Reasons for the larger share of postdocs being temporary visa holders are multifaceted.

First, postdoc pay has historically been very low, and U.S. citizens may have better-paying employment options. Second, temporary resident postdocs may have different incentives to take postdoctoral research positions compared with their US-born counterparts (Borjas 2009, Lan 2012). Third, U.S. academic institutions do not face caps on the number of visas for foreign talent and are free to hire them. Regardless of the reason, in the fields most likely to hire postdocs, the majority of postdocs are temporary visa holders.

3. The Market for Postdoctoral Researchers

The economist's standard tools of market analysis – supply and demand – can help us to make sense of the changing numbers of postdocs. On the one hand, the supply of postdocs reflects several different factors. The supply of postdocs is increased by new doctoral recipients produced in the U.S. or choosing to seek jobs in the U.S. after completing graduate school abroad. Supply will increase to the extent that a larger number of new graduates choose to pursue postdocs or if fewer new Ph.D.'s are able to secure tenure-track faculty appointments and enter postdocs while waiting for a faculty opening. Meanwhile, the supply is reduced by exits of more senior postdocs who either secure tenure-track faculty positions or give up on this goal and take jobs in industry or outside of science. If faculty hiring slows, then the stock of postdocs is likely to increase at least in the short run because fewer postdocs exit to faculty positions and because fewer new Ph.D.'s secure faculty positions. On the other hand, the demand for postdocs is largely driven by available funding. The bulk of funding to support postdocs comes from sponsored research funds; however, the relationship between grant funding and postdoc demand is complicated because principal investigators must weigh how to allocate these funds between supporting graduate students, postdocs, and more permanent research staff. Presumably, their choices reflect shifts in the relative cost and productivity of these different groups of workers. Thus, shifts in the relative productivity of these different types of research labor also matter.

The large increase in postdoc numbers over the last four decades reflects growth in both supply and demand. While not entirely conclusive, the falling remuneration and limited career prospects of postdocs suggest that, at least over the last few decades, the growth of supply of postdocs has outpaced the growth of demand. Since the late 1990s, reports by the NIH and the National Academies have raised concerns about the deteriorating working conditions, long hours, lack of benefits, forced geographic mobility, and, most importantly, lack of future employment opportunities faced by postdocs (NIH 2012, NIH 2018, NIH 2023, NRC 1998, NRC 2005, NAS 2014, NASEM 2018). These studies have all noted that the length of time spent in postdoc positions has increased, while the prospects of transitioning to independent research faculty positions have declined.

A number of recent studies by economists support the view that the growth in biomedical postdocs in this period was attributable primarily to increases in the supply of doctorate recipients (Stephan and Ma 2005, Stephan 2012a, Stephan 2012b, Teitelbaum 2014, Freeman et al 2001, Borjas 2009 and Garrison and Gerber 1998). In the absence of a comparable increase in faculty positions and the elimination of mandatory retirement at universities in 1994, this increased supply of doctorates had the inadvertent effect of expanding the supply of potential postdocs (Blau and Weinberg 2017). Using a simulation model, Ghaffarzadegan and Xu (2018) demonstrate that there was a reduction in the number of younger scientists hired into tenure-track academic positions by roughly 20 percent after the end of mandatory retirement.

While these results suggest an important role for supply-side forces in the growing number of postdocs, demand-side influences also appear to have been important. The demand for postdocs depends critically on how they are funded. Using data from the GSS, in 2010, 18 percent of postdocs were funded on traineeships and fellowships, while 65 percent were funded by research grants and another 17 percent had other types of funding. By 2023, only 14 percent of postdocs were funded on traineeships and fellowships, 62 percent were funded on research grants, and 24 percent had other forms of support. Clearly, demand for postdocs is driven by principal investigators with funding needing research support on their projects.

Between 1998 and 2004, the NIH ran what is in effect an uncontrolled experiment on the effects of substantially increasing the funds available to support biomedical research. In this period, the NIH pursued a five-year program to double available funding from $9.8 billion to $19.6 billion. The rapid acceleration in funding is apparent in Figure 7, which plots both current and inflation-adjusted NIH research grant figures from 1973 through 2024. Increased funding made available to a slowly growing pool of faculty researchers resulted in increased demand for biomedical research labor. Because of the time lags involved in producing new Ph.D.'s, the initial effect of this demand was to cause an influx of foreign temporary residents to fill new postdoc positions (Blume-Kohout and Clack 2013, p. 2). However, increased funding also resulted in an increase in support for graduate students, and enrollment in Ph.D. programs in the biomedical sciences expanded. Recent research shows that a 10 percent increase in public support of graduate student training increases the number of doctorates by about 8-9 percent (Shvadron et al 2025).

With normal time to degree in these programs of 5-6 years, the bulk of these students completed their studies just as the NIH doubling was coming to an end or within the next few years (Blume-Kohout 2013). The number of doctorate recipients in the life sciences at U.S. universities, which had been nearly stable at around 8,500 from 1998 through 2004, began to increase in 2005, rising to about 12,000 by 2012 (nearly 40 percent above its 1998 level, Figure 2). The rapid increase in doctorate recipients, which was not accompanied by a comparable increase in permanent faculty positions, resulted in increases in both the number of doctorate recipients without definite employment at the time of graduation, which rose from 27.6 percent in 1998 to 37percent in 2012, and the share of those with definite commitments who had accepted positions as postdoctoral researchers, which increased from 60.9 percent in 1998 to a peak of 70 percent in 2010 (Figure 3 and NCSES 2022, Survey of Earned Doctorates, special tabulations).

To sum up, it seems that the NIH doubling first increased demand for postdocs but ultimately caused an even larger increase in supply and further eroded conditions for students completing Ph.D.'s once funding began to fall in real terms (Figure 7). The result was greatly increased attention to the problem of too many postdocs as articulated in a series of National Academies reports from the 2010s. Among the most controversial recommendations was that biomedical Ph.D.'s should consider teaching in middle- and high schools (NRC 2011). Even before the NIH doubling, in 1998 the NRC report, *Trends in the Early Careers of Life Scientists*, raised concerns that "the current level of Ph.D. production now exceeds the current availability of jobs in academe, government, and industry where they can independently use their training" (NRC 1998, p. 4). As we show in Figure 3, rather than Ph.D. programs shrinking, they were expanded. There was a rapid increase in postdocs in biomedical and health research fields from 1998 to 2010. Between 2000 and 2010, the number of biomedical postdocs increased 134 percent.[3]

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[3] According to Kahn and Ginther (2017), the average length of time it took to obtain a doctorate in biomedical fields was 7.5 years in 1998, which means that those students admitted during the doubling would have finished their degrees starting in 2005, when the acceleration in biomedical doctorates begins.

Since the early 2000s, there have been several proposals seeking to address the imbalance between the supply of and demand for postdocs in biomedicine. Many observers have focused on the low pay and poor working conditions of postdocs, calling on universities to improve the working conditions of postdocs and on funding agencies to increase minimum salaries for these positions (National Research Council 1981; Institute of Medicine 2000; National Institutes of Health 2012; Institute of Medicine 2014; National Academies of Sciences, Engineering and Medicine 2018). Setting price floors would, of course, further reduce demand for postdocs by raising their cost, while possibly increasing the supply by making them more attractive to new Ph.D.'s. Other scholars have argued that providing better information about career prospects for science and engineering doctorates might reduce the inflow of new postdocs and thus help to redress the imbalances in the system (Ganguli, Gaulé, and Cugalj 2020)

Interestingly, by the 2010s, as concern about the excess supply of postdocs was intensifying, the relationship between variations in the NIH budget and postdoc numbers appears to have largely broken down. Although it may only have occurred with a long lag, it seems that by the 2010s, biomedical doctorates had begun to adjust their behavior in light of the declining opportunities to secure independent researcher positions. In Figure 8, we compare the number of postdocs in biomedical and health fields, the number of biomedical faculty in U.S. research universities, the number of R01 grants awarded each year, and the constant dollar NRSA stipend for first-year postdocs. The NRSA stipend for first-year postdocs has not decreased in real terms since 2013. Beginning in 2017, the number of R01 grants awarded increased by 31 percent while the number of faculty increased only 2 percent and the number of postdocs fell by 7 percent. The number of doctoral degrees in biomedical fields also increased by 7 percent. If postdocs are desirable workers, then the increase in the number of R01 grants should have increased the number of postdocs demanded and hired, yet the number of postdocs fell.

In Figure 9, we compare the real value of the average R01 award and the real value of the starting NRSA postdoc salary (both adjusted to 1998 dollars). The average real value of an R01 grant peaked initially in 2003, and the real value of the NRSA stipend peaked as well. While the real value of the NRSA stipend trended downward or remained flat, the number of R01 grants (Figure 8) and the average real value of an NIH R01 award (Figure 9) dropped by 14.5 percent by 2013. From 2013–2024, the real value of the average R01 award reached a new peak in 2020 before falling sharply through 2024. The postdoc stipend increased in 2024 in response to recommendations from the NIH Advisory Committee to the Director to raise postdoc salaries (NIH 2023). Nevertheless, it is puzzling that the reductions in funding and R01 grants did not reduce postdoctoral appointments between 2009 and 2017, and that the increase in grants and the real value of an NIH R01 award since 2017 did not also increase postdoctoral employment.[4] The results are not consistent with the demand for postdocs waning in recent years.

The most recent study of biomedical postdocs, the 2023 NIH *Re-envisioning NIH Supported Postdoctoral Training*, echoed the concerns of the three previous studies. However, unlike in 2012 and 2018, when postdocs were plentiful, the sharp decline in the number of postdocs starting in 2020 raised significant concerns. In response, this study called for increasing the postdoctoral stipend to $70,000. The NIH responded by raising the NRSA stipend for postdoctoral fellows from $56,484 in FY2023 to $62,652 in FY2025, an 11 percent increase. As

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[4] We also examined whether the increase in postdoc salaries by years of experience may have affected the demand for postdocs. In 2017, a fifth-year postdoc's NRSA stipend was 14 percent higher than a first-year postdoc salary. In 2024, that ratio was 13 percent. This suggests that changes in the cost of more senior postdocs were not influencing the change in demand for postdocs.

prices of postdocs increase, other things equal, the expectation is that the demand for postdocs will fall.

To drill down further, recent data produced by the NIH have shown how postdocs are utilized on research projects. Starting in 2015, the NIH began to enumerate the type of staff on each funded project. Using recently reported data from NIH, we calculated the share of principal investigators, co-investigators, postdocs, graduate students, staff scientists, technicians, and the number of NIH research grants in Figure 10A.[5] Between 2017 and 2022, the number of NIH research project grants (RPGs) increased by almost 6,000. The number of PIs has increased by close to 8,700, and staffing also changed dramatically. In 2017 there were 30,000 postdocs employed on NIH research grants, but by 2022 that number fell by about 1,100. Staff scientists also decreased by 353, while the number of graduate students increased by 5,300. The NIH also reported on how much effort was allocated by staff type. Graduate students spent an average of six calendar months, while postdocs spent seven, and staff scientists spent over five months. Starting in 2021, there was a significant decline in the number of postdocs supported on NIH grants.

In Figure 10B, we normalized staffing numbers by the number of grants. The number of PIs increased slightly from 1.1 to 1.14. The number of co-investigators also increased from 1.29 to 1.3. Graduate students per grant did not change. However, the number of postdocs per grant fell from 0.86 in 2017 to 0.71 in 2022, the number of staff scientists also dropped from 0.25 to 0.21 and the number of technicians dropped from 0.62 to 0.53. There appears to be substitution away from postdocs, staff scientists, and technicians towards co-investigators.

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[5] These data were available at https://nexus.od.nih.gov/all/2024/03/02/number-of-postdoctoral-researchers-supported-by-nih-grant-awards-fy-2017-fy-2022/ (accessed in April 2024). This webpage was removed from the NIH website with the following notice: "We plan on refreshing and rereleasing our older, popular content and migrating historical blog posts over the next few months."

4. The Impact of Postdocs on Careers

From the point of view of the aspiring researcher, the years spent as a postdoctoral researcher are best viewed as a period of on-the-job training paid for by foregone earnings, which are presumably repaid by a higher salary in the future. One of the key results of recent research is that while this is true for postdocs who secure faculty positions, the human capital acquired as a postdoc has little value outside of academia.

Using data from the SED and SDR to compare the career outcomes of those who started in the postdoc to the counterfactual of those who skipped the postdoc in biomedical fields, Kahn and Ginther (2017) found that the share of U.S. trained doctorate recipients entering postdocs had remained roughly stable between 1980 and 2010. They found that after 2000, a sharp drop in the share of these Ph.D. recipients transitioning to faculty positions within 10 years of graduation (Kahn and Ginther 2017, p. 92). In addition, they found that postdocs had better productivity characteristics (e.g., graduated from higher-ranked programs and were more likely to be employed as research assistants in graduate school); however, there was no economic return to taking the postdoc. Postdocs were paid substantially less in future employment than those who skipped the postdoc. While the postdoc was useful for obtaining an academic tenure-track research position, Kahn and Ginther found that the likelihood of achieving this goal dropped considerably over time.

Using similar data and methods, Main and Wang (2019) and Main, Wang, and Tan (2021) examine the impact of postdoctoral training on the careers and salaries of engineers. These authors find that engineering postdocs are positively selected and are more likely to have academic jobs after graduation. Using more-recent waves of the SED and SDR to examine career outcomes, Diethorn and Marschke (forthcoming) and Cheng (2023) reinforce the previous findings. Using a task-based framework, Diethorn and Marschke (forthcoming) show that postdoc penalties arise when postdoctoral training is not used in subsequent jobs. Categorizing career paths for research doctorates into six job types—postdoctoral researcher, tenure-track academic, non-tenure track academic, for-profit industry, non-profit, and government—Cheng (2023) found that although postdoctoral positions allow scientists to remain engaged in research, the likelihood of obtaining an academic job fell over time, and they experienced significant earnings penalties from taking a postdoc. Andalib, Ghaffarzadegan, and Larson (2018) model the postdoc as a labor force queue. Using data from the SDR they found that only 17 percent of scientists who enter the postdoc queue eventually are employed in tenure-track academic positions. Taken together, the literature shows that postdoc positions attract on average the more productive doctorate recipients, but these postdocs pay a significant price in terms of foregone earnings by engaging in postdoctoral research, and a declining fraction are able to secure academic positions that reward their postdoc experience.

However, not all postdoctoral positions are created equal. NIH training programs and fellowships have been shown to improve subsequent career outcomes. Levitt and Levitt (2017) found that NIH's early-stage investigator program increased success rates of younger scientists in receiving NIH R01 funding. However, Levitt (2010) found that women were more likely to leave scientific research careers than men when examining the association between the 1992–1994 cohorts of the NRSA F32 postdoctoral fellowship program and their subsequent biomedical careers. Using NIH administrative data and a regression discontinuity design that compared those who were awarded an NIH F32 postdoctoral fellowship and those that had competitive scores but were not funded, Jacob and Lefgren (2011) found that NIH postdoctoral fellows had more publications and received higher dollar amounts in subsequent NIH funding compared to non-awardees. In related work that used similar data and propensity score matching, Heggeness et al (2023) found that receiving an NRSA F32 postdoctoral award increased the probability of receiving subsequent NIH research funding by about 7 percent and the probability of receiving NIH R01 funding by about 5 percent. Pickett (2019) echoes these findings by showing that first-time R01 awardees were more likely to have had K-series career development funding from the NIH.

5. Postdocs and the Production of Scientific Knowledge

The argument of the preceding sections is that, in the absence of mechanisms linking the inflow of aspiring researchers into postdoc positions to the likely opportunities to enter independent faculty research positions, increases in the availability of federal R&D funding increased graduate student numbers and encouraged growth in the supply of postdocs,at least in some areas of science, well beyond the number needed to fill faculty vacancies. Increased supply has resulted in postdocs becoming an increasingly important part of the scientific workforce, where they play a key role in the organization of labs and the production of new scientific knowledge. Growth in the number of postdocs has, in turn, reduced the value of the advanced training these positions provide. As postdocs' role has shifted toward production of new knowledge, opportunities for training have diminished and the value of the training they do receive has declined, since many will ultimately exit the academic sector for industry or government jobs that place less value on these skills.

A convincing test of the conjectures of the preceding paragraph is difficult given the complex feedback between graduate student numbers, postdocs, and funding and the lack of truly experimental variation in the data. That said, combining new data sources may yield additional insights. We combine data on the numbers of postdocs and graduate students from the NCSES Survey of Graduate Students and Postdoctorates in Science and Engineering with R&D expenditures based on data reported in the Higher Education Research and Development Survey (HERDS) and data on faculty numbers, publications, and citations obtained from Academic Analytics (a private company that collects data on university faculty and their research output). Counts of publications are adjusted by the number of coauthors in the Academic Analytics universe.[6] Data from these sources are available from 2009 through 2022. We limit our analysis to the most research active U.S. universities, focusing on those that accounted for 90 percent of cumulative R&D expenditures in this period.[7] In addition, because of the work involved in merging the different data sets, we restrict attention to seven broad fields of scholarship: (1) biomedical science, (2) chemistry, (3) chemical engineering, (4) electrical engineering, (5) computer science, (6) psychology, and (7) economics.[8] These seven fields of study span a wide range of approaches to research and provide insight into differences in the utilization of postdocs in scientific production.

5.1 The Distribution of Postdoctoral Researchers

A striking result of this analysis is the extent to which research expenditures and postdocs are concentrated at a small number of universities. Figure 11 shows the relationship between the

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[6] For example, this chapter would assign .5 publications to the University of Kansas and .5 publications to Iowa State University.

[7] Using the NSF HERDS, 90 percent of R&D expenditures were concentrated in the top 173 universities or academic medical centers in this period. Because these 173 entities include multiple entries for some universities for which postdoc and graduate student numbers are reported in aggregate form, merging the HERDS data with data on graduate students and postdocs reduces the number of institutions to 147. Not every discipline considered here is represented at each university in the sample, so numbers of observations are lower for some fields of study.

[8] Because of the way the Academic Analytics data are collected, assigning individuals to universities and academic disciplines is not always straightforward. In particular, individuals may appear in the database multiple times with affiliations to different universities, as well as appearing multiple times within a university if they are associated with more than one department or field of study.

cumulative distribution of funding and postdocs by plotting the Lorenz curves. In this figure, if funding and postdocs were equally distributed, they would lie along the 45-degree line. Both postdocs and research funding curves are well below this line of equal distribution, but the line for postdocs is lower than that for funding, indicating it is more unevenly distributed. According to the GSS, the top 10 institutions that employ postdocs have 30 percent of all postdocs but only 16 percent of total research funding.[9] In Figure 12 we compare the distribution of postdocs to that of faculty and publications. Both faculty and publications are closer to the 45-degree line, hence more equitably distributed than postdocs, with the faculty being somewhat more evenly distributed than publications.

In Table 1 we break these aggregate differences down by field of study. For each field of study, we report the share of that discipline's postdocs, federal R&D expenditures, faculty, and graduate students accounted for by the top 10 percent of universities at five-year intervals. Funding is most concentrated in electrical engineering, computer science, and economics, where 50-60 percent of expenditures are concentrated at the top 10 percent of institutions. Funding is most equitably distributed in chemistry, chemical engineering, and psychology, where the top 10 percent of institutions account for about 30 percent of expenditures. Biomedical sciences fall somewhere in between, though the concentration of funding has been increasing over time (a trend that is apparent in a number of other disciplines as well).

The concentration of postdocs is consistently high across all disciplines, with the top 10 percent of institutions accounting for nearly 40 percent of the postdocs. Consistent with Figure 11, the concentration of postdocs is higher than that of R&D expenditures in every discipline except electrical engineering and psychology. Levels of concentration are similar in the other

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[9] The top five universities for employing postdocs are Harvard, Stanford, Johns Hopkins, the University of Minnesota, and MIT.

disciplines. In contrast to the concentration of postdocs and research expenditures at a relatively small number of universities, faculty and graduate training are relatively dispersed. In most fields, the top 10 percent of institutions account for less than 25 percent of the regular tenure-track faculty, and graduate student numbers parallel faculty distribution. Taken together, these results are consistent with those found in Zhang et al (2022). They attribute increased research productivity to greater numbers of funded graduate students and postdocs at prestigious universities.

5.2 Postdocs and Scientific Production

One implication of the increased reliance of academic science on postdocs is that they are making an important contribution to the production of new scientific knowledge. This topic has so far been largely neglected in the literature. We are aware of only one paper that has examined the association between the number of postdocs and science outcomes. Using a combination of HERDS and GSS data, Rosenbloom and Ginther (2017) found that academic institutions with more postdoctoral researchers in the previous period received higher amounts of federal research funding in chemistry in subsequent periods. Although not able to disentangle the direction of causation, Rosenbloom (2023) finds a strong positive association between publications per faculty member and postdocs per faculty member in a number of disciplines in cross-university panel regressions.

Other researchers have used the Early Career Doctorates Survey (ECDS) to examine early career outcomes. Chang, Phou, Basner, and Desai (2022) found that having published as a doctoral student is associated with a subsequent research career. Kahn and MacGarvie (2024) compared postdoctoral experiences of temporary-resident and U.S. citizen postdoctoral researchers and found that temporary resident postdocs were less likely to be involved in grants, teaching, and external collaboration, received less mentoring from their supervisors, and were paid less.

Given the critical roles that postdocs play in career outcomes and research production, we now turn to developing a research agenda to gain a deeper understanding of this career stage.

6. Research Agenda

Data Availability. As mentioned previously, the quality of data available on postdocs is limited and measured with error. U.S. statistical agencies do not have reliable counts of postdocs working in the country (Science and Engineering Indicators, 2012). Future research contributions will depend on access to administrative data that links postdocs to their funding as well as the principal investigators that they work for. At the same time, surveys that collect data on postdocs are currently under threat. The Early Careers Doctorate Survey has not been fielded since 2017. The SDR was supposed to be collected in 2025 but was suspended. There are some indications that the National Center for Science and Engineering Statistics plans to merge the SDR with the National Survey of College Graduates and the National Training, Education, and Workforce Survey—a group that does not even have bachelors' degrees. Clearly, preserving existing surveys while gaining access to administrative data such as the NIH's Information for Management Planning Analysis and Coordination (IMPAC II) would go a long way towards supporting research on the effect of postdocs on academic careers.

Documenting Key Facts. Assuming that barriers to data on postdocs are removed, there are a number of important and unanswered questions that would shed light on the role of the postdoc. First, given the paucity of data, descriptive studies would be useful. How long are postdoc appointments? How many postdocs are there? How are postdocs supported financially?

Second, while many studies have examined the impact of postdocs on individual careers, few papers have studied the role of postdocs in the research production process. Third, how do postdocs compare across research fields? Most research has focused on biomedicine given the predominance of postdoctoral positions in biomedicine and health disciplines. However, postdocs have increased rapidly in engineering, thus studies of the impact of postdocs in different fields are warranted. Fourth, the majority of doctorates will end up working in private industry. Is postdoctoral training required to be productive in industry jobs? Fifth, our analysis has demonstrated that the U.S. relies critically on temporary residents to fill postdoc positions. Given the significant changes in U.S. immigration policy, as well as restrictions on grants to selected universities that hire a significant share of postdocs, will we observe the impact on scientific productivity of these negative supply shocks in the coming years?

Workforce Composition. Use of administrative data such as UMETRICS would be useful to examine the roles that postdocs play in research labs since job titles are available in these data. Clearly, there is a trend on projects funded by the NIH to decrease the hiring of postdocs. More work is needed to understand whether this is a supply phenomenon (e.g., fewer postdocs willing to work for low wages with reduced prospects for academic jobs), a demand phenomenon (e.g., PIs are stretching their grant dollars by substituting towards cheaper labor), or both. A detailed analysis of the substitution between graduate students, postdocs, and staff scientists is warranted. While staff scientists are prevalent at NIH, our analysis showed that they make up a decreasing share of employees on NIH grants. In addition, staff scientists are difficult to study without access to NIH administrative data.

Postdocs and Research Funding. Given the relationship between research funding and postdoctoral employment (Figure 11), further investigation into the concentration of research funding and postdocs should be examined. Perhaps the changes in federal funding priorities under the current administration will lead to greater equality in the allocation of research funding as well as the number of postdocs. Alternatively, if federal research funding is cut dramatically, then opportunities to work as postdocs will necessarily be limited. Institutions with more postdocs have larger research teams (Zhang et al 2022).   Researchers need to understand how team size affect the quality and quantity of research. Research has found that larger labs produce incremental science while smaller labs are more innovative (Wu, Wang, and Evans 2019). It remains an open question as to whether research performed by postdocs is more incremental or innovative. While researchers have found that overall team size in a field has a negative impact on career prospects (Andalon et al 2024), more work remains to understand how the size and composition of an individual's team affect subsequent career outcomes.

There is significant evidence that the NIH F32 fellowship mechanism that provides independent research funding to postdocs promotes subsequent NIH research funding and independent research careers (Jacob and Lefgren 2011, Heggeness et al 2023).   However, the impact of fellowship funding in other fields deserves attention. Training grants and fellowships may provide improved mentoring that launches students on independent research careers. Like postdocs, mentoring by principal investigators is rarely measured or studied.

Substitution of Capital for Labor. Research activities are increasingly automated. Previous research has attributed increases in research productivity in chemistry to computerization of labs in the 1990s and early 2000s (Rosenbloom et al 2015). The AlphaFold Artificial Intelligence (AI) system predicts protein 3D structures and received the Nobel Prize in Chemistry in 2024. According to DeepMind, AlphaFold has been used in over 200,000 research papers.[10] As use of AI and automation increases in biomedical research, it is likely that research productivity will increase. If AI systems are substitutes for repetitive labor produced by postdocs, then the demand for postdocs will likely decrease. Alternatively, if AI increases the productivity of postdocs, perhaps this will reduce the length of postdocs in biomedical fields and reduce the age of achieving research independence. The impact of AI and automation on the demand for postdocs promises to be a fruitful area of future research.

7. Discussion and Conclusions

This chapter has examined the economics of postdoctoral researchers by considering the supply and demand for postdocs, the impact of postdocs on career outcomes, and the role of postdocs in the research production process. Research inevitably involves continuing investment in human capital as investigators grapple with new questions on the frontiers of human knowledge. Postdoctoral research positions emerged first as a period in which scholars could invest heavily in the development of the human capital necessary for success in their chosen field. The value of these skills acquired by postdocs in biomedical science, chemistry, physics, and some related fields made postdoctoral appointments an important step on the path to an independent research career. This situation persisted from the late nineteenth century through the 1960s.

During the 1960s, the rapid growth of U.S. higher education spurred by the arrival of the baby boom generation on college campuses, supported by the expansion of federal R&D funding in the wake of Sputnik, and further encouraged by individuals seeking draft deferments led to

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[10] https://deepmind.google/blog/alphafold-five-years-of-impact/#:~:text=They%20used%20AlphaFold%20alongside%20comparative,AlphaFold%202%20in%20their%20methodology.

considerable growth in numbers of graduate students, postdocs, and faculty. Beginning in the early 1970s, slowing undergraduate enrollments and a deceleration of federal funding resulted in a slowdown in the creation of faculty positions. By the 1970s, doctorates entering postdoc positions found it harder to exit into independent faculty research roles. By the late 1970s, this imbalance was becoming apparent to those concerned with higher education and the health of the scientific workforce (National Research Council 1981).

Since the 1980s, the lack of articulation between the forces affecting the supply of postdocs entering positions and the factors affecting the creation of new faculty positions into which postdocs can exit has resulted in the relatively more rapid growth of postdocs than faculty and shifted the make-up of the U.S. scientific workforce toward larger research teams with more postdocs. As the length of time spent in postdocs has increased and the proportion successfully exiting into faculty positions has declined, there are feedback loops that may have helped to slow the number of students seeking Ph.D.'s and entering the supply of postdocs. However, the long lags between decisions to enter Ph.D. programs and degree completion, combined with the challenges of forecasting and imperfect information, have meant these feedback effects have not been terribly effective. Meanwhile, fluctuations in the availability of research funding, such as the well-publicized doubling of NIH expenditures beginning in the late 1990s, supported a substantial expansion of funding for graduate student research assistants in the biomedical sciences, which produced, with a lag of five or more years, an increase in aspirants for faculty positions, who saw no other route to these positions than to take postdoc positions.

Taking a deeper look at the relationship between postdoctoral employment and NIH funding yields new insights. The real value of the average NIH grant fell between 2003 and 2013 before peaking at a higher level in 2020. Despite the decreased value of the NIH grant, postdoctoral employment remained steady. When the number and value of NIH grants increased starting in 2017, the number of postdocs employed dropped. This suggests that while demand-side factors mattered more in the early 2000s, by the late 2010s, supply-side factors were the more important factor affecting postdoctoral employment. In addition, the decline in biomedical postdocs, despite increasing numbers of biomedical Ph.D.'s, belies the conventional wisdom in the previous literature that more doctorates result in more postdocs (Stephan and Ma 2005, Stephan 2012a, Stephan 2012b, Teitelbaum 2014, Freeman et al 2001, Borjas 2009, and Garrison and Gerbi 1998). After 2019, biomedical postdoctoral positions became less attractive for both international and U.S. citizen scientists.

These broad outlines of the growing reliance of the U.S. scientific enterprise on postdoctoral researchers are discernable from aggregate data. But to make further progress we need to develop better disaggregated data that provide a higher resolution picture of where postdocs are employed and what their role is in the production of scientific knowledge. In section five of this chapter, we have combined newly available data on individual faculty productivity from Academic Analytics with publicly available data on postdocs, graduate students, and research funding to begin such an exploration.

This investigation demonstrates first that the training and employment of postdocs is much more highly concentrated across universities than are numbers of faculty or graduate students. It also reveals substantial variations across disciplines in the use of postdocs. As reflected in the aggregate data, reliance on postdocs is most prominent in the biomedical sciences, chemistry, and chemical engineering. Postdocs remain relatively rare in psychology and electrical engineering, and quite rare in economics and computer science.

Taken together with the historical narrative in this chapter, these results supported the view that variations in research funding have played an important part in the expansion of postdoc numbers over time and across space. However, this relationship has decoupled for the NIH in the past twenty years. The shift in NIH staffing from postdocs to graduate students may be the result of biomedical doctorates understanding that the postdoc is only valuable for academic jobs that are becoming increasingly scarce.

Given the current changes in the federal research funding landscape, it may be the case that we have reached peak postdoc. The number of postdoctoral researchers in the U.S. peaked in 2019, possibly due to the effect of COVID-19 pandemic on the labor market. Although numbers today are slightly higher than in 2019, changes in immigration policy brought about in the first and second Trump Administrations, the introduction of artificial intelligence, and the recent increases in postdoc compensation mean that the number of postdocs in the U.S. is unlikely to increase.

Our analysis showed that the majority of postdocs in this country are temporary residents. Announced executive orders and changes in immigration policy have reduced the number of international students studying in the U.S. NAFSA: The Association of International Educators estimates that there will be 150,000 fewer international students enrolled in the fall of 2025.[11] According to the Center for American Progress, as of July, the Trump Administration has terminated grant awards ranging in total value from $6.9 to $8.2 billion.[12] These policies will limit the number of postdocs employed in the U.S. For the foreseeable future, there will be fewer postdocs and as a result, less research produced.

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[11] https://www.nafsa.org/fall-2025-international-student-enrollment-outlook-and-economic-impact

[12] https://www.americanprogress.org/article/mapping-federal-funding-cuts-to-us-colleges-and-universities/

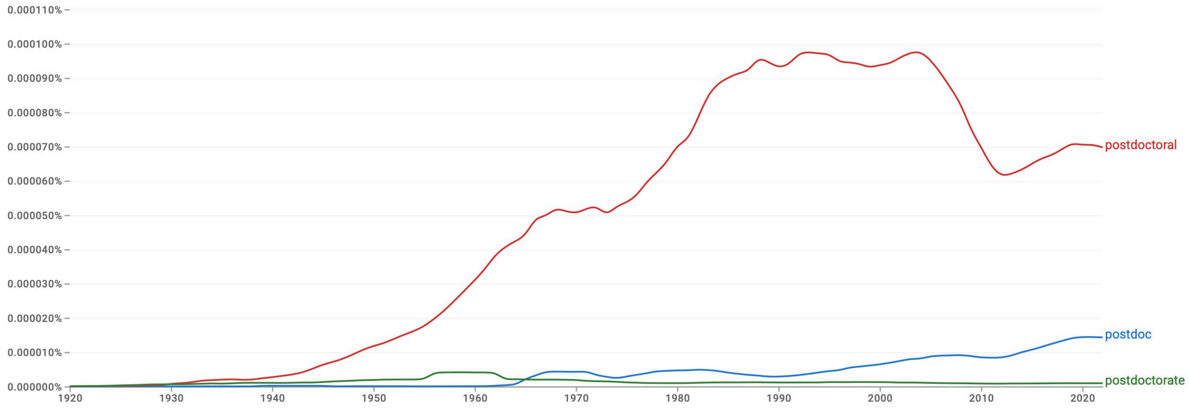

Figure 1: Google N-Gram for postdoc, postdoctorate or postdoctoral, 1900–2022. Source: Google Books Ngram Viewer (https://books.google.com/ngrams). Retrieved August 9, 2025.

Figure 2: Doctoral Degrees Awarded by Field, 1980–2023. Source: Survey of Earned Doctorates.

Figure 3: Postdoctoral Researchers by Field, 1994–2023. Source: Survey of Graduate Students and Postdoctorates.

Figure 4: Growth in Postdoctoral Researchers by Field, normalized to 100 in 2000, 2000–2023. Source: Survey of Graduate Students and Postdoctorates.

Figure 5: Postdocs by Citizenship Status, 1994–2023. Source: Survey of Graduate Students and Postdoctorates.

Figure 6: Share of Postdoctoral Researchers and Graduate Students who are Temporary Visa Holders by Field, 1980–2023. Source: Survey of Graduate Students and Postdoctorates.

Figure 7: NIH Funding of Research in Real and Nominal Dollars, 1973–2024. Source: National Institutes of Health, Office of External Research Table #304 NIH Research Grants. Constant dollar series deflated using the Biomedical Research and development Price Index (BRDPI), based on 1950 prices.

Figure 8: Biomedical & Health Postdocs, NIH R01 Grants, and Biomedical Faculty at Research Institutions FY2009–FY2022. Postdoc Source: NSF Survey of Graduate Students and Postdoctorates.; R01 Grants and NRSA Postdoc Stipends Source: NIH Data Book; Faculty Source: Academic Analytics.

Figure 9: NIH Average R01 Award and NRSA Postdoc Stipend, 1998 Constant Dollars 1999–2024. Source: National Institutes of Health. Constant dollar series deflated using the Biomedical Research and development Price Index (BRDPI), based on 1998 prices.

Figure 10A: Number of Research Project Grants (RPGs) and Total Employment on NIH-Funded Research Grants by Role, FY2017–FY2022. Source: NIH Office of Extramural Research.

Figure 10: Total Employment on NIH-Funded Research Grants by Role Normalized by Number of Research Project Grants, FY2017–FY2022. Source: NIH Office of Extramural Research.

Figure 11: Lorenz curve showing the distribution of postdocs and total research funding in FY2023. Sources: Higher Education Research and Development Survey and Survey of Graduate Students and Postdoctorates.

Figure 12: Lorenz curve showing the distribution of postdocs, faculty and research publications. Sources: Higher Education Research and Development Survey, the Survey of Graduate Students and Postdoctorates, and Academic Analytics.

	2010	2015	2020	2022
Biomedical				
Graduate_Students	26.4	25.1	29.1	30.8
Postdocs	41.4	40.5	41.9	43
Regular_Faculty	22.1	22.5	22.1	24.1
Fed_R&D	34.4	37.5	38.6	38.5
Chemical_Engineering				
Graduate_Students	28.2	28.3	24.7	27.5
Postdocs	42.6	42	39.1	41.7
Regular_Faculty	23	20	19.1	19.2
Fed_R&D	33	33.2	33.1	36.7
Chemistry				
Graduate_Students	22.1	23.3	23.1	23.4
Postdocs	36.1	42.1	37.8	39.1
Regular_Faculty	19.9	21.2	19.5	21.9
Fed_R&D	31	32.5	28.3	28.1
Computer_Science				
Graduate_Students	32.6	41.1	49.2	48.7
Postdocs	49.3	52.5	54.7	56.4
Regular_Faculty	26.8	26.2	25.5	27.1
Fed_R&D	56.5	57.8	60	58.3
Economics				
Graduate_Students	27.2	28.8	30.2	33.4
Postdocs	67	66.2	60.9	66.8
Regular_Faculty	21.9	22.7	22.7	25.1
Fed_R&D	53.4	63.8	56	66
Electrical_Engineering				
Graduate_Students	34.2	32.4	34.1	37.8
Postdocs	46.7	48.1	43.6	42.7
Regular_Faculty	27	25.6	28.5	29.8
Fed_R&D	51.8	61.3	61.7	62.7
Psychology				
Graduate_Students	26.4	25.9	33.7	38.5
Postdocs	43.5	40.7	39.6	44.6
Regular_Faculty	22.7	21.5	22.9	23.3
Fed_R&D	31.9	33	33.2	32.6

Table 1: Percentage of Students, Postdocs, Faculty and Federal R&D Expenditures at the top 10% of institutions in each category, Selected Years.

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