nature genetics

Is the US producing enough scientists?

Why do young people go into science? Many can't imagine doing anything else—the excitement of discovering new things is irresistible. Robert Oppenheimer once referred to "physics and the obvious excellences of life it brings". Stephen Jay Gould wrote movingly of being a street kid from New York City who hoped one day "to become a scientist and to make, by my own effort, even the tiniest addition to human knowledge…" For talented people, at least in countries where a wide range of opportunities are available, these decisions are often based on the feeling that there is simply no other kind of life that would be as personally rewarding. For others, however, different kinds of rewards no doubt loom large, with employment and salary prospects being the most obvious. As a result, anyone interested in understanding the flow of people into science must come to grips with the larger economic forces that might be shaping it. In this vein, it's well worth having a look at a draft report recently posted for public comment by the US National Science Board's task force on National Workforce Policies for Science and Engineering (see http://www.nsf.gov/nsb/). Younger scientists in particular should take note, as the more historically aware among them may find it uncomfortably familiar reading.

The document provides an informative overview of the state of the 'pipeline' of scientific talent in the US and its importance for maintaining America's leading role in many areas of research. Its central argument is that American strength in science and engineering (S&E) is threatened by an over-reliance on foreign-born scientists, particularly in light of increased global competition for talent and a persistent under-representation of native-born women and minorities. A number of recommendations are offered: increased financial assistance to qualified students, innovative efforts to improve undergraduate education in science (particularly at those institutions that succeed in training women and minorities), more generous stipends for graduate students and postdoctoral fellows, increased emphasis on preparing students for a wide range of careers in science, better training for science teachers and a national effort to build a database on the science and engineering workforce.

At first blush, much of this is sensible, even laudable. Who could object to educating more Americans in science? And yet the tone of the report, characterized by admonishments that "current trends of supply and demand…may seriously threaten our long-term prosperity, national security, and quality of life," suggests a crisis that is simply not apparent. (A quote from a 2001 report on national security that adorns the executive summary—to the effect that mismanagement of science and education poses a danger that is "second only to a weapon of mass destruction detonating in an American city"—surely doesn't help.) A recent news story in *Science* noted that the report "avoids such controversial terms as 'shortage' and 'shortfall', opting instead for the more nuanced concept of 'underproduction'…" To understand the need for nuance, it helps to look back a few years.

A much-discussed 1989 National Science Foundation report predicted a looming 'shortfall' of 675,000 recipients of undergraduate degrees in S&E. In his book *Science, Money, and Politics: Political Triumph and Ethical Erosion*, David Greenberg details the way in which the import of that number was misconstrued. Many observers at the time missed the point that the shortfall of 675,000 had nothing whatsoever to do with anticipated demand for scientists—it simply accounted for a reduction in the rate at which graduates were being produced. Graduate students and postdocs who left research after long and unsuccessful efforts to find jobs in academia were left wondering what happened.

Hence, the very carefully chosen word 'underproduction' is offered. In 1989, the shortfall was said to be due to an expected wave of retirements of senior faculty. In 2003, the problem is proposed to be a loss of foreign-born scientists without replenishment of the pipeline by native-born graduates, with particular deficits in the number of native-born women and minorities who might fill the gap. When Jeffrey Mervis of *Science* recently asked George Langford, the vice chair of the task force, about rising unemployment rates in many areas of S&E, Langford acknowledged this "temporary condition" but stressed the importance of having enough scientists to drive US economic growth and security.

Producing more science graduates is undoubtedly a good thing for American science; whether it's a good thing for young American scientists, however, is much less clear, and the current generation of students will be right to be skeptical. The reasons for this were outlined in an excellent 1999 article in the *New Republic* by Scott Stossel ("Uncontrolled Experiment").

Fundamentally, Stossel argued, American science is a victim of its own success. The impressive increases in funding from the National Institutes of Health have led to an army of graduate students and postdoctoral fellows to carry out the promises of all the funded grant applications. But even this generous level of support isn't adequate to satisfy the demand for independent jobs when these postdocs want to become principal investigators themselves. At the same time, foreign-born students see these low-paying fellowships at well-regarded American graduate programs as relatively attractive. Given that this puts further downward pressure on salaries, the effect is to discourage many American students from embarking on the long training period that is necessary to secure an academic position. To be sure, many students see science as a calling and are perfectly willing to take their chances; others, however, are less likely to ignore the laws of supply and demand when their livelihoods are on the line.

The National Science Board report makes much of some indications that global competition for S&E workers is intensifying. And perhaps this is true. But rather than promoting this as a potential crisis, why not take the view that it offers a welcome opportunity to address some imbalances in the pipeline of scientific talent in the US? Although foreign-born scientists have been a boon to American science (and the American economy), the brain drain from their countries of origin has been a persistent problem. If these scientists take increasingly attractive opportunities in their home countries, that ought to be a net gain for international science, while at the same time giving young American scientists a bit more leverage in their own marketplace. This is not to suggest that the US government should actively exclude foreign students (and recent reports of tightened visa requirements are not encouraging). But if such a trend is part of a natural redistribution of scientific talent around the world, there is much to be said for it.

So by all means let's recruit more women and minorities to science in the US. Better education will help, as will an understanding of the market forces that may help or hinder such efforts. But let's do it with realistic expectations for the future employment prospects of those just starting out, while not losing sight of the best of all reasons for training new scientists: the excitement of discovery and the excellences of life it promises. ■