

CAREERS

STARTING OUT Efforts to track PhD careers get under way slowly **p.122**

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COLUMN

Wanted: information

Detailed career data will help people to plan for life after a PhD, say **Viviane Callier** and **Nathan L. Vanderford**.

Most students who enrol in US science and engineering PhD programmes hope to pursue an academic career. However, the gulf between the supply of newly minted PhDs and the availability of faculty positions widens each year. Some 36,000 people earned science and engineering PhDs in the United States in 2011, but US universities create only around 3,000 tenure-track positions annually. And with about 70% of those graduates taking a postdoctorate (M. Schillebeeckx, B. Maricque and C. Lewis *Nature Biotechnol.* **31**, 938–941; 2013), many trainees end up in a holding pattern, waiting for faculty jobs that are unlikely to materialize.

This is because the higher-education sector has not delivered an essential component

of an efficient market: current and precise information about job prospects, including the specific attributes and training that have enabled PhD holders to find success in and outside academia, and the differences in those job markets for science, technology, engineering and mathematics (STEM) subfields.

Although some trainees may be told that faculty positions are a long shot, self-delusion is often part of the decision to pursue lengthy postdoctoral fellowships. After all, those who go to graduate school undeterred were often at the top of their undergraduate class, and believe they can 'beat the odds' of the job market. They have never experienced what it is like to be average — surrounded by equally bright peers. Of course, the research enterprise colludes

in this self-delusion, because it would not survive without the cheap labour supplied by graduate students and postdocs. In addition, trainees may have the intellectual ability to excel in academia, but many are left unprepared for the financial, psychological and personal costs of being on the academic job market for several years. Nor do many of them fully grasp the cost of waiting for a job that might never materialize. Students may remain woefully uninformed about alternatives, because there is even less information about the job market for non-faculty careers, or about the combination of skills and experience that are required to land a job outside academia.

Without better information about the specific set of qualifications, skills and experience required for finding a tenure-track or non-academic job in individual STEM fields, the job market is unlikely to be self-adjusting. Institutional demand for cheap research labour will continue to pull in hordes of graduate students and postdocs, even though the demand for tenure-track faculty members is vanishingly small.

Those pursuing a PhD need a more accurate picture of the academic and non-academic job markets, and they need it well before they graduate. This would provide a smooth transition rather than a rude awakening upon graduation. Federal agencies such as the US National Institutes of Health (NIH) and the US National Science Foundation (NSF) provide support for most US graduate students and postdocs, and they should also step up as information brokers. They should track career outcomes for academics and beyond, and gather data to compare people with and without PhDs in similar industries or capacities so that potential candidates can assess whether a PhD programme is likely to pay off. This information will not only benefit trainees, but also help federal agencies to manage the investment of government money in training STEM graduates. When graduates have limited career options that match their training, the return on investment is suboptimal.

Trainees need to know what employers are looking for. For faculty jobs, publications, gender and institutional prestige play a part, but so do complementarity with potential colleagues' research and an institution's orientation towards research, teaching and diversity. The criteria for hiring in non-academic careers are different, with an emphasis on transferable skills such as leadership, communication ►

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► and teamwork. Non-academic employers also value work experience — sometimes more than academic credentials — and trainees who are interested in non-academic careers should gain this experience early on to avoid the common PhD catch-22 of being labelled simultaneously over- and under-qualified.

For the sake of future scientists, information about the current and projected state of the job market should be regularly collected, analysed and disseminated. Universities should curate data about former trainees. For academics, that information should include their grant, publication and teaching records as well as outreach and mentoring activities, and the criteria that academic hiring committees use to evaluate candidates. For non-academics, data should include the training, internships and work experience that led to employment.

The US National Postdoctoral Association in Washington DC is collecting data about postdocs' career paths as well as about institutional compensation, benefits and career services (see page 122). The NSF this winter launched an Early Career Doctorates survey that will gather in-depth information about postdocs and others who have earned their doctorates within the past ten years. The NIH's newly created Division of Biomedical Research Workforce in Washington DC may become the ideal organization for gathering and disseminating data about PhD graduates in the biomedical sciences.

These data will help funding agencies to craft policies that encourage institutions to give people with PhDs options for careers in non-faculty positions. One way to do this is to provide diverse education and training to PhD trainees so they can pursue careers in industry, consulting, entrepreneurship, science policy, writing and editing, administration or management. Federal funding agencies must find ways to ease pressure on trainees to work day and night for publications and grants, and instead foster ways to gain work experience and explore non-academic career paths while still in training.

These long-term solutions will not help current graduate students and postdocs, who must seek professional-development counselling, develop transferable skills and network within and outside academia. Ultimately, the careers of hundreds of thousands of future PhD holders depend on access to career information that will help to better match supply with demand. ■

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POSTGRADUATE CAREERS

The hunt for the elusive alumni

New efforts aim to track the careers of postgraduates.

BY PAUL SMAGLIK

Finding a job after finishing a PhD can be a tough slog. But a handful of US- and UK-based data-gathering initiatives could help science PhD holders to make more-informed decisions about their career options.

Previous efforts to track post-PhD career outcomes have focused mainly on one-off surveys, which usually offer little information beyond broad trends. Many also exclude postdoctoral researchers, who are difficult to follow if they work under a principal investigator's grant or are employed under a different job title.

In January, the US Council of Graduate Schools (CGS) in Washington DC published a report, *Understanding PhD Career Pathways for Program Improvement*, that calls for better measurement of postgraduate career outcomes. It estimates that about half of PhD graduates in science, technology, engineering and maths (STEM) find their first jobs outside academic institutions, but little other information is available. "We do not know the specifics of their careers: the nature and kinds of work produced and their long-term trajectories," the report says. It asks member institutions to use social media to locate and to conduct surveys of alumni.

Some US institutions, including Vanderbilt University in Nashville, Tennessee, have already initiated alumni-tracking schemes. Roger Chalkley, who heads Vanderbilt's biomedical research education and training programme, has started tracking the career paths of postdocs and graduate students using publication records and LinkedIn, among other social-media sites.

Vanderbilt's tracking results broadly mirror the trends reported by the CGS. About half of the university's STEM alumni stay in academic positions, although only about 20% land tenure-track jobs.

The other PhD graduates take on teaching, administration or laboratory-management positions, says Chalkley. "There's been an increasing flow of postdocs going to non-tenure research tracks."

Social-media sites are a key component of a global tracking venture launched by Vitae, a UK-based careers-support organization for researchers. Rather than seeking quantitative data about careers — the percentage of scientists who go into academic, industrial or



government positions, for example — Vitae is gathering information about the career paths of specific individuals.

This approach is useful, says Vitae head Janet Metcalfe, because the biggest information gap is in what junior scientists do after their postdoctoral research — particularly if they do not land an academic position. "That's what people really want to know — if I don't make it on the academic route, what are my prospects?" she says.

The venture's first phase drew around 600 respondents: half were from the United Kingdom and the rest came from all over the world. Vitae will publish its results this month, although it has already posted several dozen stories of respondents' career paths online; these stories show that scientists can find professional fulfilment outside academic institutions, Metcalfe says. A second phase is under way: the results will be released this summer.

Longitudinal studies that follow large groups of scientists over time can present a clear picture of career progression, says Patrick Mulvey, a statistician at the American Institute of Physics in College Park, Maryland.

This winter, the US National Science Foundation launched just such a study, which will follow a cohort of scientists who earned their doctorates in the past decade. The study aims to bridge the gap between conventional surveys, which use rigorous sampling, and more-qualitative surveys, which emphasize individual stories.

When it delivers its results in 2016, the study should provide a cohesive picture of why each participant made their career choices and how they feel about them. But for now, the hunt for the elusive alumni continues. ■

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