Biotech Career Pathways in Northern California: A Workshop for Solano County Counselors

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What is Biotechnology?

The use of living organisms, or parts thereof, to provide useful products, processes and services.

Cells are the basic building blocks of living organisms

Scientists in the field of biotechnology modify cellular DNA in order to produce useful proteins or biomolecules or change other cell traits.
Agricultural Biotechnology

► Enhanced pest and disease resistance

► Decrease use of chemicals on farmland

► Enhanced vitamins, micronutrients, etc.

► Increased stress tolerance: drought, salinity, cold, etc.

► “Pharming” to make vaccines and therapeutics.

► Use of cellulosic biomass for biofuels
Industrial Biotechnology

Useful proteins or biomolecules may be produced on an industrial scale by making transgenic cells (bacteria, fungi, CHO cells, plant or algal cell cultures), followed by large scale fermentation and biomolecule collection...aka “Biomanufacturing”

Molecules produced via biomanufacturing include:

- **Pharmaceuticals** for the treatment of many diseases and disorders (Genentech, Novartis, Amgen, many others...visit [www.baybio.org](http://www.baybio.org) for a list of the local biotech pharma companies)

- **Enzymes** for the production of cheese, bread, detergents, textiles, plastics, etc... (Novozymes)

- **Antibodies** used in vaccines, medical diagnostics, molecular biology research, biosensors, etc...
Biotech Scientists Use Interdisciplinary Skills (molecular biology, chemical engineering, computer science, etc..) to Address Many Types of Questions

**Biofuels & Bioenergy**
- Can we design transgenic plants and microorganisms to produce inexpensive, renewable sources of fuel and energy?

**Stem Cells & Tissue Engineering**
- Can we use embryonic stem cells or reprogrammed adult stem cells to regenerate all tissues of the human body?
- Can we develop imaging systems to track stem cells in the human body?
- Can we program stem cells to stop dividing once tissue is repaired?

**Bioremediation**
- Can we use transgenic plants and microorganisms to efficiently remove toxins from soil and water?

**Genomics, Proteomics & Bioinformatics**
- Can we identify DNA sequence variations in the Human Genome that correlate to specific diseases and other traits?
- Can we use the genome sequences of pathogenic microorganisms and viruses to help us design more effective drug treatments and vaccines?
Early Training for Careers in Biotechnology

Take “College Prep” High School Courses:

- **Science Classes** (Biology, Chemistry, Physiology, etc...) with hands-on laboratory training
- **Math Classes** (Algebra, Geometry, Calculus, etc...)
- **Computer Classes**
- **English Classes**

*In High School, build the skills needed to:*

- Work effectively as the member of a team
- **Precisely** handle lab equipment and gather data
- Carefully **analyze** and solve problems, based on known facts or data
- Clearly **communicate** the results of your work (written and verbal)
Thriving Biotech-Related Life Science Job Markets

- Research
- Administration
- Teaching
- Sales & Marketing
- Patent Law
- Government Regulatory Affairs
- Technical Writing
- Health Care
Education & Training for a Career in the Life Science Industry

High School Diploma

~4-5yrs

Community College Certificate

~2yrs

Community College AS Degree

~2yrs

Bachelor’s of Science (BS) Degree

~2-3yrs

Master’s of Science (MS) Degree

~5-7yrs

Doctoral Degree (PhD)

~5-7yrs

Laboratory Technician

~$35-40,000/yr

Research Scientist

~$50-70,000/yr

Laboratory Director

~$65-100,000+/yr

Biotech Company CEO

~$100,000+/yr

More years of experience

1-2yrs

~2yrs

~4-5yrs

~2yrs

~2yrs

~5-7yrs
Education & Training for a Career in Life Science Academia

- High School Diploma
- Community College Certificate ~1-2yrs
- Community College AS Degree ~2yrs
- Bachelor’s of Science (BS) Degree ~4-5yrs
- Master’s of Science (MS) Degree ~2-3yrs
- Doctoral Degree (PhD) ~5-7yrs
- Laboratory Technician ~$35-45,000/yr
- Research Scientist ~$50-70,000/yr
- Adjunct Faculty (~temporary) ~$40-50,000+/yr
- Community College Prof/Admin ~$50-100,000+/yr
- University Professor/Administrator ~$50-100,000+/yr
- Postdoctoral Researcher (~temporary) ~$40-50,000+/yr
- K-12 Teacher ~$45-70,000/yr
- K-12 Credential ~1-2yrs
- Postdoctoral Researcher (~temporary) ~$40-50,000+/yr
- Adjunct Faculty (~temporary) ~$40-50,000+/yr
- Community College Prof/Admin ~$50-100,000+/yr
- University Professor/Administrator ~$50-100,000+/yr
- Postdoctoral Researcher (~temporary) ~$40-50,000+/yr
1-2 Year Biotech Programs & Related Courses Offered in the Region

► **Solano Community College**
  - Applied Biotech Certificate (pending)
  - Industrial Biotech Certificate
  - Industrial Biotech Degree (AS)
  - [http://www.solano.edu/degrees/catalog_200809/biotech.pdf](http://www.solano.edu/degrees/catalog_200809/biotech.pdf)

► **American River College, Sacramento** (restructuring)
► **City College of San Francisco** (Certificates)
► **College of San Mateo** (AS Degree)
► **Contra Costa College, San Pablo** (Certificates)
► **Foothill College, Los Altos** (Certificate & AS Degree)
► **Laney College, Oakland** (Certificate)
► **Ohlone College, Fremont** (Certificate)
► **Skyline College, San Bruno** (Certificate & AS Degree)
► **Vista College, Berkeley** (Certificate & AS Degree)
4 Year & Graduate Training Programs

► **CSU Sacramento**
  - BS, MS in Biological Sciences (various majors)
    - [http://www.csus.edu/bios/](http://www.csus.edu/bios/)

► **CSU San Jose**
  - Professional Masters in Biotech (MBT)

► **UC Davis**
  - BA/BS in Biological Sciences (various majors)
    - [http://admissions.ucdavis.edu/academics/major_view.cfm?major=bbis](http://admissions.ucdavis.edu/academics/major_view.cfm?major=bbis)
  - BS in Biotechnology
    - [http://admissions.ucdavis.edu/academics/major_view.cfm?major=abit](http://admissions.ucdavis.edu/academics/major_view.cfm?major=abit)
  - MS/PhD in Biological Sciences (various majors)
  - Designated Emphasis in Biotechnology (for PhD students)

Note: There are other state (UC, CSU, private) and national universities offering similar programs.
Local Careers in Biotech Industry

N. California is the birthplace of biotech!
~100 Life Sciences companies exist along the I-80 Corridor

Over 100,000 Jobs!

Nationwide, the median income of those in the life sciences is ~$66,480.
Life Science Companies in the Greater Sacramento Valley*

- Affymetrix
- AgraQuest
- Alza
- Antibodies, Inc.
- Arcadia Biociences
- BioRad
- Dade Microscan
- Davis Sequencing
- Genentech
- Glycometrix (seed stage)
- Hygieia Labs
- IDEXX Labs
- Jackson Labs
- Lipomics Technologies
- Mesolytics (seed stage)
- Miltenyi Biotech
- MMI Genomics
- Monsanto, Calgene campus
- Novozymes
- Novartis
- Pediatric Biosciences (seed stage)
- Pioneer Hibred
- Seminis Seeds
- Synthia LLC (seed stage)
- Thermogenesis
- Telomolecular
- Ventria Biosciences
- Volcano
- Vitalea (seed stage)

(*not complete list)
Finding Biotech Career Information Online

► BioTech SYSTEM
  - http://biotechsystem.ucdavis.edu/biotech_training.cfm
  - Regional consortium supporting biotech education in Solano, Yolo and Sacramento counties and outlying areas of N. California

► Bio-Link
  - http://www.bio-link.org/
  - Informational website on regional biotech programs and industry, teacher professional development, curriculum, “Equipment Depot”, etc...
  - NSF-funded Center based at San Francisco City College, Director Elaine Johnson

► Biotech Work Portal
  - http://www.biotechwork.org/
  - A comprehensive website with links to information on biotech careers, educational programs, job postings, labor market data, etc...
  - Sponsored by the San Diego Workforce Partnership and BioSpace

► BiotechEmployment.com
  - http://www.biotechemployment.com/
  - An eJobstores.com database providing annual data on job postings and salaries in the biotech industry
Online Resources for Career Planning

► CareerOneStop
  - http://www.careeronestop.org/
  - A career information website sponsored by the US Dept of Labor

► Career Voyages
  - http://www.careervoyages.gov/
  - Career information website hosted by the US Department of Education and the US Department of Labor

► California Employment Development Department
  - http://www.edd.ca.gov/
  - Includes data on California biotech jobs and industry growth
The California Employment Development Department (EDD) Records Data on Biotech Jobs in the State

http://www.labormarketinfo.edd.ca.gov/?PAGEID=136

Under the Microscope, Biotechnology Jobs in California

The occupational analysis includes a job description, skills, knowledge and abilities, wages, training requirements, job outlook, and additional sources of information.

Animal Handlers
Animal Technicians
Assay Analysts
Biochemical Development Engineers
Bioinformatics Specialists
Biostatisticians
Clinical Research Associates
Customer Service Representatives
Documentation Coordinators
Documentation Specialists
Graphic Designers
Greenhouse Assistants
Instrumentation/Calibration Technicians
Laboratory Assistants
Laboratory Support Workers
Library Assistants
Manufacturing Engineers
Manufacturing Research Associates
Manufacturing Technicians
Medical (Technical) Writers
Microbiologists
Plant Breeders
Process Development Associates
Process Development Engineers
Production Planners and Schedulers
Quality Assurance Auditors
Quality Control Analysts
Quality Control Engineers
Quality Control Inspectors
Research Associates (R&D)
Research Scientists
Safety Specialists
Sales Representatives
Scientific Programmer Analysts
Technical Services Representatives
Validation Technicians

The report includes a wide variety of biotechnology occupations - from Animal Handler and Greenhouse Assistant to Bioinformatics Specialist and Scientists. Education requirements vary considerably as well. Some jobs require a doctorate degree, others a high school diploma. Some jobs can be filled with a minimum level of experience, others require a job candidate to be fully prepared to begin working at top speed right away.

For ease of use, the report has been broken into three parts. Blank pages have been inserted into these documents to allow for correct placement when printed front-to-back (requires Adobe Reader to view).

Biotechnology Report Cover

Part 1 - Executive Summary, Introduction, and Overview
Part 2 - Biotechnology Occupations
Part 3 - Appendices
Standard Occupational Classification (SOC) Job Family
19-0000 - Life, Physical, and Social Science Occupations

- 19-1011 Animal Scientists
- 19-1012 Food Scientists and Technologists
- 19-1013 Soil and Plant Scientists
- 19-1021 Biochemists and Biophysicists**
- 19-1022 Microbiologists**
- 19-1029 Biological Scientists, All Other**
- 19-2031 Chemists
- 19-2032 Materials Scientists
- 19-4011 Agricultural and Food Science Technicians (Greenhouse Technicians)**
- 19-4021 Biological Technicians (Assay Analysts)**
- 19-4031 Chemical Technicians (Assay Analysts)**

http://www.labormarketinfo.edd.ca.gov/OccGuides/SOCJOBFamily2.aspx?soc=19&Geography=0604000095
Introducing A New Regionally Focused Online Resource... CareerGPS

► Penny Cobarrubia
Program Associate for Linking Education and Economic Development (LEED)

- http://www.leed.org/
- http://careergps.com/
CareerGPS is a **unique resource** to the Sacramento region, allowing educators and training providers to tailor curriculum and programs to meet specific workforce needs;

CareerGPS is a **powerful database** that allows civic interests and economic developers with information to grow critical industries that align with economic objectives and provide high value, high wage careers;

CareerGPS will equip job seekers and students with information to "navigate" career and educational pathways.