Academic labour shortages

A lack of trained scientists could slow down research in Europe

Philip Hunter

Scientists have always warned about the doom of research that could result from a shortage of students and skilled labour in the biomedical sciences. In the past, this apocalyptic vision of empty laboratories and unclaimed research grants has seemed improbable, but some national research councils and the European Union (EU) itself now seem to think that we may be on the brink of a genuine science labour crisis in Europe. This possibility, and its potential effects on economic growth, has proven sufficiently convincing for the European Commission (EC) to propose a 45% increase to its seven-year research and development budget of 45%—from €55 billion, provided under the Framework Programme (FP7), to €80 billion—for a new strategic programme for research and innovation called Horizon 2020 that will start in 2014.

This bold proposal to drastically increase research funding, which comes at a time when many other budgets are being frozen or cut, was rigorously defended in May 2012 by the EU ministers responsible for science and innovation, against critics who argued that such a massive increase could not be justified given the deepening economic crisis across the EU. So far, the EU seems to be holding to the line that it has to invest more into research if Europe is to compete globally through technological innovation underpinned by scientific research.

Europe is caught in a pincer movement between its principle competitors—the USA and Japan, which are both increasing their research budgets way ahead of inflation—and the emerging economies of China, India, Brazil and Russia, which are quickly closing from behind. The main argument for the Horizon 2020 funding boost came from a study commissioned by the EU [1], which led the EC to claim that

Europe faces an “innovation emergency” because its businesses are falling behind US and Japanese rivals in terms of investment and new patents. As Martin Lange, Policy Officer for Marie Curie Actions—an EU fellowship programme for scientists—pointed out, “China, India and Brazil have started to rapidly catch up with the EU by improving their performance seven per cent, three per cent and one per cent faster than the EU year on year over the last five years.”

According to Lange, Europe’s innovation gap equates to a shortage of around 1 million researchers across the EU, including a large number in chemistry and the life sciences. This raises fundamental issues of science recruitment and retention that a budget increase alone cannot address. The situation has also been confused by the economic crisis, which has led to the position where many graduates are unemployed, and yet there is still an acute shortage of specialist skills in areas vital to research.

This is a particularly serious issue in the UK, where around 2,000 researcher jobs were lost following the closure of pharmaceutical company Pfizer’s R&D facility in Kent, announced in February 2011. “The travails of Pfizer have affected the UK recruitment market,” explained Charlie Ball, graduate labour market specialist at the UK’s Higher Education Careers Services Unit. The closure has contributed to high unemployment among graduates, particularly chemists, who tend to be employed in pharmaceutical research in the UK. “Even among people with chemistry doctorates, the unemployment rate is higher than the average,” he said.

The issue for chemists, at least in the UK, is not a skills shortage, but a skills mismatch.

Ball identified analytical chemistry as one area without enough skilled people, despite the availability of chemists with other specialties. He attributes part of the problem to the pharmaceutical industry’s inability to communicate its requirements to universities and graduates, although he concedes that doing so can be challenging. “One issue is that industry is changing so quickly that it is genuinely difficult to say that in three or four years time we will need people with specific skills,” Ball explained.

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Alongside this shortage of analytical skills, the UK Medical Research Council (MRC) has identified a lack of people with practical research knowledge, and in particular of experience working with animals, as a major factor holding back fundamental and pre-clinical biomedical research in the country. It has responded by encouraging applications from non-UK and even non-EU candidates for doctoral studentships that it funds, in cases where there is a scarcity of suitable UK applicants.

But, the underlying problem common to the whole of Europe is more fundamental, at least according to Bengt Norden, Professor of Physical Chemistry at the University of Gothenburg in Sweden. The issue is not a shortage of intellectual capital, Norden argues, but a growing lack of investment into training chemists, which in turn undermines life sciences research.

Similarly to many other physical chemists, Norden has worked mainly in biology, where he has applied his expertise in molecular recognition and function to DNA recombination and membrane translocation mechanisms. He therefore views a particularly acute recruitment and retention crisis in chemistry as being a drag on both fundamental and applied research across the life sciences. "The recruitment crisis is severe," Norden said. "While a small rill of genuinely devoted 'young amateur scientists' still may sustain the recruitment chain, there is a general drain of interest in science in general and chemistry in particular." He attributes this in part to sort of a 'chemophobia', resulting from the association of chemistry with environmental pollution or foul odours, but he also blames ignorant politicians and other public figures for their negative attitude towards chemistry. "A former Swedish Prime Minister, Goran Persson, claimed that 'his political goal was to make Sweden completely free from chemicals'," Norden explained by way of example.

Scientists themselves also need to do a better job of countering the negative perceptions of chemistry and science, perhaps by highlighting the contribution that chemistry is already making to clearing up pollution. Chemistry has been crucial to the development of microorganisms that can be used to break down organic pollutants in industrial waste, or clear up accidental spillage during transport. In fact, chemistry has specifically addressed the two major challenges involved: the risk that genetically engineered microorganisms could threaten the wider environment if they escape, and the problem that the microorganisms themselves can be poisoned if the concentration of pollutants is too high.

A team at the University of Buenos Aires in Argentina has solved both problems by developing a material comprising an alginate bead surrounded by a silica gel [2]. This container houses a fungus that produces enzymes that break up a variety of organic pollutants. The pores of the hydrogel can limit the intake of toxic compounds from the polluted surroundings, thus controlling

the level of toxicity experienced by the fungus, whilst the fungus itself is encapsulated inside the unit and cannot escape. Norden and others believe that if such examples were given more publicity, they would both improve the reputation of chemistry and science in general, and help to enthuse school students at a formative age.

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Unfortunately, this is not happening in schools, according to Norden, where the curriculum is failing both to enthuse pupils through practical work, and to inform them of the value of chemistry across society: "school chemistry neither stimulates curiosity nor does it promote understanding of what is most important to everybody," he said. "It should be realized that well-taught

chemistry is a necessary tool for dealing with everyday problems, at home or at work, and in the environment, relating to function of medicines, as well as what is poisonous and what is less noxious. As it is, all chemicals are presented simply as poisons."

Norden believes that a broader cultural element also tends to explain the particular shortage of analytical skills in chemistry. He believes that young people are more inclined than ever before to weigh up the probable rewards of a chosen profession in relation to the effort involved. "There seems to be a 'cost-benefit' aspect that young people apply when choosing an academic career: science, including maths, is too hard in relation to the jobs that eventually are available in research," he explained. This 'cost-benefit' factor might not deter people from studying subjects up to university level, but can divert them into careers that pay a lot more. Ball believes that there is also an issue of esteem, in that people tend to gravitate towards careers where they feel valued. "Our most able graduates don't see parity in esteem between research and other professions being represented by the salary they are paid," he explained. "That is an issue that needs to be resolved, and it is not just about money, but working hard to convince these graduates that there is a worthwhile career in research."

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Lange suggests that it would be much easier to persuade the best graduates to stay in science if they were able to pursue their ideas free from bureaucracy or other constraints. This was a main reason to start the Marie Curie Actions programme of which Lange is a part, and which will be continued under Horizon 2020 with a new name, Marie Skłodowska-Curie Actions, and an increased budget. "The Marie Curie Actions have been applying a bottom-up principle, allowing researchers to freely choose their topic of research," Lange explained. "The principle of 'individual-driven mobility' that is used in the Individual Fellowships empowers

researchers to make their own choices about the scientific topic of their work, as well as their host institutions. [...] It is a clear win-win situation for both sides: researchers are more satisfied because they are given the opportunity to take their careers in their own hands, while universities and research organizations value top-class scientists coming from abroad to work at their institutes."

Lange also noted that although Marie Curie Fellows choose their own research subjects, they tend to pursue topics that are relevant to societal needs because they want to find work afterwards. "More than 50% of the FP7 Marie Curie budget has been dedicated to research that can be directly related to the current societal challenges, such as an ageing population, climate change, energy shortage, food and water supply and health," he said. "This demonstrates that researchers are acting in a responsible way. Even though they have the freedom to choose their own research topics, they still address problems that concern society in general." In addition, Marie Curie Actions also encourages engagement with the public, feeding back into the wider campaign to draw more people into science careers. "Communicating science to the general public will be of importance as well, if we want to attract more young people to science," Lange said. "Recently, the Marie Curie Actions started encouraging their Fellows to engage in outreach activities. In addition, we have just launched a call for the Marie Curie Prize, where one of the three Prize categories will be 'Communicating Science'."

Another important element of the EU's strategy to stimulate innovative cutting edge research is the European Research Council (ERC). It was the first pan-European funding body for front-line research across the sciences, with a budget of €7.5 billion for the FP7 period of 2007–2013, and has been widely heralded as a success. As a result, the ERC is set to receive an even bigger percentage increase than other departments within Horizon 2020 for the period 2014–2020, with a provisional budget of €13.2 billion.

Leading scientists, such as Nobel laureate Jean-Marie Lehn, from Strasbourg University in France, believe that the ERC has made a substantial contribution to innovative research and, as a result, has boosted

the reputation of European science. "The ERC has done a fantastic job which is quite independent of pressures from the outside," he said. "It is good to hear that taking risks is regarded as important." Lehn also highlighted the importance of making it clear that there are plenty of opportunities in research beyond those funded, and therefore dictated, by the big pharmaceutical companies. "There is chemistry outside big pharma, and life beyond return on investment," he said. Lehn agreed that there must be a blend between blue sky and goal-oriented research, even if there is an argument over what the blend and goals should be.

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There is growing optimism that Europe's main funding bodies, including the national research councils of individual countries, have not only recognized the recruitment problem, but are taking significant steps to address it. Even so, there is still work to be done to improve the image of science and to engage students through more stimulating teaching. Chemistry in particular would benefit from broader measures to attract young people to science. Ultimately, the success of such initiatives will have much broader effects in the life sciences and drug development.

CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

REFERENCES

1. EC (2011) Innovation Union Scoreboard 2010. The Innovation Union's Performance Scoreboard for Research and Innovation. Brussels, Belgium: European Commission. <http://ec.europa.eu/research/innovation-union/pdf/>
2. Perullini M, Jobbágy M, Mouso N, Forchiassin F, Bilmes SA (2010) Silica-alginate-fungi biocomposites for remediation of polluted water. *J Mater Chem* 20: 6479–6483

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