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Career Options and Future Prospects in Biotechnology

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Abstract

The advent of Biotechnology courses a few decades ago appeared to provide a better alternative to young students for their career options. The applications of Biotechnology are vast as it caters to various agricultural, animal husbandry, fishery, health, pharmaceutical, industrial sectors and more. Biotechnology includes diverse subjects apart from biology making it interdisciplinary. Along with the technical part and engineering applications, biotechnology is giving rise to various new fields with various job opportunities.

Introduction

As the name suggests, bio-technology is a combination science of biology and technology. Biotechnology uses the biological systems of the living organisms or their parts to make technological advances in the welfare of the society. It is the use of biological constituents (systems or organisms) to make or modify or manipulate living organisms to develop new products useful to the mankind. Biotechnology can be defined as an assortment of tools employed by scientists to recognize and manipulate the genetic make-up of the living organisms for applications benefitting the production or processing of agricultural products by developing high yielding, nutritional rich, biotic and abiotic resistance plants.

Who Can Study Biotechnology?

- Any student with biology, chemistry, physics and mathematics in their class 12 can take up Biotechnology as their specialization in their undergraduate course.
- This undergraduate programme in biotechnology can be B.Sc. Biotechnology or B.E./ B.Tech Biotechnology.
- The B.Sc. programme is 3 years while the B.E./ B.Tech programme is for 4 years.
- Students' interested higher education can go for the master's level in biotech after their undergraduation.
- Again, masters in biotechnology can be in M.Sc., M.E./ M.Tech.
- A graduate degree in any of the life sciences is acceptable for a PG programme in biotechnology.
- Students interested in research and development can continue their studies by pursuing their Ph.D degrees in biotechnology and related field.
- Most of the colleges. Universities, IIT, NIT are offering B.Sc. Biotechnology or B.E./ B.Tech, M.Sc., M.E./ M.Tech Biotechnology.

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The General Career Opportunities for Biotechnologists

The domain on which a trained biotechnologist can work is vast. As there are several disciplines involved in biotechnology, there is a great demand for experts in various sectors like industrial sector, environmental sector, medical sector, food manufacturing, pharmaceuticals, health-care and pharmaceuticals, agriculture, food manufacturing *etc*. Owing to this diverse profile, it can have widespread applications across multiple disciplines associated with bio products, food and nutrition, textiles, chemical, environment, animal sciences, agriculture, and many more with a promise of offering ample opportunities to the aspirants in the upcoming future. Across the world, numbers are reflecting an increasing trend for the students. Biotechnological applications are used widely in the following industries:

- Pharmaceutical, Medicine Healthcare (Insulin, caccine, molecular diagnostic kit for Corona, Malaria, Dengu).
- Agriculture (Bt Cotton, Swarna Sub1 submergence resistant variety, Golden, Banana tissue culture).
- Animal husbandry (Diagnostic kits, Vaccine *etc*.)
- Genetic engineering (Herbicide resistance variety).
- Environmental conservation (Genetically modified microbe to clean oil spills)
- Fishery
- Textile industry
- Cosmetics
- Biotechnologists can find jobs in both private and government undertakings with specializations in different sub-disciplines. They are engaged in various sectors as Research Associate, Lecturer or Professor, Sales Manager, Quality Analyst, Plant Breeder, Environment Specialist, Medical scientists, Biological technicians, Medical and Clinical Lab Technologists & Technicians, Biochemists and Biophysicists, Biomedical Engineers, Microbiologists, Epidemiologists, R&D and Process Development Scientists, Bio-manufacturing Specialists, Bio-production Operators.

The Different Organization Where the Biotechnologists are Finding Their Jobs are:

- Research organizations
- Universities/ Colleges/ Academic institutes
- Biotechnological companies
- Pharmaceutical and chemical companies
- Agricultural and crop production companies
- Food and beverage companies
- Hospitals and other medical organizations

(a) Academic Institutions and Research Organization

- The Government of India National Biotechnology Board (NBTB)
- The Department of Science and Technology (DST)
- Council for Scientific and Industrial Research (CSIR)
- Indian Council for Medical Research (ICMR)
- Department of Atomic Energy (DAE)
- Indian Council for Agricultural Research (ICAR)
- Defense Research Development Organization (DRDO)
- Indian Institute of Science (IISC)
- Biotechnology Consortium of India Ltd (BCIL)
- Indian Council of Agricultural Research (ICAR)
- DRDO
- State and central universities

(b) Top Industries Who Hire Biotechnologists

- Biocon
- Panacea Biotech
- Rasi seeds
- Serum Institute of India
- Machyo Monsanto Biotech
- Novo Nordisk
- Indian Immunological
- Venkateshwara Hatcheries
- Ranbaxy
- Dr. Reddy's Lab
- Primal Healthcare
- Aventis
- Indian Immunological

(c) Central and State Governments

- Forensic laboratory
- Plant tissue culture and seed corporations
- Forensic laboratory
- Biofertilizer and micro nutrient agency
- Biopesticide agency

(d) Entrepreneurship

1. Biocon

This Bangalore based company is the largest biopharmaceutical company in India. Founded in 1978 with a budget of Rs. 10,000.00, Biocon started as a

company selling the enzyme papain. In the 1990's, founder KiranMazumdar-Shaw decided to change the focus of the Company from selling enzymes to selling biopharmaceuticals. Subsequently, Shaw became one of the richest women in India. Today, Biocon sells insulin and monoclonal antibodies, among other products. The Company had an annual revenue of Rs. 4,709 crores in 2018.

2. Sea6 Energy

This startup was founded in 2010 by four IIT Madras graduates and works towards the development of scalable solutions to solve the problem of overconsumption of energy in India. The Company is developing techniques to convert photosynthetic biomass like plants and algae to fuels, in an effort to battle the increasing commercial use of energy in the Country. Incubated at the Centre for Cellular and Molecular Platforms (C-Camp) and funded by the Department of Biotechnology, the startup has patented techniques to facilitate large scale cultivation of selected sea plants.

3. Bharat Biotech

Headquartered at Hyderabad, this Company was founded in 1996 by an Indian scientist, Krishna Ella. One of the leading biopharmaceutical companies in India, Bharat Biotech was the first to develop and patent vaccines for the Zika virus, Zikavac, in the world. It is the first pharmaceutical company to develop a generic drug in India. Now this company has developed Corona vaccine named "Covaxin".

4. GANIT Labs

Founded in 2010 in Bangalore by Dr. Vinay Panda and Dr. Vijaya Chandru, Genomics Application and Information Technology Labs (GANIT Labs) is an independent government funded startup. GANIT Labs studies genomes related to oral cancer and helps in mapping their genes. It is also involved in creating analytical tools which effectively analyze and manage large scale genome data, mainly from genome sequencing of disease tissues like cancer.

5. MedGenomes

Founded by Sam Santosh in 2013, MedGenomes provides personalized genetic tests and medicines for a range of ailments like cancer, diabetes and neurological ailments. The Company has headquarters in the U.S.A., and India and claims to operate the largest next gen sequencing lab in Southeast Asia. In 2017, the Company secured a whopping Rs. 192 crores in funding. In 2018, MedGenomes was given the MedTech Breakthrough Award for Biomedical Research. With the growth of the biotechnology industry and a renewed interest of investors in it, the success story of these biotechnology startups will inspire many biotechnology entrepreneurs out there who are aspiring to start their own company one day.

What Skills Must One Have to Adopt A Career in Biotechnology?

Once you are targeted and poised, you are anticipated to boost a few attributes to work as foundation stones to gain a balanced success. One must possess, if not all, but most of the following skills to excel in the Biotech sector.

- Quick learning abilities.
- Complex problem-solving approach.
- Efficiency to work as a team player with excellent communication skills.
- A dynamic personality.
- An investigative and creative mind.
- Innovative and creative thinking.
- Management and Analytical skills.
- Flexibility having the ability to adapt to changes.
- Firm desire to attain success in career.
- Academic institutes are always open to offer the lectureship.
- Chemical Industries also offer employment for biotechnologists.
- Aquaculture Industries may also provide openings to techniques expertise.

What is the Salary Range for these Professionals?

The remuneration here, depends on your academic qualification and skills like other job profiles. Fresh graduates can expect a monthly salary in the range of Rs. 8,000.00 to Rs. 20,000.00. With increase in level of experience, there is abundant scope for getting better salary.

Scholarships

1. A.M.M. Arunachalam–Lakshmi Achi Overseas Loan Scholarship
2. Aga Khan Foundation International Fellowship Program
3. AICTE National Doctoral Fellowship (NDF)
4. Bharat Petroleum - Scholarship for higher studies
5. BristishChevening Scholarships
6. Cambridge-Nehru Scholarships
7. Chinese government scholarship
8. CSIR – Senior Research Fellowship
9. CSIR- Junior Research Fellowship
10. Czech Government Scholarship

11. DBT (Department of Biotechnology)– Junior Research Fellowships

12. DBT– Post Doctoral fellowship in Biotechnology and Life Sciences

13. DBT's Biotech Consortium India Ltd conducts BITP

14. DBT- various collaborative fellowships

15. Developing Solutions Joint Chevening Scholarships

16. Developing Solutions Taught Masters Scholarship for India

17. DFID Commonwealth Shared Scholarship Scheme (CSSS)

18. DST – Young Women Scientist Award

19. Fair & Lovely Foundation Scholarships

20. HomiBhabha Centre for Science Education (a centre of TATA INSTITUTE OF FUNDAMENTAL RESEARCH), Research Scholarships

21. ICMR – Junior Research Fellowship Examination

22. ICMR – Senior Research Fellowship

23. ICMR – Short Term Research Studentship For Medical Students

24. India Undergraduate High Achiever Scholarships

25. Indian Academy of Science Summer Research Fellowships

26. ICAR's (Indian Council for Agriculture Research) Junior Research Fellowships (JRF)

27. ICAR Senior Research Fellowship (SRF)

28. Indira Gandhi PG Scholarship for Single Girl Child

29. Inlaks Foundation

30. INSA-COSTA-CSIR Travel grants

31. Japanese Government Scholarship

32. JNTata Endowment Scholarship

33. K.C. Mahindra Education Trust Scholarship

34. KAUST DISCOVERY SCHOLARSHIPS

35. KishorVaigyanikProtsahanYojana

36. Lady Tata Memorial Trust Research Fellowship

37. Ministry of Human Resourse Development International Scholarships

38. National Brain Research Centre, Scholarships and Fellowships

39. National Institutes of Health (NIH) Undergraduate Scholarship Program (UGSP)

40. National Overseas Scholarships/ Passage Grant for SC and Backward castes/tribes/ Minorities

41. National Talent Scholarship Examination by ICAR for 10+2 students

42. National Talent Search Examination

43. Oil and Natural Gas Corporation Ltd. (ONGC) Scholarships to SC/ST StudentsPaul Foundation Scholarships

44. Post Graduate Scholarships for professional Courses for SC/ST candidates

45. Rajiv Gandhi National Fellowship Scheme (RGNFS) for SC/ ST Candidates

46. RD Birla SmarakKosh Grants

47. RD Sethna Scholarship Fund

48. Research Associateship for SC/ST Candidates

49. Rhodes Scholarship

50. Sahu Jain Trust Scholarships

51. Scholarship scheme for higher education for students of the Scheduled Castes and the Scheduled Tribes- approved by The Union Cabinet

52. Scholarships for studies in UK (M.S/PHD)

53. Shyama Prasad Mukherjee Fellowship

54. SOPHIA MERIT SCHOLARSHIPS Inc

55. TATA Innovation Fellowship sponsored by DBT

56. Tata Memorial Centre & Tata Memorial Hospital- Junior Research Scholarships For Cancer Biology

57. The Gates Cambridge Scholarships

Conclusion

When thinking about biotechnology, many people picture a scientist in a lab coat developing a lifesaving drug or medical device. While this image represents one common biotechnology career path, lab work is not the only option. With many exciting discoveries to make and new problems to solve, biotechnology professionals can make a difference in the lives of others in many ways. There's more good news for job seekers. The biotechnology industry is a major economic driver, generating approximately $ 140 billion in revenue. Currently, U.S. biotechnology firms employ over 1.66 million people, but with the need for rapid innovation, the demand for skilled professionals will continue to rise.

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