AMERICAN RIVER COLLEGE

Biology & Biotechnology

Overview

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 wide range of lecture, laboratory, and field courses for majors and non-majors alike, whether for transfer, vocational training, or general interest.

Division Dean
Dr. Rina Roy

Department Chairs
Justin Moore
Phone (916) 484-8107

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 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).

Catalog Date: June 1, 2020

Degree Requirements

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

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.

Catalog Date: June 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 400</td>
<td>Principles of Biology (5)</td>
<td>4 - 5</td>
</tr>
</tbody>
</table>
### 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.

### Catalog Date: June 1, 2020

### Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 300</td>
<td>Introduction to Astronomy (3)</td>
<td></td>
</tr>
<tr>
<td>ASTR 310</td>
<td>The Solar System (3)</td>
<td></td>
</tr>
<tr>
<td>ASTR 320</td>
<td>Stars, Galaxies, and Cosmology (3)</td>
<td></td>
</tr>
<tr>
<td>ASTR 330</td>
<td>Introduction to Astrobiology (3)</td>
<td></td>
</tr>
<tr>
<td>ASTR 400</td>
<td>Astronomy Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>ASTR 481</td>
<td>Honors Astronomy: Stars, Galaxies, and Cosmology (4)</td>
<td></td>
</tr>
<tr>
<td>ASTR 495</td>
<td>Independent Studies in Astronomy (1 - 3)</td>
<td></td>
</tr>
<tr>
<td>ASTR 499</td>
<td>Experimental Offering in Astronomy (0.5 - 4)</td>
<td></td>
</tr>
<tr>
<td>CHEM 305</td>
<td>Introduction to Chemistry (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 306</td>
<td>Introduction to Organic and Biological Chemistry (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 309</td>
<td>Integrated General, Organic, and Biological Chemistry (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 310</td>
<td>Chemical Calculations (4)</td>
<td></td>
</tr>
<tr>
<td>CHEM 400</td>
<td>General Chemistry I (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 401</td>
<td>General Chemistry II (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 420</td>
<td>Organic Chemistry I (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 421</td>
<td>Organic Chemistry II (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 423</td>
<td>Organic Chemistry - Short Survey (5)</td>
<td></td>
</tr>
<tr>
<td>CHEM 495</td>
<td>Independent Studies in Chemistry (1 - 3)</td>
<td></td>
</tr>
<tr>
<td>CHEM 499</td>
<td>Experimental Offering in Chemistry (0.5 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOG 300</td>
<td>Physical Geography: Exploring Earth's Environmental Systems (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 301</td>
<td>Physical Geography Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>GEOG 305</td>
<td>Global Climate Change (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 306</td>
<td>Weather and Climate (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 307</td>
<td>Environmental Hazards and Natural Disasters (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 308</td>
<td>Introduction to Oceanography (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 309</td>
<td>Introduction to Oceanography Lab (1)</td>
<td></td>
</tr>
</tbody>
</table>

A minimum of 18 units from the following:

Total Units: 18

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.
<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 391</td>
<td>Field Studies in Geography: Mountain Landscapes (1 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOG 392</td>
<td>Field Studies in Geography: Coastal Landscapes (1 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOG 393</td>
<td>Field Studies in Geography: Arid Landscapes (1 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOG 394</td>
<td>Field Studies in Geography: Volcanic Landscapes (1 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOG 495</td>
<td>Independent Studies in Geography (1 - 3)</td>
<td></td>
</tr>
<tr>
<td>GEOG 499</td>
<td>Experimental Offering in Geography (0.5 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOL 300</td>
<td>Physical Geology (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 301</td>
<td>Physical Geology Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>GEOL 305</td>
<td>Earth Science (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 306</td>
<td>Earth Science Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>GEOL 310</td>
<td>Historical Geology (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 311</td>
<td>Historical Geology Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>GEOL 320</td>
<td>Global Climate Change (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 325</td>
<td>Environmental Hazards and Natural Disasters (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 330</td>
<td>Introduction to Oceanography (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 331</td>
<td>Introduction to Oceanography Lab (1)</td>
<td></td>
</tr>
<tr>
<td>GEOL 345</td>
<td>Geology of California (3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 390</td>
<td>Field Studies in Geology (1 - 4)</td>
<td></td>
</tr>
<tr>
<td>GEOL 495</td>
<td>Independent Studies in Geology (1 - 3)</td>
<td></td>
</tr>
<tr>
<td>GEOL 499</td>
<td>Experimental Offering in Geology (0.5 - 4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 310</td>
<td>Conceptual Physics (3)</td>
<td></td>
</tr>
<tr>
<td>PHYS 311</td>
<td>Basic Physics (3)</td>
<td></td>
</tr>
<tr>
<td>PHYS 312</td>
<td>Conceptual Physics Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>PHYS 350</td>
<td>General Physics (4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 360</td>
<td>General Physics (4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 410</td>
<td>Mechanics of Solids and Fluids (5)</td>
<td></td>
</tr>
<tr>
<td>PHYS 421</td>
<td>Electricity and Magnetism (4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 431</td>
<td>Heat, Waves, Light and Modern Physics (4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 495</td>
<td>Independent Studies in Physics (1 - 3)</td>
<td></td>
</tr>
<tr>
<td>PHYS 499</td>
<td>Experimental Offering in Physics (0.5 - 4)</td>
<td></td>
</tr>
</tbody>
</table>

**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 395    | Natural History Field Study (0.5 - 4)                           |             |
| 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)                            |             |
### General Science Associate in Science (A.S.) degree

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.

**Catalog Date:** June 1, 2020

#### Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT 303</td>
<td>Survey of Biology</td>
<td>4 - 5</td>
</tr>
<tr>
<td>or BIOL 310</td>
<td>General Biology</td>
<td></td>
</tr>
<tr>
<td>or BIOL 400</td>
<td>Principles of Biology</td>
<td></td>
</tr>
<tr>
<td>or BIOL 440</td>
<td>General Microbiology</td>
<td></td>
</tr>
<tr>
<td>or BIOL 442</td>
<td>General Microbiology and Public Health</td>
<td></td>
</tr>
<tr>
<td>BIOT 301</td>
<td>Biotechnology and Human Health</td>
<td>3</td>
</tr>
<tr>
<td>BIOT 311</td>
<td>Biotechnology Laboratory Methods - Molecular Techniques</td>
<td>2</td>
</tr>
<tr>
<td>BIOT 312</td>
<td>Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 305</td>
<td>Introduction to Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>or CHEM 309</td>
<td>Integrated General, Organic, and Biological Chemistry</td>
<td></td>
</tr>
<tr>
<td>or CHEM 400</td>
<td>General Chemistry I</td>
<td></td>
</tr>
<tr>
<td>ENWR 300</td>
<td>College Composition</td>
<td>3</td>
</tr>
<tr>
<td>MATH 120</td>
<td>Intermediate Algebra</td>
<td>4 - 5</td>
</tr>
<tr>
<td>or STAT 300</td>
<td>Introduction to Probability and Statistics</td>
<td>1</td>
</tr>
</tbody>
</table>

**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.

### Career Information

- **Course Code:** NATR 306
  - **Course Title:** Introduction to Rangeland Ecology and Management (3)

- **Course Code:** NATR 307
  - **Course Title:** Principles of Sustainability (4)

- **Course Code:** NATR 310
  - **Course Title:** Study Design and Field Methods (4)

- **Course Code:** NATR 320
  - **Course Title:** Principles of Ecology (4)

- **Course Code:** NATR 322
  - **Course Title:** Environmental Restoration (2)

- **Course Code:** NATR 330
  - **Course Title:** Native Trees and Shrubs of California (4)

- **Course Code:** NATR 332
  - **Course Title:** Water Resources and Conservation (3)

- **Course Code:** NATR 346
  - **Course Title:** Water Resources and Conservation (3)

- **Course Code:** NATR 349
  - **Course Title:** Experimental Offering in Natural Resources (0.5 - 4)

- **Course Code:** PSYC 310
  - **Course Title:** Biological Psychology (3)

- **Course Code:** PSYC 311
  - **Course Title:** Biological Psychology Laboratory (1)

- **Course Code:** PSYC 495
  - **Course Title:** Independent Studies in Psychology (1 - 3)

- **Course Code:** PSYC 499
  - **Course Title:** Independent Studies in Psychology (1 - 3)

**Total Units:** 18

1 must be transfer-level and must include one laboratory course in a physical science and one laboratory course in a biological science.
Biology (BIOL) Courses

BIOL 102 Essentials of Human Anatomy and Physiology

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

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.

BIOL 130 Microbiology for Funeral Services

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

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 299 Experimental Offering in Biology

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 300 The Foundations of Biology

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

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
BIOL 305 Natural History

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.

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: CSU; UC (BIOL 390, 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
Catalog Date: June 1, 2020

BIOL 310 General Biology

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.

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: Eligible for ENGRD 310 or ENGRD 312 AND ENGW 300; OR ESLR 340 AND ESDL 340
General Education: AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
Catalog Date: June 1, 2020

BIOL 322 Ethnobotany

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.

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: CSU; UC
General Education: AA/AS Area VI
Catalog Date: June 1, 2020

BIOL 332 Introduction to Ornithology

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.

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: Eligible for ENGRD 310 or ENGRD 312 AND ENGW 300; OR ESLR 340 AND ESDL 340
General Education: AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
Catalog Date: June 1, 2020

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

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.

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Transferable: Eligible for ENGRD 310 or ENGRD 312 AND ENGW 300; OR ESLR 340 AND ESDL 340
General Education: CSU Area B2; IGETC Area 5B
Catalog Date: June 1, 2020

BIOL 352 Conservation Biology

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.

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Transferable: CSU; UC
General Education: AA/AS Area IV; CSU Area B2; IGETC Area 5B
Catalog Date: June 1, 2020
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.

**BIOL 375 Marine Ecology**

- **Units:** 3
- **Hours:** 54 hours LEC
- **Prerequisite:** None.
- **Advisory:** CSU; UC
- **Transferable:** CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
- **General Education:** CSU; UC
- **Catalog Date:** June 1, 2020

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**

- **Units:** 0.5 - 4
- **Hours:** 3 - 24 hours LEC; 18 - 144 hours LAB
- **Prerequisite:** None.
- **Transferable:** CSU
- **Catalog Date:** June 1, 2020

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**

- **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 ENGRD 312; OR ESLR 340 AND ESLR 340.
- **Transferable:** CSU; UC
- **General Education:** C-ID BIOL 190; Part of C-ID BIOL 135S
- **Catalog Date:** June 1, 2020

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.

**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 ENGRD 312; OR ESLR 340 AND ESLR 340.
- **Transferable:** CSU; UC
- **General Education:** C-ID BIOL 140; Part of C-ID BIOL 135S
- **Catalog Date:** June 1, 2020

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.

**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 ENGRD 312; OR ESLR 340 AND ESLR 340.
- **Transferable:** CSU; UC
- **General Education:** C-ID BIOL 140; Part of C-ID BIOL 135S
- **Catalog Date:** June 1, 2020

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.

**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:** C-ID BIOL 150; Part of C-ID BIOL 135S
- **Catalog Date:** June 1, 2020

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.
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
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: Part of C-ID BIOL 115S
Catalog Date: June 1, 2020

This course emphasizes the integration of structure and function of the human body. It is built on the study of anatomical terminology, cells, and tissues, followed by expansion into the integumentary, skeletal, muscular, and nervous systems. Laboratory study is enhanced by the microscopic investigation 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. BIOL 431 must be subsequently taken to complete the study of all major body systems.

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 115S
Catalog Date: June 1, 2020

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.

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
Catalog Date: June 1, 2020

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

Units: 5
Hours: 54 hours LEC; 108 hours LAB
Prerequisite: BIOL 430 and 306, CHEM 305, 309, or 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; 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
Catalog Date: June 1, 2020

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

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: Placement into ENGWR 480 through the assessment process.
Transferable: CSU; UC
General Education: AA/AS Area IV; CSU Area B2; CSU Area B3; IGETC Area 5B; IGETC Area 5C
Catalog Date: June 1, 2020

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 491 Science Skills and Applications II

Units: 0.5
Hours: 27 hours LAB
Prerequisite: None.
Corequisite: Current enrollment in a science, nutrition, or nursing course.
Transferable: CSU
Catalog Date: June 1, 2020

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

Units: 1 - 3
Hours: 54 - 162 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

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 499 Experimental Offering in Biology

**Units:** 0.5 - 4  
**Prerequisite:** None  
**Transferable:** CSU  
**Catalog Date:** June 1, 2020

### Biology - Field Studies (BIOLFS) Courses

### BIOLFS 499 Experimental Offering in Biology Field Studies

**Units:** 0.5 - 4  
**Prerequisite:** None  
**Catalog Date:** June 1, 2020

### Biotechnology (BIOT) Courses

### 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  
**Catalog Date:** June 1, 2020

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

**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  
**Catalog Date:** June 1, 2020

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

**Units:** 2  
**Hours:** 36 hours LEC  
**Prerequisite:** None  
**Transferable:** CSU; UC  
**Catalog Date:** June 1, 2020

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 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  
**Catalog Date:** June 1, 2020

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

**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  
**Catalog Date:** June 1, 2020

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

**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 ENGRD 300; OR ESLR 340 AND ESLW 340.  
**Transferable:** CSU  
**General Education:** AA/AS Area III(b)  
**Catalog Date:** June 1, 2020
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.

**BIOT 499 Experimental Offering in Biology**

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.5 - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>June 1, 2020</td>
</tr>
</tbody>
</table>