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ABSTRACT

This report looks at trends from 1973 to 1993 in new science and engineering doctoral degree recipients' post-graduation plans in order to note changes in the proportion planning postdoctoral appointments (postdocs). Examination of this question found that between 1973 and 1993 the proportion of doctoral graduates with "definite plans" at the time of graduation declined nine percent from 75 to 66 percent. The decline was much steeper between 1988 and 1993 (8 percentage points) than between 1973 and 1988 (1 point). "Definite plans" were defined to mean a commitment for a job or postdoctoral appointment. In addition, the proportion of graduates planning an academic job declined from 51 percent in 1973 to 32 percent in 1993 while those whose definitely planned option was the postdoc increased from 21 percent to 39 percent over the same period. The review also looked at a sample of doctoral graduates from May/June 1990 with definite plans for a postdoc and examined what they were actually doing in September 1991. Of the sample, 59 percent were on post-doctoral appointment 15 to 16 months after graduation with the proportion higher in the life sciences that in the physical sciences. Finally, the analysis describes the number and characteristics of those reporting that they held postdocs in 1991, regardless of their plans at the time of degree award. Contains four tables. (JB)

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Office of Scientific and Engineering Personnel
Doctorate Records Project

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# Ph.D.s and Postdoctoral Appointments

In recent years the higher education community has been concerned that growing numbers of Ph.D.s are taking or extending postdoctoral appointments in order to wait for better job market conditions. Although overall demand for scientists and engineers has remained strong, there are fewer job opportunities in the academic sector and fewer positions in basic research—areas where Ph.D.s could traditionally expect to find employment.[1] New Ph.D.s, in particular, are having trouble finding jobs.[2] This situation has been attributed to a combination of changes, including cuts in defense spending, industrial restructuring, and reductions in the growth of federal R&D spending.

Postdoctoral appointments (or "postdocs") may be used to provide respite for those unable to find employment when the job market is poor. Alternatively, postdocs may be used to increase research skills and experience, to improve employment prospects, or to provide a chance to switch fields. Whether taken by choice or for lack of a better alternative, the increase in the number of postdocs over the past decade raises questions about their benefits and value. What are the motivations of those who apply? What ultimately happens to Ph.D.s who take these positions?

The postdoc is difficult to describe and quantify because it is both "further study" and "employment." Also, there is no common definition of the term. However, most people would agree that postdocs are temporary positions usually held by recent Ph.D. recipients who are doing full-time research under a mentor. Postdocs are commonly used to increase one's training in research prior to accepting a long-term professional job in academe or industry.

The National Research Council collects data that can be used in examining the status of postdocs. The Survey of Earned Doctorates (SED) is an annual census of all research doctorates at the time they earn their degree from a U.S. college or university. The Survey of Doctorate Recipients (SDR) is a biennial follow-up survey of employment outcomes based on approximately 8 percent of the doctorates in the SED.[3]. The SED asks about the postgraduation plans of new Ph.D.s, while the SDR collects data on positions actually held at a later point in time.

In this *Issues Brief* we first look at trends over the 1973-1993 time period in new Ph.D.s' postgraduation plans in order to note changes in the proportion planning postdocs. We then look at what a sample of Ph.D.s who graduated in May-June 1990 with definite plans for a postdoc were actually doing in September 1991 (the latest year for which data are available). Finally, we describe the number and characteristics of those reporting that they held postdocs in 1991, regardless of their plans at the time of degree award.

## More New Ph.D.s Have Uncertain Employment Plans

What proportion of graduating Ph.D.s have clear future plans and how has this changed over time? Between 1973 and 1993 the proportion of Ph.D.s with "definite" plans at the time of finishing the doctorate declined 9 percentage points, from 75 percent to 66 percent ("definite" plans means Ph.D.s who had a commitment for a job or postdoctoral appointment). The decline was much steeper, however, between 1988 and 1993 (8 points) than between 1973 and 1988 (1 point).

The amount of uncertainty Ph.D.s faced over this period as gauged by postgraduation plans differed considerably by broad field (see Table 1). In 1973 about three-quarters of Ph.D.s in all fields had definite postgraduation plans. By 1993 only life science Ph.D.s had sustained this proportion (74 percent). In engineering the proportion with definite plans dropped from 75 percent in 1973 to 57 percent in 1993. Humanists and social scientists saw similar declines, dropping 10 and 14 percentage points, respectively, between 1973 and 1993.

[1] National Academy of Sciences, *Reshaping the Graduate Education of Scientists and Engineers*, Washington, D.C., National Academy Press, 1995

[2] "No Ph.D.s Need Apply," *Newsweek*, December 5, 1994

[3] The SDR and SED are conducted by the National Research Council. The SED is sponsored by the National Science Foundation (NSF), the National Institutes of Health (NIH), the U.S. Department of Education (USED), the National Endowment for the Humanities (NEH), and the U.S. Department of Agriculture (USDA). The SDR is sponsored by the NSF, NIH, NEH, and the U.S. Department of Energy.

## More New Ph.D.s Are Planning Postdocs

What did those with definite plans report they were going to do immediately after receiving the doctorate? The proportion of graduates planning an academic job (not counting postdoctoral appointments) declined from 51 percent in 1973 to 32 percent in 1993 (see Table 2).[4] What did increase as a definitely planned option was the postdoc, from 21 percent to 39 percent over the time period (see Table 3).

The increase in the proportion of new graduates with definite plans for postdocs varied greatly by field. Life sciences—a field that traditionally offers many postdocs—saw the largest percentage-point increase in Ph.D.s with plans for a postdoc. By 1993 two-thirds (67 percent) of life scientists had definite plans for postdocs, up from 44 percent in 1973. While postdocs have also long been common for physical scientists, the proportion grew more slowly, increasing 11 points, to 49 percent in 1993. Definite plans for postdocs in engineering and the social sciences, fields that traditionally have awarded few postdocs, also grew at a fast pace during this time period. Engineering doubled and the social sciences (including psychology) more than doubled their 1973 proportions to 26 percent and 21 percent, respectively. Even in humanities, traditionally an area with very few postdocs, the proportion of new Ph.D.s with definite plans for postdocs doubled to 6 percent between 1973 and 1993. Thus, in all fields over the 20-year period the proportion of those with definite plans to work in academe declined while the proportion planning postdocs increased.

Men were slightly more likely than women to have definite plans for postdocs in 1993, 40 percent compared with 36 percent. In 1973 similar proportions of men and women had definite plans for postdocs—21 percent. In contrast, women were more likely than men to have definite plans for academic jobs, although this may reflect their respective field concentrations. In 1973, 62 percent of women and 49 percent of men planned a job in academe (see Table 2). By 1993, however, there had been about a 23-point drop in both groups: 39 percent of women and 27 percent of men had such plans.

## How Do Plans Compare with Later Outcomes?

In this section we compare plans with outcomes. Using the SDR, we looked at May-June 1990 doctorate recipients who had definite plans for postdocs to see what they were doing in September 1991, the latest time period for which data are available.[5] About 59 percent were on postdoctoral appointments 15 to 16 months after graduation. The proportion was higher in the life sciences (74 percent ) than in the physical sciences (59 percent). Why the difference between plans and outcomes? There could be several reasons: (1) it is possible that some Ph.D.s had completed their postdocs by September 1991 if the appointment had been less than 15 to 16 months in duration; (2) plans are just that and do not necessarily come to fruition; and (3) given that there is no universally understood definition of a postdoc, it may be that some Ph.D.s used different definitions when answering the SED and the SDR.

Thus, we can conclude that plans for postdoctoral study at the time of degree award do not necessarily correspond with status 15 to 16 months later. This may reflect a volatile job market, postdocs that had ended, or a problem in defining and counting postdocs. Although only 59 percent of Ph.Ds. with definite plans for postdocs held one at the time of the SDR, almost all Ph.D.s (96 percent) were employed. The proportion not employed and seeking employment (a traditional measure of unemployment) was only 1.2 percent in 1991.

## Regardless of Plans, Who Held a Postdoctoral Appointment in 1991?

Regardless of plans at the time of degree award, who actually held a postdoc in 1991? According to the SDR, there were 11,600 doctorates with degrees earned in the U.S. holding postdocs in 1991, most in the life sciences (7,300).[6] The physical sciences accounted for another 2,800, while all other fields had only 1,500 postdocs. Overall, the large majority of postdocs were men (69 percent), although that proportion varied considerably by field. In the physical sciences 81 percent were men, and in the life sciences 67 percent were men (see Table 4). By citizenship, about one in five postdocs with U.S.-earned doctorates were non-U.S. citizens (21 percent), compared with about one in three in the physical sciences (32 percent) and one in seven (16 percent) in the life sciences.

Where were postdocs working? Most were employed in the academic sector (77 percent), followed by government (9 percent), business/industry (4 percent), and "other" sectors combined (9 percent). The share in business/industry was somewhat higher in the physical sciences (7 percent), particularly compared with the life sciences (3 percent).

What were postdocs doing? Most (74 percent) named basic research as their primary work activity, that is, the activity on which they spent the most hours during a typical week on the job. Another 15 percent reported applied research as their primary activity. About 3 percent reported teaching, usually with basic or applied research named as their secondary work activity.

## What Do These Data Show?

Our data show that increasing numbers of Ph.D. recipients have uncertain employment prospects at the time of degree award. Further, among those with definite plans, fewer are planning jobs in academe. This may mean that there are

[4] In this *Issues Brief*, Ph.D.s with definite plans for postdocs or academic employment are expressed as a percentage of all those with definite plans.

[5] May-June graduates are the latest cohort included in the 1991 SDR and represent about 40 percent of all FY 1990 graduates.

[6] This estimate does not include postdocs with doctoral degrees from foreign institutions or those earned after June 30, 1990.

more job seekers in teaching and basic research than there are available positions. Some of the slack may be taken up by jobs in industry and applied research and some by postdocs. While the number of new graduates planning jobs in academe is decreasing, the number planning postdocs is clearly increasing.

Although more Ph.D. recipients are planning postdocs after earning their doctorates, these plans do not necessarily correspond with their status 15 to 16 months later. Our data do not explain the reasons for this difference or why more Ph.D.s are planning postdocs in the first place. Is it to increase their knowledge or training in research, to meet requirements for future employment, or do they perceive the postdoc as their only option in a tight job market? Answers to these questions—and to the question of what career benefits ultimately accrue to Ph.D.s who take these positions—are needed to facilitate decisionmaking by graduate students, academic administrators, and policymakers. Most would agree that postdocs offer important training for Ph.D.s planning research careers. However, increasing numbers of postdocs may be cause for concern if research jobs are scarce.

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For more information about the Survey of Earned Doctorates or the Survey of Doctorate Recipients, please contact the National Research Council, 2101 Constitution Ave., Room TJ 2006, Washington, DC 20418. Write to the above address, call (202) 334-3161, or send e-mail to phdsurvy@nas.edu.

Table 1 Ph.D.s with Definite Postgraduation Plans in the United States upon Graduation, 1973-1993, (percent)

| | 1973 | 1978 | 1983 | 1988 | 1991 | 1993 |
|---|---|---|---|---|---|---|
| Total | 75.3 | 72.2 | 72.3 | 74.4 | 70.0 | 65.9 |
| Physical sciences | 74.1 | 77.1 | 77.8 | 78.9 | 71.1 | 66.5 |
| Engineering | 75.2 | 80.0 | 77.8 | 73.8 | 64.7 | 57.1 |
| Life sciences | 76.2 | 76.5 | 75.0 | 77.0 | 74.0 | 73.8 |
| Social sciences | 79.8 | 70.2 | 69.0 | 73.2 | 71.4 | 66.4 |
| Humanities | 71.2 | 61.3 | 63.6 | 66.2 | 65.0 | 60.8 |
| Male | 77.1 | 74.3 | 74.5 | 76.0 | 70.0 | 65.4 |
| Female | 66.5 | 65.6 | 67.3 | 71.1 | 70.0 | 66.8 |

See NOTE, Table 3.

Table 2 Ph.D.s Planning Employment in Academe in the United States (Excluding Postdoctoral Appointments) as a Percentage of Those with Definite Plans, 1973-1993

| | 1973 | 1978 | 1983 | 1988 | 1991 | 1993 |
|---|---|---|---|---|---|---|
| Total | 50.9 | 40.4 | 36.1 | 32.3 | 32.7 | 31.5 |
| Physical sciences | 31.0 | 23.7 | 22.7 | 20.4 | 20.5 | 19.9 |
| Engineering | 21.8 | 21.4 | 29.3 | 25.8 | 20.5 | 17 4 |
| Life sciences | 35.5 | 25.9 | 21.4 | 18.4 | 17.6 | 16.4 |
| Social sciences | 63.3 | 50.4 | 42.2 | 38.9 | 42.1 | 39.6 |
| Humanities | 88.4 | 78.8 | 76.6 | 74.3 | 78.4 | 80.5 |
| Male | 49.0 | 37.6 | 33.7 | 29.9 | 28.7 | 27.0 |
| Female | 61.5 | 50.6 | 42.1 | 37.6 | 40.1 | 39.2 |

See NOTE, Table 3.

Table 3 Ph.D.s Planning Postdoctoral Appointments in the United States as a Percentage of Those with Definite Plans, 1973-1993

| | 1973 | 1978 | 1983 | 1988 | 1991 | 1993 |
|---|---|---|---|---|---|---|
| Total | 21.2 | 27.7 | 29.1 | 35.2 | 35.6 | 38.5 |
| Physical sciences | 38.0 | 38.8 | 37.3 | 48.1 | 46.7 | 49.1 |
| Engineering | 12.6 | 15.6 | 12.9 | 19.6 | 20.4 | 25.8 |
| Life sciences | 43.9 | 56.1 | 59.4 | 64.9 | 65.5 | 67.3 |
| Social sciences | 8.3 | 13.4 | 14.0 | 15.9 | 17.4 | 20.8 |
| Humanities | 3.3 | 4.3 | 3.6 | 6.3 | 6.4 | 5.7 |
| Male | 21.3 | 28.3 | 29.5 | 35.9 | 37.1 | 40.1 |
| Female | 21.0 | 25.8 | 28.1 | 33.6 | 32.8 | 35.9 |

NOTE: "Total " excludes education and professional/other fields. Physical sciences includes mathematics and computer sciences. Employment in academe includes two- and four-year colleges and universities, medical schools, and junior or community colleges.

SOURCE: National Research Council, Survey of Earned Doctorates.

Table 4 Ph.D.s with Postdoctoral Appointments in the United States in 1991 (percent)

| | Total All Fields | Physical Sciences | Life Sciences |
|---|---|---|---|
| Gender | | | |
| Male | 68.9 | 81.1 | 66.6 |
| Female | 31.1 | 18.9 | 33.4 |
| Citizenship | | | |
| U.S. citizen | 79.3 | 68.2 | 84.5 |
| Non-U.S. citizen | 20.7 | 31.8 | 15.5 |
| Employment Sector | | | |
| Academe | 76.6 | 75.8 | 76.5 |
| Business/industry | 4.1 | 7.2 | 3.3 |
| Government | 9.2 | 10.0 | 9.2 |
| Other | 9.3 | 6.3 | 10.4 |
| Primary Work Activity | | | |
| Basic research | 74.2 | 78.1 | 79.6 |
| Applied research | 15.2 | 16.1 | 13.0 |
| Teaching | 2.8 | 2.0 | 0.2 |
| Other | 6.6 | 3.1 | 6.5 |

NOTE: Excludes Ph.D.s with doctoral degrees from non-U.S. institutions. "Total All Fields" includes physical sciences, engineering, life sciences, social sciences, and humanities. Percentages may not add to 100 because of missing data.

SOURCE: National Research Council, Survey of Doctorate Recipients.