

Why pursue the postdoc path?

Complex, diverse rationales require nuanced policies

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Concerns have been raised about labor market imbalances that see a growing number of postdoctoral researchers pursuing a limited number of faculty positions (1–4). Proposed demand-side solutions include capping the duration of postdoc training or hiring more permanent staff scientists (1, 4, 5). Others focus on the supply side, arguing that Ph.D.'s need better information about labor market conditions and nonacademic career options (4, 6, 7). Unfortunately, it is not

POLICY clear why Ph.D. students pursue postdoc positions and how their plans depend on individual-level factors, such as career goals or labor market perceptions. We describe evidence of a “default” postdoc and of “holding patterns” that suggest a need for increased attention to career planning among students, their mentors, graduate schools, and funders.

We surveyed Ph.D. students at 39 research-intensive U.S. universities in the spring of 2010 and again in the spring of 2013. We also used online sources to hand-collect information on respondents’ career outcomes. Details on survey strategy, sample characteristics, and measures are provided in the supplementary materials (SM, tables S1 to S3). We focus on 5928 respondents who, in 2010, were enrolled in Ph.D. programs in the biological and life sciences (37.47%), chemistry (11.23%), physics (14.27%), engineering (27.14%), and computer sciences (9.89%). Our featured analyses distinguish broadly between biological and life sciences and other fields; see SM for more detailed field comparisons (fig. S1 and table S3).

GOALS, INFORMATION, ABILITY. In 2010, ~79% of students in the biological and life sciences and 53% in other fields planned a postdoc. We examine how students’ plans relate to three key factors: career goals, information about labor market demand, and proxies for ability. It is often assumed that Ph.D.’s do a postdoc primarily as a pathway

to a research-oriented faculty position (4, 8). We asked respondents to ignore job availability and rate the attractiveness of different academic and nonacademic career paths (see SM). Students planning a postdoc are more likely to have academic career goals (see the first figure). However, career goals are quite diverse even among these postdoc-planning students, with more than one-third not rating a research-oriented faculty position as their most attractive career. This may be surprising, given that the postdoc is not typically considered a stepping-stone toward nonacademic careers. However, 78% of re-

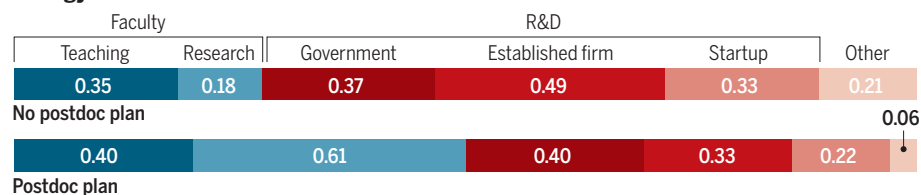
S5). However, students’ beliefs regarding how many years of postdoc are required to get a full-time position in their preferred sector—likely higher when the supply of graduates exceeds demand—are a strong predictor of postdoc plans.

If high-ability scientists have a greater chance of securing scarce full-time positions, they face a lower risk of “wasting” time in a postdoc and should be more likely to plan one. On the other hand, they may feel less of a need to increase their market value through postdoctoral training. To examine the role of ability, we used three objective proxies: respondents’ peer-reviewed publications, fellowships from a federal agency, and their Ph.D. program’s National Research Council (NRC) ranking. Respondents also subjectively assessed their research ability relative to peers. Biological and life scientists with higher scores on all measures are more likely to plan a postdoc (table S4). Fellowships,

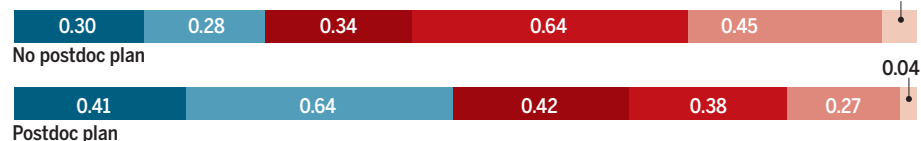
Students’ highest-rated careers

Share of students giving a particular career their highest attractiveness rating, putting job availability aside (careers rated independently, ties possible). *N* = 5911.

Biology or life sciences



Other fields



spondents in the biological and life sciences and 42% in other fields believed that at least 1 year of postdoc training was required for a Ph.D.-level research and development (R&D) position in industry in their field (see SM). Unfortunately, there is little empirical evidence showing whether the postdoc benefits graduates pursuing nonacademic careers (1).

Postdoc plans may also depend on the perceived demand for full-time researchers. Limited job availability may discourage individuals from investing in low-paid postdoc training if the chances of obtaining full-time positions that reward this training are slim (9). On the other hand, challenging labor markets may encourage students to pursue a postdoc in order to become more competitive. We found that perceived job availability in academia and industry has no systematic relation with postdoc plans (tables S4 and

NRC ranking, and subjective ability also predict postdoc plans in other fields. This partly reflects that higher-ability students are more likely to aspire to faculty positions (see SM).

Only 62% of biological and life sciences students (56% in other fields) reported having thought about their careers to a large or great extent. Those who had thought more about their careers are less likely to plan a postdoc, especially in the biological and life sciences (table S4). This may reflect that many students see a postdoc as the “default” until they explicitly consider their long-term career paths (4). Advanced students are less likely to plan a postdoc, consistent with learning processes and a declining interest in faculty careers over time (10, 11). Foreign students who are unsure whether to stay in the United States after graduation are more likely to plan a postdoc than those intending

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to leave, perhaps because the postdoc keeps options open (table S5). Respondents who agreed to the statement “When I fail in something, I am determined to continue trying until I succeed” are more likely to plan a postdoc, which indicates that “persistence” may be important not just for scientific productivity (12) but also for career decisions.

CAREERS AND MARKETS. Of students who graduated by 2013, 74% took a postdoc in the biological and life sciences, compared with 46% in other fields (fig. S2). We asked postdoc respondents to the 2013 survey ($N = 1006$) why they did a postdoc. The most frequent reason was “A postdoc increases the chance to get my desired job.” Among those without postdoc plans in 2010, the most frequent reason was “I experienced difficulty finding another job” (fig. S3). In conjunction with our earlier results, these patterns suggest that low demand for full-time researchers leads many students to plan postdoc training well before graduation, but also forces some into unplanned postdoc “holding patterns” afterwards (13). The observed transitions into postdocs were likely facilitated by plentiful positions (4), and demand for postdoc trainees may have been particularly strong because of funding from the 2009 American Recovery and Reinvestment Act.

When asked whether they started the postdoc primarily to obtain a tenure-track faculty position, 60% of bio-life scientists and 51% of other scientists answered yes. When asked about their single most preferred career, 43% of respondents in the biological and life sciences and 44% in other fields chose faculty with a focus on research, but the majority preferred other career paths (fig. S4).

A common concern is that junior scientists—especially those aspiring to faculty positions—lack information about career prospects in academia (1, 9, 14). We asked respondents to estimate the share of Ph.D.’s in their field who hold a tenure-track position 5 years after graduation and compared their estimates with actual shares published in the Science and Engineering Indicators (15). Respondents are very accurate (see the box above and fig. S5), although more recent actual shares in the biological and life sciences have dropped below their expectations.

Given that not all Ph.D.’s aspire to faculty positions, graduates who actively pursue this path have a higher probability of becoming faculty than the population average (see SM).

We asked postdocs who aspire to faculty positions to estimate the probability of their holding a tenure-track position 5 years after graduation. We see evidence of overconfidence among postdocs in the biological and life sciences but not in chemistry or physics (table S6). Overall, postdocs have a good sense of conditions in the academic labor market, although some may be overconfident regarding their own chances of securing a faculty position.

Finally, only 4% of biological and life sciences postdocs felt a “severe lack of information” regarding careers in academic research, but that share increased to 21% for research careers in government, 34% in established firms, 42% in startups, and 44% for nonresearch careers. Corresponding figures in other fields are not much lower (table S3), which suggests that a substantial share of junior scientists proceeded to the postdoc stage without sufficient information to evaluate nonacademic career options.

BETTER DATA, BETTER PLANNING. Many students plan postdocs yet do not aspire to the tenure track. A large share of postdocs prefers careers outside of academia. Thus, comparing numbers of graduates or postdocs to available faculty positions provides limited insight into labor market imbalances. Our results give urgency to the National Academies’ (4) recommendation to collect better data on junior scientists’ career aspirations, which would enable more nuanced comparisons of career goals and outcomes. Many graduates pursue a postdoc with the goal to obtain nonacademic positions, which highlights the need for data on whether and how nonacademic employers require and reward postdoctoral training (4, 16).

We find that challenging labor markets encourage rather than discourage students to invest in postdoctoral training. Although this seems logical if students are strongly committed to a particular career, it provides an individual-level explanation for why the supply of postdocs does not decrease despite low demand for full-time researchers (13) and potentially contributes to persistent labor market imbalances (9, 14). Whereas the recent National Academies report recommends that students make career plans early in the Ph.D. program, we argue that they should consider labor market conditions and career options before starting a Ph.D. program. Do-

ing so may avoid escalating commitment to a research career and may prevent individuals from entering a postdoc holding pattern. Graduate schools could encourage career planning by requiring that applicants analyze different career options and justify why a Ph.D. is the most promising path forward. Funding agencies could implement similar requirements, especially in conjunction with moving a larger share of funding from research grants to training grants and individual fellowships (4, 5).

Postdocs know that only a small share of graduates will obtain a faculty position, and warnings about limited job prospects in academia may have little impact on decisions to pursue postdocs and academic research. However, junior scientists require better information on nonacademic careers, consistent with concerns expressed by the National Academies and the National Institutes of Health (4, 6). This holds in the biological sciences and in other fields. Better career information should come from advisers but also from sources such as postdoc offices, professional associations, or internships and experiential career development opportunities (e.g., as part of NIH’s BEST program). Just as important, students need to actively access and process the available information and seriously consider the implications for their own careers (4, 7). ■

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