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Stockpiling PhDs for the new millenium

In September 1998, the US National Research Council (NRC) published a report[1] arguing that too many PhDs are being awarded in the life sciences, so that many current students will be unable to find jobs that use their scientific training. The report made several recommendations, the most controversial of which was that PhD programs should be frozen to prevent further growth. Although the report has been widely discussed, there is little sign that its recommendations are being heeded. At the Society for Neuroscience meeting this October, the US-based Association of Neuroscience Departments and Programs (ANDP) presented its own findings on recent trends in US neuroscience training. The ANDP survey (which will be published early next year) found a threefold increase in the annual number of PhD degrees awarded specifically in neuroscience over the last ten years; moreover, the total number of students in neuroscience PhD programs has almost doubled between 1996 and 1998.

This continuing expansion, however, may be short sighted. The fundamental problem is that principal investigators are training young scientists to follow in their footsteps at a much higher rate than such positions are becoming available. In a memorable analogy, Shirley Tilghman of Princeton University, who chaired the committee that prepared the NRC report, compared the current situation to that of planes in a 'holding pattern' above an airport, burning up fuel as they wait for an opportunity to land. The stack is growing larger; more scientists are spending longer in graduate and postdoctoral training, working long hours for low pay in the hope of building a publication record that will eventually land them a job. When they reach the bottleneck of finding a tenure-track position, many will be in their late thirties, having spent more than a decade in training that is often too specialized to be useful outside their chosen field.

This rapid increase in young trainees is certainly beneficial to established investigators. It fosters intense competition, increases the pool of cheap labor and gives faculty members leverage over their junior colleagues. One might even argue that it benefits society as a whole, by providing taxpayers with more research for their money. However, as the NRC report noted, it is likely to have negative effects in the longer term, promoting disillusionment and discouraging future students from embarking on research careers. Such problems are already becoming apparent in the UK, says Martin Raff of University College London, who feels that poor job prospects are leading to a decline in the quality of students. Raff is chair of the UK life sciences committee, which favors a decrease in the number of graduate students trained and an increase in stipends for the remaining positions. Raff himself has trained about 75 scientists in his career, and as he says, "that's not a steady state".

The NRC report cited neuroscience as a growth area, and some people would argue that the trends identified in the report are not applicable to this field. Whether or not this is true in the short term, however, growth cannot continue indefinitely—the question is not whether but when it will end. It is impossible to anticipate the future of public funding for neuroscience or the growth of the biotechnology industry, so it is very difficult to predict the prospects of current graduate students, who will enter the job market in the next decade.

The 'Darwinian' view is that the situation should be left to market forces, and that students will stop entering the field once the job market is saturated. This, however, ignores the long time lag in the feedback loop, and it also assumes that students will make sensible decisions based on complete information. One recommendation of the NRC report was that graduate programs should provide prospective students with statistics on the employment of past graduates. In reality, however, such information remains difficult to find. Although the ANDP survey found that few neuroscience PhDs were unemployed, it did not determine what percentage were in tenure-track jobs, and individual departments are understandably reluctant to gather and disclose information that might discourage prospective applicants. One survey of US biochemistry PhDs found that only 34% were in tenure-track faculty positions 10 years after their doctorate[2], and this picture is unlikely to be different for neuroscientists.

Yet those who run the system have little incentive to change it. Although many faculty members acknowledge that the job market for young scientists is becoming more difficult, few volunteer to cut the size of their own labs in response. So what can or should be done? If, as the NRC recommends, accurate and up-to-date information about career outcomes is widely available to young scientists (preferably at the undergraduate level) and discussed explicitly by their mentors, students can make informed career decisions. Graduate students should also be provided with a dignified exit route if they choose not to pursue a PhD, and departments should establish (or strengthen) the masters degree programs geared toward these students. Programs could also do much more to prepare students for careers outside academia. Although some have started to expose their students to non-academic career options such as science journalism, patent law or consulting, it is important to recognize that these jobs are also rare and competitive and will not absorb the slack. Therefore, students need to be better prepared for other careers, for instance by developing their management, communication and computational skills, and by avoiding early overspecialization. Perhaps most importantly, a cultural change in the research environment is needed. To many scientists, the phrase 'alternative careers' is hardly more distinguished than 'alternative medicine'. This needs to change, so that students choosing non-academic paths are not stigmatized as failures or drop-outs.

1. *Trends in the Early Careers of Life Scientists* (National Academy Press, Washington DC, 1998).
2. Nerad, M. & Cerny, J. *Science* **285**, 1533–1535 (1999).