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Two decades of PG teaching in biotechnology in India

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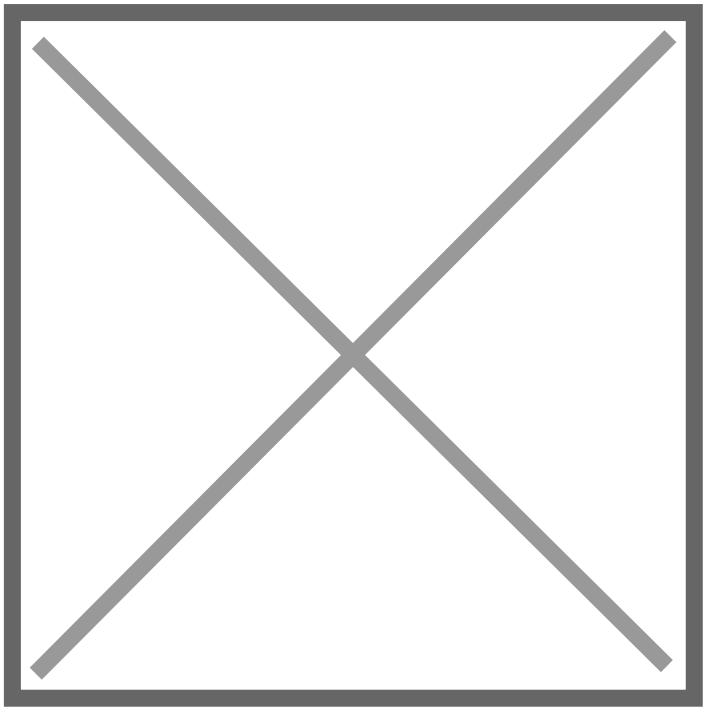


Two decades of PG teaching in biotechnology in India

Keeping in mind the demand for trained manpower in specific areas, the DBT has extended its programs to over 61 universities in general, medical, agricultural, marine, veterinary, industrial and pharmaceutical biotechnology.

Realizing the tremendous potential of biotechnology in improving human and animal health, increasing agricultural productivity and providing safe and clean environment, the Indian government started a multi agency, the National Biotechnology Board comprising the University Grants Commission (UGC), Indian Council of Medical Research (ICMR), Council of Scientific & Industrial Research (CSIR) and Department of Science & Technology (DST) way back in 1982. This was subsequently upgraded to a full-fledged Department in 1986 to give much desired impetus to this area.

Schedule for admission

- Issue of application forms and submission of completed forms March
  Entrance examination May

- Declaration of results July

Whom to contact

Dr S Chandrasekaran, co-ordinator (evaluation) Academic, Administrative Building, JNU, New Delhi-110067 OR respective course coordinators.

Preference by students

JNU, BHU and MKU are the first three choices of students for MSc general biotech course at the time of admission. Similarly, TNAU and GBPUAT are preferred choices of candidates for MSc Ag Biotech.

Timely interventions of the Department of Biotechnology (DBT) in creating talent pool, infrastructure for R&D and incentives for industry have led to an unprecedented 35 percent annual growth of biotech industry in last four years. This boom is expected to continue and newer opportunities will be created in the area of clinical research and manufacturing, field testing of GM crops, regulatory affairs such as IPR and biosafety, consultancy for business planning and global collaborations.

Well-trained manpower in multi disciplinary and rapidly advancing area of biotechnology is a pre-requisite for meaningful R&D and production. India can take pride in being one of the first few countries in the world to initiate an integrated program of human resource development in biotechnology comprising post graduate teaching programs, short-term training courses for upgrading skills of mid-career scientists, faculty involved in undergraduate and postgraduate teaching, training in leading overseas laboratories in gap areas where expertise does not exist in the country.

The DBT took a conscious decision to start only postgraduate teaching programs in biotechnology as it is a highly specialized, laboratory intensive course. Specialization at undergraduate level narrows down future options and laboratory facilities and expertise is often lacking in undergraduate institutions. The postgraduate courses were supported initially in 1985 in six universities jointly with UGC, Indian Council of Agricultural Research (ICAR) and the then Department of Ocean Development as collaborative, inter-departmental and inter-institutional programs. Institutions are selected based on existing expertise, infrastructural facilities such as laboratories, lecture halls, library, R&D grants on competitive funding and nearby institutions engaged in biotechnology R&D.

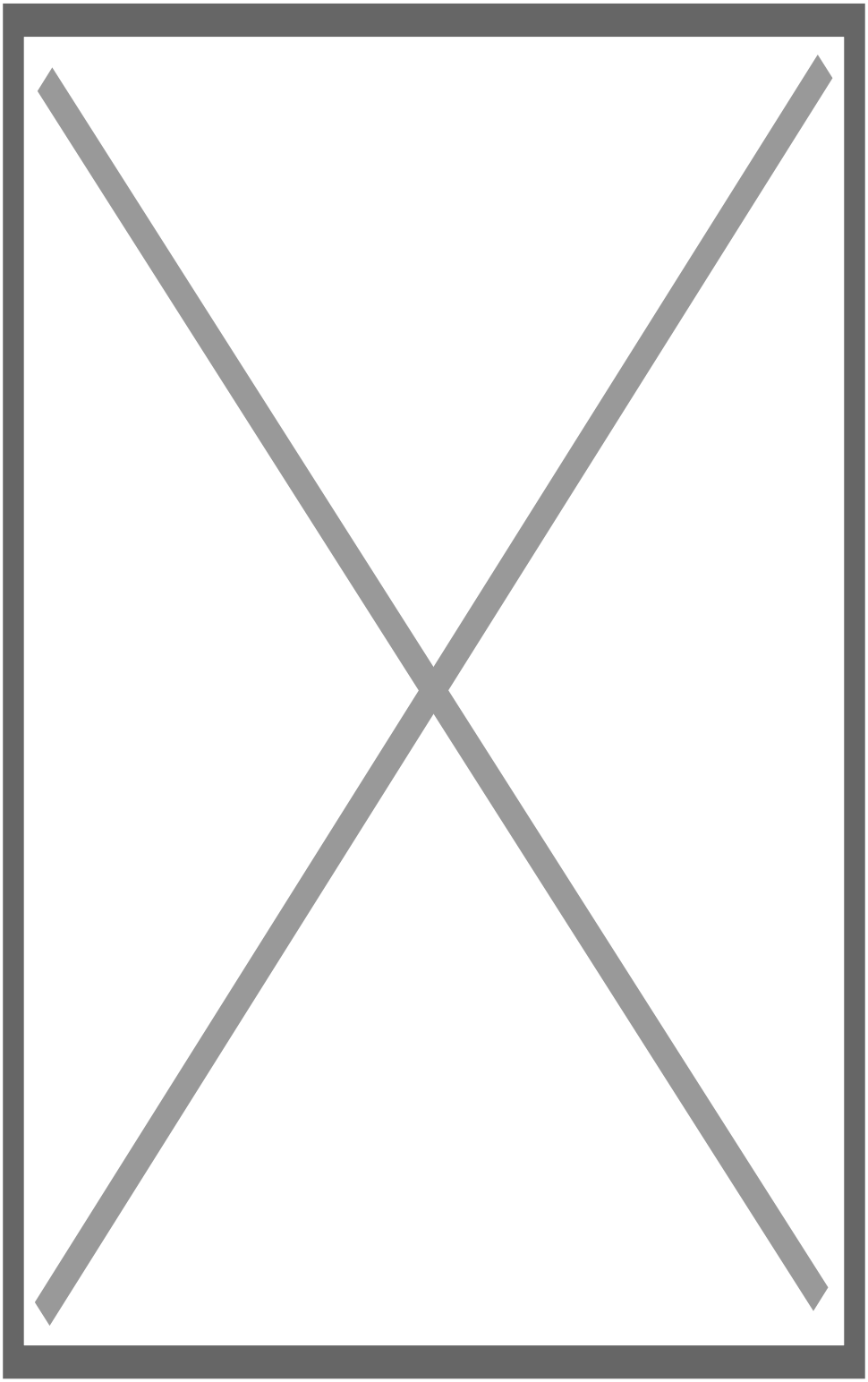
India is a vast country and keeping in mind the demand for trained manpower in specific areas and regional aspirations, these programs have been expanded in over 61 universities in general, medical, agricultural, marine, veterinary, industrial, pharmaceutical biotechnology. New programs in food and nutrition, clinical pharmacology and product development, bioinstruments and biomedical standards, bioenterprise management and financing and regulatory affairs are being contemplated.

Grants for specialized infrastructural facilities, laboratory equipment, maintenance grant for equipment and recurring grant for consumables, studentship, books and journals, visiting faculty, travel, contingency, and thesis are provided on the basis of actual number of students admitted.

These programs are periodically reviewed by in-house advisory committees, annual meetings of course coordinators of all participating universities as well as joint DBTÃ¢â?¬â??UGC HRD task force.

As a result of two decades of intensive support by the DBT, the standard of teaching and research in biotechnology and allied areas of life sciences has improved considerably.

The success of teaching programs can be judged by expertise of faculty, quality of students admitted, curriculum and placement of students.

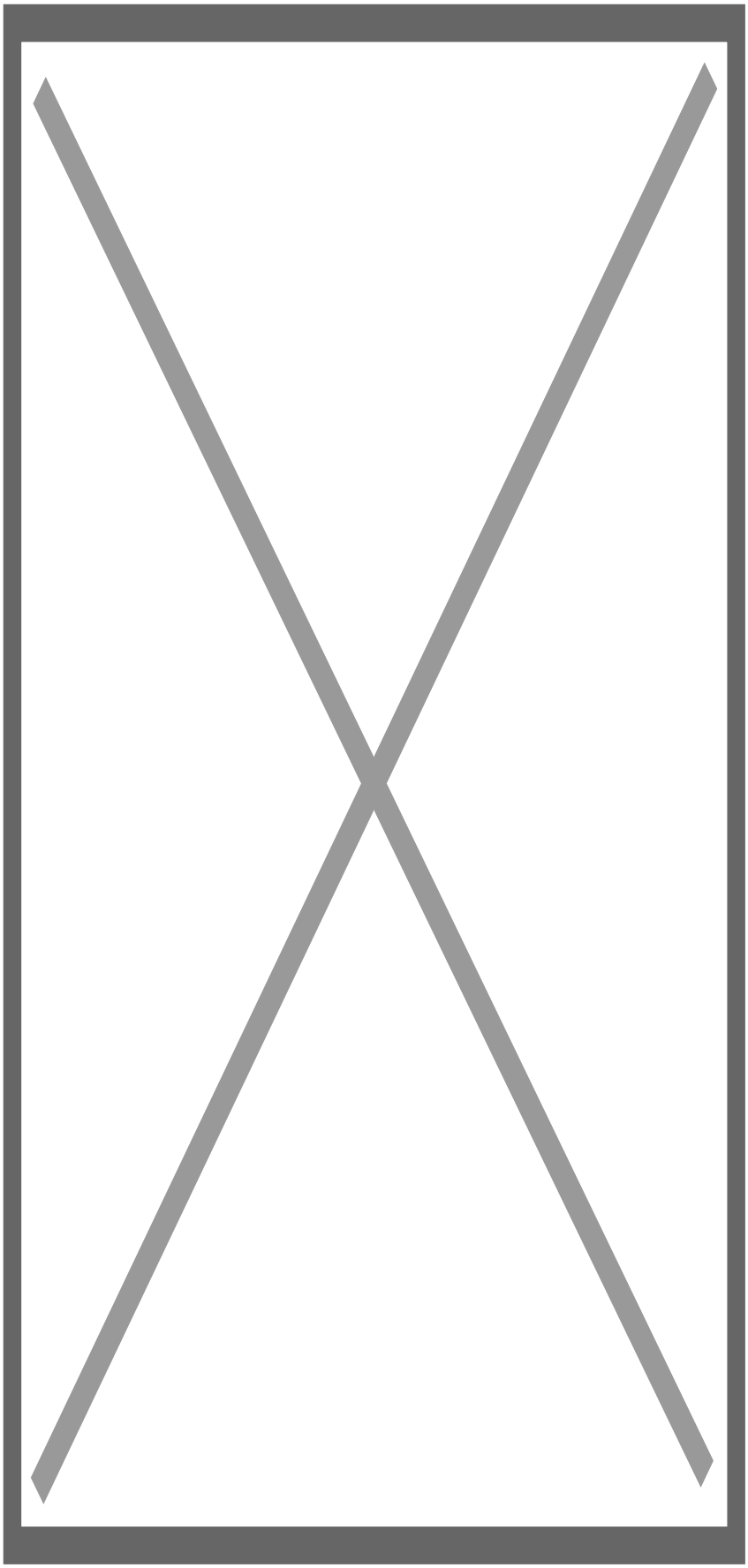


Selection of students

To provide allÃ¢â?¬â??India representation, maintain uniformity and ensure selection of quality students, students for MSc general and marine biotechnology in 29 universities, MSc Ag. in eight universities, MVSc. biotechnology in three universities and MTech in two universities are admitted through Common Entrance Test (CET) conducted by JNU at 53 centers all over the country and two overseas centers. Admission to other universities or IITs is made through a joint entrance test conducted by IIT or tests conducted by the respective universities.

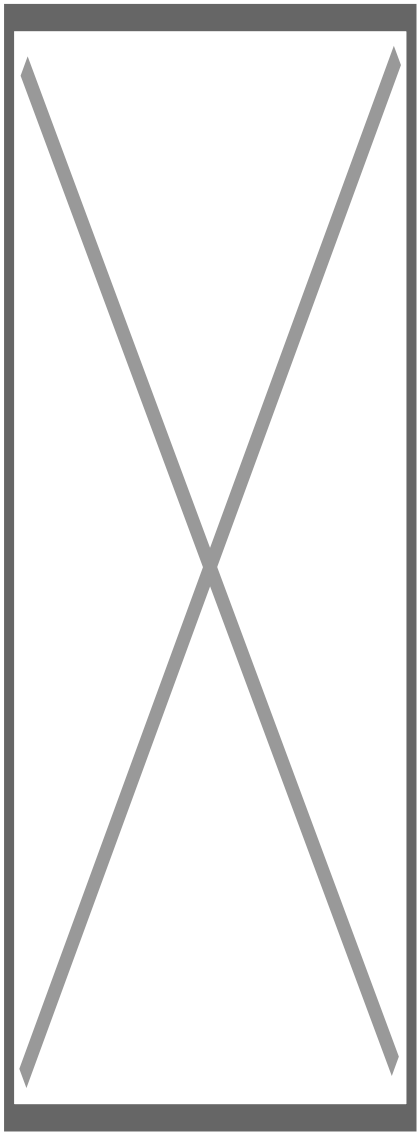
The courses are very popular and admission procedure is highly stringent as 22,365 students competed for 560 seats of MSc and MTech through JNU CET in 2006-07.

Students from all parts of the country appear in CET and selected candidates also reflect true all India representation.



Who can apply?

Candidates with a Bachelor's degree under 10+2+3 pattern of education in physical, biological, agricultural, veterinary and fishery sciences, pharmacy, engineering/technology, four years BSc (physician assistant course); or medicine (MBBS) or BDS with 55 percent marks can apply. Only those candidates who have passed the qualifying examination in 2006-07 and those who will appear in 2008 will be eligible for JNU CET for admission to MSc/MTech biotechnology in 2008. Students who have passed the qualifying examination prior to 2006 will not be eligible for JNU CET.



Admission test

Question paper for CET comprises of two parts with multiple choice questions. Part A has questions at 10+2 level from physics, chemistry, mathematics and biology. Each question carries one mark and negative marking of half mark. Part B has questions at bachelor's level requiring thinking and analysis. There are 40 questions from physics, mathematics and biology and 20 from chemistry. The candidates are required to attempt 60 questions of three marks each and one mark is deducted for wrong answer. The question papers are jointly set and evaluated by course coordinators of participating universities

Curriculum

Model course curricula have been developed by the Department of Biotechnology through a consultative process to maintain uniformity and ensure minimum standard of education. The curriculum revision exercise is undertaken periodically to incorporate latest developments.

In the ongoing curriculum revision exercise, a lot of disparity has been noticed in total credits allotted to different courses as well as number of hours per week for each credit by different universities. Credits allotted to a course range from 64 to 166. Time and credits for theory differ from 12-20 hours per week and 39-88. Similar breakup for practicals is 6-24 hours per week and 17-78. The time and credits allotted to project work varies from six months to one year and 5-26. Efforts are being made to rationalize these disparities.

Addition of courses in new areas like nanobiotechnology, stem cell, IPR, genomics and proteomics and optional course on communication skills is being contemplated in the ongoing curriculum revision exercise.

Intellectual capital

Intellectual capital in the form of faculty resources is the most important input in an academic program. The number and educational background of faculty is a major indicator. Support to teaching programs has helped in creation of extremely talented 350 faculty members. The details of permanent core faculty and their area of specialization can be accessed at www.dbtindia.nic.in.

In the universities conducting postgraduate teaching programs supported by the DBT, the number of core faculty ranges from 1-25. Most of the teaching programs also draw faculty from other departments within the university and nearby institutes. The number of associate faculty varies from 2-21. In many universities, a number of faculty positions are lying vacant. There is provision for inviting visiting faculty to supplement teaching in gap areas. Faculty upgradation programs are conducted in leading national laboratories to keep abreast with latest developments.

The faculty has received a large amount of extramural grants on competitive funding basis. During the last five years, the faculty associated with the teaching program from 34 universities have published 1,719 papers in high impact journals. The impact factor of scientific journals 2001 can be accessed from www.genebee.msu.su/journals/1/01/01.html. Details of impact factor are available for 1,151 publications. In addition to faculty from universities who have received sustained financial support for 10-20 years like the IITs (Delhi, Kanpur and Mumbai), All India Institute of Medical Sciences, Madurai Kamraj University, Banaras Hindu University, Aligarh Muslim University, and Devi Ahilya Vishwavidyalaya, some of the new entrants like Jiwaji University, Gwalior, National Brain Research Centre (NBRC), Manesar, Tezpur University and University of Kashmir have also published papers in high impact journals. The faculty have contributed edited books, chapters in books, patents and technologies.

As many as 570 students have been awarded PhD degrees in biotechnology related areas under the supervision of faculty members from 50 universities and 567 students are enrolled for PhD at present.

Placement analysis

The placement of students passing out is an important indicator of success of teaching program. A large number of students coming out of these programs qualify in CSIR-UGC National Entrance Test (NET) for Junior Research Fellowship (JRF), DBT Biotechnology eligibility test (BET) for JRF. Students are pursuing research in leading national and international laboratories e.g. Tata Institute of Fundamental Research, Mumbai, Bhabha Atomic Research Centre, Mumbai, Indian Institute of Science, Bangalore, National Institute of Immunology, New Delhi, Centre for Cellular and Molecular Biology, Hyderabad, JNU, NBRC, International Centre for Genetic Engineering and Biotechnology, New Delhi, National Centre for Cell Science, Pune, National Centre for Biological Sciences, Bangalore, University of Cambridge, UK, National University of Singapore, Singapore, University of Sydney, Australia, John Hopkins University, University of Texas, Purdue University, Carnegie Mellon University, University of Utah, University of Iowa, Michigan State University, Washington State University, USA, Hanover Medical Institute, Dortmund University and Ruhr University, Germany. Several students find placement in companies such as Biocon, Dr Reddy's Laboratories, Shantha Biotech, Panacea, Advanced Enzyme Technology, Bharat Serum, Intas Pharmaceuticals, Serum Institute, US Vitamins, Wockhardt and Zydus Cadila Pharmaceuticals.

The analysis of first placement of about 1,000 students passed out during 1985-1995 showed only 12 percent students opted for industry while similar analysis of 2,000 students passed out during 2000-05 indicates a healthy trend of 17 percent students opting for industry. As expected, MSc students opt for PhD and MTech students take up jobs in industries.

Due to liberal grants for creation of infrastructural facilities and recurring grants for consumables, thesis, library, studentship and visiting faculty, the programs supported by the DBT offer intensive hands-on training. However, mushrooming of self financing courses without proper expertise and infrastructure has led to large number of disillusioned students unable to find proper placements.

In a recent exercise undertaken for assisting postgraduate biotechnology students in finding placement in industry, proposed salaries to be offered ranged from Rs 5,000 to Rs 15,000 per month, which is not commensurate with industry in other sectors

for the same level of qualification.

Bridging skill gaps

The growth in the Indian biotech industry is bound to create requirement for well-trained manpower. However, the industry experts feel that the students produced by Indian universities lack practical skills and the ability to think critically.

To reduce the gap between skill sets of students produced by universities and that required by the industry, the DBT is facilitating industrial training of postgraduate students in biotech industries for six months. All students are given a stipend and a bench fee of Rs 50,000 per student is provided to industry to attract them to accommodate more students for training. This training refines the academic knowledge base of students by complementing with practical skills to match the needs and expectations of industry.

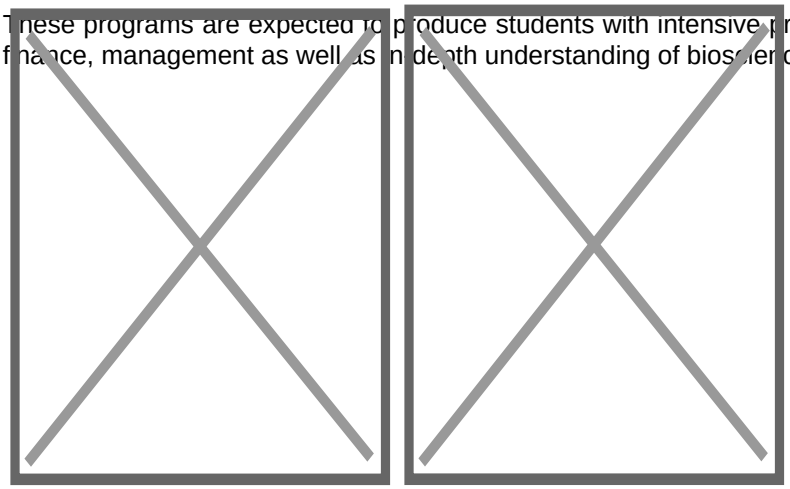
Industrial training helps over 30 percent students in finding permanent placement. It may be good idea to undertake thesis/dissertation (as part of MSc degree) in industry which could enhance their acceptability by industry.

Need to diversify

With years of continued support for teaching programs, a number of students with basic biotechnology specialization have been produced in the country. However, there is a need to initiate diversified models of hybrid education such as master of bioscience degree combining business and science in a team based, project focused curriculum to produce flexible, mature and experienced pool of talented students.

A number of universities in the US, UK and Australia are running such innovative courses on Masters in Bioscience enterprise. In India, Pune University, Panjab University and Amity University have initiated MBA Biotechnology.

These programs are expected to produce students with intensive practical training along with strong background in business, finance, management as well as in depth understanding of bioscience industry.



Dr Suman Govil, adviser & **Shubhlata Sharma**, senior scientific officer, Department of Biotechnology, Ministry of Science & Technology, New Delhi.

The authors express heartfelt thanks to the course coordinators of participating universities for providing details of faculty, student admission and placement. The data covered in the article is illustrative and not exhaustive.

Note: The views expressed in this article are those of the authors and not necessarily of the organization to which they belong.