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EDITORIAL

Biotechnology courses

Biotechnology is a popular and fashionable word in scientific circles, nowadays. The perceived utility of the spectacular advances in basic molecular biology, spawned the biotechnology industry in the United States, over two decades ago. Today, biotechnology research is an integral part of the efforts of major multinational companies, to carve out a piece of the cake in the area of agricultural and biomedical products. While small research-based companies are still a very prominent part of the biotechnology scene, the successes of the last decade have persuaded large, intrinsically conservative, industry giants to invest substantially in the area of biotechnology.

Classical biotechnology is even older than this century. Fermentation and the production of vaccines, predate the many advances of 20th century science, that sowed the seeds of modern biotechnology. The modern era can, arguably, be traced to the fundamental advances made in molecular biology, which allowed not only an understanding of the structure of DNA and the transfer of genetic information, but also made possible the cloning, amplification and manipulation of genes. The ability to transform cells with foreign genetic material was realized in the 1970s, ushering in the era of genetic engineering; probably the most widely discussed topic in biology in recent times. Indeed, genetically engineered crops and vaccines are the subject of much scientific interest and public debate. The success of projects to clone animals, of course, has raised the spectre of human cloning, adding yet another dimension to the controversies that surround the remarkable growth of biotechnology. Genomics is the most recent of biology's new frontiers. Even as genome sequences of diverse organisms pour into computerized databases, an end appears in sight even for the enormously complex (and expensive) human genome programme; a project that may prove the final testing ground for both sequencing technologies and the computational handling of sequence data. Genomics appears to have opened up apparently limitless possibilities, not the least of which is the ability to define the extent of our understanding (or indeed our ignorance) of an organisms genes and their products.

Even as the scope of modern biology explodes, the great potential for converting scientific advances into technological successes has brought a new (and at least in India, a somewhat unfamiliar) commercial dimension to the practice of biology. How many of the claims of modern biotechnology will stand the test of time and the demands of the marketplace remain to be seen. Nevertheless, the promise of the field is enough to attract both investors and speculators and to act as a magnet for students hoping to embark on careers in an area that appears to be exploding.

In India, the government moved quickly to create a Department of Biotechnology (DBT, initially the National Biotechnology Board, NBTB) in the 1980s, whose initial efforts to promote research and training in areas of modern biology were largely successful. Unfortunately, today, DBT is stretched thin; its activities encompass human resource development, funding of biological research, running several frontline institutions and serving as the nodal agency for coordinating many emerging ('mission mode') programmes of practical utility in the areas of agriculture and medicine. DBT pioneered the M Sc Biotechnology programme in a few chosen Universities; a postgraduate initiative that provided an entry into biology for students initially trained in all areas of science. Ample funding for infrastructure and a largely committed faculty ensured that these programmes, in the early years, provided a much needed infusion of bright and motivated students into the area of biological research. Unfortunately, the initial momentum has not been maintained at many centres. The problem has been compounded by a mushrooming of 'Biotechnology' courses, including programmes even at undergraduate (B Sc) level. Part of the blame must rest on the ill advised move of the University Grants Commission to imagine that 'Biotechnology' would be a 'vocational course'. A consequence has been that we now have a surfeit of indifferent biotechnology programmes, which focus neither on basic modern biology nor on its technological fallout. To some extent the problems of biotechnology courses resemble those of management or computer applications courses. There are

a few good academic programmes buried in a sea of indifferent and sometimes inappropriately advertised courses.

The fundamental problem, of course, is that it is hard to define the discipline of biotechnology. Botany, zoology, microbiology, fermentation technology, molecular biology, biochemistry, biophysics and even some fringes of chemistry emerge in biotechnology courses. Inevitably the precise slant of a 'biotechnology' programme is largely determined by the composition of the departmental faculty. Many institutions have simply chosen to rename old courses, while others have already begun bachelor's and

master's degree courses, without any formal teaching department in place. Some of these 'virtual biotechnology' programmes are so seriously flawed (sometimes entirely dependent on guest lecturers), that they can only be viewed as a marketing strategy to attract students to courses, that have no academic merit. The approach of universities and autonomous educational institutions in starting new programmes with complete disregard for academic considerations merits serious attention.

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