

Area: Science and Engineering  
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Degree: A.S. - Biotechnology  
 A.S. - General Science  
 Certificate: Biotechnology

Biologists are fully engaged in meeting the challenges of the future, helping to improve the quality of human life and preserve our world's biodiversity. The Biology courses at ARC provide students with the breadth and depth of knowledge necessary to more fully understand the living world. The Biology Department offers a long list of lecture and laboratory courses for majors and non-majors alike, whether for vocational training, transfer, or merely general interest.

### DEGREES AND CERTIFICATES

#### Biotechnology Degree

Major Code: 011517A01

This degree provides the theory and skills necessary for entry into the biotechnology field, which uses cellular and molecular processes for industry or research. Course work includes practical laboratory skills with emphasis on good laboratory practice, quality control, and regulatory issues in the biotechnology workplace. Completion of the degree also prepares the student for transfer at the upper division level to academic programs involving biotechnology.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- apply biological and chemical concepts to biotechnology research and its practical applications.
- demonstrate biotechnology laboratory procedures involving protein and DNA techniques, cell culture methods, and solution preparation.
- design and interpret experiments involving biotechnology laboratory procedures.
- evaluate biotechnology laboratory practices in the context of good laboratory practice, quality control, and regulatory issues.
- analyze biotechnology data using mathematical and statistical methods.
- integrate laboratory skills and theory into job-related tasks in the biotechnology workplace.
- appraise social and ethical issues related to advances in biotechnology research and its practical applications.

#### Career Opportunities

This degree prepares the student for entry-level work in the bioscience industry in the areas of research and development, production, clinical testing, and diagnostic work. Potential employers include biotechnology and pharmaceutical companies, as well as laboratories in hospitals, government, and universities.

Requirements for Degree		29-35 Units
BIOL 400	Principles of Biology (5) .....	4 - 5
or BIOL 440	General Microbiology (4)	
or BIOL 442	General Microbiology and Public Health (5)	
BIOT 301	Biotechnology and Human Health .....	3
BIOT 307	Biotechnology and Society .....	2
BIOT 311	Biotechnology Laboratory Methods - Molecular Techniques .....	2
BIOT 312	Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques.....	2
[ CHEM 305	Introduction to Chemistry (5) .....	5 - 10
and CHEM 306	Introduction to Chemistry (5) ]	
or CHEM 309	Integrated General, Organic, and Biological Chemistry (5)	
or [ CHEM 400	General Chemistry I (5)	
and CHEM 401	General Chemistry II (5) ]	
ENGWR 300	College Composition .....	3
ENGWR 301	College Composition and Literature (3) .....	3
or ENGWR 302	Advanced Composition and Critical Thinking (3)	
STAT 300	Introduction to Probability and Statistics .....	4
<b>And a minimum of 1 unit from the following:</b> .....		<b>1</b>
BIOT 498	Work Experience in Biotechnology (1 - 4)	
or BIOT 305	Introduction to Bioinformatics (1)	

**Associate Degree Requirements:** The Biotechnology Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

#### Biotechnology Certificate

Major Code: 011416C01

This certificate provides the theory and skills necessary for entry into the biotechnology field, which uses cellular and molecular biology processes for industry or research. Course work includes practical laboratory skills with emphasis on good laboratory practice, quality control, and regulatory issues in the biotechnology workplace. This certificate is suitable for preparing the student for the biotechnology workplace at the support personnel level.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- apply biological and chemical concepts to biotechnology research and its practical applications.
- demonstrate biotechnology laboratory procedures involving protein and DNA techniques, cell culture methods, and solution preparation.
- design and interpret experiments involving biotechnology laboratory procedures.
- evaluate biotechnology laboratory practices in the context of good laboratory practice, quality control, and regulatory issues.
- assess the impact of biotechnology on social and ethical issues.

### Career Opportunities

This program prepares the student for entry-level work in the bioscience industry in the areas of research and development, production, clinical testing, and diagnostic work. Potential employers include biotechnology and pharmaceutical companies, as well as laboratories in hospitals, government, and universities.

See [losrios.edu/gainful-emp-info/gedt.php?major=011416C01](http://losrios.edu/gainful-emp-info/gedt.php?major=011416C01) for Gainful Employment Disclosure.

Requirements for Certificate	24-26 Units
BIOL 303 Survey of Biology (4).....	4 - 5
or BIOL 310 General Biology (4)	
or BIOL 400 Principles of Biology (5)	
or BIOL 440 General Microbiology (4)	
or BIOL 442 General Microbiology and Public Health (5)	
BIOT 301 Biotechnology and Human Health .....	3
BIOT 311 Biotechnology Laboratory Methods - Molecular Techniques .....	2
BIOT 312 Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques.....	2
CHEM 305 Introduction to Chemistry (5) .....	5
or CHEM 309 Integrated General, Organic, and Biological Chemistry (5)	
or CHEM 400 General Chemistry I (5)	
ENGWR 300 College Composition .....	3
MATH 120 Intermediate Algebra (5).....	4 - 5
or STAT 300 Introduction to Probability and Statistics (4)	
<b>And a minimum of 1 unit from the following:.....</b>	<b>1</b>
BIOT 305 Introduction to Bioinformatics (1)	
or BIOT 307 Biotechnology and Society (2)	
or BIOT 498 Work Experience in Biotechnology (1 - 4)	

### General Science Degree

Major Code: 011229A01

This program provides a broad study in the fields of biological and physical sciences in preparation for transfer to a four-year program and continuation of studies in upper division science courses.

#### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate new and accepted ideas about the natural universe using scientific methods.
- analyze a wide variety of natural phenomena using basic definitions and fundamental theories of biological or physical sciences.
- apply appropriate quantitative and qualitative methods to interpret and analyze pertinent data.
- outline the basic concepts and fundamental theories of a natural science.
- articulate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the progress of science.
- discuss ethical components of scientific decision making and apply personal and social values within the process of decision making in scientific endeavors.

### Requirements for Degree 18 Units

A minimum of 18 units from the following: ..... 18<sup>1</sup>

#### Physical Science Courses:

ASTR	300, 310, 320, 330, 400, 481, 495, 499
CHEM	305, 306, 309, 310, 311, 400, 401, 420, 421, 423, 495, 499
GEOG	300, 301, 305, 306, 307, 308, 309, 390, 391, 392, 393, 394, 495, 499
GEOL	300, 301, 305, 306, 310, 311, 320, 325, 330, 331, 345, 390, 495, 499
PHYS	310, 311, 312, 350, 360, 410, 421, 431, 495, 499
PS	300, 301, 495, 499

#### Biological Science Courses:

ANTH	300, 301, 303, 370, 372, 480, 495, 499
BIOL	300, 301, 303, 305, 310, 322, 332, 342, 352, 370, 375, 390, 400, 410, 415, 420, 430, 431, 440, 442, 482, 490, 491, 495, 499
BIOT	301, 305, 307, 308, 311, 312, 499
NATR	300, 302, 303, 304, 305, 306, 307, 310, 320, 322, 324, 330, 332, 346, 495, 499
PSYC	310, 311, 495, 499

<sup>1</sup>must be transfer-level and must include one laboratory course in a physical science and one laboratory course in a biological science

**Associate Degree Requirements:** The General Science Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

## Biology

### BIOL 102 Essentials of Human Anatomy and Physiology 4 Units

General Education: AA/AS Area IV

Hours: 54 hours LEC; 54 hours LAB

This course examines body systems from an anatomical and physiological point of view. The basic anatomy and physiology of all the body systems are covered with an emphasis on developing vocabulary in each area. This course meets the minimum science requirements for Paramedic, Healthcare Interpreting, Gerontology, Health Care, and Funeral Service programs.

### BIOL 103 Human Anatomy for Funeral Services 4 Units

Corequisite: FSE 300

Enrollment Limitation: An off-site clinical laboratory component of the course will require an enrollment limitation including - a background check, drug screening, and testing for hepatitis B.

General Education: AA/AS Area IV

Hours: 54 hours LEC; 54 hours LAB

This course is an intensive study of the structure of the human body including the four major tissue types and the following organ systems: integumentary, skeletal, muscular, nervous, cardiovascular, respiratory, digestive, urinary, and reproductive. Laboratory assignments develop skills of observation, investigation, and identification of selected structures. The dissection of a human cadaver emphasizes the regions and structures relevant to embalming techniques. This course is designed for students preparing for a career in funeral service.

**BIOL 115 Basic Anatomy and Physiology 3 Units**

Advisory: ENGRD 116 (Proficient Reading) and ENGWR 102 (Proficient Writing) with a grade of "C" or better; OR ESLR 320 (Advanced-Low Reading) and ESLW 320 (Advanced-Low Writing) with a grade of "C" or better.

*General Education: AA/AS Area IV*

Hours: 54 hours LEC

This course covers basic human anatomy and physiology of the skin, skeletal, muscular, nervous, circulatory, and lymphatic systems. This course serves as a requirement for the Gerontology: Health Care Degree and the Gerontology: Health Care Certificate, and for the Healthcare Interpreting Certificate. Either BIOL 115 or 116 may be taken first; however, both courses are necessary for a complete study of human anatomy and physiology.

**BIOL 116 Basic Anatomy and Physiology 3 Units**

Advisory: ENGRD 116 (Proficient Reading) and ENGWR 102 (Proficient Writing) with a grade of "C" or better; OR ESLR 320 (Advanced-Low Reading) and ESLW 320 (Advanced-Low Writing) with a grade of "C" or better.

*General Education: AA/AS Area IV*

Hours: 54 hours LEC

This course provides instruction involving basic human anatomy and physiology. It covers body organization, basic chemistry, cells, and tissues. In addition, BIOL 116 covers respiratory, digestive, urinary, endocrine, and reproductive systems. BIOLOGY 116 serves as a required course for the Healthcare Interpreting Certificate. Either BIOL 115 OR 116 may be taken first, however, both courses are necessary for a complete study of human anatomy and physiology.

**BIOL 130 Microbiology for Funeral Services 3 Units**

*Prerequisite: CHEM 130 with a grade of "C" or better*

*Corequisite: FSE 312, 330, and 340*

Advisory: BIOL 300 with a grade of "C" or better

Hours: 54 hours LEC

This course covers a survey of the basic principles of microbiology. It relates these principles to Funeral Service Education especially as they pertain to sanitation, disinfection, public health, infectious disease, and embalming practice.

**BIOL 295 Independent Studies in Biology 1-3 Units**

*Prerequisite: None*

Hours: 54-162 hours LAB

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

**BIOL 300 The Foundations of Biology 3 Units**

Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*General Education: AA/AS Area IV; CSU Area B2; IGETC Area 5B*

*Course Transferable to UC/CSU*

Hours: 54 hours LEC

This course for non-science majors covers basic biological principles and how they relate to humans. Topics include an introduction to the philosophy of science and basic cell chemistry, structure, and physiology. An introduction to basic genetics (transmission and molecular) as well as some biotechnology principles are discussed. Additionally, human body systems, evolution, reproduction and development, as well as ecology and human impacts on the environment are addressed.

**BIOL 301 Evolution 3 Units**

Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*General Education: AA/AS Area IV; CSU Area B2; IGETC Area 5B*

*Course Transferable to UC/CSU*

Hours: 54 hours LEC

This non-science majors course is an introduction to evolutionary biology. It explores the history of life and the mechanisms that give rise to the diversity of life on earth. Topics include the scientific method, the history of evolutionary thought, the origins of life, population genetics, speciation, evolutionary developmental biology and systematics.

**BIOL 303 Survey of Biology 4 Units**

Advisory: MATH 100, MATH 104, or MATH 132; AND ENGRD 116 and ENGWR 102, OR ESLR 320; and ESLW 320 with a grade of C or better.

*General Education: AA/AS Area IV; CSU Area B2; CSU Area B3;*

*IGETC Area 5B; IGETC Area 5C*

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 54 hours LAB

This course covers the basic principles of cell biology, genetics (transmission and molecular), ecology, and evolution. Emphasis is also placed on the interrelationships among living organisms, and on the relationship of biological structures and functions. Plant and animal dissection are included as part of the laboratory activities. This course provides science preparation for those entering a Multiple Subject Teacher Credential Program and is taught with an inquiry-based approach. Field trips are required.

**BIOL 305 Natural History 4 Units**

Advisory: ENGRD 116 (Proficient Reading) and ENGWR 102 (Proficient Writing) with a grade of "C" or better; OR ESLR 320 (Advanced-Low Reading) and ESLW 320 (Advanced-Low Writing) with a grade of "C" or better.

*General Education: AA/AS Area IV; CSU Area B2; CSU Area B3;*

*IGETC Area 5B; IGETC Area 5C*

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 54 hours LAB

This course covers basic biological and ecological principles to explain the origin and diversity of living organisms. Topics range from landscape formation and habitats to the adaptations organisms have evolved to live in their environment. Although this is a broad survey course, emphasis is placed on California environments. Dissection is not part of this curriculum. This course is designed as an introductory course and for non-majors who enjoy the outdoors. Field trips may be required.

**BIOL 310 General Biology 4 Units**

Advisory: MATH 32, MATH 42, or STAT 105 with a grade of "C" or better; and eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*General Education: AA/AS Area IV; CSU Area B2; CSU Area B3;*

*IGETC Area 5B; IGETC Area 5C*

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 54 hours LAB

This laboratory course for non-science majors covers basic biological principles and how they relate to humans. Concepts include cell chemistry, structure, and physiology; genetics (transmission and molecular); biotechnology; human body systems; evolution; reproduction and development; ecology; and human impacts on the environment.

**BIOL 322 Ethnobotany 3 Units***General Education: AA/AS Area VI**Course Transferable to CSU*

Hours: 36 hours LEC; 54 hours LAB

This course focuses on the multicultural use of plants. Emphasis is on the identification and use of plants from several cultures including the American Indians, Europeans, South Americans, and Chinese. Topics include the use of plants for food, medicine, basketry, technology, shelter, and music. Sight recognition of plants is emphasized. An analysis of ethnicity and ethnocentrism is also included. Field trips may be required.

**BIOL 332 Introduction to Ornithology 3 Units**

Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*General Education: AA/AS Area IV Course Transferable to CSU*

Hours: 18 hours LEC; 108 hours LAB

This introductory course covers the biology and natural history of birds. Topics include evolutionary origins of birds and of flight, avian anatomy and physiology, and bird behavior, such as migration, song, feeding ecology, and mating systems. Conservation strategies are also investigated. Laboratory work explores bird structure and function, taxonomic classification, and species identification, particularly of those found in California and the western United States. Field trips are required.

**BIOL 342 The New Plagues: New and Ancient Infectious Diseases Threatening World Health 3 Units**

Advisory: ENGWR 102 (Proficient Writing) and ENGRD 116 (Proficient Reading) with a grade of "C" or better; OR ESLR 320 (Advanced-Low Reading) and ESLW 320 (Advanced-Low Writing) with a grade of "C" or better.

*General Education: CSU Area B2; IGETC Area 5B**Course Transferable to UC/CSU*

Hours: 54 hours LEC

This course explores the biology, epidemiology, and pathology of selected pathogens such as prions, viruses, bacteria, protozoa, and helminths that threaten public health on a global scale. It explores the interaction between human behavior and disease agents on the emergence of new infectious agents and the re-emergence of ancient plagues.

**BIOL 352 Conservation Biology 3 Units***General Education: AA/AS Area IV; CSU Area B2; IGETC Area 5B**Course Transferable to UC/CSU*

Hours: 54 hours LEC

This course introduces biological and ecological principles involved in understanding and analyzing environmental problems and exploring scientifically sound conservation approaches. Major topics include forms and patterns of biodiversity, values of biodiversity, threats to biodiversity, conservation at the population and species levels, applied conservation biology, and conservation and sustainable development at the local, regional, national, and international levels. This course places emphasis on scientific processes and methodology, while also examining the economic, social, political, and ethical aspects of conservation issues. Course themes are explored through extensive use of interactive case studies, discussion, and activities surrounding relevant current events. Field trips may be required.

**BIOL 370 Marine Biology 4 Units**

Advisory: "ENGRD 116 (Proficient Reading) and ENGWR 102 (Proficient Writing) with a grade of "C" or better; OR ESLR 320 (Advanced-Low Reading) and ESLW 320 (Advanced-Low Writing) with a grade of "C" or better."

*Enrollment Limitation: The course is not open to students who have completed BIOL 482.**General Education: AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C**Course Transferable to UC/CSU*

Hours: 54 hours LEC; 54 hours LAB

This course introduces marine biology. It includes the study of cell biology, evolution, physical oceanography, marine algae, marine vertebrate and invertebrate animals, and the ecology of various marine zones. Field trips focusing on the Central and Northern California coast are required. A portion of this course may be offered in a TBA component of 54 hours which may include but is not limited to natural history of the rocky intertidal, invertebrate identification, salt marsh ecology, sandy beach ecology, or estuary ecology.

**BIOL 375 Marine Ecology 3 Units**

Advisory: MATH 32, MATH 42, or STAT 105 with a grade of "C" or better; and eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*Course Transferable to CSU*

Hours: 54 hours LEC

This course for non-science majors is an introduction to the marine physical environment, the diversity of marine life, and the complex interactions between the two. It uses the marine environment as a model for introducing the key concepts of the scientific method, ecology, evolution, biodiversity, and sustainability.

**BIOL 390 Natural History Field Study .5-4 Units***Course Transferable to CSU*

Hours: 3-24 hours LEC; 18-144 hours LAB

This course focuses on the ecology and natural history of specific habitats of biological interest. Course content varies according to field destination but may include topics in botany, zoology, marine, conservation, and geography. Field study methodology and tools are also covered. Field trips are required and field trip expense fees may be required.

**BIOL 400 Principles of Biology 5 Units***Prerequisite: CHEM 400 with a grade of "C" or better*

Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

*General Education: AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C**Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This course introduces biological concepts important for a general understanding and background for biology majors and pre-professional programs. Emphasis is on the scientific method and basic processes common to all forms of life. Topics include cell structure and function, cell physiology, cell reproduction, Mendelian and molecular genetics, evolution, and ecology. (C-ID BIOL 190)

**BIOL 410 Principles of Botany 5 Units**

*Prerequisite:* BIOL 400 with a grade of "C" or better

*Advisory:* Eligible for ENGRD 310 or ENGRD 312 AND ENGRD 300; OR ESLR 340 AND ESLW 340

*General Education:* CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This course covers the general principles of botany for science majors. It builds upon and applies concepts developed in cell and molecular biology to the study of plants. The anatomy and physiology, morphology, ecology, and evolution of higher plants are covered. Topics include the diversity, taxonomy, and evolutionary trends observed among the cyanobacteria, protists, fungi, and plants, with special emphasis on higher plants of all major phyla. General ecological principles are covered, including population, community, and ecosystem dynamics. Field trips may be required. (C-ID BIOL 155; Part of C-ID BIOL 130S)

**BIOL 415 Introduction to Biology: Biodiversity, Evolution, and Ecology 5 Units**

*Prerequisite:* BIOL 400 with a grade of "C" or better

*Advisory:* Eligible for ENGRD 310 or ENGRD 312 AND ENGRD 300; OR ESLR 340 AND ESLW 340

*General Education:* CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This course, intended for science majors, introduces the ecological and evolutionary processes that shape biodiversity, relating the patterns of biodiversity to small and large scale environmental effects. The diversity of life on Earth (including animals, plants, fungi, protists, and additional unicellular organisms) is covered. Overarching themes include evolutionary mechanisms, phylogenetic analysis, interactions of organisms with the environment, and global processes and patterns. Not open for credit to students who have completed BIOL 410 and BIOL 420 with a grade of C or better. Field trips may be required. (C-ID BIOL 140)

**BIOL 420 Principles of Zoology 5 Units**

*Prerequisite:* BIOL 400 with a grade of "C" or better

*General Education:* CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This course covers general principles of zoology. Topics covered include a survey of the animal kingdom, embryology, evolution, systematics, ecology, and comparative anatomy and physiology. Field trips may be required. (C-ID BIOL 150; Part of C-ID BIOL 130S)

**BIOL 430 Anatomy and Physiology 5 Units**

*Prerequisite:* CHEM 305, 309, or 400 with a grade of "C" or better; AND ENGLWR 101 or ESLW 320 with a grade of "C" or better, or placement into transfer-level English through the assessment process.

*Advisory:* Eligible for ENGRD 310 or ENGRD 312; OR ESLR 340  
*General Education:* AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This lecture and laboratory course in human anatomy and physiology emphasizes the integration of structure and function. The underlying basis of the course is built on the study of anatomical terminology, cells, and tissues. The course expands this study into the integumentary, skeletal, muscular, and nervous systems. Laboratory study is enhanced by the microscopic study of tissues, examination of anatomical models, and the dissection of preserved material. Laboratory study is also enhanced by the examination of prosected whole cadavers as well as prosected head, torso, upper and lower extremities, and individual organs. Laboratory activities also include both wet-lab experiments and computer simulations. Both BIOL 430 and BIOL 431 must be taken to complete the study of all major body systems. (Part of C-ID BIOL 115S)

**BIOL 431 Anatomy and Physiology 5 Units**

*Prerequisite:* BIOL 430 with a grade of "C" or better

*Advisory:* Eligible for ENGRD 310 or ENGRD 312; OR ESLR 340

*General Education:* AA/AS Area IV

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This lecture and laboratory course in human anatomy and physiology emphasizes the integration of structure and function. It provides students with an understanding of the structure, function, and regulation of the human body through the physiological integration of the following systems: cardiovascular, lymphatic, respiratory, digestive, urinary, endocrine, and reproductive. Laboratory study is enhanced by the microscopic study of tissues, examination of anatomical models, and the dissection of preserved material. Laboratory activity is also enhanced by the examination of whole cadavers as well as prosected head, torso, upper and lower extremities, and individual organs. Laboratory activities also include both wet-lab experiments and computer simulations. Both BIOL 430 and BIOL 431 must be taken to complete the study of all major body systems. (C-ID BIOL 115S; Part of C-ID BIOL 115S)

**BIOL 440 General Microbiology 4 Units**

*Prerequisite:* CHEM 305, 309, or 400 with a grade of "C" or better  
*Advisory:* Eligible for ENGRD 310 or ENGRD 312 AND ENGRD 300; OR ESLR 340 AND ESLW 340; AND BIOL 300 or CHEM 306 with a grade of "C" or better.

*General Education:* CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 72 hours LAB

This course introduces microorganisms and their effects on human health. It examines the structure, physiology, metabolism, and genetics of microorganisms. Laboratory work includes aseptic technique, morphological and biochemical properties of microorganisms, and medically relevant issues regarding microorganisms.

**BIOL 442 General Microbiology and Public Health 5 Units**

*Prerequisite:* CHEM 306, CHEM 309, or CHEM 400 with a grade of "C" or better; OR CHEM 305 with a grade of "C" or better and one of the following: BIOL 300, BIOL 303, or BIOL 310 with a grade of "C" or better

*Advisory:* Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340 with a grade of "C" or better.

*General Education:* CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 108 hours LAB

This course provides a survey of bacteria, viruses, fungi, protozoa, and helminths that are associated with human infectious diseases and public health. It examines their cellular and molecular structure, physiology, metabolism, and genetics. Laboratory work introduces methods for cultivating and characterizing microorganisms.

**BIOL 482 Honors Marine Biology 4 Units**

*Prerequisite:* Placement into ENGWR 480 through the assessment process.

*General Education:* AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

*Course Transferable to UC/CSU*

Hours: 54 hours LEC; 54 hours LAB

This course is an honors level introduction to marine biology. Using a seminar style, it explores physical oceanography, marine algae, marine vertebrate and invertebrate animals, and the ecology of various marine zones. Field trips focusing on inter-tidal organisms of the Central and Northern California Coast are required. A portion of this course may be offered in a TBA component of 54 hours which may include but is not limited to designing and conducting experiments in the rocky intertidal, invertebrate identification, salt marsh ecology, sandy beach ecology, estuary ecology, or comparative anatomy of fishes. The course is not open to students who have completed BIOL 370.

**BIOL 490 Science Skills and Applications .5 Units**

*Corequisite:* Current enrollment in a science, nutrition or nursing course.

*Course Transferable to CSU*

Hours: 27 hours LAB

This course offers individualized instructional modules designed to acquire or improve reading skills in the various science classes and in the nursing program. A partial list of skills may include the following: textbook comprehension, principles of learning and retention, note taking, annotating, discipline-based vocabulary, paraphrasing, reading graphics, test taking, and problem solving. This course is offered in a flexible TBA format of 27 laboratory hours in order to accommodate the student's schedule. Registration is open through the tenth week of the semester. Pass/No Pass only.

**BIOL 491 Science Skills and Applications II .5 Units**

*Prerequisite:* BIOL 490

*Corequisite:* Current enrollment in a science, nutrition, or nursing course.

*Course Transferable to CSU*

Hours: 27 hours LAB

This course offers individualized instructional modules designed to acquire or improve study strategies for science, nursing, or nutrition courses. Strategies include goal setting, the intensive study cycle, graphic organizers, constructing and interpreting graphs, mastering science vocabulary, self monitoring while reading, coding method of reading, and advanced problem solving. This course is offered in a flexible TBA format of 27 laboratory hours to accommodate the student's schedule. Registration is open through the ninth week of the semester. Pass/No Pass only.

**BIOL 495 Independent Studies in Biology 1-3 Units**

*Course Transferable to CSU*

Hours: 54-162 hours LAB

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

**Biotechnology****BIOT 301 Biotechnology and Human Health 3 Units**

*Prerequisite:* BIOL 300, BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better

*Course Transferable to CSU*

Hours: 54 hours LEC

This course introduces biotechnology as it pertains to human health and disease. Topics include an introduction to molecular biology and genetics, recombinant DNA technology, biopharmaceutical products, forensics and genetic testing, stem cells and regenerative medicine, genomics and bioinformatics, and ethical issues arising from biotechnology disease diagnosis and treatment.

**BIOT 305 Introduction to Bioinformatics 1 Unit**

*Prerequisite:* BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, BIOT 301, or BIOT 307 with a grade of "C" or better

*Course Transferable to CSU*

Hours: 14 hours LEC; 14 hours LAB

This course examines the basic concepts and techniques in bioinformatics, the computer analysis of nucleic acids and proteins. Topics include biotechnology databases, database searching, structure and function analysis of biological molecules, sequence alignment and analysis, and biological applications of bioinformatics.

**BIOT 307 Biotechnology and Society 2 Units**

*Course Transferable to UC/CSU*

Hours: 36 hours LEC

This course examines the scientific and social impact of biotechnology by introducing basic technical concepts to examine recent advances. Topics include biotechnology applications in medicine, agriculture, industry, and the environment, and their ethical implications and public perception.

**BIOT 308 Exploratory Field Experience in Biotechnology Education 3 Units**

*Prerequisite:* BIOL 303, 310, or 400 with a grade of "C" or better

*Enrollment Limitation:* Current TB clearance is required prior to work in schools. Fingerprinting may also be required.

*General Education:* AA/AS Area III(b)

*Course Transferable to UC/CSU*

Hours: 36 hours LEC; 54 hours LAB

This course is an education-based field experience in biotechnology and bioinformatics that allows students to explore science teaching as a career choice. Students are assigned to area high schools to observe and assist in a science classroom. Students have the opportunity to learn and practice important biotechnology and bioinformatics teaching skills and to examine social and educational issues related to the school environment. Field trips and off-site activities are required for this course.

**BIOT 311 Biotechnology Laboratory Methods -  
Molecular Techniques 2 Units**

*Prerequisite:* BIOL 300, BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better

*Course Transferable to CSU*

Hours: 18 hours LEC; 54 hours LAB

This course covers basic concepts and techniques to work effectively in a bioscience laboratory. Topics include laboratory solution preparation, recombinant DNA methods and nucleic acid analysis techniques, protein separation and analytical techniques, good laboratory practice, and product quality issues.

**BIOT 312 Biotechnology Laboratory Methods -  
Microbial and Cell  
Culture Techniques 2 Units**

*Prerequisite:* BIOL 300, BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better

*Course Transferable to CSU*

Hours: 18 hours LEC; 54 hours LAB

This course covers basic concepts and techniques to work effectively in a bioscience laboratory. Topics include media preparation, microbial and plant cell culture techniques, biosafety guidelines, and DNA and enzyme diagnostic techniques.

**BIOT 498 Work Experience in  
Biotechnology 1-4 Units**

*Advisory:* Eligible for ENGRD 310 or ENGRD 312 AND ENGRD 300; OR ESLR 340 AND ESLW 340.

*Enrollment Limitation:* Students must be in a paid or unpaid internship, volunteer position, or job related to biotechnology with a cooperating site supervisor. Students are advised to consult with the Biotechnology Department faculty to review specific certificate and degree work experience requirements.

*General Education:* AA/AS Area III(b)

*Course Transferable to CSU*

Hours: 60-300 hours LAB

This course provides students with opportunities to develop marketable skills in preparation for employment or advancement within the field of biotechnology. It is designed for students interested in work experience and/or internships in transfer-level degree occupational programs. Course content includes understanding the application of education to the workforce, completion of Title 5 required forms which document the student's progress and hours spent at the work site, and developing workplace skills and competencies. During the semester, the student is required to attend a weekly orientation and 75 hours of related paid work experience, or 60 hours of unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. First-time participants are required to attend a weekly orientation and a final meeting. Returning participants are required to attend the first class meeting, a mid-semester meeting, and a final meeting and may meet individually with the instructor as needed to complete a work site observation and all program forms, receive updates, and assignments. Students may take up to 16 units total across all Work Experience course offerings. This course may be taken up to four times when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.