When will biotechnology mature?

Richard Pearson

The science of 'biotechnology' will be judged during the 1990s by what new products are launched, not by promises. But there will still be a demand for qualified workers.

BIOTECHNOLOGY is now entering a critical phase as the multinational chemical and pharmaceuticals companies move closer to the centre of action via a mixture of indigenous growth and selective takeover. In its early days, biotechnology was driven by the push of the scientists and the only constraints were those of feasibility. Now the needs of the marketplace and cost control are paramount.

Progress so far has been rapid, and is expected to continue to be so in pharmaceutical, agriculture and food, but lower oil prices are expected to slow developments in chemicals and the environmental opportunities are still likely to take some years to realize.

Overall the OECD (Organization for Economic Cooperation and Development) sees that the short-term impact on employment is likely to be negative due to rationalizations and cost reductions, with cause and effects often appearing in different continents as Third-World producers for example lose out as crop yields increase. What is seen as certain is the continually rising qualification profile of those working in the industry and the need for the continual updating of skills and retraining[1].

In the United Kingdom, one-third of the new recruits last year to biotechnology work were graduates, while 17 per cent had PhDs and a further 20 per cent had postdoctoral qualifications. Half of these recruits entered work related to bioprocess technology.

The perceived value of doctoral programmes in biotechnology is shown by the way the level of student interest has held up throughout the 1980s despite improving job attractions for first-degree graduates and the falling value of postgraduate grants. Most doctoral students pursued their postgraduate study because of the intrinsic interest of the subject and found places on their own initiative or with the help of their undergraduate supervisor; few were attracted by advertising or the work of the careers services. In contrast, those going on to masters' courses were more likely to see them as an opportunity to gain access to the biotechnology labour market.

Funding

In 1988 there were over 1,100 full-time PhD studentships in biotechnology and around 200 at masters' level. At PhD level, the dominant funding source was the SERC (Science and Engineering Research Council), which accounted for about 45 per cent of the studentships awarded, although only a minority of these were funded through the specialist Biotechnology Directorate, the others being funded through the more general science boards. Non-SERC sources included the other research councils (accounting for about 10 per cent), industry, academic institutions, private and other sources; overseas funds, including those directed through the British Council, accounted for nearly one in five students. This proportion of research-council funding in biotechnology is rather higher than the 35 per cent across all the sciences.

At masters' level, the main funding sources were private funding (one third) while the Training Agency (formerly the Manpower Services Commission) and the British Council each funded approximately 10 per cent of the total. SERC funding was low because it concentrates on support at doctoral level in answer to the needs of industry.

A survey of postgraduates completing their research since 1982 showed that one in three were women, their representation being highest on masters' courses, and that the mean age of all the students was 26. While fewer than 10 per cent of those taking part in PhD programmes had degree classes below an upper second, one in five of those on masters' courses had such degrees. Interestingly a higher proportion of students from sandwich courses were to be found on the PhDs' than on the masters' courses. In terms of source disciplines, biochemistry and microbiology dominated, followed by applied biology and chemistry and chemical engineering.

Once into their postgraduate study, most students found their needs for interest being met, and felt they received a good standard of supervision and provision of training in research techniques. But concern was expressed about the lack of training in team working and there were complaints at the low value of maintenance grants and awards.

The possession of a PhD was seen as an advantage both in getting a job on completion of the course (80 per cent entering biotechnology related employment) and in subsequent performance in it. A masters' degree was seen to be rather less valuable and reflected lack of relevant experience and the weaker demand in the labour market for this qualification, only 66 per cent of those with masters' degrees entering biotechnology-related employment.

Employers reported that skill shortage remained selective and that while the supply of PhDs was growing, the quality seemed to be falling. The range of shortages now also embraces specialists in plant molecular biology, cultures, microbial physiologists and downstream processing. The problems are worst in higher education, where the ability to offer jobs only on short-term contracts and inflexible salary structure are major barriers to recruitment[2].

Management

In addition to a continuing supply of doctoral and postdoctoral graduates, training needs in the future are seen to centre on scientific updating where distance learning will become increasingly important. Following the recent expansion in the supply of short courses, of which more than 75 now exist, provision is thought to be saturated, although there is a need for more specialist, rather large-scale, conferences. There is also a growing interest in management and business-related training and the need to improve the more general induction of new staff into their organization. At a more basic level, biotechnology is also entering secondary school curricula, while a number of undergraduate courses are now under way, although there is little evidence yet of a demand for these specialized courses from industry[3].

In the 1990s and beyond, there will have to be increased investment in training and widening of the skills base if biotechnology is to overcome the market, cost and social challenges and so meet its full potential. □

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1. *Biotechnology — Economic and Wider Impacts* (OECD, Paris, 1989).
2. *Training for Employment in Biotechnology* (SERC/IMS, 1989).
3. *Manpower and Training Needs for UK Biotechnology* (Biochemical Society, London, 1989).