

# Biotechnology

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## Industrial Biotechnology

### Program Description

This program prepares graduates to work in the biotechnology industry as production technicians. A production technician operates and maintains the equipment used to manufacture protein pharmaceutical products. Students will grow bacterial, yeast, and mammalian cells and recover the proteins that they produce. They will follow good manufacturing practices by maintaining records in order to comply with quality assurance procedures and government regulations. Students in the program must be able to adjust their time to a flexible schedule.

### Certificate of Achievement and Associate in Science Degree

The Certificate of Achievement can be obtained upon completion of the 22-24-unit major with a grade of C (2.0) or better in each course. The Associate in Science Degree can be obtained upon completion of 60 units, including the major, general education requirements and electives. All courses in the major must be completed with a grade of C or better or a P if the course is taken on a Pass/No Pass basis.

### Program Outcomes

Students who complete the Industrial Biotechnology Certificate of Achievement/ Associate Degree will be able to:

1. Understand the structure and function of protein pharmaceuticals and evaluate which protein properties a production facility can exploit to purify a particular protein from other cellular components.
2. Construct a pathway analyzing how a drug or biologic is produced by genetically engineered cells and subsequently purified.

REQUIRED COURSES .....	Units
BIOT 051 Principles of Biotechnology .....	3
BIOT 052 Business and Regulatory Practices in Biotechnology .....	3
BIOT 062 Cell Culture and Protein Recovery .....	4
BIOT 063 Biotechnology Instrumentation: Quality Control & Genetic Engineering .....	4
BIO 014 Principles of Microbiology .....	4
OR	
BIO 002 Principles of Cell and Molecular Biology .....	5
CHEM 010 Intermediate Chemistry .....	4
OR	
CHEM 001 General Chemistry .....	5
<b>Total Units .....</b>	<b>22 – 24</b>

**NOTE: Prior knowledge and use of computers is advised, including word processing, spreadsheets, and databases.**

This is a Gainful Employment Program. For additional information, please visit  
[http://www.solano.edu/gainful\\_employment/](http://www.solano.edu/gainful_employment/) and select "Industrial Biotechnology."

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## Applied Biotechnology

### Certificate of Achievement

A Certificate of Achievement can be obtained by completion of the 18-unit major with a grade of C or better or a P if the course is taken on a Pass/No Pass basis in each course.

### Program Outcomes

Students who complete the Applied Biotechnology Certificate of Achievement will be able to:

1. Understand the structure and function of protein pharmaceuticals and evaluate which protein properties a production facility can exploit to purify a particular protein from other cellular components.
2. Construct a pathway analyzing how a drug or biologic is produced by genetically engineered cells and subsequently purified.

<b>REQUIRED COURSES</b> .....	<b>Units</b>
BIOT 051 Principles of Biotechnology .....	3
BIOT 052 Business and Regulatory Practices in Biotechnology .....	3
BIOT 062 Cell Culture and Protein Recovery .....	4
BIOT 063 Biotechnology Instrumentation: Quality Control & Genetic Engineering .....	4
BIOT 160 Basic Concepts/Methods in Biotechnology ...	4
<b>Total Units</b> .....	<b>18</b>

**Note:** Prior knowledge and use of computers is advised, including word processing, spreadsheets, and databases.

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**BIOT 051** **3.0 Units**  
**Principles of Biotechnology**  
*Prerequisite:* BIO 014 or BIO 002 or BIOT 160. *Course Advisory:* Eligibility for English 001 and SCC minimum Math standard. This course covers topics important in the development, production, recovery, and analysis of products produced by biotechnology. The course traces the path of a drug or biologic from the cell through the production facility, the final processing, and into the human body. It discusses the growth characteristics of the organisms used to produce pharmaceutical proteins, the techniques used in product recovery, and the techniques used in product analysis. *Three hours lecture.*

**BIOT 052** **3.0 Units**  
**Business and Regulatory Practices In Biotechnology**  
*Course Advisory:* Eligibility for ENGL 001 and SCC minimum Math standard. Examines how basic business principles and sound manufacturing procedures assure the quality and safety of a product as the manufacturing team moves a product down the biotechnology production pipeline. It explores the role of governmental oversight and regulation during the discovery, development, and manufacturing of new products produced by biotechnology. *Three hours lecture.*

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## **BIOT 062**

**4.0 Units**

### **Cell Culture And Protein Recovery**

*Prerequisite:* BIO 014 or BIO 002 or BIOT 160. *Course Advisory:* Eligibility for English 001. This laboratory course teaches the skills needed to serve as a technician in biotechnology production. Students grow and monitor bacterial, yeast, and mammalian cells on a laboratory scale that emulates the large-scale production used in industry. Students will become familiar with the cleaning, sterilization, aseptic inoculation, operation, and monitoring of fermenters and bioreactors. Students then recover and purify proteins produced by those cell cultures. They recover and purify proteins using centrifugation, ultrafiltration, and chromatography techniques. The course emphasizes the use of current Good Manufacturing Practices (cGMP), and students gain experience following Standard Operating Procedures (SOP). *Two hours lecture, six hours lab.*

## **BIOT 063**

**4.0 Units**

### **Biotechnology Instrumentation: Quality Control & Genetic Engineering**

*Prerequisite:* BIO 014 or BIO 002 or BIOT 160. *Course Advisory:* Eligibility for English 001. Familiarizes students with small scale laboratory practices, both those used in a research laboratory and those used by a quality control department in industry, to analyze the quality of a cell culture process and the purity of protein products produced by cells in culture. The course emphasizes the use of Good Laboratory Practices (GLP) in these analyses. Students will gain experience in techniques used to analyze nucleic acids and in the genetic engineering of cells. They will also gain experience with the common assays used in Quality Control including electrophoresis, High Performance Liquid Chromatography (HPLC), Enzyme Linked Immunosorbant Assay (ELISA), and Polymerase Chain Reaction (PCR) to test products generated using cell culture. *Two hours lecture, six hours lab.*

## **BIOT 160**

**4.0 Units**

### **Basic Concepts/Methods in Biotechnology**

*Course Advisory:* MATH 330; SCC minimum English standard with a minimum grade of C. This course is not designed for students intending to transfer. This course serves as a prerequisite to Solano College's biotechnology courses by giving students knowledge of the basic concepts in biology and chemistry used in biotechnology while also developing the basic laboratory skills required to succeed in the field. *Two hours lecture, six hours lab.*