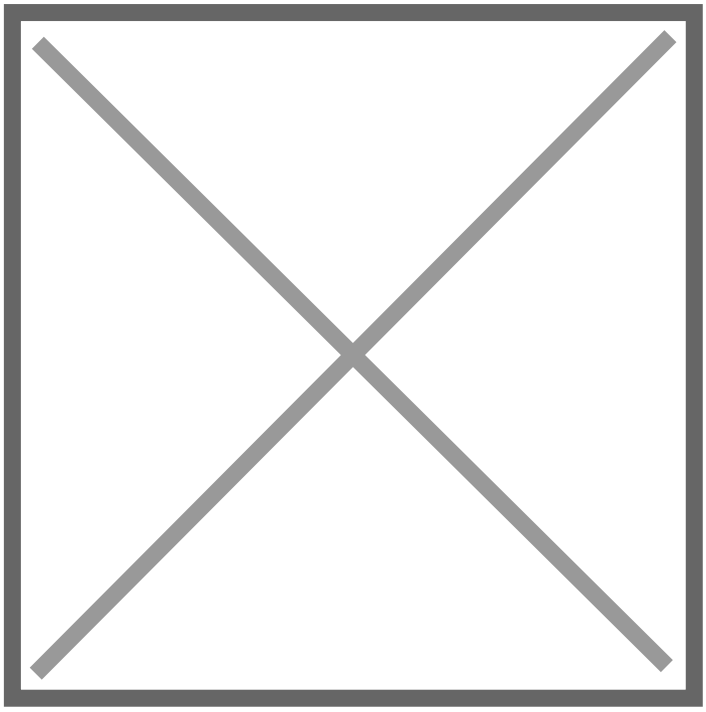
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Thrust on Quality Education

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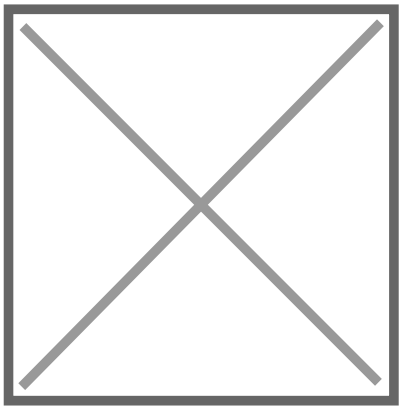
Thrust on Quality Education

With a wide spectrum of courses running in general and specialized sectors of biotechnology, the bottomline is the effort to breed excellence and not mediocrity in biotech education.

Human capital is the key driver for global competitiveness in the biotechnology sector. This has been increasingly recognized by the Indian academicians, scientists, policy makers and industrialists, leading to concerted efforts in the area of human resource generation. In the recent years, along with increasing the talent pool, there has also been a strong focus on its quality too.

Emphasis on quality

The recent cancellation of registration of all the private universities in the state of Chattisgarh was a strong step taken by the Supreme Court in this direction.



With the large number of private, state-funded, Centre-supported institutes in the fray, the pertinent questions being deliberated over and addressed in various forums related to biotechnology education are: How to ensure uniform and standard quality education across the vast number of biotech educational institutes; Is there need of a regulatory body to oversee the quality of education imparted? In principle, it has been acknowledged that there is a need for such a body. In fact, the Department of Biotechnology (DBT), the nodal government agency which drives, supports and provides direction for the human resource generation in the area of biotechnology has highlighted the need to set up a regulatory body for the

maintenance of standard education under the name of All-India Board of Biotechnology Education under the AICTE.

Many of the concerns raised by the various stakeholders regarding quality human resource generation have been addressed in the Draft National Biotechnology Development Strategy released by the DBT on March 31, 2005. The Strategy charts an integrated 10-year road map for giving impetus to the Indian biotech industry, research and development, human resources generation and infrastructure development. To address the requirement of human resource generation and further augment the existing efforts of the DBT, the development strategy has proposed some strategic action plans.

Course structure

The biotech curriculum is also being put under a scanner and academicians have put in a voracious demand for its restructuring according to current international trends. Dr Sameer Brahmachari, director, Institute of Genomics and Integrative Biology (IGIB) opines, "We need new approaches for learning. All countries like Singapore, Europe, US, Germany have floated, integrative courses. In these courses transdisciplinary subjects are taught together for problem solving. Integrative teaching is a new model where dis-coordinated information is given and students have to synthesize information, to integrate the knowledge to create new knowledge, new information or new conclusion. This cuts across the subjects and orients the students for information processing in biology". Many are of the view that the two-year masters programs are not equipped to impart all the relevant information. Dr K Kannan, professor, School of Biotechnology, Guru Govind Singh Indraprastha University, Delhi, comments, "The present 2-year masters programs cannot teach technology in such a short span. It requires a 4-5 year course program as it involves a whole gamut of subjects like IPR issues, marketing, biomanufacturing, biosafety, bioethics, strategic management, product formulation, clinical trials, etc. Biotech education should be structured just like that of the IITs, which take students after 10+2 to teach them the engineering technology." Adding to these views, Prof Deepak Pental, director, Delhi University, South Campus, said, "The education system has to be completely revamped. We should have BTech degrees in agricultural biotechnology, which should be offered in five universities to start with. IARI should take the lead. We should teach plant biochemistry, mapping techniques, etc and should have a strong field working environment"

According to Prof Pradip Sinha, head, Biological Sciences and Bioengineering department, IIT Kanpur, "The HRD program in biotechnology has to shed its old classical format. Until now biotechnology was perceived with a narrow window of molecular biology focus. But now it is time to redefine biotechnology. For example, where do we place tissue engineering, stem cell, biomedical devices, drug design in the context of biotechnology. There is a need of interfacing with other disciplines. Secondly in the context of overall biotechnology framework, the technology concept should not be introduced early without the basic knowledge." "Ultimately every student must look for some domain specialization, they should try to see themselves as master in something. Only then they will find useful interface to get into biotech related issues," he added.

The lack of adequate industry-academia interaction in the curriculum is also being looked at with concern as this prevents the students from developing a realistic industry perspective. "In the Indian universities and academic institutions, a lot of high quality academic work is going on but what is missing is the awareness and the orientation of the industry. Unless and until the manpower that is generated has the awareness of how to commercialize and what are the compulsions of commercialization, the industry cannot really pick up. We have great academics but not enough work to bring it to a commercial level. There is an obvious disconnect between the academicians and the industry," observed Dr Chandra Mittal, professor and associate chair, Department of Biotechnology, Houston Community College, US. "The students in this area in India are good but have very less exposure to the application side of things," he added.

Most of these issues are being looked into and would be addressed through the National Biotechnology Development Strategy.

Innovative Initiatives

Recognizing the need to introduce specialized courses in biotechnology as the field matures, DBT has introduced some innovative courses recently. A one-year PG Diploma course in Genetic Engineering and Bioprocess Development was started in the MS University of Baroda in 2002-03 and a two-year MTech course in pharmaceutical biotechnology was started at the National Institute of Pharmaceutical Education & Research, Mohali in 2003-04.

With India adhering to the TRIPS regime, it has become crucial to create awareness about the various IPR issues, patents in relation to biotechnology. In 2003-04, a one-year PG diploma course in Intellectual Property Rights and Biotechnology was started in the National Law School of India University, Bangalore with the support of DBT.

There have been other initiatives too. For instance, the University of Pune launched a unique two-year full time MBA program in biotechnology. This was the first such program by an Indian university or institute and now many institutes are following suit. The syllabus is based on the requirements of the industry. Sixty percent of the syllabus covers the managerial aspect and

about 40 percent biotechnology.

Bioinformatics, an offshoot of biotechnology, has been lately attracting a lot of attention. This has led to specialized BSc/MSc and BTech courses in this branch. Bharathiar University, Coimbatore and Pune University, which has a center of excellence in Bioinformatics, offer a two-year MSc course in Bioinformatics. Recently, the Centre of Bioinformatics at IIT Delhi became a National Centre and now offers interdisciplinary MTech programs in Bioinformatics.

The Indian Institute of Science (IISc), Bangalore, which is engaged in path-breaking bioresearch activities and initiatives and training is the coordinator for post doctorate fellowship program in biotechnology in the country. It has proposed for a one-year specialized training program before PhD and after the Masters course. The focus of the program is to learn the modern techniques so as to cut down the time on research.

To enthuse and encourage students to go for higher education in biotechnology, in the financial year 2004-05, the DBT-JRF program was started and 43 JRFs (Junior Research Fellow) were selected from 24 universities/institutions. In addition, DBT is planning to increase the PhD fellowships to 200 per annum.

Present scenario

According to the Draft Biotechnlogy Strategy, today there are over a hundred national research laboratories employing thousands of scientists. There are more than 300 college level educational and training institutes across the country offering degrees and diplomas in biotechnology, bioinformatics and the biological sciences, producing nearly 500,000 students on an annual basis. More than 100 medical colleges add 17,000 medical practitioners per year. About 300,000 postgraduates and 1500 PhDs qualify in biosciences and engineering each year. Thus India has many assets in its strong pool of scientist and engineers, vast institutional network and cost effective manufacturing.

The Indian biotechnology industry too is growing at a fast pace. According to BioSpectrum estimates during 2003-04, the biotech industry has grown by 39 percent and the industry revenues stood at Rs 3,265 crore ($705 million). Industry estimates project that biotechnology as a business segment for India has the potential of generating revenues to the tune of $5 billion and creating one million jobs by 2010 through products and services.

According to the draft Biotech Strategy, the reliable estimates of human resource availability for the next 10 years are required. Though expert consensus indicates that there is adequate enrollment currently at the post-graduate and under-graduate levels, the quality is inconsistent. Areas such as intellectual property rights, regulatory issues and industrial training have received inadequate attention. There is a consensus that there is an urgent need to augment the number of PhD programs in life sciences and biotechnology. On this issue, Dr MK Bhan, secretary, DBT, opines, "There is a misconception that the country is lacking in skilled and qualified manpower. It is not the right kind of thinking since practical exposure in the industry is required for any qualified person to become skilled. What we are actually lacking is scientific leadership. Without effective leadership, it is not possible to create successful enterprises. Quality education is a must and those with the minds to excel will be in high demand."

Creating a critical mass

Largely, the credit of creating a broad talent pool focused on biotechnology and related disciplines goes to DBT. The first countrywide efforts to streamline biotech education and focus on human resource generation were by done by DBT soon after its establishment in 1986.

A snapshot view of biotechnology education at various levels is given below.

Bachelors level

The past five-six years have seen a lot of activity happening in the biotechnology space. Due to the popularity, scope and increasing awareness about the subject, BSc Biotechnology is now being offered by a sizeable number of universities/private colleges at the undergraduate level also, like Bangalore University (Karnataka) and Chaudhary Charan Singh University, Meerut, (UP) and many other institutes are likely to introduce these courses.

Although BSc Biotech is a new concept, many prestigious institutes have been offering a four-year BTech course in Biotechnology for quite some time now, like the IITs. Out of the 1,222 engineering colleges that got the AICTE's approval (All India Council of Technical Education) to offer courses in science and technology, 133 colleges are offering biotechnology as one of the courses for the academic year 2004-05. The BE in biotechnology has picked up in the last few years in states like Tamil Nadu, Karnataka and Andhra Pradesh where many biotech companies have a base. It is expected that many engineering colleges in Maharashtra, Punjab and Rajasthan would join the list of colleges offering biotech courses.

Masters level

The first two-year general biotechnology-teaching courses were introduced at the Masters level in top universities like Madurai Kamaraj University, Jawaharlal Nehru University, Pune University, MS University, Baroda in 1985-86 by the DBT. Subsequently the course was introduced in other universities and today there are 30 DBT supported courses running in the country.

DBT also supports seven agricultural biotechnology courses; one in medical biotechnology, two in marine biotechnology, one in industrial biotechnology, three in neurosciences at the MSc level. In addition, it also supports 6 MTech courses in biochemical engineering, bioprocess technology and biotechnology. As on date, 55 post graduate teaching courses are being supported on a regular basis and 15 universities/ centers have been provided one-time financial support for strengthening their ongoing PG courses. The intake in the various post graduate courses is around 900 per year. During 2004-05 nine new proposals (2 MSc Biotechnology, 4 MSc Agricultural Biotechnology, 1 M Tech Marine Biotechnology, 1 MVSc Animal Biotechnology and 1 placement cell proposal) are in the final stages of approval by the DBT.

During the year 56 post doctoral fellows were selected, 11short-term training courses were supported in multidisciplinary areas of biotechnology. And about 100 students have been placed in different industries for a 6-month training. In addition to the DBT supported postgraduate courses many state universities, private colleges and institutes also offer masters degree in biotechnology.

Doctorate level

The Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR) and DBT are the government agencies involved in supporting and encouraging biotechnology research and training.

There are nearly 19 CSIR labs like Central Drug Research Institute, Lucknow, CFTRI, Mysore, Institute of Genomics and Integrative Biology, Delhi which are actively involved in biotech research and training. The ICAR promotes science and technology programs in agricultural research and education and carries out research directly through ICAR institutes and national research centers, project directorates and also in association with the State Agricultural Universities.

The ICMR formulates, coordinates and promotes biomedical research in India. The ICMR national institutes offer opportunities for research in the area of medical biotechnology.

DBT has been instrumental in the creation of the many "National Centers of Excellence" which are involved in high ended research and training in specialized areas. Like the National Institute of Immunology, New Delhi, National Center for Cell Science, Pune, Centre for DNA fingerprinting and diagnostics, Hyderabad, National Brain Research Centre, Manesar, National Centre for Plant Genomic Research, New Delhi, among others. DBT further plans to set up centers of excellence in the fields of marine biotechnology, animal biotechnology, herbal medicine, molecular medicine and bioinformatics.

Apart from these, there are high caliber institutes like the Indian Institute of Science, Bangalore, Tata Institute of Fundamental Research, Mumbai, International Centre for Genetic Engineering and Biotechnology, New Delhi, which conduct sophisticated research and training in biotechnology.

In order to build a successful biotechnology sector, large talent pools are required in multiple scientific disciplines such as molecular and cell biology, chemistry, physics, engineering, bioinformatics, medicine and agriculture.

Ultimately the focus of the entire chain of biotech educational institutes is to create a strong pool of academic leaders/entrepreneurs/specialists, who will lead the biotech revolution through sustained innovation.

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