An international bio-labour market

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The rapid development of biotechnology is creating a demand for new skills. But the industry matures the emphasis will move towards more traditional skills in bioprocess enginering.

SCIENCE has always been an international activity, with a regular interchange of staff and ideas between countries. In most subjects, however, such job mobility is restricted to a limited number of senior academics, together with a larger flow of postdocs seeking training places, chiefly in the United States. By 1981, more than half the doctorates awarded in engineering in the United States went to foreigners and almost 60 per cent of the postdoctoral students were from overseas. Indeed, it has been estimated that more US Government grants are given to foreign students to study in the United States than to Americans to study overseas. On a smaller scale, the United Kingdom has, for many years, acted as a centre for postgraduate and postdoctoral training, especially for students from the Commonwealth. This interchange of staff is seen to be beneficial to all concerned, providing both training and research assistance, and a cross fertilization of ideas and experience between countries.

Occasionally, however, a sudden surge in the commercialization of a particular area of science, or increased allocation of funds in one country, has caused imbalances in the supply and demand for key skills. As a result, countries with a competitive advantage in the labour market, most notably in North America, can trigger off a "brain drain" from less advantaged labour markets. Thus, in the past thirty years, the United Kingdom has seen the alarm bells ringing over the brain drain of its doctors, nuclear scientists, electronics specialists and, most recently, biotechnologists. West Germany has joined Britain in expressing concern, while France, with a much smaller pool of indigenous skills, is actively encouraging its own nationals working overseas with biotechnology skills to return home.

The latest report from the US Office of Technology Assessment (OTA), *Commercial Biotechnology* (see *Nature* 2 February, p.399), provides a valuable international perspective on the rapidly developing world labour market for biotechnology skills. Biotechnology is of course an interdisciplinary activity, embracing diverse skills in biochemistry, biology, microbiology, genetics, medical and veterinary sciences and bioprocess engineering. The scientific side, in particular, requires high qualifications; it is unlikely that anybody without at least three years postdoctoral experience would be considered as a specialist in biotechnology. Despite its "newness" and classification problems, some estimates are beginning to emerge of the numbers involved at a professional level. The OTA study estimates that there are about 5,000 people employed by companies in the United States in biotechnology research and development. There are no estimates, however, for the academic world nor the public laboratories. OTA was unable to find any estimates for France, Germany, Switzerland, Japan or the United Kingdom, the main countries with a significant involvement in biotechnology. A report soon to be published by the UK Science and Engineering Research Council puts the total number of professionals in all sectors at just under 2,000, with nearly half in commercial companies. A crude estimate therefore suggests that the total number worldwide may be under 30,000, a smaller figure than for those working in semiconductors, perhaps the most closely analogous sector.

The OTA report provides a useful profile of the skills of the 5,000 people in commercial research and development. It shows just over a third with skills in genetic manipulation, and a third related to processing activities. Much of the research and public attention so far has been focused on the advances in genetic manipulation, and the new venture "glamour" companies such as Biogen, Celltech and Cetus have been able to offer highly attractive and well publicized terms of employment, often including equity shares, to attract the best genetics specialists from all corners of the world. Salary levels of up to $100,000 a year have been quoted. At the same time, many of the established industrial companies, notably those in pharmaceuticals, have also been investing and recruiting heavily in this area, both nationally and internationally. Such international mobility, particularly where the flow is not reciprocated, will only be sustained as long as there is a clear imbalance in the skills available, allied with differential reward structures between the countries. These rewards of course need not be just monetary; they also include quality of life and environment, research facilities and the freedom to develop new ideas and take risks.

Looking internationally, the OTA report says that the United States has the largest number of genetics specialists, and after a period of shortages few companies are now reporting shortages of staff with the basic skills. Similarly, the United Kingdom and West Germany also seem to have an adequate pool of such skills. The one major exception is said to be Japan, where an earlier lack of investment in basic science did not allow a basic pool of skills to develop. To remedy the situation, the Japanese have started in-house training, sending people abroad to be trained, including five corporate researchers sent to Genex for a three-month course at a cost of $120,000 each. Mobility between companies is also being encouraged, a rare phenomenon in Japan. No attempt has so far been made to attract foreign nationals, although individual foreign consultants, working in their home countries, are being engaged.

It is in the bioprocess engineering area, the application of biotechnology, that future international shortages seem most likely to occur. In the United States, it is thought that shortages of these skills may cause a bottleneck to the rapid commercialization of biotechnology and several US companies are actively recruiting in Europe to overcome such shortfalls. The United Kingdom seems also to have a potential shortage of such skills, as does France, which has an all-round skill shortage, but West Germany has a more adequate supply. Ironically Japan, which lacks the basic skills, is, as in other technologies, well supplied with the applied staff, in this case bioprocess engineers, many of whom have a background in microbial physiology, an area of potential skill shortage in most Western countries. As bioprocess engineering is still in its infancy, and seems to require more practical experience than the more "academic" genetic manipulation areas, it seems that there will be a premium on anyone with such skills in the future and international mobility could well increase.

In its short history, biotechnology has seen one international migration prompted by the rush of investment in genetic manipulation. As the supply of people with these skills has increased to near-sufficiency in many countries, the flow has abated. The market may have gone quiet for now, but as biotechnology matures, a second international migration could take place as the leading companies seek to recruit in the limited world pool of experienced bioprocess engineers. □

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