

## Biotechnology

Biotechnology is a package term for biological technology. It is the integrated use of molecular biology

Biochemistry, Microbiology & Genetic Engineering used for the welfare of human beings

One of the recent definitions of biotechnology is, “The application of Scientific & Engineering Principles to the processing of Materials by biological agents to provide goods & services”.

Agents include a wide range of biological Substances such as Enzyme & Whole cell of particular Organisms; the word services courses processes such as waste & water treatment.

Where is biotech applied?

Biotechnologies are applied across several sectors of economic activity, including health care, Agriculture, Food processing & Industrial applications.

Biotechnology is a young science, which is in budding stage, with limitless possibilities.

Broadly speaking, it combines three sciences & is concerned with three fields:-

- Health & Medicine
- Agriculture & Animal Husbandry
- Industry

Where all other branches science is saturated, biotechnology is an emerging field all over the world. It is this science which will yield the wonder drugs of tomorrow is also new varieties of plants & animals.

### Health care

Biotech products and techniques can be found in four major areas of health care, including: biopharmaceuticals, gene therapy, diagnostic testing and tissue replacement.

Therapeutic drugs and vaccines made using biotech techniques are referred to as “biopharmaceuticals,” and are likely to become the leaders in the treatment of a plethora of diseases condition. Areas of active research include autoimmune disorders, cancer, cardiovascular diseases, genetic defects, infectious diseases, nephrology disorders, specifically, biopharmaceuticals targeting anemia, cancer, heart diseases, impotence, infectious diseases lysosomal storage disorders multiple sclerosis, psoriasis, and rheumatoid arthritis will likely be the most prevalent in the remainder of the decade.

### Agriculture:-

Biotech has been a tremendous helps in improving the nutritional contents of plants and produce disease & herbicide resistant crops. Biotech is also very useful in developing more productive crops for farmers, it is used to increase the number of fruits and the required quality of fruits & Crops, Seedless fruits and blood red colored apples, we find in market are the examples of biotech.

### Animal Husbandry

Animal farmers also use Biotechnology, to develop genetically engineered animal growth hormone which results in production of high yield & quality of animal products. Some diseases that affect the animals can also be treated using genetic engineering & Biotech.

### Pharmacy

This Field is the house of maximum biotechnologists as it provides great scope for Research & Development. Many new varieties of medicines coming into the market are

the result of Biotech. Various vitamins like B2, B12 & enzyme are manufactured more nutritionally in large quantities. Various research labs like Ranbaxy, Cipla, Dr. Reddy, Biocon, etc. are highly based on Biotechnology.

### Food Production

Various food products, produced by natural process like Bread, Cheese, Wine, Vinegars, etc. are now being produced at large scale using Biotechnology.

Biotechnology processes are also useful in food production as it manufacture more nutritional food, which is free from side effects & toxics.

### Waste Management

Biotech is now used to reduce pollution, oil & Petrol pollution can be reduced by developing a particular bacteria, which dissolves polluting elements in the same way pollution caused by pesticides, herbicides etc. can be reduced using Biotechnology.

### Fuels

An alternative form of fuel can be produced using Biotech research is going on to produce a less polluting fuel than petrol which will be renewable also and can be produced by decomposing Waste materials, and this can become possible only due to Biotechnology

### Industry

Industries are using Biotechnology in various processes, which has led to cleaner processes that produce less waste & use less energy and water in various industrial sectors like chemicals paper industry, Textiles, Metals, and Minerals etc.

### Medical Investigation

Various medical diagnostic tests are the gifts of Biotechnology. Like the various blood tests for AIDS, pregnancy tests etc.

- Biotech has also helped in developing vaccines for hepatitis B, Which is otherwise a fatal disease.
- In the same way, Biotech is used in developing medicines fore otherwise incurable inherited disorders.
- Biotech is the back bone of research & development going on for fatal diseases like cancer & AIDS.

These are only a few examples we have put forward. Biotech has come up a boon for Human Health and is touching all the areas concerned with Health.

### Law & Justice

Biotechnology is also a great help for criminal investigation & forensic medicine. It has provided us various procedures to trace out like DNA fingerprinting, Paternity tests etc.

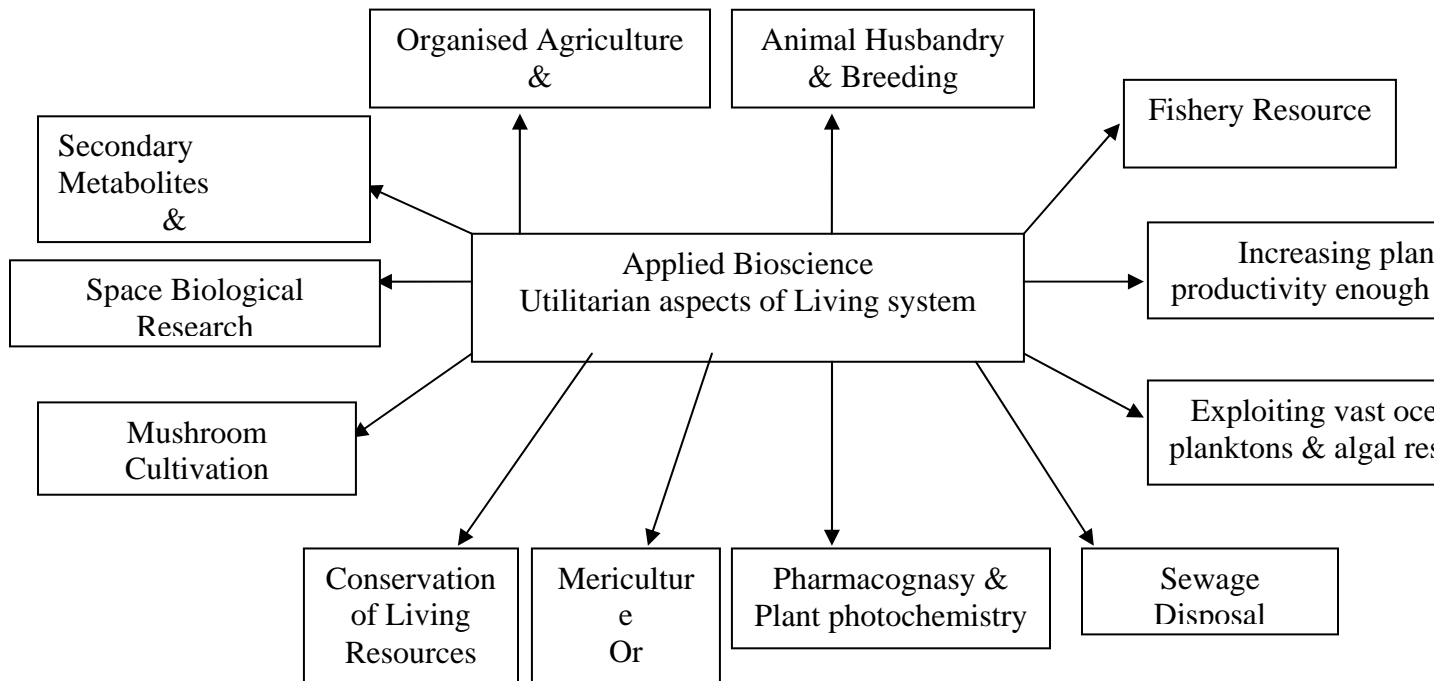
## Major Tools & Techniques Used For Developing Products in Biotech

Tools / Techniques	Description	Leading Company
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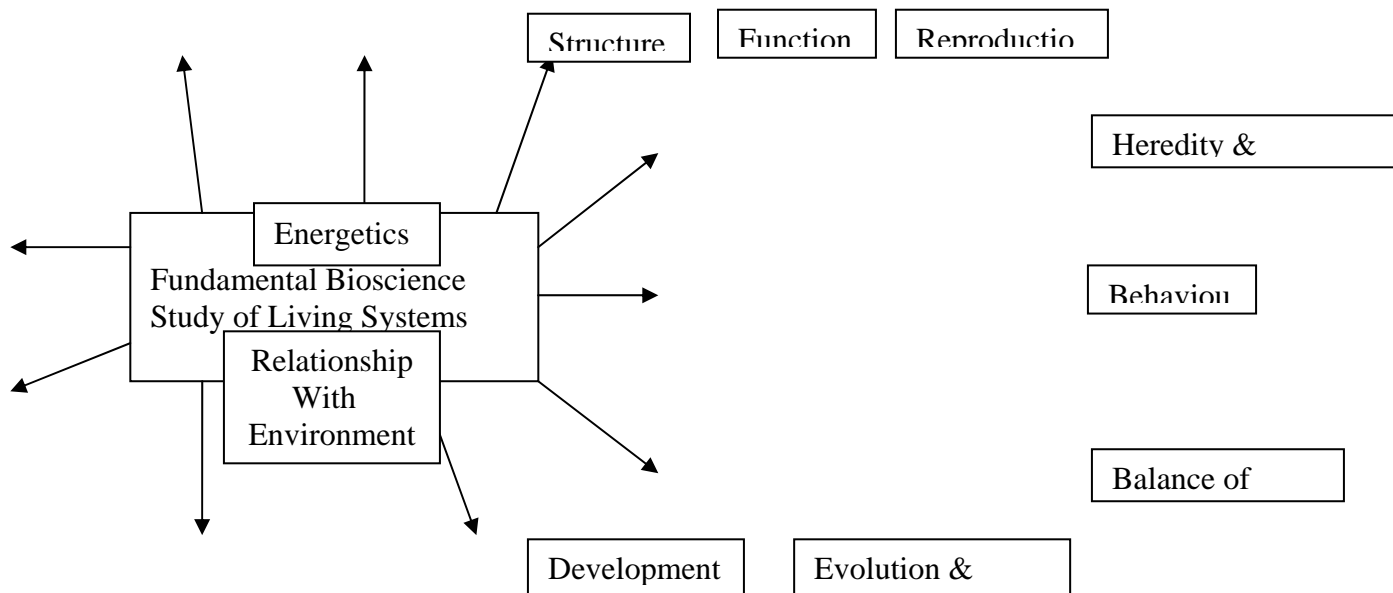
Genomic databases	Database that compile information on Characteristics, expression and function of genes and proteins, the features of single nucleotide polymorphisms, aspects of medicinal chemistry and drug screening.	Celera Genomic Group and Incyte Genomic Inc.
Biochip	Miniature Slide or plate that allows researchers to perform tests to understand the structure and function of genes and protein.	Affymetrix
High- performance liquid chromatography (HPCL)	HPCL provides a more automated way to separate proteins than do 2-D gels or isotope – coated affinity tags, but is not as sensitive as these methods.	Waters Crops and Agilent Technologies
Isotope – Coated affinity tags (ICAT)	A newer, more sensitive method for labeling proteins, ICAT can detect proteins that 2-D gels might miss.	Applied Biosystems Group
Mass Specrometry (MS)	Instruments that measure the mass – to- charge ratio of peptides (Protein fragments) and allow scientists to quantify the characteristics of proteins.	Applied Biosystems waters, and Termo Electron Crop.
2-D gels	Used to Separate thousands of proteins from cell or tissue samples, After separation onto a gel, protein characteristics are analyzed by specialized computer software.	Amersham Biosciences

X-Ray crystallography	Used to determine the three dimensional structure of a small- molecules drug targeting specific cellular pathways which may interrupt a protein's synthesis	Structural Genomix Inc. and Syrrx Inc.
Thermocycler or polymerase chain reaction (PCR)	A machine that separates fragments of DNA samples Among its many application PCR is used for paternity tests, to detect residues of transgenic crops in food and to detect viral diseases before symptoms are manifest.	Bio- Red Laboratories Inc.

### The Spectrum of Studies in applied bioscience



## The Spectrum of studies in Fundamental Bioscience



## Biotech Today

The biotechnology industry tripled in the 1990s and had a May 2002 market capitalization of \$224 billion. In 2002 a total of 1,446 companies employed over 142,900 people in the U. S. alone. Of those companies, 318 are publicly held. Over 325 million people have benefited from the more than 130 FDA- approved drug and vaccines produced by the industry. Over two- third of these drug were approved in the last six years. A research- driven industry, U. S. biotech companies spent \$16.3 billion on research and development (R&D) in 2002. With the top 5 spending an average \$89.400 per employee.

## Career Prospects

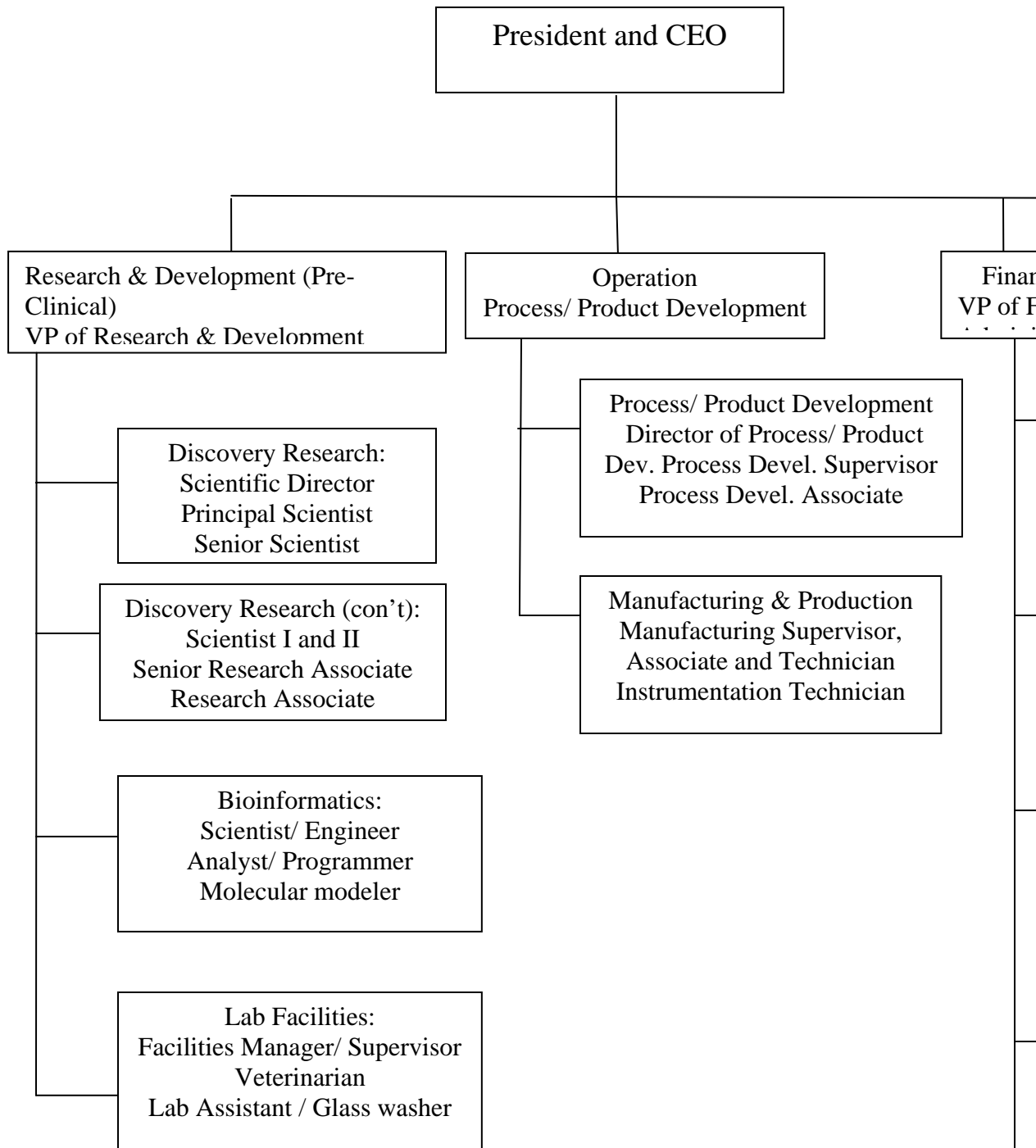
### Biotech Company Organization

Biotech Companies focused on healthcare application contain the major departments:-



Organization of Medium / Large Sized Companies

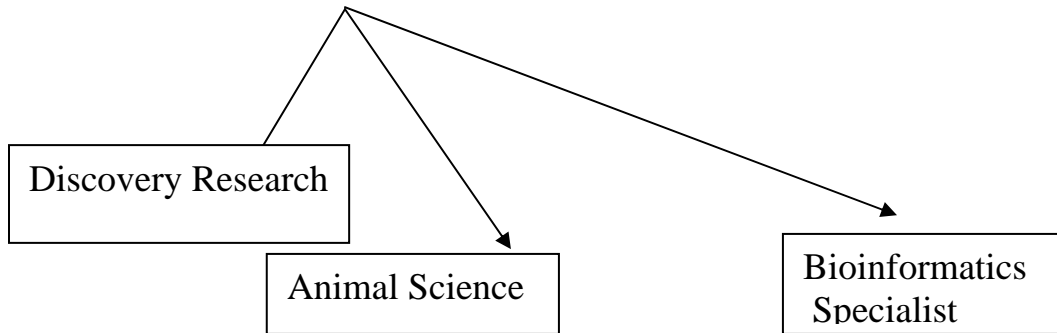




## Choosing a Career Paths

### TO Lab or Not to Lab

With in a lab, you can choose from 3 career point:-

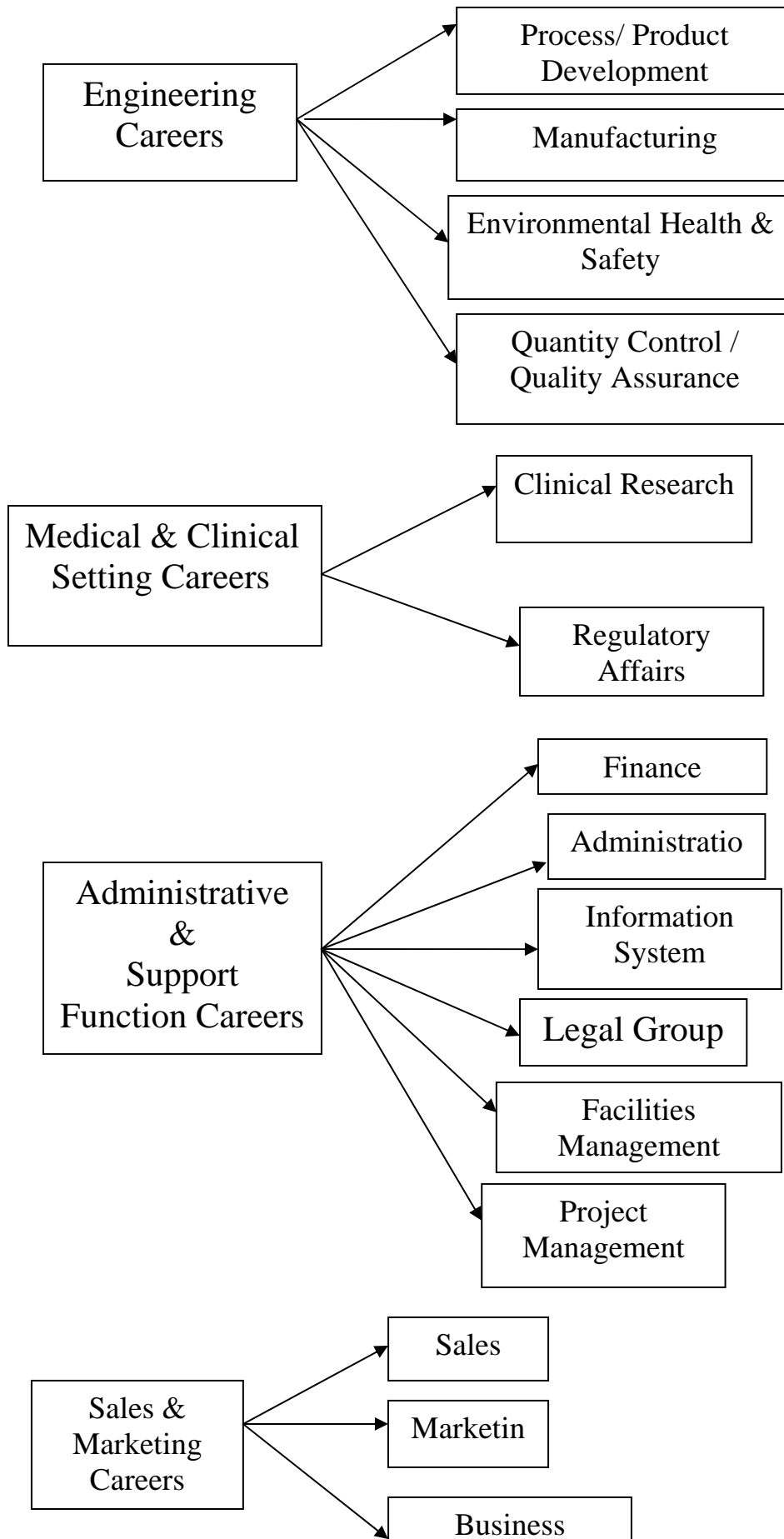


### Non- Laboratory Research Career Paths

Non- Laboratory research career in biotech encompass a large range of function including

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## How It Comes Together

<b>Group</b>	<b>Internal Interface</b>	<b>External Interfaces</b>
Discovery Research	<ul style="list-style-type: none"> <li>▪ Scientist within own group</li> <li>▪ Scientist in other groups</li> <li>▪ Bioinformatics professionals</li> </ul>	Scientist at government laboratories and university research centers
Product/ Process development	<ul style="list-style-type: none"> <li>▪ Discovery scientist</li> <li>▪ Toxicologists</li> <li>▪ Clinical Researches</li> </ul>	Clinical Researches
Animal testing	<ul style="list-style-type: none"> <li>▪ Product/ Process development engineers</li> <li>▪ Quality and Validation managers</li> <li>▪ Clinical data managers</li> </ul>	Scientist at government laboratories and university research centers
Clinical Research	<ul style="list-style-type: none"> <li>▪ Process/ development engineers</li> <li>▪ Toxicologists</li> <li>▪ Clinical data managers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Hospitals</li> <li>▪ Clinics</li> <li>▪ Patients</li> <li>▪ Patient advocate group</li> </ul>
Medical Affairs	<ul style="list-style-type: none"> <li>▪ Clinical Researches</li> <li>▪ Regulatory affairs managers</li> </ul>	Regulatory agencies, mostly the FDA
Business development	<ul style="list-style-type: none"> <li>▪ Senior executives</li> <li>▪ Medical director</li> </ul>	Counterparts at prospective partner companies
Finance and administration	<ul style="list-style-type: none"> <li>▪ CFO</li> <li>▪ VP, Business development</li> <li>▪ VP, Operations</li> <li>▪ VP, R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>▪ Venture capitalists</li> <li>▪ Private equity investors</li> <li>▪ Investment press</li> </ul>

## Profiles of Biotech Professionals

### Entry- Level Scientist

Name of Position – Assistant Scientist

Function – Discovery Research

Education Level – BS, Solid state Chemistry & Material Engineering

Company type & Size - 100 Employee; Small, Private, Specially Pharmaceuticals Company

Hours per Week – 40 - 45hrs.

Salary Range - \$ 40,000 - \$ 60,000

Perks – Stock options, Subsidized break fast & lunch for small fee

### Business Development Manager

Name of Position – Business Development Manager

Function- Business Development

Education Level – BS in Microbiology, MBA

Company type & Size – 300 Employee, Mid size Company; < \$ 150 – 200 \$ million in Revenue.

Hours per Week- 50- 60

Salary range - \$ 100k – \$ 125k

Perks – Company Car, Performance Bonus, Reduced Price Stock offering

Bioinformatics analyst

Name of Position – IT/ Bioinformatics Analyst

Function – Bioinformatics

Education Level – BS in Biology with a focus in Computational Biology

Company type & Size – Part of a Center in a university; funded by corporation; group has 7 Employee & 3 new analyst position open.

Hours per Week – 40 - 50hrs.

Salary Range - \$ 40,000 - \$ 50,000 (academic salary range)

Perks – Standard benefits package that comes academic position; flexible work arrangement, where gp. Members can work from home 2 days per week this is Standard for group members.