

**CROSS TALK**

# How do we fix the broken postdoc pipeline?

BY GREG BOUSTEAD

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Earlier this year, *Nature* **published an article** on the enormous challenges many postdoctoral researchers face in securing academic appointments. The article **struck a nerve**. To many, it's basic math: too few faculty jobs relative to the number of postdocs. But is there a clever fix?

We asked autism researchers at different stages in their careers to come up with possible solutions to this 'postdoc pileup.'

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## You can't get there from here

Where I grew up, the winding Vermont roads and backwoods trails sometimes meant we had to break unwanted news to a weary traveler: 'You can't get there from here.' We never meant it as an absolute, but when someone arrived in a Mercedes and wanted to get to a cabin in the middle of a bog, it turned out to be a reality.

The solution was simple, however. Had they planned ahead and outfitted their sedan with 40-inch 'swampers' (a.k.a. mud tires), they could have made it through the bog swimmingly.

Similar logic holds true in science. With the right mix of tools and training, however unconventional,

Ph.D. students can get where they need to go. But they often lack these tools.

The trouble starts with graduate science education, which is geared to churn out academic scientists. The measure of success has traditionally been how many of their students go on to postdoctoral fellowships and how many of those postdocs go on to faculty positions. Graduate programs and the funding agencies both dictate this one-track measure. So it's no wonder that each new crop of bright-eyed graduate students arrives with the same expectations.

As the *Nature* article and many others argue, the expectation of an academic job is not realistic given the lack of availability of these jobs and current funding for research. So it seems the real problem is that scientific training and expectations do not match the reality of the job market. In other words, it should not take a postdoc 3, 4 or 10-plus years of working 70-hour weeks for a fraction of what their skills are worth to come to the harsh reality that no faculty position awaits.

The solution should start with graduate education and even the graduate school admissions process. Students need to be realistic about the odds of getting a faculty job. Perhaps more important, they should temper this reality with the exciting fact that the value of a Ph.D. extends much further than academia.

Doctoral and postdoctoral programs need to balance academic training with that needed to pursue alternative careers. It's no longer enough to have a seminar, brown bag lunch or evening session on 'alternative career paths.' The reality is that faculty jobs are now the alternative career. Therefore, training and access to careers outside of academia need to be fully integrated into graduate education and postdoctoral programs.

This is no easy change. But the alternatives — such as increasing postdoc salaries, enforcing time limits or applying other Band-Aid solutions — are superficial when what is ultimately needed is systemic change.

That said, I'm currently in the throes of my postdoc fellowship and do see merit in its toils. I see value in the survival-of-the-fittest method — or whatever Nietzschean aphorism applies — and understand that there has to be a selection process to determine who becomes a principal investigator in the sciences.

Still, we need to truly respect that it's not a singular path or destination. To ensure that the incredible aptitude of doctoral trainees is realized, we need to get them the type of tires they need to drive both on and off the beaten path.

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Gul Dolen

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## A culture of dissent can effect change

The postdoctoral fellowship was originally conceived as a sort of ‘pre-sabbatical’ period that allowed a freshly minted Ph.D. to learn a new technique before starting his or her own lab. A generation or two ago, these fellowships were typically between one and three years long. Longer postdoc stints were uncommon — not only because permanent academic positions were more abundant, but also because it was possible to collect enough data for publication in the most prestigious journals in that amount of time.

Comparing my own postdoctoral experience to that of the generation before me, the transformation is striking. For example, the first *Nature* paper published by each of my mentors contained fewer than four figures (Bear, *et al.*, 1983<sup>1</sup>; Malenka, *et al.*, 1986<sup>2</sup>; Kauer *et al.*, 1988<sup>3</sup>), while mine had 22 (Dolen, *et al.*, 2013<sup>4</sup>). What’s more, I was roughly 10 years older than they’d been at the time of publication, and my fellowship was as much as four times as long.

Four possible solutions emerged from the *Nature* article: term limits, reducing the number of postdoc positions, increasing postdoc salaries and creating more staff scientist positions. Each of these possibilities is reasonable, but they restrict the scope of the discussion to what I would call ‘troubleshooting austerity.’

It is painfully obvious that the real problem is the dearth of permanent academic positions in the face of **recent funding cuts**. Yet eliminating austerity is rarely even considered as a possible solution.

To seriously participate in the worldwide debate over austerity, we as a scientific community must be better informed about the economic and political structure that produced it. For example, it is significant to note that the U.S. **federal government spends** only 3 percent of its discretionary budget on science, but about 55 percent on the military. What’s more, the entire discretionary budget is less than what the government gives away in tax breaks to various groups (which notably does not include postdocs receiving federal fellowship awards).

Together, these figures are a brutal reminder of the failure of academic scientists to influence political discourse. How can we do better?

Perhaps the most important side effect of the tenure system is protecting scientists who speak their

minds and thereby enabling intellectual and political dissent among the academic class. Unfortunately, this protection has been eroded by the increasing financial insecurity imposed by austerity.

In my experience, there is a tacit hostility toward political discourse — at conferences, at dinners with invited speakers and even, to some extent, at private faculty meetings. I suspect this is partly due to a fear that the government will resent scientists for ‘taking sides’ on politically sensitive issues. What this approach fails to recognize is that Congress will ignore us if we don’t take a strong position.

I believe encouraging a culture of dissent is a priority if we are to effect meaningful policy change. Integral to this cultural shift is the recognition that we as scientists must develop and promote legislative reforms that ‘take a side’ — which need not, and indeed should not, be restricted to two-party politics — in order to achieve the political and economic goals that best serve science.

In the end, fearless political engagement from the research community will get us closer to fixing a broken postdoctoral system than will tweaks to academic programs.

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## A one-size-fits-all model no longer works

The past two decades have witnessed a crisis in clinical research, evidenced by the dwindling number of academic scientists, particularly in the field of mental health. I serve in multiple roles directing postdoctoral training programs, locally and nationally. I believe that three major factors have contributed to the difficulty.

First, we need to pay postdoctoral fellows more, as their salaries are often lower than even those of entry-level research assistants. In the absence of reasonable salaries, it is all too tempting, for neuroscientists, clinicians and physicians in particular, to leave academic medicine or neuroscience and pursue private practice or industry opportunities.

Second, as the National Institutes of Health **budgets become tighter**, academic environments need to step up to provide more stable financial support for junior investigators and junior faculty.

Finally, I think younger generations want more balance in their training and diversity in possible career paths than did my generation of academic researchers. This may be a good thing. Helping junior investigators more mindfully plan their long-term career trajectory is critical, and taking into consideration a desire for a more diverse approach will only serve to improve science.

Providing more opportunities for junior faculty to achieve an individualized balance among research, teaching and clinical components may go a long way to maintaining a strong academic workforce. A one-size-fits-all model no longer works. We have to take a more flexible approach to what constitutes an academic career. For those who wish to pursue research full time, we must provide more direct university funds — as is common in non-biomedical education — to smooth out the sometimes-rough waters of extramural funding.

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## Make prolonged postdocs more prestigious

Postdoctoral fellows face pressure as never before to pull off the magic act of convincing a faculty search committee that they are ‘the one.’ The situation is not only disheartening to postdocs but also frustrating to the faculty who witness their disappointment.

Rather than shortening the postdoctoral period, we should formally extend it, eliminating the guilt associated with staying in such a position for five, six or seven years. This way, young scientists can build their résumés over time and gain the name recognition that may help them land an academic position.

Following a three-year postdoctoral fellowship with Max Cowan at Washington University, I was fortunate to move with him to the Salk Institute as a ‘staff scientist.’ I was essentially a glorified advanced postdoc, but I had the time to complete critical studies and successfully compete for my first R01 grant. I then obtained a faculty position at the institute.

Transitional positions like this one are more commonplace now than they were when I trained. Formalizing their existence might go a long way to improving the odds that junior scientists receive faculty positions or successfully pursue alternative scientific careers. I applaud the U.S. National Cancer Institute for establishing the ‘research specialist awards,’ which provide trainees with an adequate salary and time to build a competitive portfolio for a faculty position, or perhaps decide to take on more of a staff scientist role.

Instead of moving to a new institution following their postdoctoral period, many postdoctoral fellows stay where they are. At the MIND Institute in Davis, California, where I work, several of the outstanding participants in our Autism Research Training Program have preferred to stay at the university beyond their postdocs to continue building and utilizing our unique resources. And they often become junior faculty members while remaining within the laboratories of their postdoc sponsors.

This situation offers unique opportunities and challenges. For these bright young scientists to advance, universities often mandate that they show ‘independence’ from their postdoc sponsor. Yet these young people often do not receive the space and start-up packages that would normally be associated with an external recruitment. So the resources that they need to do their work are often linked to that senior scientist.

To free these junior faculty members from this Catch-22, universities will need to find creative ways to value their contributions within the context of complex multidisciplinary projects. We may need new rules for advancement to deal with this ‘new normal.’

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## Consider several flexible solutions

Careers in academic research have changed in size and shape over the past few decades. Gone are the glory days, when one did a single three-year postdoc before moving on to an academic position.

In retrospect, that time was too short. I wish I had stayed at that stage longer, luxuriating a bit more in those research-only years. But there was a lot less pressure on the career pipeline in the mid-1980s. One could feel reasonably confident that a strong record as a lab trainee equaled a good chance at an academic position.

Gone too, for the most part, is the two-part pattern that prevailed for the past 30 years. One longer (four to five years) or two shorter (about two years each) postdoctoral stints allowed training in different skill sets and more choice when applying for the ‘real job.’

Now, according to the data from the *Nature* article, we have a significant proportion of postdocs spending six years or more as postdocs, with no clear career path out.

We need to consider several flexible solutions to the problem. These may involve fundamental shifts in our culture, such as changes in both lab size and composition, as **Shirley Tilghman**, president emerita of Princeton University, alluded to in the *Nature* article. But such changes take time and adjustment of resources if we are to avoid significant disruptions.

There are several questions that need to be addressed to deal with the problem.

Should we decrease the input to the pipeline by training fewer Ph.D. students? If the only ‘valid’ outcome for our trainees is a tenure-track academic position, then we must decrease the inflow. There just aren’t enough academic positions. But do all Ph.D. students really need postdoctoral training to find a good job?

Should we divert the flow after five years? The idea of imposing an outflow valve by enforcing a five-year postdoc term limit seems like a radical non-solution, especially with the current state of limited alternatives. Some people need or want more training.

Should we increase the number of distinct outflow paths? Increasing the number of staff scientists may provide a partial solution, but it requires shifts in funding, which take time. There are many professional options, both within and outside of science, besides research — from scientific outreach to the pharmaceutical industry to creative start-ups. Let’s make outflow paths to those more readily available.

Perhaps the most intelligent solution is a combination of approaches. We should limit the number of Ph.D. students to some degree while also expanding the alternative paths they can take. The biggest mistake, however, would be to impose a sharp cutoff to the postdoc period, without regard to the needs and concerns of the trainee or the trainer.

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