


Biology & Biotechnology

| American River College


Biologists are fully engaged in meeting the challenges of the future, helping to improve the quality of human life and to conserve our world's biodiversity. Through a variety of lecture and laboratory courses, the Biology Department Faculty are committed to serving all students including biology major, allied health, and general education students in a collegial and supportive atmosphere. All biology courses aim to develop an understanding of biological principles but vary in emphasis from cell and molecular biology to the study of the human body to the biodiversity in our local ecosystems.

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Associate Degrees for Transfer

A.S.-T. in Biology

The Associate in Science in Biology for Transfer degree provides students with a major that fulfills the general requirements of the California State University for transfer. Students with this degree will receive priority admission with junior status to the California State University system. The Associate in Science in Biology for Transfer (AS-T) degree may be obtained by the completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program outlined below (earning a C or better in these courses) and (b) the Intersegmental General Education Transfer Curriculum for Science, Technology, Engineering, and Mathematics (IGETC-STEM).

Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
BIOL 400	Principles of Biology	5
BIOL 415	Introduction to Biology: Biodiversity, Evolution, and Ecology (5)	5 - 10
or [BIOL 410	Principles of Botany (5)	
and BIOL 420]	Principles of Zoology (5)	
CHEM 400	General Chemistry I	5
CHEM 401	General Chemistry II	5
MATH 355	Calculus for Biology and Medicine I (4)	4 - 5
or MATH 400	Calculus I (5)	
[PHYS 350	General Physics (4)	8 - 9
and PHYS 360]	General Physics (4)	
or [PHYS 410	Mechanics of Solids and Fluids (5)	
and PHYS 421]	Electricity and Magnetism (4)	

COURSE CODE	COURSE TITLE	UNITS
Total Units:		32 - 39

The Associate in Science in Biology for Transfer (AS-T) degree may be obtained by completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program, and (b) the Intersegmental General Education Transfer Curriculum for Science, Technology, Engineering, and Mathematics (IGETC for STEM).

Student Learning Outcomes

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

- apply the scientific method: define problems clearly, construct testable hypotheses, design and execute appropriate experiments, analyze data, and justify appropriate conclusions.
- demonstrate knowledge of scientific terminology and interpret principle concepts of biology.
- demonstrate content knowledge, laboratory skills, and study skills to be successful at a four-year institution.
- record and analyze data using appropriate laboratory skills and instrumentation.
- assemble and critically evaluate technical information from the scientific literature.
- apply safe laboratory practices.
- work effectively in groups, as leaders or team members, to solve problems and interact productively with a diverse group of peers.
- demonstrate awareness of the role of biology in contemporary societal and global issues.

Associate Degrees

A.S. in Biotechnology

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.

Degree Requirements

COURSE CODE	COURSE TITLE	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 Organic and Biological Chemistry (5)	
or CHEM 309]	Integrated General, Organic, and Biological Chemistry (5)	
or [CHEM 400	General Chemistry I (5)	

COURSE CODE	COURSE TITLE	UNITS
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)	4
A minimum of 1 unit from the following:		1
BIOT 498	Work Experience in Biotechnology (1 - 4)	
or BIOT 305	Introduction to Bioinformatics (1)	
Total Units:		29 - 35

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.

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 Information

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.

A.S. in General Science

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.

Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
A minimum of 18 units from the following:		18 ¹
Physical Science Courses		
ASTR 300	Introduction to Astronomy (3)	
ASTR 310	The Solar System (3)	
ASTR 320	Stars, Galaxies, and Cosmology (3)	

COURSE CODE	COURSE TITLE	UNITS
ASTR 330	Introduction to Astrobiology (3)	
ASTR 400	Astronomy Laboratory (1)	
ASTR 481	Honors Astronomy: Stars, Galaxies, and Cosmology (4)	
ASTR 495	Independent Studies in Astronomy (1 - 3)	
ASTR 499	Experimental Offering in Astronomy (0.5 - 4)	
CHEM 305	Introduction to Chemistry (5)	
CHEM 306	Introduction to Organic and Biological Chemistry (5)	
CHEM 309	Integrated General, Organic, and Biological Chemistry (5)	
CHEM 310	Chemical Calculations (4)	
CHEM 400	General Chemistry I (5)	
CHEM 401	General Chemistry II (5)	
CHEM 420	Organic Chemistry I (5)	
CHEM 421	Organic Chemistry II (5)	
CHEM 423	Organic Chemistry - Short Survey (5)	
CHEM 495	Independent Studies in Chemistry (1 - 3)	
CHEM 499	Experimental Offering in Chemistry (0.5 - 4)	
GEOG 300	Physical Geography: Exploring Earth's Environmental Systems (3)	
GEOG 301	Physical Geography Laboratory (1)	
GEOG 305	Global Climate Change (3)	
GEOG 306	Weather and Climate (3)	
GEOG 307	Environmental Hazards and Natural Disasters (3)	
GEOG 308	Introduction to Oceanography (3)	
GEOG 309	Introduction to Oceanography Lab (1)	
GEOG 391	Field Studies in Geography: Mountain Landscapes (1 - 4)	
GEOG 392	Field Studies in Geography: Coastal Landscapes (1 - 4)	
GEOG 393	Field Studies in Geography: Arid Landscapes (1 - 4)	
GEOG 394	Field Studies in Geography: Volcanic Landscapes (1 - 4)	
GEOG 495	Independent Studies in Geography (1 - 3)	
GEOG 499	Experimental Offering in Geography (0.5 - 4)	
GEOL 300	Physical Geology (3)	
GEOL 301	Physical Geology Laboratory (1)	
GEOL 305	Earth Science (3)	
GEOL 306	Earth Science Laboratory (1)	
GEOL 310	Historical Geology (3)	
GEOL 311	Historical Geology Laboratory (1)	
GEOL 320	Global Climate Change (3)	
GEOL 325	Environmental Hazards and Natural Disasters (3)	
GEOL 330	Introduction to Oceanography (3)	
GEOL 331	Introduction to Oceanography Lab (1)	

COURSE CODE	COURSE TITLE	UNITS
GEOL 345	Geology of California (3)	
GEOL 390	Field Studies in Geology (1 - 4)	
GEOL 495	Independent Studies in Geology (1 - 3)	
GEOL 499	Experimental Offering in Geology (0.5 - 4)	
PHYS 310	Conceptual Physics (3)	
PHYS 311	Basic Physics (3)	
PHYS 312	Conceptual Physics Laboratory (1)	
PHYS 350	General Physics (4)	
PHYS 360	General Physics (4)	
PHYS 410	Mechanics of Solids and Fluids (5)	
PHYS 421	Electricity and Magnetism (4)	
PHYS 431	Heat, Waves, Light and Modern Physics (4)	
PHYS 495	Independent Studies in Physics (1 - 3)	
PHYS 499	Experimental Offering in Physics (0.5 - 4)	
PS 300	Introduction to Physical Science (3)	
PS 301	Physical Science Laboratory (1)	
PS 495	Independent Studies in Physical Science (1 - 3)	
PS 499	Experimental Offering in Physical Science (0.5 - 4)	
Biological Science Courses		
ANTH 300	Biological Anthropology (3)	
ANTH 301	Biological Anthropology Laboratory (1)	
ANTH 303	Introduction to Forensic Anthropology (3)	
ANTH 370	Primatology (3)	
ANTH 372	Primatology Field Studies (2)	
ANTH 480	Honors Biological Anthropology (3)	
ANTH 495	Independent Studies in Anthropology (1 - 3)	
ANTH 499	Experimental Offering in Anthropology (0.5 - 4)	
BIOL 300	The Foundations of Biology (3)	
BIOL 301	Evolution (3)	
BIOL 303	Survey of Biology (4)	
BIOL 305	Natural History (4)	
BIOL 310	General Biology (4)	
BIOL 322	Ethnobotany (3)	
BIOL 332	Introduction to Ornithology (4)	
BIOL 342	The New Plagues: New and Ancient Infectious Diseases Threatening World Health (3)	
BIOL 352	Conservation Biology (3)	
BIOL 370	Marine Biology (4)	
BIOL 375	Marine Ecology (3)	
BIOL 390	Natural History Field Study (0.5 - 4)	

COURSE CODE	COURSE TITLE	UNITS
BIOL 400	Principles of Biology (5)	
BIOL 410	Principles of Botany (5)	
BIOL 415	Introduction to Biology: Biodiversity, Evolution, and Ecology (5)	
BIOL 420	Principles of Zoology (5)	
BIOL 430	Anatomy and Physiology (5)	
BIOL 431	Anatomy and Physiology (5)	
BIOL 440	General Microbiology (4)	
BIOL 442	General Microbiology and Public Health (5)	
BIOL 482	Honors Marine Biology (4)	
BIOL 495	Independent Studies in Biology (1 - 3)	
BIOL 499	Experimental Offering in Biology (0.5 - 4)	
BIOT 301	Biotechnology and Human Health (3)	
BIOT 305	Introduction to Bioinformatics (1)	
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)	
BIOT 499	Experimental Offering in Biology (0.5 - 4)	
NATR 300	Introduction to Natural Resource Conservation and Policy (4)	
NATR 302	Introduction to Wildlife Biology (4)	
NATR 303	Energy and Sustainability (3)	
NATR 304	The Forest Environment (3)	
NATR 305	Fisheries Ecology and Management (4)	
NATR 306	Introduction to Rangeland Ecology and Management (3)	
NATR 307	Principles of Sustainability (4)	
NATR 310	Study Design and Field Methods (4)	
NATR 320	Principles of Ecology (4)	
NATR 322	Environmental Restoration (2)	
NATR 324	Field Studies: Birds and Plants of the High Sierra (1.5)	
NATR 330	Native Trees and Shrubs of California (4)	
NATR 332	Wildflowers of California (3)	
NATR 346	Water Resources and Conservation (3)	
NATR 495	Independent Studies in Natural Resources (1 - 3)	
NATR 499	Experimental Offering in Natural Resources (0.5 - 4)	
PSYC 310	Biological Psychology (3)	
PSYC 311	Biological Psychology Laboratory (1)	
PSYC 495	Independent Studies in Psychology (1 - 3)	
PSYC 499	Experimental Offering in Psychology (0.5 - 4)	
Total Units:		18

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

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.

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.

Certificate of Achievement

Biotechnology Certificate

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.

Certificate Requirements

COURSE CODE	COURSE TITLE	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)	
A minimum of 1 unit from the following:		1
BIOT 305	Introduction to Bioinformatics (1)	

COURSE CODE	COURSE TITLE	UNITS
or BIOT 307	Biotechnology and Society (2)	
or BIOT 498	Work Experience in Biotechnology (1 - 4)	
Total Units:		24 - 26

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.

Gainful Employment

The US Department of Education requires colleges to disclose a variety of information for any program that is eligible for financial aid that "prepares students for gainful employment in a recognized occupation." The following link provides Gainful Employment Disclosure information for this certificate program:

[Gainful Employment Information for Biotechnology Certificate of Achievement \(https://web.losrios.edu/gainful-emp-info/arc/30336/30336.htm\)](https://web.losrios.edu/gainful-emp-info/arc/30336/30336.htm)

Career Information

This certificate 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.

Biology (BIOL)

BIOL 102 Essentials of Human Anatomy and Physiology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
General Education:	AA/AS Area IV

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.

Student Learning Outcomes

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

- identify major organs, cavities, bones and bone markings, muscles, and blood vessels on models or drawings.
- explain how different organ systems contribute to the maintenance of the living cells of our bodies.
- explain how different organ systems work together to maintain homeostasis.
- correlate course knowledge of organ systems to disease, aging, and healing processes.

- integrate the body's structural design with its functioning to explain how life is maintained.
- differentiate between credible sources of scientific information and anecdotes or stories.

BIOL 103 Human Anatomy for Funeral Services

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
Corequisite:	FSE 300
Enrollment Limitation:	An off-site clinical laboratory component of the course may require a background check, drug screening, and testing for hepatitis B.
General Education:	AA/AS Area IV

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

Student Learning Outcomes

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

- identify all body parts, body structures, organs, and tissues of the human body at a detailed level on models.
- assess and identify structures on a previously dissected human cadaver.
- demonstrate proper dissection technique on an undissected human cadaver.
- dissect and identify specific anatomical structures in human cadavers that are relevant to embalming procedures.
- analyze the relationships between anatomical systems by applying principles of the scientific method and inquiry.
- identify specific anatomical guides, linear guides, and anatomical limits of structures relevant to embalming procedures.
- demonstrate appropriate behavior in the presence of a human cadaver.
- enumerate ethical issues regarding working with human cadavers.

BIOL 130 Microbiology for Funeral Services

Units:	3
Hours:	54 hours LEC
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

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.

Student Learning Outcomes

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

- identify basic microbial morphology and describe basic microbial physiology.
- interpret the relationships and interactions between a host and a parasite.
- assess the effect of environmental disinfection and decontamination procedures.
- describe the fundamentals of the infectious disease process.
- categorize specific and nonspecific defense mechanisms against disease.
- distinguish between the various methods of transmission of infectious disease.
- differentiate between normal flora, true pathogens, and opportunistic pathogens.
- identify examples of human disease and corresponding infectious agents with special emphasis on control and prevention of disease.

BIOL 295 Independent Studies in Biology

Units:	1 - 3
Hours:	54 - 162 hours LAB
Prerequisite:	None.

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

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU; UC (BIOL 300, 303 & 310 combined: maximum credit - two courses; no credit for BIOL 300 if taken after BIOL 400)
General Education:	AA/AS Area IV; CSU Area B2; IGETC Area 5B

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.

Student Learning Outcomes

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

- explain basic cellular, anatomical, and physiological mechanisms by which organisms, including humans, maintain homeostasis.
- describe the basic processes of cellular reproduction and genetics.
- describe implications of modern biotechnologies.
- apply evolutionary theory to various organisms.
- evaluate new situations using the scientific method, including evaluating the validity of data and forming appropriate conclusions.
- propose solutions to biological problems.

- analyze data using quantitative reasoning and basic mathematical concepts.
- analyze changes in biodiversity over time.

BIOL 301 Evolution

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; IGETC Area 5B

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.

Student Learning Outcomes

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

- analyze new situations using the scientific method, evaluate the validity of data, and form appropriate conclusions.
- describe the contribution of key individuals to the development of the theory of evolution.
- explain the forces that act to change the genetics of populations over time.
- explain the concept of species and how new species form.
- explain recent discoveries in the field of evolutionary developmental biology.
- describe major events in the evolution of life on earth.

BIOL 303 Survey of Biology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
Advisory:	MATH 100 or 132 with a grade of "C" or better
Transferable:	CSU; UC (BIOL 300, 303 & 310 combined: maximum credit - two courses; no credit for BIOL 303 if taken after BIOL 310 or 400))
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

This course covers the basic principles of cell biology, genetics (transmission and molecular), ecology, and evolution. It also emphasizes the process of science, interrelationships among living organisms, and the relationship of biological structures and functions. Laboratory activities include plant and animal dissection. This course provides science preparation for those entering a Multiple Subject Teacher Credential Program. Field trips are required.

Student Learning Outcomes

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

- identify properties that are common to all living things, and identify representatives of the major groups of organisms

- compare and contrast the structures and functions of cells, tissues, and organ systems of major groups of organisms
- apply the scientific method: use inquiry, data collection, quantitative reasoning, and basic mathematical concepts to analyze the results of a simple experiment
- assess the scientific quality of information based on scientific processes
- explain how the mechanisms of evolution and the evidence supporting the theory of evolution account for both the unity and diversity of life
- interpret results of ecological studies, including graphs, diagrams, and charts
- correlate the basic concepts of DNA synthesis, cell division, sexual reproduction, and transmission genetics
- understand the importance of gene expression in creating the organism

BIOL 305 Natural History

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

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, it emphasizes 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.

Student Learning Outcomes

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

- analyze the biological differences in structure and function of several California ecosystems.
- examine the different relationships between species.
- apply general biological and ecological concepts to explain origins of life hypotheses, extant biological diversity, and individual traits that promote survival, growth, and reproduction.
- incorporate the principles of natural selection to explain relationships between species' adaptations and the environment.
- explain the mechanisms of evolution and their impact on adaptations over geologic time.
- recognize common species of plants and animals in the field, and the biomes of California.
- assess the importance of climate and geology to plant and animal adaptations.
- evaluate the importance of biodiversity to ecosystem health.
- record observations on adaptations and ecology in natural environments.
- evaluate biological data and form logical conclusions suggested by the data.
- assess the scientific quality of information based on the process of science and the scientific method.

BIOL 310 General Biology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
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.
Transferable:	CSU; UC (BIOL 300, 303 & 310 combined: maximum credit - two courses)
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

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.

Student Learning Outcomes

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

- explain major molecular, cellular, physiological, ecological, and evolutionary principles.
- apply major molecular, cellular, physiological, ecological, and evolutionary principles to basic biological problems.
- apply the scientific method to a biological problem.
- assess information from a variety of sources for scientific validity and meaning.
- analyze a particular biological structure and explain its function.
- evaluate a hypothesis in the laboratory using inquiry, data collection and analysis, quantitative reasoning, and basic mathematical skills.

BIOL 322 Ethnobotany

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	None.
Transferable:	CSU; UC
General Education:	AA/AS Area VI

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.

Student Learning Outcomes

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

- identify herbs, shrubs, and trees using plant keys
- compare and contrast uses of plants from many cultures
- prepare American Indian foods
- gather and prepare plants according to appropriate seasons and methods
- compare and contrast ethnobotanical issues facing American Indians, South Americans, Europeans, and Chinese
- construct traditional items including baskets, regalia necklaces, digging sticks, and others

BIOL 332 Introduction to Ornithology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU; UC
General Education:	AA/AS Area IV

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.

Student Learning Outcomes

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

- examine the nature of scientific thought and methodology as it applies to the analysis of avian biology
- compare and contrast the current scientific hypotheses regarding the evolution of birds and flight and evaluate the evidence supporting these views
- analyze the evolutionary forces that have led to specific avian adaptations to flight, including morphological, physiological, and behavioral traits
- explain the genetic mechanisms that generate bird biodiversity
- assess the scientific quality of information based on the process of science and the scientific method in the field of ornithology
- identify the major conservation concerns in the field of ornithology and the scientific efforts that may mitigate these threats
- evaluate the effectiveness of citizen science, digital data, and metadata systems to obtain quality ornithological data
- demonstrate the proper use of binoculars and field guides in order to identify birds in the field

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

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340
Transferable:	CSU; UC
General Education:	CSU Area B2; IGETC Area 5B

This course explores the biology, epidemiology, and pathology of selected pathogens such as prions, viruses, bacteria, protozoa, fungi, 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.

Student Learning Outcomes

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

- compare and contrast the anatomical and functional characteristics of infectious agents.

- describe the etiology, transmission, epidemiology, treatment, and prevention of major infectious diseases.
- explain how host defenses respond to infectious agents.
- assess the effects of selected infectious agents on human populations throughout history.
- evaluate factors that lead to the emergence or re-emergence of infectious diseases worldwide.
- apply microbiology concepts to current issues in human health and infectious disease.
- list examples of infectious agents used as biological weapons.
- demonstrate expertise for a specific infectious disease by preparing an oral research presentation including visual illustrations.
- explore how infectious diseases can be controlled by vaccines, antimicrobial agents, and behavioral and social changes.

BIOL 352 Conservation Biology

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; IGETC Area 5B

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.

Student Learning Outcomes

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

- apply fundamental biological and ecological terms, concepts, and principles to the critical analysis of conservation issues
- examine biodiversity in terms of biological structure, composition, and function at the genetic, species, ecosystem, and landscape levels
- analyze the interrelationships between biological, physical, and social systems
- assess the scientific integrity of information
- evaluate the effectiveness of conservation strategies
- apply the scientific process to conservation problem solving and personal decision making

BIOL 370 Marine Biology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU; UC (BIOL 370 & 482 combined: maximum credit - one course)

General Education:

AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

This course is an introduction to 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 and serve as the laboratory component of this course. Field experiences may include but are not limited to natural history of the rocky intertidal, invertebrate identification, salt marsh ecology, sandy beach ecology, or estuary ecology. This course is not open to students who have completed BIOL 482.

Student Learning Outcomes

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

- identify and analyze the interrelationships between chemistry, geology, biology, and ecology in the ocean.
- explain oceanographic phenomena, such as waves, currents, and tides.
- identify and classify the various life forms in the ocean.
- evaluate major adaptations of various organisms and their evolutionary origins.
- compare and contrast various marine zones.
- apply the scientific method to a biological problem by formulating hypotheses and analyzing data.

BIOL 375 Marine Ecology

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
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.
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; IGETC Area 5B

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.

Student Learning Outcomes

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

- describe the interconnectedness between the physical environment and living organisms.
- describe the interconnectedness among different living organisms in marine ecosystems.
- describe the interconnectedness between humans and the marine environment.
- explain how evolutionary processes have influenced marine organism adaptations and the biodiversity of marine communities.
- apply basic ecological principles (e.g., biodiversity, community dynamics, primary production, the niche, energy flow, or nutrient cycles) to marine organisms and/or marine ecosystems.
- apply the concept of sustainability to the human use of marine resources.
- paraphrase and evaluate the scientific credibility of websites and/or magazine articles related to current marine ecology issues.

BIOL 390 Natural History Field Study

Units:	0.5 - 4
Hours:	3 - 24 hours LEC; 18 - 144 hours LAB
Prerequisite:	None.
Transferable:	CSU

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.

Student Learning Outcomes

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

- relate biological and ecological concepts and processes to specific locations in California
- describe site-specific biological and ecological phenomena
- analyze the interrelationships between biological, physical, and social systems at a particular site
- hypothesize about the causal mechanisms, both evolutionary and environmental, that make the natural history of specific field sites unique
- compose field notes
- collect and analyze field data
- demonstrate the use of field equipment

BIOL 400 Principles of Biology

Units:	5
Hours:	54 hours LEC; 108 hours LAB
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.
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
C-ID:	C-ID BIOL 190

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.

Student Learning Outcomes

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

- describe the scientific method.
- demonstrate skills in laboratory procedures and apply critical thinking in laboratory experiments.
- evaluate data generated in the laboratory for validity and scientific meaning.
- analyze interactions between biological systems.
- assess a problem and formulate a solution in the laboratory by using inquiry, data collection and analysis, quantitative reasoning, and basic mathematical concepts.

BIOL 410 Principles of Botany

Units:	5
Hours:	54 hours LEC; 108 hours LAB
Prerequisite:	BIOL 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.
Transferable:	CSU; UC
General Education:	CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
C-ID:	C-ID BIOL 155; Part of C-ID BIOL 130S

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. It covers the anatomy and physiology, morphology, ecology, diversity, and evolution of higher plants. Thorough cladistic analysis is used to study phylogenetic relationships among the cyanobacteria, protists, fungi, and all major plant phyla. It also covers general ecological principles. Field trips may be required.

Student Learning Outcomes

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

- identify plant cells, tissues, and organs
- describe the development of the primary and secondary plant body from the seed to the mature plant
- evaluate the environmental adaptations of plants as these adaptations relate to the plants' anatomy, morphology, and physiology
- demonstrate the use of plant keys to identify botanical organisms in the field
- identify examples of how plants utilize hormones to interact with and respond to the external environment
- describe the physiological pathways that plants utilize to create and store sugars and to uptake minerals
- classify organisms into their respective domain, kingdom, and phyla based on their identifying characteristics
- analyze evolutionary trends among fungi, cyanobacteria, protists, and plants
- describe the major advances and evolutionary trends of the plant phyla as they adapted further onto land (charting nonvascular plants through anthophyta)
- generate hypotheses relating to ecology
- state basic ecological principles
- apply the scientific method

BIOL 415 Introduction to Biology: Biodiversity, Evolution, and Ecology

Units:	5
Hours:	54 hours LEC; 108 hours LAB
Prerequisite:	BIOL 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
Transferable:	CSU; UC
General Education:	CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
C-ID:	C-ID BIOL 140

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.

Student Learning Outcomes

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

- define and give examples of the levels of organization seen in living things from cells, organs, tissues, and tissue systems to ecosystems.
- explain evolutionary mechanisms for both macroevolution and microevolution and how they relate to the diversity of life. Apply them to specific examples.
- investigate various mechanisms used by organisms to produce, store, and use energy.
- describe processes involved in embryologic development of major taxa stressing the patterns observed and relating them to evolutionary principles.
- use evolutionary mechanisms to critique the major body plans of organisms showing they are a result of environmental adaptations and shared ancestry.
- compare and contrast anatomical and physiological characteristics of major taxa. Focus on evolutionary relationships and adaptations to the environment.
- systematize various phyla by creating phylogenetic trees using anatomical and physiological data. Use trees to extrapolate the relationship of organisms. Evaluate hypothetical trees.
- identify basic ecological principles.
- identify, compare, and contrast life cycles observed in the major taxa with the focus on how these life cycles relate to evolutionary mechanisms and ecological principles.
- identify, compare, and contrast representative reproductive strategies seen in major phyla; detail how these relate to evolutionary mechanisms and ecological principles.
- analyze the relationship of organisms to their biotic and abiotic environment.
- integrate ecological principles with issues that affect the human condition.

BIOL 420 Principles of Zoology

Units:	5
Hours:	54 hours LEC; 108 hours LAB
Prerequisite:	BIOL 400 with a grade of "C" or better
Transferable:	CSU; UC
General Education:	CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
C-ID:	C-ID BIOL 150; Part of C-ID BIOL 130S

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.

Student Learning Outcomes

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

- describe reproductive and developmental processes used by animals.
- demonstrate anatomical characteristics of animals using dissection methods.

- list the characteristics of the major animal phyla.
- construct phylogenetic trees based on anatomic, physiologic, and embryologic data.
- interpret phylogenetic trees.
- compare and contrast anatomy and physiology of the animal phyla.
- analyze the environmental adaptations of animals based on anatomic and physiologic characteristics.
- evaluate the microevolutionary processes that produce patterns in nature.
- evaluate phylogenetic hypotheses with anatomic and physiologic data.
- integrate developmental, anatomical, and environmental data to hypothesize evolutionary relationships between animals.

BIOL 430 Anatomy and Physiology

Units:	5
Hours:	54 hours LEC; 108 hours LAB
Prerequisite:	CHEM 305, 309, or 400 with a grade of "C" or better; AND ENGWR 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
Transferable:	CSU; UC
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
C-ID:	Part of C-ID BIOL 115S

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.

Student Learning Outcomes

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

- assemble general anatomical structures within the hierarchy of levels of organization
- incorporate appropriate anatomical terms to correlate the position and relationship of anatomical structures
- predict negative and positive feedback responses to changes in homeostasis
- correlate the chemical structure of atoms and molecules to their physiological functions
- predict the function of a particular cell based on its organelles
- examine how tissues establish the framework of organs and systems
- integrate the type of tissue present with the function of the organ
- identify specific anatomical components of the integumentary, skeletal, muscle, and nervous systems using appropriate tools (microscope, models, preserved organs, and cadaver prosections)
- describe the mechanisms of neural communication and control
- describe the mechanisms of muscle contraction

- evaluate data collected during experimental challenges to homeostasis
- research physiological changes caused by cellular and organ pathology

BIOL 431 Anatomy and Physiology

Units:	5
Hours:	54 hours LEC; 108 hours LAB
Prerequisite:	BIOL 430 with a grade of "C" or better
Advisory:	Eligible for ENGRD 310 or ENGRD 312; OR ESLR 340
Transferable:	CSU; UC
General Education:	AA/AS Area IV
C-ID:	Part of C-ID BIOL 1155

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.

Student Learning Outcomes

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

- identify specific anatomic components of the endocrine, cardiovascular, immune, respiratory, urinary, digestive, and reproductive systems using appropriate tools (microscope, models, preserved organs, and cadaver material)
- diagram the functional relationship between each organ and the system to which it belongs
- illustrate the relationship between basic embryonic development and mature functional structures
- correlate the mechanisms by which the functional cells of each of the major systems respond to maintain homeostasis
- evaluate the neuronal and hormonal responses to changes in cardiovascular and respiratory dynamics
- evaluate the neuronal and hormonal responses to changes in digestive dynamics
- measure physiologic data during challenges to cardiovascular, respiratory, urinary, and digestive systems
- collect data through experimental challenges to cardiovascular, respiratory, urinary, and digestive challenges to homeostasis
- predict the outcome of pathophysiological changes to various body systems

BIOL 440 General Microbiology

Units:	4
Hours:	54 hours LEC; 72 hours LAB
Prerequisite:	CHEM 305, 309, or 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; AND BIOL 300 or CHEM 306 with a grade of "C" or better.
Transferable:	CSU; UC

General Education:

CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

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.

Student Learning Outcomes

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

- analyze the properties of microorganisms in terms of cellular anatomy and physiology.
- summarize the properties of microorganisms in terms of biochemistry and genetics and correlate these properties to applications in biotechnology.
- apply microbiology concepts to current issues in human health and infectious diseases.
- demonstrate proper microbiology laboratory techniques involving microscopy, biochemical tests and diagnostic media to characterize microorganisms of significance to human health.
- describe how physical and chemical methods can be used to control microbial growth.
- explain how the human body interacts with various microorganisms through symbiotic relationships and host defenses.

BIOL 442 General Microbiology and Public Health

Units:	5
Hours:	54 hours LEC; 108 hours LAB
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.
Transferable:	CSU; UC
General Education:	CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

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.

Student Learning Outcomes

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

- evaluate the anatomical, physiological, biochemical, and molecular properties of microorganisms.
- apply microbiology concepts to advances in biotechnology.
- evaluate how physical and chemical methods can be used to control microbial growth.
- apply microbiology concepts to current issues in public health and infectious disease.
- explain how host defenses interact with pathogenic microorganisms.
- design and evaluate experiments involving microscopy, biochemical tests, DNA techniques, and diagnostic media.
- describe various infectious diseases, including the causative agent(s), signs and symptoms, pathogenesis, virulence factors, epidemiology, diagnosis, treatment, and prevention.

BIOL 482 Honors Marine Biology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	Placement into ENGWR 480 through the assessment process.
Transferable:	CSU; UC (BIOL 370 & 482 combined: maximum credit - one course)
General Education:	AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C

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.

Student Learning Outcomes

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

- analyze the interrelationships between chemistry, biology and ecology in the marine environment (including oceanographic phenomena such as waves, currents, and tides).
- examine and support with experimental data the mechanisms of cell biology which allow marine organisms to survive in their environment.
- categorize and contrast the various life forms found in the marine environment.
- analyze and interpret data from current scientific journals and evaluate the broader implications of each study.
- formulate hypotheses in marine biology, design experiments to test them, and interpret and present the data.
- critique plans of action for marine conservation.

BIOL 490 Science Skills and Applications

Units:	0.5
Hours:	27 hours LAB
Prerequisite:	None.
Corequisite:	Current enrollment in a science, nutrition or nursing course.
Transferable:	CSU

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.

Student Learning Outcomes

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

- apply the preview strategy to co-requisite course text chapters meaningfully
- construct paraphrases for concepts presented in co-requisite course textbooks or in their class notes
- prepare notes for their co-requisite class and review these notes based on the Student Learning Outcomes for the co-requisite course
- interpret various types of graphs and diagrams from their co-requisite course
- create concept maps in order to see relationships between ideas presented in their co-requisite course

- assess various test taking strategies appropriate for their co-requisite course
- demonstrate ability to read "actively" in their co-requisite course textbook

BIOL 491 Science Skills and Applications II

Units:	0.5
Hours:	27 hours LAB
Prerequisite:	BIOL 490
Corequisite:	Current enrollment in a science, nutrition, or nursing course.
Transferable:	CSU

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.

Student Learning Outcomes

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

- develop short- and long-term goals and assess progress in reaching these goals.
- refine time management techniques and apply new techniques for avoiding procrastination.
- analyze vocabulary development strategies and apply pertinent ones to science courses.
- choose and apply the appropriate problem-solving strategies for science courses.
- construct and interpret various graphs of scientific data.
- apply active reading strategies in science texts.
- create content-based graphic organizers to facilitate understanding of complex topics.
- utilize the strategies of intensive study cycles.
- assess performance on science course exams in order to modify study strategies.

BIOL 495 Independent Studies in Biology

Units:	1 - 3
Hours:	54 - 162 hours LAB
Prerequisite:	None.
Transferable:	CSU

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.

Biology - Field Studies (BIOLFS)

Biotechnology (BIOT)

BIOT 301 Biotechnology and Human Health

Units:	3
Hours:	54 hours LEC
Prerequisite:	BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better
Transferable:	CSU

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.

Student Learning Outcomes

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

- relate biological macromolecules, such as nucleic acids and proteins, to their physical properties and cellular function.
- integrate the roles of DNA, RNA, and proteins with the expression of genetic traits of cells and organisms.
- analyze the scientific concepts underlying biotechnology techniques.
- evaluate new developments in biotechnology research on current human health and disease issues.
- explain how information-based biotechnology approaches, such as genomics and bioinformatics, are used to address biomedical issues.
- examine current ethical and social issues in the use of biotechnology for human health.

BIOT 305 Introduction to Bioinformatics

Units:	1
Hours:	14 hours LEC; 14 hours LAB
Prerequisite:	BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, BIOT 301, or BIOT 307 with a grade of "C" or better
Transferable:	CSU

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.

Student Learning Outcomes

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

- explain biological applications of bioinformatics concepts.
- design data retrieval strategies from bioinformatics databases.
- set up a data analysis using bioinformatics computational tools.
- analyze structure and function bioinformatics data.

BIOT 307 Biotechnology and Society

Units:	2
Hours:	36 hours LEC
Prerequisite:	None.
Transferable:	CSU; UC

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.

Student Learning Outcomes

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

- explain biotechnology applications in medicine, agriculture, and industry.
- correlate recent advances in biotechnology research with new products and processes.
- evaluate social and ethical issues involving biotechnology.

BIOT 311 Biotechnology Laboratory Methods - Molecular Techniques

Units:	2
Hours:	18 hours LEC; 54 hours LAB
Prerequisite:	BIOL 300, BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better
Transferable:	CSU

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.

Student Learning Outcomes

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

- organize and prepare materials needed for nucleic acid and protein laboratory techniques.

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Design and perform laboratory procedures involving manipulation of nucleic acid and protein samples.



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- assess biotechnology laboratory procedures on the basis of good laboratory practice, quality control, and regulatory issues.

BIOT 312 Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques

Units:	2
Hours:	18 hours LEC; 54 hours LAB
Prerequisite:	BIOL 300, BIOL 303, BIOL 310, BIOL 400, BIOL 440, BIOL 442, or BIOT 307 with a grade of "C" or better
Transferable:	CSU

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.

Student Learning Outcomes

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

- organize and prepare materials needed for culture media preparation, aseptic cell cultures, and DNA and enzyme diagnostic tests.
- design and perform laboratory procedures involving microbial and cell culture techniques, DNA analysis of microbiological samples, and microbial enzyme diagnostic tests.
- interpret and evaluate the experimental results of cell culture experiments, microbial DNA analysis, and enzyme diagnostic tests.
- assess the quality of laboratory data using descriptive statistical measures.

BIOT 498 Work Experience in Biotechnology

Units:	1 - 4
Hours:	60 - 300 hours LAB
Prerequisite:	None.
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.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU
General Education:	AA/AS Area III(b)

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 complete 75 hours of related paid work experience, or 60 hours of related unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. All students are required to attend the first class meeting, a mid-semester meeting, and a final meeting. Additionally, students who have not already successfully completed a Work Experience course will be required to attend weekly orientations while returning participants may meet individually with the instructor as needed. 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.

Student Learning Outcomes

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

- demonstrate application of industry knowledge and theoretical concepts in biotechnology related to a transfer degree level career as written in the minimum three (3) learning objectives created by the student and his/her employer or work site supervisor at the start of the course.
- make effective decisions, use workforce information, and manage his/her personal career plans.
- behave professionally, ethically, and legally at work, consistent with applicable laws, regulations, and organizational norms.
- behave responsibly at work, exhibiting initiative and self-management in situations where it is needed.
- apply effective leadership styles at work, with consideration to group dynamics, team and individual decision making, and workforce diversity.
- communicate in oral, written, and other formats, as needed, in a variety of contexts at work.
- locate, organize, evaluate, and reference information at work.
- demonstrate originality and inventiveness at work by combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities using critical and creative thinking skills such as logical reasoning, analytical thinking, and problem-solving.

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