

BIO 296: Topics in Biology

Units: 1-3

Prerequisites: None

Acceptable for Credit: CSU

Lecture 1 hour.

Lecture 2 hours.

Lecture 3 hours. (0401.00)

Course Typically Offered: TBA

This course gives students an opportunity to study topics in Biology that are not included in regular course offerings. Each Topics course is announced, described, and given its own title and 296 number designation in the class schedule.

BIO 298: Directed Study in Biology

Units: 1-3

Prerequisites: None

Enrollment Limitation: Instructor and department chair approval and successful completion of 12 units of college work with at least a 3.0 grade-point average.

Acceptable for Credit: CSU

Laboratory 3 hours

Laboratory 6 hours

Laboratory 9 hours. (0401.00)

Course Typically Offered: TBA

This course allows students to pursue a special area of interest in order to achieve specific goals beyond the scope of existing courses within the discipline. Students work independently and interact directly with an instructor on an individual basis and as prescribed by the Directed Study Agreement.

BIO 299: Occupational Cooperative Work Experience

Units: 1-4

Prerequisites: None

Corequisite: Complete 75 hrs paid or 60 hrs non-paid work per unit.

Enrollment Limitation: Career Center approval. May not enroll in any combination of cooperative work experience and/or internship studies concurrently.

Acceptable for Credit: CSU

Course Typically Offered: TBA

Cooperative Work Experience is intended for students who are employed in a job directly related to their major. It allows such students the opportunity to apply the theories and skills of their discipline to their position and to undertake new responsibilities and learn new skills at work. Topics include goal-setting, employability skills development, and examination of the world of work as it relates to the student's career plans. Students may not earn more than 16 units in any combination of cooperative work experience (general or occupational) and/or internship studies during community college attendance.

Biotechnology



The expanding field of biotechnology devotes itself to improving human health through the research, development, testing, manufacturing, and marketing of products related to the biomedical 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.

Contact Information

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Associate Degree

Degree programs include the completion of a general education (GE) pattern of courses. The knowledge, skills, and abilities gained as a result of completing general education, referred to as GE outcomes, can be viewed here (p. 54).

**Associate in Arts Degree
Research and Development**



Students may earn the above-named associate degree by completing a certificate of achievement and the general education courses required for MiraCosta College's Associate in Arts degree (see Associate Degrees (p. 54)). 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.

Program Student Learning Outcome Statement:

- ▶ Upon completion of the program, students will report that they were sufficiently developed to meet employer expectations for entry-level performance in a technical laboratory.

Certificates

**Certificate of Achievement
Bioprocess Technology**

This certificate provides a foundation in, and practical application of, the technologies employed by biotechnology companies engaged in the production of cell-derived products from small to large scales. Through a combination of applied lecture and hands-on laboratory instruction, students acquire the confidence, competence, and compliance for technical work in a regulated environment. Bioprocess technologies encompass the operation of specialized equipment and instrumentation used to produce biopharmaceuticals or reagents utilized by biotechnology, pharmaceutical, and academic research labs. Students learn to grow a variety of cells, express a biomolecule of interest, and recover the desired biomolecule through a series of purification steps. They learn to follow good manufacturing practices by maintaining records in order to comply with quality system requirements

and government regulations. This certificate is designed for bioprocess-technician skill development as well as professional development for those already employed in the industry.

Program Student Learning Outcome Statement:

- ▶ Upon completion of the program, students will be able to successfully perform a technical laboratory task by employing the appropriate equipment and tools, safely and effectively.

Required courses:		
BTEC 110	Basic Techniques in Biotechnology	4
BTEC 120	Business and Regulatory Practices in Biotechnology	3
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
Select at least one course from the following:		
BTEC 210	Data Analysis with Excel	1
BTEC 292	Internship Studies	
BTEC 299	Occupational Cooperative Work Experience	

Total Units **12**

**Certificate of Achievement
Research and Development**

The Research and Development certificate is designed to meet the increasing need for entry-level laboratory technicians, especially in the field of research and development. Technicians in this field must be proficient in the application of scientific methodology to solve problems. They must learn and implement laboratory procedures and use specialized laboratory equipment. Competency in organizational, computational and communication skills is required. This three-semester program is designed to give students the theoretical background and practical experience necessary to be an effective laboratory technician as well as to prepare them for upper division course work in the biosciences. Graduates of this biotechnology program can expect to be employed in various capacities, including quality control, quality assurance, production, applied research, product development, analytical testing, and academic (basic) research.

Program Student Learning Outcome Statement:

- ▶ Upon completion of the program, students will report that they were sufficiently developed to meet employer expectations for entry-level performance in a technical laboratory.

Required courses:		
BIO 100	General Biology (Lecture and Lab)	3-4
or BIO 101	General Biology	
or BIO 105	Genes and Technology in Society	
BTEC 110	Basic Techniques in Biotechnology	4
BTEC 120	Business and Regulatory Practices in Biotechnology	3
BTEC/BIO 180	Biostatistics	4
CHEM 108	Preparatory Chemistry	3
CHEM 110	General Chemistry	5

CHEM 111	General Chemistry	5
CSIT 110	Computer Applications	1-3
or CSIT 115	Intermediate Computer Applications	
or CSIT 128	Microsoft Excel for Business	
or BTEC 210	Data Analysis with Excel	
ENGL 100	Composition and Reading	4
MATH 64	Intermediate Algebra	4
Select at least 4 electives from below:		4-5
BTEC 201	Advanced Cell Culture	
BTEC 203	Techniques in DNA Amplification	
BTEC 204	Recombinant DNA	
BTEC 206	Principles of Separation and HPLC	
BTEC 207	Techniques in Immunochemistry and ELISA	
BTEC 211	Technical Writing for Regulated Environments	
BTEC 221	Bioprocessing: Cell Culture and Scale-up	
BTEC 222	Bioprocessing: Large Scale Purification	
BTEC 230	Techniques in Biofuels Production and Analysis	
BTEC 292	Internship Studies	
BTEC 299	Occupational Cooperative Work Experience	
Total Units		40-44

Certificate of Proficiency

Laboratory Skills

This certificate is designed to meet the increasing need for trained and competent associates in laboratory environments. The required courses provide students with fundamental laboratory skills to start or enhance a career in the biosciences. Students completing this certificate can expect employment utilizing their technical skills in the performance of tests and routine tasks inherent to a wide range of laboratory environments. This certificate is intended for the development of general laboratory skills as well as professional growth for those already employed in the industry.

Program Student Learning Outcome Statement:

- ▶ Upon completion of the program, students will be able to successfully perform a technical laboratory task by employing the appropriate equipment and tools, safely and effectively.

Required courses:		
BTEC 110	Basic Techniques in Biotechnology	4
BTEC 120	Business and Regulatory Practices in Biotechnology	3
Select at least four courses from the following:		4-5
BTEC 201	Advanced Cell Culture	
BTEC 203	Techniques in DNA Amplification	
BTEC 204	Recombinant DNA	
BTEC 206	Principles of Separation and HPLC	
BTEC 207	Techniques in Immunochemistry and ELISA	
BTEC 210	Data Analysis with Excel	

BTEC 211	Technical Writing for Regulated Environments	
BTEC 221	Bioprocessing: Cell Culture and Scale-up	
BTEC 222	Bioprocessing: Large Scale Purification	
BTEC 230	Techniques in Biofuels Production and Analysis	
BTEC 292	Internship Studies	
BTEC 299	Occupational Cooperative Work Experience	
Total Units		11-12

Courses

BTEC 110: Basic Techniques in Biotechnology

Units: 4

Prerequisites: None

Advisory: ACE 50/ENGL50/ESL 50 or eligibility determined by the English placement process; MATH 64 or eligibility determined by the math placement process; CHEM 108; and BIO 101 or BIO 100 or BIO 105.

Acceptable for Credit: CSU

Lecture 2 hours, laboratory 6 hours. (0430.00)

Course Typically Offered: F, SP

This course focuses on the basic laboratory skills needed for employment in the bioscience/biotechnology industry. Students learn laboratory safety and documentation while acquiring skills in the maintenance and calibration of basic lab equipment, calculation and preparation of lab solutions and media, and routine handling of both bacterial and mammalian cell cultures (tissue culture). Students also develop fundamental skills in spectroscopy, centrifugation, performance of assays, gel electrophoresis, and the purification and handling of biological molecules, such as proteins and DNA.

BTEC 120: Business and Regulatory Practices in Biotechnology

Units: 3

Prerequisites: None

Acceptable for Credit: CSU

Lecture 3 hours. (0430.00)

Course Typically Offered: F, SP

This course examines basic business principles and practices utilized in the discovery, development, and production phases of new product development. It explores the role of governmental oversight and regulation in assuring the safety, efficacy, and quality of a biotechnology product.

BTEC 180: Biostatistics

Units: 4

Prerequisites: MATH 64 or eligibility determined by the math placement process.

Advisory: BIO 100 or BIO 101.

Enrollment Limitation: Not open to students with prior credit in: BIO 180, BTEC 180, MATH 103, PSYC 104, PSYC 104H, SOC 104, SOC 104H, BUS 204.

Acceptable for Credit: CSU, UC Credit limitation

Lecture 3 hours, laboratory 3 hours. (0430.00)

Course Typically Offered: F, SP

This introductory statistics course covers the principles and practice of statistical design and analysis for scientific experimentation. Topics include hypothesis formation, experimental design and execution, data analysis, and communication with application to scientific fields, such as the biological and health sciences. The course includes laboratory application with extensive use of computer software for statistical analysis and simulation. UC CREDIT LIMITATION: Credit for BUS 204, MATH 103, PSYC 104/SOC 104, PSYC 104H/SOC 104H, or BIO 180/BTEC 180.

BTEC 201: Advanced Cell Culture

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.50 hour, laboratory 1.50 hours. (0430.00)

Course Typically Offered: SP

This advanced course teaches skills in the proper handling of cells from higher organisms, such as plants, mammals, and insects, that are routinely maintained in culture in the biotechnology laboratory. Instruction focuses on growth and manipulation techniques and long-term maintenance of various laboratory cell cultures that may include anchorage-dependent and suspension cell lines as well as stem cell cultures.

BTEC 203: Techniques in DNA Amplification

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: F OR SP*

This advanced course provides skills in the performance of the polymerase chain reaction (PCR), a technique commonly used to amplify DNA in forensics and the biotechnology laboratory. Instruction focuses on understanding the process; potential applications of DNA amplification; and the skills related to the set up, performance, and evaluation of the outcome of the technique. The course assumes some prior knowledge of solution preparation and gel electrophoresis.

BTEC 204: Recombinant DNA

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: F OR SP*

This advanced course provides skills in recombinant DNA technology used to analyze and manipulate DNA in the biotechnology laboratory. Students learn about the process of cloning and analyzing DNA and acquire the skills necessary to cut, piece together, and introduce new DNA molecules into prepared host bacterial cells.

BTEC 206: Principles of Separation and HPLC

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: F OR SP*

This advanced course provides skills in the separation of biomolecules from complex mixtures using high performance liquid chromatography (HPLC). Instruction focuses on understanding the principles of separation, acquiring skills in the separation of various biomolecules, and analyzing the outcome for the purpose of determining system performance and biomolecular purification. The course assumes some prior knowledge of solution preparation, assays, and spectroscopy.

BTEC 207: Techniques in Immunochemistry and ELISA

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: TBA

This advanced course provides skills in the use of antibody reagents as a tool in the biotechnology laboratory. It focuses on the nature and specificity of antibody reagents for the identification and quantification of biological molecules. Students learn how to set up, perform, and analyze techniques utilizing antibodies, such as Westerns and ELISAs.

BTEC 210: Data Analysis with Excel

Units: 1

Prerequisites: None

Advisory: CSIT 100.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: F

This course teaches how modern spreadsheet programs can be used to collect and organize data for subsequent tabulation, summarization, and graphical display. It utilizes various forms of scientific data to teach the techniques and skill that facilitate the capture, analysis, and management of data. Topics include importing and organizing data, filtering and sorting, graphing, and statistical analysis functions.

BTEC 211: Technical Writing for Regulated Environments

Units: 1

Prerequisites: None

Advisory: Eligibility for ENGL 100.

Acceptable for Credit: CSU

Lecture 1 hour. (0430.00)

Course Typically Offered: SP

This course provides the requisite tools to understand why technical writing exists and how that writing works in conjunction with the many types of documents found in regulated environments. It also develops the techniques needed to deliver clear and complete passages with precise language. Students apply best practices for technical writing to a variety of documents, including reports, standard operating procedures (SOP), and investigations.

BTEC 221: Bioprocessing: Cell Culture and Scale-up

Units: 1.5

Prerequisites: None

Advisory: BTEC 110, BTEC 120

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 2.25 hours. (0430.00)

Course Typically Offered: F

This laboratory course develops the skills and knowledge related to the culture of cells in increasingly larger scales for the production of biological molecules. Students grow and monitor a variety of cells (bacterial, yeast, and/or mammalian) on a laboratory scale that emulates the large-scale production used in industry. They become familiar with the cleaning, sterilization, aseptic inoculation, operation, and monitoring of fermenters and bioreactors. The course emphasizes the use of current Good Manufacturing Practices (cGMPs) and process control strategies, and students gain experience following Standard Operating Procedures (SOPs).

BTEC 222: Bioprocessing: Large Scale Purification

Units: 1.5

Prerequisites: None

Advisory: BTEC 110; BTEC 120.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 2.25 hours. (0430.00)

Course Typically Offered: SP

This laboratory course develops the skills and knowledge related to purification of biological molecules produced on a large scale. Students utilize the most common types of separation equipment, including tangential flow filtration, centrifugation, and column chromatography. They become familiar with the cleaning, sanitization, calibration, operation, and monitoring of large-scale purification equipment. The course emphasizes the use of current Good Manufacturing Practices (cGMPs) and process control strategies, and students gain experience following Standard Operating Procedures (SOPs).

BTEC 230: Techniques in Biofuels Production and Analysis

Units: 1

Prerequisites: None

Advisory: BTEC 110.

Acceptable for Credit: CSU

Lecture 0.75 hour, laboratory 0.75 hour. (0430.00)

Course Typically Offered: F(EVEN)

This advanced course introduces students to the rapidly developing field of renewable energy and, specifically, biofuels production through a combination of lecture and applied laboratory techniques.

BTEC 292: Internship Studies

Units: 0.5-3

Prerequisites: None

Corequisite: Complete 75 hrs paid or 60 hrs non-paid work per unit.

Enrollment Limitation: Instructor, dept chair, and Career Center approval. May not enroll in any combination of cooperative work experience and/or internship studies concurrently.

Acceptable for Credit: CSU

Course Typically Offered: TBA

This course provides students the opportunity to apply the theories and techniques of their discipline in an internship position in a professional setting under the instruction of a faculty-mentor and site supervisor. It introduces students to aspects of the roles and responsibilities of professionals employed in the field of study. Topics include goal-setting, employability skills development, and examination of the world of work as it relates to the student's career plans. Students must develop new learning objectives and/or intern at a new site upon each repetition. Students may not earn more than 16 units in any combination of cooperative work experience (general or occupational) and/or internship studies during community college attendance.

BTEC 296: Topics in Biotechnology

Units: 1-4

Prerequisites: None

Acceptable for Credit: CSU

Lecture 1 hour.

Lecture 2 hours.

Lecture 3 hours.

Lecture 4 hours. (0430.00)

Course Typically Offered: TBA

This course gives students an opportunity to study topics in Biotechnology that are not included in regular course offerings. Each Topics course is announced, described, and given its own title and 296 number designation in the class schedule.

BTEC 299: Occupational Cooperative Work Experience

Units: 1-6

Prerequisites: None

Corequisite: Complete 75 hrs paid or 60 hrs non-paid work per unit.

Enrollment Limitation: Career Center approval. May not enroll in any combination of cooperative work experience and/or internship studies concurrently.

Acceptable for Credit: CSU

Course Typically Offered: TBA

Cooperative Work Experience is intended for students who are employed in a job directly related to their major. It allows such students the opportunity to apply the theories and skills of their discipline to their position and to undertake new responsibilities and learn new skills at work. Topics include goal-setting, employability skills development, and examination of the world of work as it relates to the student's career plans. Students may not earn more than 16 units in any combination of cooperative work experience (general or occupational) and/or internship studies during community college attendance.

Business Administration



The Business Department offers theoretical and practical courses for students planning to transfer as business majors, career and technical courses that lead to certificates of proficiency and achievement, and courses designed to improve workplace skills. Career opportunities in business include accounting, marketing, finance, small business development, and management in retail, service, manufacturing, government, and nonprofit organizations.

Contact Information

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Christina Hata
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Associate Degrees



Degree programs include the completion of a general education (GE) pattern of courses. The knowledge, skills, and abilities gained as a result of completing general education, referred to as GE outcomes, can be viewed here (p. 54).

Associate in Science Degree

Associate in Science in Business Administration for Transfer Degree

Students completing this associate degree will have completed lower-division major preparation requirements for a business administration degree, an emphasis or option within a business administration degree, or a degree considered similar to business administration at a participating California State University (CSU) campus. Following transfer to a participating CSU campus, students will be required to complete no more than 60 units to obtain a bachelor's degree; however, some CSU campuses accepting this degree may require additional lower-division major preparation. This degree may not be appropriate preparation for students transferring to a CSU campus not accepting this degree or to a university or college that is not part of the CSU system. Students should consult with a MiraCosta counselor for further information regarding the most efficient pathway to transfer as a business administration major and to determine which CSU campuses are participating in this program.

To complete the degree, students must fulfill the following requirements:

- ▶ Complete 60 semester (90 quarter) CSU transferable units
- ▶ Complete all courses required in the major with a "C" or better
- ▶ Complete the CSU-GE or CSU-IGETC* general education pattern
- ▶ Achieve a minimum CSU transferable GPA of 2.0
- ▶ Complete a minimum of 12 units in residence at MiraCosta College.

*Students completing UC-IGETC may be awarded the degree, but they will not meet CSU admission requirements.