



Guide for

Biochemical Engineers in California

May also be called: Biochemical Development Engineers; Biochemical Research Engineers; Engineering Directors; and Process Engineers

What Would I Do?

Using their knowledge of cell and molecular biology, chemistry, and engineering, Biochemical Engineers develop products such as food, medicine, or vaccines. They also design or improve environmental processes such as water purification or biomass to fuel conversion. They prepare and conduct experiments and analyze the results using strict methodologies. Biochemical Engineers consult and collaborate with biologists, chemists, environmental consultants, manufacturing personnel, and others as they design and evaluate products or processes. They also develop procedures to shift product development from the laboratory to large-scale manufacturing.

In addition to chemical engineering principles, Biochemical Engineers have in-depth knowledge of biological systems, such as the production of specific products using enzymes or microorganisms. Biochemical Engineers and chemical engineers often work together in production facilities—for example, Biochemical Engineers develop and implement a fermentation process for production of ethanol from sugars, and chemical engineers distill and purify the compound to produce biofuels.

Tools and Technology

Biochemical Engineers use a variety of tools and technology in the course of their work, such as electronic counters, environmental growth chambers, fluorospectrometers, and nuclear magnetic resonance (NMR) spectrometers. They use analytic or scientific, computer-aided design (CAD), and operating system software, as well as word processing, presentation, and spreadsheet applications.

Important Tasks and Related Skills

Each task below is matched to a sample skill required to carry out the task.

Task	Skill Used in this Task
Devise scalable recovery, purification, or fermentation processes for producing proteins or other biological substances for human or animal therapeutic use, food production or processing, biofuels, or effluent treatment.	Engineering and Technology
Design or conduct studies to determine optimal conditions for cell growth, protein production, or protein or virus expression or recovery, using chromatography, separation, or filtration equipment, such as centrifuges or bioreactors.	Biology

Develop biocatalytic processes to convert biomass to fuels or fine chemicals, using enzymes of bacteria, yeast, or other microorganisms.	Science
Prepare technical reports, data summary documents, or research articles for scientific publication, regulatory submissions, or patent applications.	Written Expression
Confer with research and biomanufacturing personnel to ensure the compatibility of design and production.	Active Listening
Design or direct bench or pilot production experiments to determine the scale of production methods that optimize product yield and minimize production costs.	Judgment and Decision Making
Develop methodologies for transferring procedures or biological processes from laboratories to commercial-scale manufacturing production.	Production and Processing
Design or conduct follow-up experimentation, based on generated data, to meet established process objectives.	Critical Thinking
Develop recovery processes to separate or purify products from fermentation broths or slurries.	Chemistry
Advise manufacturing staff regarding problems with fermentation, filtration, or other bioproduction processes.	Problem Sensitivity
Modify or control biological systems to replace, augment, or sustain chemical or mechanical processes.	Systems Analysis

Source: U.S. Department of Labor [Occupational Information Network \(O*NET\)](http://online.onetcenter.org) at online.onetcenter.org.

Working Conditions

Most Biochemical Engineers work in office buildings, laboratories, or industrial plants. Since this is often a hands-on occupation, they may spend considerable time on noisy factory floors. They may be exposed to hazardous chemicals and machinery; therefore, wearing personal protective clothing and following proper safety procedures are important. They may also lift and move items up to 50 pounds.

Engineers generally work a 40-hour week; however, deadlines may bring additional pressure to a job, requiring longer work hours, which may include weekends and holidays.

Biochemical Engineers are typically not members of labor organizations; however, Engineers who work for government agencies may belong to a union.

Will This Job Fit Me?

Biochemical engineering may appeal to those who enjoy working with ideas and activities that require an extensive amount of thinking and include practical, hands-on problems and solutions.

Aspiring Engineers should be creative, inquisitive, analytical, and detail oriented. They must be able to work independently as well as part of a team. Effective oral and written communication skills are critical.

What Wages and Benefits Can I Expect?

Wages

A formal salary survey for Biochemical Engineers is not available; however, their earnings are typically comparable to the broader group of Engineers, All Other. According to the Occupational Employment Statistics Survey, wages in 2012 for Engineers, All Other in California ranged from \$78,423 to \$123,868

annually or \$37.70 to \$59.56 hourly. The median wage was \$100,936 annually or \$48.52 hourly. The median is the point at which half of the workers earn more and half earn less.

Benefits

Biochemical Engineers generally receive medical, dental, and disability insurance as well as vacation, sick leave, and retirement benefits. Some employers may also offer additional benefits, such as education assistance and flexible spending accounts and work schedules.

What is the Job Outlook?

Most job openings will be created by the need to replace Biochemical Engineers who retire or leave the field for other reasons.

How Do I Qualify?

Education, Training, and Other Requirements

A bachelor's degree in biochemical or chemical engineering or a related field is generally the minimum educational level that employers will consider for biochemical engineering positions. Biochemical and chemical engineering programs involve extensive coursework in biology, chemistry, mathematics, and physics, as well as hands-on laboratory classes. Advanced computer skills are also vital to the Engineer's education. Research or university teaching positions usually require a master's or doctoral degree. Some chemical engineers receive additional education or training to become Biochemical Engineers.

Experience

Biochemical engineering graduates with internship experience generally have greater employment opportunities than those with no experience. Most senior Engineer positions require four or more years of experience.

Early Career Planning

High school students interested in a biochemical engineering career should take college preparatory biology, chemistry, physics, and English courses. They should also take computer science courses and as many math classes as possible, including algebra, geometry, and calculus. Students would also benefit from participating in extracurricular science or engineering activities geared toward middle and high school students, such as Odyssey of the Mind; Science Olympiad; and Science, Technology, Engineering, and Mathematics (STEM) programs.

Training programs such as biotechnical or chemical engineering technology may also be available through Regional Occupational Programs (ROP). To find an ROP program near you, go to the California Association of Regional Occupational Centers and Programs website at www.carocp.org/carocps.html.

Work-Study Programs

Some colleges and universities help students find work-study programs or internships. Internships are usually paid and are an opportunity for the sponsoring organization to recruit future employees.

Continuing Education

Continuing education is currently not a requirement for Biochemical Engineers in California; however, most Engineers take continuing education courses to stay up to date with the latest scientific, industrial, or technological advances in the field. Engineers must also stay current with regulatory issues.

Licensing and Certification

A Professional Engineer (PE) license is not required for Biochemical Engineers; however, some Engineers may possess a chemical engineering license, which may enhance job prospects. Engineers whose work affects the public must obtain a PE license, which must be renewed every two years.

Contact the agency that issues the license for additional information. Click on the license title below for details.

Chemical Engineer www.labormarketinfo.edd.ca.gov/OccGuides/LicenseDetail.aspx?LicID=7692

Professional associations may offer certificates related to biochemical engineering, such as the Certified Pharmaceutical Industry Professional. For more information, go to the U.S. Department of Labor's Career InfoNet website at www.acinet.org and scroll down to "Career Tools." Select "Certification Finder" at www.acinet.org/certifications_new/default.aspx and follow the instructions to locate certification programs.

Where Can I Find Training?

There are two ways to search for training information at www.labormarketinfo.edd.ca.gov/?Pageid=1013:

- [Search by "Field of Study"](#) to find what programs are available and what schools offer those programs. You may use keywords such as: Biochemical Engineering or Engineering.
- [Search by "Training Provider"](#) to find schools by name, type of school, or location.

Contact the schools you are interested in to learn about the classes available, tuition and fees, and any prerequisite course work.

Where Would I Work?

A formal survey of industries has not been conducted for Biochemical Engineers at this time. However, references from subject matter experts and job listings indicate that the largest industries employing Biochemical Engineers in California are food and pharmaceutical manufacturing, waste treatment and remediation, as well as government and academia.

Finding a Job

Direct application to employers remains one of the most effective job search methods. Internet job listings, job fairs, college career centers, or professional associations may also provide job leads. Online job opening systems include JobCentral at www.jobcentral.com and CalJOBSSM at www.caljobs.ca.gov.

To find your nearest One-Stop Career Center, go to [Service Locator](http://www.servicelocator.org) at www.servicelocator.org. View the [helpful job search tips](http://www.labormarketinfo.edd.ca.gov/occguides/JobSearchTips.pdf) at www.labormarketinfo.edd.ca.gov/occguides/JobSearchTips.pdf for more resources (requires [Adobe Reader](#)).

Yellow Page Headings

You can focus your local job search by checking employers listed online or in your local telephone directory. Below are some suggested headings where you might find employers of Biochemical Engineers.

- Biochemical
- Biotechnology
- Colleges & Universities
- Engineering
- Engineers
- Food Manufacturing
- Food Processing
- Government Offices
- Pharmaceuticals
- Waste Management

Find Possible Employers

To locate a list of employers in your area, use “Find Employers” on the LaborMarketInfo website at www.labormarketinfo.edd.ca.gov/aspdotnet/databrowsing/empMain.aspx?menuChoice=emp.

- Select the search for employers by occupation.
- Select a geographic area.
- Search for an occupation by keyword, occupation, or category.
- Select one of the top industries that employ the occupation. This will give you a list of employers in that industry in your area.
- Select “View Filter Selections” to limit your list to specific cities or employer size.
- Select an employer for the street address, telephone number, size of business, website, etc.
- Contact the employer for possible employment.

Where Could This Job Lead?

As Engineers gain knowledge and experience, they are assigned more difficult or specialized projects with greater independence to develop products, solve problems, and make decisions. Engineers may also advance to senior or managerial positions.

Related Occupations

Below is a list of occupations related to Biochemical Engineers.

- Biochemists and Biophysicists (SOC 19-1021)
- Biomedical Engineers (SOC 17-2031)
- Chemical Engineers (SOC 17-2041)
- Chemists (SOC 19-2031)
- Food Scientists and Technologists (SOC 19-1012)
- Materials Engineers (SOC 17-2131)
- Nuclear Engineers (SOC 17-2161)

Other Sources

- California Board for Professional Engineers, Land Surveyors, and Geologists
www.pels.ca.gov
- Accreditation Board for Engineering and Technology (ABET)
www.abet.org
- American Chemical Society
www.acs.org
- American Institute of Chemical Engineers
www.aiche.org
- National Society of Professional Engineers
www.nspe.org
- Society for Biological Engineering (SBE)
www.aiche.org/sbe

These links are provided for your convenience and do not constitute an endorsement by the EDD.

For the Career Professional

The following codes are provided to assist counselors, job placement workers, or other career professionals.

System	Code
SOC – Standard Occupational Classification at www.bls.gov/soc	17-2199
O*NET – Occupational Information Network at online.onetcenter.org	
Biochemical Engineers	17-2199.01
Interest Codes (RIASEC) at online.onetcenter.org/find/descriptor/browse/Interests/#cur	IR
CIP – Classification of Instructional Programs at http://nces.ed.gov/ipeds/cipcode	
Biochemical Engineering	14.4301
TOP – Taxonomy of Programs at https://misweb.cccco.edu/webproginv/prod/invmenu.htm (California Community Colleges)	
Engineering, General	0901.00

The California Occupational Guides are a product of:
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