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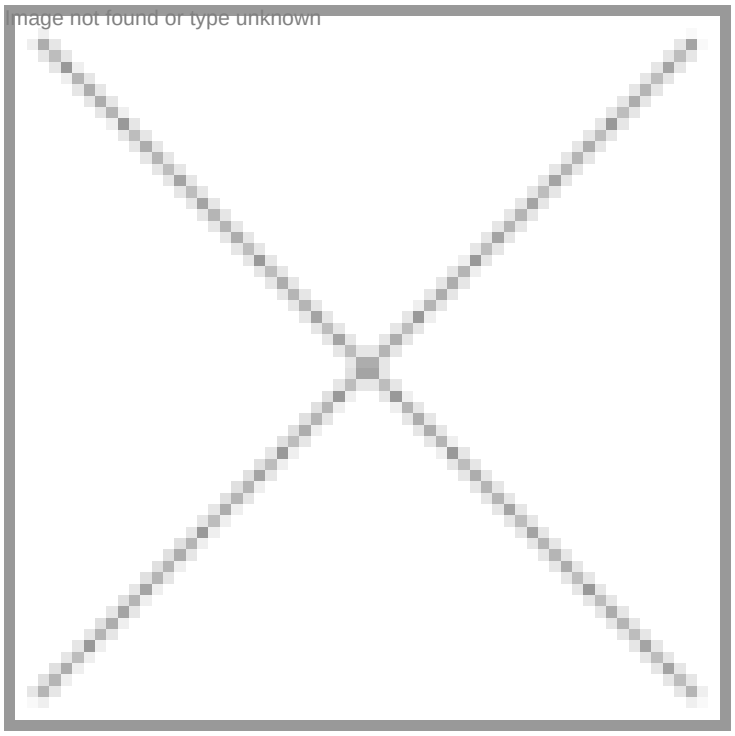
UK Biotech Education High on Research and Training

08 September 2005 | News



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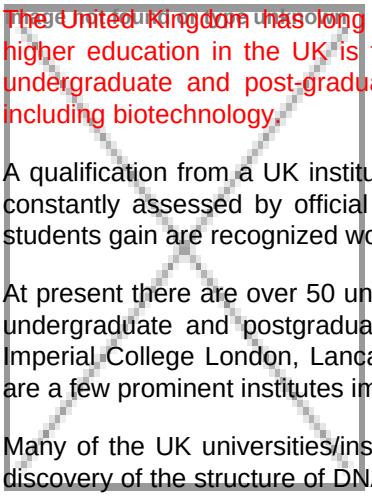

The United Kingdom has long been an attractive destination for overseas students. One in eight students pursuing their higher education in the UK is from a foreign country. Currently, there are about 16,000 Indian students pursuing various undergraduate and post-graduate programs in the UK. Most of these students have enrolled for specialized programs including biotechnology.

A qualification from a UK institution is very prestigious as standards are high at all levels. The universities and colleges are constantly assessed by official bodies that grade the standard of their research and teaching. The qualifications that the students gain are recognized worldwide and the UK courses encourage independence, creativity and self-reliance.

At present there are over 50 universities offering a range of courses in biotechnology and related specializations, both at the undergraduate and postgraduate level, in the UK. The University of Cambridge, Oxford University, University of Essax, Imperial College London, Lancaster University, University of Sheffield, University of Abertay Dundee, and Leeds University are a few prominent institutes imparting biotechnology education.

Many of the UK universities/institutes have been at the forefront of some exciting biosciences since the last 50 years. The discovery of the structure of DNA at Cambridge in 1953; birth of Dolly the sheep, the first mammal cloned from an adult cell at Roslin Institute, Scotland in 1997; the crucial contributions of the UK research institutes to the human genome project which led to its completion in 2003, are some of the important milestones marking the progress of the UK in the biosciences arena.

Imbibing biotechnology education in the hub of such activity indeed has its own advantages.

Essentially, biotechnology is an interdisciplinary field to train students in the application of modern technology, quantitative engineering methods, and principles of mathematics, chemistry and physics to the concepts of biology and medicine. Programs in the UK universities offer a range of focuses and often promote collaborative research across several departments within the university. The study courses are highly structured and focused with a lot of inbuilt flexibility. There are options of switching between related courses after the first year during under graduation and pursuing either a 3-year honors course or a four-year "sandwich" program. The sandwich program with a year of industry experience or overseas education helps in kickstarting a student's career even before the completion of the degree. The postgraduate courses are a one-year period of intense training either through taught or research option. The courses are structured as independent discrete study modules thus providing an exit route with a relevant certification during the course.

A very unique feature of the UK universities is the strong industry-academia linkage in the area of biotechnology. There is a large spinout of companies from the universities of the UK with Cambridge and Oxford leading the trend. At present there are about eight spinout companies from the University of Oxford in a year. There were about 70 spinouts between 1994-1999 while during 1999-2000 alone there were 199 spinouts from the various universities speaking about the strong entrepreneurial ethos prevalent in the UK. Overall, currently there are about 480 companies in the biotech arena, employing about 23,000 people in the UK. This vibrant and thriving biotech industry offers enough avenues for employment to skilled students on completion of their education.

Understanding that arranging finances could be an area of concern for international students, the UK institutions offer thousands of scholarships and bursaries for them and more than 21, 000 international students receive scholarship funding from the UK Government every year. The government has also made provisions under the existing work regulations for international students in the UK to work up to 20 hours a week when studying and full time during vacations.

Finally, interaction with international peers, exposure to the UK biotech industry, gaining insights into its work culture; and most importantly getting access to global biotech networks in addition to a world-class degree, are the important attractions of studying
in the UK.

NOTE: A detailed overview of the course structure, relative advantages, new course programs both at the undergraduate and postgraduate level with some illustrative examples are given in the subsequent pages of this section. It should be noted that the examples are only indicative in nature and there are many such programs available across the country.

Biotech Education with Industry Exposure

The undergraduate courses in biotechnology and related subjects in the United Kingdom are a recent trend. Many of these courses started about three to five years ago and were developed as a comprehensive module suiting the requirements of the industry.

There is a broad selection of biotechnology and related courses available at the undergraduate level with many options depending on the strength of the universities and other departments that can support developing new programs. There are undergraduate honors degree programs in biological sciences, biochemistry, human biology, bioinformatics, biotechnology and other related disciplines. The general aim of the undergraduate course is to equip the graduates to pursue higher degrees focused on research or more vocational courses like a masters degree.

Why a UG degree in the UK?

Apart from the obvious advantages of a world-class international exposure of the biotech industry, many universities under the UK educational system offer a unique opportunity to gain first hand experience by working with a biosciences company. Most of the universities have extensive links with companies and organizations in diverse fields from the pharmaceutical industry to medical research. For example, the University of Berminghan, which offers undergraduate degree programs in Biological Sciences, Biochemistry, Human Biology and Bioinformatics, has tie-ups with companies like GlaxoSmithKline, AstraZeneca, Celltech, Cambridge Antibody Technology, Novartis among others for the one-year professional placement of students. A year in the industry enables students to place the theoretical aspects of their subject into a professional context and increases their employment prospects on
graduation.

Another big advantage is the flexibility offered by the courses. This is the keyword while designing the study programs; all of which are modular with a wide range of options in the latter stages of the degree. The first year is generally an introduction to a whole range of subjects. This provides a firm base to build on in the second and third years, while also providing an option for students to choose a different degree scheme within the institute, should they wish, at the end of the first year. During the second and third years, the students combine various subjects based on what interest they have to make up the final degree. The course program is structured in such a way that it allows the student to delay the ultimate choice of specialization until the second year and to switch between related areas if the interests change.

Course structure

Typically, most of the universities provide an option of choosing from a three-year BSc honors course or a four-year BSc honors course. The four-year course is also known as a "Sandwich" course, with a year of study overseas or industry experience. In such a scenario, the student will have a chance to either transfer to work within industry or study at another foreign university for a year typically the US/Germany/Australia/ Singapore/Sweden depending on mutual agreements signed by the universities. The study transfer is done in the second year whereas the work experience is mostly carried out in the third year of study. Transfer credits for courses are accepted to the 'mother' campus of the student. For instance, the University of Wales, Aberystwyth offers a BSc degree in Genetics and Biochemistry. As part of this course, a student may spend one or two semesters at a university in France, Germany, Spain or Portugal as part of the European Union Socrates student exchange program. The University also has a well-established exchange program with Universities in the USA. Between years two and three, there is an opportunity to take a year's work experience through the "Year in Employment Scheme", which helps a student to test out possible future careers, learn new skills, carry out work towards the honors project and improve the career prospects.

Similarly the Liverpool John Moores University offers a BSc degree in biotechnology via the "sandwich" route. The students spend the third year on a professional training placement. Current students of the Liverpool University are placed in laboratories in hospitals, research institutes and pharmaceutical/biotechnology companies both in the UK and abroad. A professional training tutor aids the students in finding a suitable placement, a process that usually starts at the beginning of the second year. The BSc biotechnology degree program of the University of Nottingham allows for a period of study/training at a European University, a placement through Universitas 21, or a practical year between years two and three. The Universitas 21 or U21 as it is popularly known is a global alliance of key universities. The Nottingham University recently introduced exchanges in which undergraduates spend one semester with its partners and the marks obtained count towards their degree. Examples of its current partners are Australia (Melbourne, Sydney, Brisbane), New Zealand (Auckland), Canada (McGill, British Columbia), USA (Virginia), Singapore, and China (Fudan, Hong Kong). The University of Reading also offers a four-year sandwich course in biotechnology with a two six-month placements in industry as a core component.

Course curriculum

The course duration is three or four years and the academic session starts from September/October. The study programs enable the student to acquire a firm grounding in biotechnology and to specialize in several aspects of the subject. The degree aims to apply recent developments in molecular and cell biology to a wide range of industrially important problems. Particular emphasis is placed on recent advances happening in this area.

A general course outline for a BSc honors course will consist of study of general modules in fundamental biology and related disciplines like Chemistry, Biochemistry, Physiology, Microbiology and Cell Biology. Along with these, sometimes the students have to select a number of electives based on their interests and future career plans.

During the second year, the foundations that were laid down previously are built upon and additionally the student is exposed to more specific modern biological and biotechnological subjects, eg. Cell Culture, Immunology, Analytical Chemistry, Food Microbiology, Structure of Biological Macromolecules and Medical Biochemistry among others.

In the final year, the student can choose the direction in which he/she wishes to proceed e.g. Environmental Biotechnology, Molecular Biotechnology, Protein Science, Animal and Plant Cell Technology. Generally the honors students undertake an independent research project in their final year.

Some universities also offer an undergraduate course in the related area of Bioinformatics. The course provides integrated training in all aspects of biological and computer sciences that are needed in this new area. Students take modules in core biosciences areas such as Molecules of Life; Molecular Cell Biology; Genes, Genomes and Heredity; and Evolution and Biodiversity, while at the same time learning fundamental computing skills such as working in UNIX environments, use of CGI and writing PERL scripts, programming in C and Java, and database, design, construction and maintenance. The course programs emphasizes on direct hands-on experience, using bioinformatics tools and learning about and understanding how to access and interpret the huge amount of data currently accumulating online. There are both three and four-year degree courses with professional placement in bioinformatics. The University of Birmingham was one of the first in the UK to offer an undergraduate degree in Bioinformatics which provides the students an option of spending a year either externally in a company or an institution to gain work experience, or doing an intercalated year in computer science, refining and developing their programming expertise.

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Career prospects

This kind of undergraduate scheme of study offers employment avenues in the growth areas of biomedicine, forensic science, DNA profiling (humans, animals, plants), clinical cytogenetics and genetic counseling, biotechnology and food production, and aspects of biodiversity and the conservation of genetic resources and endangered species.

The broad-based knowledge of modern biology also equips a student for a higher degree, postgraduate course or a career in medical, public health or forensic science laboratories and in the pharmaceutical industry. Many graduates passing out from the UK universities find work as professional scientists and managers in the biotechnology industry and as technical personnel in the biosciences companies. The wide range of options in the course program opens up job opportunities in the environmental, food, biomedical, pharmaceutical and agrochemical sectors.

Gaining entry at UG level

Most UK institutions accept the Indian school leaving qualifications (especially from the two main national boards: The Central Board of Secondary Education and the Council for the Indian School Certificate Examinations) for admission to undergraduate courses. The state boards are considered on a case-to-case basis. Applicants have to meet the minimum marks requirements and this varies from institution to institution. Competitive institutions generally expect a much higher percentage of marks.

The institutions also consider other factors such as extra-curricular activities, relevant part-time work experience and the quality of the application. The personal statement and the reference from the principal/teacher are also very crucial.

The Universities and Colleges Admission Service (UCAS) co-ordinates applications for undergraduate courses in the UK which means that a student only needs to fill up one UCAS application form and can apply to a maximum of six courses. The student needs to send the completed form to apply online through 'International Apply'. UCAS will forward it to the institutions concerned. There is an option of applying online through 'International Apply' too. The deadline for UCAS application to University of Oxford and Cambridge is October 15, and for other applications is January 15. All applications received after June 30 are put into clearing.

Another important criterion for study in the UK is that all students need to show that they have an adequate knowledge of written and spoken English. In the case of international students, this usually means taking either an IELTS or TOEFL test.

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