

Careers in Biotech

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Biotechnology – can be divided into 3 areas

Human health care – applications in:

- Monoclonal antibodies
- Detection and treatment of diseases
- Vaccines
- Human growth and other hormones

Agriculture and animal health care

- Food additives, proteins, enzymes and vitamins
- Biopesticides and biofertilizers
- Improved crop yield and quality
- Animal feed supplements
- Vaccines

Energy/environmental management

- Biomass from chemicals, wastes, residues & fuel crops
- Enhanced oil recovery
- Chemicals and solvents
- Decomposition and detoxification of chemicals
- Biosensors and biochips

- Enzymes
- Other proteins
- Improved and new antibodies, drugs and vitamins
- Gene therapy
- Plant growth hormones
- Diagnostic reagents for plant and animal diseases
- Transgenic animals
- Microbial nitrogen fixation and manipulation of symbionts
- Improved microbial systems for environmental control of air, water & soil
- Extraction of low-grad metals and recovery of valuable metals
- Hydrogen and carbon dioxide production

Types of companies

- **Life Science** – pick and shovel, kits, reagents and instrumentation (Ambion, Invitrogen, ABI, Promega, Amersham Biosciences)
- **Biotech** – higher risk/reward, VC, burn-rate, market ups and downs (Amgen, Chiron, Celera, Genentech)
- **Diagnostics** – diagnose and stage, molecular diagnostics (the future?) (Roche, Chiron, Abbott, Wyeth, SmithKline)
- **Big Pharma** – huge, many opportunities, “the big show” (Bristol-Myers, Eli Lilly, Glaxo Wellcome, Novartis, Pfizer)

Types of jobs at a life science companies

- **R&D:** assistant, associate, scientists, senior scientists, director, VP
- **Manufacturing:** production, formulation, filling, production planning, purchasing, materials management, packaging, director, VP
- **Quality Control:** assistant, associate
- **Marketing:** product mgmt, business development, legal, VP
- **Technical Service:** marketing communications, PR, Dir
- **Sales:** technical field reps, service reps, sales manager, VP
- **Legal:** patent and trademarks, licensing, litigation, counsel, general counsel

Techniques used at typical life science companies

In vitro transcription
PCR
Real-time PCR
Reverse transcription
Tissue culture
Cloning

Agarose gel electrophoresis
Polyacrylamide gel electrophoresis
RNA isolation
Northern blotting and hybridization
Poly(A) RNA isolation
RNA amplification

Expression profiling (microarrays)
in situ hybridization
Nuclease protection assays
in vitro translation

Instrumentation used at typical life science companies

Thermal cyclers
Gene chip scanner/microarray scanner
Capillary electrophoresis instruments
MALDI, TOF Mass spectrometry
Fluorescence plate readers
TCA precipitations

Robotic platforms and liquid handlers
2D gel electrophoresis
Gene chip hybridization stations
Real time PCR instruments
HPLC purification and analytical
Coupled GC/MS

Luminometers
Column fractionation
Bioinformatics and statistics software
Liquid scintillation counter

Direction life science is moving

Functional Genomics – transcriptomics
Proteomics and cell biology
Bioinformatics – bioinformatology
Molecular Diagnostics
Small interfering RNAs (siRNA) and micro RNA (miRNA) – gene expression and regulation

Related science careers

Technical writing, publishing
Scientific translations
Science journalism
Consulting (after experience)

Entrepreneurial business
Patent agent or science law related
Public policy analyst
Regulatory affairs

Biomedical engineering
Process engineer

Typical life science company salary ranges (entry level and experienced)

R&D Senior Scientist (PhD), \$60-80K to \$70-110K
 R&D (MS): \$40-50K to \$45-60K
 R&D (BS): \$39-45K to \$45-55K
 Production (BS): \$28-38K to \$35-55K
 Quality Control (BS): \$30-40K to \$35-55K
 Field Sales Rep: \$55-70K to \$60-110K

Marketing Product Manager: \$45-55K to \$70-130K
 Technical Services Rep: \$40-50K to \$50-65K
 IT: \$40-60K to \$50-90K
 Web: \$40-60K to \$50-75K
 Shipping/packaging: \$10/hour
 Customer Service: \$12-15/hour

Biotech company summary

Company	Revenue 2005 (\$M) (Health-care)	R&D Exp. 2005 (\$M) (Health-care)	Employees 2005 (Total)
Pfizer	51,298	7,442	106,000
Johnson & Johnson	50,514	6,312	115,600
GlaxoSmithKline	39,430	5,709	100,728
Sanofi-Aventis	33,999	5,034	97,181
Novartis	32,212	4,846	90,924
Roche	28,502	4,579	68,218
AstraZeneca	23,950	3,379	65,300
Abbott Laboratories	22,338	1,821	59,735
Merck & Co.	22,012	3,848	61,500
Bristol-Myers Squibb	19,207	2,746	43,000
Wyeth	18,776	2,749	49,732
Eli Lilly & Co.	14,645	3,026	42,600
Amgen	12,430	2,314	16,500
Boehringer Ingelheim	11,870	1,693	37,406
Bayer	11,738	1,188	93,700
Baxter	9,848	533	47,000
Schering-Plough	9,508	1,865	32,600
Takeda Pharmaceutical	9,184	1,417	15,069
Procter & Gamble	7,852	N/A	138,000
Astellas Pharma	7,434	1,214	15,000
Daiichi Sankyo	6,707	1,357	18,434
Genentech	6,633	1,262	9,563
Schering AG	6,608	1,222	25,037
Novo Nordisk	5,631	848	22,007
Teva Pharmaceutical Ind.	5,250	369	14,698
Eisai	4,957	797	9,081
Merck KGaA	4,848	721	29,133
Akzo Nobel	4,381	681	61,340
Alcon	4,369	422	12,700
Forest Laboratories	2,962	410	5,050
Altana	2,944	520	13,276
UCB	2,914	636	8,525
Solvay	2,826	437	28,730
Chugai Pharmaceutical	2,773	424	5,357
Genzyme	2,735	503	8,200
Serono	2,586	594	4,826
Biogen Idec	2,423	748	3,340
Bausch & Lomb	2,335	306	14,000
Taisho Pharmaceutical	2,320	197	5,191
Allergan	2,319	391	5,055
CSL Ltd.	2,148	119	7,000
Gilead Sciences	2,028	278	1,900
Mitsubishi Pharma	2,019	410	5,902
Chiron	1,920	434	5,500
King Pharmaceuticals	1,773	263	2,795
Kyowa Hakko Kogyo	1,769	239	5,800
Shionogi & Co.	1,653	276	4,997
Watson Pharmaceuticals	1,646	125	3,844
Dainippon Sumitomo Pharma	1,646	253	5,142
Shire Pharmaceuticals	1,599	336	2,403

Resources

Web Sites: Biojobnet.com, Sciencejobs.com, Medzilla.com, Bio.org

Books:

As the Future Catches You, J. Enriquez (read this first!)

The Wet Feet Insider Guide to Careers in Biotech & Pharmaceuticals

From Alchemy to IPO: The Business of Biotechnology, C. Robbins-Roth

Opportunities in Biological Science Careers, C.A. Winter

Opportunities in Biotechnology Careers, S.S. Brown