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Better training for non-academic careers

As more PhD students and postdoctoral fellows transition to professions outside academia, training programmes must prepare scientists for these alternative careers.

Traditionally, career paths for research scientists have involved completing a Bachelor's and Master's degree, then obtaining a PhD, performing several years of postdoctoral training in which research and teaching experience is gained, and then becoming a tenure-tracked assistant professor, associate professor and, finally, full professor. There are many reasons why an academic career (especially in microbiology) is highly desirable. A previous opinion piece in *mSphere* highlighted the positives, which included academic freedom, leadership opportunities, working with talented trainees and networking with other researchers[1]. However, a report published by The Royal Society stated that only 0.45% of students that complete a PhD will secure a professorship at a university. While this number may depend on the field of study and country, and there are alternative permanent positions within the sphere of an academic career, it is widely accepted that there is an imbalance between the number of early-career researchers (ECRs) and the number of available permanent faculty positions[2]. Another study followed a cohort of PhD students from 39 US research universities and found that while the vast majority of students start the PhD interested in an academic research career, over time 25% lose interest[3]. This is likely due to a myriad of factors, but one that may contribute to this decline is the relative job insecurity before landing a permanent position at a university. The majority of academic jobs at the postdoc level are on fixed-term contracts and tenure track positions come with the risk of not obtaining tenure[4]. It is therefore not surprising that a growing number of ECRs are considering alternatives.

Given the nature of a PhD, many may feel that their skills reflect the often highly specialized research projects they are working on and that they cannot be directly applied to non-academic jobs. However, ECRs acquire a very diverse set of skills during their training in the lab, including critical thinking, resilience, data analysis and problem-solving, to name just a few. This is usually accompanied by teaching experience, as well as project management, science communication, teamwork and writing skills developed through publications and grant applications. Nevertheless, the vast majority of PhD programmes do not have structured training to support students in the transition to a non-research-based career. Indeed, a report from the Organisation for Economic Co-operation and Development concluded that research institutions around the world should increase their efforts to broaden training for PhD students and postdoctoral researchers to prepare them for non-academic jobs[4].

While uncommon, opportunities for non-research-based training in PhD programmes do exist. The Biotechnology and Biological Sciences Research Council, part of UK Research and Innovation, mandates a three month internship as part of their Doctoral Training Partnerships PhD programme. This provides students with the opportunity to gain work experience outside the lab, for example, in patent law, editorial, public engagement or medical writing. For postdocs, Prosper was launched in 2019 by three UK universities funded by Research England with the aim of supporting meaningful career development. Interestingly, their model actively involves employers from various sectors and principal investigators, both of which have critical roles in career choices made by ECRs. Some universities are also using virtual or self-guided training courses on non-academic careers, providing guidance on how to get experience outside academia, and information on potential career options and how to identify key transferable skills such as networking, project management, communication and leadership. These examples demonstrate what universities and funders can do to support ECRs in their career development both in and outside academia. However, broader implementation is needed.

For any readers considering a non-academic career, *Nature* has published a 'Careers toolkit'. This includes several articles providing guidance on writing a great non-academic CV[5], securing internships[6], working in science communication[7], transitioning from academia to industry[8] and building a career in scientific publishing[9]. Further information on non-academic jobs can be found on the Nature Careers site, and other articles have summarized alternative career paths for PhDs, including museum curation, working for a non-profit organization or working as a data scientist in industry. Other resources include 'Versatile PhD', 'Jobs on Toast' and 'From PhD to Life', as well as a *Nature* podcast on 'how to select your first scientific role in industry'.

As editors of *Nature Microbiology*, we have all transitioned from academia to an alternative career. While not active researchers, we are still members of the scientific community attending conferences, reading and evaluating articles for publication and commissioning content on a wide range of topics. If this piques your interest, two of our editors (locum chief editor Emily White and senior editor Kyle Frischkorn) have recently contributed to the International Society for Microbial Ecology's 'Career Choice Interviews', where they explain their transition from the lab to working as a journal editor. You can also read the thoughts of previous team members here, who have all gone on to pursue different career paths (although all somewhat related to editing) and our former chief editor, Andrew Jermy, has previously summarized what a modern science editor should strive for. During our travels to conferences or when visiting institutions, we often give career talks that describe our career journeys and share tips with anyone who is interested in being an editor. So, if you see us out and about, please do grab us for a chat.

Although steps are being taken to provide ECRs with valuable information on alternative career options, overall, there is still a lack of broad and systematic information and training on this topic. Providing careers knowledge and guidance to these highly skilled researchers should be a top priority for universities and funders to unlock opportunities, translate research skills and increase career satisfaction.

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