DISHA

A CAREER RESOURCE BOOK FOR LIFE SCIENCE AND BIOTECHNOLOGY STUDENTS

SUMAN GOVIL

IndiaBioscience

Cover Page Concept

'Disha' is a Hindi word which means direction. We have chosen 'Disha' as the title of the book as it is meant to provide guidance to life science and biotechnology students on choosing a career direction and embarking upon it. The book guides students in selecting the appropriate course and institution, honing the requisite skill-sets, as well as formulating and implementing a strategy to achieve their career goals.

DISHA : A Career Resource Book for Life Science and Biotechnology Students

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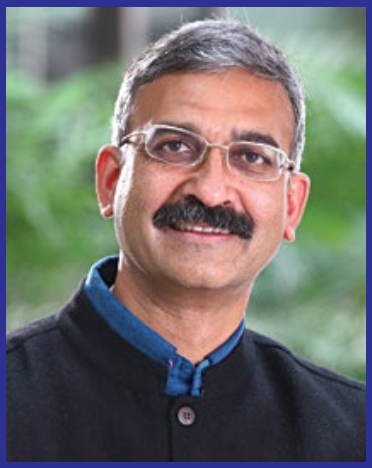


Satyajit Mayor
Centre Director, NCBS-TIFR, Bangalore

Preface

I am extremely happy that IndiaBioscience has taken this initiative to bring out a comprehensive book titled **"DISHA: A Career Resource Book for Life Science and Biotechnology Students"**. This book is expected to be a one-stop resource for life science and biotechnology students in India.

I am aware of many a student's dilemma when they find themselves at a crossroads in their career, often due to lack of awareness or proper guidance. It is important to exercise an informed choice about the course one wishes to pursue and find an appropriate college/university/institution. Choosing a subject which interests one and not succumbing to peer pressure is sound advice. While specializing at the undergraduate/postgraduate level may narrow down one's options, specialization at a later stage, for example at the PhD or postdoc level, can be an appropriate course of action for an academic career. But as we look at a changing world, there are many exciting options available if we do not restrict ourself to teaching or research and these career paths are equally exciting, challenging and rewarding. For example, opportunities are available in science policy, science administration and management, technology transfer, intellectual property rights management, science communication and outreach, technical writing, industrial research and development, quality assurance/control, marketing, technical sales and many other fields.

A sound PhD and postdoctoral experience has an immense capacity for empowering an individual in a number of ways. In addition to technical skills, this experience trains one in thinking critically and rationally, multi-tasking, systematically solving problems, navigating professional relationships, working in teams, exercising leadership, managing time, resources and events, compiling and analyzing data, resolving conflicts, communicating effectively, etc. It also allows one to identify one's strengths, including both inborn talents and acquired skills. It also helps an individual to identify areas in which improvement is necessary to match the requirements of the many career options available today.

To identify an exciting career opportunity, one may consult reliable sources of information like Science Careers, Nature Jobs, NIH website, IndiaBioscience, Cheeky Scientist Association, etc., although many of these are not India-centric. It is always valuable to gain first-hand information through activities like internships, volunteering, networking, informational interviews with experts in relevant fields, etc. Increasing one's social media presence on LinkedIn and other platforms also brings additional opportunities for interaction. It is also important to master skills like preparing a resume which can convince an employer that one is the best candidate for a job.

IndiaBioscience has been conducting interactive workshops called "Crafting your Career" in different parts of the country and has also initiated a podcast series on the same topic on their channel "IndiaBiospeaks" to help students navigate their careers in science. It is out of this engagement that when Suman Govil, ex Sr. Advisor to DBT, came to us with the idea of an up-to-date current resource book about how to access these materials in an efficient manner, we were extremely excited to engage with her on this important contribution.

Suman Govil has extraordinary experience in this area, having worked at the Department of Biotechnology since its inception as the National Biotechnology Board in 1982. Over the past 30 years, she has been responsible for curricular planning and enhancements, and for starting the Star College scheme for strengthening undergraduate science education. She was also responsible for numerous fellowships for doctoral and post-doctoral research, policy and strategy formulation, and extramural research funding at DBT. Along with Shweta, a visual designer who mainly focuses on editorial and graphic design for print, illustration, packaging and brand identity, Suman has put together a very important contribution. I wish to compliment my colleague Smita Jain, Executive Director, IndiaBioscience who initially encouraged Suman to go ahead with this valuable project, and who has been a continuous source of input and oversight at every step of the way. Suman has used her vast experience in penning down this book and Shreya Ghosh, Program Manager, Science Communication, IndiaBioscience, has ably edited the book. I sincerely hope that this book would be very useful to many. Do give us your feedback to help us improve future editions. And here's wishing all of you a better-informed career.

Satyajit Mayor
Centre Director, NCBS-TIFR, Bangalore

01

Careers in Life Science and Biotechnology: An Introduction

01

Careers in Life Science and Biotechnology: An Introduction

Your career is the sum total of all the decisions that direct your educational, social, and economic endeavours. It reflects your personality, unique characteristics, and basic life values. Often, the term “career” is used as a synonym for occupation, trade, profession or vocation and refers to what a person does to earn a living. Different people use different criteria to measure career success. While for some, financial/material accumulation is important, others look for recognition, and yet others strive to make a contribution to society and help others. Successful career development requires self-assessment, decision-making, occupational awareness, systematic exploration, and guided implementation.

This book is meant to provide guidance to life science and biotechnology students on choosing a career path and following it successfully. We will discuss strategies for assessing interests, skills, values etc. and using this understanding to decide on a career direction and a course of study. We will also talk about the expectations and requirements of various career paths, as well as different ways of preparing yourself for the job application process. Globally, there have been concerted efforts in this direction and career support groups/ associations have been formed to provide relevant information to students. However, in India, such efforts are scanty and only scattered information is available. In this book, we have made systematic efforts to bridge this gap and compile India-centric information on career development.

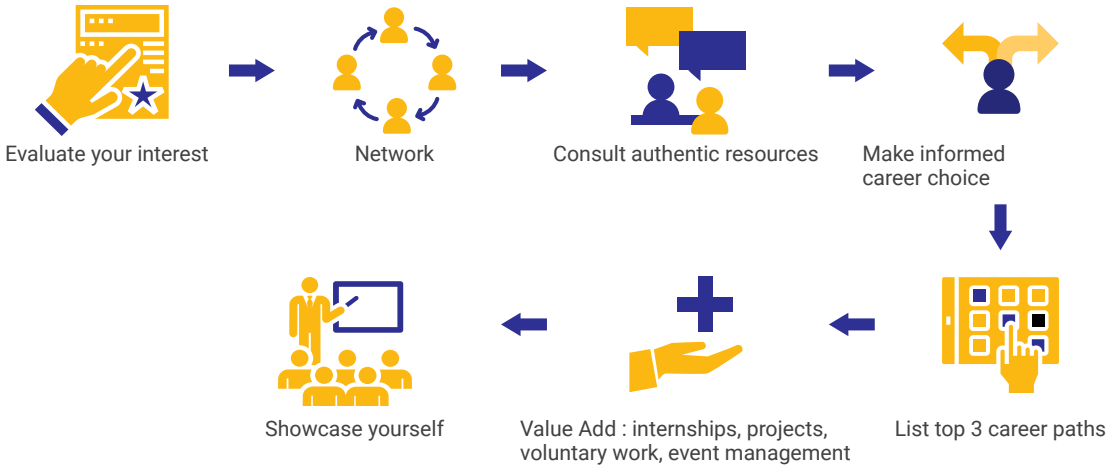
Although there are diverse job roles currently available for students or researchers with a background in life science or biotechnology, many students lack complete information on these roles. Students today have many career options that they can choose from, including bench research, product development, marketing. policymaking, regulatory affairs, strategic planning, technical writing, science communication, and more. We hope that this book will help you evaluate your own strengths and weaknesses, choose a career path based on your interest, and systematically work on building a successful career.

1.1. Strategically Plan your Career

In order to build a successful career, you have to be proactive and spend adequate time in planning as well as in strategically implementing this plan. You should begin with some introspection and awareness of what are the things that you enjoy doing the most, dislike doing, or are interested in doing in the future. Interact with your community, learn about upcoming areas and challenges, and test the market to get a feel of where you are headed. You can also take up internships or voluntary assignments to get an “insider view”. Look at all the possibilities carefully and talk to people from many different career paths to get first-hand information and a wider perspective.

Begin with what excites you today. Your priorities could change tomorrow and you may change the direction of your path to what excites you then. But it is important to begin with something you enjoy right now. If you feel stuck in a place which isn’t right for you, try and look for other opportunities that suit you better because you will never be able to give your 100% in a job which you don’t like.

Different people have different interests, values, goals, beliefs and experiences that guide their lives towards the paths they



follow. You cannot say that some of these paths are right or others are wrong - they are just different. What works for one person may not work for another. Each individual needs to figure out which path will work best for them and make them happy. Don't be afraid to deviate and find your own way. At the same time, keep in mind that you have to strike a balance between finding work that you love and work that will pay your bills.

The need for credible, authentic information about career opportunities in the life science landscape in India has been felt very strongly in recent times. Our aim in this book is to share knowledge, tools, and techniques that will empower students to navigate and craft their career paths. This knowledge can also help students select appropriate courses and institutes for pursuing higher education. We hope that this book will also guide students in charting a career in the life sciences domain by matching their interests, skills, and training with the requirements of employers.

1.2. Understand the Expectations of Different Career Paths

If you are a student, you are used to an academic environment with adequate supervision where you don't have to worry about funding, timelines, etc. Once you decide to take up a job, you will need to understand that different career paths will have different expectations and requirements. As an example, if you choose to be an academic researcher, you may end up working on the same research problem for decades as you delve deeper and deeper into understanding a fundamental biological process or principle. On the other hand, if you choose to work in Research

Career Options

Academic Careers

- *Faculty in Colleges, Universities, and Autonomous Research Institutes*
- *Scientist in Research Institutions*

Non-academic Careers

Jobs in Industry

- *Research & Development*
- *Product Management*
- *Quality Control and Quality Assurance Management*
- *Human Resource (HR) Management*
- *Technical Sales and Marketing*
- *Technical Writing*
- *Consultancy, Business Development & Equity Research*

Bioentrepreneurship

Intellectual Property Rights

Technology Transfer

Regulatory Management

Science Communication & Public Outreach

Science Management & Administration

Science Public Policy

Specialized Services

- *Core Facility Management*
- *Bioinformatics*
- *Career in Big Data Science*
- *Clinical Trials Management*

and Development (R&D) in an industry, you will have to let go of projects once certain conditions change, for example if the project advances from research to clinical development, if it does not yield desired results, if the company's focus changes, or if your expertise is required in another project. You will, therefore, have to be more flexible and adaptable in the latter case. Likewise, expectations and requirements for intellectual property or regulation or science communication will be very different. An in-depth analysis of your strengths and weaknesses and an understanding of the expectations and requirements of different career paths will help you acquire or hone the skills necessary for following the career path of your choice.

Please do not hesitate to choose a career other than academia, if your interests lie in that direction. Such careers can also be very challenging, innovative and financially rewarding. To be successful in an industry environment, you have to demonstrate the ability to lead teams, to work as a team member, to be a great communicator, and to trust others. You will need to be proactive, network and find mentors. You will also have to grow your expertise in different directions and keep your eyes and ears open.

Laboratory-based research roles focus on product development and quality testing and give preference to candidates with experience in laboratory techniques. Commercial roles in product development, product management, marketing, business development and analysis, on the other hand, will give preference to candidates with experience in management, business administration, and commercial acumen. Business development may be a good option for someone with a degree in science and interest or training in business. Most companies value people with a scientific background as customers like to interact with someone who understands science and scientific language.

Technical support roles are customer-oriented, meant to provide support to customers and resolve their complaints. Life sciences reagents and product companies employ a wide range of qualified researchers in product development, testing, product management, business development, technical support and marketing. There are also roles in regulatory affairs, strategic planning, technical writing, science communication, research administration, etc.

You are not expected to be an expert in every pathway. Instead, you should aim for excellence in your field of science and be aware of market trends. As you go up the ladder, you will have to acquire strategic and leadership skills. You will have to carve out your own path to make sure you end up where you want to be. Therefore, don't hesitate to diversify to a new area if you find yourself stuck or at a standstill.

1.3. Make an Informed Career Choice

Students often find themselves perplexed about choosing the right career path and don't know how to proceed. As a young student, you may not have enough experience, expertise, and information about upcoming careers or clarity about your own interests. In today's digital world, students are flooded with online information but may not have the maturity to decide whether this information is correct, complete, and relevant.

Career counsellors can play an important role here as they can evaluate whether you are unsure about career choices, whether you are aware of career options and job trends, or if there is any undue parental pressure and disconnect from parents. Their assessment is based on scientific tools such as psychometric tests, interest-based tests and personality assessments. They can also provide accurate information about career paths, skills, and training. Career counsellors can help students refine their options by conducting proper research in shortlisted career choices. You should also carefully evaluate the reputation and previous achievements of the career counsellor in helping students make career decisions before approaching them for an assessment.

You will also need to make informed decisions at the level of higher education. At times, it may so happen that you don't get admission in the subject of your choice in top-ranking institutes and make it to middle-ranking institutes in the subject of your choice. You should carefully evaluate the pros and cons of both options before arriving at a final decision. In India, the trend of sending children abroad for higher studies has also picked up due to affluence among parents. Of course, opportunities for learning may be better in good academic institutions abroad due to flexibility in subject combinations, a culture of research-backed educational institutions, higher rates of innovation, etc. Perhaps difficulties in securing admission in good public sector institutions due to unrealistic cut-off percentages for admission as well as rigidity in choosing subjects from different streams in India also encourage people to go abroad for higher studies. In either case, if you are planning to join an overseas institution for higher studies, you should carry out proper research about the quality of education being imparted there before taking admission.

It is important to understand market trends given that many of the top career choices today did not exist a decade ago and what is valid today may not be valid after a decade. For example, with automation picking up, labour oriented jobs are likely to be weaned out. There will be huge scope for artificial intelligence, nanotechnology, development of mobile apps, big data management, 3D printing, etc.

This is precisely the reason that we decided to bring out this book. The aim

of this career resource book is to provide guidance for students navigating through the career exploration process. We encourage all students to go through the process of examining what they love about the careers they chose to pursue, including those on the academic track or industry. This process may simply reconfirm that a faculty career or industry job is absolutely right for you, or it may open up completely different avenues that you had not been previously aware of. However, if your career choices and priorities change in the future, or if your job preferences shift, early career exploration will ensure that you'll be ready to handle your altered professional identity with resilience.

Please don't begin your job search with preconceived notions about job roles and titles. Use keywords of interest to research and identify job titles which may be of interest and see if parallel roles with different titles exist in different settings. If you are not sure what keywords to start with, please consider these questions:

What parts of your training and research, did you enjoy the most?

Which of these, you would like to spend your time on?

What skills (including transferable skills) do you enjoy using?

You can also take the help of online tools like myIDP *(https://myidp.sciencecareers.org)* or ImaginePhD *(https://www.imaginephd.com)* to assess your interests, skills, values, and potential career matches. myIDP (individual development plan) is a free, web-based career-planning tool to help graduate students and postdocs in life sciences to define and pursue their career goals. It helps you introspect, examine your skills, interests and values, explore different career paths which may be suitable for you, set realistic goals, and prepare a working plan.

It is very important to make informed career choices. Begin by shortlisting possible career paths which might be suitable for you. Think of these options as Plan A, Plan A' etc. instead of delineating them as backup plans (Plan B, Plan C etc.). You may ultimately decide to pursue one of them, but thinking about paths in this way will ensure that you always have options and choices and that you do not feel stuck or like a failure if one option does not work out.

The decision on choosing a career path should be made based on awareness, self-assessment, exploration, and implementation with sincere commitment. If you are not sure about where to start learning about different career sectors, types and roles, check out what alumni from your department or institute have moved on to do and conduct a few informational interviews. Listen to career-related podcasts (for example, IndiaBiospeaks - *https://indiabiospeaks.libsyn.com*, HelloPhD - *https:// hellophd.com)* and talk to science professionals in different careers to know about what they do in their role, field, company, etc. Be on

the lookout for career panels, professional development events, career counselling symposia, professional networking events etc. to learn more about all the career possibilities. You can also look at Biocareers *(https://biocareers.com)* which is a career hub for postgraduate life scientists and organizes a number of free webinars.

1.3.1. Skill Analysis

Once you have narrowed down a few careers of interest, it is important to do a **skill profile analysis** to understand your suitability for that field. Collect a set of representative job ads (3-5 per field may be good to begin with) and group similar jobs in a pile. Pick one career field at a time and look for patterns in the data in the job ads in that pile. This will give you an idea about common skill requirements. The next step is a **skill gap analysis**. Pick one career path of interest and identify common skills, keywords, experience requirements in job advertisements in that career field, and then analyse how you measure up. This will also help you identify areas where you need more practice. Take the time to reflect on areas where you'd like to grow more and make a plan of action to build skills.

There is a plethora of opportunities available not only for academically bright students but for all students, as different jobs require different skills and different students have their own strengths. You must understand that for career success, academic brilliance alone is not enough. You need to project your strengths in such a way that you appear to be the most suitable candidate for the job to the prospective employer. You should systematically work on your weaknesses to overcome them and convert them into your strengths. You will need to cultivate social skills, communication skills, stress management skills, and troubleshooting to enhance your employability. Having better insights about career opportunities will also help you in making good decisions and reducing time in undesirable job roles.

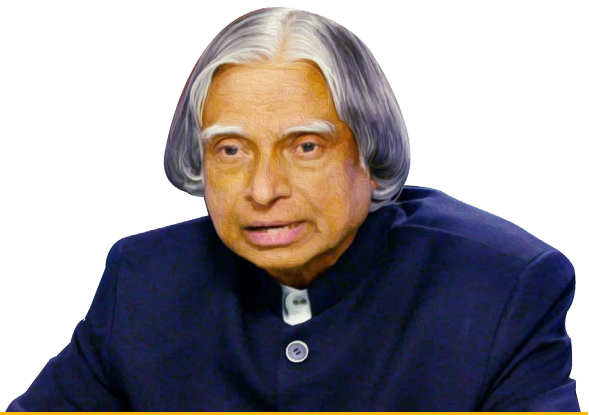
Prepare a resume that is tailored to showcase your skills and experience. Before applying for jobs, you should also consider factors like location, financial remuneration, career growth etc. and draw a list of potential employers. Next, research such potential employers to find out more about their activities, achievements, existing team etc. Use this information to decide whether you want to work for these employers, and if yes, how you can bring value to their teams.

It may so happen that somewhere along the way you realize that you aren't as interested in a particular career as you had initially thought and that you are a better fit for another position. This is perfectly all right and early career exploration will help you identify and prepare for a career personalized for you. We are sure that an exciting career awaits you! Go, grab the opportunity and the sky will be the limit.

1.4. Advice for Students

Our beloved Hon'ble Late President Abdul Kalam rightly said,

"Without your involvement, you cannot succeed, with your involvement, you can't fail."



Plan your job search strategy and try to achieve targets and milestones according to a set time schedule. Periodically evaluate your plan and take corrective measures if required. Always remember that it is hard to get what you don't even ask for. Don't be disheartened by problems that you encounter and don't run away from them. Plan your daily time by making a "to-do list" which will also help in reducing stress and lead to effective functioning. Master time management skills by prioritising your work.
Don't lose faith in yourself and face situations boldly, confidently and with patience.

1.4.1. Identify your Goals

You must have a clear idea of who you want to be and clarity on what you know, as well as what you need to learn and improve. Once you pen down your dream, it will become your goal. Your goal must be specific, measurable, relevant and realistic so that it can be attained in a specific time frame.

Make a plan, get to work, stick to your plan and no one can stop you from achieving your goal.

1.4.2. Identify your Strengths

STRENGTH

WEAKNESS

OPPORTUNITIES

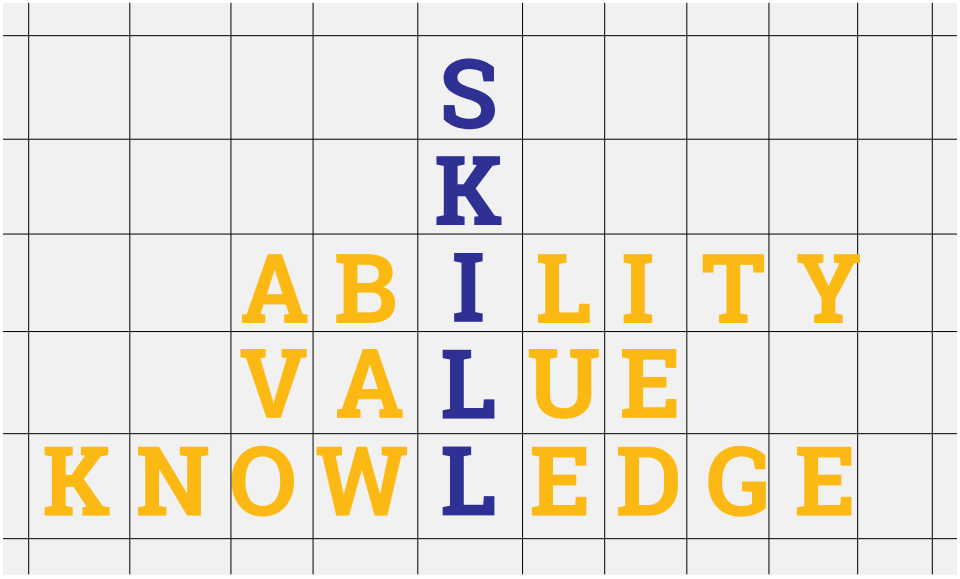
THREATS

You must identify your strengths and build your success on your strengths. Work systematically on your weaknesses and convert them into strengths. Have faith in your own abilities and believe in yourself.

At the same time, keep empowering yourself with knowledge and try to apply this knowledge wherever possible. A good way to build your strengths is introspecting or reflecting on your experiences and learning from your past mistakes. Remember that every person's situation is different and hence everyone's strengths and needs are also different. Learn to say no to peer pressure and make your own choices on the basis of your strengths.

1.4.3. Understand your Skills and Value

You must realise that your career path is about you. You are not the only one facing a difficult choice. Many others have successfully made similar decisions before you and you can soon join them. Choose wisely and have faith in yourself.



Often students don't know their own worth or value as a science student, for e.g. their ability to plan experiments, think critically, solve problems, analyse data, manage teams and funds, etc. As a result, they don't project their own capability while applying for jobs. They are often disillusioned after a few unsuccessful attempts at trying to obtain a job and end up thinking that no one would hire them. This then gives rise to myths like "Organisations only want to hire people with experience and don't hire fresh postgraduates or PhDs." They become highly critical of themselves and start living in a cocoon and isolating themselves from others.

You should gain experience in new areas by volunteering for seminars/symposia/ journal clubs, taking up internships or fellowships, obtaining additional training in specialized topics like intellectual property rights, technology transfer, management, etc. You should take stock of the skills you may already have and use them to shortlist career options that are of interest to you. Try to match your skills with skills needed by employers and make efforts to hone or nurture skills in which you find yourself lacking. When you face an interview panel or have to negotiate salary, be confident in your abilities, and present your case strongly.

1.4.4. Gain Experience

If you gain experience in your chosen career path through relevant training or internships or projects, it will demonstrate your sincerity and genuine interest to potential employers. For planning the next stage of your career, you should not wait for your studies and/or current stage to get over. In fact, you should devote a fraction of your efforts to your personal and professional development and should be open to gaining new experience(s) throughout your professional career.

You must understand that just having a degree and posting your resume on an online website would not get you interview calls or a job. You need to be proactive, creative, and follow a well-planned job search strategy. You need to divide your time between looking for jobs, preparing resumes, submitting applications, and networking with professionals in the field.

You should also understand the importance of interdisciplinarity in today's scientific landscape. Try to interact with peers and experts from related fields and take up internships/projects or additional courses to equip yourself with skills and enhance your employability. For example, experience with writing for your college magazine, being on the editorial team of your institute newsletter, assisting your supervisor in conducting laboratory practicals etc. can come in handy if you decide to follow a career in teaching or science communication/outreach. You can consider working in the technology transfer office of your university to get first-hand experience in technology transfer, or helping your supervisor in writing and defending projects to learn the tricks of the trade for obtaining funding for projects.

1.4.5. Build Networks

Networking will help you learn about jobs which are not publicly advertised (in fact more than 80% of the jobs are filled without advertising), the culture of different companies/organisations, and skill requirements for different job roles. It can also generate referrals and help you in making a career choice or landing your dream job.

Students should proactively form career support groups with volunteers and experts who are willing to help their peers and juniors. This community of talented professionals would serve as a support system, provide easy access to information through informational interviews, help in placements for an internship etc. Your peers and seniors will also be your champions, advocates, and anchors. They will give you psychological support in addition to technical support. Members of such career support groups should have freedom of expression and encourage each other. This can serve as a platform for posting jobs, sharing expertise, and learning. It can be a

place where professionals, who have gone through the job search process and are settled in their careers now, can selflessly give back to the community. Through such a group, students can also collectively create and update a directory of companies in different sectors, collating information on their research focus, size and type of company, possible openings, expertise required, etc. Similarly, students can also collectively gather information about various courses offered by different colleges/universities, eligibility criteria, important dates for applications and admissions, placement of past graduates etc. in the form of a ready reckoner.

1.5. Advice for Parents

Many students face tremendous parental/family pressure to be in a career of their parent's choice. Parents must understand that kids should be allowed to do what they like to do and what they are good at, in order to be successful in any career. At times, parents may not be aware of emerging career options as they are often engrossed in their own careers.

One sincere request to parents is "Please don't pressurize your children to follow a profession/business of your choice." Let your kid follow his/her dreams. Parents should help in identifying interests, aptitude and personality of the child, assessing their comfort level in different subjects and activities, and if need be, taking the help of expert career counsellors or scientific brain-mapping techniques. Schools, colleges and universities should arrange career counselling workshops for students to inform them about the courses offered, range of career options in different subjects etc. to help students make informed decisions about which path to take.

1.6. Advice for Teachers

Teachers play a vital role in shaping the minds and careers of young students. Teachers should introduce students to core scientific concepts, lay emphasis on practical training, and encourage their students to apply their scientific knowledge. They should motivate students to think critically, ask insightful questions, find answers independently, and analyse relevant information/data. They should also encourage students to take up hands-on training, internships, projects etc. to expand their skillset.

Teachers should also encourage students to form journal clubs, career support groups, alumni associations etc. They should try to create awareness among students about different career options available and help them assess their strengths and weaknesses so that they can try to improve. Another way in which teachers can help in their students' career development is to organise placement fairs and arrange lectures by experts from different fields.

1.7. Resources for Students

Having a successful and rewarding career requires conscious, in-depth planning, and it is difficult to make rational career decisions without accurate information about available career options. Many career-related resources in the American context have been brought out by the National Institute of Health, Cheeky Scientist Association, American Association for Science, Nature Jobs, Science Careers etc. However, guidance material relevant to Indian scenario is scattered and not easily available. IndiaBioscience has taken a lead in this area and has been conducting a series of "Crafting your Career (CYC)" seminars and workshops in different parts of the country. IndianBioscience, as part of their podcast series "IndiaBiospeaks", has done a series focusing on science careers. IndiaBioscience has also brought out an e-resource booklet which deals with career options for life science and biotechnology students; however, this needs further elaboration.

1.8. How this Book will be Helpful

This career resource book is expected to provide a snapshot overview of different career paths for life science and biotechnology students. Its goal is to provide information about tools, tips, job market and potential employers for different career paths so that you can explore which option(s) is most suitable for you as per your skills, interests, and values. Its objective is to enable and empower you by providing you with relevant information and helping you make informed choices.

The book will provide guidance on how to choose a career path, how and where to look for job openings, how to prepare your resume and CV, how to prepare your elevator pitch, how to improve your social media presence (LinkedIn, in particular), and how to project yourself as the best candidate for an advertised position. We will try to bust prevalent myths and expose you to realities, duly substantiated by facts, so that you can make informed decisions. We will talk about how to choose a

course and a college/university for your undergraduate/postgraduate training. We will also discuss how to choose your research problem and supervisor if you choose to do a PhD/post-doc and how to make the most of your postdoc experience to prepare for the next stage of your career. We will also help you learn how to present your skills and develop needed skills while transitioning to a new career path.

As the the percentage of science PhDs holding tenure track positions 5-6 years after the completion of their PhD is declining over last several years, we have refrained from using the term "alternative" or "non-conventional" or "non-traditional" for careers other than academic because very few students enter faculty positions and it's not fair to use these terms for careers which provide employment to the majority of students. Students are often not aware of available opportunities and may lack clarity about their own interests, likes and dislikes. This may also lead to confusion about how to decide what to do and even having decided, how to get there.

In this book, we have included information about jobs in several different sectors and fields, in addition to the traditional academic roles of teaching and research. In case you decide to transition away from academics, you should not feel ashamed about not following the conventional path. In fact, you will be surprised to discover a lot of skills like collaborating, time management, data analysis, troubleshooting, multi-tasking, fund management, etc. which one acquires while doing a PhD can come in very handy in jobs outside academia as well.

This book is expected to serve as a one-stop resource for students in life science and biotechnology as it will provide consolidated information about different career options in academics, research, industry, specialised services etc. It will also delve into the skills needed for each option, training required, and potential employers for each option. We will also provide guidance on choosing the right course and institution, selecting topics for doctoral and post-doctoral research, choosing a supervisor and institution for PhD etc. We will also cover tools for understanding your own interests and strengths and using the knowledge gained to facilitate decision making. Networking, informational interviews, navigating the job application process, and negotiating salary will be covered in substantial detail.

A very important component of this publication is "Learn from Leaders", where questions about employability, skill sets, handling success and failures, etc. have been answered by leaders in different fields of science. This, no doubt, would come very handy to prospective job seekers so that they can identify their own strengths and weaknesses and hone their skills to enhance their employability.

1.9. Conclusion

This is the best time to be in the Indian life science space as more opportunities than ever, before are present today. A number of new universities, IITs, IISERs and AIIMSs have been set up by Government of India. Several private sector universities have also been established. At the same time, the Indian biotech industry is also looking up, fueled by an innovative and entrepreneurial ecosystem, proactive policies by the government, and availability of skilled manpower.

Searching for jobs can often be a very challenging and daunting task. Make sure that you are not missing out on an exciting and rewarding career path outside academic and industrial research just because of lack of awareness. You must understand that while your supervisor may be a nice and well-meaning person, he/she might encourage you to follow an academic career path simply because he/she may not be aware of other options.

You should take your own decision after considering all pros and cons like your interest, skills, availability of jobs, expectations from job, etc. Please make use of opportunities available to you in your institute and acquire maximum hands-on training and transferable skills to develop an all-rounded personality. Make connections and network.

We expect you to introspect, explore, and make a well-informed decision. To plan a successful and rewarding career, you should consider all options and discover what is exciting to you. You should make sure that in addition to scientific training, you develop and nurture new and transferable skills to succeed in your chosen career path. Go and connect with mentors, learn from their experience, and do informational interviews with experts in the fields of your interest before arriving at a decision.

We are confident that if you do an objective analysis and strategically plan your career, a bright future awaits you. All the best for all your future endeavours!

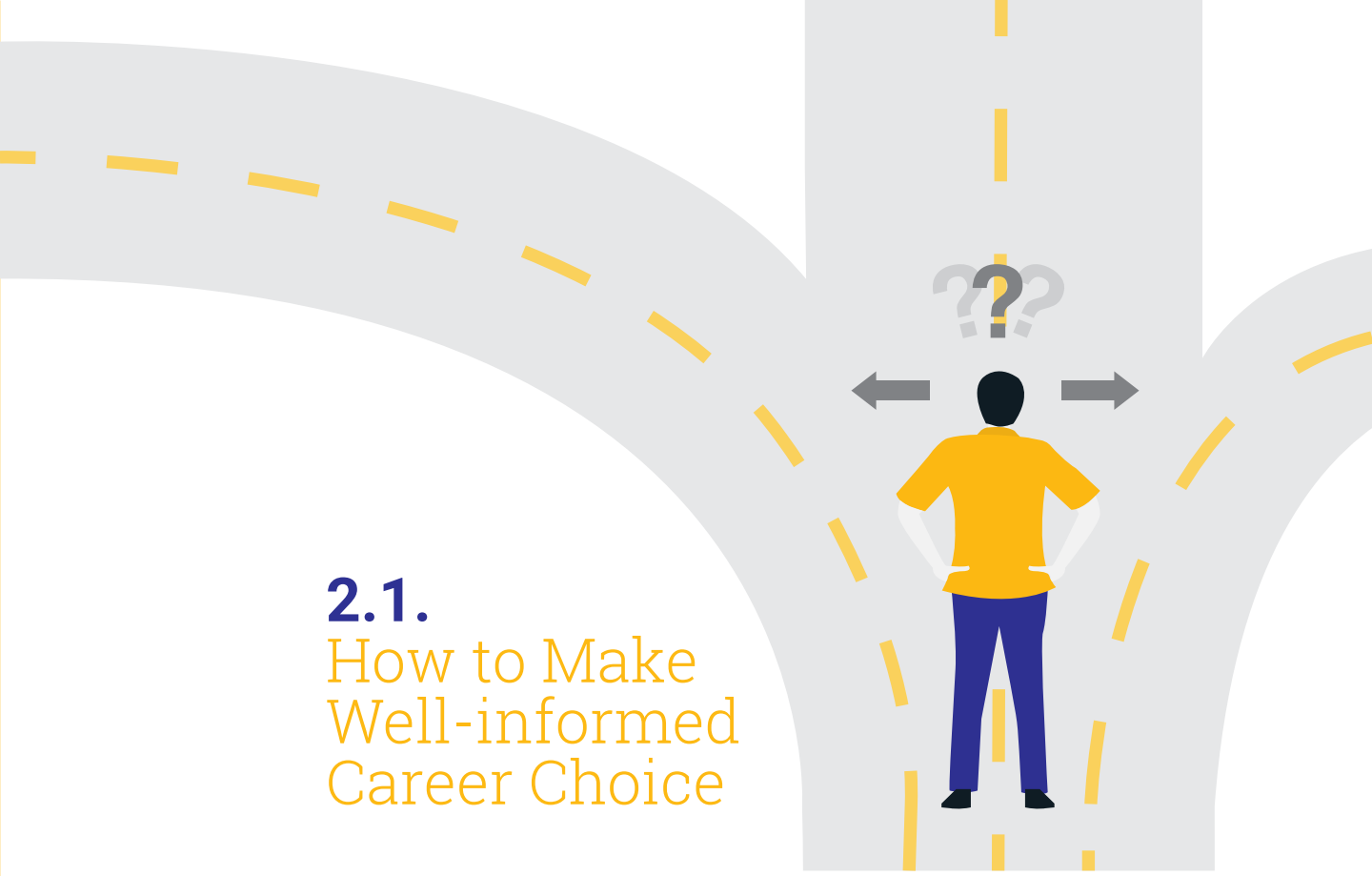
02

Formulating and Implementing Job Search Strategy

02

Formulating and Implementing Job Search Strategy

In our interactions with post graduate and doctoral students of life sciences and biotechnology in India, we have observed that students often first acquire qualifications and then start exploring different career options. Our objective in this book is to help students understand their interests and identify career paths which will be suitable for them and accordingly decide which courses they should pursue, what kind of summer training/internships they should take up, and what additional skills they should acquire. In this chapter, we will discuss strategies for choosing a career path, preparing resumes and cover letters, networking, conducting informational interviews, preparing for interviews and presentations, negotiating salary etc. We hope that this information will enable students to make informed career decisions and move ahead in their career.



2.1. How to Make Well-informed Career Choice

Life Science students often find themselves at a crossroads where they are not in a position to make an informed career choice. They don't have a clue about how to start, where to start, which position they want, whether or not they are fit for that position, whom to approach, how to approach and so on. This is primarily due to a lack of sufficient knowledge about different career options and skill-sets required. Students are also often confused about ways of acquiring skills and the right time to make the first move towards looking for jobs. Students working in academic institutions often have their supervisors encouraging them to go for higher studies and bring out good research publications. They are assured that if they do good science, everything else will fall in place. However, good science and research publications alone are not enough to get you a job. Although there are a number of vacant faculty positions in universities, IITs, IISERs etc., the chances of fresh students getting these jobs are minimal as the total number of PhDs coming out every year far exceeds the number of faculty positions available. Moreover, for these positions, one may need teaching experience, a requirement most fresh students are unable to fulfil. Although most Ph.D. students and post-doctoral fellows wish to pursue an academic career, data shows that more than 80% end up in careers outside academia. For students who have primarily worked in an academic environment throughout, the transition to any other career path seems confusing and

scary due to the lack of correct information and mistaken perceptions about the industry environment or other career paths.

As a student at crossroads, you need to ask yourself a number of questions to determine what is right for you in order to make an objective assessment and take a balanced view. Selecting the right career path should not be left to chance or availability of opportunity or feedback/ inputs from others. You are the best judge of your true self and are the one best-suited to make a career decision as per your personality, character, interests, achievements, capability, skills, ambitions, values, etc. Your career choice should be based on an objective assessment of who you are, what you like to do, what you don't like to do, what you need to learn, and what you like most about research.

Let us say you want to be an active bench scientist. You like to ask questions, plan experiments and search for answers. Now, are you an original researcher who likes uncertainty or are you okay with SOP(Standard operating procedure)-driven routine work? Are you an independent worker or a good team player? Do you have good communication skills and interpersonal skills? Are you willing to take risks or do you want a stable job with security? Write down the answers to these questions as it will help you recognize your unique qualities which set you apart from your competitors.

You also need to understand the difference between academic and industry environments. The academic environment has more independence and flexibility. It permits you to work on a topic of your interest and might sometimes offer better work-life balance due to flexibility in timing. In industry, you are expected to work as a member of a team towards a common goal as per the company's overall agenda and objectives, and you may not be able to take up work on your own research interest. To know more about academic, research, and industry environments, you should research them online and talk to your seniors who are working in universities, research institutions or companies. You can also talk to career counsellors and to recruiting managers. You should network with experts from academia and industries and seek informational interviews to understand their career trajectories. If you are speaking to someone who's currently in an industry position, ask them how and why they transitioned into industry, what are their job roles, what are the skill-sets required, are they satisfied or not, and what you should do to add value to your resume and to match industry expectations.

You should also try to understand industry trends, strategy, structure, factors, innovations etc. and keep up with breakthroughs shaping the market. Try to gather information about current products and products in pipeline, news of mergers and acquisitions, etc. You should also collect information about trends and movements across the talent marketplace. Knowledge about demand and supply of trained manpower, industry trends and requirements in upcoming areas will be very useful and will serve as a handy tool to devise your strategy for acquiring and upgrading skills and developing and nurturing your talent. It will also give you an edge over your competitors.

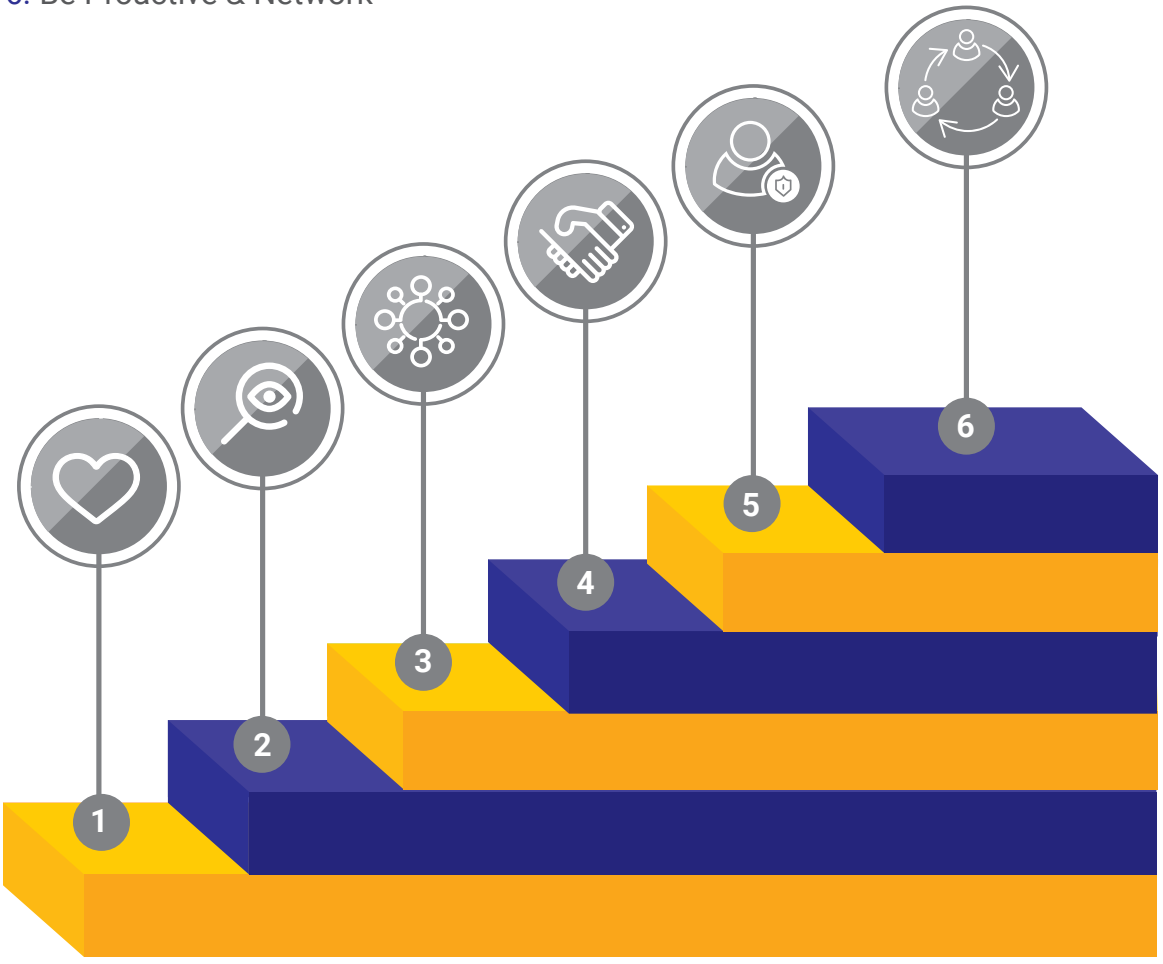
You must carefully evaluate and understand your own interests, aptitude, expectations, and capability and accordingly make a decision about your career. If you are interested in research or are passionate about teaching, please make an all-out effort to fulfil your dreams. However, if you decide to work in a field other than academia, please do not worry about what your supervisor or friends will think about your decision.

You should clearly understand the difference between a career and a job. Major career decisions should not be made simply on the basis of availability of job opportunities. You must follow your passion. In case you make a wrong choice and don't like your job, it is not the end of the road as you can always change your job and try out a new path.

There are also several doubts in the mind of students who are planning to transition into industry, like - will I disappoint my supervisor if I inform him/her about my decision to transition to an industry job? Will I be allowed to publish? What if I don't like the industry job or what if I lose my job, will I be able to come back for an academic job? And so on. You must understand that less than 20% of the students who complete their PhD end up in tenured faculty positions. So, you are not the first candidate to move away from academia. Don't waste your time, effort and energy on unnecessary apprehensions. Instead, focus on your job search strategy and wholeheartedly implement it.

Principles to Make an Informed Career Decision

1. Follow your Passion
2. Have Clarity
3. Value-Add & Diversify
4. Match-Making
5. Create an Authentic Profile
6. Be Proactive & Network



Principles to make an informed career decision:

1. Follow your Passion

The first and most important principle is "Do what you like to do, what you are passionate about". Don't opt for a discipline or career option if you are not interested in it.

2. Have Clarity

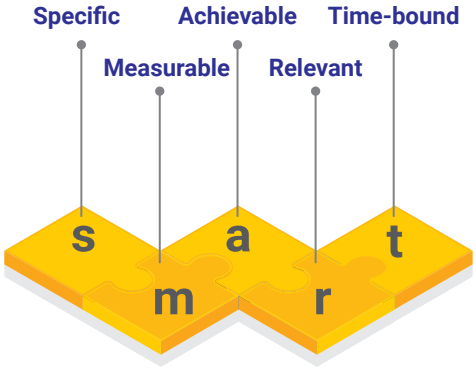
Reflect, introspect and understand your likes and dislikes. Clarity about what you don't want to do is essential so that you can focus your time and energy on what you do want to do. Understand your personality. Are you are an introvert or an extrovert? Do you like to work alone or are you a team player? Do you want a stable job or are you willing to take risks, for e.g to set up a new enterprise or work for a start-up? Do you like to do original, innovative work or are you comfortable in routine, repetitive jobs which are detail oriented (e.g., sample testing in diagnostic lab or in production division of any company where work involves following SOPs)? Make your choice based on careful assessment of your skills, capability, likes, dislikes and requirements for different job roles.

3. Value-Add and Diversify

In addition to your MSc or PhD, take additional courses offered by other departments such as management, marketing, Intellectual Property Rights (IPR) and regulation, and take relevant online courses to value-add to your resume. Take part in extracurricular activities like organising journal clubs, conferences or editing your college magazine. Seek out experience beyond your laboratory and department. Connect with diverse people. Transferable skills that you cultivate and the network that you develop will be very useful when you apply for jobs.

4. Match-Making

You should not feel pressured to remain in academia simply because most of your peers might be exercising that option. You don't have to feel guilty for not being a part of the herd and should try to transition to an area of your choice if an academic career doesn't match your interests or values. Based on your interest, your qualification, potential applications of your research, please identify which sector you wish to work in and what roles you are willing to perform. Once you have done this, you should set a goal for yourself and take the necessary steps to achieve your goal. Make sure you define a time frame to achieve your goal. Your goal must be SMART.



According to your interests and preference for geographical location, prepare a list of companies and/or research organizations by sector, research focus, type and size, kind of jobs available etc. Note down the skill-sets needed for different job

roles. Common industry job roles include R&D, Production, Business Development, customer facing roles such as marketing or science communication, outreach, intellectual property rights protection, etc. Prioritise companies and potential employers in your area of interest. Do extensive research about the employers from their website and social media pages to understand their vision and mission. Also, gather information about the team, present projects, upcoming projects, existing products, news about new products in pipeline, acquisition or merger etc. Other sources of information are networks such as LinkedIn, alumni associations, current and past employees, professionals in the field, etc.

You can also use online resources like myIDP *(https://myidp.sciencecareers.org/)* which match interests with abilities, and take courses by NIH Office of Intramural Training & Education (OITE) *(https://www.training.nih.gov)* or FAES (Foundation for Advanced Education in the Sciences) *(https://faes.org)*to know more about career options. Another great source of information is informational interviews with your seniors or experts who are working in companies or other organizations in relevant roles. You can also take the help of career counsellors for making a well-informed decision about your future career path.

5. Create an Authentic Profile

Create a profile that is authentic, precise, comprehensive but brief. Basically, your profile should be a condensed synopsis of your core credentials which can set you apart from the crowd. It should have the potential to hook a reader instantly. Your profile should reflect your productivity, communication skills and innovations. Elaborate if you initiated a new project, implemented a new technique, optimised an assay or enhanced scientific understanding in any way. List your talents and unique attributes which set you apart from other candidates. Be realistic and don't exaggerate. Don't give unnecessary, irrelevant information. Don't just tabulate your qualifications in chronological order; highlight how your experience will be beneficial to the employer.

Don't post the same profile for different jobs in different companies or institutes. Prepare a template, then align it according to the requirements of different employers and change it appropriately. You must realise that most companies and institutes receive thousands of applications for each advertised position. An HR manager, at best, will spend 5 to 7 seconds on a resume which has not been rejected by an automated Applicant Tracking Software. Read job postings and advertisements carefully and employ key words and phrases (including skills needed) from the job advertisement in your resume to ensure that your application will not be rejected by automated software.

The onus lies on you to highlight your accomplishments as well as technical and transferable skills to suit the employer's requirements. Specify traits such as leadership, team role, conflict resolution, collaboration, resource management. If you are transitioning into industry, you can use www.scientificresumes.com to create resume templates as this website has been

developed by scientists to help researchers change their academic CV to a format appropriate for industry. Make sure that your resume is aesthetically pleasing and easy to read with lots of white space and ensure that it includes information about your significant achievements. While listing your achievements, follow STAR Principle:

Situation
Task
Action taken
Result

List your STAR statements in the form of bullets so that your resume catches the attention of the hiring manager. You must quantify your results - number of publications, amount of grant received, number of events organized etc. We will discuss creating your professional profile and resume-building in more detail later in this chapter.

6. Be Proactive & Network

Often students post their profile on sites such as Naukri.com, MonsterIndia.com, Career builder, or even company websites and wait for interview calls. You must understand that lakhs of resumes are posted on these websites every week and individual companies also receive over hundreds of resumes every day and recruiting managers only spend 5 to 7 seconds per resume. Don't be passive. Be proactive and patient. Do not rely completely on advice from your supervisor or the career counsellor in your university as they may know very little about industry requirements and expectations in a field different from theirs. Network with relevant people in your chosen career for insider information, guidance, mentoring and referrals. Apply for specific jobs in the area of your choice.

You are what you imagine yourself to be. There are endless possibilities and you should not make any compromises while making career decisions and choices. Don't be disappointed if you do not receive an interview call for a job you had your heart set on. Instead, re-evaluate your application, learn from your own mistakes and from other people's experience. Keep reinventing yourself and improving your resume.

This was, in a nutshell, advice about evaluating yourself and making an informed career choice. Once you have clarity about which career path(s) you may wish to pursue, you need to proactively formulate your job search strategy and take steps to implement this strategy in a timely manner.

Suggested Further Reading

- Top 10 strategies for a successful job search | The Balance Careers - *https://www.thebalancecareers.com/top-strategies-for-a-successful-job-search-2060714*
- Job search skills and strategies: The complete guide | Resume Genius - *https://resumegenius.com/blog/career-advice/job-hunting-tips*
- The 6 best ways to find a job in 2019 - *https://www.careeraddict.com/job-search-strategies*
- Why it is not a failure to leave academia, Nature 560, 133-134 (2018) - *https://www.nature.com/articles/d41586-018-05838-y*
- A roadmap to successful career exploration - *https://www.insidehighered.com/advice/2018/07/30/tool-help-grad-students-strategically-plan-their-careers-opinion*
- I lost a job offer because I didn't apply these 5 strategies | Cheeky Scientist *https://cheekyscientist.com/strategies-to-get-a-job-offer/*
- 20 effective or successful job search strategies & techniques - *https://content.wisestep.com/job-search-strategies/*
- How long do recruiters spend reading your CV? | Undercover recruiter- *hhttps://theundercoverrecruiter.com/infographic-recruiters-spend-5-7-seconds-reading-your-cv/*
- Survey of earned doctorates | National Science Foundation - *https://www.nsf.gov/statistics/srvydoctorates/*
- Most Ph.D.s aren't professors - *https://medium.com/bits-and-behavior/most-ph-d-s-arent-professors-13a741ef6868*
- If your resume isn't 6-second worthy - *https://www.inc.com/jt-odonnell/if-your-resume-isnt-6-second-worthy-studies-reveal-recruiters-will-toss-it.html*
- Top 10 reference websites for PhDs transitioning out of academia into industry jobs. - *https://cheekyscientist.com/top-reference-websites-for-phds-leaving-academia/*

2.2. Job Search Strategy

Having defined your goals, you should proactively formulate a job search strategy. Applying for jobs online and simply posting your resume and waiting for an interview call may not lead you anywhere. In this highly competitive job market, you have to employ various job-search strategies to stand out in the crowd and find an appropriate job. You will have to adopt a multi-pronged strategy and learn how to multi-task. Some steps that you can take are:

You will also need to improve your social media presence to enhance your search engine ranking so as to stand out from your peers and to get your resume noticed by your dream companies. You should set daily, weekly, monthly goals to your job search process and review your progress frequently. Once you get selected for an interview, take time to prepare and research the company. Dress appropriately and practice answering probable questions. Also prepare for asking questions from your interviewers and for giving a presentation as per the topic identified by the organization.

Applying for jobs is an iterative process and you need to be patient, persistent and ready to focus with your full attention. Each resume and cover letter needs to be tailored to the post you are applying for. Establish a good quality template and make quick modifications according to the post advertised. You might have to go through several interview rounds including telephonic and video interview, behavioural and in-person interviews with HR, hiring managers and supervisors and on-site interview. You will have to stay positive and learn to deal with rejections.

In the next section, we will discuss some of the necessary steps in the job-search process in more detail.

2.3. Creating and Maintaining a LinkedIn Profile

LinkedIn is a business and employment oriented service which operates via its mobile apps and website. It is the largest virtual professional business networking site with over 500 million members. It is a powerful platform to find and connect with peers, get in touch with old colleagues, prospective employers, experts, suppliers, clients, investors, partners etc. LinkedIn also makes it possible to get introductions and referrals, and find jobs. You can identify potential collaborators, network with experts, share your expertise, and get information about vacancies from its job portal. Similarly, recruiters, hiring managers, consultancy firms and potential start-up owners also use LinkedIn to identify strong, prospective candidates for filling vacant positions. Companies also use LinkedIn pages for promoting their brand and building their online marketing strategy. It is an excellent resource for job seekers and people looking for a career change.

2.3.1. How to Prepare your LinkedIn Profile

Your LinkedIn summary should be creative, interesting and genuine. It should showcase your accomplishments as well as list your technical and transferable skills. You should narrate your professional background in a way that makes you come across as a subject expert to the reader. You must remember that you are targeting recruiters and hiring managers, so the summary should project you in the best light.

Your profile should demonstrate your passion and establish your credentials and credibility. Try to demonstrate your problem solving skills and substantiate with examples. Highlight your personality by listing what you are best at, what you enjoy doing, etc. If you are already in a job, then narrate the rewarding aspects of your job. If you are working for a company, you can list what do you love about your employer and how your company makes customers' lives easier, better or more enjoyable. You can follow the following simple rules to make your profile different from that of your competitors, allowing it to stand out.

1. Complete Profile

Your profile must give complete details about your skills, your past experience and your previous jobs, if any.

2. Create Customised URL

You should have your customised URL with LinkedIn.com/your name. Go to the **Edit Profile** screen and click **Edit** next to your **Public Profile URL**. Specify your desired address and then click **Set Custom URL**.

3. Choose a Professional Photo

Choose a clear, high resolution, professional image. You can also use an image showing you delivering a lecture or working in the lab as your profile picture.

4. Choose an Appropriate Tagline

Use a headline that highlights you and sets you apart from your competitors. You can use your elevator pitch in 10-12 words (maximum 120 characters) as your tagline.

5. Target Job Descriptions

Go through job descriptions of sample positions in the sector of your interest and find out keywords. Use these keywords intelligently in your summary and experience sections to grab the attention of recruiters.

6. Use the "Summary" Section Wisely

Your summary should cover your key skills, qualifications, work interest, past experience and your significant achievements. You can add photos, videos and slideshows to your summary. Go to **Edit Profile**, scroll down to **Summary**, click on the **Upload** or **Link** buttons to add multimedia files such as photos, videos, powerpoint presentations etc. to show yourself in action.

7. Quantify

Wherever possible, use numbers such as

number of publications, number of papers presented, number of events organised, number of seminars attended, amount of grant received, number of papers reviewed, number of review articles written, etc.

8. Avoid Use of Generic Words

Avoid using words like sincere, hardworking, committed, innovative, systematic, as they are used by practically everyone. Be more creative.

9. Highlight Significant Achievements

You should highlight your contributions and substantiate them with examples. Describe the situation, the action you took, and the result or impact of this action (STAR principle). Showcase yourself as a high performer by listing examples of specific assignments, out-of-turn promotions, awards and honours received (e.g. best paper award, best poster award, university rank, etc).

10. Don't Use Third Person

You are describing your own achievements, so use first person. Describe your personality and your interests in your own words so that people can get to know you.

11. Fill the "Current Job Position" Section even if Unemployed

If you are unemployed currently, say that you are "In transition" and use the job title you wish to transition to. Alternatively, you can join a course and say 'Student'. If you leave "Current Position held" vacant, then you will be missed in searches because recruiting professionals mostly use current job title to search for candidates.

12. Work Experience

You can highlight your contributions by adding your important publications, articles etc. to your profile. You can also consider publishing your work on the LinkedIn platform or feeding your blog, if you have one, into your LinkedIn profile.

13. Include Only Strategic Recommendations

Request your supervisor or boss to write you a specific recommendation on LinkedIn so as to highlight your contributions. You should approach different people and request them to highlight particular skills or experiences. Please delete unsolicited or poorly written recommendations. For this, select **Edit Profile**, go to the specific position, and **Click Manage**. Uncheck the box next to the recommendation which you wish to delete. Click **Save Changes**.

14. Update Frequently

Update your LinkedIn status frequently so that your contacts can see your updates. Include most relevant skills only and delete outdated skills from your profile. This shows that you are a dynamic person and are constantly upgrading yourself by acquiring new qualifications and new skills.

15. Join Relevant Groups

You should join relevant groups in your field and actively participate in important events and discussions. You can also share interesting articles, news etc. Groups are also helpful in searching for jobs.

16. Be Selective

You should be choosy in selecting your contacts and add only people known to you or whom you wish to know.

17. Use Privacy Settings

If you are in a job and are on the lookout for a new job but do not want to disclose this to your company and boss, use privacy settings in order to maintain confidentiality .

18. Give Correct Contact Details

Give your correct email, twitter, blog details in the "Contact information" section so that people can get in touch with you.

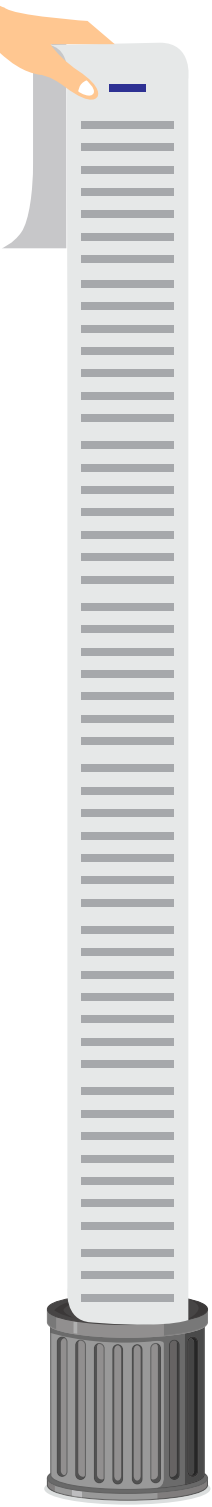
19. Subscribe to Premium Features

A premium subscription allows you to send mails to recruiting managers, HR managers directly. This is optional and you should make the decision about the premium subscription only after weighing anticipated benefits vis-a-vis cost involved.

You must understand the importance of networking in finding a job as most recruitments happen through employee referrals. LinkedIn is a great tool that facilitates professional networking. Your networking on LinkedIn should begin as early as possible. It should be amply clear to you that you don't always get a job on the basis of what you know. In fact, it's quite likely that you may get a job on the basis of who you know or who knows you. Therefore, if you take some time early on to make preparations for your future and have a sound professional presence on LinkedIn, by the time you will start searching for jobs, your network would be well established, which will definitely give you an edge over others who start late.

Suggested Further Reading

- 5 reasons why you need a LinkedIn account. - *https://www.socialmediatoday.com/content/5-reasons-why-you-need-linkedin-account*
- 10 tips for making LinkedIn useful, even if you already have a job. - *https://www.popsci.com/make-linkedin-useful/*
- The 31 best LinkedIn profile tips for job seekers. - *https://www.themuse.com/advice/the-31-best-linkedin-profile-tips-for-job-seekers*
- How to network on LinkedIn like a pro. - *https://www.business.com/articles/linkedin-networking-tips/*
- Give your LinkedIn profile a complete makeover in under an hour. - *https://www.fastcompany.com/90201284/give-your-linkedin-profile-a-complete-makeover-in-under-an-hour*
- 7 creative LinkedIn summary examples to help you craft your own. - *https://blog.hubspot.com/sales/linkedin-summary-examples*
- You have a new job. Here's what to put on your LinkedIn profile. - *https://www.linkedin-makeover.com/2018/02/21/new-job-linkedin-profile/*



2.4. Preparing your Resume

Your resume is an essential part of your job search strategy. It is not a formality and should not be taken casually. Your resume needs to be prepared with utmost care and attention as out of every 250 resumes, only 4-5 candidates might get an interview call. Your resume must clearly demonstrate to the hiring manager that you are the best candidate for the advertised position and should be tailor-made to the advertised job position. On an average, an employer might spend only 6 to 7 seconds in reviewing a resume, provided it is not already rejected by an automated tracking software.

To avoid rejection at the first stage, you must use specific keywords as per the job description and roles specified by the employer. Please don't go overboard in use of keywords as smart hiring managers will be able to figure this out using tools like keyword density checkers which can easily detect the use of too many keywords by tracking the percentage occurrence of keywords. Your resume should showcase skills, talent, and experience which make you the ideal candidate for the post. It has to be precise, clear, brief, succinct, and tailored to the specific position. This means that you can and should have more than one resume.

It is important to distinguish a resume from a Curriculum Vitae (CV). Your CV highlights your academic accomplishments and is a detailed document which, in addition to contact information, educational qualifications and work experience, should cover technical and academic achievements like grants received, grants evaluated, fellowships received, teaching/ research positions held, professional affiliations, paper or poster presentations, publications in peer reviewed journals, patents, technologies developed/ transferred/commercialised, awards and honours etc. In your CV, educational qualifications should be in reverse chronological order, i.e. from latest to first.

Your resume, on the other hand, should be brief and need not include everything you have ever done. It should be aesthetically pleasing and easy to read. Do not include unimportant or irrelevant information. You should include a link to your online profile in your contact details because data shows that 60-70% of recruiters review candidates' online profiles to verify particulars and number of employers using social media to screen candidates has increased by 500% over the last decade.

Don't include a photo unless specifically requested. Use the same name on your resume, LinkedIn profile, Twitter or Facebook to avoid confusion (e.g. avoid putting permutations like Arvind Kumar Gupta, Arvind K. Gupta, A.K. Gupta in different profiles). In contact details, give the phone number and professional email address which you check regularly.

On the top one-third of the page, carefully word your elevator pitch or summary statement to describe who you are, what you do, what you want to do, what are your strengths, interests and how you can

add value to the potential employer. Use keywords mentioned in the advertisement for the job to avoid being screened out by automated applicant tracking software. Use a visual centre and emphasize with graphics, textbox, bullets and bold font

what value you can offer to the company, your most significant accomplishments, industry specific skills, news articles covering your work etc. to capture attention.

Resume Sample: Postdoc Applying to Industry

Content & Design Notes

Note: Resume sample shown at reduced size

Remove hyperlinks!

ARTI SINGH
123 Second Floor, Presidential Tower
Mobile: +91 9900 1234 56 Email: arti@gmail.com

Name is largest text

Run spellcheck to avoid spelling errors !

SUMMARY OF QUALIFICAITIONS

Biostatistician with over five years experience and expertise in:

- Leading and managing complex, high-level research projects
- Adapt at demonstrating proficiency in lab techniques
- Maintain Top Secret with CI Polygraph (Active)

Headers, subheads and body text should be same font size

Headers: Bold all cap

Subheads: Bold and Sentence Case

EDUCATION

IIT, Mumbai
PhD, Biostatistics, June 2015
Concentration in Epidemiology
Relevant Coursework: Advanced Regression, Program Evaluation Methods, Management, Advanced Statistical Models, Comparative Biostats Processes
Thesis: Determining High-Risk Candidates for Epidemiological Measures

Gargi College, Delhi University, BSc. Statistics (Hons.)
Delhi University, Department of Mathematics, M.Sc

EXPERIENCE

National Institutes of Health, National Institute of Cancer.....Frederick, MD
Postdoctoral Research Fellow.....July 2015- June 2018

- Develop methods to identify type IV secretion effectors with the aim of elucidating role of these molecules in host-microbe interaction
- Conduct an epidemiological survey to determine overall burden and effects cancer pathogens on population health, specifically in rural areas
- Present result findings at lab and institute-wide meetings to discuss research efforts
- Assess compliance and efficacy under primary research aims in conjunction with mentor Edward Jones

For each entry under "Experience", include the name of the organisation, position title, location, dates and describe responsibilities and accomplishments

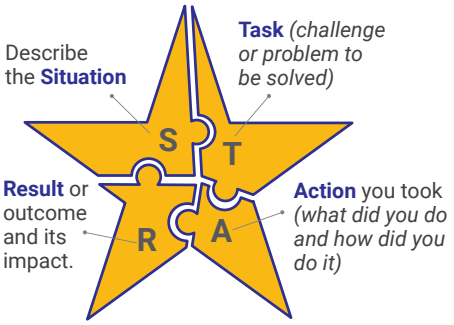
Use Tabs, not spaces, to set precise alignments

SKILLS/TRAININGS

Computer Skills: Proficient in Excel, Power Point, Word; Experience using SAS
Soft Skills: Public Speaking, Problem Solving
Technical Skills: Chromatographic techniques, Spectroscopic techniques, maintenance of laboratory equipment, Safe storage of chemicals and disposal of waste
Trainings: Workplace, Dynamics & Management Bootcamp Series

List computer programs or technical skills and professional development activities or training that you possess or attended

In the summary or experience section, use clear, concise bullet points to focus on significant accomplishments, technical skills/experience, soft skills, or personality traits relevant to the role. According to the job description, give examples of your experience in specific areas, such as team management, resource management, event management, networking and collaboration, conflict resolution, leadership, project management, specific skills, techniques, relevant training or publications/patents etc. In the experience section, you should indicate your core responsibilities and achievements in each job role that you have previously occupied. As discussed earlier, use the STAR technique to list your achievements:



Use quantifiable parameters or targets as far as possible e.g., obtained funding worth Rs._____, involved in evaluation of __ projects, improved efficiency by reducing cost by __ or time by __, used automation and could reduce team size by __ members, effectively reducing cost by __ per year etc.

List your experience by relevance to specific position, not date. While listing your achievements, be realistic and honest. Don't be modest but don't make exaggerated claims either. Don't include irrelevant data. If you are a member of a team, clearly indicate so. If you held a leadership role, substantiate by examples of 'how you motivated your team'.

Use examples to demonstrate how your skills and experience are relevant to the responsibilities of the job you are applying to. Your resume should highlight that you will be able to save time and money for your employer and/or contribute meaningfully to their progress. Please avoid generic descriptors such as hardworking, dynamic, proactive, self-motivated, etc. Instead, focus on specific skills and accomplishments that make you different from others. If you are already working in an industry position, check your performance reviews for positive feedback in order to identify your most noteworthy accomplishments and best work attributes. If you have specialised skills for example, proficiency in programming languages or fluency in a foreign language, highlight them in your resume. If you have worked with well-known scientists, companies, clients, please include this information prominently, as it can help increase the credibility of your resume. However, there is no need to include professional references in a resume.

A good strategy is to keep a record of your accomplishments and feedback in the form of a 'Master Resume'. Otherwise, you may find it difficult to recall specific examples at the time of resume writing. A few questions which may help you recall your accomplishments are given below:

- Did you face any problems or challenges in your previous job or as a

PhD student or post-doctoral fellow? What steps did you take to resolve or minimise the problem?
- Did you introduce a new innovative step or technique or modify an existing technique?
- Have you standardised a new assay?
- How was your result received by your supervisor or team leader and your fellow team members?
- Were you involved in developing/ designing a new plan of action, strategy or computer program, which led to a reduction of time/cost? Did you improve efficiency by substituting raw material, different technique, enzyme, improved strain etc.?
- Did you offer an innovative solution at crucial juncture when your laboratory/ company was facing a challenge/ constraint to resolve the problem?
- Were you involved in grant writing or reviewing articles?

Your resume should be perfect. Proof-read and check for spelling and grammatical mistakes carefully as mistakes reflect very poorly about the candidate. It may also be a good idea to take help from professional editors to polish your resume on services such as elance or Fiverr. You may like to check the charges for these services and decide accordingly.

Suggested Further Reading

- 17 things that make this the perfect resume - *press.careerbuilder.com*
- Number of employers using social media to screen candidates... - Career Builder - *press.careerbuilder.com*
- 18 tips to help your resume stand out from the rest (infographic) - *https://www.entrepreneur.com/article/317403*
- Making your resume more ATS – friendly. - *https://www.business2community.com/human-resources/making-your-resume-more-ats-friendly-02087726*
- How to write a great resume| The complete guide| Resume Genius - *https://resumegenius.com*
- You never have second chance to make a good first impression! - *https://www.biospace.com/article/you-never-have-a-second-chance-to-make-a-good-first-impression-/*
- Tips for editing and proofreading your resume. - *https://www.thebalancecareers.com/resume-proofreading-checklist-2063191*

2.5. Writing Cover Letters

A unique, well-prepared cover letter showcases how you are the best candidate for the advertised post. Your cover letter should make your application stand out from your competitors and show that you are worthy of consideration even if your resume is not the best out of all the candidates. Please do not send cover letters en masse. At times, students even forget to change company, institute or PI names when they are sending the same cover letter to multiple employers. This reflects very poorly on them and most employers don't even want to look at such letters.

Cover Letter Sample: Postdoc Applying to Industry

Note: Cover letter sample shown at reduced size

Subhash Chand
1, Nilgiri Apartments, New Delhi-110019 · +91-9999006353 · subhashchand85@gmail.com

September 1, 2019

Amitava Saha
Head, Human Resources, Biocon Ltd.
20th KM, Hosur Road, Electronic City,
Bangalore-560100

Dear Mr. Saha,

I am writing to apply for the performance management specialist position advertised in the Limjobs.com. As specified, I am enclosing complete job application, certification, resume and three references for your kind consideration.

I strongly believe that my educational background and strong technical experience make me a highly competitive candidate for this position. My key strengths that would be extremely useful for this position are:

- I have experience in finalising plan, goal setting, implementation of plans and seeking funding.
- I have exceptional communication (both written and oral) and leadership skills .
- I am quick learner, technology savvy and add value to the team due to my analytical ability.

With my BTech in biotechnology, MTech in bioinformatics and MBA in biotechnology, I have a comprehensive understanding of job requirements of a performance management specialist.Please see my resume for additional information on my experience.

Please contact me for additional information via email at subhashchand85@gmail.com or phone at +91-9999006353.

Thankyou

Sincerely,

Subhash Chand

Make sure to find out the name of the person you are writing to and always address the letter to an individual. Don't begin your letter with "To whomsoever it may concern" or "Dear Sir/Madam". Not making the effort to find out the name of relevant person indicates casual approach and lack of interest on your part. Try to be formal, but not obsequious. Don't be overconfident and please refrain from using phrases like "your company would be lucky to have me". It is always better to let your work speak for you. Instead of including what you haven't done, it's always better to list and highlight what you have done. Please don't send incomplete information and don't ask for details which are already covered in the job listing. It sends a message that you didn't even bother to read the advertisement carefully. Please proofread carefully and check for grammatical and spelling mistakes. Your cover letter and resume signify your brand, so use the same formatting, font, etc. in cover letter and resume.

Network on LinkedIn or in person at conferences and make sure to put the name of contact person from company prominently in your cover letter so as to catch the attention of the hiring manager. Address your application to the hiring manager by name. Don't use unprofessional email addresses (e.g. imhere2smile@gmail.com or bigboy@yahoo.com).

Suggested Further Reading

- I've hired dozens of people during my career- here are 8 cover letter mistakes that immediately raised red flags - *https://www.businessinsider.in/ive-hired-dozens-of-people-during-my-career-here-are-8-cover-letter-mistakes-that-immediately-raised-red-flags/articleshow/65314656.cms*

2.6. Maintaining Authentic, Updated Profiles on Social Media

Many HR departments examine your online profiles and compare them with your application as a part of the vetting process. You must ensure that your online profiles on social media are authentic and updated.

Generally, researchers disseminate outcome of their work via publications and presentations in conferences but their outreach is limited. It may be a good idea to use ResearchGate, SlideShare, BioArxiv etc. to share pre-print versions of manuscripts, data files, presentation slides, documents, videos and infographics to have a wider reach. Social Media is a great tool for networking and sharing work or ideas or views. Connections made on these platforms can lead to academic discussions, promotions and endorsements, scientific collaborations, job referrals, etc. Publons is a useful and novel website which allows users to anonymously or non-anonymously take credit for peer reviews of manuscripts of academic journals. Many tools and academic journals are linked via ORCiD, a unique scientist's identifier accompanying a public profile that can function as electronic CV. It may take only 2 hours per month to update and maintain an online presence and consequently make a huge impact with much wider outreach. It is also a good idea to join relevant groups on social media and actively participate in discussions to attract the attention of potential employers.

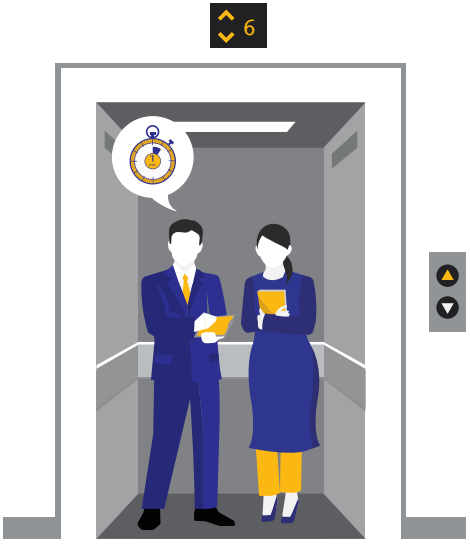
2.7. Obtaining Reference Letters

When you apply for a job, in many places you will be required to give 3-4 references and recommendation letters. You must understand that these recommendation letters may be used as an initial decision-making tool and may seal your further chances if not written properly. Therefore, you must give utmost attention to selecting suitable person(s) for writing recommendation letters for you. You should identify a well-known figure in the field, who knows you reasonably well and will give an honest judgement about you within the prescribed time frame. Brief him/her properly about the expectations of the employer and inform him/her gently, without giving offense, that the recommendation letter should contain his/her realistic, accurate, fair, transparent and honest assessment. It should provide important insights about your character, scientific accomplishments, potential, personality and general abilities. It should duly substantiate his/her intentions with

actual data as it may be used as a de-facto decision making tool.

Please provide a short brief about your salient achievements when you request a person to give a recommendation letter. Follow up with him/her if s/he needs any additional information and ensure that the deadline is met. The recommendation letter should give a balanced, realistic opinion covering your various attributes and weaknesses or limitations - a balanced, thoughtful and personal letter is considered better than a general, uncritical, positive letter. The recommender should reflect on your contributions and his/her relationship with you. S/he should demonstrate that s/he knows you well enough to make well-informed and objective judgement. S/he should also summarise your influence on the field, and your most important scientific and personal characteristics, along with your work, its relevance and context. There is no need here to elaborate on facts and specifics of individual papers. Instead, s/he should present the big picture but should not be superficial. It is great if s/he can discuss how you have advanced understanding in the field and give examples to support. It also makes a good impression if your recommender is laudatory and enthusiastic in summarising your personality, e.g. do you get along well with others, were you an important member of the laboratory and scientific community, were you helpful and generous etc. The recommendation letter should not reveal personal details which are not relevant for professional considerations

2.8. Perfecting your Elevator Pitch



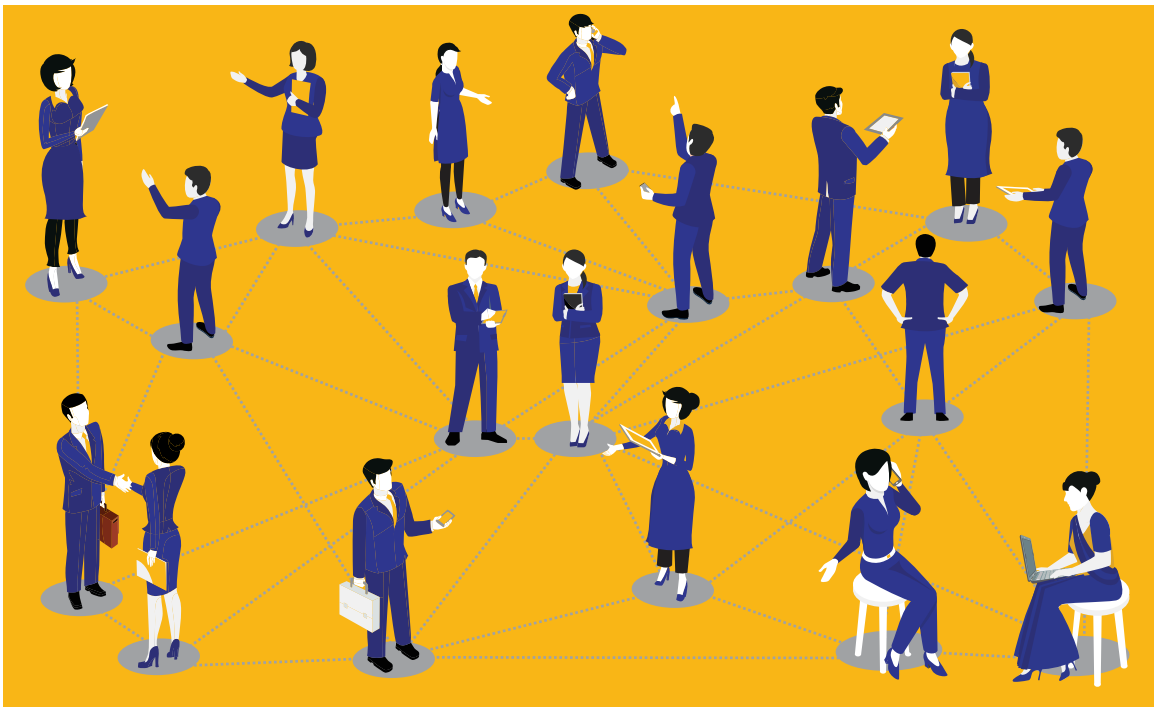
Giving an elevator pitch means explaining to someone who you are and what you do in the time-frame of riding an elevator (lift) - i.e. within 30 seconds to 1 minute. You should be ready with an elevator pitch when you go for an informational interview, conference presentation, or panel discussion, so that you are not caught unawares. It is very useful to have an elevator pitch ready when someone asks you to talk about yourself or when you have to introduce yourself to a stranger.

2.8.1. A Few Tips for Preparing Perfect Elevator Pitch

1. Keep It Short and Simple (KISS principle).
2. Don't use jargon or complex words.
3. Be natural. Smile. Narrate it like a short story. If you make a positive impression in your elevator pitch, that means you have made a lasting impression.
4. The pitch should cover who you are, what you do and what you want to do.
5. Practice so that it comes naturally to you. Record and hear yourself speak. Practice before a mirror and if possible, before friends and family.
6. You may be talking to a potential employer, a possible collaborator, or colleague, or the pitch may be used to introduce you to an audience when you are chairing a session or are a panelist. So, you need to be careful, as often the first impression is very important.
7. Speak slowly. Make your pitch interesting to listen to and remember.
8. Keep a general elevator pitch ready at all times as you may run into a big opportunity any time. First write down all your ideas, then remove unnecessary details and jargon. Connect it like a story.
9. Take inputs from people who don't know about your work, and polish your write-up on the basis of this feedback.
10. Make your pitch interesting for someone who may not know about your field of work and try to involve the listener in conversation.

2.9. Building Professional Network

It is no longer possible to work in isolation in an academic environment, especially if you work on interdisciplinary projects. If you are considering transitioning to industry, you need to network and share the excitement of your research with others, as effective networking can give your career a boost. A recent survey by LinkedIn showed that 47% of unemployed candidates get a job through networking. Research conducted by Harvard University and cited in Forbes also showed that overall 85% jobs are achieved through networking. This proves that networking should be an important component of your job search strategy. In fact, even within academia, networking can help you with collaborations, publishing your work, getting referrals, as well as identifying new job opportunities. For sectors other than academics, networking is essential as you are planning to move to an unknown territory and need to identify new job opportunities as well as skill-sets. In academia, you can attend conferences,



present your research outcome and develop connections with people working in your field. For industry careers, you can visit stalls and promotional stands put up by industries, meet sales representatives who visit your institution for promotional activities and troubleshooting (servicing of equipment), and collect information about people in your area of interest.

Try to follow the 80:20 rule while networking. Speak less, listen more. 80% of the conversation should be finding out about them, while only 20% should focus on you. For e.g., you can ask them what do they like best about their job? What are the biggest challenges in their business? What are the skill-sets required for job like theirs? Are there any openings in their company or other companies? Tell them in brief about what you do and what you want to do and try to build a valuable relationship. Networking can guide you in making the correct career choice, tapping into hidden job markets, getting referrals and more. To make it meaningful, try to add value to the relationships by sharing relevant articles, news and pertinent information.

To get maximum benefits from networking, you must focus on the following:

1. Set a goal

You should have clarity about what you wish to accomplish by networking, i.e. whether you want to collect information about a particular profession from people working in that area, find out about new job opportunities, receive mentorship, set up collaborations, start a new business, diversify to another area etc.. Based on your goal, you can reach a decision on how to proceed further.

2. Do proper research and identify individuals

Once you are clear about your goal of networking, you should identify individuals with the right skill-sets, experience, position and connections to help you attain said goal. You have to judiciously build relationships with people in your area of interest who are willing and in a position to help or guide. It may be a good idea to begin with people from the same city or alumni of the same institute to get easy access. If you do preparatory work, you will be better equipped to network. Be ready with a concise, creative elevator pitch and align your elevator pitch with the people you will be meeting.

Once you have shortlisted people with whom you wish to network, connect with them online, for example, through LinkedIn groups, meetup.com, young professionals groups, StartupGrind.com, Eventbrite.com etc. Add all probable connections on LinkedIn. Send an introductory email and follow up with a phone call.

3. Reach out and Connect

When you reach out to individuals, be honest, introduce yourself and specify your reason for contacting. Don't make too many demands. Be patient and proactive. Don't give up even if you don't receive an immediate response. You can send at least 2 reminders by email or on social media with a gap of 7 to 10 days between emails as the person may be busy with official engagements and travelling.

4. Meet in person

If you are in touch with a person for a while and have judged his/her response and willingness to help, then seek a meeting in person at a time and place convenient to him/her. Please specify the reason for meeting – collaboration, exploring job options, referral, etc.

Highlight your skills which are of interest to the person whom you are meeting. Be confident and careful about your body language. Engage in the conversation, ask intelligent questions and be an active and interested listener. Try to develop and nurture relationships. In addition to company or organization-specific questions, you can talk about industry trends, recent technological advancements, etc. Once the meeting is over, follow up through email/phone. Try to add value to the relationship by linking them to something useful like a recent publication or news in their area of interest, so that it is clear that you don't view them just as a resource. Make only one specific request at a time. Once in a while, update them about your achievements.

5. Be Proactive

Networking is a strategic venture. Figure out a list of events in your area of interest in the next three months. Try to attend one or two networking events per month, if possible. Keep track of relevant events and people you would like to meet or have met already. Contact conference organizers or event managers before the event and collect details of experts, panelists, and participants. From these, shortlist people whom you would like to meet. When you attend an event, challenge yourself to connect with a minimum of 3 people. Carry your business card with your LinkedIn profile address. Exchange business cards and hold brief discussions. Write down key

facts gleaned from the discussion on the back of his/her business card and follow up with a mail citing the conversation you had and build on it. Expand your network by tapping into your contact's network as well. Ideally, your one-third of your network should consist of people who are just starting their career, one-third of those at the same stage as you, and one-third of senior people with years of experience so that you can get guidance and mentorship. Keep your mind and options open. This would facilitate building a meaningful, productive network which will play an immensely important role in achieving your goals.

Suggested Further Reading

- Networking your way to more and better referrals - *https://www.therainmakerblog.com/2018/08/articles/networking/networking-your-way-to-more-and-better-referrals/*
- Three surprising ways your network can help your job search - *https://www.fastcompany.com/90206768/three-surprising-ways-your-network-can-help-your-job-search*
- 5 types of networking events actually worth your time - *https://www.careercontessa.com/advice/5-worthwhile-networking-event-types/*
- 7 deadly mistakes PhDs make when networking for a job. *-https://cheekyscientist.com/deadly-mistakes-when-networking-for-job/*
- 8 networking tips for PhDs to advance their careers.- *https://cheekyscientist.com/8-networking-tips-for-phds-to-advance-their-careers/*
- The beginners guide to professional networking - *https://www.brightnetwork.co.uk/graduate-career-advice/networking/how-network-successfully-getting-started/*
- Successful networking is all about having the right energy. - *https://www.entrepreneur.com/article/315064*
- Avoid these 5 mistakes when talking to a job recruiter. - *https://cheekyscientist.com/mistake*

2.10. Conducting Informational Interviews

Informational interviews are meant to help you understand different career options and skill requirements, as well as your own aptitude and suitability for different jobs. They can also give you information on how to apply for jobs or get referrals, and help you get insider information about vacancies. They might also help you in understanding how to prepare for

interviews, how to negotiate for salary, etc. in a specific field. The main objective of an informational interview is to seek guidance and information, and not to get a job. It is an effective and valuable tool which can help you make the correct career choice.

After narrowing down your career choices, you should select a few people from each career path. Do some online research about each of them and seek time for an informational interview. For ease of access, you could choose an alumnus of the same university where you graduated from or ask your supervisor to introduce you to some of his contacts. You can also follow up with experts you met in a networking event.

During the interview, you should briefly introduce yourself and explain your objective. Follow the 80:20 principle and let him/her do most of the talking. Put in effort beforehand to research and ask the right questions, in order to get the desired information. Focus on learning from the expert about his/her present position, job role, skills needed, present responsibilities, growth opportunities in his/her career, recruitment procedure, relevant people in the field in his/her company and other companies whom you can talk to. You can also ask if s/he is happy in the job, how does s/he strike work-life balance, how and why s/he took up this job, what challenges s/he faced and how s/he managed. You can also check with him/her about any career openings, any expansion plans in his/her company, or ask for specific advice for a job seeker like you.

If the person you are interviewing is from an industry, and depending on how much time you have for the interview, you can also ask specific questions about the company like promising new products, area of research, culture, management style, organization of company, whether company policies are employee friendly or not etc. At the end of this conversation, based on first hand information, you would understand the job responsibilities, expectations, requirements for that job position and how s/he found the job. You will also understand the culture of a potential future workplace. The expert might also evaluate you for your technical and transferable skills. You may also get information about organizations and names of one or two other experts to contact in related fields. This exercise will also improve your ability to handle a job interview and build your self confidence. You should always thank the interviewee for sparing his/her time and sharing important insights. Within 2 days of the interview, try to send a written thank you note mentioning clearly how you benefited by talking to him/her and how his/her guidance was valuable for you.

Suggested Further Reading

- 3 steps to a perfect informational interview. - *https://www.themuse.com/advice/3-steps-to-a-perfect-informational-interview*
- An informational interview: 10 tips to prepare. - *https://www.monster.com/career-advice/article/informational-interviewing*
- Informational interviewing. - *https://career.berkeley.edu/Info/InfoInterview*
- How an informational interview can boost your career. - *https://www.thebalancecareers.com/how-an-informational-interview-can-help-your-career-2058564*
- Finding the information you need. - *https://www.insidehighered.com/advice/2018/06/18/advice-how-reach-out-and-network-effectively-opinion*
- How to send a follow up email after no response. - *https://blog.hubspot.com/sales/how-to-send-a-follow-up-email-after-no-response*
- 50 questions that turn informational interviews into actual interviews - *https://cheekyscientist.com/questions-that-turn-informational-interviews-into-actual-interviews/*

2.11. Preparing for Interviews

The interview process can comprise of several rounds and may take place on-site or via telephone or video call.

Four 'P' principle:

Prepare
Practice
Present
Participate

Give the same importance to job interview preparation as you would for a thesis defence. Be patient and confident. You should practice for the interview by framing questions and writing probable answers in advance. Practice in front of a mirror.

You may also record a video of your practice interview to check for any pronunciation mistakes and body language issues (posture, facial expression, eye contact, gestures). Do mock interviews with friends, seniors, supervisor or career

counsellors, and ask for their genuine feedback. Work on their suggestions. The day before the interview, try to have 8 hours of sound sleep and equip yourself with enough energy to sustain you for a day-long interview.

If you are transitioning to industry from academia, during the first screening interview with a recruiter, they may ask simple questions like:

- Tell us about yourself.
- Why do you want to transition to industry?
- Why do you want to work in our company?
- Do you have relevant experience?
- Are you willing to relocate?
- Have you worked earlier in fast-paced environment with strict time schedules? "How do you communicate with colleagues?

In the next step, you may have an interview with an HR manager which primarily focuses on behavioural questions and sometimes a few technical questions. For skype interviews, please make sure that you make proper arrangements for lighting, decide time of interview taking into consideration internet speed, wear proper formal clothes as for in-person interview, and prepare properly. If you get an on-site interview call, you should discuss with the hiring manager in advance to know what their expectations are and the names of the people you will be meeting. You should also confirm whether you are required to make a presentation. If yes, confirm the topic of the presentation, as well as its focus and duration. You must understand that usually employers and organizations receive thousands of applications for any single post and you may be one of a lucky dozen who get selected for a skype interview or one of 3-4 candidates for on-site interview. Companies spend a lot of money and precious time in hiring new recruits, so you must practice enough to bring out the best in you.

Please don't reach late for the interview as this indicates poor time management and lack of seriousness or respect for other people's time. Don't dress inappropriately or casually for an interview. This will convey the impression that you are not taking the job seriously since your appearance is often the first thing that the interviewers will notice about you. Instead, dress formally and professionally. During the interview, please put your phone in silent mode. Make eye contact with panel members, smile and greet everyone. Demonstrate to the interviewers that you have integrity, conviction and loyalty and can handle failures and disappointments. Show your enthusiasm, excitement and passion for the job and your willingness to integrate with the existing team. Highlight your troubleshooting skills with specific relevant examples. Please remain alert during the interview and don't get distracted, as it may signal to the interviewers that your attention span is limited and you will not be able to follow strict schedules.

Always listen to the questions carefully and then respond. Avoid giving vague answers. If you do not know the answer to a question, say so clearly. Give to-the-point answers. Never use foul language for your supervisor or past employer. Before the interview, read the advertisement carefully

to know the specific skills required for the advertised position and during the interview, demonstrate how you will bring those skills to the company. You can also identify skill-gaps in the existing team through your prior research and talk to the interviewers about how you may be able to fill that skill-gap and add value.

Please carry your portfolio, copies of resume, cover letter, copies of publications, originals, notepad and pen. Remember that most hiring managers know within first 90 seconds of the interview whether they will hire a candidate or not. Therefore, how you present yourself, what you say, and how you say it during those 90 seconds may determine your career trajectory. Hiring managers look for critical thinking, interpersonal skills, communication skills, organisational skills and management skills. Manners, timeliness, tidiness, attitude, core values, knowledge about the organization, and finally technical and communication skills are usually the main factors for success or failure of candidates at the interview. You should also use the interview as an opportunity to figure out whether the job is a good match for you in view of your strengths and weaknesses. For an industrial position, collect information about the company before the interview by researching the company's website about their vision, mission, present products and products in pipeline, competitors, team members and competencies, etc. Also collect information from the company's social media sites and contact your connections at the company for insider information and industry trends. If you know who your interviewers are going to be, you can check their LinkedIn profiles to know more about their career trajectories. This may help you ask insightful questions and demonstrate your knowledge, preparedness and seriousness for the job.

Please don't allow the interview to turn into an interrogation. Instead, treat it as a professional conversation by engaging with the interviewers and asking intelligent and thought-provoking questions.

2.11.1. A few Sample Interview Questions and Tips for Answering

Tell us about yourself.

Tip: You don't have to describe everything about yourself. Be precise and share technical and transferable skills which are relevant for the advertised position. Highlight how you are the best candidate for the position and can add value or fill gaps in the skill-sets of the existing team.

Why should we hire you?

Tip: You should project your technical and transferable skills, as well as your past experience which is relevant to the

advertised position. Showcase how you are uniquely qualified to help their projects given your training and experience and what value you will bring to the team or how you will fill skill-gaps in their existing team.

What makes you believe that you are a good employee?

Tip: You should specify your main contributions during your career. For example, mention if you developed a new technique, product, or device, or if you standardized a new assay. Speak about how your work led to better scientific understanding of the field.

Are you an ethical employee?

Tip: Tell the interviewers that yes, you are an ethical employee and will follow any rules prescribed. You can also give an example from your experience. For example, you may mention that when you collect human samples like blood, you inform the patient and his/her relatives about the objectives of your work and only collect samples after their consent is received.

Why do you want to transition into industry and leave academia (if you are applying for an industry position)?

Tip: One way to answer this can be to mention any research leads that you may have obtained during your PhD, and propose that you would like to upscale and market them for the benefit of society. Although money is important, never say that you wish to take up an industry job due to lack of opportunity in academia or for earning money. As far as possible, don't bring in personal or family reasons.

Why are you interested in this position and our company?

Tip: Based on your research about the company and relevant industry trends, you should substantiate your preference with data. For example, you can say - "As per the latest Biospectrum survey, your company is among the top 20 companies in the field and company policies and culture are employee-friendly".

What are the advantages of working in our company versus other companies?

Tip: Highlight the positive features of the company, for example, innovative nature of work, emphasis on R&D, employee friendly policies, ethical functioning, etc.

What do you know about our company's products, services, R&D activities, employee strengths, background, etc?

Tip: Your research about company, its existing products and products in pipeline, existing team and their expertise should help you answer this question.

How will you manage deadlines?

Tip: Emphasize that you will be required to multi-task and adhere to strict time schedules. For example, one way to meet deadlines is to classify your work into 4 categories: Important and Urgent, Important but Not Urgent, Not Important but Urgent and Not Important, Not Urgent. Accordingly, you can finish the most important and urgent work on priority basis. At the same time, you may also be able to delegate work to your team members based on their capability and capacity and motivate them to finish the work as per defined deadlines.

How will you cope with pressure and balance your work with personal life?

Tip: Planning and systematizing work to adhere to deadlines, delegation of work, use of technology etc. would be important in maintaining work-life balance.

What would you do if things do not work?

Tip: You can mention that if you don't get desired results, you will analyse the results and reasons for failure and take necessary corrective measures. Talk about having a plan B ready in case plan A does not yield results. Substantiate this with examples of similar situations in your past research career.

Please tell us your strengths and weaknesses.

Tip: Strengths can be attributes like quick learner, skilled at critical and objective analysis etc. Describe a specific example using STAR technique. Situation, Task, Action taken and Result achieved. If possible, substantiate with examples to demonstrate how your skills and experience can be relevant to the responsibilities of the proposed job. When you are describing a weakness, make sure you mention the steps you have taken to work on this weakness, and/or ways you can convert this into a strength. For example, "I was not very confident in giving presentations in front of a large audience but I have worked on it, by joining Toastmaster and initiating a Journal Club in my department where every student had to give a presentation about his/her research topic or any latest development. By practicing first before known and then unknown audiences, I am reasonably confident now." Thus, you must demonstrate to your interviewers that you are making efforts to overcome your weaknesses.

If we gave you a budget of Rs. 1 crore, how would you spend it?

Tip: Here, you should demonstrate a clear knowledge of the company's goals and interests. You can refer to their website and say that you saw that they are thinking of expanding into a new area (for example, e-learning or live events) and you would wish to put a good portion of marketing budget into that but would need to consult all stakeholders and consider their feedback before taking a final decision.

How much do you expect to be paid?

Tip: You should assess your market value based on your qualifications, experience, the city where you will be required to live, as well as salary trends in the industry for the job role you are applying to and be ready with a range before the interview. Say that you will be excited to accept a reasonable, competitive offer. Only if they insist on a specific figure should you mention your desired salary range and justify, if needed, why you should be paid that amount.

2.11.2. Some Additional Questions

- Please describe an error in judgement that you made and its impact.
- Describe the most satisfying moment in your life.
- What tasks do you not like to do?
- What issues should the team consider when evaluating the value of the company's existing product line?
- If hired, what you would wish to change about your department in our company?

2.11.3. Questions for Interviewers

- What will be my role in the company?
- What are the opportunities for advancement in this role?
- How will you help with my professional development?
- Who will be my supervisor and what is his/her style of functioning? What team projects does s/he supervise and how many team members in his team and their expertise?
- What is the typical career trajectory of people working in this company?

Next Steps:
Don't leave the interview without asking about the next step in the process. Follow up with a thank you mail. If you committed to send additional material during the interview, please send the required information as early as possible.

Don't stop your job search after the interview even if one of the interviewers tells you that you probably got the job because hiring decisions are complex processes. Keep your job strategy moving forward until you sign a written contract. In fact, if you have more than one job offer, it not only acts as a big morale booster but also leaves you in a better position to negotiate salary and benefits. Sometimes, you may have to do behavioural interview over the phone after the onsite interview and another phone interview with team leader with whom you would be working directly. Once the company takes the decision to give you the job offer, thec HR manager may call you for salary negotiations and other logistics.

2.11.4. How to Prepare for a Presentation During the Interview

Once you get shortlisted for on-site interview, please make sure to prepare and practice well for the technical presentation as this is often the final step of the selection process. You must check with the hiring manager about the topic for presentation as well as its focus and duration. Clarify any doubts you may have beforehand, and ask about their expectations. You can also enquire about the names of the panel members, if not confidential. Make sure to gather this information beforehand, because depending upon the job role, sometimes your presentation for an industry position will not be about your own research work, but about one of the company's products. Please keep in mind the following:

1. Introduce yourself
While introducing yourself, you can briefly highlight your transferable skills and extra-curricular interests to demonstrate to your potential employer that you are a talented, multi-faceted person and would add value to the company.

2. Tailor your presentation according to the audience
If you are presenting to a mixed audience with differing levels of scientific background, then present appropriately. Don't use scientific jargon and explain in simple language.

3. Explain the relevance of your work
Since your audience is most likely going to be mixed and may not necessarily have the same research background as you, please describe the background and relevance of your work before proceeding to outcomes or results.

4. Understand the purpose of the presentation
Based on your discussion with hiring manager, you must have clarity about the objective of your presentation. Accordingly, highlight yourself or your research or the company's products.

5. Highlight important results
Decide one important thing which you would like them to remember and take away from your presentation e.g., a research result, specific skill, etc. and communicate accordingly.

6. Don't read from slides
Show data, images on slides to engage audience and capture their attention. Don't read out text from slides, instead talk extempore. Practice the talk beforehand, but make sure that you do not sound rehearsed.

7. Practice your presentation
Practice your presentation in front of a mirror. You can also record a video of yourself giving the talk and later watch and listen. You can also practice before your friends, seniors, supervisor, etc. Give it the same importance you would give your thesis defence or other scientific talks.

8. Don't overload the presentation with data
Remember that you don't have to show all your data in the presentation. Too much text and data can be very distracting for the audience. Select important, relevant data and highlight them.

9. Format your presentation carefully
Use legible font and readable font size. Choose colour carefully. Use good quality images. Cite the source, if you use images or data from someone else. Check your presentation from a distance to verify its readability.

10. Watch your body language
Don't fiddle with your hands, fingers, hair, pen or the laser pointer. Be calm, composed and confident.

11. Follow STAR Principle
You need to make an effort to persuade your employer to hire you. Follow the STAR principle to highlight your most significant contribution(s) while presenting your data. Describe the Situation, Task in hand, Action you took and Result or outcome. This can help you explain how you handled difficult situations and achieved the desired results.

12. Highlight the relevance of your work to the Company's focus (for an industry position)

Research the company, their existing products, products in pipeline, techniques employed and team expertise beforehand. During the presentation, show the relevance of your work, experience and expertise to the audience. This would demonstrate to the company that you are interested in the company and are serious about the job as you have made substantial efforts to find out information about the company.

13. Proofread

Be very careful while checking for spelling mistakes and grammatical errors. In addition to tools such as Spell check or Grammarly, take help from friends, seniors, or a professional editor.

14. Highlight your skills

Read the job description for the advertised post carefully. Highlight your relevant technical, transferable skills such as leadership skills, troubleshooting skills, adhering to deadlines, etc. Since you would have already gone through several stages of the selection process by this time, be confident. Present your work in an engaging manner and involve the audience.

Suggested Further Reading

- How to answer the 6 most common job-interview questions - *https://www.thecut.com/article/how-to-answer-common-interview-questions.html*
- Ask a real recruiter: How do I prove that I'm the best candidate in an interview? - *https://www.themuse.com/advice/how-do-i-prove-that-im-the-best-candidate-in-an-interview-question*
- Most Common interview mistakes to avoid - *http://www.wehirepeople.com/2018/12/27/most-common-interview-mistakes-to-avoid/*
- Prioritize the needs of the audience when giving a presentation - *https://www.nature.com/articles/d41586-018-06021-z*
- 10 awesome interview tips from actual hiring managers - *https://theundercoverrecruiter.com/interviewing-tips-from-hiring-managers/*
- 14 things smart people do the night before an interview - *https://www.ivyexec.com/career-advice/2018/night-before-interview/*
- How to tell if a job interview went well: 7 signs you rocked it- *https://www.roberthalf.com/blog/job-interview-tips/how-to-tell-if-a-job-interview-went-well-7-signs-you-rocked-it*
- 4 Crucial tips for writing the interview thank you note - *https://www.careercontessa.com/advice/crucial-tips-interview-thank-you/*
- 23 tips to improve your public speaking skills - *https://www.careeraddict.com/public-speaking-tips*
- You're not management material until you master these 3 interview prep strategies. - *https://cheekyscientist.com/master-these-3-interview-strategies-to-be-considered-management-material/*
- 5 Big-Picture Mistakes New Ph.D.s Make on the Job Market. - *https://www.chronicle.com/article/5-Big-Picture-Mistakes-New/243475*

- I didn't get a job offer until I started asking these 7 questions in interviews. *- https://cheekyscientist.com/ask-these-7-questions-in-job-interviews/*
- Interview questions to ask before, during and after *- https://cheekyscientist.com/interview-questions-to-ask/*

2.12. Negotiating Salary

Negotiating salary is an important, essential part of the hiring process. If you don't negotiate, it might send a wrong signal to your employer that you are not confident about your worth. On an average, even if you assume a nominal 10% increase in salary in your first job if you had negotiated, you may incur cumulative loss of lakhs of rupees in your career as it will have cascading effect in your subsequent assignments given that your previous salary is an important factor in deciding your next salary. A report by CNBC suggests that only 39% people negotiate their salaries, perhaps because they are either desperate and scared of losing the job or don't know how to go about it. Salary is one of the most important factors in accepting a job offer. You should receive compensation that is commensurate to your qualifications, skills and experience as it will impact job satisfaction.

You should practice negotiating before the interview. For this, you should do proper research and decide your market value keeping in mind salary trends and market compensation range for similar job titles. Research compensation rates for people with similar qualifications, experience and skill-sets. Other factors which play into the market value are the city where the job is, your life-style, the company's interest in hiring you, etc. You should take help from your seniors, experts, and recruiters in deciding salary range.

Please do not be in a hurry to broach the salary conversation with your prospective employer and wait for the right stage. You should display your suitability for the job to the employer and be sure that the job is the correct choice for you. If the hiring manager asks you for salary expectation, show your enthusiasm and passion for the job and opportunity and don't give the number first. Indicate that you will consider a reasonable, competitive offer positively. You can also ask the prospective employer for an appropriate pay range for the position. You should never signal to the employer that the salary is your biggest motivator for the job.

Also, make sure to think beyond the gross pay, and take into consideration the benefits package such as medical or travel allowance, flexible timings, opportunity to learn and grow etc. If you are not happy with the salary offered, clearly mention that you were hoping for more than the offered amount. In case the hiring manager expresses difficulty in considering any raise as they have set scales and don't usually negotiate, then ask him/her for past precedents and circumstances in which it was considered. Also ask him/her that if

it is not in his/her power, who needs to be brought in conversation to consider raising the offer.

Remain positive, excited and enthusiastic and talk specifically about your skills, experience and value you would bring. Believe in yourself. You must understand that the company has invested a lot of time and effort in hiring you and would not want to lose you. At the same time, don't be rigid. Give specific examples comparing your case to the past precedents. Remember that it is hard to get what you don't ask for. Evaluate alternatives and take a well-informed decision. Come to an amicable solution without jeopardizing your job offer. Get a written offer and convey acceptance while thanking them for giving you an opportunity to prove yourself.

Suggested Further Reading

- When should you start discussing salary in an interview? - *https://www.roberthalf.com.au/blog/jobseekers/when-should-you-start-discussing-salary-interview*

03

Career Options for Life Science and Biotechnology Students

03

Career Options for Life Science and Biotechnology Students

In the previous chapter, we have discussed how to make an informed career choice, how to network with professionals, how to prepare an elevator pitch, resume and cover letter, how to prepare for presentations and interviews, etc. In this chapter, we shall discuss different career options available for life science and biotechnology students in India.

Most Indian life science students are not aware of career options outside academia as we do not have culture of joint or adjunct faculty positions in universities and industries, public private partnerships are relatively recent, not many people are willing to take risk and set up their own enterprises or work in start ups. So, supervisors and faculty members often end up advising students to concentrate on doing good work and publishing papers; however, this alone may not be enough to land good jobs because of fierce competition fuelled by low demand and increasing supply.

A very small proportion of PhDs and postdocs are able to secure tenured faculty positions. Therefore, it is imperative that students should explore careers other than academia.

Embarking on a successful and rewarding career requires conscious in-depth planning. It is difficult to make a rational career decision without having access to complete and accurate information about the different career options that are available. While some information about career paths has been put out by the National Institute of Health *(https://researchtraining.nih.gov)* , Cheeky scientist association *(https://cheekyscientist.com)* and American Association for the Advancement of Science/career-path *(https://www.aaas.org/careers)*, guidance material relevant to the Indian scenario is by and large lacking. IndiaBioscience previously published an e-resource booklet *(https://indiabioscience.org/careers-in-science/booklet-on-careers-in-indian-science)* which deals with career options for life science and biotechnology students. However, this needs further elaboration. Details of key skills required, job roles, potential employers and training needed for each career option would empower students and facilitate decision making. This can also help students develop a focused strategy to secure a job quickly in a sector of their choice.

3.1. Career Options

Some of the many career options presently available for science students are - teaching and research in the academic sector, jobs in biotech or pharma industry, science administration, management, policy, communication and outreach, intellectual property rights (IPR), technology transfer and regulatory jobs, setting up your own enterprise, specialised services such as core facility management, bioinformatics, big data management,

clinical trials etc. It is important to do work that you value and enjoy, and which suits your temperament and personality.
A carelessly made career choice can result in lost years and dissatisfaction, and hence, avoid taking up a job just because an immediate opportunity is available. Instead, you should choose a career based on your interest and passion and once this decision is made, you should focus on networking, resume building, acquiring advanced training, and supplementing technical knowledge. It is expected that the information in this chapter will serve as a one-stop resource for students. It is intended to help you in making the best choice for a career path after assessing yourself, matching your aptitude and skills with the requirements of the job, and filling gaps, if any, by acquiring appropriate training.

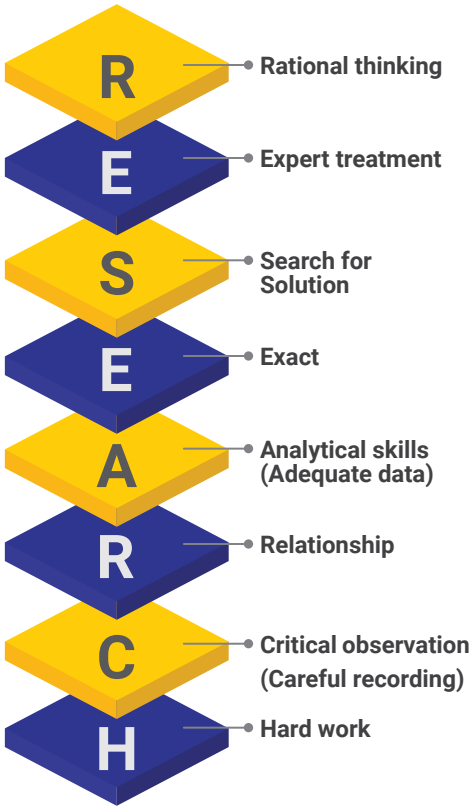
Now, we will discuss career options for life science and biotechnology students in academia (teaching and research), industry (R&D, production, quality analysis and control, marketing, equity research, technology transfer, intellectual property rights protection, etc.) and specialized services (bioinformatics, big data, etc.). We will try to cover skill-sets required for different options, training required, potential employers, etc. so that you can select the options that are most suitable for you. You can also try to network with relevant people and acquire skills by doing summer/winter training, internships, voluntary work, online courses etc. to add value to your resume. Once you have narrowed down your options, you should then prepare your resume, conduct informational interviews, and prepare for interviews and presentations, to enhance your employability.

3.2. Academic Careers

There are immense opportunities for students who wish to pursue a career in education and research. India has a large network of institutions of higher learning. There are 47 central universities, 370 state universities, 123 deemed universities, 282 private universities, 23 IITs, 31 NITs, 23 IIITs, 7 IISERs, AIIMS, and around 35000 affiliated colleges which offer undergraduate and postgraduate courses, and conduct doctoral and post-doctoral research. In addition, agricultural universities and veterinary universities also award degrees. In recent years, several new institutions of higher learning, viz. IITs, IISERs, NIPERs, AIIMS have been set by the Government of India and several private sector universities have also come up, creating a lot of opportunities for students seeking faculty positions. Faculty members play a major role in mentoring students and shaping young minds. If you wish to remain in academics, you need to acquire a PhD degree and postdoctoral experience. Here, we shall discuss some tips on selecting your topic of research, selecting an appropriate laboratory and supervisor, and making the most of your research experience.

3.2.1. Guidance for Pursuing PhD

If you have finished your graduation/ post-graduation and are interested in pursuing a PhD, you must first understand what is research and what is expected of a research student. Research is an original contribution to existing knowledge. Research brings advancement by verifying old facts or discovering new facts through an objective and systematic method of finding solutions. Research results should be replicable to ensure validity. One way to think about Research is:



Before beginning your PhD journey, please ask yourself a few questions. Why do you want to pursue a PhD? Do you have the patience and persistence to continue for 4-5 years? Do you have a 'never give up' attitude or are you easily demoralised by small obstacles? Can you accept failures? Are you an independent-minded person or do you need constant guidance? What are your personal and professional expectations from a PhD? What are your long term goals? What would be your ideal career path once your PhD is over?

As a PhD scholar, you will be expected to identify gaps in existing knowledge, critically review literature, pose useful and relevant research questions, devise testable hypotheses, design experiments to prove or disprove hypotheses, collect, document, analyse and interpret data from your experiments, build new hypotheses based on your work, find solutions to problems, obtain necessary ethical approvals, communicate your ideas and results to specialists and non-specialists, and finally, foresee and plan short, medium and long term goals for your research.

As the number of PhDs produced is much higher than faculty positions advertised, you will also have to acquire transferable skills during your PhD that will be useful if you wish to later transition to a non-academic field, such as industry. The primary goal of a PhD program is to prepare promising students for outstanding scholarly and professional achievement, to instil an ability for independent and critical thinking/judgement, and to inspire students to use their knowledge and training for the betterment of society.

During a PhD, students also receive training on current best practices in research and teaching, including appropriate techniques, tools, methods and use of sophisticated equipment. Students are expected to maintain integrity, follow ethical standards, maintain detailed, organized and accurate laboratory records, as well as analyse and present research data. Research scholars will have to develop an ability to clearly articulate ideas and balance clarity and precision so that there is no ambiguity. Creativity, self-motivation, focus, problem-solving skills, time management, independence, self-confidence, willingness to accept failures, perseverance, and ability to face uncertainty are some essential traits for success for research scholars.

3.2.1.1. Obtaining Fellowships

Currently, there are a number of fellowship programmes in India to encourage students to pursue research, including but not limited to DST-INSPIRE, DBT-JRF, CSIR-UGC NET, ICMR-JRF, ICAR-JRF and more. Details such as name of funding agency, mode of selection, number of fellowships, eligibility covering subject, academic qualification, % marks, age, amount of fellowship and contingency are given in **Table 1.** Amount of fellowship is revised frequently, so, please check respective website for latest information.

CSIR and UGC jointly conduct the National Entrance Test (NET) twice every year (July and December) for selecting Junior Research Fellows and determining eligibility for lecturership. For lecturership applicants, there is no upper age limit. Toppers of CSIR-UGC JRF(NET) are awarded Dr. Shyama Prasad Mukherjee (SPM) fellowship.

In addition to these fellowships granted to individual students, each of these funding agencies also sponsor a number of research projects to faculty and scientists working in universities or research laboratories, which have provisions for JRF/SRF positions. Several universities and research institutes also have a scope for special fellowships for pursuing research, that are specific to that university/ institution.

Students interested in pursuing research should look at the websites of these funding agencies and find out how and when to apply, as well as the curriculum, question paper pattern, past question papers etc. in case of a written entrance test. Make sure you prepare thoroughly and wholeheartedly.

An independent fellowship gives you a lot of freedom and flexibility in choosing your supervisor and topic of research. In case you don't get along well with the supervisor, many of these fellowships allow you to exercise the option of changing laboratories. Moreover, fellowships in sponsored projects often end at the same time as the initial duration of the project getting over (which is usually around 3 years). In a few universities, students working in sponsored research

Table 1 : Details of a few fellowships for pursuing PhD

Heading	CSIR-UGC	DBT	DST	ICMR	ICAR
Mode of Selection	NET (National Entrance Test)	BET (Biotechnology Eligibility Test)	INSPIRE (Innovation in Scientific Pursuit for Inspired Research)	National Exam	ICAR-JRF, AIEEA (All India Entrance Exam for Agricultural Sciences) -PhD
Number	-	275	1000	120	-
Eligibility in terms of degree	BS/MS, BE/B.Tech/B. Pharma, MBBS, MSc Chemical Sciences, Earth Sciences, Life Sciences, Mathematical Sciences, Physical Sciences	BS/MS, BE/B. Tech/B.Pharma, MPharma, MBBS, MSc, MSc.(Ag), BVSc, MVSc Biotechnology, Agricultural, Marine, Medical, Environmental, Bioresource Biotech, Bioinformatics, Molecular & Human Genetics, Neuroscience	All Sciences	Life Sciences, Social Sciences	Agriculture & Allied Sciences
Maximum age on cut off date	28 yrs. for G 33 yrs. for SC, ST, PH, Women 31 yrs. for OBC	28 yrs. for G 33 yrs. for SC, ST, PH, Women 31 yrs. for OBC	-	28 yrs. for G 33 yrs. for SC, ST, PH, Women 31 yrs. for OBC	-
Minimum marks in Qualifying degree (UG Or PG)	55% for G 50% for SC, ST, PH	60% for G 55% for SC, ST, PH	70% marks or equivalent CGPA for INSPIRE fellows or first rank holders	55% for G, OBC 50% for SC, ST, PH, VH	60% marks or OGPA of 6.60/10 or 3.25/5 or 2.6/4 for G,OBC and under privilege and 55% or OGPA of 5.5/10 or 2.75/5 for SC/ST/PH
Fellowship Amount	**CSIR JRF** Rs. 31,000/- p.m. for 2 yrs. **CSIR SRF** Rs. 35,000/- p.m. for 3yrs. Contingency Rs. 20,000/- per annum **CSIR SRF** Rs. 35,000/- p.m. for 3yrs. Contingency Rs. 20,000/- per annum **UGC JRF** Rs. 25,000/- p.m. for 2 yrs. Contingecy Rs. 12,000/- per annum	**DBT JRF** Rs.31,000/- p.m. + HRA for 2 yrs. **DBT SRF** Rs. 35,000/- p.m. + HRA for 3 yrs. Contingency Rs. 30,000/- per annum	**DST JRF** Rs. 31,000/- p.m. for 2 yrs. **DST SRF** Rs. 35,000/- p.m. for 3 yrs. Contingency Rs. 20,000/- per annum	**ICMR JRF** Rs.31,000/- p.m. for 2 yrs. **ICMR SRF** Rs. 35,000/- p.m. for 3 yrs. Contingency Rs. 20,000/- per annum	**ICAR JRF** Rs. 8,500/- p.m. + Contingency **ICAR SRF- AIEEA-PhD** Rs. 16,000 p.m. in 1st yr
Website	https://csirhrdg.res.in	www.bcil.nic.in	https://dst.gov.in	https://www.icmr.nic.in	https://www.icar.org.in

projects are not permitted to register for a PhD. In many leading universities and institutions, students who have not cleared a fellowship exam are not eligible to apply for PhD admission. Hence, it becomes imperative that you give priority to clearing the appropriate entrance exam for an independent fellowship.

3.2.1.2. Choosing the Institute and Research Topic

Your next step should be shortlisting universities and institutes where research in your area of interest is being pursued. Once you have located a few such organisations, try to find out about the admission process, eligibility, important dates and mode of selection. It is very useful to be in touch with your seniors and fellow students for advice and keeping track of important deadlines.

Once you have secured admission to a PhD program, you must focus your attention on choosing a research topic. Choose a topic that interests you and conduct a preliminary survey of literature to learn about the existing status, gaps in knowledge and other researchers working in the field. You can use this information to shortlist narrow and focused research questions which are interesting and relevant. Draft a brief research proposal

and prepare a list of prospective supervisors who are conducting research in a related field by looking at university or institute websites, project listings, academic profiles, research outputs such as publications, blogs, editorials, books, press articles, etc.

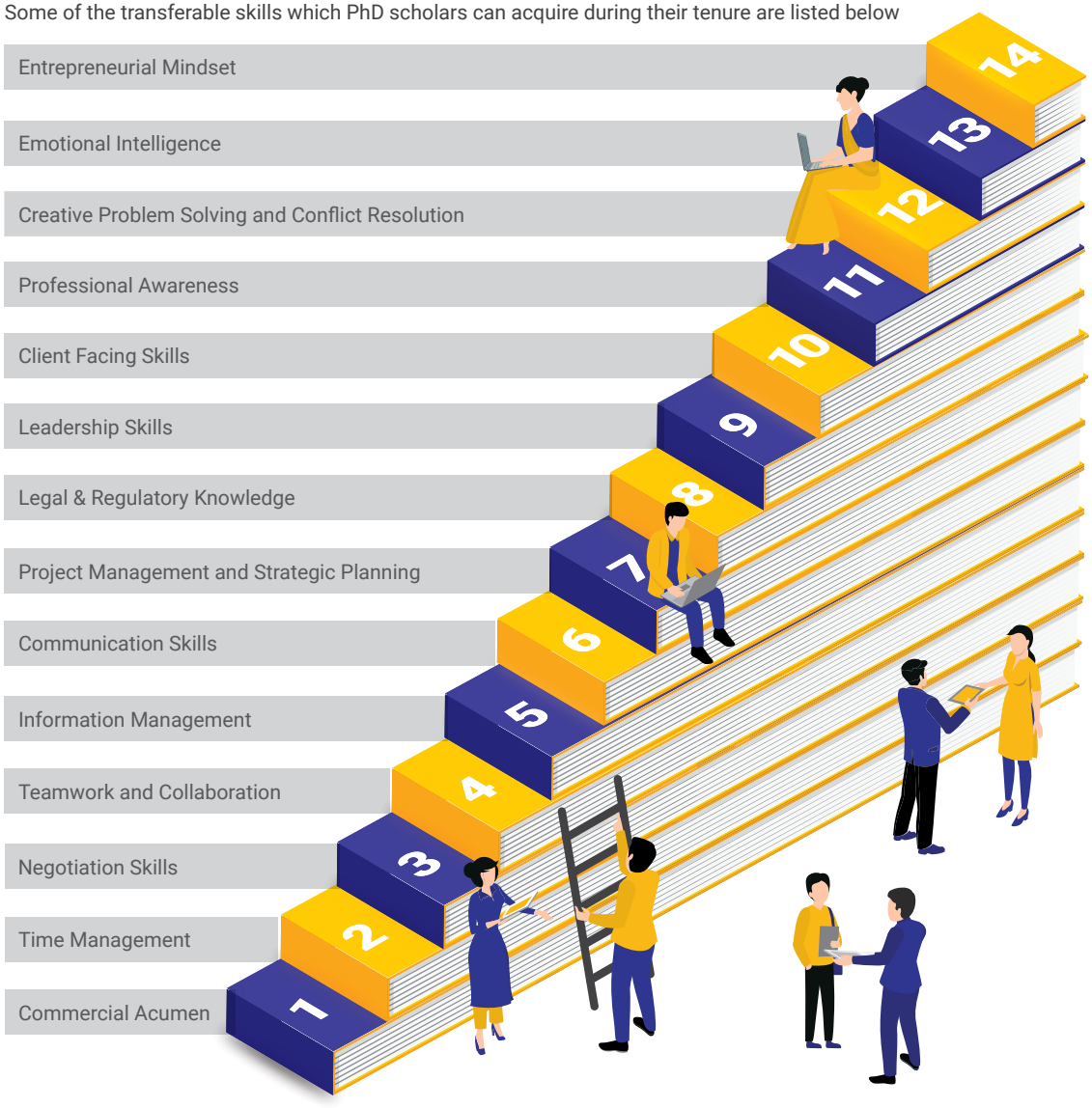
If possible, before joining a laboratory, talk to present and past students as well as other laboratory staff to gain more information about the lab atmosphere, integrity of the supervisor, employment status of past students, present number of lab members etc. You can also ask about general work conditions, such as the number of hours the supervisor expects you to be in the laboratory per day, the average number of years taken by students to finish their PhD, availability of fellowship(s) and funding etc. A few institutions allow PhD students to work for a few weeks in 3-4 laboratories (called rotations) to facilitate decision making regarding choice of supervisor and research project for PhD.

If you receive good feedback from the lab members and your interests match with the potential supervisor's, go through their research publications in detail and write to them about how your research interest and experience match with theirs. Please do not send the same email to several Principal Investigators (PIs). Even if you have a common central template and are copying and pasting certain details, please make sure that you have changed all relevant information. Keep this email short and to the point and always address the supervisor by name (e.g. "Dear Dr X"). Many students write impersonal emails with headings such as "To whomsoever it may concern" without bothering to find out the name or gender of the PI, which reflects very poorly on them. Many PIs may not be interested in supervising students with such a casual and indifferent approach. Be proactive and if possible, seek time for an in-person follow-up meeting. If the PI agrees for such a meeting, be sure to reach on time. While meeting them, introduce yourself and specify why you are interested in working in that particular area and under their supervision. Always carry a copy of your resume and publications (if any). Discuss the availability of fellowships in his/her laboratory, your chances of clearing fellowship exams, and other relevant issues.

Once you have joined a laboratory and selected your topic of research, conduct a thorough review of the literature to refine your research problem and learn all relevant techniques. Make sure to clearly define your goals and deadlines, and work in a focused manner to achieve them. Try to network with senior students and other faculty members. In addition to scientific work, you should also take part in voluntary activities, such as editorial work, organizing seminars/symposia, journal clubs, etc. to acquire additional skills and experience. This can also help you build networks both within and outside your organization. Try to present the outcome of your own research to others in the field and play an active role during seminars by asking relevant questions. These skills would come in very handy when you finish your PhD, even if you decide to transition to jobs other than those in academia.

Transferable Skills

Some of the transferable skills which PhD scholars can acquire during their tenure are listed below



3.2.1.3. Transferable Skills

Some of the transferable skills which PhD scholars can acquire during their tenure are listed below:

1. Commercial Acumen

You should try to take up business courses if your university has a business management division that offers them. You can also enroll for online or distance learning courses to understand current industry trends, making financial projections, managing budgets, predicting trends, assessing the strategy of competitors, regulatory laws, etc. This would be very handy to you in managing your contingency grants or allocating budgets for consumables in your laboratory as a PhD student, in submitting projects to funding agencies as a PI if you join a university or research institute after your PhD, and for jobs in the industry if you wish to transition to an industry career.

2. Time Management

Research requires students to be well-organised and efficient at multitasking and time management, which can be a very handy tool to ensure timely submissions in other lines of work.

3. Negotiation Skills

Your technical knowledge can add to your confidence and enable you to take well-informed decisions before entering strategic partnerships. Your communication skills would come in handy while developing trust and good relationships with partners/co-workers/ clients and systematically exchanging ideas. Learning how to negotiate in a professional manner can give you an edge over others.

4. Teamwork and Collaboration

Research scholars are usually good team players. The ability to prioritise work and delegate tasks to team members can help in achieving assigned targets. Students hoping to transition into an industry career path should learn interpersonal skills and develop oral as well as written communication skills, as the industry environment is more collaborative and teamwork is essential. You should also try to be accommodative while working with others.

5. Information Management

Research scholars collect, assess, evaluate, interpret and analyse large volumes of data. Understanding all the available information as well as communicating the same is an important part of a research scholar's work. They also come up with ideal strategies to stay ahead of competitors.

6. Communication Skills

Good oral and written communication skills are essential for explaining your proposal and findings to scientists, decision-makers, and funding agencies. They can also help you obtain funds for your proposal from venture capitalists, angel investors, etc. This would also be very useful during the recruitment process by helping you write your resume, prepare for the interview, presentation, etc. You also need to learn the art of simplifying complex science

according to the target audience. You could consider writing blogs, newspaper articles, review articles etc. to refine your skills. Another good practice is to present the outcome of your research to your labmates and other researchers so that you may overcome any initial reluctance or hesitation.

7. Project Management and Strategic Planning

PhD scholars get tremendous opportunities to work on complex projects under limited budgets, which helps them learn how to judiciously utilize resources and efficiently manage the timely implementation of projects. They also learn how to manage and motivate people, how to assess strengths and weaknesses of team members, and how to delegate tasks based on capability and capacity of individuals to ensure smooth and timely completion of projects. They also learn how to remain calm and handle unfavourable situations as science is unpredictable and one may not always get the desired results. Research scholars have to anticipate problems and find the right solutions. They also learn strategic planning, visualizing the big picture, and defining short, mid and long term goals. All of these skills are handy while transitioning to a different career path.

8. Legal & Regulatory Knowledge

As a PhD student, you are expected to follow rules and regulations in the use of reagents, equipment etc. Based on your research area, you should also be familiar with ethical guidelines for collection of clinical samples, obtaining informed consent of patients, regulatory guidelines for recombinant research and so on. You have to be conscious of confidentiality of data, protection of your intellectual property, and the political, legal and ethical implications of your work. You should try to empower yourself by taking up courses on Intellectual Property Rights (IPR) and regulations, either run by the Law department of your university or via online courses. This would facilitate a smooth transition if you choose a career as a patent examiner or regulatory consultant later.

9. Leadership Skills

You should proactively try to nurture and demonstrate leadership qualities. This can take the form of a small project, for example, you could start a career support group, alumni association, journal club etc.

10. Client Facing Skills

PhD scholars get ample opportunities to interact with a variety of people, including scientists, faculty members, other research scholars, undergraduate and postgraduate students, industry representatives, reagent suppliers, journal editors etc., in the course of their day-to-day work. Through seminars and journal clubs, they also get used to cross-questioning. A few institutes also give training in grant writing and defending. This can empower students by aiding in confidence building, minimising social awkwardness, and preparing them to interact with people from diverse fields (such as funding agencies, clients etc.) in an efficient and professional manner.

11. Professional Awareness

PhD scholars are often very creative and innovative and have the ability to

handle challenging situations maturely and professionally. They also get used to learning continuously. Each of these traits would be very useful in representing an industry brand.

12. Creative Problem Solving and Conflict Resolution

Research scholars apply innovative, out of the box thinking to solve problems. They plan and anticipate problems and probable solutions. These skills help them apply their scientific and technical knowledge to technical problem solving and troubleshooting. They also learn conflict management strategies, and how to identify the root cause of problems (technical, behavioural, structural, logistical, etc.). Their training in working in teams, looking at problems from different angles, publishing joint papers, collaborating within the laboratory or with other laboratories (and at times with other disciplines for interdisciplinary projects), can be very handy in resolving conflicts within the team.

13. Emotional Intelligence

PhD training leads to the development of patience, perseverance and equanimity. With experience, research scholars are able to predict chances of possible conflict and take precautionary measures and preventive steps without vitiating the atmosphere, resulting in developing mutual trust and respect with coworkers.

14. Entrepreneurial Mindset

In an academic environment, PhD scholars mostly work independently and learn to take responsibility. They function with minimum supervision, act decisively, and respond to unexpected challenges. These traits are very desirable if you decide to set up your own enterprise in the future.

In light of the above transferable skills which most PhD scholars acquire in addition to subject expertise and technical knowledge, you must realise your own worth and project your strengths while transitioning to the next step in your career. Remember that even in academia, doing good science alone is not enough. You need to formulate a strategy to translate your academic credentials successfully into a career. Make wholehearted efforts to obtain the job of your choice if you decide to transition to industry or set up your own enterprise. Knowledge about global industry trends, prevailing regulatory laws, and latest developments in the field would enable you to take correct career and business decisions.

Suggested Further Reading

- 10 skills that will give you an edge while applying for management positions. - *https://cheekyscientist.com/skills-that-give-an-edge-when-applying-for-management-positions/*
- List of 26 core competencies science PhDs can leverage over other job

applicants. - *https://cheekyscientist.com/list-of-core-competencies-phds-can-leverage-over-other-job-a*

- Teach undergraduates that doing a PhD will require them to embrace failure.- *https://www.nature.com/articles/d41586-018-06905-0*
- 7 things that typical PhD scientist does not know about a biotech or Pharma job sector. - *https://www.biospace.com/article/7-things-the-typical-phd-scientist-doesn-t-know-about-a-biotech-or-pharma-job-search-/*
- 3 top biotechnology and pharmaceutical industry trends every PhD should know. - *https://cheekyscientist.com/3-top-biotech-and-pharmaceutical-industry-trends-every-phd-should-know/*
- Do you have transferable skills within the life science industry? - *https://www.proclinical.com/blogs/2016-11/transferable-skills-within-the-life-science-industry*
- What do PhD students take for granted.- *https://www.quora.com/What-do-PhD-students-take-for-granted*
- Is the life of a PhD easy. - *https://www.quora.com/Is-the-life-of-a-PhD-easy*
- 7 advantages PhDs have over other job candidates. - *https://cheekyscientist.com/job-candidates/*
- Top 5 list of transferable job skills biotech & biopharma companies look for in PhDs.- *https://cheekyscientist.com/top-5-list-of-transferable-job-skills-biotech-biopharma-companies-look-for-in-phds/*
- PhD skills that landed me my corporate job! - *https://bitesizebio.com/41023/phd-skills-that-landed-me-my-corporate-job/*

3.2.2. Guidance for Obtaining Postdoctoral Training

A postdoctoral fellowship is not a job, but a transitional training opportunity which is expected to prepare you for an independent job. It should not be taken as a compulsory and logical step for all PhDs as its usefulness depends on your career choice.

If you wish to transition to a job in industry, a postdoctoral fellowship in an academic institution may not necessarily give you an added advantage. Instead, industrial postdoctoral positions could be useful for students who are not ready to take up jobs in industry directly, as these positions often have the possibility of having two mentors, one from academia and one from industry. This can help students understand the industry environment and allow industries to evaluate the performance of prospective employees. Universities should also create training courses, certificate programmes, internships jointly with industries specifically for students planning to transition to industry so that they can get an idea of industry work environment and expectations.

Postdoctoral fellows form an important link in the chain of people contributing to research in many parts of the world, but in India, they are under-utilized and under-valued. In India (https://indiabioscience.org/columns/opinion/the-curious-case-of-the-missing-indian-postdoc), faculty to postdoc ratio is 2.8:1 in the Indian Institute of Science (IISc), Bangalore, as compared to 1:1 at Stanford University, USA. The figures will be further skewed for other Indian universities and research institutions. There are few fellowship opportunities for postdocs in India but going by highly conservative estimates, there will be at least 12,500 potential postdocs graduating every year out of a total pool of 1,25,000 students enrolled in PhD. At the same time, the number of total postdoctoral fellowships available per year in India may be in the range of 400-500 which is rather small for a country of this magnitude.

The problem is further compounded by limited number of applicants for available postdoc positions and vacancies not being filled due to non-availability of suitable candidates. If utilised and encouraged properly, postdocs could contribute tremendously to scientific research output since they don't have teaching commitments, don't have to worry about arranging funds like faculty, and don't have coursework commitments like PhD students. In developed countries, postdocs are paid almost at par with young faculty, while in India, postdocs are paid very poorly. Another major problem faced by Indian postdocs is a clear preference for overseas-trained postdocs during faculty hiring. Perhaps, including a component of 6 months to 1 year overseas training as an integral part of postdoc fellowship could partially reduce the problem of brain drain of postdocs from India, as well as reduce discrimination against postdocs who chose to stay back in the country. We should also consider hiring foreign postdocs in our institutions to increase diversity in the research environment. Postdocs are expected to participate in advanced research training under the supervision and guidance of their mentors. The training, in addition to bench work, should involve participation in all relevant research and academic activities such as review of literature, preparation of manuscripts, responding to referees, poster or oral paper presentation at seminars, participation in workshops for grant writing/scientific presentation etc. Training in teaching or other activities as per your career choice (e.g. scientific writing, technical writing, IPR, regulation, etc) can also be really useful. Training acquired during your postdoc tenure can prepare you to establish yourself as an independent professional in an area of your choice.

Postdoctoral training should be high intensity and designed to refine and expand skills such as analytical thinking, research techniques, public presentation and professional writing. Do not treat postdoctoral training as a stopgap arrangement and prepare your career development plan early. Refine your goals in consultation with your mentor. Try to pursue your career objectives with determination and demonstrate outstanding productivity in every aspect of your training. A postdoc is a great

time to learn how to function responsibly and autonomously. Demonstrating independent thinking and action can instil confidence that you are ready to function independently. During this time, try to interact with your supervisor and other faculty members for career and research advice.

3.2.2.1. Postdoctoral Fellowships in India

Once you have decided that you wish to take up a postdoctoral position, your first priority should be to search for postdoctoral fellowships and find out details such as eligibility, mode of application, selection process, important deadlines etc. Postdoctoral fellowships in India are provided by different funding agencies like DBT-RA, Wellcome Trust/DBT India Alliance, ICMR etc. These fellowships are updated from time to time and it would be best to check the website of funding agency for up-to-date details.
For details of different post doctoral fellowships, number of fellowships per year, mode of selection, eligibility, website, etc., please refer to **Table 2.**

In addition to these fellowships granted to individual postdocs, DST, DBT, CSIR, ICMR, Wellcome Trust/DBT India Alliance also sponsor a number of research projects to faculty and scientists working in universities or research laboratories which have provisions for project-based Research Associateships (RA) . If you do not have an individual postdoctoral fellowship, you can look for advertisements by principal investigators of funded projects for project positions. Of course, individual fellowships give you a lot more freedom and flexibility to join a laboratory of your choice.

Alongside securing a fellowship, you must develop greater clarity about the type of research you are going to pursue and ideas for specific projects. You should take help from faculty members, senior and present students in choosing good laboratories to which you can apply. You must start early as vacancies in good laboratories get filled quickly. You need not wait for submission of your PhD thesis and can start applying as soon as you have a good paper published or accepted.

Depending on your career choice, you should identify your goals and assess your strengths and weaknesses. Choose a mentor who can inspire you to do quality work and help you overcome your weaknesses. Look for leaders in your area of interest. If you are looking for a career other than academia, then you should identify probable mentors who might have expertise in helping you navigate the transition. Have informational interviews with shortlisted mentors to understand their position, experience and willingness to accept and supervise you. Also determine if your prospective mentor has guided others in achieving their career goals, academic or non-academic. This would ensure that they are capable, willing

Table 2: Details of a few fellowships for post doctoral students and/or principal investigators

Heading	DBT-RA	DBT-Wellcome Trust India Alliance Early Career	DBT-Wellcome Trust India Alliance Intermediate	DBT-Wellcome Trust India Alliance Senior	ICMR-PDF
Application Process	Specific research proposal, mentor, presentation	Research proposal and sponsor, preliminary application, full application, interview	Research proposal and sponsor, preliminary application, full application, interview	Research proposal and sponsor, preliminary application, full application, interview	-
Number	100 All India 25 NER	-	-	-	50
Eligibility in terms of degree	PhD/MD/MS, submitted thesis	0-4 yrs. post PhD or upto 15 yrs. MD/MS/MPH	4-15 yrs. post PhD or upto 15 yrs. MD/MS/MPH	7-15 yrs. post PhD or upto 15 yrs. MD/MS/MPH	PhD/MD/MS within 3 years of completion
Maximum age on cut off date	40 years, 45 yrs. for Women	No Age restriction	No Age restriction	No Age restriction	32 years for G, 37 years for SC/ST/OBC/PH/Women
Nationality	Indian	No Nationality restriction	No Nationality restriction	No Nationality restriction	Indian
Duration	2 years, extendable upto 2 years	5 years	5 years	5 years	2 years, extendable by 1 year
Fellowship Amount	**DBT RA** 1- Rs. 36,000/- p.m. + HRA **DBT RA** 2- Rs. 38,000/- p.m. + HRA **DBT RA** 3- Rs. 40,000/- p.m. + HRA	Rs. 10,36,800/-p.a. basic scientists Rs. 13,44,000/-p.a. clinicians+ 25% NPA	Rs. 13,82,400/-p.a. basic scientists Rs. 16,80,000/-p.a. clinicians+ 25% NPA	Rs. 16,12,800/-p.a. basic scientists Rs. 19,56,000/-p.a. clinicians+ 25% NPA	Rs. 50,000/-p.m.+ HRA, NPA as applicable, Contingency Rs. 3 lakhs p.a.
Place of work after availing fellowship	Any Indian Research Institute/ University	Any Indian Research Institute/ University, upto 2 years anywhere in world, except first and final year	Any Indian Research Institute/University, upto 2 years anywhere in world, except first and final year	Any Indian Research Institute/ University, upto 2 years anywhere in world, except first and final year	ICMR Research institute or Centre
Website	https://biochem.iisc.ac.in/dbtra.html	www.indiaalliance.org	www.india alliance.org	www.india alliance.org	www.icmr.nic.in.

HRA- House Rent Allowance, NPA- Non Practicing Allowance, NER- North Eastern Region, RA- Research Associate, PDF- Post Doctoral Fellowship

and equipped to help you achieve your aims.

When you are contacting prospective advisors, please address them by name and do not send the same email to different researchers. If you are working from a common template, please make sure that you have changed all the details before you send the email. In your cover letter, you must mention why you are interested in that lab, how your interest matches with theirs, what project you want to work on if selected, etc. Once you have a lead for a postdoctoral position, prepare a specific proposal indicating your proposed objectives, methodology, work plan with defined timelines as well as your previous experience and technical skills.

Your official application can be accompanied with a recommendation letter from your PhD supervisor or a faculty member from your research advisory committee (thesis committee) who is familiar with your work. You should also add contact details of 3 references (phone number and email) in your CV and mention in your mail that additional recommendation letters can be sent upon request. Please inform the people you have listed as references that you have applied for a postdoctoral position in a particular laboratory and given their name as reference, so that they are not caught unawares if the PI gets in touch with them. Proofread your email, CV and proposed research proposal for content, presentation and grammar before sending. You can also show it to your friends, seniors and supervisor and incorporate their feedback appropriately. If you receive an offer, try to visit the laboratory at least once before formally accepting to avoid any mismatch later.

3.2.2.2. Making the Most of your Postdoctoral Tenure

1. Select an exciting position in a good laboratory

To get a balanced view of the kind of research done in the laboratory you are planning to join, discuss the science with your probable mentor as well as other faculty members or seniors and review past literature in the field. Talk to past and present doctoral and postdoctoral fellows in the prospective laboratory to learn about the laboratory environment. You can ask questions about academic freedom, flexibility, publication record, career trajectories of former lab members etc. Also assess whether the geographical location of the laboratory and surroundings suit you and will allow you to pursue your academic as well as extra-curricular interests. Finally, do not join a laboratory if the science does not excite you.

2. Select a laboratory and project with scope to develop new skills

Try to make an effort to move out of

your comfort zone. Do not take up a postdoctoral position in the same laboratory from where you finished your PhD. Try to maximise your knowledge and experience in diverse fields as it will expand your perspectives, enhance your marketability, and aid your career growth.

3. Have a backup plan

You should consider taking up two projects, one project which will satisfy your intellectual curiosity and one which will give you publishable results even if the first project fails. Research is highly unpredictable and even carefully planned projects may not give desired results. So, having a backup plan is essential for securing your future.

4. Choose a supervisor and project in line with your career goals

You should carefully choose a laboratory and supervisor who will help you achieve your career goals. If you are looking for a faculty position, then you must study the credentials of your mentor, the track record of the laboratory in producing high quality publications, and placement of earlier students. If you opt for a young mentor, you will have the advantage of getting more time and guidance and learning from his fresh experience of securing a position, while a senior mentor may be able to help you in securing a job due to better contacts and network.

5. Discuss authorship before initiating a project

Develop an understanding with your mentor about authorship in the very beginning to avoid conflicts and disappointments later on.

6. Duration of postdoctoral tenure

You must have clarity in your mind regarding approximate duration of postdoctoral tenure. 3 years is a reasonable time to get enough experience and secure a position. If you do not have an independent fellowship, find out about the source and duration of funding before joining the laboratory. An independent fellowship gives you immense independence and freedom to choose institution, laboratory and mentor. Otherwise, your choices will be limited and you may be compelled to work with an investigator who has a fellowship in his project. Accept a one-year position only if you are joining the laboratory to master a particular technique or have prior postdoc experience and need to take up short term assignment to acquire the requisite skills or years of experience to become eligible for certain positions.

7. Evaluate growth potential

You must perform regular reviews of the current status of research in your proposed project to assess scope for contribution by you. In rapidly advancing areas, it may so happen that your proposed work has already been achieved by someone else. In such a case, you may be required to change your project accordingly.

8. Work in an emerging area

Early entrants in an emerging area will have an edge and prior experience can help you capture such opportunities.

9. Progress monitoring

To build accountability, you should report your progress regularly to your mentor. You should learn from your mentor's experience

as he/she may also have navigated the same challenges which you are facing at present.

After successful completion of postdoctoral tenure, you will be expected to have demonstrated productivity and creativity, refined your problem-solving and scientific thinking skills, learnt oral and written communication skills as well as skills related to teaching, supervision, networking and teamwork.

Suggested Further Reading

- The postdoc series: Insights, options, careers. Naturejobs. - *http://blogs.nature.com/naturejobs/2015/03/02/the-postdoc-series-insights-options-careers/*
- The postdoc series: What comes next? Naturejobs blog. - *http://blogs.nature.com/naturejobs/2015/04/20/the-postdoc-series-what-comes-next/*
- The postdoc series: The plight of the postdoc. Naturejobs. - *http://blogs.nature.com/naturejobs/2015/03/16/the-postdoc-series-the-plight-of-the-postdoc/*
- The postdoc series: Postdocs in industry. Naturejobs. - *http://blogs.nature.com/naturejobs/2015/03/23/the-postdoc-series-postdocs-in-industry/*
- The postdoc series: The podcast. Naturejobs. - *http://blogs.nature.com/naturejobs/2015/03/26/the-postdoc-series-the-podcast/*
- **Muniyappa,K. 2007.** The role of postdoctoral training for careers in research and higher education**. Current Science. 92(4): 450-454.**
- **Bourne, P.E. & Friedberg, I. 2006.** Ten simple rules for selecting a post doctoral position. **PLOS Computational Biology: 2(12): e 181.**
- Is India ready to boost its post doctoral training. - *https://indiabioscience.org/columns/indian-scenario/is-india-ready-to-boost-its-post-doctoral-training*
- Postdoc or not? Natural Science Careers.- *http://naturalscience.careers/postdoc-or-not-2/*
- To do or not to do a postdoc. IndiaBioscience. - *https://indiabioscience.org/columns/opinion/to-do-or-not-to-do-a-postdoc*
- The do's and don't's of finding a good postdoc. - *https://indiabioscience.org/columns/opinion/the-dos-and-donts-of-finding-a-good-postdoc*
- Are we doing enough? IndiaBioscience. - *https://indiabioscience.org/columns/opinion/are-we-doing-enough*
- Are we doing enough for today's graduate student? | Emerald Insight - *https://www.emerald.com/insight/content/doi/10.1108/09513540410563103/full/html*
- The curious case of the missing Indian postdoc. - *https://indiabioscience.org/columns/opinion/the-curious-case-of-the-missing-indian-postdoc*
- Postdoctoral culture. - *https://indiabioscience.org/columns/opinion/postdoctoral-culture*
- Need for a nationwide Indian postdoctoral association. - *https://indiabioscience.org/columns/opinion/*

postdoctoral-culture

- Careers of an elite cohort in U.S. basic life science postdoctoral fellows and the influence of their mentor's citation record. BMC Med Educ 10:80.
- Ten simple rules for selecting a postdoctoral position-NCBI-NIH. - *https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1664706/*
- Avoiding the postdoctoral glut: an alternative route to a career in academia. **2000. Clin. Anat.**
- 5 ways postdocs can become top PhD job candidates for industry positions. *- https://cheekyscientist.com/how-postdocs-become-top-phd-job-candidates-for-industry/*
- **Bourne, PE. 2007**. Ten simple rules for graduate students. **PLOS computational biology.**- *https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.0030229*
- Are graduate students rational? Evidence from the market for biomedical scientists. **2013**. **PLOS ONE.**
- 12 tips to finding postdoctoral mentors and labs. *-https://www.asm.org/Articles/2018/December/Careers-Education-Career-Options-Planning-13*
- Young investigator perspectives: teaching and the postdoctoral experience: impact on transition. Am. J. Physiol. Gastrointest Live. *- https://www.physiology.org/doi/pdf/10.1152/ajpgi.00007.2014*
- Enhancing graduate and post doctoral education to create a sustainable biomedical workforce. *- https://www.genengnews.com/insights/enhancing-graduate-and-postdoc-education-for-a-sustainable-workforce/*
- **Tlsty, T.D.** Career advice for life scientists II. **The American Society for Cell Biology: 172-174.**
- Transitioning successfully from postdoc to faculty - NIH Office of Training *- https://www.training.nih.gov/assets/CSSlides2018.pdf*

3.2.3. Guidance for Taking up Faculty Positions in Academic Institutions

Faculty positions are highly rewarding as they provide an opportunity to shape young minds. In India, faculty positions are available in universities, their affiliated colleges, autonomous colleges, and autonomous institutes such as IITs, IISERs, NIPERs etc. We have universities in the public (central and state universities) as well as private sectors. In general, undergraduate teaching is performed in colleges affiliated to universities and postgraduate teaching is confined to university departments. However, in some states, affiliated colleges offer both undergraduate as well as postgraduate

teaching. Most university departments conduct primarily postgraduate teaching, while a few of them also offer undergraduate teaching.

Normally, teachers in undergraduate colleges bear enormous teaching loads and are not expected to perform research. However, in universities and institutions, in addition to teaching postgraduate courses, faculty members are expected to carry out research, obtain funding, supervise research scholars and postdocs, and manage funds and personnel. In addition to teaching and research, faculty members also have to take part in formulating, revising and updating the curriculum. They also need to evaluate assignments and exam papers as well as prepare question papers for exams.

To be eligible for faculty positions, students need to clear the lecturership eligibility test conducted by CSIR-UGC NET(National Entrance test) or SLET/ SET (State Level Eligibility Test). In the last few years, a large number of new educational institutions have been created by the government and several new private universities have also come up. In addition, there are a large number of vacancies in existing universities, which means there are a large number of faculty positions available. However, a large number of fresh PhDs are produced every year and several students with postdoctoral experience are also looking for jobs.

For securing a faculty position, you need a sound track record of publications. You must also evaluate your skills to see if a teaching position is a good fit for you. Some necessary skills are: a passion for teaching, simplifying complex scientific concepts, engaging students and answering queries, being confident, patient, innovative, committed and technology-savvy, good communication and leadership skills, remaining updated with latest developments, and being willing to inculcate a value system in your students by setting a positive example.
You should try to acquire teaching experience by supervising tutorials or practicals as a PhD scholar or postdoctoral fellow. You can also accept guest/visiting/ contractual faculty positions for more teaching experience which will give you an added advantage over your competitors.
Students who do not wish to go for a PhD or postdoc, can also opt for teaching positions in schools and play a role in inculcating scientific spirit and temperament in young students. For this, you can go for a BEd degree after completing your BSc or MSc and join as Trained Graduate Teacher(TGT) or Post Graduate Teacher (PGT). There are a large number of Government funded/aided, Central, Navodaya, Sarvodaya as well as private schools in all parts of the country.
Once you have decided to try for a faculty position in a university or educational institute, you should be on the lookout for advertisements for faculty positions as well as insider information for probable vacancies, hiring criteria and expectations.
You could also opt for scientist positions in autonomous research institutions of DST, DBT, ICMR, ICAR, CSIR laboratories which will give you a lot of freedom and flexibility to pursue research without teaching responsibility except supervising PhD and post-doc students.

You should devote time for networking with relevant mentors with common research interests and go through websites of funding agencies to know their funding priorities and screening process. You should try to align your research interest with the priorities of funding agencies and formulate a research proposal. In India, in general, only faculty who hold regular positions are eligible to apply for grants. Therefore you should explore, with your supervisor or mentor in university where vacancy is likely to arise, whether you can submit joint research proposals. This experience of writing and defending a research proposal would give you an edge over other applicants.

Similarly, you should devote your energy and time to gaining teaching experience, writing papers, reviews, blogs and popular articles and learning new techniques. Keep challenging and updating yourself continuously so that your application stands out.

You should prepare a nice job application which consists of five components: Cover letter, CV, Research statement, Teaching statement and Letters of recommendation. Try to update your personal webpage (or LinkedIn profile) with your publications, research interests as hiring committees might want to verify your particulars. Your CV should include a summary of your research interests, publications, presentations, job experience, teaching credentials, awards and honours, etc. The cover letter should be customised to the specific post and should include a statement on why you are applying for that particular post. You should also mention how and why you are the most suitable candidate, what value you will add to the department and who can be your potential collaborators.

The research statement should cover the novelty and importance of your work and its applicability to the advertised post. It should also mention your track record and significant contributions as well as your vision and proposed future research work. You must indicate clearly the direction your research would take once you are selected for the faculty post as this would instil confidence in hiring committee that you have the potential to be an independent researcher and guide students.

The teaching statement should include your teaching assignments as a PhD or postdoctoral fellow, e.g. involvement in practicals for postgraduate students, preparation of laboratory manuals, course work or assignment preparation and evaluation, participation in curriculum formulation and revision exercise, etc.

You will need a number of recommendation letters (the numbers may vary for different universities) to accompany your applications. You should get one letter from each of your supervisors, one or two letters from faculty members in your research advisory committee who are well conversant with your work, and one letter preferably from outside your parent institution. Please brief the referees about your work, career choice and expectations, so that they can comment objectively about the impact of your work.

Good universities or institutes often receive thousands of applications for each post advertised and generally they may not shortlist more than a dozen applicants for the interview. Your job application should stand out and you should keep an open mind while applying for jobs. Don't be very choosy while applying for jobs initially. If you are lucky and have more than one job offer, you can opt for the one that suits you best.

Usually, hiring committees meet several times a year to go through received applications and decide important factors for shortlisting candidates for interviews. **A few important factors considered by hiring committees in shortlisting candidates for interview are described below:**

Qualifications and Publication Record

First author publications in good journals help a lot. Conference presentations as first author and best poster/paper awards will also increase the likelihood of you being considered for the position. The status/rank of the university or institution from where you completed your PhD or postdoc also makes a difference.

Research Area

In addition to a strong CV and excellent recommendation letters, factors like how your research area will complement and supplement the research already being conducted in the department, whether you can teach classes in gap areas, whether you have potential collaborators etc. are also key to your selection.

Recommendation Letters

Your recommendation letters should reflect your technical and intellectual capability, research interests, and how you advanced science in your research area through your contributions. They can also talk about your teaching style, your personality, etc. As a job applicant, you may have very little control over the recommendation letters. So, you should select your referees judiciously, talk to them beforehand explaining your work and expectations from the letter (i.e. what areas it should cover) and address their questions and concerns.

3.2.3.1. Interview Process

Faculty job interviews include several steps such as job talk/presentation, interaction with hiring committee, interactions with faculty, deans, directors, students, etc. Dress formally for the interview as this demonstrates your seriousness. As you will have a number of one-on-one meetings with faculty, deans, director of research, vice chancellor etc, you should research your probable interviewers beforehand. Go through their personal websites, their LinkedIn profiles, the university website, etc.

If you are required to give a presentation, try to prepare your slides in a universal format like PDF to avoid any compatibility issues and in addition to having your presentation on your laptop, carry it on

a USB stick and email it to yourself so that it can be accessed from anywhere. Proofread the presentation carefully and also seek feedback from your seniors, colleagues and supervisors. Your presentation is expected to serve the dual purpose of presenting your significant research contributions and showcasing your teaching ability. Your slides should be self explanatory. Try not to put too much data or text on slides as it can be very distracting.

Your talk should be tailor-made to the audience as the interview committee may have subject specialists as well as people from science management, administration etc. Talk about the importance of your research area, your key contributions, implications and impact of your work, problems you faced and how you solved them, and finally, your vision for future research. You should rehearse your presentation beforehand and try to practice before unfamiliar audiences. Prepare a list of probable questions and replies to them. You may also record your presentation and check your body language, pronunciation mistakes, etc.

An interview should be a conversation and not an interrogation. You should also prepare a few questions for the interviewers like teaching load, class size, present number of faculty and their specializations, growth trajectory, new initiatives planned by the department, areas you will be expected to teach, funding status, scope for expansion etc. After the interview, send a thank you note reiterating your interest and enthusiasm for the job. Be patient as the hiring process takes time and a decision will be made only after all candidates have been interviewed. It is a good idea to keep in touch in the meantime.

Sometimes you may get a direct offer, while at other times, if there are several good candidates, employers may try to ascertain your seriousness about taking up the job before issuing an offer letter. A few universities also give you a time-limit for joining to ensure that you cannot delay the decision for too long. Once you get a formal offer, find out about the salary (this is often standard and non-negotiable in public sector universities and institutions except that you may be given a few increments), laboratory space, seed grant to initiate your laboratory, the number of students who can register for PhD in your lab etc. If you have several job offers and have made up your mind not to accept a particular offer, politely decline to avoid blocking someone else's chance and delaying the hiring process, which ends up having repercussions for the students.

Suggested Further Reading

- 2019 Career Handbook – Science Careers by Journal Science-AAAS. - *https://www.sciencemag.org/booklets/2019-career-handbook*
- 10th Annual NIH Career Symposium Newsletter 2017. - *https://www.training.nih.gov/assets/Career_Symposium_2017_Newsletter.pdf*
- Maximise your chances of landing a faculty job. Science, AAAS. - *https://www.sciencemag.org/careers/2013/10/maximize-your-chances-landing-faculty-job*
- Academic job applications: five mistakes to avoid. - *https://www.theguardian.com/higher-education-network/2015/oct/26/academic-job-applications-five-mistakes-to-*
- Academic job hunt advice: Tips for searching for and landing a professorship. - *http://matt.might.net/articles/advice-for-academic-job-hunt/*
- Career Services - NIH Office of Intramural Training and Education (OITE) - *https://www.training.nih.gov/career_services*

3.3. Non-academic Careers

It is well known fact that most countries produce more PhDs than the number of jobs available in the higher education and research sectors. But you should not get demoralised by this as there is a wealth of rewarding job options in many fields outside academia and research. Some of these include industry positions such as R&D, production/manufacturing, QA/QC, marketing, regulation, IP, consultancy, equity research, as well as sectors such as science policy, technical writing, science communication, bioinformatics, core facility management, etc. Upon completing your PhD, you will have gained knowledge and learnt specialised techniques.

Moreover, you will have acquired competencies like negotiation skills, experience in qualitative and quantitative analysis, problem solving skills, ability to plan a project and adhere to time schedule, working independently with minimum supervision, ability to communicate effectively to diverse audiences etc. At this point, you need to introspect and do a realistic evaluation about job prospects based on your interest, passion and skills. You might have enjoyed a lack of supervision and freedom to pursue any project of your interest while in academics; this is something you may need to forgo in other professions where you would be needed to work on projects as per your employer's requirements. Believe me, you will not regret your decision to diversify and utilise your training in a meaningful way in a new field.

3.3.1. Guidance for Students Willing to Transition to Industry

Many students do not have enough knowledge about career options other than academia because of lack of exposure and awareness. Supervisors and other faculty members are also often not able to guide students into this transition given their own unfamiliarity with the industry ecosystem. As a PhD, you should not confine yourself to only traditional careers in academia and research, and should also look at non-traditional career options. Try to understand the opportunities available and gain in-depth knowledge of different career options. Understanding changing trends in industry can also help you make an intelligent and well informed decision which suits your aptitude and goals.
Try to take time out to study the skill-sets required by different career options and see how you can best position yourself for a particular career of your choice. Make a list of your technical and transferable skills (e.g. research, teaching, training, handling equipment, managing grants, personnel, time, multi-tasking, troubleshooting, decision making, etc.) and make a wholehearted effort to chase your dream career. Don't give up until you succeed in finding your dream job and keep reinventing yourself as per your aspirations.

The biotechnology industry can be broadly classified into four categories, viz. biopharmaceuticals, bioagriculture, bioservices and bioinformatics. The Biopharma sector covers biosimilars, molecular diagnostics, vaccines, natural product based drug discovery, biomedical devices, genomic testing and regenerative medicine. The Bioagri sector consists of crop biotechnology (transgenic crops, hybrid varieties, molecular marker assisted breeding, plant tissue culture, biofertilizers, biopesticides etc.), animal biotechnology (animal breeding, drugs, vaccines, diagnostics, nutraceuticals, feed, etc.), aquaculture, biofuels, etc. The Bioservices sector includes clinical and contract research services and finally, Bioinformatics has applications in all biotechnology sectors, including creating and managing databases and software tools, *in silico* drug designing, genome sequencing, etc.

Career opportunities in the biotechnology industry can be broadly classified into the sectors of Research & Development (R&D), production/manufacturing, Quality Assurance (QA) and Quality Control (QC), marketing/management, technology procurement/transfer, management of intellectual property and regulatory affairs, technical writing, etc. Career opportunities under each category require general scientific qualifications along with sector-specific training and specialisation. In the next section, we shall take a look at specific requirements of each of these sectors.

Suggested Further Reading

- PhD jobs: How to transition from academia to business. - *https://cheekyscientist.com/phd-jobs/*
- Why earning a PhD is an advantage in today's industry job market - *https://www.nature.com/articles/d41586-019-00097-x*
- How to sail smoothly from academia to industry. **Nature 555 : 549-551.**
- Top 10 alternative biotech career options outside the research lab. - *https://www.biotecnika.org/2018/07/top-10-alternative-biotech-career-options-outside-the-research-lab/*
- 12 careers for life scientists outside of the lab. - *https://www.biospace.com/article/12-careers-for-life-scientists-outside-of-the-lab-/*
- Alternative careers for biotechnology & life science graduates. - *https://www.stoodnt.com/blog/top-11-alternative-careers-for-biotechnology-life-science-graduates-hot-jobs-outside-*
- Top 10 list of alternative careers for PhD science graduates. - *https://cheekyscientist.com/top-10-list-of-alternative-careers-for-phd-science-graduates/*
- 5 strategies to jumpstart a stagnant career. - *https://cheekyscientist.com/strategies-to-jumpstart-a-stagnant-career/*
- 10 skills that will give you an edge when applying for management positions - *https://cheekyscientist.com/skills-that-give-an-edge-when-applying-for-management-positions/*
- Advice on biotechnology career options in India and abroad. - *http://www.careerizma.com/blog/biotechnology-careers-india-abroad/*
- Break into the biotech industry. - *https://www.newscientist.com/article/mg21428692-800-break-into-the-biotech-industry/*
- Top 10 list of alternative careers for PhD Science. - *https://cheekyscientist.com/top-10-list-of-alternative-careers-for-phd-science-graduates/*
- Science Careers in Industry: Top Ten Myths | OITE Careers Blog - *https://oitecareersblog.wordpress.com/2016/05/09/science-careers-in-industry-top-ten-myths/*
- Top 20 industry positions for Ph.D.'s – Cheeky Scientist- 2016 edition. - *https://cheekyscientist.com/guidebook/*
- Where do I begin? Industry careers for scientists. - *https://www.cheekyscientist.com*
- Careers in Science : Expanding the horizon. E resource book by IndiaBioscience. - *https://indiabioscience.org/careers-in-science*
- Leaving academia : How to get a job in industry after your Ph.D. - *https://www.nextscientist.com/job-in-industry-after-your-phd/*
- From academia to industry: seven tips for scientists making the leap - *https://www.nature.com/articles/d41586-019-00692-y*
- How to sail smoothly from academia to industry. Nature 555 :549-551.
- Research in industry: A great career choice: Naturejobs Blog - *http://blogs.*

nature.com/naturejobs/2016/05/13/research-in-industry-a-great-career-choice/

- Why it is not a failure to leave academia. *- https://www.nature.com/articles/d41586-018-05838-y*
- Which future do you want? Scarcity in academia or abundance in industry. *- https://cheekyscientist.com/which-phd-future-do-you-want-scarcity-in-academia-or-abundance-in-industry/*
- 10 Signs You'll Like Working in Biotech - Bitesize Bio *- https://bitesizebio.com/4367/10-signs-youll-like-working-in-biotech/*

3.3.1.1. Research & Development

In the technology-intensive areas of biotechnology, continuous innovation including modification of existing products and development of new products is essential and hence, a strong Research & Development (R&D) program is a must for any company's success. If you possess hands-on skills and experience with specific models and techniques, have a deep understanding of different technologies, are a quick learner who is willing to work under strict time schedules, then becoming an R&D scientist/manager could be the right career choice for you.
As a research scientist/manager, you will be required to design/carry out experiments and do bench research as an important component of your projects. You will also be required to align projects undertaken by your team with the vision and strategy of your company and ensure judicious and appropriate utilization of resources. You will have to interact with the marketing team to understand consumer interests and business trends and accordingly, decide new projects to be initiated or prioritise existing projects. In a business environment, timelines for completion of projects and definite milestones need to be defined and efforts to complete project within initially stipulated budget are highly relevant (otherwise, you may lose to your competitors and economic viability of product will suffer due to time and cost over-run). Collaboration with product development, marketing, financial and regulatory teams is essential, and hence, excellent interpersonal skills are highly valued. You are expected to multi-task since you need to manage your team and budget at the same time as evaluating scientific data and maintaining collaboration with other groups to ensure logical conclusion of your projects.

Key Skills

- Hands-on experience in cutting edge techniques
- In-depth subject knowledge
- Being a quick learner and being able to assimilate and absorb new developments to introduce appropriate modifications in work plans
- Interpersonal skills
- Time management skills to ensure

timely implementation of projects
- Team management skills - allocating work to team members according to their capability and maintaining harmony in the group
- Judicious allocation and utilisation of financial resources

Key Responsibilities

- Organising brainstorming sessions to discuss and finalise new ideas
- Remaining up-to-date with advanced R&D developments
- Understanding customer expectations on to-be manufactured products
- Planning and implementing new programs and protocols
- Performing experiments and analysing data
- Establishing project goals and priorities by collaborating with marketing and production teams
- Overseeing development of new products from the initial planning phase to implementation or production
- Coordinating transfer of new technologies, products and manufacturing processes
- Suggesting training tools to enhance employee performance and skill development

Sample Job Titles

Sr. Research Scientist, Sr. Scientist Analytical, Research Scientist, R&D Research Associate, R&D Laboratory Technician, Technical Research Associate, Technical Service & Application Development Scientist, Intern-R&D

Potential Employers*

Biotechnology Companies

Biopharma: Biocon, Bangalore: Serum Institute of India, Pune, Panacea Biotec Ltd., Delhi, Dr. Reddy's Laboratories Ltd., Hyderabad, Wockhardt, Mumbai, GlaxoSmithKline Pharmaceuticals Ltd., Mumbai, Bharat Serums and Vaccines Ltd., Mumbai, Indian Immunologicals Ltd., Hyderabad, Shantha Biotechnics Ltd., Hyderabad

BioAgri: Rasi Seeds, Salem, National Agro Industry, Ludhiana, Poabs Organic Estates, Tiruvalla, Monsanto India, Mumbai, Advanta India Ltd., Hyderabad, Lemken India Agro Equipments Pvt. Ltd., Nagpur, Nuziveedu Seeds Ltd., Hyderabad, DuPont India, Gurugram, Rallies India Ltd., Akola

Bioinformatics Companies

(Please refer 3.3.9.2)

** The lists of companies in differents sectors in this chapter are illustrative and not exhaustive.They have been compiled as guidance material for students to encourage them to learn about different career options by looking at the website of some of these companies. IndiaBioscience is not in any way connected with these companies nor is endorsing them.*

Suggested Further Reading

- 10 In-demand biotechnology careers shaping our future. - *www.northeastern.edu/graduate/blog*
- Research & development manager job description. - *https://study.com/articles/research_development_manager_job_description_salary.html*

3.3.1.2. Product Management

Product managers develop products (diagnostic kits, vaccines, new drugs, fertilizers, pesticides, etc.), conduct market research, identify potential products, plan product requirements, determine specifications, decide production timetables, plan pricing and market launch, etc. They work with internal teams and stakeholders to generate ideas and then prioritise ideas as per the company's vision. If you are excited about taking laboratory innovation to the market and taking it to a logical conclusion and commercial success, you should explore a career as a product manager.

Product managers analyse market trends/ potential and identify potential products by evaluating market requirements and take decisions in line with the company's strategy. They also collaborate with the marketing wing of the company for positioning products for market launch. They are expected to look beyond and ahead of time and competitors to get them early entrant advantage and gain insights into future opportunities, as well as to anticipate challenges and competitive threats. They have to assimilate information from different sources and come up with sound strategic alternatives to existing products. Product managers are responsible for improving the market penetration of existing products as well as bringing new products and services into the market. They have to boost the commercial success of new products and oversee the phasing out of older products. Product managers serve as a bridge between customers and the production and marketing teams.

Key Skills

- Subject area knowledge
- Coordinating with cross-functional teams
- Interpersonal skills
- Communication skills (oral, written, visual)
- Leadership skills

Key Responsibilities

- Generating and prioritising ideas for products
- Creating and updating roadmap for projects
- Planning strategy for product development and coordinating tasks and timetables for implementation of plan
- Leading cross-functional teams and keeping senior management updated
- Adjusting project plans in light of new information and feedback and communicating changes to key stakeholders
- Conducting customer research, analysing feedback, promotional material for new features

Sample Job Titles

Senior Product Manager, Technical Product

Manager, Product Manager, Assistant Product Manager, Manufacturing Product Manager, Retail Product Manager

Potential Employers*

Biotechnology Companies *(Pl. refer 3.3.1.1.)*
Biotechnology Equipment manufacturers ,
Biotechnology Reagent suppliers
(please refer 3.3.1.6.)

Training

Relevant Online Courses

- Brand and Product Management - *https://www.coursera.org/learn/brand-management*
- Strategic Leadership and Management - *https://www.coursera.org/specializations/strategic-leadership*
- Strategic Management and Innovation - *https://www.coursera.org/specializations/strategic-management*
- Digital Product Management: Modern Fundamentals- *https://www.coursera.org/learn/uva-darden-digital-product-management*
- Viral Marketing and How to Craft Contagious Content - *https://www.coursera.org/learn/wharton-contagious-viral-marketing*

Suggested Further Reading

- How to become a product manager in India. - *https://www.stoodnt.com/blog/how-to-become-a-product-manager-in-india-product-management-careers-jobs/*
- How to get a product manager job within life sciences | Proclinical blogs - *https://www.proclinical.com/blogs/2018-2/how-to-get-a-product-manager-job-within-life-sciences*
- Forget the MBA. Here's the fastest way to become a product manager - *https://hackernoon.com/forget-the-mba-heres-the-fastest-way-to-become-a-product-manager-b3a230a7c055*
- What does a product manager in a pharma/biotech company do? - *https://www.quora.com/What-does-a-product-manager-in-a-pharma-biotech-company-d*

3.3.1.3. Quality Control & Quality Assurance Management

Quality control is a system of maintaining standards of manufactured products by testing samples of the output against prescribed quality specifications. As a quality assurance manager, you will be required to ensure implementation of all the planned and systematic activities that are prescribed by the quality system. Compliance to quality control standards provides confidence to management, regulators, certifiers, customers and

government agencies about the quality of product or service under consideration. If you do not want to be a bench-level scientist, are ready to familiarise yourself with rules and regulations to ensure quality of produced goods, have good interpersonal skills, and are willing to work with cross-functional teams, you could consider a career in quality assurance and/or control.

3.3.1.3.1. Quality Control Manager

Key skills

- Critical thinking
- Complex problem solving
- Monitoring/assessing performance and taking corrective measures
- Systems analysis and evaluation
- Time management
- Decision making and cost-benefit analysis
- Operations analysis and technology design
- Quality control analysis, inspection of products, services or processes to evaluate quality and performance

Key responsibilities

- Understanding specifications and prescribed norms and guidelines
- Monitoring operations to ensure that production standards are met
- Recommending adjustments to the assembly or production process
- Inspecting, testing or measuring materials or products being manufactured
- Discussing inspection results with production team

Sample Job Titles

Quality control inspector, Quality control manager, Quality control analyst, Quality control specialist, Quality supervisor, Quality systems manager

3.3.1.3.2. Quality Assurance Manager

Key Skills

- Excellent technical knowledge & skills
- Planning and organisational skills
- Teamwork and collaboration
- Problem solving and critical thinking
- Communication & interpersonal skills
- Updated knowledge about national and international standards

Key responsibilities

- Determining, negotiating and setting in-house quality procedures, standards and specifications for quality, health and safety of products
- Working with operating staff to establish procedures, standards and systems
- Acting as a catalyst for change and improvement in performance and quality of products
- Monitoring and ensuring compliance of standards in manufacturing processes
- Assessing customer requirements and ensuring these are met
- Setting customer service standards

Sample Job Titles

Quality assurance manager, Quality assurance officer, Quality assurance analyst, Quality assurance associate, Quality assurance coordinator, Reliability/ safety engineer, Quality engineer, QA/QC manager

Training

- Online Quality assurance courses. - *https://www.coursera.org/lecture/teach-online/how-do-you-ensure-quality-assurance-in-online-cour*
- Top online courses in Quality Management 2018/2019.- *https://www.onlinestudies.com/Courses/Quality-Management/*
- Quality assurance training and certification online- *https://www.zarantech.com/quality-assurance-training/*
- PG diploma courses in quality assurance. - *https://www.igmpiindia.org/*
- Industry Program in Pharma Quality Assurance and Quality Control - *http://www.bii.in/Industry_Program_in_Pharma_Quality_Assurance_and_Quality_Control*

Potential Employers *

Biotechnology Companies
(Please refer 3.3.1.1.),
Biotechnology Equipment manufacturers, Biotechnology Reagent suppliers
(Please refer 3.3.1.6.)

Suggested Further Reading

- Scope of Quality Assurance and scope of Chemistry in ... - PharmaTutor - *https://www.pharmatutor.org/smart-question-and-answers/scope-of-quality-assurance-and-chemistry-in-pharmaceutical-industry.html*
- Quality control | Biotech Careers - *https://www.biotech-careers.org/job-areas/quality-control*
- Quality control (QC) and quality assurance (QA) in pharma and ... - *https://www.bruker.com/applications/pharma-biopharma/drug-manufacturing/qa-qc.html*
- What does a quality control inspector do? - CareerExplorer - *https://www.careerexplorer.com/careers/quality-control-inspector/*
- What Does A Quality Control Inspector Do? - Career Explorer - *https://www.careerexplorer.com/careers/quality-control-inspector/*
- What is the difference between QC

and QA in pharmaceuticals? - Quora - *https://www.quora.com/What-is-the-difference-between-QC-and-QA-in-pharmaceuticals*

3.3.1.4. Human Resource (HR) Management

Human resource specialists are expected to oversee efficient running of the workplace, employee satisfaction and productivity. Their responsibilities include creating and placing job advertisements, screening applications, scheduling and conducting interviews as well as implementing programs and services such as talent acquisition, staffing, employment processing, health and welfare benefits for employees etc. If you love to interact with people and enjoy improving employee welfare and productivity, you could consider a career as a human resource manager. To gain experience, you could start work as a freelance recruiter, recruitment consultant, career adviser etc.

Key Skills

- Up-to-date knowledge of HR policy, legal provisions
- Negotiating with a range of stakeholders such as senior management, experts, employees
- Positive, confident, accessible and friendly personality

Key Responsibilities

- Ensuring that the business is legally compliant in all HR activities
- Assisting in hiring, developing job descriptions, finalising job advertisements, screening and interviewing candidates
- Projecting company positively to new recruits, carrying out orientation of new hires, overseeing contract signing
- Processing transfers, promotions and terminations
- Developing employee reward and recognition schemes to drive excellence
- Providing information about HR policies, job duties, working conditions, wages, opportunities for promotion and benefits to present and prospective employees
- Managing and implementing an effective employee performance review system
- Addressing and resolving employment relations issues such as complaints, harassment, sexual harassment allegations etc.
- Interfacing with recruitment agencies
- Influencing, facilitating and implementing HR policy

Sample Job Titles

Human Resource Manager, HR specialist, HR consultant, HR recruiter, Personnel

coordinator, Technical recruiter, Job placement specialist, Employee interviewer, HR assistant, Hiring manager, Talent acquisition manager, Training and development manager, Compensation and benefits specialist, Labour relations manager, Employee assistance plan manager

Training

- Post-Bachelor's and Graduate Certificates in Human Resource ... - *https://www.humanresourcesedu.org/hr-post-degree-certificates/*
- Distance Post Graduate Diploma in HR Management |- *https://www.mitsde.com/PGDinHumanResourceMng*
- Distance PG Diploma in Human Resource Management - *https://www.mitsde.com/PGDBAinHumanResource*
- PGDM, Post Graduation Diploma in HR, Human Resource Management - *https://www.itm.edu/post-graduation-diploma-management/human-resource-management/*
- Postgraduate Diploma in Human Resource Management - *https://www.xlri.ac.in/academic-programmes/school-of-human-resources/pgdhrm.aspx*

Potential Employers*

Biotechnology Companies *(Please refer 3.3.1.1.)*

Placement Agencies: Radial HR Solutions, Bangalore, ABC Consultants, Kolkata, ARGC Manpower Consultants, Mumbai

Suggested Further Reading

- Top 10 Biotech Jobs With Good Future Career Opportunity - BioTecNika - *https://www.biotecnika.org/2018/07/top-10-biotech-jobs-with-good-future-career-opportunity/*
- Changing Role of HR Managers in Pharmaceutical Industry - *http://globalresearchonline.net/journalcontents/v30-2/13.pdf*

3.3.1.5. Technical Sales and Marketing Specialists

For students who wish to remain in science and love to interact with new people but are not interested in traditional academic roles or performing active bench science, marketing is the perfect choice. Life science students generally do not think very highly of marketing jobs and this mindset needs to change as marketing is not only a financially rewarding career but also plays an important role in bringing innovative products to the market. In a marketing role, you are expected to interact with professionals such as researchers, scale-up scientists, clinicians etc. and introduce them to your company's innovative products (e.g. new diagnostic kits, new drug molecules, new vaccines,

etc) so as to encourage them to use these products. The process should not, hence, be confused with the marketing of conventional products. In addition to scientific and technical knowledge, training in analysing large amounts of data and comparing strength and weaknesses of one method or technique with another are very handy tools for students who wish to transition to marketing roles. If you have good technical knowledge, are aware of the latest scientific developments, have excellent communication skills and ability to convince others, marketing could be the perfect career choice for you.

Key Skills

- Technical knowledge of the relevant scientific sector and scientific products
- Interpersonal skills to interact with R&D, scale-up and production teams, as well as stakeholders such as clinicians, medical representatives, etc.
- Being detail-oriented
- Analytical and quantitative skills for preparing techno-economic feasibility reports for new products, which cover details such as market size, other major players, possible competitors, how to convince investors, leadership and management etc.
- Interfacing between scientists and consumers by providing requirements and feedback of users to scientists
- Knowledge of marketing requirements
- Understanding of commercial landscape, knowledge about business competitors and their existing and upcoming products
- Oral presentation and Technical writing skills

Key Responsibilities

- Facilitating product advancement from development stage to implementation stage
- Adapting to changing scenarios within the company and market
- Convincing users about latest scientific advances and strengths of the product
- Interacting with prospective clients and suggesting appropriate products for their needs and providing customised solutions, whenever possible
- Developing promotional material for medical representatives, regulatory agencies, general public, etc.

Sample Job Titles

Manager- Business Development, Manager - Sales & Marketing, Sales Head, Marketing Executive, Sales Executive, Executive- Customer Relations, Business Development Executive, Cluster Sales Manager, Sales & Relationship Manager, HR & Marketing Manager, Key Account Manager (Sales & Client Relationship)

Potential Employers *

Biotechnology Companies (please refer 3.3.1.1), **Bioinformatics Companies** (please refer 3.3.9.2.), **Biotechnology Equipment manufacturers , Biotechnology Reagent suppliers** (please refer 3.3.1.6.)

Training

- MBA in Biotechnology by Punjab University, Savitribai Phule University of Pune, Amity University, MBA in agri-business management by UAS, Bangalore, UAS, Dharwad, MBA courses run by IIMs, other institutions

Relevant Online Courses

- Market Research - *https://www.coursera.org/specializations/market-research*
- Market Research & Consumer Behavior - *https://www.coursera.org/learn/market-research*
- Marketing Strategy -*https://www.coursera.org/specializations/marketing-strategy*
- Business Analytics - *https://www.coursera.org/specializations/business-analytics*
- Business Strategies for Emerging Markets - *https://www.coursera.org/learn/business-strategies*

Suggested Further Reading

- Five ways to develop effective business communication skills. - *https://www.bbntimes.com/en/technology/five-ways-to-develop-effective-business-communication-skills*
- Top 5 List of Transferable Job Skills Biotech & Biopharma Companies ... - *https://cheekyscientist.com/top-5-list-of-transferable-job-skills-biotech-biopharma-companies-look-for-in-phds/*
- 6 Soft Skills That Are Highly Valued in Biotech Sales & Marketing ...- *https://www.smrgroupltd.com/2017/02/03/marketing-sales-skills-6-soft-skills-highly-valued-biotech-candidates/*
- Skills For Successful Career In Biotech Sector - Top 10 Skill List - *https://www.biotecnika.org/2019/05/skills-for-successful-career-in-biotech-sector-top-10-skill-list/*

3.3.1.6. Technical Writing

Technical writers are skilled wordsmiths who distil complex technical information and produce documents in easy to understand and simple language. They have to follow a user-oriented approach to prepare documents, keeping in mind the requirements of the target audience. These documents should not have any ambiguity and clarity is of utmost importance.

Technical writers need to have a good command over language, writing and communication skills, as well as subject knowledge, an analytical mind and critical thinking. Proficiency in creating appropriate visual aids is also a plus.

As a technical writer, you should know how to ask questions and who are the best people to be approached for answers in order to present a balanced view while maintaining ethical standards. You will be expected to communicate with subject specialists from different departments within the company (e.g. product development team, engineering

team, marketing team, etc.) to understand processes, identify logical gaps and seek clarifications if there is ambiguity. You will also need to manage expectations and deadlines.

Technical writing can have many different forms, and can include developing user manuals, developers guides, installation manuals, help documents, tutorials, press releases, print ads, online ads, banners, business proposals, product descriptions, product specifications, technical reports, documents, scientific papers, review articles, blogs, articles, website content and more. As a technical writer, you can be involved in regulatory writing, writing and editing grant applications, manuscripts, freelance writing, etc. There are ample employment opportunities for technical or medical writing even in biotech and pharma companies, contract research organizations, and market research companies.

As a technical writer, you should ensure readability of your document by using proper formatting and design choices as well as validate and proofread documents to ensure accuracy and user-friendliness. If you have the ability to evaluate and analyse complex information and a willingness to help non-technical people understand this information, you could consider a career as a technical writer.

Key Skills

- Subject area knowledge
- Analytical mind and attention to details
- Research and exploration skills
- Critical thinking for reasoned and clear judgements
- Creative writing and design skills
- Interviewing and listening skills
- Curiosity and willingness to learn new things
- Team work (collaboration with subject specialists), accepting and assimilating feedback
- Grasp of technology
- Usability testing

Key Responsibilities

- Determining needs of end users of technical document
- Studying product samples, interacting with subject specialists and product developers to make easy-to-use products
- Writing/developing and standardising user-friendly content to meet the needs of the target audience
- Standardising content across platforms and media
- Gathering usability feedback from customers, designers, manufacturers and revise document as per feedback

Sample Job Titles

Technical writer, Junior technical writer, Technical editors, Technical content developer, Content editor/manager/writer, Communication specialist, Web writer

Potential Employers *

Biotech Equipment Manufacturers :
Bionics Scientific Technologies (P) Ltd, Delhi, ACMAS Technologies Pvt. Ltd,

Sonepat, Biotechnologies INC, Labtop Instruments Private Limited, Mumbai, Advance Scientific Equipment Pvt. Ltd, Mumbai

Biotech Reagent Suppliers : Organo Biotech Laboratories (P) Ltd., New Delhi, Recombigen Laboratories Pvt. Ltd., New Delhi, BR Biochem Life Sciences Pvt. Ltd., New Delhi, Sanofi India Ltd., Mumbai, Marion Biotech Pvt. Ltd., Noida, Bioimagene India Pvt. Ltd., Mumbai

Advertising agencies: Lintas Media Group, Mumbai, Creative Media & Marketing, New Delhi

Biotechnology Companies *(Pl. refer 3.3.1.1.)*

Training

- Industry Certificate in Medical Writing by Institute of Good Manufacturing Practices India - *https://www.igmpiindia.org/MWIndustrycertification.html*
- Advanced PG Diploma in Clinical Research & Medical Writing by James Lindt Institute - *https://www.jli.edu.in/course/advanced-pg-diploma-in-clinical-research-medical-writing/*
- Mass communication course by Jamia Millia Islamia University, New Delhi
- Course on Graphic Design, Visual Communication, Animation at NID, Ahmedabad, IIT, Mumbai, MS University of Baroda, Pearl Academy

Relevant Online Courses

- Technical Writing - *https://www.coursera.org/learn/technical-writing*
- Writing in the Sciences - *https://www.coursera.org/learn/sciwrite*

Suggested Further Reading

- Technical Writing in the Pharmaceutical Industry - *http://www.piramalpharmasolutions.com/insights/blogs/technical-writing-pharmaceutical-industry*
- Technical Writing for Pharmaceutical and Biotech Companies 101 -https://www.writeinteractive.com/post/technical-writing-for-pharmaceutical-companies-101
- Five Skills Every Technical Writer Needs | I'd Rather Be Writing - *https://idratherbewriting.com/2007/09/26/five-skills-every-technical-writer-needs/*
- Technical Writing for the Pharmaceutical, Medical Device and Biotech Industries- *https://www.complianceonline.com/technical-writing-for-the-pharmaceutical-medical-device-and-biotech-industries-webinar-training-704531-prdw*

3.3.1.7. Consultancy, Business Development & Equity Research

If in addition to scientific and technical skills, you have a flair for business, are gifted with good communication skills and love to interact with people from diverse backgrounds, consultancy, business development and equity research may be suitable career paths for you. Your work will involve preparing feasibility reports to convince investors about the economic viability of project or product, evaluating new inventions/product/ technology to determine if they are worthy of investment, identifying new investment opportunities etc.

You will need to be aware of the latest technological and commercial developments in the sector of your choice. Potential employers may include venture capital firms or large private companies involved in corporate venture capital. You will be expected to conduct in-depth SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of new invention(s), in order to identify its competitive advantages and predict chances of its success. This job puts a lot of responsibility on your shoulders as you will be generating actionable insights which will materially impact business or investment decisions. This also offers great opportunities to network with people and build connections, which can be very useful if you have entrepreneurial aspirations and decide to launch your own start-up at a later date. This career path can also be very rewarding as you will be instrumental in bringing new innovations to the market for the benefit of society. While scientific skills alone are not enough to succeed this field, those with a PhD degree are usually preferred for leadership positions over MBAs without a scientific background, since knowledge of the core discipline is key for success. Business related skills can either be acquired while on the job or by taking up management-related courses.

Key Skills

- Keeping up with recent advancements in the field
- Ability to conduct competitive analysis
- Good communication skills (oral and written)
- Interpersonal skills and networking
- Multi-tasking, coordinating multiple projects and working in a time-sensitive environment

Key Responsibilities

- Assisting companies in expanding and diversifying customer base by acquiring new customers and selling additional products/services to existing customers
- Analysing financial data and public records of companies to predict

company's financial scenario
- Providing research support to the investors and facilitating decision making about best investment opportunities

Sample Job Titles

Senior business insight director, Business development officer, Manager business development, Business development executive, Business executive, Business development manager, Research analyst, Equity analyst, Data analyst, Credit analyst, Financial analyst, Investment advisor, Quantitative analyst

Potential Employers *

Venture Capitalists: Nadathur Holdings and Investments Pvt. Ltd., Accel Partners and Karnataka Information Technology Venture Capital Fund (Kitven), (Karnataka Government Backed Fund, raised funding from Karnataka State Industrial Bank), APIDC Venture Capital Ltd., MPM Capital
Consultancy Firms: Ernst & Young, Gurugram, Mckinsey & Company, Bangalore, Mumbai, L.E.K. Consulting, Mumbai, New Delhi, SGS India, Voisin Consulting Life Sciences, Bangalore
Equity Research Firms :
Indian: CLSA India, Mumbai, Motilal Oswal, India Infoline , Edelweiss, Anand Rathi, SBI Capital, ICICI Securities, JM Financial, Emkay, Axis Securities, IDFC Securities, Kotak Securities, SPARK Capital
Global Players: JP Morgan, Morgan Stanley, Deutsche Bank, Merrill Lynch, Goldman Sachs, Macquire, Nomura, CLSA
Biotechnology Companies *(Pl. refer 3.3.1.1)*

Training

- MBA, MBA with specialisation in financial analysis, MFA (Master of science in financial analysis), Master of Science in Finance, Certification as Chartered Financial Analyst, CA, CPA, Ph.D and Post Doc in Life sciences or Biotechnology with appropriate training or inclination

Relevant Online Courses

- Equity Research - SLA Consultants India - *https://www.slaconsultantsindia.com/equity-research-analyst-certification-course.as*
- Equity Research and Financial Modeling - ForeVision - *http://www.forevision.co.in/learning-and-development-managerial-skills-equity-research.php*

Suggested Further Reading

- Pharmaceutical consultancy: a view to a skill - Nature - *https://www.nature.com/articles/nrd782.pdf?origin=ppub*
- Business forecasting : understanding the basics. - *https://www.investopedia.com/articles/financial-theory/11/basics-business-forcasting.asp*
- What is a business analyst? A key role for business-IT efficiency. - *https://www.cio.com/article/2436638/project-management-what-do-business-analysts-actually-do-for-software-imple*
- Biotech Consultant: Job Description and Requirements - Study.com- *https://study.com/articles/Biotech_Consultant_Job_Description_and_Requirements.html*

- Financial Analyst vs. Financial Consultant Careers. - *https://www.investopedia.com/articles/professionals/091515/career-advice-financial-analyst-vsfinancial-consultant.asp*

3.3.2. Bioentrepreneurship

If you have an innovative idea with commercial potential and you are willing to tolerate a little risk, then setting up your own enterprise may be a good option for you. Entrepreneurship is critical to the country's economic development as well as societal well-being as entrepreneurs create jobs and drive innovation. As an entrepreneur, you are expected to prepare feasibility reports to assess economic potential of your idea, competitors in the field, existing and future products in pipeline, market size, etc, so that you can take well-informed decisions.

Start-ups offer a training opportunity that can teach you how to shift your thinking from theory into practice. Learning how to impress others and explain your project in a comprehensive and detailed manner is extremely important. Team work, developing ideas, addressing an audience, executing plans are some important skills needed for this. If you value independence, creativity, and autonomy, you could be successful as an entrepreneur.

To begin with, you should gather a team with complementary expertise and delegate responsibility wherever needed. You would need strong interpersonal skills as well as knowledge of data analysis and interpretation to convince investors/ venture capitalists to invest in your idea. Time management is crucial for success, hence, you need to set time-bound targets and milestones and ensure their timely implementation. Judicious utilisation of financial resources and efficient personnel management are also important for success. To begin with, you will have to multi-task as your team may have only a few members. It may be a good idea to outsource specialised work to professionals instead of hiring so as to reduce your liability. In addition to subject knowledge, you would need to be updated with regulatory requirements.

Many schemes to support commercialisation of research and training of students to set up their own enterprises have been initiated by the Government of India, including programmes such as 'Innovate in India', 'Make in India' and 'Start-up India'. Biotechnology offers tremendous scope for strengthening economic growth through innovative technologies with applications in agriculture, health, environment, energy, etc. Some departments involved in encouraging bioentrepreneurship are: National Science & Technology Entrepreneurship Development Board (NSTEDB) and Technology Development Board (TDB) set up by Department of Science & Technology (DST), Biotechnology Industry Research Assessment Council (BIRAC) set up by De-

partment of Biotechnology (DBT), Ministry of Small & Medium Scale Enterprises, and the Department of Industrial Promotion & Policy.

BIRAC alone has supported around 500 start-ups and entrepreneurs in the last few years in diverse areas such as biomedical devices, therapeutics, specialty enzymes, plant tissue culture, biofertilizers, biopesticides, etc. 30 incubators have been set up across the country which have resulted in the development of over 100 products and technologies and generation of 150 intellectual property(IP).

For those interested in bioentrepreneurship, competitions can serve as a "way-in". DBT has been organizing Best Entrepreneur Student Teams (BEST) competition for student teams for the last several years. Initially, it was held jointly with British Council, then, it was organized by Association of Biotechnology Led Enterprises (ABLE). Student teams come up with prospective ideas and present their ideas before experts from academia, industry, financial experts from banks, investors, venture capitalists, angel investors. Teams get lot of mentoring and selected teams get award money as well as support to take their ideas to a logical conclusion.

For the last 2 years, BIRAC has been organising the National Entrepreneurship Competition inviting innovative, path breaking ideas. The selection process involves regional rounds and selected participants undergo intense mentoring at a residential boot camp. These programmes provide much desired impetus to students and scientists willing to set up their own enterprise.

Key Skills

- Passion and Motivation to succeed
- Willingness to take risk
- Confidence, Determination, Hard work, Dedication, Discipline
- Adaptability and Flexibility
- Knowledge of subject area, product, market, IPR, Regulatory requirements
- Effective Planning
- Time, Money & Project Management
- Interpersonal Skills, Leadership skills
- Communication Skills
- Networking

Key Responsibilities

- Selection of ideas and technologies
- Preparation of feasibility reports
- Presentation before investors for seeking funding
- Communicating with stakeholders
- Team selection, personnel management
- Judicious utilisation of financial resources

Training

- Training courses organised by DBT, BIRAC, DST
- Online Course by Entrepreneurship Development Institute of India, Ahmedabad, IGNOU, Symbiosis university
- MBA from IIMs, IIT, FMS, University of Delhi

- MBA Biotechnology from University of Pune, Punjab University, Amity University
- MBA Agri- Business Management from UAS, Bangalore; Dharwad
- Internship in C-CAMP, Bangalore
- BEST(Biotechnology Entrepreneur Student Teams) Competition organised by DBT through ABLE (Association of Biotechnology Led Enterprises), National Bio Entrepreneurship Competition organised by BIRAC through C-CAMP, Bangalore .

Relevant Online Courses

- Entrepreneurship - *https://www.coursera.org/browse/business/entrepreneurship*
- MSc in Innovation and Entrepreneurship (HEC MSIE) - *https://www.coursera.org/degrees/omie*
- Healthcare Innovation and Entrepreneurship - *https://www.coursera.org/learn/wo-pmo-healthcareinnovation*
- Trading Biotech Stocks – Understanding the Healthcare Sector - *https://www.udemy.com/course/trading-biotech-stocks/*
- Technology Commercialization, Part 1: Setting up your Idea Filtering System *https://www.coursera.org/learn/technology-commercialization*
- Innovation Management - *https://www.coursera.org/learn/innovation-management*
- Medical Technology and Evaluation - *https://www.coursera.org/learn/healthcare-medical-technology*
- Healthcare Marketplace Specialization - Coursera - *https://www.coursera.org/specializations/healthcare-marketplace*
- Innovation: From Creativity to Entrepreneurship - *https://www.coursera.org/specializations/innovation-creativity-entrepreneurship*

Few start-ups with products/ services in market*

Biopharmaceuticals: Axio Biosolutions Pvt. Ltd., Ahmedabad; Cardiac Design Labs Pvt. Ltd., Bengaluru; Embryyo Technologies Pvt. Ltd., Pune; E-Spin Nanotech Pvt. Ltd., Kanpur; Wrig Nanosystems Pvt. Ltd., New Delhi; Sohum Innovation Labs India Pvt. Ltd., Bengaluru

Bioagriculture: Revelations Biotech Pvt. Ltd., Hyderabad; Sushila Biofertilizer Company Pvt. Ltd., Jaunpur; The Unati Cooperative Marketing-cum-Processing Society Limited, Hoshiarpur

Bioindustry: Krya Solutions Pvt. Ltd., Chennai; Sea6 Energy Pvt. Ltd., Bengaluru

Bio Services: Affigenix Biosolutions Pvt. Ltd., Chennai; Bioklone Biotech Pvt. Ltd., Chennai; Genext Genomics Pvt. Ltd., Nagpur; LeadInvent Technologies Pvt. Ltd., New Delhi; MRD LifeSciences Pvt. Ltd., Lucknow; Osteo3d Pvt. Ltd., Bengaluru; Phasorz Technologies Pvt. Ltd., Chennai, Bengaluru; Swagene Pvt. Ltd., Chennai

Suggested Further Reading

- The entrepreneur's guide to a biotech startup, 4th edition-UCLA CTSI. - *https://www.ctsi.ucla.edu/researcher-resources/files/view/docs/EGBS4_Kolchinsky.pdf*
- Trailblazers: Mapping the journey of young Bioentrepreneurs – The National Academy of Sciences, India and Biotech Consortium India Limited
- Here's how you can build a startup

without external funding-entrepreneur. - *https://www.entrepreneur.com/article/316567*

- 3 top biotechnology and pharmaceutical industry trends every PhD should know. - *https://cheekyscientist.com/3-top-biotech-and-pharmaceutical-industry-trends-every-phd-should-know/*
- 6 Trends PhDs Must Know About The Biopharma Market | Cheeky ...- *https://cheekyscientist.com/trends-phds-must-know-about-the-biopharma-market/*
- 4 Must Have Characteristics in Biotechnology Entrepreneurship -*http://www.biolyse.ca/4-characteristics-of-successful-biotech-entrepreneurs/*
- 6 Characteristics of Successful Entrepreneurs – Biosource Consulting- *http://biosourceconsulting.com/6-characteristics-of-successful-entrepreneurs/*
- Biotechnology Entrepreneurship | ScienceDirect - *https://www.sciencedirect.com/book/9780124047303/biotechnology-entrepreneurship*
- Paths to entrepreneurship in the life sciences : Article : Bioentrepreneur - *https://www.nature.com/articles/bioent831*
- Afraid to join a biotech start-up? - *https://pharma-recruitment.com/join-a-biotech-start-up/*

3.3.3. Career in Intellectual Property Rights

An intellectual property rights professional helps researchers protect their intellectual property through filing for patents or copyrights or trademarks, etc. For most inventions which have a potential for application, completion of laboratory work is followed by patent filing for protection of the inventor's rights and possible commercialization. Most law firms, companies and government organizations employ people with scientific backgrounds to work on patent-related matters as technical advisors and patent examiners. If you are detail oriented and are interested in learning, reading and writing about diverse scientific fields, a career in intellectual property could be right for you.

You will need to learn how to understand legal terms, search patent databases to determine the patentability of proposed inventions, and draft patents. You will be instrumental in converting technological advancements to commercial successes. An understanding of legal language and a wide knowledge of the subject area helps IP professionals transition into consultants and advisors for start-ups. An IP professional has to be knowledgeable in technology as well as patent laws. IP professionals can be **Patent Agents, Patent Examiners or Patent Attorneys.** Students with a PhD in any science area can join law firms as scientific consultants or patent agents to act as a bridge between scientists and lawyers. Patent agents or patent examiners are generally

appointed by Govt. of India and they must have a degree in science, engineering or technology in addition to qualifying the patent agent exam conducted annually by the Controller General of Patents. A degree in law is not essential to become a patent agent.

Patent examiners have to review patent applications to decide whether the patent should be granted or not. They have to search literature and patent databases to determine patentability of invention under consideration. Later on, they can also pursue law degree to work as patent attorneys.

Patent attorneys or lawyers work for clients and IP firms and help in filing and maintaining IP, as well as in litigation and other related matters. A degree in science, technology or engineering is not necessary to become a patent attorney. Instead, a degree in law and enrolment in any State Bar Council is a must. Patent agents are involved in patent prosecution and practice before the Controller of Patents while the role of patent attorney is linked to patent litigation and practicing before the court. Patent attorneys cannot file a patent. Instead, patent attorneys develop strategies to protect new and existing products, prepare and negotiate license agreements, and work on litigation concerning patent issues.

IP lawyers need interpersonal skills as they work with a range of professionals from academia and companies. They also need to have good documentation skills to draft patents or file litigation in cases of disputes.

Key Skills

- MSc or PhD in science with knowledge of intellectual property laws
- Diverse knowledge of subject
- Research and written communication
- Interpersonal skills for interfacing with researchers and lawyers
- Understanding of expectations of client, awareness about patent laws and issues in litigation, experience in drafting patents

Key Responsibilities

- Conducting IP due diligence, prior art search to determine patentability, third party patent studies
- Collecting data from researchers, compiling documents and facilitating draft patent application, information disclosure statements, amendments to claims
- Performing comparative analysis of inventions and patents and keeping track of patents due to expire and to advise clients
- Facilitating commercialisation of patented products by drafting industrial licensing agreement and negotiation regarding technology transfer agreement including fee
- Protecting interests of the client in cases of infringement of rights by filing litigation

Sample Job Titles

Patent examiner, Patent Agent, Patent

Attorney, Patent Analyst, Patent Counsel, Patent Associate, Patent Specialist
Potential Employers in India
Indian Patent Office, Patent Cells in Government Scientific Departments
Biotechnology companies *(pl. refer 3.3.1.1.)*

Few Noted IPR Firms *

Anand & Anand Advocates, New Delhi, Lakshmikumaran & Sridharan, New Delhi, Maheshwari & Co. Advocates & Legal Consultants, New Delhi, Remfry and Sagar, New Delhi, Bengaluru & Chennai, Saikrishna & Associates, Noida, Biswajit Sarkar & Associates, Kolkatta

Training

Relevant Online Courses

- Patenting in Biotechnology - *https://www.coursera.org/learn/patenting-bio-ipr*
- Protecting Business Innovations via Copyright - *https://www.coursera.org/learn/protect-business-innovations-copyright*
- Protecting Business Innovations via Trademark | Coursera - *https://www.coursera.org/learn/protect-business-innovations-trademark*
- Drug Commercialization - *https://www.coursera.org/learn/drug-commercialization*
- Drug discovery - *https://www.coursera.org/learn/drug-discovery*
- The Three Pillar Model for Business Decisions: Strategy, Law & Ethics- *https://www.mooc-list.com/course/three-pillar-model-business-decisions-strategy-law-ethics-coursera*
- European Business Law: Doing Business in Europe - *https://www.coursera.org/learn/eu-law-doing-business*
- WIPO's Free Online Course on Intellectual Property. - *https://lawlex.org/lex-bulletin/wipo-free-online-course-on-intellectual-property/3636*
- Intellectual Property 101(FREE) - IIPTA *-https://www.iipta.com/product/intellectual-property-101/*

Suggested Further Reading

- Career as Intellectual Property Attorney / IPR Professional | - *https://career.webindia123.com/career/options/law_socialscience/intellectual-property-attorney-as-a-career/index.htm*
- Career in Intellectual property: A legal outlook to innovative science - *https://Indiabioscience.org/columns/indian-scenario/career-in-intellectual-property-a-legal-outlook-to-innovative-science*
- Career In Patents & Copyright Industry After Masters in Life Sciences - *https://www.biotecnika.org/2019/03/career-patents-copyright-industry/*
- Intellectual property rights: An overview and implications in ... - NCBI - *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217699/*
- In Person: A Career in Biotech Patent Law | Science | AAAS- *https://www.sciencemag.org/careers/2011/10/person-career-biotech-patent-law*

3.3.4. Technology Transfer

If you are excited by the idea of learning about new inventions which have potential for commercialization, then, a career in technology transfer may be the correct option for you. Technology transfer is the sharing and transfer of new technology from inventor to secondary user for further development into practical and commercially relevant applications and products. Technology transfer includes discoveries, inventions, know-how, innovations, and intellectual property like patents, trademarks, copyrights, and trade secrets. The work may also involve protection of intellectual property, preparing memorandum of understanding (MoU)s, and industrial licensing. Technology transfer experts identify research with potential commercial interest, find companies which work in the field and would be interested in the product/technology/service, evaluate the cost of technology/product/services based on their economic potential, help in upscaling of technology from laboratory scale to pilot and large scale, mediate in discussions for transfer of technology, and finalise agreements.

Key Skills

- Strong science background and understanding of the needs of the scientific community as well as the public
- Technology transfer knowledge including protection of intellectual property by patents, copyright, trademark, industrial licensing, standard agreements and procedures
- Interpersonal skills for engaging with stakeholders
- Communications skills, both oral and written
- Negotiation skills
- Time management

Key Responsibilities

- Establishing relationships with scientists
- Building relations with companies with objective of forging collaborations and technology licenses
- Reviewing disclosure of inventions, identifying commercial product scenario and assessing unique features and proposed benefits
- Evaluating market potential of inventions, market size, market need, competitive advantage and barriers to market absorption
- Recommending technology transfer path for new inventions and collaborating with IP management groups (IP protection, assigning rights of inventors)
- Drafting and negotiating licenses and other related contracts

Sample Job Titles

Licensing and Patenting Associate, Licensing and Patenting Manager,

Technology Transfer Specialist, Technology Transfer Policy Specialist, Chemical Engineer- Technology Transfer and Scale-up, Formulation Scientist-Technology Transfer, Research Scientist-Technology Transfer(Formulations), Head, Technology Transfer, Sr. Executive, Technology Transfer, General Manager, Technology Transfer, Head, Formulations and R&D, Manager, Process Engineering & Scale-up, Process Engineer, Marketing Coordinator, Monitoring and Enforcement Officer, Senior Licensing and Patenting Manager, Senior Advisor for Industrial Licensing, Senior Advisor for Intellectual Property Transactions, Senior Technology Transfer Policy Advisor, Senior Royalties Administrator, Senior Monitoring and Enforcement Officer, Senior Advisor for Monitoring and Enforcement

Potential Employers *

Government Agencies such as Department of Science & Technology, Department of Biotechnology, Department of Scientific & Industrial Research, Indian Council for Agricultural Research, Indian Council for Medical Research, Department of Industrial Policy & Promotion, Department of Health, IITs, IISERs, Universities, Private Companies, Patent Law Firms *(pl. refer 3.3.3)*, Non-Governmental Organizations, Biotech Consortium India Ltd., New Delhi, BIRAC, New Delhi, **Biotechnology companies** *(pl. refer 3.3.1.1)*, **Bioinformatics companies** *(pl. refer 3.3.9.2)*

Training

- Internship in Technology Transfer Cell in Government agencies
- Patent Examiner courses by Indian Patent Office, USPTO
- Internship with Patent Agents/ Attorneys (Law Firms)
- Technology Transfer courses/ certificate course
- Law and/or Management Degree

Relevant Online Courses

- Online courses on IPR and Technology Transfer by Supreme Court, Indian Patent Office, WIPO, USPTO
- Technology transfer and commercialisation - Online course *https://thetransferinstitute.com/tech/training/technology-transfer*
- Online course Technology Transfer and Research Commercialization - *https://www.slideshare.net/thetransferinstitute/online-course-technology-transfer*
- Technology Transfer and Commercialisation - Programs and Courses - *https://programsandcourses.anu.edu.au/2019/course/laws8317*
- Fundamentals of Technology Transfer. - *https://www.astp-proton.eu/events/training-courses-2/fundamentals-technology-transfer-2/*

Suggested Further Reading

- Career Options series: technology transfer. OITE careers blog. - *https://oitecareersblog.wordpress.com/2016/02/22/career-options-series-technology-transfer/*
- 5 Skills You Need To Have For A Job In Technology Transfer | Cheeky ...*https://cheekyscientist.com/skills-you-need-for-a-job-in-technology-transfer/*
- Technology Transfer: a boon to the

developing biotechnology - *https://hopkinsbio.org/uncategorized/technology-transfer-boon-developing-biotechnology-economies/*

- Technology Transfer - an overview | ScienceDirect Topics - *https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/technology-transfer*
- Technology transfer in pharmaceutical industry - The Pharma Innovation- *http://www.thepharmajournal.com/archives/2017/vol6issue3/PartD/6-1-26-206.pdf*
- Best Practices for Technology Transfer | BioPharm International - *http://www.biopharminternational.com/best-practices-technology-transfer*

3.3.5. Regulatory Management

Regulatory science involves developing new tools and standards to assess the safety, efficacy, quality and performance or regulated products. Regulatory managers are expected to assess risk-benefit ratios and facilitate sound and transparent regulatory decision making. This is a versatile and dynamic field and is essential for ethical conduct of research as well as development, production, and sale of products within regulated industries (food, pharmaceuticals, medical devices, energy, biotech, healthcare products etc). If you do not want to be limited to a single scientific problem and prefer diversity and variety, if you can keep yourself up-to-date with the global scenario in scientific advancements, and if you would like to apply this knowledge in proposing new regulations or suggesting modifications in existing laws, regulations and policies, then a career in regulatory affairs may be the correct option for you.

Framing of regulations and stringent implementation by Government agencies is essential to ensure that companies and business houses follow essential laws and guidelines during manufacture and marketing of products. Regulatory managers employed by companies carry out documentation and timely filing of regulatory paperwork for obtaining necessary regulatory approvals. Regulatory affairs requires expertise from multiple disciplines, both scientific and legal.

Key Skills

- Sound scientific background
- Documentation and data analysis
- Knowledge of scientific regulations, and policy
- Oral and written communication skills
- Analytical and organizational skills, including the ability to evaluate potential product candidates and trials
- Capacity for quick learning
- Project and time management skills
- Interpersonal skills such as ability to mediate, negotiate with different groups and arrive at a consensus

Key Responsibilities

- Interfacing with researchers, businesses, quality control and regulatory groups for method development and validation
- Substantiating claims and supporting product development
- Accurate testing of product and designing studies to meet regulatory requirements
- Conducting research about existing and future competitor companies and products to determine potential risk of financial losses in case technology does not work as anticipated
- Developing study material for healthcare providers and promotional material jointly with technical writers
- Ensuring compliance of product labelling and preparing promotional material

Sample Job Titles

Regulatory Affairs Specialist, Regulatory and Quality Affairs Analyst, Policy Manager, Scientist, Regulatory Affairs Associate, etc.

Potential Employers *

Major Regulatory Affairs Agencies in the Central Government and State Governments:

Government Departments are responsible for framing appropriate regulations and ensuring their implementation. They may allocate this job to existing officers who need to acquire requisite expertise and/or may hire experts.

A few examples are given below:

- Clinical Trials Regulations in India (Central Drugs Standard Control Organisation) – Drug Controller of India ensures implementation of clinical trials regulations in India, approval of licenses of specified categories of drugs, review test results submitted by sponsors to decide about safety of drug for clinical trials, marketing of drugs for public consumption and its labelling
- Food Safety and Standards Authority of India (Ministry of Health & Family Welfare) - Protecting and promoting public health through regulation and supervision of food safety
- Environment Protection Act (Ministry of Environment and Forests and Central and State Pollution Control Boards)– Protection and improvement of the human environment and prevention of hazards to human beings, other living creatures, plants and property.
- Regulations and guidelines of biosafety of recombinant DNA research and biocontainment (Ministry of Environment & Forests, Department of Biotechnology)
- National guidelines for Stem Cell Research (Department of Biotechnology and Indian Council for Medical Research)
- Human DNA Profiling Bill (Department of Biotechnology)
- Guidelines for Clinical Laboratory Practices (Indian Council for Medical Research)

Regulatory Affairs Administrator in the Private Sector:

These companies are responsible for collecting, analysing necessary data for timely submission to Government for obtaining necessary approvals.

- Stells Biopharma Pvt. Ltd., Bengaluru
- Lifecare Innovations Ltd., Gurugram

Training

Relevant Online Courses

- Training in Biotech Regulation I Regulatory Affairs Course - *http://www.regulatoryinstitute.com/biotech-regulatory-affairs-program.html*
- Biotechnology: Biotechnology Regulatory Affairs, M.Sc - *https://www.mastersportal.com/studies/56493/biotechnology-biotechnology-regulatory-affairs.html*

Suggested Further Reading

- How is it to work in regulatory affairs in a pharmaceutical ... - *https://www.quora.com/How-is-it-to-work-in-regulatory-affairs-in-a-pharmaceutical-company-What-skills-do-you-need-and-what-personalities-thrive-in-this-area*
- Options in regulatory affairs – specialties and skill-sets - *https://regulatory.usc.edu/files/2015/03/15-3_Regulatory-Rapporteur-specialities-skillsets-wm-Smerkanich-Locke.pdf*
- 6 Essential Skills of a Regulatory Affairs Professional - LinkedIn - *https://www.linkedin.com/pulse/20140730184407-22974881-6-essential-skills-of-a-regulatory-affairs-professional*
- Departments and Job Descriptions in a Biotechnology Company ... - *https://www.massbioed.org/writable/files/CareerInformation/biotech_job_descriptions_salary_ranges.pdf*
- Working in Regulatory affairs: careers and trends - *https://www.northeastern.edu/graduate/blog/working-in-regulatory-affairs-careers-and-trends/*
- Career options series: regulatory affairs. OITE careers blog- *https://oitecareersblog.od.nih.gov/2016/04/13/career-options-series-regulatory-affairs/*
- The Current Biotechnology Regulatory System (Preparing for Future Products of Biotechnology) - *https://www.ncbi.nlm.nih.gov/books/NBK442204/*
- Modernizing the Regulatory System for Biotechnology Products - EPA - *https://www.epa.gov/sites/production/files/2017-01/documents/2017_coordinated_framework_update.pdf*

3.3.6. Science Communication & Public Outreach

Science communication and public outreach refers to generating public awareness, popularising results of current research, as well as educating the citizens of the country about science. If you have a passion for communicating science to the public, have strong storytelling skills, can simplify complex scientific concepts and make them interesting, science outreach and/or communication is the perfect choice for you. Science students develop writing skills while working on projects, dissertations, research publications and thesis, some of which can be meaningfully utilized in this profession.

As a science communicator, you don't need in-depth knowledge of specific scientific fields, but you should be able to understand and appreciate research. You have to understand the implications of technology and give a fair, unbiased picture for which you need the ability to read, analyse, assimilate and describe unfamiliar data as well as the capacity for critical, structured and fast thought. You can arouse curiosity in students about science by engaging with school or college students. Candidates with undergraduate, postgraduate, or doctoral degree in science, and skills such as storytelling, science curriculum development, teaching, research, preparation of educational material such as models or exhibits, writing blogs, designing web sites etc. would be perfect for this field. Social media has facilitated direct interfacing with the public and has provided access at the same time as lowering the need for infrastructure or resources.

Government funding agencies are currently under tremendous pressure for communicating benefits of science to the public so as to justify allocation of resources for science, particularly the use of taxpayer money. To be a science communicator, you need to have a knack for assessing your target audience and the ability to distil complex scientific concepts using simple, easy to understand language for a lay audience. You should be open to feedback and criticism and follow ethical journalism practices.

Key Skills

- Communication skills, both oral and written
- Remaining updated with latest developments in the field
- Teaching/Education
- Writing/editing lucidly and clearly
- Multimedia-based outreach/ communication
- Web design or development (optional)
- Research methods and data analysis
- Interpersonal communication skills

Key Responsibilities

- Communicating the excitement, importance and relevance of scientific discoveries and technological

developments to society
- Creating awareness amongst people with non-scientific background about the latest scientific developments
- Presenting complex scientific data in an easily understandable form
- Presenting an unbiased, balanced view without any prejudice

Sample Job Titles

Program Director/Manager/Coordinator/ Specialist, Outreach Coordinator, Science Writer/Educator, Online Communications Specialist, Science Editor, Science Journalist, Public Engagement Officer, Communication Coordinator, Content Writer, Science Exhibit Developer, Learning Coordinator, Museum curator, Animator, Graphic designer, etc.

Potential Employers *

Schools, Colleges, Universities, National Science Museum, National Museum of Natural History, National Institute for Science Education and Research, National Institute for Science & Mathematics Education Development, IndiaBioscience at National Centre for Biological Sciences, Bangalore, Vigyan Prasar set up by Department of Science & Technology, Directorate of Advertising and Visual Publicity, Government of India, CSIR National Institute for Science Communication and Information Resources (Scientific Reporter, Vigyan Pragati), Journals/Magazines like Current science, Nature(India), Journal of Scientific & Industrial research, Down to Earth, Biospectrum, Biotechnika, Advanced Biotech, Science Academies like INSA, NSA, NASA etc., as editor, author, peer review expert, Media Houses like Doordarshan, Zee, Sony, NDTV, Colours, etc., Newspapers such as Hindu, Statesman, Times of India, Indian Express, Hindustan Times, Financial Express, Economic Times, etc.

Training

- Scientific Journalism courses run by NCBS, IISER-Pune, DBT-Wellcome Trust India Alliance
- M .Sc. Science & Technology Communication (CSIR-NISCAIR)
- Internship programmes at Vigyan Prasar, IndiaBioscience
- Course on Graphic Design, Visual Communication, Animation, Photography, Film making at NID, Ahmedabad, National Film Institute of India, IIT, Mumbai, SHRISHTI, Pearl Academy
- Mass communication course by Jamia Millia Islamia University, New Delhi

Relevant Online Courses

- Online course on science journalism - *http://www.wfsj.org/course/en/index.html*
- Science communication skills for journalists - *https://scidevnet.teachable.com/p/communication-course-for-scientists*
- Media skills for scientists - *https://scidevnet.teachable.com/p/* communication-course-for-scientists
- Writing in the sciences- *https://online.stanford.edu/courses/som-y0010-writing-sciences*
- An online course on the art of science communication - ASBMB - *http://www.asbmb.org/Outreach/Training/ASC/*

Suggested Further Reading

- The importance of science communication. Naturejobs - *http://blogs.nature.com/naturejobs/2014/09/04/the-importance-of-science-communication/*
- Science communication: what it takes. Naturejobs - *http://blogs.nature.com/naturejobs/2017/02/10/science-communication-what-it-takes/*
- Life as a full-time science communicator-the scientific basement. - *https://www.thesciencebasement.org/blogging-science/life-as-a-full-time-science-communicator/*
- Career options series: science education and outreach. OITE careers. - *https://oitecareersblog.wordpress.com/2016/08/08/career-options-series-science-education-outreach/*
- How to get a job in science education and outreach. OITE careers blog. - *https://oitecareersblog.od.nih.gov*
- Science communication in the field of fundamental biomedical research (editorial) - *https://www.sciencedirect.com/science/article/pii/S1084952117304494*

3.3.7. Science Management and Administration

As a science manager, you will be expected to wear multiple hats and be involved in policy formulation, priority area identification, formulation and evaluation of projects in identified thrust areas etc. You will have to interact with scientists, bureaucrats and politicians and should possess persuasion and negotiation skills to get the expected results. You will be expected to read and remain up-to-date with the latest developments in the field and cannot be confined to a narrow area of specialization.

As a science administrator, you will be expected to provide day-to-day logistics, i.e., administrative and financial support to scientific teams by ensuring timely submission of financial documents and follow-up with funding agencies for timely receipt of grants. You will also play a role in judicious allocation and utilization of grants to different groups within the organization as per the institutional priority and mandate. You will also be involved in managing contracts, MoUs, material transfer agreements etc. following rules and regulations related to ethics, biosafety and clinical practices.

3.3.7.1. Science Administrator

Key Skills

- Project management and coordination
- Knowledge of technology transfer, IP, regulatory affairs etc.
- Organization skills and time Management
- Excellent communication skills

Key Responsibilities

- Providing administrative, financial and logistic support to scientists to assist in the smooth implementation of their duties
- Ensuring timely submission of necessary documents to funding agencies and following up to facilitate timely release of grants
- Ensuring appropriate allocation of budget as per institute mandate and its judicious utilisation
- Facilitating compliance of rules, regulations and guidelines
- Assisting with technology transfer, industrial licensing, filing of patents, etc.
- Acting as a bridge between funding agencies, scientists and financial managers

3.3.7.2. Science Manager

Key Skills

- Multi-tasking and coordination with multiple stakeholders
- Subject knowledge as well as knowledge about regulatory guidelines
- Knowledge about intellectual property rights protection, technology transfer, industrial licensing etc.
- Team work, time and project management
- Excellent oral and written communication skills

Key Responsibilities

- Formulating policy and strategy for implementation of policies
- Providing support to research programmes of the organisation
- Identifying priority areas, formulating project proposals, submitting to funding agencies for consideration of financial support
- Coordinating preparation of annual plans, five year plan, performance budget, annual report and other necessary documents
- Ensuring compliance to rules and regulations

Sample Job Titles

Science manager, Scientific officer, Director, Advisor, Consultant, Administrative officer, Grants Manager, Grants Advisor, Project Coordinator

Potential Employers *

Universities, autonomous research institutions of DST, DBT, CSIR, ICMR, ICAR, NGOs involved in research, DBT Wellcome Trust India Alliance, international research organisations

Training

- Workshops on Science Administration & Management organised by Newton Bhabha Fund, British Council of India
- Internships in Government Departments like DST, DBT, BCIL, BIRAC, TDB, SERB, Niti Aayog, Research institutions, DBT- Wellcome Trust India Alliance, IITs, IISERs

Relevant Online Courses

- Science Management and Leadership Degree Programs | - *http://www.webster.edu/masters/science-management-and-leadership.html*
- Science Management Degree Program Information - Study.com- *https://study.com/articles/Science_Management_Degree_Program_Information.html*

Suggested Further Reading

- Converting biotech scientists to managers : Article : Bioentrepreneur - *https://www.nature.com/articles/bioent789*
- Transforming Scientists into Managers | The Scientist Magazine - https://*www.the-scientist.com/profession/transforming-scientists-into-managers-53974*
- Project Management for Scientists, Part 1: An Overview | Science | AAAS - *https://www.sciencemag.org/careers/2002/05/project-management-scientists-part-1-overview*
- MBA Program with Biotechnology & Life Sciences Specialization - *http://www.careerprofiles.info/biotechnology-mba-degrees.html*
- 4 dos and don'ts for scientists moving into management - Elsevier - *https://www.elsevier.com/connect/4-dos-and-donts-for-scientists-moving-into-management*
- Management for Scientists: What Makes a Good Manager Anyway? - *https://blog.addgene.org/management-for-scientists-what-makes-a-good-manager-anyway*
- Master of Science in Administration - Wikipedia - *https://en.wikipedia.org/wiki/Master_of_Science_in_Administration*

3.3.8. Science Public Policy Advisor/ Advocate

Science Policy involves deciding national priorities, evaluating the current status of research in a particular field, identifying gaps so that programmes can be formulated and supported for education and research as per the country's needs, allocating appropriate financial resources, formulating guidelines and regulations for ethical conduct of science etc. Science policy experts are expected to act as a bridge between scientists, bureaucrats, politicians and the public. Science policy experts can be a catalyst for change in current science policies. In general, there is a wide communication gap between scientists and policymakers. Science policy experts bridge this communication gap by providing relevant information to politicians, policymakers and the general public in order to facilitate decision making. Science policy experts explain the importance of research done by scientists and its relevance to society.

They attempt to take a balanced view of any new technology, keeping in mind ethical and safety considerations. If you like to interact with diverse audiences and wish to influence policymaking or bring about changes in existing science policies based on the experience of stakeholders, then a career as a public policy advisor/ advocate is the perfect choice for you.

Key Skills

- Broad knowledge of different fields of science
- Knowledge of national and international science policy
- Interpersonal skills
- Communication skills, both written and oral
- Analytical skills
- Time Management
- Multi tasking
- Patience, diplomacy, persuasion and negotiating skills

Key Responsibilities

- Collecting information, assessing data, analysing problems, suggesting solutions and presenting the same in simple language which would be understandable for non-scientists
- Coordinating with expert committee members, scientists, and stakeholders such as clinicians, farmers, public, non governmental organisations, etc.
- Conducting brainstorming sessions, seminars, conferences, expert committee meetings, etc.
- Writing status reports, identifying priority areas, formulating projects, evaluating projects
- Communicating science to the general public, scientific audience, bureaucrats, politicians

Sample Job Titles

(Senior) Science Policy Analyst, Public Health Analyst, Director of Science

Policy, Public Affairs Director, Program Officer, Health Science Policy Analyst, Public Health Analyst, Scientific Program Analyst, Science and Technology Policy Analyst, Policy Analyst Manager, Director of Public Policy and Government Affairs, Advocate, Administrator, Health Policy Advisor, Scientific Program Analyst, Policy Specialist, Government Relations Manager, Director, Research Programs Advocacy, etc.

Potential Employers *

Science academies such as Indian National Academy of Science, New Delhi, National Academy of Sciences, Allahabad, Indian Academy of Sciences, Bangalore Govt. science departments like Department of Science & Technology, Department of Biotechnology, Ministry of Environment & Forests, Indian Council for Agricultural Research, Indian Council for Medical Research, Department of Industrial Promotion & Policy, DST-Center for Policy Research, Indian Institute of Science, Bangalore, DBT-Wellcome Trust India Alliance, Non-Governmental Organisations

Training

- Training and workshops in science, technology and innovation policy by UNESCO - *http://www.unesco.org/new/en/natural-sciences/science-technology/sti-systems-and-governance/capacity-development-in-sti-policy/training-and-workshops-in-sti-policy/*
- Participate in GO-SPIN - UNESCO - *https://en.unesco.org/go-spin/participate*
- Capacity Development in STI Policy | United Nations ... - Unesco - *http://www.unesco.org/new/en/natural-sciences/science-technology/sti-systems-and-governance/*
- Courses & Workshops - EMBO - *http://www.embo.org/funding-awards/courses-workshops/34-funding-awards/young-investigators*
- Research integrity - EMBO - *http://embo.org/science-policy/research-integrity*
- Workshops - EMBO -
- Science Policy Bootcamp — MIT Science Policy Initiative - *https://mitspi.squarespace.com/bootcamp*
- Workshop on Framing Evidence-based Science Policy - IndiaBioscience - *https://indiabioscience.org/events*

Suggested Further Reading

- **Chris Woolston. 2016.** Science advocacy: Get involved. **Nature 540: 611-612.**
- **Norma Betheke, Paul Gellert & Joachim Seybold. 2018.** Encourage early-career scientists to shape policy. **Nature 562 : 344.**
- The science of science advocacy. The Scientist magazine.- *https://www.the-scientist.com/news-opinion/the-science-of-science-advocacy-31850*
- An introduction to achieving policy impact for early career researchers- *https://www.nature.com/articles/s41599-018-0144-2*
- Help to shape policy with your science - Nature - *https://www.nature.com/articles/d41586-018-06038-4*
- Career option series: Science policy. OITE careers blog. - *https://oitecareersblog.od.nih.gov/2015/12/10/career-options-series-science-policy/*
- Science Policy Forum -IndiaBioscience - *https://indiabioscience.org*

3.3.9. Specialized Services

Specialised services provide an ecosystem with sophisticated instruments, facilities, trained manpower and reagents to facilitate researchers in conducting experiments in a cost effective manner.

3.3.9.1. Core Facility Management

Core facilities are centralised technology-based laboratories with shared research resources that provide access to sophisticated instruments, technologies, services as well as expert consultation. These core facilities are highly beneficial to researchers and start-up companies as they can get access to sophisticated, expensive equipment by paying nominal charges. Core facilities such as next generation sequencing, flow cytometry, mass spectrometry, FT-NMR, animal imaging laboratory, genomics, proteomics are established within research institutions by funding agencies to ensure optimum usage and democratise access to expensive resources given that these facilities cannot be provided at each university or institution. Sometimes, core facilities are also established by business houses to provide paid services to clients. The facilities have dedicated personnel and equipment and provide access to cutting-edge instrumentation. They serve as service and training centres for the research community. Core facilities are expected to recover a portion of their cost by charging their users and generally, institutional core facilities charge nominal rates from students and researchers and higher rates from commercial organizations.

If you like tinkering with technology and have a knack for working with sophisticated instruments, then working at core facility could be a suitable choice for you. You will be expected to understand the importance of customer interactions and should be comfortable with providing services. As a core facility director/ manager, you will be expected to determine what new technology/equipment to buy or upgrade, learn how to operate and maintain the same, oversee marketing, advertising, training etc. and understand the research needs of your clients. To get insights into new technologies, you will need to interact with clients and vendors, as well as study online resources. You will need to build networks with researchers in research institutions as well as R&D and marketing teams in technology companies You will have to learn to run an efficient, business-based model to market your services and expand your customer base by drawing new users. Customer service and project management skills are crucial to core lab scientists. At present, the market for core laboratory services is growing rapidly.

Key Skills

- Technical competence in handling and maintaining sophisticated equipment
- Proficiency in lab management
- Oral and written communication skills
- Experience in customer oriented service facility
- Time management and adhering to deadlines
- Accuracy, efficiency and cost - effectiveness

Key Responsibilities

- Working with the director of the institution to promote a collaborative research environment and deliver efficient service to users
- Managing and operating core facilities and serving as a focal point for equipment repair, maintenance, replacement
- Implementing operational modifications to improve accuracy, efficiency and cost-effectiveness
- Assessing needs of customers and latest developments in the field in order to develop new services and technologies to assist users and phase out obsolete equipment
- Overseeing administrative functions such as budgeting, user charges fixation, revision, etc.
- Promoting core services and its functions to potential stakeholders to expand the customer base
- Providing services and organising training workshops for researchers
- Negotiating with vendors for pricing of equipment/reagents/spare parts

Sample Job Titles

Core Facility Manager, Research Manager, Core Facility Director, Research Core Facility Director, Research Technologist, Research Technician

Potential Employers *

Regional Sophisticated Instrumentation Centres set up by Department of Science & Technology, Infrastructural facilities like National Centre for Microbial Resource (NCMR), NCCS, Pune , Microbial Type Culture Collection (MTCC), IMTECH, Chandigarh, Flow Cytometry and Imaging Facility at ILS, Bhubaneswar, Biotechnology Core Instrumentation Facility (BTCIF) at TIDCO Centre for Life Sciences, Biosafety Facility (level 3) for Tuberculosis Research, University of Delhi South Campus (UDSC), Delhi, Biotech Incubators/Parks set up by Department of Biotechnology, Biotechnology Industrial Research and Assistance Council (BIRAC), Gene Bank at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, etc.
Core facilities created by Companies

Training

- International Training Courses for Core Facility Staff | Euro-BioImaging - *http://www.eurobioimaging.eu/content-page/international-training-courses-core-facility-staff*
- International Training Courses for Core Facility Staff | Global BioImaging - *https://www.globalbioimaging.org/*

international-training-courses-for-core-facility-staff

- Leadership and Management in Core Facilities, Short Course - *https://www.shortcoursesportal.com/studies/84103/leadership-and-management-in-core-facilities.html*

Suggested Further Reading

- **Julie Gould. 2015.** Core facilities: Shared support. **Nature 519: 495-496.**
- Institutional core facilities: prerequisite for breakthroughs in the life sciences. - *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4967956/*
- Building a Sustainable Portfolio of Core Facilities: a Case Study -https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6078059/
- Metrics for Success: Strategies for Enabling Core Facility Performance and Assessing Outcomes - *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4736753/*
- Best Practices for Core Facilities: Handling External Customers - *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3605920/*
- A Framework for Managing Core Facilities within the Research Enterprise - *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2729482/*

3.3.9.2. Career in Bioinformatics

Bioinformaticians develop systems to collect data, develop algorithms, and use specialized computer software to process and analyse data and genetic information and design databases. They also study and analyse publicly accessible, commercial and proprietary genomic, proteomic or post-genomic databases for clinical or basic research purposes. They develop new software applications or customize existing applications to meet specific scientific needs. They compile data for use in fields such as gene expression profiling, genome annotation and structural bioinformatics. They work with other researchers to analyse problems, recommend technology based solutions, and devise computational strategies. If you have a thorough understanding of biology and are familiar with statistical and computational tools, then you could explore a career as a bioinformatics specialist.

Key Skills

- Knowledge of programming languages – Python, R, Matlab, Perl, Ruby, SAS etc. and specialised software for different applications
- Good communication skills
- Multitasking and project management
- Working knowledge of biology/genomics
- Data analysis and visualization

Key Responsibilities

- Programming, statistical modelling
- Creating of data algorithms and specialised software to identify, classify and analyse components of biological systems
- Consulting with scientists and researchers, maintaining laboratory documents and analysing data sets

Specializations

- Sequence analysis
- Gene and protein expression
- Structural bioinformatics
- Network/systems biology
- Software development
- Database management/programming

Sample Job Titles

Data Analyst, Systems Analyst, Bioinformatics Analyst, Bioinformatics Associate, Software Developer, Biostatistician/Bioinformatician, Computational Biologist, Bioinformatics/ Staff Scientist, Research Assistant/ Associate, Biologics Database Programmer, Computer Analyst, Molecular Modelling Assistant, Post-doctoral Fellow, Research Scientist, Senior Scientist, Professor/Assistant Professor, Computational Genomics Specialist, Bioinformatics Specialist

Potential Employers *

Universities/IITs/IISERs, Research Institutions, Pharmaceutical Companies, Information Technology (IT) service provider, Biotechnology Companies, Scientific Departments in Government such as Department of Science & Technology, Department of Biotechnology, Department of Scientific & Industrial Research, National Informatics Centre

Bioinformatics Companies: Accelrys Software Solution Pvt. Ltd., Bangalore, Premier Biosoft India Pvt. Ltd., Indore, Bigtec Pvt. Ltd., Bangalore, Bijam Biosciences Pvt. Ltd., Hyderabad, Bioimagene India Pvt. Ltd., Mumbai, Biobase Databases India Pvt. Ltd., Bangalore, CLC Bio India, Hyderabad, Genotypic Technology, Bangalore, Jubilant Life Sciences, Noida, Ocimum Biosolutions, Hyderabad, Siri Technologies, Bangalore.

Training

- MSc Bioinformatics
- PhD Bioinformatics
- BTech/MTech Biotechnology, Bioinformatics

Relevant Online Courses

- Online Bioinformatics Courses | edX- *https://www.edx.org/learn/bioinformatics*
- Online Courses in Bioinformatics - *http://www.iscb.org/online-courses*
- Bioinformatics Online Courses *-https://www.coursera.org/browse/health/bioinformatics*

Suggested Further Reading

- Your passport to a career in bioinformatics. - *https://www.springer.com/gp/book/9788132211624*
- Careers in Bioinformatics

- International Society for Computational Biology - *https://www.iscb.org/bioinformatics-resources-for-high-schools/careers-in-bioinformatics*
- Will a masters in bioinformatics help me in getting a job.- *https://www.biostars.org/p/7086/*
- How should I start my career in bioinformatics??? - Biostars - *https://www.biostars.org/p/230095/*
- Career option series:Bioinformatics. OITE careers blog. - *https://oitecareersblog.wordpress.com/2016/05/23/career-options-series-bioinformatics/*

3.3.9.3. Career in Big Data Science

Big data plays a very important role in driving decisions, innovation and productivity. It is used in areas as diverse as analysing sequence genomes, creating new combinations of pharmaceutical compounds, performing predictive diagnosis, environmental monitoring, analysing social media trends to formulate election strategy, evaluating meteorological data for predicting weather, analysing retail data to drive sales etc. An in-depth understanding of data science and techniques for analysis of quantitative and qualitative data to identify patterns and predict trends is necessary for success in this field. Previously, business managers used to rely on their experience, intuition, and instinct to make decisions. Nowadays, in the era of big data, quantitative methods used by operation analysts and economists provide strong evidence to guide management decisions on production, distribution, marketing and personnel management and also help in adjusting business strategies based on future predictions. Data mining, which uses a combination of statistical and computer programming skills, can also allow retailers to understand purchase patterns of customers.

The field of data science is not new as computational biologists/chemists, bioinformatics experts, and geographers have been using computational approaches to make sense of scientifically-relevant data for a long time. However, exponential rise in smartphones and internet use has led to an exponential increase in demand for trained personnel who can use computational approaches and power to efficiently use and analyze large amounts of data.

A significant portion of the demand for data analysis can be attributed to clinically relevant sources. In the last two decades, advances in scientific tools and techniques have increased the volume of data and knowledge within the biomedical enterprise. Hence, we need scientists who can integrate their scientific background and interests with computational tools and approaches to tackle these vast databases. If you have an understanding of statistical principles and programming and would like to use your knowledge to analyse large volumes of data, you could

consider a career in big data science. This is an emerging field and offers tremendous opportunities.

Key Skills

- Understanding of mathematical and statistical approaches (machine and deep learning)
- Programming ability (python, R, SAS, Matlab, SQL, Spark etc)
- Basic knowledge of computer architecture
- Data visualisation
- Data acquisition, analysis and management, simulation and modelling
- Business analytics and data mining
- Effective communication skills

Key Responsibilities

- Collecting, generating, extracting, analysing and/or visualizing data
- Interpreting data to provide actionable inputs
- Developing computational tools

Sample Job Titles

Data scientist, Data analyst, Database Specialist, Data and Analytics manager, Data management, Database administrator, Data architect, Data engineer, Machine learning engineer.

Potential Employers *

Ocimum Biosolutions (India) Ltd., Hyderabad, Strand Life Sciences Pvt. Ltd., Bangalore, Jubilant Biosys Ltd., Bangalore, QBURST, Trivendrum, Prismetric, Ahmedabad, Fullestop, Jaipur, Softweb solutions, Ahmedabad, Simform, Ahmedabad, Orangemantra, Gurgaon, Loginworks Softwares Pvt. Ltd., Noida, Classic Informatics Pvt. Ltd., Chandigarh

Training

Relevant Online Courses

- Big Data, Genes, and Medicine - *https://www.coursera.org/learn/data-genes-medicine*
- Applied Data Science with Python- *https://www.coursera.org/specializations/data-science-python*
- Genomic Data Science- *https://www.coursera.org/specializations/genomic-data-science*
- Data Science Math Skills - *https://www.coursera.org/learn/datasciencemathskills*
- Python for Genomic Data Science- *https://www.coursera.org/learn/python-genomics*
- Statistics for Genomic Data Science- *https://www.coursera.org/learn/statistical-genomics*

Suggested Further Reading

- Considering a career in biomedical data science? What you need to consider. OITE careers blog. -https://oitecareersblog.od.nih.gov/2017/12/04/considering-a-career-in-biomedical-data-science-what-you-need-to-consider/

- 9 Must-have skills you need to become a Data Scientist,updated - *https://www.kdnuggets.com/2018/05/simplilearn-9-must-have-skills-data-scientist.html*
- What Skills Do I Need to Become a Data Scientist? - Simplilearn - - *https://www.simplilearn.com/what-skills-do-i-need-to-become-a-data-scientist-article*
- What is Data Science? 8 Skills That Will Get You Hired in Data | Udacity- *https://blog.udacity.com/2014/11/data-science-job-skills.html*
- 10 Skills To Master For Becoming A Data Scientist | Edureka - *https://www.edureka.co/blog/how-to-become-a-data-scientist/*
- Skills for Every Data Scientist - Master's in Data Science - *https://www.mastersindatascience.org/data-scientist-skills/*
- The Most in Demand Skills for Data Scientists - Towards Data Science- *https://towardsdatascience.com/the-most-in-demand-skills-for-data-scientists-4a4a8db896db*
- What are the Skills Needed to Become a Data Scientist in 2018 - *https://towardsdatascience.com/what-are-the-skills-needed-to-become-a-data-scientist-in-2018-d037012f1db2*

3.3.9.4. Clinical Trials Management

Science students who are involved in preclinical research for new innovations in medical research generally have a limited knowledge about the long and stringent clinical trials process and the regulatory approvals required for commercialization of such new innovations. If you are interested in taking a project to a logical conclusion and commercializing a new advancement, are familiar with regulatory processes, have patience, perseverance, and excellent communication skills, and are willing to coordinate with different departments and regulatory agencies, a career in clinical trials management may be right for you.

As a clinical trials manager, you have to recruit the appropriate number of volunteers, get consent forms signed, write protocols for studies, create clinical research forms and other key documents used to collect clinical data, as well as obtain approval of ethical boards. You have to ensure the smooth functioning and monitoring of clinical trials while complying with regulatory guidelines. Correct interpretation of data and early and accurate corrective measures are crucial for clinical trials. Proficiency in communication, efficient coordination and strong interpersonal skills come very handy for this role.

Clinical trials managers are involved in a range of activities and services like discovery of new drug molecules, formulation R&D to develop new formulations of existing drugs, project management, monitoring of clinical trials, testing safety of drugs, collaborating

with technical/ medical writers to develop appropriate content, ensuring that regulatory guidelines are followed accurately, etc.

Timely completion of clinical trials holds the key to getting regulatory approval as delays result in huge financial losses and can lead to rejection. Hence, time management and coordination with all team members is essential in this assignment. Since clinical trials are held at multiple locations, you will be required to travel and interact with people from diverse socio-economic, linguistic and cultural backgrounds and oversee clinical trials. You will also be expected to train clinical research associates, data management professionals and educate regulatory officials, bureaucrats and politicians about the potential of your product and its advantages over the current products in simple language so as to facilitate getting timely approvals.

Clinical trial Managers are hired by major research hospitals, contract or clinical research organizations and major pharmaceutical companies. Knowledge about patents due to expire soon and taking timely action for developing and expediting commercialisation of new drugs could help a company in capturing market shares. Contract research organizations offer support for pre-clinical and clinical (Phase I to IV) studies as well as provide post-marketing activities to pharma companies, biotech enterprises and universities and research hospitals and institutions.

Due to difficulties and delays in getting necessary clinical trial approvals due to public perception about non-ethical conduct of trials and compensation issues, CROs in India have suffered. Hopefully, correct and quick policy measures will be taken up so that a sector in which Indian companies have shown leadership and which has the potential to employ a large number of students does not suffer.

Key Skills

- Knowledge of subject area and regulatory requirements
- Interpersonal skills
- Proficiency in communication and coordination
- Documentation skills
- Analytical skills and data interpretation
- Negotiation and networking
- Time management

Key Responsibilities

- Planning, conducting and overseeing clinical trials using good clinical practices, preparation of protocols
- Obtaining approvals for trials from ethics committee and ensuring conduct of trials as per prevailing regulations
- Recruiting volunteers, getting consent forms signed, ensuring safety
- Determining whether the product accomplishes the goal for which it was produced
- Monitoring trial progress to ensure compliance with and adherence to project plan and to identify, evaluate and rectify problems

- Managing trial budgets and maintenance of accounts
- Coordinating with different departments and prepare regulations for clinical trial activities and ensure compliance
- Adhering to time-frame and maintain accuracy in process

Sample Job Titles

Clinical Research Coordinator, Clinical Research Scientist, Clinical Research Analyst, Clinical Research Associate, Clinical Trial Monitor, Clinical Research Consultant, Clinical Quality Assurance Auditor, Clinical Safety Analyst, Medical Writer, Biostatistician, Data Manager, Research Assistant, Regulatory Coordinator, Regulatory Specialist, Senior Regulatory Associate, Clinical Trial Management System Manager, Senior Business Development Associate, Senior Quality Assurance Specialist, Patent Recruitment Specialist, Administrator Clinical Systems Information

Potential Employers *

Contract Research Organizations (CRO)
Quintiles- Global CRO with offices in Bangalore, Ahmedabad, Mumbai, New Delhi: PPD- Gurgaon, Bangalore, Mumbai Paraxel- Hyderabad, Bangalore, Delhi, Mumbai, Gurgaon, Chandigarh

Indian CROs: Siro Clinpharm, Mumbai, GVK Bio, Hyderabad, Bangalore, Gurgaon, Mumbai, Ahmedabad, Clininvent, Mumbai, CliniRX Tangent Research India Pvt. Ltd., Chennai, Navitas Life Sciences, Mumbai, Manas Clinical Research Pvt. Ltd., Vadodara

Pharmaceutical Companies:
Accenture India, New Delhi, Pfizer, Aurangabad, Panacea, New Delhi, SRL Diagnostics, Gurugram, Serum Institute, Pune, Cadilla Healthcare Ltd., Ahmedabad, Jubilant Life Sciences Pvt. Ltd., Noida, Eli Lilly and Co., Gurugram, Avesthagen, Bengaluru, Sanofi Aventis, Mumbai

Biotechnology Companies *(Pl. refer 3.3.1.1.)*

Training

- Professional Diploma in Clinical Trial Management - *https://www.jli.edu.in/course/professional-diploma-in-clinical-trial-management/*
- Global Institute of Health Science - Clinical Trials Management Training *https://www.gihsonline.com/clinical-trials-management/*
- Postgraduate Certificate in Clinical Trial Management - *https://parexel-academy.com/en/fortbildungen/postgraduate-certificate-in-clinical-trial-management/*
- Clinical Trials Management Certificate | UChicago Graham - *https://grahamschool.uchicago.edu/academic-programs/professional-development/clinical-trials*

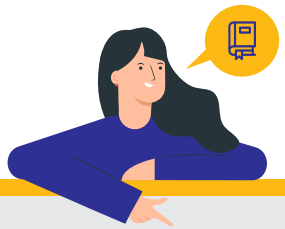
Suggested Further Reading

- 4 Essential Skills for Clinical Trial Project Managers - Forte Research - *https://forteresearch.com/news/4-essential-skills-ideal-clinical-trial-project-manager/*

- 8 Must-Have Competencies for the Clinical Research Professional *- https://forteresearch.com/news/8-must-competencies-clinical-research-professional/*
- Top Skills for Clinical Research Associates (CRA) and Coordinators *...- https://clinicaltrialpodcast.com/25-soft-skills-to-boost-your-clinical-research-career/*
- Top 3 Skills For Clinical Trial Project Manager | Applied Clinical Trials*-http://www.appliedclinicaltrialsonline.com/top-3-skills-clinical-trial-project-manager*
- How to get a clinical project manager job | Proclinical blogs*- https://www.proclinical.com/blogs/2015-12/how-to-get-a-clinical-project-manager-job*
- A career in clinical research | New Scientist Jobs*- https://jobs.newscientist.com/en-gb/article/a-career-in-clinical-research/*

3.4. Conclusion

In this chapter, we have discussed various academic and non-academic career options for life science and biotechnology students. For each career option, we have included details such as key skills, key responsibilities, job titles, training required, courses available, potential employers, and references for further reading. We believe that this will help students arrive at a decision about probable career choice(s) and take appropriate action, for e.g. trying to acquire the necessary training and requisite skills for that career path. From many years of experience based on interactions with students, we have seen that students first acquire qualifications and then start exploring career choices. We strongly feel that it should be the other way round and hence, we will discuss options for higher education in India in the next chapter. However, if you have already obtained your educational qualifications (like UG, PG, PhD and postdoc), the current chapter as well as Chapter 2 should enable you to formulate a strategy for making a suitable career choice, attaining a desirable position, and achieving excellence in whichever path you choose.



Academic Careers

- *Faculty in Colleges, Universities, and Autonomous Research Institutes*
- *Scientist in Research Institutions*

Non-academic Careers

Jobs in Industry

- *Research & Development*
- *Product Management*
- *Quality Control and Quality Assurance Management*
- *Human Resource (HR) Management*
- *Technical Sales and Marketing*
- *Technical Writing*
- *Consultancy, Business Development & Equity Research*

Bioentrepreneurship

Intellectual Property Rights

Technology Transfer

Regulatory Management

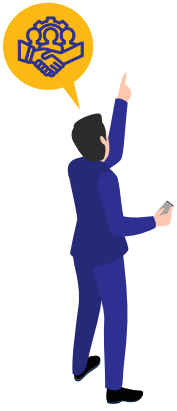
Science Communication & Public Outreach

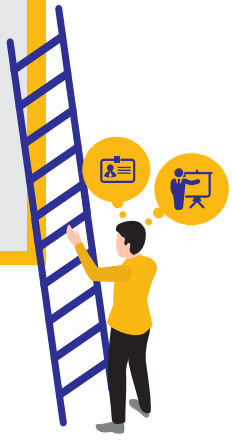
Science Management & Administration

Science Public Policy

Specialized Services

- *Core Facility Management*
- *Bioinformatics*
- *Career in Big Data Science*
- *Clinical Trials Management*





Career Options

04

Selecting an Appropriate Course and Institute

04

Selecting an Appropriate Course and Institute

Crucial decisions like which subjects to major in during undergraduate/postgraduate education can have long lasting effects on your career goals and hence, should be well thought out. I am sure when you opted for the science stream in Class XI, you considered your interest, aptitude, capability and so on. However, after completion of 10+2, you may be better equipped with practical experience and maturity and may like to carefully consider your decision (in consultation with your well-wishers), keeping in mind some important factors such as your interest and passion, availability of courses, career options you are interested in, number of years you'll need to devote to higher education according to the career path you have chosen, etc.

It may be useful to take help and get psychometric testing done to analyse your personality and shortlist courses and careers suited to the same. Psychometric tests are standard scientific tests which measure an individual's mental capabilities, intelligence, personality, skills and behavioral style. These can also test specific skills like verbal, numerical and diagrammatic reasoning. Thus, they can give you clues about the suitability of a particular course or job role based on your aptitude and cognitive abilities.

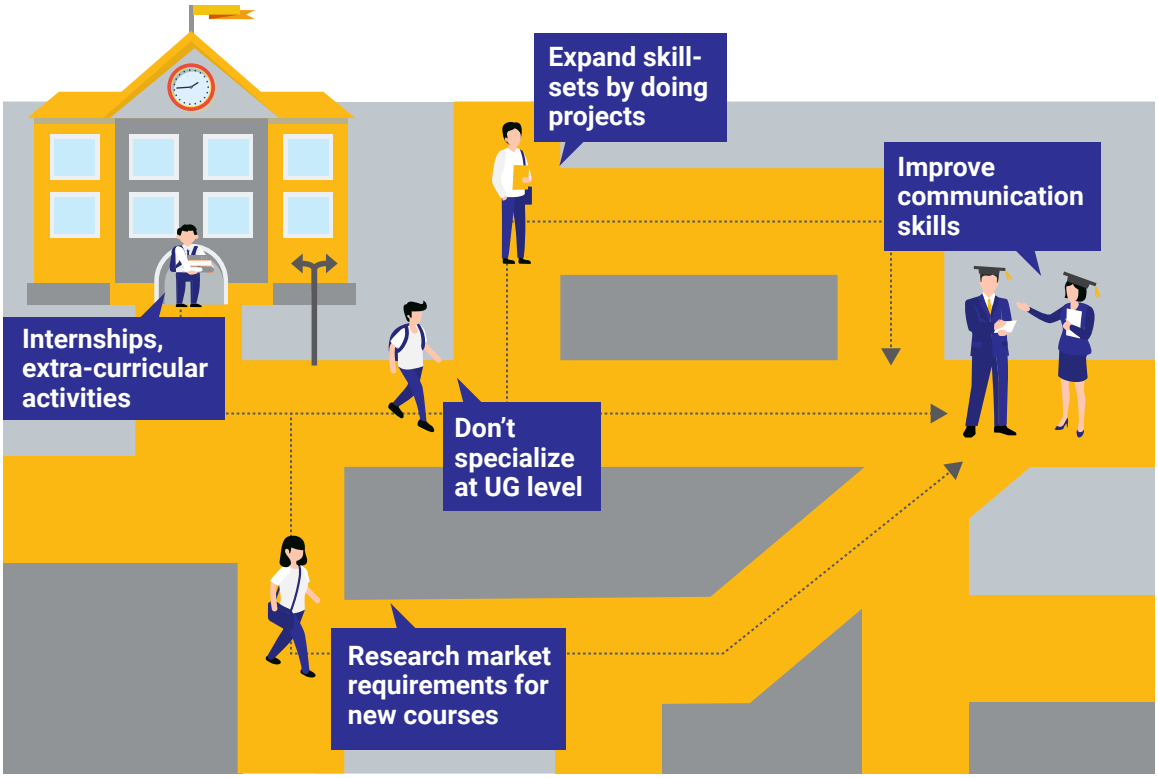
It may also be worthwhile to consult a professional career counsellor who can facilitate decision-making by informing you about suitable career options. They can also help you develop a contingency plan, in case your first preference doesn't work out. Career counsellors are equipped to offer professional advice keeping your personality, educational background, interests, and immediate and long term career goals in mind .

Sometimes, you may need to opt for a course which was not your first preference. This is all right. Do not waste time over a lost opportunity and move on. For example, students who wish to pursue medicine or engineering often make multiple attempts at these entrance exams, and only opt for pure science streams once these options are exhausted. However, this loss of time can be disadvantageous as several fellowships have age-restrictions. My advice, therefore, is to be realistic and practical. Since time is crucial, try not to delay taking these decisions.

At times, you may have to make compromises while selecting courses, or choosing a college or university due to financial, familial, or geographic restrictions. Just remember not to make this decision casually and arbitrarily, since a thoughtless decision may lead you to be stuck in a field which you do not like and are not passionate about. Understand and take responsibility for this decision, as it will involve the next several important years of your life and play a significant role in your happiness in your chosen career.

In the absence of proper guidance and lack of maturity or experience, students often first acquire educational qualifications and then start looking for jobs to match said qualifications. We feel that career decisions should be informed choices based on your interests and passion, and accordingly, you should acquire educational qualifications and experience to convert your dream into reality. Therefore, in this book, we have tried to first inform you about different career options available for life science students in India (Chapter 3). Based on which of these options you are interested in and the skill-sets needed for the same, you should plan how to attain these qualifications and empower yourself to succeed in a field of your choice.

In this chapter, we shall discuss broad guiding principles to be kept in mind while deciding which course to pursue, which subjects/courses to take up, which colleges/university to apply to, where to do internships and how and when to apply. All of these decisions revolve around what you want to do after attaining a degree, including studying further or entering a job immediately.



A few golden principles you should keep in mind are:

1. Try not to specialize too much at the undergraduate level as it may narrow your options. As an example, it may be easier for someone with a BSc in Life Sciences or even BSc Botany or Zoology (Hons.) to find a teaching job in biology at a school, than someone with a BSc in Biotechnology as very few schools may be offering biotechnology while all schools with a science option offer biology. Similarly, as per the present educational structure at most Universities, BSc (Life Sciences) students have more options for MSc courses (e.g. biochemistry, microbiology, genetics, plant molecular biology, botany, zoology, biotechnology, etc.), but students with an undergraduate degree in biotechnology may not be eligible for MSc botany or zoology at many places.

In addition, specialization at undergraduate or postgraduate levels may not necessarily give you any added advantage while applying for jobs. Many biotech companies may prefer candidates who have an MSc in Biotechnology as compared to specialized degrees such as marine biotechnology or bioresource biotechnology. Domain knowledge in a narrow discipline will be advantageous only if you are very sure of continuing in that field post completion of your degree. Otherwise, this may actually reduce your opportunities (e.g. a student with a specialized degree in Bio-pharma may not be suitable for Agri-biotech companies). Also, keep in mind that colleges/universities often initiate new courses based on the availability of funding and in-house expertise and not necessarily based on demand and supply of trained manpower in that field. Keep all of these factors in mind while selecting a course.

2. Do not get carried away by the hype created when a new course is offered at a college or a university. First research the market requirements for that course, job availability and placement, availability of faculty expertise to deliver the course content, etc. At times, such courses end up serving old wine in a new bottle by simply renaming existing courses without any change in core content or structure.

3. Try to expand your skill-sets and experience by taking up projects, internships etc. while in college or university.

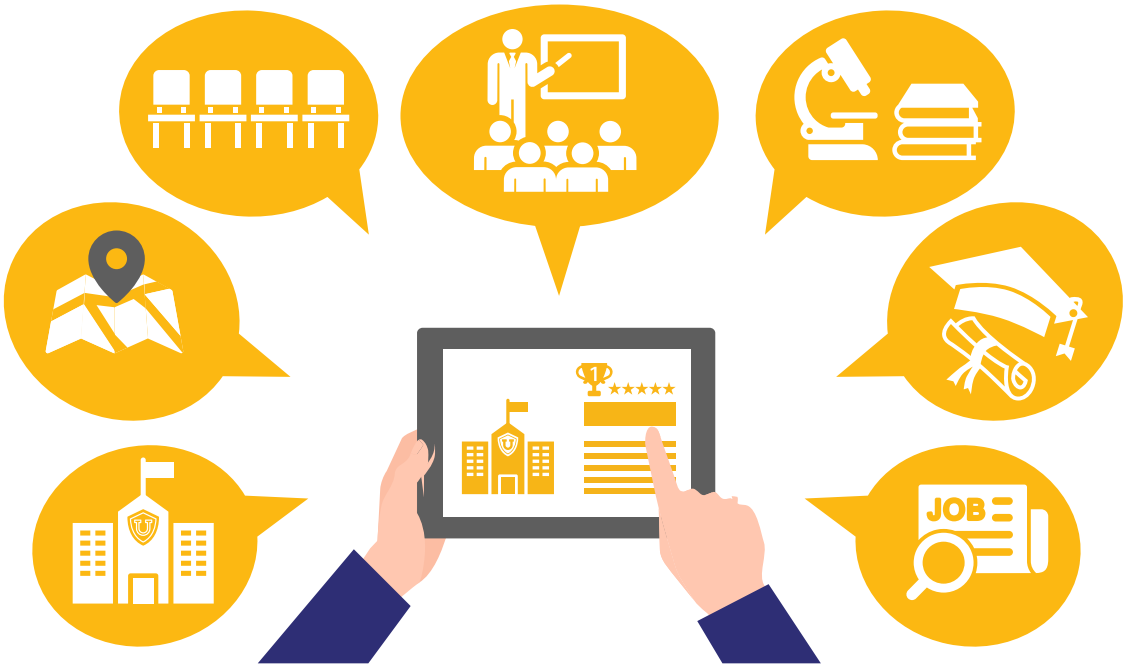
4. Actively participate in extracurricular activities like college festivals, college magazines, journal clubs, etc. These experiences will be invaluable and help you build your network, improve your communication skills, and gain confidence.

Remember that 'one size does not fit all'. Do not follow the herd-mentality and enter a rat-race blindly without understanding your own strengths and interests. Do not join a course or a college just because your friends or all the "good students" are taking admission there. Since this is one of the first major decisions of your life and may play an important role in your future success and happiness, give it due time and consideration. Make a well-informed decision after considering your interest, aptitude and understanding, and do not hesitate to take professional help if you have any doubts. Once you have made an initial decision about which course you would like to pursue, try to look at the course content and talk to a few senior students pursuing that course before arriving at a final decision.

4.1. Selecting a College or a University

Once you have an idea of which course you would like to pursue, the next major important decision you will need to make is which college or university to apply to. You should look at the website of the college(s) you are proposing to join and carefully compile some relevant information. Some of the details you should look at are: number of teachers, their educational background, number of students, student-teacher ratio, laboratory and library facilities, alumni placements, etc. Also try to find out the usual cut-off percentage at the time of admission in the course of your interest, drop-out rates, previous year's results etc.

Based on this data, do a realistic evaluation of your chance of securing an admission and shortlist a few colleges. It may also be worthwhile to look at the rankings of these colleges by various national surveys, e.g. those conducted by India Today *(https://www.indiatoday.in)*, Outlook *(https://www.outlookindia.com)*, National Assessment & Accreditation Council (NAAC) *(www.naac.gov.in)*, National Institute Ranking Framework (NIRF) *(https://www.nirfindia.org)* etc. Check whether the college is private/government/autonomous/



university-affiliated etc. and whether it is legally recognized for providing valid degrees.

It can help if you prepare a table with details like important deadlines, documents required for admission etc. for each of your shortlisted colleges. Make sure your application is complete in all respects and that you submit it in a timely manner and promptly appear for subsequent interviews/counselling, if any. You must also keep your contingency plan ready, in case you do not succeed in securing admission in the course/college of your choice.

Sometimes, you may secure admission in your desired institute, but not in the course that is your first preference. Or you may get selected for a course of your choice, but in an institute that is not your first choice. Here, you may need to make a hard decision of whether you should go for your desired subject or your desired institute. Weigh the pros and cons of both alternatives before arriving at a final decision as choice of subject as well as the reputation of the institute are both very important and crucial factors. Assign relative weightage to both factors, talk to seniors who might have faced similar situations as well as to the faculty of both institutes, and consider carefully your strengths, requirements and expectations, before taking a final call.

Once you have secured admission in a course of your choice in a good institution, please make whole-hearted efforts to acquire as much knowledge, experience and skills as possible in these 2-4 years. Be proactive and participative.

Try to do projects and internships during summers or winters. Summer projects in research institutes can give you much needed exposure on the basics of scientific methods. Some of the things you can learn from projects are how to choose a scientific problem, how to design experiments and analyse results, how to use correct controls, how to determine sample size, how to conduct literature reviews, how to prepare project reports, etc. You may also get a chance to engage in troubleshooting and understanding why something did or didn't work - a valuable skill for any potential career. You may learn how to deal with real data and ambiguity, how to critically analyse existing literature, and how to interpret results. This exposure will help you decide whether or not you would like to pursue research at a later date and this experience will add value to your CV. It has been observed that larger numbers of students who have had undergraduate research exposure, go on to pursue PhDs.

Try to maximise your learning by attending lectures by eminent scientists and taking online courses in related and relevant fields. As per your interest, try to take courses in management, intellectual property regulation, science communication, etc. offered by sister departments in your institute or nearby institutes. Learn as many techniques as possible and lay a lot of emphasis on practical training. While pursuing your degree, if you realize that you are not enjoying this course and your interest and true passion lies somewhere else, and you decide to switch trajectories, try to make this decision as early as possible.

4.1.1. Role of Teachers

When you decide on a college or institute, try to collect important data about teachers, their educational background, teaching methodology they use, how updated they are with modern teaching methods (as they may have acquired their qualification long time ago), and so on as teachers play a very important role in shaping the future of their students. The following few paragraphs will help you in shortlisting a good institute on the basis of in-house faculty.

The best teachers are those who cite real life examples and make biology relevant by presenting problems in a real life context, who stimulate curiosity in students, who demonstrate their passion for the discipline and who take joy in sharing their understanding of the world with their students. Good teachers introduce students to scientific inquiry, the use of evidence, and the core biology concepts that will help students to apply knowledge and make informed decisions about biology-related problems in their lives. Thus, teachers have a unique opportunity and responsibility to ensure that all students gain a basic understanding of science as a way to learn about the natural world.

Undergraduate teachers face unique challenges as students come from diverse social, economic and ethnic backgrounds.

The number of students in each class is large, the teachers need to finish the syllabus on time, and at the same time, strike a balance between promoting understanding of concepts and applying this knowledge in real-life situations. Teachers need to lay more emphasis on problem solving and not overload students with facts. For this, they should devise assessment tools to measure understanding of subject and ability to apply knowledge gained, rather than just testing rote-learning of factual information. Learning outcomes should include competencies to be developed, concepts to be understood, and factual knowledge to be acquired. The ideal classroom should be interactive, inquiry driven, relevant, cooperative, and collaborative.

Teachers should assess the level of knowledge and experience of their classes in the beginning of the session and accordingly devise their content. Based on frequent assessment and student feedback, faculty should identify gaps and misconceptions in student learning and formulate teaching strategies accordingly. Eventually, students should be able to think critically, ask informed and insightful questions, collect relevant information, communicate well, and work efficiently. The teacher's approach should be based on "What my students want to learn" rather than "What I want to teach".

Teachers should use a combination of different evaluation strategies such as daily interaction, quizzes, mid-semester evaluation, discussing research papers etc. They should also provide students with opportunities to engage in research. Student involvement in hands-on research helps in cultivating scientific thinking, gaining first hand experience of asking questions, designing experiments, interpreting results including unexpected outcomes, coping with failed experiments and considering alternate approaches, learning new techniques, etc.

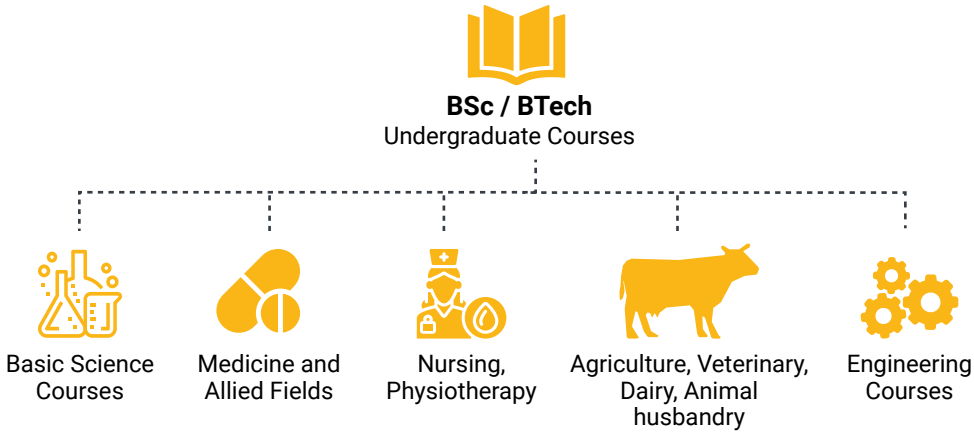
An example of a place where this strategy has been employed successfully is DBT-supported star colleges, where undergraduates who have received research experience have been observed to gain a deeper understanding of the research process and learn techniques, use of equipment, troubleshooting etc. In the beginning, teachers cited multiple reasons for not taking up project work, including insufficient training of students, lack of trained laboratory staff, lack of time due to the semester system, pressure to complete syllabus, lack of interest amongst students etc. However, gradually, this initial hesitation has been replaced by enthusiastic participation by students and teachers.

Faculty should be given ample opportunities to upgrade their knowledge and incentives to recognize and reward good teaching. For example, IISER Pune has conducted 3-tier faculty training programmes in DBT Star colleges, supported jointly by DBT and British Council. Such workshops focus on pedagogical tools and conduct training at both basic and advanced levels.

4.2. Undergraduate Courses

Students taking biology, physics, chemistry and/or mathematics at 10+2 level have multiple options and based on their interest, merit and choice of career path, they can opt for any of the courses shown in the figure below:

Once you have narrowed down your choices, please make a list of colleges offering the course, eligibility, admission process like entrance test, deadline for submitting application, recent cut-off percentages, fee structure, ranking of college, placements of earlier batches etc. and refine your choice. At the same time, try to make a realistic assessment of your chances.



4.2.1. Basic Science Courses

Students who are inquisitive, wish to find answers to fundamental questions, have keen observation skills, enjoy practical training, and are willing to pursue post graduation and research, should opt for basic science courses:

BSc in Life Sciences, Biological Sciences, Botany, Zoology (Hons.), Microbiology, Biochemistry, Biophysics, Genetics, Wild Life Biology, Forestry, Environmental Sciences, Environmental Biology, Neurobiology, Physiology, Anthropology, Food Technology, Food Science & Nutrition, Biotechnology, etc.

4.2.2. Medicine and Allied Fields

Students who have a keen interest in understanding how the human body functions or in the diagnosis of diseases and treatment, who are compassionate and willing to work long hours which would need physical and emotional strength, and who wish to reduce the suffering of patients, should opt for these courses:

MBBS (Bachelor of Medicine and Surgery), **BHA** (Bachelor of Hospital Management), **BHMS** (Bachelor of Homeopathic Medicine & Surgery), **BUMS** (Bachelor of Unani Medicine & Surgery), **BAMS** (Bachelor of Ayurvedic Medicine & Surgery), **BSMS** (Bachelor of Siddha Medicine & Sciences), **BDS** (Bachelor of Dental Sciences), **Bachelor of Physiotherapy, Diploma and Bachelors in Pharmacy** (B.Pharma), **BTech** (Pharma), **BSc Yoga Science**, **WBNYS** (Bachelor of Naturopathy and Yoga Science).

4.2.3. Nursing, Physiotherapy

Students who wish to develop competence in nursing and patient care, have compassion, attention to detail, adaptability and flexibility and are willing to work for long hours should opt for these courses:

Diploma; BSc (Hons.) Nursing, **Physiotherapy**, **Diploma in Diet and Nutrition**, **Food & Nutrition**, **Sports & Nutrition**, **Food Technology.**

4.2.4. Agriculture, Veterinary, Dairy, Animal Husbandry

Students who wish to learn about breeding new plant or livestock varieties, increasing agricultural productivity, farming practices, grain and seed processing, dairy processing, feed manufacturing, etc. should opt for these courses:

BVSc (Bachelor of Veterinary Sciences), **BVSc & AH** (Bachelor of Veterinary Sciences and Animal Husbandry), **BSc** (Agriculture, Horticulture), **Diploma in dairy Technology**, **Diploma in Animal Husbandry and Dairying.**

4.2.5. Engineering Courses

Students who enjoy mathematics and physics, are technology-savvy and wish to learn technical skills to provide solutions to practical problems should opt for engineering courses:

BTech (Biotechnology, Agriculture Engineering, Dairy Technology, Chemical Engineering, Polymer Engineering, Textile Engineering, Biomedical Engineering, Marine Engineering, Medical Electronics Engineering).

I would like to reiterate that you should avoid specializing at undergraduate level as it can narrow your options during post-graduation as well as while applying for jobs. It is an important decision of your life and will have a bearing on your future career choices. Hence, carry out proper research about your interests, likes and dislikes, career options for different courses, industry trends, job requirements in different sectors etc.. If you have doubts, please do not hesitate to take guidance from your teachers, professional counselors, experts.

For details of courses, eligibility, institutes/ universities offering these courses, please refer to CBSE Compendium of academic courses after +2 *(https://www.successcds.net)*

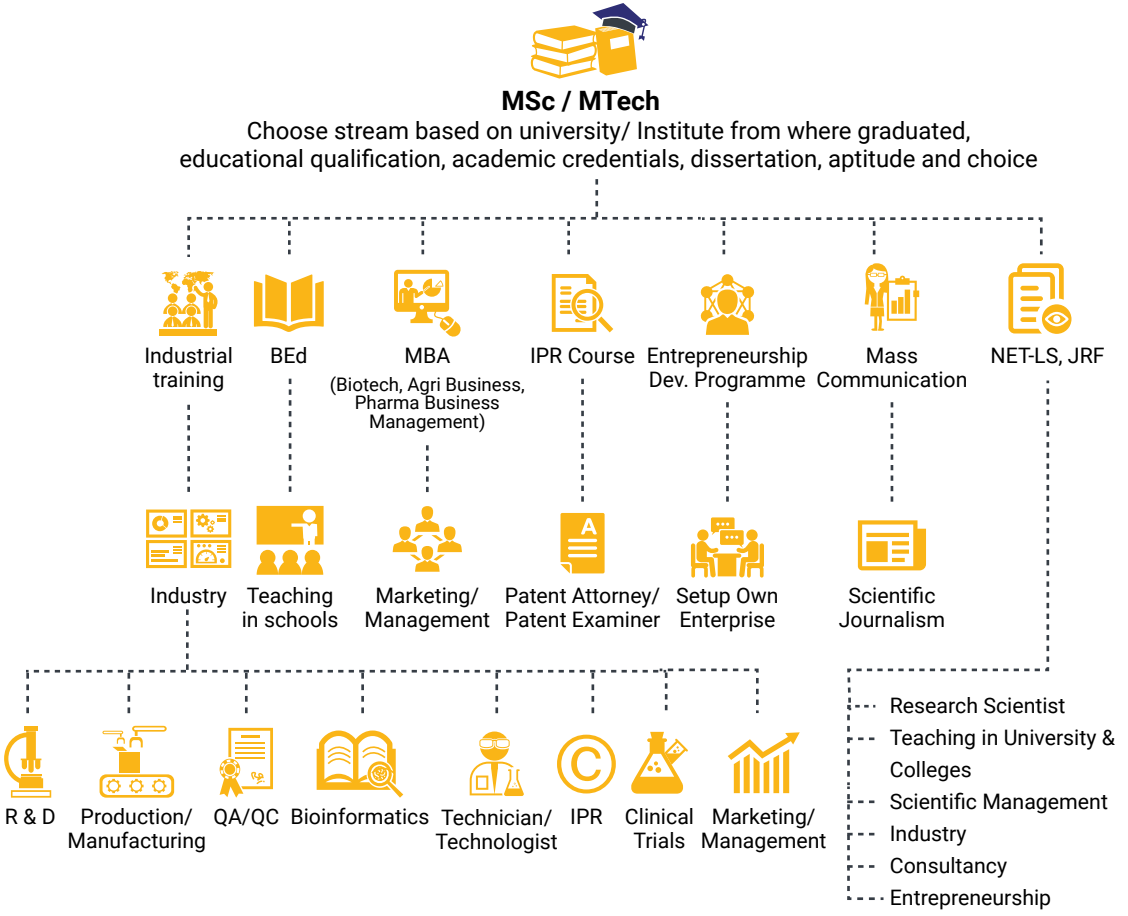
4.3. Postgraduate Courses

Many Indian universities do not allow students with an undergraduate degree in a different discipline to take up a postgraduate degree in a specialized discipline. This means that in many places, you may be eligible only for post-graduation degree in the same discipline in which you undertook your undergraduate degree. For certain interdisciplinary courses, e.g. biotechnology or bioinformatics, students with undergraduate degrees in basic science fields such as botany, zoology, microbiology, genetics, physics, chemistry, biochemistry, etc. may be eligible for admission to MSc. biotechnology but the reverse may not be possible. You must carefully select your choice for postgraduate degree based on your interests, eligibility and future career choices.

As far as possible, along with your core degree, you should try to take up additional courses in topics such as intellectual property rights (IPR), business management, or entrepreneurship development, if they are being offered by other departments of your university/ college. You can also take up online courses offered by Indian or overseas universities in the field of your interest. If you do not wish to continue post-graduation in the same field as your undergraduate studies, you can diversify

and take up courses in the field of your interest. For example, you can go for a BEd if you wish to enter teaching, an MBA if you are interested in business management, law/IPR courses if you wish to be a patent attorney, or mass communication and journalism if you wish to diversify to science communication and so on.

Several institutes like IITs, IISERs, NCBS, TIFR also run integrated MSc, integrated MTech as well as MSc by research courses, which are good options if you are considering a career in research. Admission to IITs is through the GATE-JAM (Graduate Aptitude Test in Engineering) exam. Candidates are admitted to IISERs through different channels, namely, Kishore Vaigyanik Protsahan Yojana (KVPY), State Board and Central Board. Admission to NCBS and TIFR is based on Joint Graduate Entrance Examination for Biology and Interdisciplinary Life Sciences (JGEEBILS), followed by interview of shortlisted candidates.



4.4. Opportunities for Pursuing Biotechnology Courses in India

This section will be devoted to postgraduate courses in biotechnology. There are a number of universities and affiliated colleges in India running postgraduate courses in biotechnology. Most of the postgraduate courses in biotechnology in the country have 3 semesters of coursework and one semester devoted to a dissertation or thesis. You should keep in mind the guiding principles discussed above while selecting a course and university/college and take the final decision based on your interest, course content, faculty, employability of students with this degree, and guidance by seniors, faculty, counsellors etc.

India can take pride in being one of the first few countries in the world to initiate postgraduate teaching programme in biotechnology back in 1985-86. These courses were initiated by the Department of Biotechnology (DBT) to cater to the need of trained manpower for the biotech industry as well as educational and research institutions. Universities were selected judiciously to ensure involvement of relevant science departments so as to impart multi-disciplinary teaching in biotechnology. To ensure quality of teaching and continuity of faculty after DBT withdrew its support, commitment to provide faculty salaries was obtained from state governments in case of state universities and UGC for central universities. These programmes exhibited a true culture of participative, collaborative effort to impart best quality of teaching.

To begin with, DBT-supported MSc courses in general biotechnology were initiated in 6 universities, which was later expanded to over 70 courses in general biotechnology including specialized MTech/MVSc/MSc (Ag) courses such as agricultural, medical, pharmaceutical, industrial, environmental, marine biotechnology. Details like the name of university/institute, name of degree, no. of seats, eligibility, mode of selection, course coordinator contact details for DBT-supported postgraduate teaching programmes are maintained by DBT. For most of the participating universities, students are selected through a common all-India written test conducted by the Jawaharlal Nehru University (JNU).

As biotechnology is rapidly advancing area, curriculum revision exercise is conducted every 3 to 5 years and feedback of present and past students, faculty, potential employers is taken into consideration. Based on feedback, new courses such as communication skills, IPR and regulation, statistics and latest bioinformatics tools have also been added by many universities in recent years, along with some remedial courses.

Realizing the immense potentialof bioinformatics in analyzing,recommending, predicting and designing new products, DBT has also supported PG courses in bioinformatics. However, riding on the IT-BT wave, several diploma and degree courses in bioinformatics were started without regard for maintaining the quality of training. To circumvent this problem, DBT initiated Bioinformatics certification (BINC) exam which lends credibility and ensures minimum quality to certified students. Indiscriminate expansion of biotechnology courses by public and private sector universities and their affiliated colleges and lack of common minimum standard in administering quality practical training has led to closing down of a few courses. A common certification exam based on the pattern of BINC or GRE could offer a practical solution by ensuring minimum standard.

Pune university, Amity university and Punjab University also run MBA programs in biotechnology. IIM, Ahmedabad, Lucknow, Institute of Management Studies, Banaras Hindu University, Punjab Agricultural University, Ludhiana, University of Agricultural Sciences, Bangalore offer MBA in agri-business Management. India Patent Office, Supreme Court of India and Bangalore Law College have courses on intellectual property law in distance learning mode.

Maximise Learning

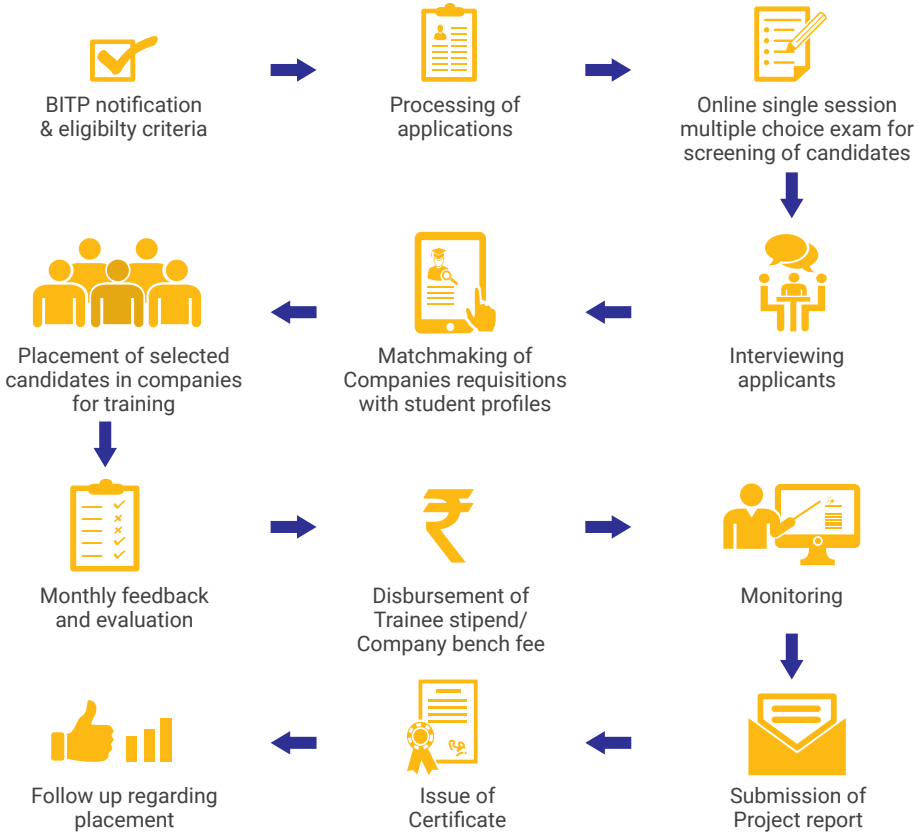
In the above sections, we have discussed undergraduate and postgraduate courses in life sciences and biotechnology being run by universities and institutes in India and different factors to be kept in mind for selection of course and institute. After you have enrolled in such a course, you should try to gain maximum exposure and acquire multiple skills by taking up additional courses, projects, internships etc. and participating in extra-curricular activities like compiling and editing of college or departmental magazines, organizing seminar/conference/journal club/alumni association/placement fairs etc.
You should be proactive and do due diligence before taking admission in a particular course in a university. You should take a well-informed decision based on the college or university's existing expertise and infrastructure, placement of earlier students, nature of jobs and average salaries offered, ranking of university etc., instead of following herd-mentality, and taking up a course and then looking for jobs. Try to keep your eyes and ears open, make connections, and network.

All the best!

4.5. Bridging Skill Gaps in Biotechnology

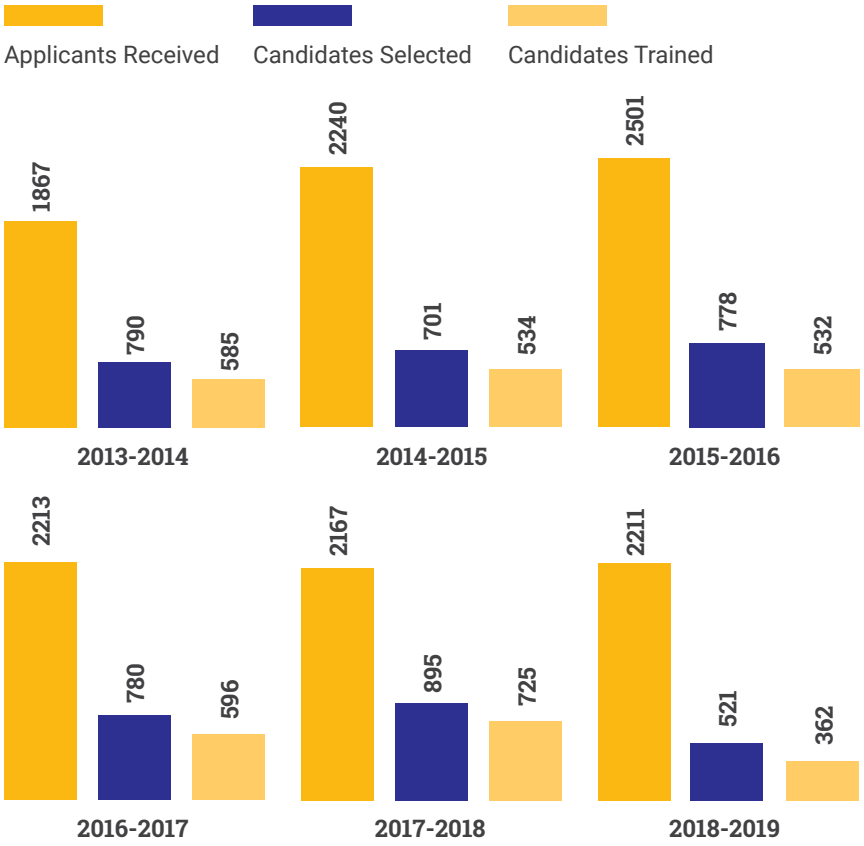
Now, we will discuss ways in which students can enhance their employability and become industry ready. Based on the fact that many biotech companies feel that biotech students lack domain expertise and are not industry ready, as well as the requirement of practical experience for many entry-level positions, DBT conceived an innovative programme called Biotech Industrial Training Programme (BITP) in 1993-94. This programme imparts practical industrial training to students for 6 months in biotech companies. Students get much needed first-hand exposure to industry requirements, expectations, work culture, targets, confidentiality, team work, etc. This training is mutually beneficial to both students and companies as it gives an opportunity to students to become industry-ready and allows industries to evaluate and select prospective employees.

BITP mode of selection:



Initially, only students from DBT-supported PG teaching programmes were eligible for BITP, but based on demand, eligibility was extended to students with B.Tech./M. Sc./M.Tech. in biotech from any Indian university in 2007. The programme made a modest beginning with training 5 students in 3 companies in 1993-94 and witnessed exponential expansion in the number of trainees as well as participating companies with 725 students in 146 companies in 2017-18. All selected students are given a monthly stipend and trainer fee to companies. On an average, 25 to 30% trainees get jobs in the trainer company or other companies in their field of training.

Trend Analysis of BITP Candidates



Based on the success of this programme, Government of Karnataka launched a modified version of this programme viz. Finishing School programme in 2011-12 with coursework for 6 months and industrial training for 6 months. 12 Finishing Schools have been established by Karnataka State Government and stipend to all selected students is provided by DBT. Students from all parts of the country are eligible and have to undergo online Karnataka Biotechnology Aptitude Test

followed by an interview. This programme has been renamed as Biotechnology Skill Enhancement Programme (BiSEP) and is gaining popularity as trained students are finding placements.

DBT has also recently approved post graduate diploma courses in genetic counseling, quality assurance and testing in plant tissue culture, big data analytics, computational biology, and personalized medicine under its skill-development programme.

Several private sector initiatives such as BIOCON academy, Institute of Bioinformatics and Applied Biotechnology (IBAB) are also offering PG diploma courses and training to enhance the employability of students.

Students who are willing to pursue a career in the biotech industry should take advantage of these programmes. Do not use these programmes as a stop-gap arrangement and remember that industrial training may not provide a significant advantage if you wish to pursue an academic career. Also remember that these programmes provide industrial training, not practical training, and are not a substitute for hands-on laboratory experience.

It is often seen that the majority of applicants for industrial training opt for R&D and very few students opt for training in production/manufacturing, QA/QC, IPR, regulation, sales and marketing. You should keep in mind that without a PhD and postdoc, growth in industry in R&D can be limited. Moreover, the majority of industry jobs lie in production, quality control and assurance, marketing and regulation etc., each of which can be exciting and fulfilling career paths. So, choose your options judiciously, keeping in mind which skill-sets are needed for different job roles (see Chapter 3) and try to sharpen and nurture your skills during the training period.

If you join an industrial training program, work hard and give your 100%. Take advantage of this opportunity by making relevant connections and creating a good impression so that your chances of absorption on completion of training are high. In case there is no opening in your trainer company, your experience will come handy in getting job in other companies in the same field as you will be able to get good referrals from your supervisor in your trainer company.

Students should choose a programme according to the guiding principles described in the chapter and maximize their learning. Take note that these are important decisions and should be made carefully. Be focused. Dream big and go all out to convert your dreams into reality.

Suggested Further Reading

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05

Indian Biotechnology Industry: Status, Opportunities, and Challenges

05

Indian Biotechnology Industry: Status, Opportunities, and Challenges

Biotechnology is an exciting, dynamic, and emerging area which has the potential to impact socioeconomic developments worldwide. It can make significant contributions in several sectors including healthcare, agriculture, food processing, and environmental management. Globally, the biotech industry was expected to grow by 37% with a compound annual growth rate of 8.2% during 2015-19, which will be verified once statistics are available. The Indian biotechnology industry is one of the fastest-growing knowledge-based industries and is expected to play a vital role in shaping India's growing economy. India's large population offers a huge market for biotech products and services. The availability of medical infrastructure and expertise (which has resulted in medical tourism), proactive government policies, and increase in investment from domestic and foreign players, have all set the right tone for innovation in the biotech manufacturing and service sectors. Low-cost manufacturing in India coupled with the availability of talented manpower at reasonable rates is also attracting outsourcing in the biotechnology research, manufacturing and services sectors.

The Indian biotech sector is highly innovative and increasing demand for biotech products has led several foreign companies to set up their base in India. The Indian biotech industry can be broadly classified into five categories, viz., biopharmaceuticals/healthcare, bioagriculture, bioservices, bioindustry, and bioinformatics. India is among the top 12 biotech destinations in the world and occupies a 2% share in the global biotech market. It is the largest producer of recombinant hepatitis B vaccine in the world. 400 biotech based drugs and vaccines targeting more than 200 diseases are currently in the clinical trial stage. India also houses the second-highest number of drug manufacturing plants approved by the FDA (USA) in the world - 527.

India is in an advantageous position to harness the potential of biotechnology due to its unique strengths, such as availability of rich bio-resources, technical expertise, skilled manpower, progressive government policies and rapidly expanding domestic markets. According to the strategy document of the Department of Biotechnology and forecast by the Association of Biotechnology Led Enterprises (ABLE), the Indian biotech sector has the potential to become a US$ 100 billion (₹ 6 lakh crore) industry in the next decade, provided that a supportive and transparent regulatory framework, better bio-manufacturing facilities, enhanced investments in R&D, and rational tax structures are in place.

5.1. Status of the Indian Biotechnology Industry

India is uniquely positioned to harness the immense potential of biotechnology in transforming all aspects of life. The Indian biotech industry has witnessed robust growth in the last 10 years with an average annual growth rate of approximately 15%. This was driven by a range of factors such as growing demand, intensive R&D activities and strong government initiatives. The Indian biotech industry is estimated to grow to US$ 100 billion by 2025 if it acquires a Compound Annual Growth Rate of 25-30%. There was a slowdown in the growth during the year 2013-14 which can be mainly attributed to delays in regulatory approvals. The industry has since been streamlined by proactive steps for bringing transparency and increasing predictability of regulatory approvals, which has led to an increase in momentum in the growth of the biotech industry. The Indian biotechnology industry's economy was valued at US$ 51 billion in 2018 as against US$ 44.47 billion in 2017, registering 14.68% growth over this period.The economy was boosted by the biopharma and bioservices sectors, especially the contract research and manufacturing services.

As per the KPMG report for Life Sciences Skill Development Council, the life sciences and biotech industry

is expected to employ 1.5-1.6 million people by 2020 with a possible supply gap of 0.3-0.4 million, which is positive news for life science and biotechnology students. The industry includes over 200+ unique job roles across core functions (manufacturing, quality, supply chain, R&D, sales & marketing) in 3 sub-sectors (pharmaceuticals, biopharmaceuticals and contract research including trials and drug discovery). Approximately 40% of such job roles are clustered at entry/junior level, 35% at mid-level and 20% at the senior level in the industry. 80% of the present workforce volume is made up by 35 job roles across life sciences sectors (covering manufacturing, quality, supply chain, R&D, sales & marketing).

The highest gap in manpower availability is expected in the quality and manufacturing segments. In manufacturing, a shortage of trained manpower is predicted at the junior level, while in quality, there is an availability gap across roles. In R&D, there is a shortage of experienced professionals for Intellectual Property (IP) and regulatory roles and in sales and marketing, as well as in specialized therapeutic areas. The industry looks for crucial attributes like technical competence, willingness to learn, time management, research ability, analytical skills, reasoning ability, communication skills, teamwork and industry experience.

5.1.1. How to Become Industry Ready

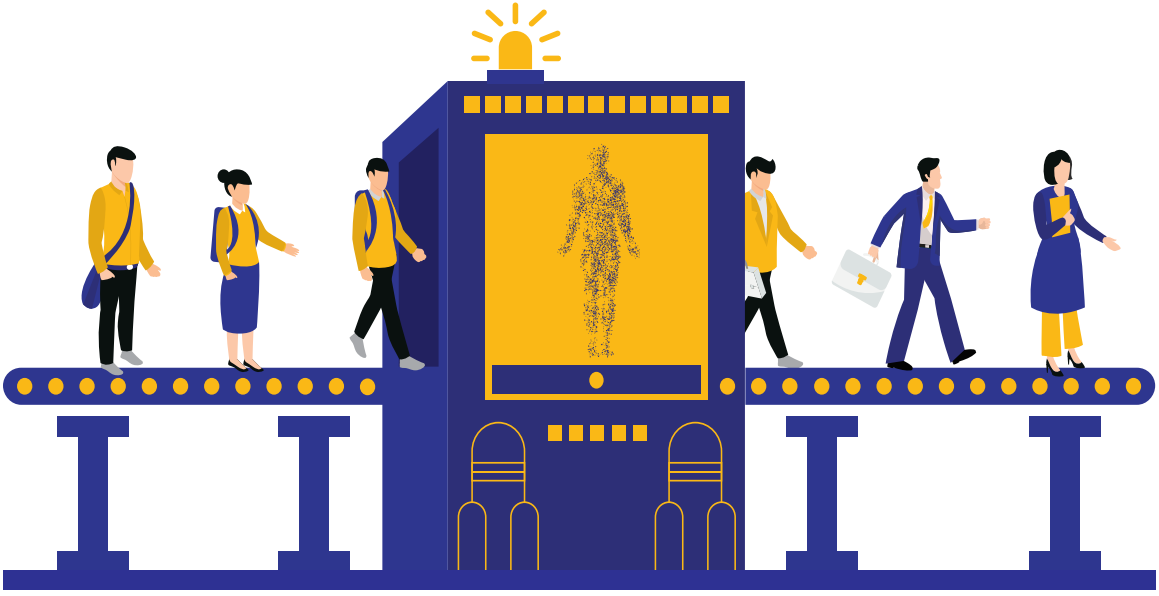
You must keep in mind that academic excellence alone is not enough and try to acquire multiple skills and participate in extracurricular activities to add value to your CV. You should also explore the possibility of internships in industry or premier research institutions to have a wider exposure and first-hand understanding of the research/industry environment and the difference in expectations between an academic and an industry environment. Along with regular course work, you should try to take online courses offered by national and international universities in the area of your interest (e.g. IPR, regulation, marketing, quality control and analysis) to empower yourself and enhance your employability. You can also try to take up courses in marketing, business management, finance and accounting, statistics, computer programming and other relevant courses offered by other sister departments in your college/university/nearby institutes. This would also help you in understanding your aptitude, making informed career choices, and cultivating your interests.

Multi-disciplinary research and collaboration are the needs of the hour. Collaboration should be aimed towards addressing common goals and not just designed to solve technical problems. It is important that you interact with experts across disciplines to widen your horizons and bring fresh ideas for collaborations.

You should not confine yourself to interacting with only your labmates; instead, expand your network to include students from other laboratories and disciplines. You should also proactively participate in extracurricular activities such as organizing journal clubs, editing college magazines, organizing seminars/symposia etc. as the skills you will acquire and the network you will develop thus would be very useful while transitioning to a job.

If you are interested in setting up your own enterprise, you should take up entrepreneurship development courses offered by entrepreneurship development institutes, IIMs etc. There are also entrepreneurship-focused competitions organized by ABLE and C-CAMP that are supported by BIRAC and Department of Biotechnology. It would be a good idea to participate in these. You should also network with start-ups. If entrepreneurship is your calling, this is an excellent time to be in India, as we have the right ecosystem, conducive environment, incubator spaces, funding options, and skilled, talented manpower. If you have an innovative idea and passion, you can choose the right team and change your dreams into reality.

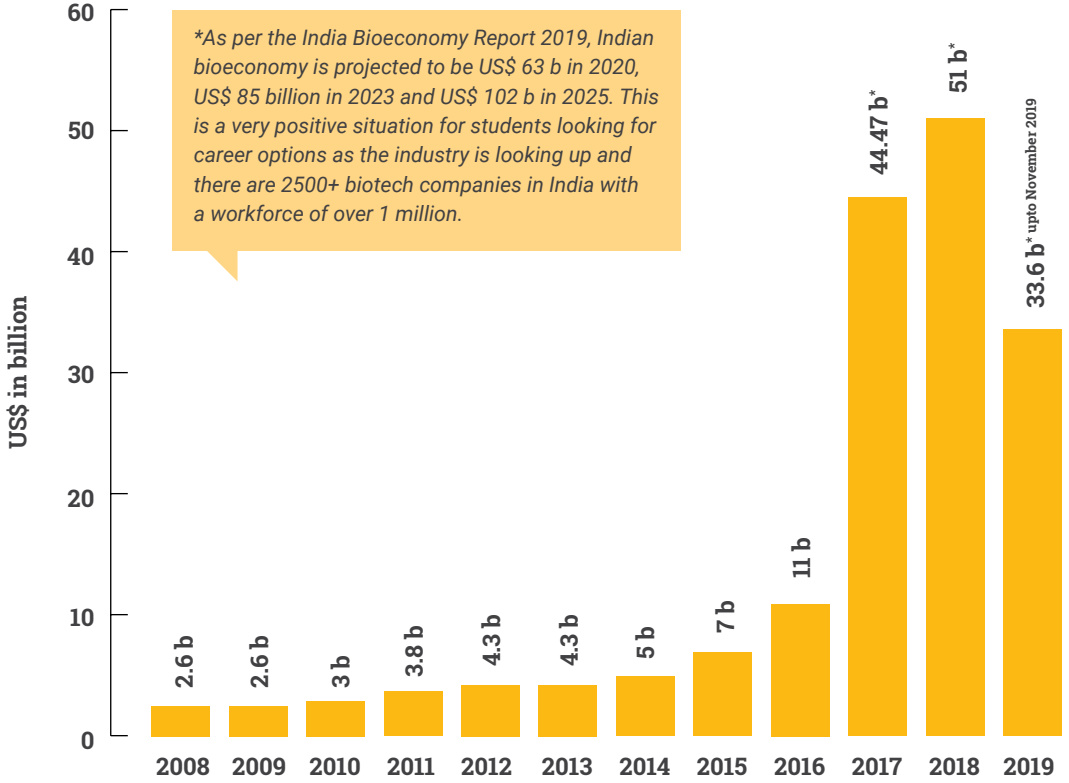
The biotech industry is a major employer of life science and biotech students and if the industry flourishes, it is a healthy sign for those employed, as well as those just entering the job market. If you are interested in taking up jobs in the biotech industry, it is important for you to understand industry growth trends and predictions for the future. You should also educate yourself about major products in the market, products in the pipeline, manpower availability and requirements, possible hurdles (if any) in the growth of the industry, skill-sets needed etc. so that you can equip yourself accordingly.



5.2. Major Growth Drivers in Biotechnology Sectors

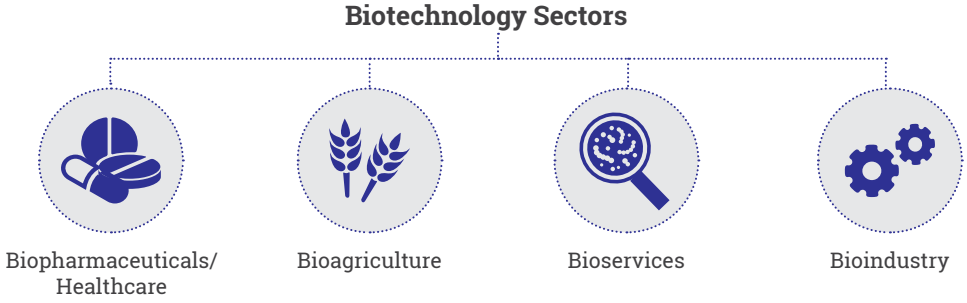
We will now discuss the growth of the Indian biotech industry in the past decade and applications of biotechnology in major sectors.

Trends in the growth of the biotechnology industry since 2008



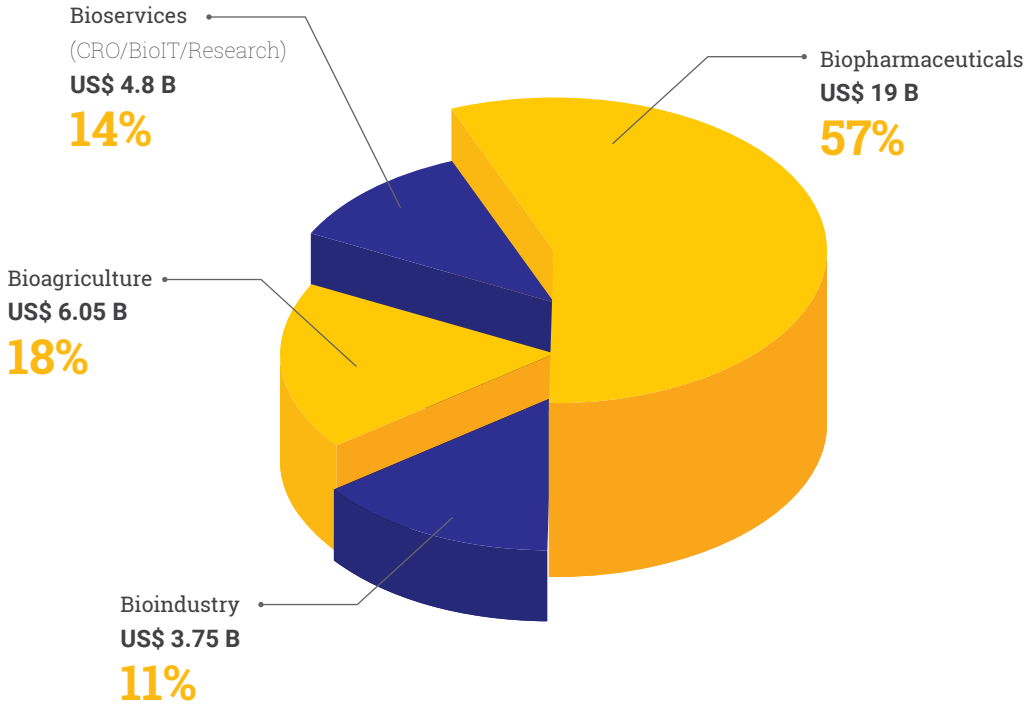
2008 - 2016 (IBEF Indian Biotechnology Industry Analysis)

Now, we will try to understand the relevance of career options and major growth drivers in each of the biotech sectors.



The biopharmaceutical sector constitutes 57% of the total biotech industry revenue in India, followed by bioagri at 18%. Clinical Research Organizations (CRO)/BioIT/ research and bioservices/bioindustry contribute 14% and 11% respectively.

Sector-wise distribution of the Biotechnology industry in India



5.2.1. Biopharma-ceuticals/ Healthcare

The Indian biopharmaceutical sector (valued at US$ 3 billion in 2015) grew at a CAGR of 10% during 2010-2015, largely driven by vaccine exports. The biopharma sector contributes 57% of the total biotechnology revenue of India. The key growth drivers are biologic drugs, generics, biosimilars, molecular diagnostics, vaccines and natural product-based drug discovery, wherein India already enjoys a strong position globally. **Diagnostics and medical devices contribute about 50% of the pharma sector of the biotechnology economy.** It is expected that biomedical devices, genomic testing and regenerative medicine shall contribute significantly to the future growth of this sector. In India, the healthcare sector is set to do well due to the increasing income of the middle class, increase in longevity leading to an ageing population, rising aspirations of the rural masses, and increase in lifestyle diseases such as cardiac diseases, cancer, diabetes etc., for which biotechnology can offer effective diagnostic, prognostic, and therapeutic treatment avenues.

5.2.1.1. Biologic Drugs/ Generics/ Biosimilars

Globally, the market for biopharmaceutical products has more than doubled in the last decade, growing from US$ 78 billion in 2006 to US$ 179 billion in 2014. It is expected to touch US$ 278 billion in 2020.

India is the 6th largest pharmaceutical market globally. The need to reduce healthcare expenses in the developed world, as well as India's inherent strengths viz. low-cost manufacturing, relevant skills, and young population, have led to a rise in the manufacturing of low-cost quality medicines in India. Generics are the mainstay of the Indian pharma market. Pharmaceutical companies in India are now upgrading their infrastructure to meet global compliance norms and diversifying their portfolios to include complex formulations. Many of them are also initiating strong R&D pipelines. India has the highest number of US FDA approved manufacturing plants outside the US and houses 527 US FDA approved drug manufacturing facilities.

The share of new biologic drugs in the market increased from 14% in 2006 to 23% in 2014 and constituted 40% share of US FDA approved drugs. These will hopefully occupy 27% of global prescription sales by 2020. Biologic drugs worth US$ 70 billion are scheduled to go off-patent between 2016 and 2020, creating a huge opportunity. Consumer pressure to reduce costs has attracted a large number of additional players, besides the original innovator companies who owned the patents which are about to expire. Since these companies would lose patent exclusivity, work on biosimilars has sped up.

To reduce healthcare costs, preference for generic drugs and biosimilars is increasing. Generics can save as much as 70% of the total cost, while biosimilars cost 10-30% less than biologic drugs. The global biosimilar market is expected to grow almost 5-folds from US$ 5 billion in 2015 to US$ 24 billion by 2019 to US$ 69 billion by 2025. By 2020, 25% of total biologics sales is expected to come from off-patent therapeutics. USA is the largest market for biologic drugs, while the biosimilar market depends largely on acceptance of biosimilars in the US.

Globally, **1015** biosimilars (also known as follow-on biologics) are currently under development **by 475 companies** to reduce the cost of biologic therapies. The first biosimilar product was approved in the US in 2015. **India approved its first biosimilar as early as 2000.**
EU has approved 19 biosimilar products for 9 branded biologic products and Japan has approved 8 biosimilar products. At present, China leads with 350+ products followed by India with **201 active biosimilars in the pipeline of 52 Indian pharmaceutical companies.**

With increased acceptance of biosimilars globally and ensuing demand, India can

try to be one of the key players. India constitutes around 8% of the global generics market by volume. **The Indian market for biologics and biosimilars is around US$ 3 billion at present and is expected to grow to US$ 13 billion by 2025.**

5.2.1.2. Vaccines

Out of the global market of US$ 30 billion for vaccines, the Indian market is around US$ 3 billion. **Vaccines produced by 12 major manufacturing plants in India are presently used in 150 countries in the world and we are the world leaders in DPT and measles vaccines.** At present, only around two-thirds of our population is covered under the Universal Immunization Program (UIP). There is an immense scope to increase demand for vaccines in India by aiming for 100% coverage under UIP, as well as by including optional vaccines and increasing export of vaccines. We need to make a strategic shift from manufacturing a large volume of low-cost vaccines to producing vaccines of the future in order to capture the global demand.

Companies would need students with a comprehensive understanding of immunology and vaccinology for large scale expansion of manufacturing facilities. Government agencies would also need to strengthen regulatory agencies for according speedy approvals and would require large numbers of qualified people for the successful implementation of the Universal Immunization Program.

5.2.1.3. Insulin

India is known as the diabetes capital of the world and is witnessing an alarming increase in the incidence of diabetes. The number of affected people is expected to increase from 51 million people in 2010 to 87 million in 2030, an increase of nearly 58%. Moreover, around 50% of the cases are undiagnosed, which indicates the enormity of the problem. Thus, there is a tremendous scope in domestic as well as global market for Indian players. In the Indian therapeutics market of US$ 0.2 billion, human insulin comprises a whopping 50% share. Companies should focus their research efforts on reducing the cost of treatment, easy administration methods, and longer-acting insulin, in order to ensure patient compliance and storage at room temperature.

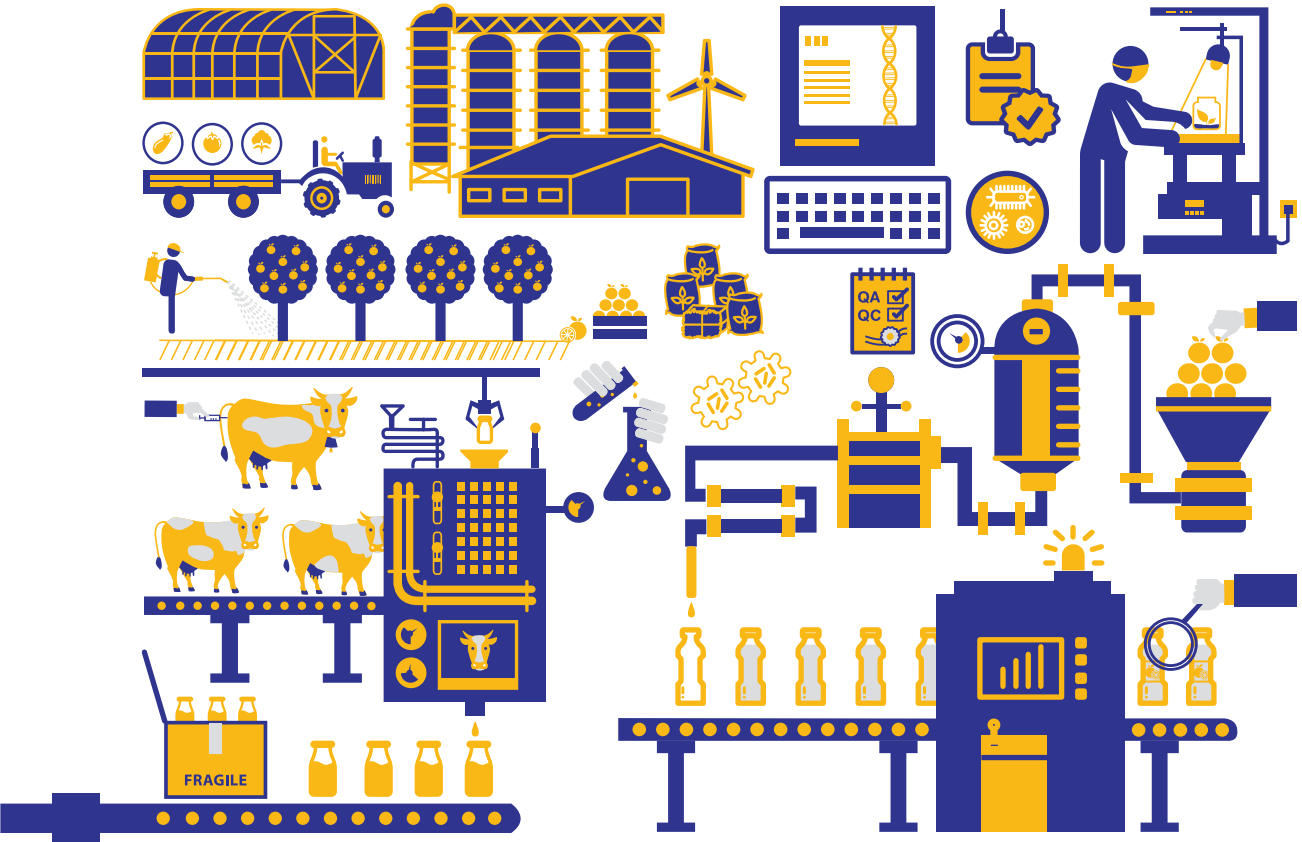
5.2.1.4. Skills Required in the Biopharma Sector

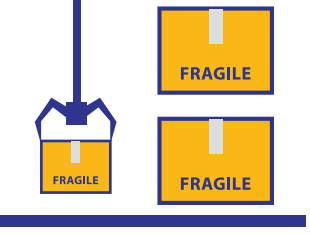
Biopharma companies need individuals with a broad understanding of basic life sciences, immunology, vaccinology and an interest in human and animal healt to facilitate rapid and effective application of research results to patients. At the same time, they also need clinicians who can communicate with basic scientists and engineers who can facilitate translation. Companies often hire people with multidisciplinary skills in processing, characterizing, device modelling, preclinical testing, animal modelling, and clinical testing.

People working in this area will have to communicate with scientific and non-scientific stakeholders such as funding agencies, regulatory agencies, ethics committees, review committees and most importantly, users (patients). Students will also find opportunities in emerging areas like regenerative medicine (medical devices and artificial organs, tissue engineering and biomaterials, cellular therapy including stem cell therapy, clinical translation etc.) The Regenerative market in the US is likely to grow to US$ 7 billion in 2020 from US$ 1.7 billion in 2015. Stem cell banking in India is also expanding rapidly and is likely to reach US$ 473 million in 2019. There is an urgent need for establishing a regulatory approval mechanism for biological devices, bioartificial organs, orthopaedic implants, stents, etc. so that our companies can reap the benefits of being early entrants.

5.2.1.5. Scope and Future Directions

Presently, there is a lot of scope for developing accurate screening and testing methods for lifestyle diseases and new infectious diseases, as well as for finding novel, effective, and innovative diagnostic methods (such as the use of biomarkers for early and accurate detection of diseases). There is also a need for further research into understanding disease mechanisms and developing vaccines, drugs and devices for prevention and/or treatment of diseases.





5.2.2. Bioagriculture

Globally, the bioagri market is estimated to grow to US$ 59 billion by 2025 from US$ 20 billion in 2016. India ranks second in the world in gross agricultural area and is the largest producer of cotton, rice, and wheat. However, our yield per hectare is much lower than countries like China and Brazil. There is tremendous scope for India to increase its productivity and increase its share of agricultural exports.

The bioagri sector is the second largest segment of the Indian biotech industry.

The bioagri sector encompasses a number of subsectors, including crop biotechnology (transgenic crops, hybrid varieties, molecular marker-assisted plant breeding and tissue cultured plants), food processing, biofertilizers, biopesticides, animal biotechnology, aquaculture, biofuels etc. Major R&D efforts are meant to improve quality, crop yield, resistance to drought and diseases, salinity tolerance, conservation of soil and water, and pest control.

Currently, the only genetically modified crop approved in the country for commercial cultivation is Bt cotton. According to the International Survey for

Acquisition of Agri-biotech Applications, India has 11.57 hectares of land covered under genetically modified crops, which puts it at the 4th spot worldwide. Due to delays and uncertainty in regulatory approvals for transgenic plants in India, industries dealing with transgenic plants have gone on the back foot. Transgenic plants have immense potential and this sector has a huge scope for expansion, provided that an efficient regulatory system is put in place.

The success of Bt cotton had encouraged a number of companies to develop technologies for improvement of crops through the transgenic route. However, uncertainty and delays in regulatory approvals have forced most companies to explore options other than GM-plants, such as marker-assisted selection and breeding. The Indian hybrid seed industry is growing at an annual growth rate of 10-15%, estimated at US$ 1.93 billion in 2016. The Indian plant tissue culture (micropropagation) industry is also expanding at an annual growth rate of 15% and is mostly export-oriented.

The bioagri sector also covers secondary agriculture such as beverages, nutraceuticals, food processing for value addition to agricultural commodities according to customer preferences, etc.

5.2.2.1. Food Processing

Food science & technology deals with manufacturing, processing, treatment, preservation, innovative packaging, minimising wastage, and distribution of food. The food processing industry is considered to be a sunrise sector and is one of the largest industries in India, ranking 5th in terms of production, consumption, export and anticipated growth. Globally, the need for food scientists is growing due to rapid urbanization, lifestyle changes, and economic prosperity.

Food Science is an applied multi-disciplinary science. It encompasses chemistry, biochemistry, chemical and process engineering, microbiology, and nutritional science, and involves studying the physical, chemical and biological nature of food as well as manufacturing, processing, treatment, preservation and marketing of food. Due to our hectic daily life, there is an increase in demand for food items that are easy to prepare and easy to consume. In addition to quality, safety and nutritional value of food also need to be taken care of. This is leading to growing market demand for more advancements and sophistication in the field of food science and technology worldwide.

The food technology industry will always be in demand and is likely to be recession-proof, so it might be a safe bet. To be a part of this industry, you would need to understand the principles of food processing, preservation and packaging and their applications in increasing

shelf life, improving nutritive value, and enhancing food quality. For students willing to take up jobs in the food industry, popular career paths lie in Research & Development (Food Scientist, Food Technologist, Food Chemist, Product Development Specialist), Quality Control & Assurance (Food Chemist, Food Inspector, Toxicologist), Food Processing (Food Processor, Process Development Specialist, Manufacturing Specialist, Food Production Manager), Nutrition (Nutritionist), Sales, Marketing & Brand Management, and finally teaching and consulting within the government, industry or academia.

5.2.2.2. Animal Biotechnology

The animal biotechnology industry includes animal breeding, production of diagnostics, vaccines and drugs for veterinary diseases, processing of food items of animal origin, and value-added products such as nutraceuticals. The demand for these products is increasing and is important for revenue generation, particularly diagnostics and nutraceuticals.

Animal breeding

Production of diagnostics, vaccines and drugs for veterinary diseases

Processing of food items of animal origin

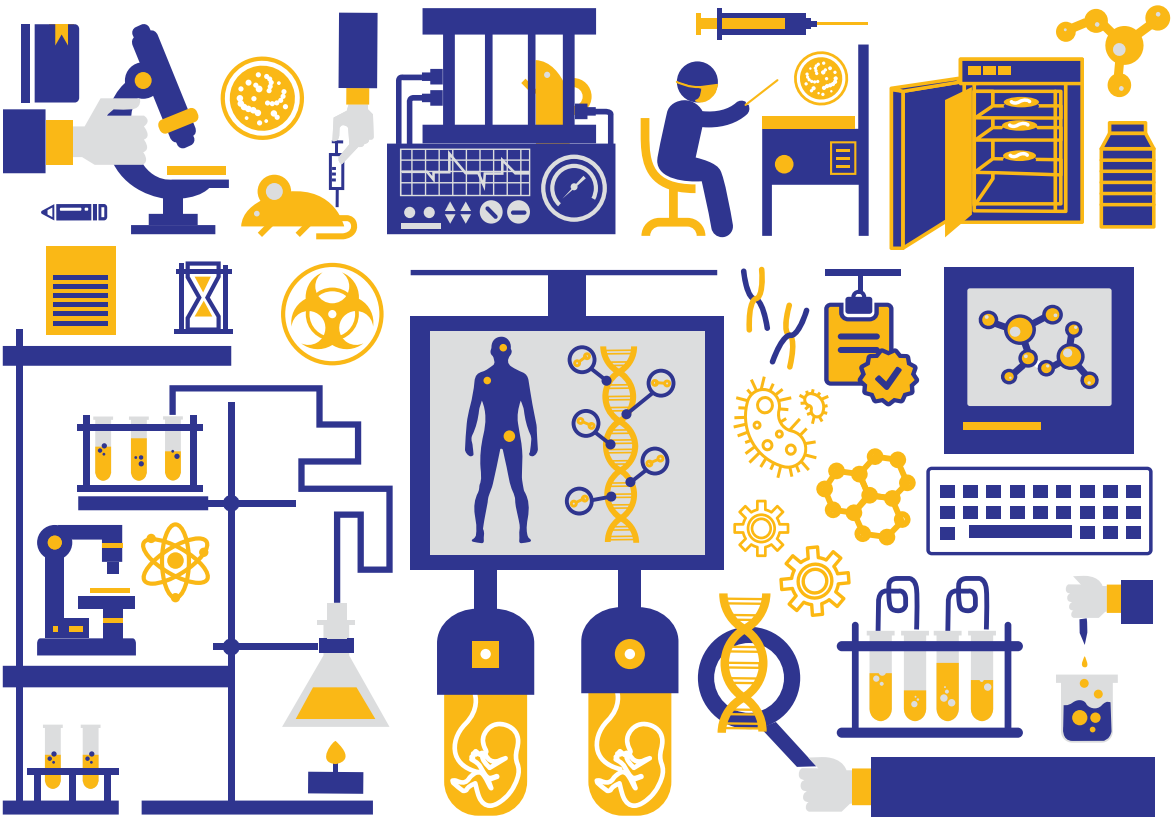
Value-added products such as nutraceuticals

5.2.2.3. Skills Required in the Bioagriculture Sector

There are several opportunities in this sector for candidates having hands-on experience in techniques such as crop transformation, marker-assisted selection and breeding, discovery of target genes through molecular biology and genetic engineering, development of tissue culture protocols etc. Major domains within the agricultural sector include agribusinesses, R&D organizations, public and private sector agencies, government and policymaking agencies, and private consulting companies.

The bioagri industry has requirements for trained personnel in research, technical support, product development, business development, marketing, administration, finance, legal and HR. Companies in this sector recruit people

with MSc or PhD degrees for scientific positions, those with MBAs for business development, management and marketing-related positions, and people with a law background or understanding of patent laws for IP-related positions. The qualification and nature of experience for career opportunities in animal biotechnology are similar to those required in the biopharma sector. Students can also consider doing an MBA in agribusiness management as this sector demands planning, trouble-shooting, and management skills.



5.2.3. Bioservices

The bioservices sector covers contract research, contract manufacturing and clinical research. The bioservices market is the third largest sector of the Indian nology industry as it accounts for 14% of the market share. Contract biomanufacturing capacity for biologics worldwide has increased from US$ 2.8 billion in 2010 to US$ 3.9 billion in 2017. Global contract research is also growing rapidly and is expected to reach US$ 95 billion by 2025 from US$ 30 billion in 2017, more than 3 times in just a span

of 8 years. This sector grew tremendously due to the outsourcing of contract research and clinical trials by developed countries to Asian countries like India, China, Thailand, Malaysia etc. because of inherent cost advantages such as raw material availability, skilled labour at reasonable rates, regulatory support etc.

The global market for contract manufacturing is expected to touch US$ 8.8 billion by 2025, rising from US$ 4 billion in 2015. India is a major player with a market of US$ 1.3 billion in 2015 which is expected to grow to US$ 4 billion by 2025. India produces 40% of all generic and over the counter (OTC) drugs consumed in the US.

The global market for clinical research is expected to touch US$ 95 billion by 2025 from US$ 30 billion in 2016. India's drug discovery and pre-clinical industry witnessed robust growth from 2010 onwards due to technical capabilities across the value chain and cost competitiveness. India offers a suitable population for clinical trials because of its diverse gene pools which can cover a large number of diseases. Cost-effectiveness, competition, and increased confidence in the capabilities and skillsets of Indian manpower has encouraged many global companies to increase their investment in clinical research in India. Global pharma companies are also outsourcing research services to India to improve their drug pipelines as the average cost of Phase I studies in India is 50% less than that in the US and European nations. In fact, in recent years, clinical research organizations in India have taken a leap forward and are moving from being merely service providers to strategic partners.

However, the industry suffered a setback in 2013-14 due to its new regulatory structure which also impacted the capacity of Indian players to conduct bioequivalence/ bioavailability studies. India, which was once a lucrative destination for clinical trials, has less than 1.5% share in global clinical trials by numbers at present due to stringent regulatory laws. Reducing lengthy processes, time span, and resolving insurance issues for volunteers in clinical trials and regulatory processes is the need of the hour to ensure the growth of this sector. Recently, the Drug Controller of India (DGCI) has eased guidelines for doing clinical trials in India by removing restrictions on the number of clinical trials to be conducted by an investigator at a time and allowing clinical trials in less than 50 bedded hospitals. The requirement of No Objection Certificate (NOC) for the addition of new sites for clinical trials has also been removed. An online submission system has also been launched to increase transparency. It is expected that these procedural reforms and recent efforts at bringing transparency and increasing predictability would help us bounce back and regain our lost position in clinical trials.

5.2.3.1. Bioinformatics

Bioinformatics is an important area with applications in all biotechnology sectors and, therefore, provides ample career opportunities for students. The advent of low-cost, whole-genome sequencing, the growing role of molecular diagnostics in precision and preventive medicine, and proliferation of data have created significant demand for professionals in bioinformatics. India possesses around 10% of the global share of professionals in bioinformatics.

The global bioinformatics market is expected to grow to US$ 12.54 billion by 2020 from US$ 4.11 billion in 2014. Western Europe and the EU contribute 55% and 30% of bioinformatics companies respectively. The global market for genomics was US$ 11 billion in 2013 and is expected to grow to US$ 20 billion by 2020. India has the scope to encash this growing opportunity with in-house expertise in IT and bioinformatics.

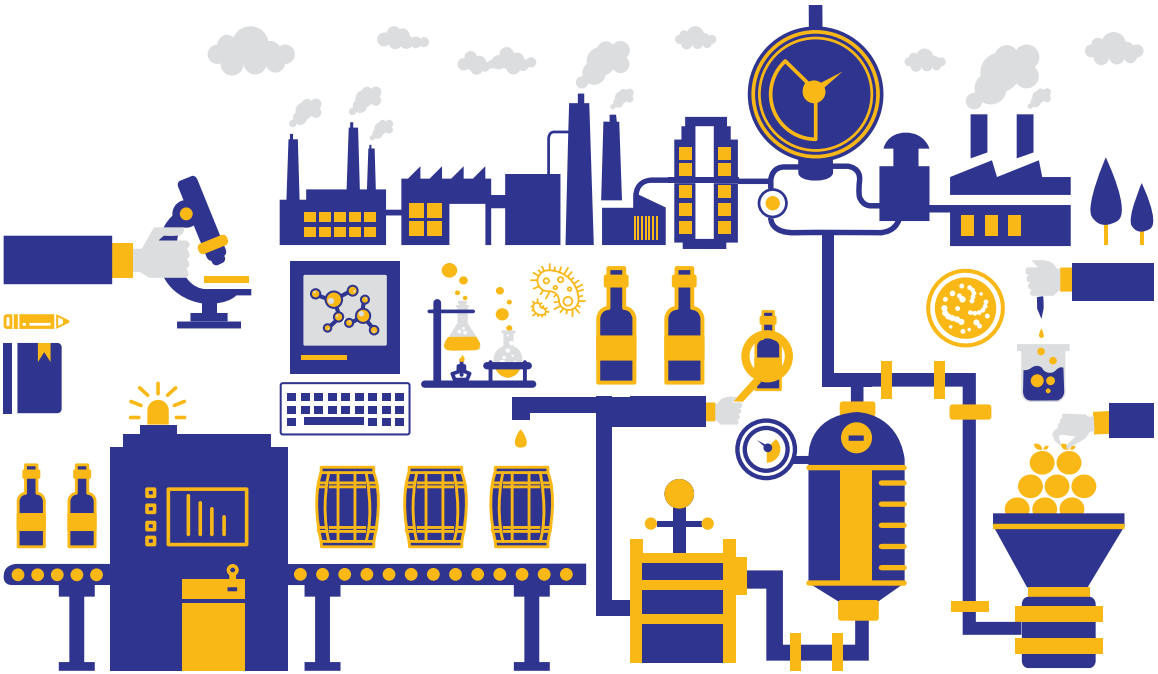
5.2.3.2. Skills Required in the Bioservices & Bioinformatics Sector

The technical expertise required to pursue a career in bioservices (contract research, contract manufacturing and clinical research) is similar to the biopharma sector. The bioservices sector includes clinical and contract research services such as bioavailability(BA)/bioequivalence (BE) trials and Phase I-IV trials. These offer opportunities in areas such as pharmacovigilance, data management, laboratory affairs, regulatory affairs, etc. You may also be required to gather the informed consent of volunteers to participate in clinical trials, design and conduct trials to avoid injury to subjects, get approval from ethics committees for clinical research etc.

All biotech companies employing modern techniques such as genomics, proteomics, metabolomics, etc., require specialists in bioinformatics. These experts are required for creating and managing databases and software tools, *in silico* drug designing, sequencing of genomes to search for specific genes and their functions, making high yielding, disease-resistant, stress-tolerant plants and animals, performing predictive diagnosis, environmental monitoring, etc. In addition to biotech companies, dedicated bioinformatics companies also need specialists in bioinformatics.

Bioinformatics is a multidisciplinary field with a wide range of career opportunities in strategy, information science & information technology, application development, data science, data mining

& analytics, entrepreneurship, and public health. In order to pursue a career in this field, you would need to learn how to use bioinformatics skills such as sequence alignment, genome analysis, next-generation sequencing, data analysis for microarray and qPCR etc. You should also familiarise yourself with tools for handling high throughput sequencing data, database search systems, and tools for obtaining gene data sets. Statistical and programming skills are also useful in this field, in addition to domain knowledge of biology, genomics and genetics, database management, data mining and machine learning. For example, a common task of bioinformaticians is to integrate data such as gene sequencing, gene expression, protein structure under one common umbrella to enable data mining.



5.2.4. Bioindustry

The bioindustry sector primarily covers enzyme manufacturing and marketing companies. Most enzymes are used in industries such as detergents, textiles, food, leather, paper and pharmaceuticals, while speciality enzymes are used for research and diagnostic needs. The global enzyme market is likely to reach US$ 6.2 billion by 2020 and US$ 10.3 billion by 2025, with 70% of the share going to industrial enzymes and 30% to speciality enzymes. North America and Europe comprise more than 60% of the enzyme market. The Indian enzyme market is only US$ 0.4 billion, which is a very negligible

share of the global market. However, with our strength in knowledge-based innovation, low-cost manufacturing and R&D capabilities, there is scope to encash this opportunity. There is also a tremendous scope for focused R&D and knowledge-based innovation to replace polluting chemical processes by eco-friendly processes employing enzymes (e.g. enzymes for effluent treatment) to ensure environmental sustainability.

5.2.4.1. Skills Required in the Bioindustry Sector

The bioindustry sector requires students with a background in biochemical engineering, biochemistry, microbiology, process development, biomanufacturing, regulation, and business-related roles for executing commercialisation strategy, marketing etc. Students who are interested in this sector should try and get hands-on experience, not limit options based on first few experiences, be open-minded and willing to play multiple roles, improve their communication skills and build their professional networks. Students planning to join this sector should also be prepared to keep learning and adapting once on a career track.

5.3. The Way Forward for the Indian Biotechnology Industry

It is important for Government agencies and biotech companies to create awareness amongst the public about the potential of biotechnology in different sectors. Biotechnology can influence agricultural productivity, promote human and animal health, provide environmentally sustainable solutions, and allow policymakers to take a balanced view of potential applications and threats based on scientific research. We need to invest in developing and strengthening our research infrastructure so that we can become self-reliant and can reduce dependence on foreign players for our daily needs. The regulatory approval process needs to be in harmony with global guidelines so as to increase the acceptability of our products world over.

Globally, the biotech industry faces intense competition. The Indian biotechnology industry is under tremendous scrutiny from consumers, financial analysts, media, and regulatory bodies due to complex issues such as patient privacy, adoption

of GM foods, potential risks of releasing genetically modified organisms into the environment, loss of biodiversity, risks to human and animal health, safety of workers in production laboratories, threats of bioterrorism etc. The Indian biotech industry also faces several additional challenges when compared to its global counterparts. These include the presence of multiple regulatory bodies, stringent and complex regulatory procedures leading to delays in approvals, lack of coordination between central and state governments, lack of stringent regulations for ensuring the quality of manufacturing, lack of academia-industry partnerships, unpredictable IP regime etc.

Companies need to invest in strategic planning and establishing systems for reducing risk and ensuring quality. We need to make dedicated efforts to improve funding options and accessibility, as well as protect and develop intellectual property. Companies should also collaborate with overseas firms for research and development, contract manufacturing, product testing, clinical trials and marketing, etc. We need to follow a proactive, scientific approach to address concerns currently faced by the industry and face challenges upfront. Finally, we need to take active steps for generating societal awareness to ensure consumer acceptability of products, and to harness the immense potential of biotechnology in transforming lives.

Suggested Further Reading

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06

Learn from Leaders

06

Learn from Leaders

All of us look up to leaders in our respective fields and get inspired by their success stories. They become our role models. In this section, we have carefully selected leaders from diverse fields within the life sciences, including science policy and management, research, education and entrepreneurship. Each individual covered in this section has not only excelled in his/her respective field but also left no stone unturned to mentor young students and professionals in charting their career paths. We have spoken with each one of them to get answers to the questions that many students might be interested in. We hope this will not only help students learn more about these leaders' journeys but also act a source of motivation and inspiration.

Before getting started, we briefed the leaders that the objective of the present exercise is to help students who feel stuck at a crossroads and find it difficult to make career decisions. In this chapter, you will have an opportunity to learn how these leaders handle success and failure, what they attribute their success to, employability traits which employers look for while recruiting people etc. We also hope that this section will help you understand the gaps in your skill-sets. Having identified them, you can work towards them systematically to convert them into strengths. We hope you will find these interviews useful and inspiring.

6.1. Interviews

This is a very important section of this publication as we requested leaders from different fields such as science policy and management, research, teaching and entrepreneurship to answer questions about employability traits, key ingredients to success. In fact, we deliberated a lot whether we should ask different questions to experts from different fields and then decided to ask same questions to all experts. We sincerely hope that this information would be very useful to students as they may not have access to the leaders but their replies would help them in understanding expectations of prospective employers, identifying their own strengths and weaknesses, gaps in skill-sets, and honing skills to enhance their employability as well as achieving their career goals.

All the best to the students!

6.1.1. K VijayRaghavan

Principal Scientific Adviser, Government of India

K VijayRaghavan, Fellow of Royal Society, is an Emeritus Professor and former Director of the National Centre for Biological Sciences (NCBS), Tata Institute of Fundamental Research, Bangalore. He served as the Secretary, Department of Biotechnology, for 5 years (2013 - 2018). In March 2018, he was appointed as the Principal Scientific Adviser to the Government of India. He was awarded the Padma Shri, India's fourth-highest civilian award, in 2013. He is also a recipient of the Infosys Prize (2009) and the Bhatnagar Prize for Science and Technology (1998). He is not only an internationally renowned scientist and science policymaker but a human being par excellence, remaining grounded and accessible, in spite of his many achievements. In fact, he is one of the few researchers, who despite a long and flourishing research career, made a career shift into science policy and agreed to shoulder higher responsibility when he took over reins of Department of Biotechnology as Secretary.

Q&A

Q. What are the key traits that each employment-ready individual should possess?

A. Important question. We lay a lot of stress on what you have been trained in, how and where have you acquired your training etc. **Attitude, educational and training background, competence, enthusiasm, passion and interest in the job are all equally important for an employer.**

Q. What are the key ingredients/traits that help one achieve success?

A. Success is in very large part due to **good luck** . However, you must be on the **lookout for opportunities** and grab them. You should not shy away from opportunities and should be willing to grab opportunities. Success does not come easy, a lot of **hard work** goes into it and it largely depends on your **ability to make use of opportunities.**

Q. How do you handle success and failure?

> **"Learn from failures, keep trying, give your best, enjoy the journey"**

A. Most of the things we try may fail but we have to take failures in our stride and learn from them. We should not repeat the same mistakes. When we succeed, our success is not only because of our efforts but because of the efforts of our team and people outside our team (the scientific community). Individuals' successes are on the foundations and effort of the team. Unless we try, we won't succeed. Keep trying. Give your best and don't worry about the outcome. Enjoy the journey.

Q. What helped you reach where you are today?

A. Basically, if you analyze successful individuals, a large number of factors such as **ecosystem, luck, team members, community etc.** play a key role in their success. **Success means greater responsibility.** Be ready to shoulder higher responsibility with each position. A position is not an award and not a sign of success, but a responsibility.

Q. What would be your key message for the youth of today?

A. Life is tough and not easy. It is a continuous struggle. **Be confident, evaluate your strengths and weaknesses. Be focused. Make the correct choices** and if you don't, then get out of the bad situation and try something else. Keep good company. First-generation students and learners should **network and choose mentors to learn from their experiences**. Leaders also should make extra efforts to mentor first-generation learners.

6.1.2. Renu Swarup

Secretary
Department of Biotechnology, Government of India

Renu Swarup took over as the Secretary, Department of Biotechnology in April 2018. She was instrumental in setting up the Biotechnology Industry Research Assistance Council (BIRAC) and as Founder/MD, initiated several schemes to promote entrepreneurship as well as the biotech industry. In DBT, she played a key role in formulating its vision document, the biotech strategy of India, as well as in conceiving and supporting R&D programmes in diverse areas. She received the Biospectrum Person of the Year award in 2012 and National Entrepreneurship award in 2017.

Q&A

Q. What are the key traits that each employment-ready individual should possess?

A. The whole area surrounding science has a large number of career opportunities available for young scientists including research, industry, academics and related fields such as science management, science communication, policy planning, technology management, etc. Each employer would like to assess the individuals applying to join them based on certain key criteria, which mainly focus on **qualification and experience relevant to the position, a broad general understanding of the area and its related disciplines, and most importantly, personality traits, which reflect the commitment, passion and confidence of the individual**. It is also essential for the individual to be able to convey to the prospective employer that he/she is a quick learner, a team player, keen to learn new things, with an aptitude for grasping, and most importantly, highly articulate with a very clear focus and ability to deliver as per target. While hiring, employers generally do a complete 360^0 assessment, which also includes the individual's ability to handle stress, to respond to crises and to take up unexpected tasks as per the exigencies of the work.

Q. What are the key ingredients/traits that help one achieve success?

"Hardwork, passion and commitment are the keys to success"

A. Some of the key aspects of success are hard work, passion, commitment, and most importantly achieving excellence with perfection while maintaining complete **integrity and organizational loyalty.** Each organization has its set vision, missions and goals. It is important for each employee to ensure that his/her task as defined within the job role is accomplished efficiently to meet the overall goals of the organization. The parameters for measuring success get more stringent as one moves up in their career. From a new entrant, as one moves up to a managerial position, then to a senior level management position, then to a team-leader/group-head position, and then finally becomes the leader of the organization, the matrices for measuring success are different. At each level, there is a change of responsibility and accordingly, higher expectations in delivery. As stated above, hard work, passion, commitment, integrity, teamwork and the ability to deliver with full responsibility are the key traits which define the overall success and personality of the individual.

Q. How do you handle success and failure?

A. Success and failure are two important components of the journey of an individual across his/her career. Each career path has both success and failure. It is important to acknowledge that both failure and success give us a lot to learn and from each of these, there are important takeaway messages. This is similar to any scientific experiment that we do. **Failure teaches us where we went wrong and how we should make sure that we do not repeat our mistakes.** Success gives us a level of confidence that what we have achieved has been an important milestone and this, then, gives us the opportunity to look at future milestones to be achieved and based on our learning, plan the way forward. This journey of failure and success is a continuous process and one should not get demoralized by failure and keep climbing the ladder towards greater and higher success.

Q. What helped you reach where you are today?

A. As I mentioned above, these are the key traits which are important in an individual's career. I learnt a lot from my parents and a strong foundation was built by my teachers and mentors. My long career has taught me that the **key ingredient to success is hard work**, more hard work, and even more hard work. It is only hard work and **complete dedication and passion** which can help you achieve the endpoint you are looking for. This has been the main philosophy I have adopted throughout my career. The other crucial factor is that whatever you do, there is a strong team which helps you to achieve your target. It is important to **stay focused**, have a **clear action plan**, and be clear in your thoughts, which helps in clear **decision making**. It is also important to accept the fact that there is a new chance to learn every day to take you further in your career as you move on.

Q. What would be your key message for the youth of today?

"No shortcut to success"

A. For the youth of today, I would just like to say that you have a lot of energy. It is important that you **channelize your energy in the right direction.** There is no shortcut to success**;** do not look for immediate short term gains. If you expect your organization to be able to give you the best career opportunity, it is also important that you give your **100% commitment** to the organization. I would like to encourage the youth to consider all opportunities available and then choose the path for yourself. Once you choose your path, there should be no looking back.

6.1.3. Shahid Jameel

Chief Executive Officer
Wellcome Trust/DBT
India Alliance

Shahid Jameel is a renowned virologist who headed the Virology Group at the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi for over 25 years. He is an elected fellow of all three major Indian science academies viz., Indian National Science Academy, Indian Academy of Science, and National Academy of sciences. He received the prestigious Shanti Swarup Bhatnagar Prize for Medical Sciences in 2000. After a long and successful stint as an active researcher, he made a career shift to science administration and management when he took over as CEO, Wellcome Trust/ DBT India Alliance. He is actively involved in the promotion of research and training in the biomedical sciences.

Q&A

Q. What are the key traits that each employment-ready individual should possess?

A. A degree is important to become eligible for a job and to understand the basics. Beyond that, experience and soft skills distinguish people who otherwise may have the same degree. These can be acquired while getting the degree

itself. For example, some work experience can be obtained by volunteering during summer and winter breaks. Taking part in organizational activities in college, learning a foreign language or a computer language, and improving oral and written communication are other things that can be done while getting a basic degree. Beyond a good academic career, all these look very good on a job application.

Q. What are the key ingredients/traits that help one achieve success?

A. Besides having a basic understanding of the subject area, the top five things on my list (in no particular order) are:

1. Hard work with attention to detail
2. Good oral and written communication skills
3. Not being afraid of making mistakes (and learning from them)
4. Ability to build partnerships
5. Cross-cultural appreciation

Q. How do you handle success and failure?

A. I consider success and failure to both be part of life and understand that neither is permanent. Therefore, I try to handle these with modesty and maturity. In careers (in contrast to education) we work in groups, wherein it becomes important to share success and failure with the team. A good leader shares success by shining light on the team while taking responsibility and protecting the team for failed efforts. Internally, it is important to **celebrate success and analyze failure** to understand root causes and reduce future risk. Failure also offers opportunity and good leaders know how to make the best of it.

Q. What helped you reach where you are today?

"Focusing on strengths and managing weaknesses"

A. I would have to say that I am completely honest with myself. I know my strengths and more importantly my weaknesses, which allows me to focus on the former and plan to manage risk associated with the latter. This has also allowed me to choose an interesting and sometimes unusual career path. Professionally, I have never done anything that I don't enjoy. The advantage of having a job that you enjoy is that you get paid for having fun and it's never a burden. There have been times when I stopped enjoying a job or learning from it, and that is when I shifted focus or careers.

I have benefitted from the support of good mentors at all stages of my career and continue to seek advice very widely. The ability to listen to people and separate the relevant from the mundane comes with experience. But one needs to consult widely and build useful partnerships.

Q. What would be your key message for the youth of today?

A. My key messages are to do well in whatever you are doing, **pay attention to detail**, don't be afraid of making mistakes, **learn from failures** and pay only fleeting attention to success and glory. If there is one other thing – read widely.

6.1.4.
LS Shashidhara

Professor, Ashoka University & Professor, IISER, Pune
(Currently, on Lien at Ashoka University)

LS Shashidhara is a developmental biologist, Professor of Biology and Dean, Research and Development, Indian Institute of Science Education and Research (IISER), Pune, and Distinguished Visiting Professor of Biology at Ashoka University. He received the prestigious Shanti Swarup Bhatnagar Prize for S & T in 2008 and is a JC Bose National Fellow of Department of Science & Technology. He is also an elected fellow of three major Indian science academies viz., Indian National Science Academy, Indian Academy of Science and National Academy of sciences and elected member of the European Molecular Biology Organization (EMBO). He is actively involved in undergraduate education and research, and in organizing pedagogy workshops for undergraduate teachers across the country. through the Star college scheme of DBT, joint faculty improvement programmes with British Council, and development of massive open online courses.

Q&A

Q. What are the key traits that each employment-ready individual should possess?

> **"Experiment to innovate new solutions"**

A. Sufficient knowledge, expertise and skills in the area of employment. **Ability to innovate** as per the job requirement and good communication skills.

Q. What are the key ingredients/traits that help one achieve success?

A. Self-learning, critical thinking and analytical abilities. One should **innovate newer solutions**, even to older problems, given one's time and context.

Q. How do you handle success and failure?

A. By objectively analyzing the reasons for failure and subjecting oneself to peer-review.

Q. What helped you reach where you are today?

A. I always learnt from people around me - my seniors, my peers and my students - from everyone I come across.

Q. What would be your key message to the youth of today?

A. Pursue your interests and passion. Be confident and don't hesitate to experiment in your life and profession.

6.1.5. Sudha Narayana Rao

Executive Director, Genotypic Technology

Sudha Rao is a neurobiologist and worked as Consultant Neurobiologist at medical centre in Cornell University, New York. She successfully pioneered genomics as a service in India and followed the motto "Genomics simplified" to create a company, Genotypic Technology, known for its ethics and cutting edge technology. She is actively engaged in maximising the efficiency of genomic and bioinformatics technologies and creating newer applications in biomedical research and agriculture.

Q&A

Q. What are the key traits that each employment-ready individual should possess?

A. Proactiveness, problem-solving skills, accountability and an ability to laugh at oneself.

Q. What are the key ingredients/traits that help one achieve success?

A. Confidence, ability to convince others and being **open to learning.**

Q. How do you handle success and failure?

"Failures motivate us to improve"

A. While success teaches us what we are doing right, it is failures that motivate us to improve and make changes that will ensure success. Both are transient and part of the journey.

Q. What helped you reach where you are today?

A. Self-conviction , a strong desire to make a difference, commitment, confidence and courage to stand by one's values.

Q. What would be your key message to the youth of today?

A. This is a beautiful world, with people of diverse talents. **Find your niche** and a career path that gives you the freedom to cultivate your strengths. **Believe in yourself.** There is no single measure of success, what matters is your journey and how you wish to live it! Best wishes for making our world a better place, for ourselves and everything on earth.

6.1.6. Hemalatha Reddy

Principal
Sri Venkateswara College, Delhi

Hemalatha Reddy is the Principal of Sri Venkateswara College, a prestigious college affiliated to Delhi University. She is actively involved in promoting quality of education, inculcating interest in research for undergraduate students, facilitating decision-making, assisting in the implementation of the star college programme of DBT, developing online courses, etc. She has long-standing experience of heading a premier educational institution. ***Note: Hemalatha Reddy has clarified that her replies are aimed at those students who are interested in faculty positions in undergraduate educational institutions.***

Q&A

Q. What are the key traits that each employment-ready individual should possess?

A. Domain expertise in the candidate's subject, as well as in related fields, is one of the most important key traits since interdisciplinarity is the need of the hour. To be updated with the latest knowledge is one of the most important traits for "to-be faculty". The ideal candidate should be a people's person, open-minded, good team worker and willing to learn from seniors, fellow colleagues, as well as students. Students willing to take up faculty positions should have excellent

communication skills and should be well-versed with the latest Information and Communication Technology (ICT) based tools. Faculty will be expected to inculcate scientific temper, critical thinking, reasoning and analytical ability amongst students. Teachers should have patience and perseverance to explain concepts to the weakest student in the class and should be good at crisis management and troubleshooting. Students look up to their teachers, so faculty should be role models, inculcate good value systems and inspire students to excel in their field.

Q. What are the key ingredients/traits that help one achieve success?

A. Hard work, introspection, willingness to learn (especially from failures), and **troubleshooting skills** are essential ingredients for achieving success.

Q. How do you handle success and failure?

"Treat success as a challenge"

A. I accept each success in my career as a challenge and a confidence booster. My present leadership assignment gave me wide exposure and an opportunity to grow and perform for the betterment of the institution, faculty, and student community. I feel people should not becomecomplacent with success. I want to learn from my own failures as well as other people's experiences to keep improving and not repeat the same mistakes again. My job involves the great responsibility of managing a large student community and requires crisis management and troubleshooting skills. I have to face new challenges all the time and need to excel not only at the individual level but also as a team so that I can take the institution to greater heights.

Q. What helped you reach where you are today?

A. Hard work, commitment, focus, willingness to learn from each challenge and giving the best to each assignment to the best of my capability have helped me reach my present position so that I can contribute to the betterment of teaching and the student community.

Q. What would be your key message to the youth of today?

A. There is **no shortcut to success.** Students should excel in their field, acquire as much knowledge as possible in their own field and related fields, keep adding value to themselves, and be innovative. Students should be willing to work in teams and understand that every experience is valuable. Learn from each experience and keep improving.

Suggested Further Reading

- IndiaBioscience: 10 Leaders, 10 Questions - *https://indiabioscience.org/columns/conversations/theme:leadership*

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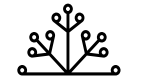

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