

# Biotechnology

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## *Industrial Biotechnology - Associate in Science Degree*

### **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.

### **Associate in Science Degree**

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 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.

<b>REQUIRED COURSES.....</b>	<b>Units</b>
BIOT 001 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
One course from List A.....	4-5
One course from List B.....	4-5
<b>Total Units .....</b>	<b>22 – 24</b>

#### **List A (select one course)**

BIO 002 Principles of Cell and Molecular Biology .....	5
BIO 014 Principles of Microbiology .....	4

#### **List B (select one course)**

CHEM 001 General Chemistry.....	5
CHEM 010 Intermediate Chemistry.....	4

**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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## Industrial Biotechnology - Certificate of Achievement

### 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

The Certificate of Achievement can be obtained upon completion of the 27-28 unit major with a grade of "C" (2.0) or better or a P if the course is taken on a Pass/No Pass basis.

### Program Outcomes

Students who complete the Industrial Biotechnology 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 001 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
CHEM 001 General Chemistry.....	5
One course from List A.....	4-5
One course from List B.....	4
<b>Total Units .....</b>	<b>27 - 28</b>

#### List A (select one course)

BIO 002 Principles of Cell and Molecular Biology .....	5
CHEM 010 Intermediate Chemistry.....	4

#### List B (select one course)

BIOT 014 Principles of Microbiology .....	4
BIOT 0160 Basic Concepts/Methods in Biotechnology...	4

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

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## **Biotechnology Laboratory Assistant**

### **Program Description**

This program serves as a Bridge to Biosciences, enabling graduates to enter the Solano College Industrial Biotechnology program or to enter an entry level position in a biotechnology company. It serves as a stackable certificate that may be followed by Industrial Biotechnology Certificate or an Applied Biotechnology Certificate. A Laboratory Assistant may be hired by life science related companies to prepare buffers, prepare media, operate routine laboratory equipment, and to clean glassware.

### **Certificate of Achievement**

The Certificate of Achievement can be obtained upon completion of the 14 unit major with a grade of "C" (2.0) 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 will be able to:

1. Demonstrate the ability to perform routine laboratory techniques including buffer preparation, media preparation, and aseptic microbial culture.
2. Demonstrate the ability to perform mathematical (algebraic) operations required for calculations important in chemistry and biology.
3. Demonstrate the ability to read and write in a range of writing style categories typical of laboratory and scholarly environments, including lab reports, expository texts, and research-based arguments.

<b>REQUIRED COURSES.....</b>	<b>Units</b>
BIOT 160 Basic Concepts/Methods in Biotechnology.....	4
MATH 330 Elementary Algebra.....	5
ENGL 360 Focused English Fundamentals .....	5

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 "Biotechnology Laboratory Assistant"

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**BIOT 001****3.0 Units****Principles of Biotechnology**

*Prerequisite:* BIO 014, BIO 002 or BIOT 160. SCC minimum English and math standards. This lecture 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.*

**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 and Genetic Engineering**

*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 160****4.0 Units****Basic Concepts/Methods in Biotechnology**

*Course Advisory:* MATH 330 with a minimum grade of C; SCC minimum English standard. 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.*