

# Biotechnology

The expanding field of biotechnology devotes itself to improving human health and well-being through the research, development, testing, manufacturing, and marketing of products related to the biomedical, food and beverage, cosmetics, and agricultural industries. The Biotechnology program provides both the theoretical background and practical experience necessary to gain employment in the biotechnology industry. Career paths include research, development, quality control and assurance, manufacturing, analytical testing, and lab technician work.

## Bachelor's Degree Program

The bachelor's degree program in biomanufacturing builds upon the associate degree program in biomanufacturing, allowing students who complete the associate degree or equivalent coursework from other colleges to enter as juniors and earn a baccalaureate. Information about the program, including eligibility requirements, the application process, and upper-division tuition, is available under Bachelor's Degree. For inquiries about the bachelor's program, please contact Dr. Dominique Ingato at [dingato@miracosta.edu](mailto:dingato@miracosta.edu).

**Academic and Career Pathway:** Math and Sciences

## Contact Information

**Chair:** Barbara Juncosa  
**Dean:** Michael Fino  
<https://www.miracosta.edu/academics/degree-and-certificate-programs/math-and-sciences/biotechnology/index.html>

**Department:** Biotechnology  
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 760.757.2121 x6874

## Full-Time Faculty

Dominique Ingato  
 Barbara Juncosa  
 Wally Perez Medina

## Bachelor's Degree

### Bachelor of Science Degree Biomanufacturing

The biomanufacturing bachelor's degree program develops the skills, abilities, and knowledge students need to work in the unique environment of biological production. It emphasizes the applied, quantitative analysis of biomanufacturing process design and performance to prepare students for employment in technical or quality positions in the manufacturing sector of the biotechnology industry, which includes biotherapeutics, diagnostics, supplies and services, and industrial products.

The biomanufacturing bachelor's degree program requires the completion of 120 semester units, including 45 units of upper-division coursework with a minimum of 12 units in residence at MiraCosta College.

The program builds upon the college's associate degree program in biomanufacturing, allowing students who complete the associate degree or equivalent coursework

from other colleges to enter as juniors and earn a bachelor's degree. Students earning the college's associate degree in biomanufacturing must complete either the CSU-GE (Plan B) or the IGETC (Plan C) general education pattern to graduate with a bachelor's degree in biomanufacturing.

### Lower-Division Major Preparation

- ▶ Overall GPA of 2.0 for all coursework
- ▶ Completion of the following lower-division course requirements with no grade less than "C" or "P":
  - ▶ BTEC 108/BTEC 108H or General biology (BIO 105 or equivalent)
  - ▶ CHEM 150/CHEM 150H
  - ▶ CHEM 151/CHEM 151H
  - ▶ BTEC 107
  - ▶ BTEC 110/BTEC 110H
  - ▶ BTEC 120
  - ▶ BTEC 210
  - ▶ BTEC 211
  - ▶ BTEC 221
  - ▶ BTEC 222
  - ▶ ENGL 100/ENGL 100H
  - ▶ Statistics (BTEC 180/BTEC 180H or equivalent)

### Application for Admission

Students complete the standard online application to the college as well as the Application for the Bachelor of Science in Biomanufacturing, which is available on the Biomanufacturing Bachelor's Degree Program webpage ([see miracosta.edu/bachelors](http://www.miracosta.edu/bachelors)). Applications for the fall 2023 cohort become available on August 1st and are due in mid-November for priority consideration and are accepted on a rolling basis after this priority deadline until the cohort is full.

Certain lower-division courses must be completed or in progress in order to submit an application for admission to the program. Please see the Biomanufacturing Bachelor's Degree Program webpage for details.

### Admission/Selection Criteria

Qualified applicants are selected for admission based on a comprehensive review process that gives additional weight to the following:

- ▶ Percentage of lower-division major preparation completed at the time of applying.
- ▶ Completion of an associate degree in biomanufacturing, research and development, or equivalent.
- ▶ Completion before entry date of BTEC 221 and BTEC 222 (or equivalent).
- ▶ Completion of additional 200-level biotechnology, biology, or chemistry courses or 100-level physics courses not listed in the program requirements.
- ▶ Completion (or partial completion) of CSU-GE (Plan B) or IGETC (Plan C).
- ▶ GPA in lower-division major preparation courses.
- ▶ Employment in the biotechnology/biomedical industry, including internships.
- ▶ Relevant life experiences or special circumstances, such as disabilities, low family income, first generation college

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student, DACA/AB 540, former foster youth, veteran status, and other criteria.

For more specific information about the comprehensive review process, please see [miracosta.edu/bachelors](http://miracosta.edu/bachelors).

### Upper-Division Tuition

Upper-division coursework costs \$130 per unit, which is an additional \$84 per unit currently charged for lower-division coursework.

### Program Student Learning Outcome Statements

Upon completion of this program, students will be able to

- ▶ design and execute a project that identifies possible options of new biomanufacturing technologies that serve as process improvements, including technical and financial benefits, and write a report evaluating those options with a final recommendation.
- ▶ perform an investigation that requires them to analyze an Out of Specification (OOS) occurrence during a production step in the manufacture of a biological substance, perform the analysis to justify the batch disposition, and incorporate this into a CAPA (Corrective Action Preventative Action) report.

Required lower-division courses:

BTEC 107	Exploring Biotechnology: Emerging Trends, Careers, and the Local Industry	3
BTEC 108	Biomanufacturing: From Gene to Product	3
or BTEC 108H	Biomanufacturing: From Gene to Product (Honors)	
or BIO 105	Introductory Biology: Biotechnology in Society	
BTEC 110	Basic Techniques in Biotechnology	5
or BTEC 110H	Basic Techniques in Biotechnology (Honors)	
BTEC 120	Business and Regulatory Practices in Biotechnology	3
BTEC 180	Biostatistics *	4
or BTEC 180H	Biostatistics (Honors)	
BTEC 210	Data Analysis with Excel	1
BTEC 211	Technical Writing for Regulated Environments	1
BTEC 221	Bioprocessing: Cell Culture and Scale-up	1.5
BTEC 222	Bioprocessing: Large Scale Purification	1.5
CHEM 150	General Chemistry I: For Science Majors *	5
or CHEM 150H	General Chemistry I: For Science Majors (Honors)	
CHEM 151	General Chemistry II: For Science Majors *	5
or CHEM 151H	General Chemistry II: For Science Majors (Honors)	
ENGL 100	Composition and Reading *	4

or ENGL 100H Composition and Reading (Honors)

Required upper-division courses:		
BTEC 300	Supply Chain and Enterprise Resource Planning in Biomanufacturing	3
BTEC 310	Biomanufacturing Process Sciences	5
BTEC 320	Design of Experiments for Biomanufacturing	4
BTEC 330	Advanced Topics in Quality Assurance and Regulatory Affairs	4
BTEC 340	Six Sigma and Lean Manufacturing	3
BTEC 360	Design of Biomanufacturing Facilities, Critical Utilities, Processes, and Equipment	3
BTEC 400	Bioprocess Monitoring and Control	4
BTEC 410	Methods in Quality, Improvements, Investigations, and Audits	4
BTEC 460	Capstone Seminar in Biomanufacturing Technologies	3
BTEC 470	Capstone Seminar in Biomanufacturing Quality	3
BIO 340	Molecular Mechanisms of Disease	3
BUS 302	Leadership and Personal Development	3
PHIL 302	Bioethics	3
Remaining required lower-division general education and elective coursework.		38
<b>Total Units</b>		<b>120</b>

\* Course satisfies a general education requirement on the CSU-GE or IGETC general education pattern.

## Associate Degrees

### Associate in Science Degree Biomanufacturing

Students may earn the associate degree by completing the Certificate of Achievement in Biomanufacturing as well as a general education (GE) pattern of courses. To be eligible for admission to the bachelor's degree program, students must complete either the CSU-GE (Plan B) or the IGETC (Plan C) pattern. Students should meet with a MiraCosta counselor to develop a written educational plan for the specific degree they wish to earn.

### Research and Development

Students may earn the associate degree by completing the Certificate of Achievement in Research and Development as well as the general education courses required for MiraCosta College's Associate in Science degree (see Associate Degrees). Students should meet with a MiraCosta counselor to identify required courses and to develop a written educational plan for the specific degree or certificate they wish to earn.

## Certificates

### Certificate of Achievement Biomanufacturing

This program expands on the skills and theoretical foundation presented in the bioprocess technology certificate to further