

engagement fellowships to support senior researchers who are developing a programme or projects to share their expertise with the public. One recipient, Roger Kneebone, based at Imperial College London, is a surgeon-turned-public-engagement fellow who plans to use live surgical simulations to engage the public. Clare Matterson, director of medical humanities and engagement at the Wellcome Trust, hopes that two reports published by the trust in November 2012 — *Analysing the UK Science Education Community: the Contribution of Informal Providers and Review of Informal Science Learning* — will prompt more grant submissions in the United Kingdom, and for ISE in general, of which there is a dearth at the moment, she says. “What is needed is a greater number of high-quality research-based proposals so we have a better understanding of how children learn through informal science experiences,” she adds. “These don’t have to be education groups; they could be people working in psychology or neuroscience, studying how people respond to different types of learning.”

In the United States, the Gordon and Betty Moore Foundation and the Noyce Foundation, both in Palo Alto, California, are funding ISE efforts ranging from citizen-science engagement to helping teachers in training learn how to develop their own interactive science-lesson plans. “We are really interested in understanding what motivates and sustains interest in science,” says Janet Coffey, a programme officer at the Gordon and Betty Moore Foundation.

Industry is also experimenting with ISE in an effort to reach the public. Novo Nordisk, headquartered in Bagsvaerd, Denmark, for example, finances the Steno Health Promotion Centre in Gentofte, Denmark, which runs a 33-million-kroner (US\$5.7 million) project called PULSE at the Experimentarium in Copenhagen, to promote healthy lifestyles for families. The project will engage and track families with children aged 6–12 years old from a variety of socioeconomic backgrounds as they design and develop healthful eating and exercise strategies. The museum is increasingly “looked at as a serious partner instead of simply an institute for kids,” says Sheena Laursen, director of international projects at the Experimentarium.

Many hope that continued research efforts that document how ISE increases scientific literacy or encourages students to pursue STEM careers will help the field to grow. “Anyone who cares about scientific literacy and STEM workforce development,” says Ellenbogen, “should pay attention to ISE.” ■

Virginia Gewin is a freelance writer in Portland, Oregon.



Q&A Francis Collins

Changes at the NIH

For years, the US National Institutes of Health has struggled with promoting non-academic career tracks for biomedical scientists, gauging the supply of PhD holders and demand for research jobs, enticing under-represented minorities into science and establishing funding avenues for early-career researchers. Hoping to bring some evidence-based clarity to these issues, NIH director Francis Collins asked two working groups of the NIH Advisory Committee to study the issues and make recommendations. They released their recommendations in two reports in June; Collins responded in December. The NIH has decided to take measures that include raising its postdoc stipend, increasing the number of grants that encourage early-career independence and offering 25 institutional grants, each worth about US\$250,000, to support training programmes that prepare students for a broad range of research-related careers, including non-academic paths.

What did you learn from the advisory reports?

The working groups put in a lot of effort collecting data to figure out what career paths PhDs were ultimately heading down. Only about 23% of US-trained biomedical PhD holders were in academic tenure or tenure-track positions in 2008, they found. Many end up in research-related positions, in industry, government, teaching, science policy, science journalism and other science-related professions. Training programmes have tended to view those tracks as secondary and have even sent messages that they are second-rate. So we need to retool to expose trainees to multiple pathways, rather than simply producing clones of their principal investigators.

What might the \$250,000 institutional grants involve?

We propose to have institutions provide actual exposure to careers outside a university setting, to help them to think more creatively about

the skills and knowledge that PhD holders might need for the job market. For example, students and postdocs may spend time at a pharmaceutical company, develop entrepreneurial skills or learn aspects of science-policy development.

Where will you get the money to support these programmes?

We can do it with the NIH Common Fund, which is dedicated to innovative initiatives, especially for topics that are relevant to multiple NIH institutes or centres. We will have to balance that with the need to continue other programmes through the Common Fund.

Unemployment is low among scientists in the United States, at 4–5%. Is the priority, then, to change expectations among those considering the academic track?

Yes, that is the intention. Unemployment is actually about 2% among biomedical PhD ►

► holders. But although the training is aimed almost entirely at preparing people for tenure-track positions in academia, only a minority of US-trained biomedical researchers end up there.

The working groups recommend supporting students and postdocs through trainee grants to shorten the time it takes to get a degree and improve the experience. Why have you declined to do so?

It is all about logistics. Something like 80% of postdocs and two-thirds of graduate students and trainees are associated with research grants — how do we put them on training grants instead? The shift would be an enormous administrative challenge. Instead, we are asking institutions to apply training-focused principles to all students and postdocs. For example, we recommend that all trainees have individual development plans to track how they are doing.

Do you think that it is the NIH's job to decide how many biomedical PhDs are needed?

This question fascinates and troubles me. It seems as though not a week goes by without someone saying that there are too many PhDs and someone else saying there are not enough. They can't both be right.

We are planning to establish a sophisticated economic-modelling unit at the NIH to determine supply and demand. We are missing a lot of data. We need to determine who is interested in going into PhD and medical doctorate–PhD programmes, and estimate the current and future demand for their skills in all sectors.

Does science need another established career track? What would it look like?

The working groups looked at career tracks for people who don't see themselves as the head of a lab. For example, on the NIH intramural campus in Bethesda, Maryland, we have a number of staff scientists. I have two in my own laboratory. I think the output per dollar spent for these scientists is very high. The working groups recommended that the peer-review process should recognize the contributions of staff scientists and consider them more favourably. At the NIH, we can encourage study sections to recognize the value of these scientists.

What is the 'diversity challenge' that the biomedical community is facing?

The diversity of the US biomedical research workforce is woefully short of that in the overall population. That is damaging our ability to carry out research as effectively as we would like. For example, there is evidence that individuals from under-represented groups tend to be interested in disparities in health between demographic groups, because they often come from communities that have experienced them. The absence of effective programmes

to recruit and retain such individuals leaves a gap in the biological sciences.

The NIH and other agencies have had various diversity initiatives, with limited effect. Can the NIH effect a sea change?

A sea change has been proposed by the diversity working group. On entrance to college, under-represented groups show a lot of interest in science. But we are losing a lot of talented people during the undergraduate years. Much of that is due to the lack of exposure to real research experience. Financial concerns about a long training period are also a factor.

We have proposed a programme called BUILD (Building Infrastructure Leading to Diversity), coming in the next 18 months. Undergraduate students at institutions that are not traditionally research-intensive will have an opportunity to do summer research in their chosen field and have their junior and senior years at college paid for. They will pay this back with two years of research in a full-time job.

The NIH is proposing to launch a mentoring network. What is its aim?

The idea is to give young scientists around the country a chance to be mentored by people who have similar interests and backgrounds. We will make awards to organizations to run the network after a competitive process.

According to a study published in 2011, African-Americans have lower rates of success with grant applications than other applicants. What is being done to address this?

We are planning more peer-review experiments, following up on concerns about possible unconscious bias in science [based on the findings in D. K. Gunther *et al. Science* 333, 1015–1019 (2011)]. We at the NIH found the evidence alarming and we are determined to get to the bottom of it.

Do you discuss career paths with the postdocs in your lab?

We talk about career paths regularly, but I'm not sure that we cover all of the options effectively. This is perhaps a wake-up call for me. Most of my trainees end up in academia, but I probably haven't done a great job of exposing them to other options.

How would you advise a postdoc struggling with career options?

It is hard to generalize; you need to take into account their dreams, their talents and the contributions that they can make in different settings. I worry that a number of them are receiving the message that if they don't get a tenure-track position, they have failed. The good news is that nearly all postdocs are likely to be employed in interesting positions, but many will not travel a narrow academic path. ■

INTERVIEW BY GENE RUSSO