Career strategies for young European scientists (XIII)

Science by the Pound (1)

Part 1 provides a general overview of the UK funding machinery and university system, followed by an introduction to the UK Research Councils. The next issue will cover how UK societies and charities focus on biomedical research.

Universities in the UK not only have their own long tradition but are also among the foremost research institutions in the world. According to a 2007 ranking of universities by The Times Higher Education Supplement (THES), the Universities of Oxford and Cambridge and Imperial College, London are among the top ten universities worldwide. Looking more closely, the UK is second in the world in productivity and impact (the overall number and citations of scientific publications).

The UK is also runner-up in the total number of Nobel Laureates. As a country with 1% of the world's population the UK undertakes 5% of the world's scientific research and produces 9% of the 17 million scientific articles published each year. Given that the UK's relative investment in research and development is below that of many direct competitor countries, this is quite amazing.

In this issue, I will try to provide a general overview of the UK funding machinery and university system, followed by an introduction to the UK Research Councils. In the next issue, UK societies and charities focussing on biomedical research will be covered in more detail. However, to sum up in advance: there is plenty of opportunity for postdocs and young investigators from abroad, but the competition for fellowships, research grants and permanent positions is tough.

The UK Funding System

The funding of the UK research base is quite complex and beyond the scope of this article. A simplified overview is presented below. Funds are provided by the government, industry, charities, international programmes and other sources. Money from the Treasury flows to several governmental departments. With an annual budget of more than £18 billion, the Department for Innovation, University and Skills (DIUS) sits at the helm. A substantial chunk of its budget comes from the government science budget. In 2004 the UK Government used its Science and Innovation Investment Framework, 2004-14 to announce its intention to sustain world-class research in the UK. The document also trumpeted an increase in the science budget from £2.7 billion in 2004/5 to £3.5 billion in 2007/8. Although there were some cutbacks in government funding in late 2007, the science budget is expected to top £4 billion early in the next decade. DIUS is in charge of supporting the main players in UK public research: the universities and research councils.

Universities and colleges of higher education are taken care of via a dual support system: the funding and the research councils, which both receive funds from DIUS. Funding councils, such as HEFCE, the Higher Education Funding Council for England (separate councils exist for Scotland, Wales and Northern Ireland), provide general block funding for research infrastructure and academic salaries. In the current academic year HEFCE will distribute £7.5 billion, including £4.6 billion for teaching and about £1.5 billion for research. Since the 1980s, research funding in the UK has been allocated according to periodic evaluations called Research Assessment Exercises (RAE). The last RAE was performed in 2001 with the result that 25 of 173 participating institutions received 75% of all research funds. The RAE system has been criticised for red tape, error-prone evaluation criteria and for condoning poor teaching. Smaller, less research-intensive universities blame RAE for the closure of single subject departments and accuse the government of gilding their silverware while other institu-

tions are suffering or perish. Thus, a new approach called the Research Excellence Framework (REF) will be implemented in 2013 and will combine quantitative indicators such as bibliometrics and light-touch expert review. The second arm of the dual support system comprises the seven independent UK research councils, which primarily provide money for research projects, fellowships and training activities, besides running their own institutes.

UK Higher Education

According to Universities UK, the major representative body of the higher education sector, there are 106 UK universities and 168 higher education institutions with 2.5 million students and 170,000 academic staff. Some institutions focus on teaching while others are more research intensive. In general, universities established after 1992 (when many colleges of higher education and polytechnics were assigned university or university college status) focus more on teaching. An association of twenty major research-intensive universities, the Russell Group, was founded in 1994 and includes the UK's leading universities of Cambridge, Oxford and London, which are sometimes also referred to as the golden triangle. The interests of 18 smaller research-intensive universities are defended by the 1994 Group, which was founded in response to the formation of the Russell Group.

The academic staff at UK higher education institutions is composed of 10% professors, 20% senior lecturers and senior researchers, 30% lecturers, 22% researchers and 18% staff on other grades. The UK lecturer is generally a university teacher in his first university position, doing research, supervising postgraduate students and teaching. Although unnecessary in the past, the qualification necessary to become a lecturer nowadays is a doctorate. After a probation period of three years the lecturer position usually becomes open-ended. After four years as a lecturer A on a relatively low income, lecturers are promoted to the level of lecturer B with the option of annual salary increases. Professors, readers and senior lecturers form the senior staff. The promotion from senior lecturer to reader in the UK academic hierarchy is often merit-based and not associated with a salary rise. The "newer" post-1992 universities often offer a different structure: lecturer, senior lecturer, principal lecturer, reader and professor. At each level the requirements for teaching, research and administration, and their importance for promotion, differ widely, especially at the departmental and institutional level.

In some disciplines more than 50% of researchers are employed as research assistants or research associates by a fixed-term, third-party funded contract. Since the demand for early contract researchers at the postdoctoral level is steadily increasing, it is becoming more difficult to obtain a permanent post as lecturer or senior researcher. In the past, postdoctoral scientists were often unable to apply for additional research grants or participate in advanced training and soft skills programmes, and left the academic sector after their third or fourth postdoc. The lack of clearly defined academic career pathways and continued education for early career researchers was often denounced. Over the last five years there have been some improvements, including the implementation of some of the recommendations made in the 2001 Roberts report. For example, the umbrella organisation of the UK Research Councils launched the RCUK Academic Fellowship scheme in 2004. This fellowship is a contribution to the overall costs of the fellow and provides £25,000 per year for five years. The fellow is expected to develop the skills required for a future academic position and the host organisation has to provide training. At the end of the funding period the host institution guarantees a permanent position, dependent upon positive evaluation during the probation period. 800 of these academic fellowships have been awarded but there are currently no plans to award new fellowships in the near future. In addition, individual institutions and funding organisations have started to establish similar career paths for postdoctoral scientists. A more effective and widespread solution to this problem, reaching beyond the publication of press releases and reports, would be highly desirable. Furthermore, the research councils distribute £20 million of Roberts money every year, which is used for career development and transferrable skills. The Roberts payment is given to research institutions and is distributed according to the number of research students or research posts on grants, with £850 given per researcher per academic year.

Research Councils UK

The UK research councils are the major source of research support in the UK higher education sector. They have a combined annual budget of £2.8 billion and employ about 12,000 staff in their own institutes. More than 30,000 scientists, includ-

ing 15,000 doctoral students, are supported by grants or fellowships each year. Each research council is autonomous and is funded primarily by the Department for Innovation, University and Skills, with additional contributions by governmental departments and agencies, industry and international organisations. In 2002, the seven existing UK research councils formed a strategic umbrella organisation called Research Council UK (RCUK) in order to provide a single political voice and maximise their efforts in research funding. Our readership is likely to be interested in the Biotechnology and Biological Sciences Research Council (BBSRC) and the Medical Research Council (MRC), introduced below.

The Biotechnology and Biological Sciences Research Council (BBSRC)

Life sciences in the UK are funded by the Biotechnology and Biological Sciences Research Council. With an annual budget of about £420 million, it supports more than 1,600 scientists and 2,000 research students. About one-third of scientists directly employed at BBSRC institutes are of non-UK origin. About 60% of the BBSRC budget goes to universities, 40% to its own institutes, such as the Babraham Institute in Cambridge and the Roslin Institute in Midlothian. Seven BBSRC Research Committees award grants and fellowships covering agriculture and food, animal sciences, biochemistry and cell biology, biomolecular sciences, engineering and biological systems, genes and developmental biology, and plant-microbial sciences. Strategic research priority areas include stem cells, synthetic biology and systems biology. In addition, there are also some cross-research council strategic topics such as ageing, nanotechnology and renewable bioenergy.

According to Nancy Mendoza of the BBSRC, most of the research scientists employed at BBSRC are recruited at the postdoctoral level. Depending on the nature and duration of the individual projects, opportunities for advancement are based on scientific merit and achievement, as well as applying for vacancies within the BBSRC. In addition, some BBSRC institutes offer additional career development plans, such as a 5-year career track, where postdocs are promoted at the end to Band F, a career grade for successful scientists with principal investigator status. For recently qualified postdocs or scientists changing discipline there is a 3-year programme for training, development and work experience.

About a third of the annual BBSRC budget is spent on so-called responsive research grants, providing financial support for scientists outside BBSRC institutes, who apply with a research project of their choice. There are four deadlines per year per committee. Over the last year there have been 1,600 grant applications, of which about 25% were funded. According to the current BBSRC delivery plan (2008-2011) the annual budget for postdoctoral fellowships will increase from £5.3 million to £10 million. I want to give you three examples of how the BBSRC promotes early to mid-career postdocs. More details are provided in the BBSRC fellowship handbook, which is published each year. The New Investigator Scheme is for newly employed lecturers, fellows and researchers. You may apply within three years of your first appointment if you have not received research funding of more than £150k. You apply as sole applicant. A co-applicant is possible for interdisciplinary projects. In contrast to previous years, there is no longer an upper award limit. You just apply for the level of funding you think is necessary to perform your project. Instead of your track record, your potential as a researcher is evaluated during the evaluation process. Over the last year about 35% of all applications have been successful.

The BBSRC also awards up to ten David Philips Fellowships per year for early-career scientists. You may apply if you have between two and six years postdoctoral research experience. International scientists have to comply with UK immigration and work permit requirements. The fellowship is for five years with the possibility of an extension to seven years. The fellowship pays your salary, which is negotiated beforehand with your host institution. In addition, applicants may request a research support BBSRC grant, which must not exceed £600k, excluding your salary. The next call for applications is expected to be in September 2008, with a deadline in the middle of November. In past years, almost 50% of these fellowships have been awarded to non-UK nationals.

Up to ten Research Development Fellowships are also available. These are for scientists at UK universities who have been at least five years in their current post and wish to perform full-time research. International applicants have to prove that they were in a comparable position before and that they have been employed at a UK institution for at least one year. Encouraged to apply are scientists performing interdisciplinary research and wishing to incorporate new methods. Awards are made for one to three years and include a research support grant and your salary, but only the proportion of time devoted to the project of the fellowship programme is taken into account. Requests of up to a total of £15k per year, excluding the salary contribution, are feasible. Up to one year of the fellowship may be spent abroad or in industry. The next call for applications will be published in September 2008. BBSRC fellowships are generally highly competitive with a success rate of about 13% in 2007.

The Medical Research Council (MRC)

The MRC is the oldest of the UK research councils and funds all aspects of biomedical research from basic to clinical and population-based research. Its intramural programme supports interdisciplinary MRC institutes and more focused MRC research units to the tune of £300 million each year. The three main MRC institutes are the Clin-

ical Sciences Centre in Hammersmith, London, the National Institute for Medical Research in Mill Hill, London, and the Laboratory of Molecular Biology in Cambridge. There are 31 MRC research units, including two units located in Gambia and Uganda, which focus on major infectious diseases. Biomedical research outside its own institutions is funded by grants, fellowships and awards to scientists at universities, medical schools and non-MRC research institutes. In the last fiscal year, around £270 million was distributed by the extramural programme, including £140 million on research grants and £72 million to support 400 new postgraduate students and about 100 new fellowships. 21 MRC centres are supported by Centre Grants, which are long-term partnerships between the MRC and UK universities. They are usually competitively funded over 5-year periods with the aim of helping universities to develop medical research centres of scientific excellence.

Priority research areas for funding currently include infections and vaccines, ageing, biomarkers, clinical and public health and global health. Translational research, which not only fills the gap between basic and clinical research but also leads to novel treatments and healthcare products, will become a major focus of research funded by the MRC. The governing body of the MRC is the MRC Council, which is in charge of its corporate policy. Four research boards with their own budgets make decisions on funding: Molecular and Cellular Medicine, Infections and Immunity, Neurosciences and Mental Health, and Physiological Systems and Clinical Sciences. Cross-board activities include a Translational Research and a Training and Careers Overview Group. International collaborations are facilitated by the MRC policy that allows international scientists to be included in grant applications as co-applicant. In the last year about one-third of all active 950 research grants had international partner countries, with the US (33%), Germany (10%) and France (7%) being the most active.

Clinical and non-clinical scientists are supported by approximately 30 different funding opportunities for studentships, fellowships and research grants. Supporting the transition to being an independent investigator is the Career Development Award. Up to two years of the five-year funding period may be spent outside the UK, in UK industry or another UK research institute. You should have at least three years of postdoctoral experience. Applications from existing MRC research fellows and scientists returning to the UK are encouraged. The award is not for scientists with a tenured academic position. Funds are provided for your salary, additional research, support staff, consumables, travel and capital equipment. There is one deadline per year, the next one is January 16, 2009. In the last round, ten out of 93 applicants got lucky.

Help for establishing yourself as an independent principal investigator is provided by the MRC's New Investigator Research Grants. Clinical and non-clinical researchers are supported by a 3-year non-renewable grant of no more than £600,000. Requirements are a post at a UK institution and a PhD, MD or DPhil. You should have had your first academic appointment or be a senior postdoc. If you have had a couple of publications and have already secured a larger grant you may not apply. There are usually three deadlines per year in January, May and September. Last year 17 out of 84 applications were promoted.

Outlook

The UK is attracting a substantial number of early career scientists from abroad. For example, 30% of all EU Marie Curie fellowships are held in the UK. In the first round of ERC Starting Grants, researchers choosing the UK as host country bagged about one-fifth of all awards. For EMBO Young Investigators and Long-Term Fellowship awardees, the UK is the most popular destination. At UK universities a quarter of newly appointed academic staff

UK Internet Resources

- Department for Innovation, Universities and Skills – *www.dius.gov.uk*
- Higher Education Funding Council for England – *www.hefce.ac.uk*
- Research Councils UK – *www.rcuk.ac.uk*
- Biotech. and Biol. Sciences Research Council (BBSRC) – *www.bbsrc.ac.uk*
- Medical Research Council (MRC) – *www.mrc.ac.uk*
- EU Mobility Portal for UK – *www.britishcouncil.org/eumobility*
- UK Researchers' Portal Vitae – *www.vitae.ac.uk*

is of non-UK origin, including 39% of researchers and 28% of lecturers. However, at higher levels foreign nationals are less common: only 12% of senior scientists/senior lecturers and 6% of professors are foreign. To meet the high demand for scientists, UK research institutions are in fierce competition for the best national and international talent. The first-rate reputation and infrastructure of the major UK research institutions, early permanent positions, lavish grants and start-up packages help to attract outstanding scientists from abroad and make already leading institutions better and better. Research Council institutes provide their junior faculty with sufficient resources to start immediately and to focus on their research project, additional grant applications being often only optional. Compared to other European countries, at least some of the postdoctoral fellowships offered in the UK are for longer time periods, such as five years or more. This may help to establish yourself as an independent scientist without the need to apply every second year for the next fellowship. However, it is highly unlikely that the Europe-wide problem of serial postdoctoral fellowships with only a marginal chance of receiving a permanent position will be solved in the UK in the near future. RALF SCHRECK

Interview

"Generally, The Situation Is Quite Good At The Moment"

The cell biologist **Hugh Pelham** was appointed head of the MRC Laboratory of Molecular Biology (LMB) in Cambridge in late 2006. After graduating from Cambridge University in 1975, he became a PhD student with Richard Jackson and Tim Hunt. Following postdoctoral studies with Don Brown at the Carnegie Institution in Washington, he joined the LMB in 1981. Today, the LMB nurtures about 60 research groups, including 160 postdocs and 90 PhD students. Famous alumni of the LMB are Max Perutz, John Kendrew, Francis Crick, Sydney Brenner, Aaron Klug, Fred Sanger, Cesar Milstein, John Sulston and many others.

LT: What are the career opportunities for postdocs and junior faculty at LMB?

Pelham: Most of our postdocs stay in academia, either for further postdoctoral training or as independent faculty. However, a significant minority take up positions in companies, often small biotech ones. We also offer fully independent junior group leader positions. Typically, these groups are initially provided with up to two positions (e.g. one support and one postdoc, or two postdocs) and often a student as well. Equipment (which is largely shared) and consumables are provided. With time they may accumulate additional students, or postdocs funded on fellowships. They may also apply for grants, though this is not essential. After about six years a decision is made whether to continue the appointment indefinitely (i.e. grant "tenure"). All groups are subject to external review every five years and, if no longer performing adequately, can ultimately be terminated, but this is rare. Though our students typically receive their PhDs from Cambridge University, our group leaders are employed directly by the MRC and do not have to teach at or be assessed by the University.

What percentage of the junior faculty is of non-UK origin?

Pelham: About one-third of all group leaders are of non-UK origin. The proportion is higher amongst the non-tenured group leaders: about 50-60%.

Are there any measures planned for the future to further improve the situation of young scientists at the LMB?

Pelham: Not particularly, though we continue to investigate flexible ways to support postdocs, including international fellowships funded by the LMB. A big improvement for everyone will come when a new state-of-the-art LMB building is constructed in 3-4 years time, which will replace the current one built in the 1960s.

Which steps are necessary to further improve the UK funding situation and quality of science?

Pelham: Generally, the situation is quite good at the moment. One general problem is to balance the justifiable requirement for research to be accountable and to produce tangible benefits against the inevitable bureaucracy and demands for planning and deliverables, which can stifle creativity. Real advances are often unpredictable and unplanned.

Would you like to make any additional comments?

Pelham: We tend to have relatively small groups, working in related areas and with group leaders very closely involved in the research. There is an excellent record of exploitation of research findings (notable in the antibody field) but without loss of the free intellectual culture of the lab. A very important feature is that we are supported by a single block grant to the whole lab, whose distribution is decided locally by scientists. This gives us considerable flexibility and also encourages collaboration and cooperation, since it is in everyone's interest that everyone else does well (the block grant being determined by the success of the lab as a whole). The result is a culture of helpfulness, which is of great benefit to all students, postdocs and group leaders.

INTERVIEW: RALF SCHRECK