BIOLOGICAL SCIENCES

Contact Information

Division
Sciences and Mathematics

Dean
Megan D'Errico

Associate Dean
Keely Carroll

Division Office
V 211, Rocklin Campus

Overview

The Biological Sciences Department offers course work in Anatomy, Biology, Botany, Microbiology, Physiology and Zoology.

TRANSFER AND MAJOR REQUIREMENTS in Biological Sciences are available in the Counseling Center. Transfer students planning to major in Biology, Botany, Zoology, Ecology, Microbiology, Anatomy, Physiology, Forestry, Wildlife Management, Natural Resources, Medicine, Dentistry, Veterinary Medicine, Optometry and Pharmacy should consult with a counselor for specific transfer requirements.

Faculty

Aoss Albumalalah
Assistant Professor, Biological Sciences
M.D., Baghdad University, Iraq, Baghdad
Ph.D., Baghdad University, Iraq, Baghdad

Mohammed Aly
Professor, Biological Sciences
M.D., Cairo University

April M. Bird
Professor, Biological Sciences
B.S., University of California, Santa Cruz
M.S., University of Oregon

Adriel B. Cruz
Professor, Biological Sciences
B.S., University of California, Davis
M.S., California State University, Sacramento

Jarred Dela Cruz
Assistant Professor, Biological Sciences
B.S., CSU Sacramento
M.S., San Francisco State University

Kwame Eshun
Assistant Professor, Biological Sciences
B.S., University of Cape Coast, Ghana
Ph.D., Loma Linda University

Emine Gunhan
Professor, Biological Sciences
M.D., Ankara University
M.S., Louisiana State University
Ph.D., University of California, Davis

Rachael Hamby
Assistant Professor, Biological Sciences
B.S., Eastern Washington University

Matthew Holdgagte
Professor, Biological Sciences
B.S., University of New Hampshire
Ph.D, Portland State University

Monique Kolster
Professor, Biological Sciences
B.A., University of California, Santa Barbara
M.S., University of Montana

Karen Le Grand
Professor, Biological Sciences
B.A., California State University, Northridge
Ph.D, University of California, Davis

Keri R. Muma
Professor, Biological Sciences
B.S., University of the Pacific
M.S., University of the Pacific

Warren R. Place
Professor, Biological Sciences
B.S., Humboldt State University
Ph.D., University of California, Davis

Heather R. Roberts
Professor, Biological Sciences
B.S., Texas A and M University
M.S., Baylor University
Ph.D., Texas Tech University

Jennifer Skillen
Professor, Biological Sciences
B.S., University of California, Davis
Ph.D., Michigan State University

Ishtar Thomas-Lane
Professor, Biological Sciences
B.A., California State University, Sacramento
M.S., California State University, Sacramento

Sasha M. Warren
Professor, Biological Sciences
A.A., Chabot College
B.S., Humboldt State University
Ph.D., University of California, Davis

Degrees/Certificates

Associate Degree for Transfer

- Biology for Transfer (p. 2)

Associate Degrees

- Biological Sciences (p. 2)
- Watershed Ecology (p. 3)

Certificate of Achievement

- Watershed Ecology (p. 4)

Biology for Transfer

AS-T Degree

This program provides students with a strong foundation in biology.

Upon completion of this degree, students will be able to apply the scientific method to design, conduct experiments, and test hypotheses; conduct scientific literature review, critically evaluate, and interpret biological information; outline the organization and integration of biological systems; apply laboratory and/or field skills necessary to answer biological questions; and, as an informed and responsible individual, evaluate contemporary biological issues that have social and/or ethical implications.

The Associate in Science in Biology for Transfer degree (AS-T) prepares students to transfer into the CSU system to complete a bachelor's degree in biology, or a major deemed similar by a CSU campus. Students earning an associate degree for transfer and meeting the CSU minimum transfer admission requirements are guaranteed admission with junior standing within the CSU system. Students are also given priority admission consideration to their local CSU campus but not to a particular campus or major. Upon transfer, students will be required to complete no more than 60 additional prescribed units to earn a bachelor's degree.

To earn the Associate in Science in Biology for Transfer degree, students must complete 60 CSU-transferable semester units with a minimum grade point average of 2.0, including both of the following:

- completion of all courses required for the major with grades of "C" or better; and
- completion of the Intersegmental General Education Transfer Curriculum for Science, Technology, Engineering, and Mathematics (IGETC for STEM) (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/intersegmental-general-education-transfer-curriculum-igetc/) pattern.[1] (Students transferring to a CSU campus must complete Area 1C Oral Communication to be eligible for admission.)

NOTE: The California State University General Education Breadth pattern (CSU GE) is NOT an option for this degree.

The exact wording of the law pertaining to associate degrees for transfer may be found in Education Code Section 66746.

It is highly recommended that, prior to transferring, students complete courses that satisfy the CSU United States History, Constitution and American Ideals graduation requirement. In all cases, students should consult with a counselor for more information on university admission and transfer requirements.

RESTRICTION: International coursework from non-United States regionally accredited institutions cannot be applied to associate degrees for transfer.

Required Courses

Code	Title	Units
BIOL 0001	General Biology	4
BIOL 0002	Botany	4.5
BIOL 0003	General Zoology	4.5
CHEM 0001A	General Chemistry I (OR)	5-6
or CHEM 0003A & CHEM 0003B	General Chemistry I - Part 1 and General Chemistry I - Part 2	
CHEM 0001B	General Chemistry II	5
MATH 0016A	Calculus for Social and Life Sciences	4
or MATH 0030	Analytical Geometry and Calculus I	
Select one of the following physics sequences:		**9-10**
PHYS 0105 & 0105L & PHYS 0110 & PHYS 0110L	General Physics I and General Physics I Laboratory and General Physics II and General Physics II Laboratory	
PHYS 0205 & 0205L & PHYS 0210 & PHYS 0210L	Principles of Physics: Mechanics and Principles of Physics Laboratory: Mechanics and Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism	
Total Units		**36-38**

1

IGETC for STEM is only an option for students earning AS-T degrees in Biology for Transfer and/or Chemistry for Transfer. IGETC for STEM certification requires the following courses *before* transfer:

- All courses in Areas 1 (except 1C for UC-bound students), 2, and 5 of the traditional IGETC;
- Two courses in Area 3 - one course in Area 3A and one course in Area 3B; and
- Two courses in Area 4 from two different disciplines.

The following deferred courses must be completed *after* transfer:

- One remaining lower-division general education course in Area 3;
- One remaining lower-division general education course in Area 4; and
- One course in Area 6 for UC-bound students who have not satisfied the requirement through proficiency.

(The deferred lower-division courses must be replaced with calculus and/or science courses that are required to be taken before transfer to the university.)

Biological Sciences

AS Degree

The Biological Science curriculum provides students with the opportunity to meet the requirements for transferring to four-year colleges in the areas of Agriculture, Animal Science, Biochemistry, Bioengineering, Biological Sciences, Biotechnology, Chiropractic, Clinical Lab Technician, Curator, Dental Hygiene, Dentistry, Environmental Studies, Forestry, Nutrition/Dietetics, Occupational Therapy, Plant Science, Pharmacy, Physical Therapy, Premedical, Nursing, Range Management, Veterinary Medicine, Wildlife/Fisheries Biologist and Zoologist, or entry level positions in related fields. In all cases, students should consult with a counselor for more information on university admission and transfer requirements. Students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/associate-degree-requirements/);
- California State University General Education Breadth (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/california-state-university-general-education-breadth-requirements/);
- Intersegmental General Education Transfer Curriculum (IGETC) (http://catalog.sierracollege.edu/archive/2024-2025/student-

resources/general-education/intersegmental-general-education-transfer-curriculum-igetc/).

Required Courses

Code	Title	Units
Select 13-15 units from the following:		**13-15**
BIOL 0001	General Biology	
BIOL 0002	Botany	
BIOL 0003	General Zoology	
BIOL 0004	Microbiology	
BIOL 0005	Human Anatomy	
BIOL 0006	Human Physiology	
Select 8-11 units from the following courses or unused courses from the previous area:		**8-11**
CHEM 0001A	General Chemistry I (OR)	
or CHEM 0003A & CHEM 0003B	General Chemistry I - Part 1 and General Chemistry I - Part 2	
CHEM 0001B	General Chemistry II	
CHEM 0002A	Introduction to Chemistry I	
CHEM 0002B	Introduction to Chemistry II	
ESCI 0001	Physical Geology	
MATH 0012	College Algebra	
MATH 0013	Elementary Statistics	
MATH 0016A	Calculus for Social and Life Sciences	
MATH 0016B	Calculus for Social and Life Sciences	
MATH 0027	Trigonometry	
MATH 0029	Pre-Calculus Mathematics	
MATH 0030	Analytical Geometry and Calculus I	
MATH 0042	Business Calculus	
PHYS 0105 & 0105L	General Physics I and General Physics I Laboratory	
PHYS 0110 & 0110L	General Physics II and General Physics II Laboratory	
PHYS 0205 & 0205L	Principles of Physics: Mechanics and Principles of Physics Laboratory: Mechanics	
PHYS 0210 & 0210L	Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism	
Select a minimum of .5 units from the following:		**.5-4**
BIOL 0016A	Local Ecosystems of Placer County	
BIOL 0016B	Local Ecosystems of Nevada County	
BIOL 0016C	Vernal Pools and the California Prairie	
BIOL 0016D	Biology of Waterfowl and Marsh Birds	
BIOL 0016E	Ecology of the Sierran Conifer Forest	
BIOL 0016G	Field Paleontology and Ancient Environments	
BIOL 0016H	Ecology of the Mendocino Coast	
BIOL 0016I	Biology of Mono Lake and the Great Basin	
BIOL 0016J	Ecology of Point Reyes National Seashore	
BIOL 0016K	Foothill Ecology of the Sierra Nevada	
BIOL 0016L	Aquatic and Riparian Environments of California Waterways	
BIOL 0016M	Marine Mammals and Birds	
BIOL 0016N	Ecology of the Modoc Plateau	
BIOL 0016O	Ecology of the High Sierra and White-Inyo Mountains	
BIOL 0016P	Ecology of Death Valley and Desert Ecosystems	
BIOL 0016Q	Ecology of Mid-Western North America	
BIOL 0016R	Canyon Lands of the Southwest	
BIOL 0016T	Ecology of the Northern California Coast	
BIOL 0016U	Ecology of the Central California Coast	
BIOL 0016V	Ecology of Southern California Deserts	
BIOL 0016W	Ecology of the Klamath and Southern Cascade Ranges	
BIOL 0016Y	Ecology of National Parks and Wilderness Ecosystems	
BIOL 0016Z	Ecology of the American River	
BIOL 0017B	Ecology of the Sutter Buttes	
BIOL 0023	Wildflower Identification	
Total Units		**21.5-30**

Recommended Electives

Code	Title	Units
CSCI 0010	Introduction to Computing	3
or CSCI 0050	Introduction to Unix/Linux	
ESS 0001	Introduction to Environmental Sciences and Sustainability	3

Watershed Ecology

AS Degree

The Watershed Ecology Technician's (WET) program offers courses leading to an associate in science degree. Watershed ecology includes the study of all aspects of the environment including organisms within an entire watershed-the land area draining into the major creeks and river systems. The program can serve as the basic preparation for entry-level positions with organizations and governmental agencies that perform a variety of environmental studies. Students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/associate-degree-requirements/);
- California State University General Education Breadth (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/california-state-university-general-education-breadth-requirements/) pattern;
- Intersegmental General Education Transfer Curriculum (IGETC) (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/general-education/intersegmental-general-education-transfer-curriculum-igetc/).

Required Courses

Code	Title	Units
BIOL 0001	General Biology	4
or BIOL 0011	Concepts of Biology	
BIOL 0013	Field Methods in Ecology	3
BIOL 0014	Natural History, Ecology and Conservation (also ESS 0014)	4
BIOL 0095	Internship in Biological Sciences	1
ESS 0013	Environmental Regulations	1
GEOG 0090	Introduction to Geographic Information Systems (GIS)	4
Select 9-12 units from any of the following emphases: [1]		**9-12**
Animal Study Emphasis		
BIOL 0003	General Zoology	
BIOL 0016D	Biology of Waterfowl and Marsh Birds	
BIOL 0016M	Marine Mammals and Birds	
BIOL 0030	Introduction to Ornithology	
BIOL 0033	Introduction to Zoology	
BIOL 0035	Introduction to Entomology	
BIOL 0036	Introduction to Mammalogy	
Plant Study Emphasis		
BIOL 0002	Botany	
BIOL 0016C	Vernal Pools and the California Prairie	
BIOL 0016E	Ecology of the Sierran Conifer Forest	
BIOL 0023	Wildflower Identification	
BIOL 0024	Wildland Trees and Shrubs (Dendrology)	
General Emphasis		
AGRI 0221	Introduction to Soil Science	
BIOL 0016A	Local Ecosystems of Placer County	
BIOL 0017B	Ecology of the Sutter Buttes	
ESS 0001	Introduction to Environmental Sciences and Sustainability	
ESS 0008	California Water	
ESS 0010	Conservation of Natural Resources	
GEOG 0001	Physical Geography	
MATH 0013	Elementary Statistics	
Total Units		**26-29**

1

Only 3 units total may be taken from the BIOL 16 and BIOL 17 field study courses. Courses are grouped according to specific interests, but students are not limited to a specific emphasis. Students opting to take BIOL 0001 are advised to consult with a counselor regarding pre/corequisites.

Watershed Ecology

Certificate of Achievement

Watershed ecology includes the study of all aspects of the environment including organisms within an entire watershed-the land area draining into the major creeks and river systems. The certificate program can serve as the basic preparation for entry-level positions with organizations and governmental agencies that perform a variety of environmental studies. A certificate is designed to provide career technical skills; it is not equivalent to an associate degree.

Required Courses

Code	Title	Units
BIOL 0001	General Biology	4
or BIOL 0011	Concepts of Biology	
BIOL 0013	Field Methods in Ecology	3
BIOL 0014	Natural History, Ecology and Conservation (also ESS 0014)	4
BIOL 0095	Internship in Biological Sciences	1
ENGL 0001A	College Reading, Writing and Research	3
or ENGL 0012	Writing in the Workplace	
ESS 0013	Environmental Regulations	1
GEOG 0090	Introduction to Geographic Information Systems (GIS)	4
Select 9-12 units from any of the following emphases: [1]		**9-12**
Animal Study Emphasis		
BIOL 0003	General Zoology	
BIOL 0016D	Biology of Waterfowl and Marsh Birds	
BIOL 0016M	Marine Mammals and Birds	
BIOL 0030	Introduction to Ornithology	
BIOL 0033	Introduction to Zoology	
BIOL 0035	Introduction to Entomology	
BIOL 0036	Introduction to Mammalogy	
Plant Study Emphasis		
BIOL 0002	Botany	
BIOL 0016C	Vernal Pools and the California Prairie	
BIOL 0016E	Ecology of the Sierran Conifer Forest	
BIOL 0023	Wildflower Identification	
BIOL 0024	Wildland Trees and Shrubs (Dendrology)	
General Emphasis		
AGRI 0221	Introduction to Soil Science	
BIOL 0016A	Local Ecosystems of Placer County	
BIOL 0017B	Ecology of the Sutter Buttes	
ESS 0001	Introduction to Environmental Sciences and Sustainability	
ESS 0008	California Water	
ESS 0010	Conservation of Natural Resources	
GEOG 0001	Physical Geography	
MATH 0013	Elementary Statistics	
Total Units		**29-32**

1

Only 3 units total may be taken from the BIOL 16 and BIOL 17 field study courses. Courses are grouped according to specific interests, but students are not limited to a specific emphasis. Students opting to take BIOL 0001 are advised to consult with a counselor regarding pre/corequisites.

Courses

Understanding course descriptions (http://catalog.sierracollege.edu/archive/2024-2025/student-resources/course-information/understanding-course-descriptions/)

BIOL 0001. General Biology
Units: 4
Prerequisite: Completion of CHEM 1A, CHEM 3A/3B, or higher level chemistry course with grade of "C" or better; AND completion of intermediate algebra or higher with grade of "C" or better or appropriate placement; AND eligibility for ENGL 11
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
Part of the BIOL 1/BIOL 140 and BIOL 1/BIOL 2/BIOL 3 course series for life science majors. Introduction to the principles of general biological concepts including the scientific method, biomolecules, cell structure and function with emphasis on cellular and molecular biology, genetics, and evolution. Lab focuses on key concepts of cell and molecular biology. Non-life science majors see BIOL 10 or BIOL 11. (C-ID BIOL 190) (CSU, UC)

BIOL 0002. Botany
Units: 4.5
Prerequisite: Completion of intermediate algebra or higher with grade of "C" or better or appropriate placement
Advisory: Eligibility for ENGL 1A
Hours: 144 (54 lecture, 90 laboratory)
Part of the BIOL 1/BIOL 2/BIOL 3 course series for life science majors. Introduction to the principles of botany, including diversity, classification, life cycles, and evolutionary trends of plants, fungi, algae, and cyanobacteria. Emphasis is on the anatomy, morphology, physiology, development, evolution, and ecology of plants. Field trips may be required; transportation will be provided. Recommended for biology majors and students in environmental science, plant biology or related programs. Non-life science majors see BIOL 14, BIOL 21, or BIOL 24. Not recommended for students taking BIOL 140. (C-ID BIOL 155) (CSU, UC)

BIOL 0003. General Zoology
Units: 4.5
Prerequisite: Completion of intermediate algebra or higher with grade of "C" or better or appropriate placement
Advisory: Eligibility for ENGL 1A
Hours: 144 (54 lecture, 90 laboratory)
Part of the BIOL 1/BIOL 2/BIOL 3 course series for life science majors. Introduction to the principles of zoology through a detailed survey of the diversity of the animal kingdom, with an emphasis on the evolution and functional anatomy of the major groups. Field trips may be required; transportation will be provided. Recommended for biology majors and students in environmental science, pre-veterinary or related programs. Non-life science majors see BIOL 33. Not recommended for students taking BIOL 140. (C-ID BIOL 150) (CSU, UC-with unit limitation)

BIOL 0004. Microbiology
Units: 5
Prerequisite: Completion of high school chemistry, CHEM A, or higher level chemistry course with grade of "C" or better
Advisory: Eligibility for ENGL 11 strongly recommended
Hours: 162 (54 lecture, 108 laboratory)
Introduction to the biochemistry, morphology, physiology, genetics, and classification of microorganisms. Emphasis on the significance of microorganisms to human health and global ecology. Laboratory topics include traditional and modern techniques of microbial classification, recombinant DNA technology, and bacteriophage biology. Students enrolling in BIOL 4 after having taken BIOL 8A will lose credit for BIOL 8A. Not open to students that have successfully completed BIOL 8B. (CSU, UC-with unit limitation)

BIOL 0005. Human Anatomy
Units: 5
Prerequisite: Eligibility for ENGL 11
Advisory: Completion of BIOL 55, 56, HSCI 03, or previous science course with grade of "C" or better, or experience in health care field; completion of MATH D with grade of "C" or better; eligibility for ENGL 1A
Hours: 162 (54 lecture, 108 laboratory)
Structural organization, relationships among structures, and histology of the human body: gross and microscopic structure of the integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, digestive, urinary and reproductive systems, from cellular to organ system levels of organization. This is a rigorous course in human anatomy primarily intended for nursing, allied health, kinesiology, and other health related majors. Cadaver prosections used for instruction. Nonmajors see BIOL 55, 56, and 56L. Students enrolling in BIOL 5 after having taken BIOL 7A will lose credit for BIOL 7A. (C-ID BIOL 110B) (CSU, UC-with unit limitation)

BIOL 0005X. Success in Anatomy
Unit: 1
Corequisite: Concurrent enrollment in BIOL 5
Hours: 18 lecture
Optional course for students concurrently enrolled in BIOL 5 to gain a deeper understanding of course material through discussions focused on anatomical concepts, terminology, and the implementation of anatomical knowledge to clinical and problem solving situations. Advanced study techniques, necessary for success in science courses, are modeled to strengthen student self-awareness, confidence, and ability to monitor learning. (CSU, UC)

BIOL 0006. Human Physiology
Units: 5
Prerequisite: Completion of CHEM 2A or 1A or 3A/3B; AND BIOL 5 or 7A/7B or 55 with grades of "C" or better
Advisory: Completion of MATH D with grade of "C" or better; completion of a non-majors general biology course with grade of "C" or better; and eligibility for ENGL 1A
Hours: 126 (72 lecture, 54 laboratory)
Study of the physiology, integration, and homeostasis of the human body from chemical through organism levels. Organ systems covered are integumentary, muscular, nervous, sensory, cardiovascular, lymphatic and immune, respiratory, urinary, digestive, endocrine, and reproductive system. Experiments using living and non-living models are performed in lab using methods of data acquisition, recording systems, and analysis of data. Primarily intended for Nursing, Allied Health, Kinesiology, and other health or life science majors. (C-ID BIOL 120B) (CSU, UC-with unit limitation)

BIOL 0010. Introduction to Biology
Units: 3
Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Designed for non-life science majors desiring an introductory biology course without a lab. Introduces the main concepts of biology, covering molecular and cell biology, heredity and nature of genes, biotechnology, evolution, diversity of life, and principles of ecology. Students enrolling in BIOL 11 after having taken BIOL 10 will lose credit for BIOL 10. Not recommended for students who have already completed BIOL 56. (CSU, UC-with unit limitation)

BIOL 0011. Concepts of Biology
Units: 4
Advisory: Eligibility for ENGL 1A and MATH 12
Hours: 108 (54 lecture, 54 laboratory)
Designed for non-life science majors desiring an introductory biology course with a lab. Introduces the main concepts of biology, covering molecular and cell biology, heredity and nature of genes, biotechnology, evolution, diversity of life, and principles of ecology. Students enrolling in BIOL 11 after having taken BIOL 10 will lose credit for BIOL 10. Not recommended for students who have completed BIOL 56 and 56L. (CSU, UC-with unit limitation)

BIOL 0013. Field Methods in Ecology
Units: 3
Formerly known as BIOL 13B
Advisory: Completion of BIOL 14 or ESS 14 strongly recommended
Hours: 90 (36 lecture, 54 laboratory)
Introduction to methods for sampling and studying environmental parameters of ecosystems and organisms. Provides experience with quantitative and qualitative field research techniques and procedures applicable to environmental assessment and population monitoring and proper reporting methods. Field trips required. Students may be required to provide their own transportation. (CSU)

BIOL 0014. Natural History, Ecology and Conservation
Units: 4
Also known as ESS 14
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
Introduction to the study of biology and ecology of organisms and ecosystems of the world, with an emphasis on California. Special focus on significance of functioning ecosystems and human influence on the environment. May include field trips during or in lieu of lab time. (CSU, UC)

BIOL 0015. Marine Biology
Units: 4
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
An introduction to the basic biological and ecological properties of major saltwater environments, including the conservation of and human impacts on marine resources. Designed for both science and non-science majors. Laboratory hours may be partially fulfilled by required field trips. Hiking and boat travel may be necessary. (CSU, UC)

BIOL 0016A. Local Ecosystems of Placer County
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study that introduces local natural areas and their inhabitants. Selected ecosystems in Placer County are investigated in the field to identify and study the characteristic plants and animals and discover their relationships with the physical environment. This class may require the ability to hike moderate distances on uneven ground. (CSU)

BIOL 0016B. Local Ecosystems of Nevada County
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study that introduces local natural areas and their inhabitants. Selected ecosystems in Nevada County are investigated in the field to identify and study the characteristic plants and animals and discover their relationships with the physical environment. This class may require the ability to hike moderate distances on uneven ground. (CSU)

BIOL 0016C. Vernal Pools and the California Prairie
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study that explores the past, present, and future of California's prairie, grassland, and vernal pool ecosystems of the Central Valley. Emphasis on remaining natural areas and conservation efforts. This class may require ability to hike moderate distances on uneven ground. (CSU)

BIOL 0016D. Biology of Waterfowl and Marsh Birds
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field identification and observation of marsh birds (primarily ducks, geese, swans, and wading birds). Includes general waterfowl biology and ecology. Emphasizes evolution, migration, reproductive cycles, current population trends, and habitat needs. Operational needs and conflicts of national and local wildlife refuge system are discussed. This class may require ability to hike moderate distances on uneven ground. (CSU)

BIOL 0016E. Ecology of the Sierran Conifer Forest
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study that introduces forest biology/ecology, emphasizing interrelationships between the Sierran forest inhabitants (animals, plants, fungi) and their environment. Study sites include a variety of forest and other associated mountain ecological communities. Depending on season offered, special topics may include: fungi biology, wildflower ecology, tree anatomy and physiology, forest nutrient cycles, forest birds, and soil organisms. This class may require ability to hike moderate distances on uneven ground. (CSU)

BIOL 0016G. Field Paleontology and Ancient Environments
Units: 1-2
Also known as ESCI 16G
Hours: 30 (12 lecture, 18 laboratory) per unit
Investigations into the ecology of environments in the geologic past through field work at fossil sites. Comparisons and contrasts made between ancient (fossil) communities and the current (living) communities of selected study sites. Differences and similarities between the plants and animals used as evidence to reconstruct ancient ecological communities. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016H. Ecology of the Mendocino Coast
Unit: 1
Hours: 26 (14 lecture, 12 laboratory)
Field study examining the Northern California Coast and its diverse ecological environments. Using the Fort Bragg/Mendocino/Fort Ross areas, investigates the biological relationships found in: the redwood, riparian, pygmy, mixed evergreen and closed-cone pine forests, and the shoreline communities of tidepool, sandy beach, dune, prairie and scrub. Plants, animals, environmental factors and effects of human activities are assessed for each of the ecological communities examined. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016I. Biology of Mono Lake and the Great Basin
Unit: 1
Hours: 26 (14 lecture, 12 laboratory)
Field study investigating the natural history and ecology of the Great Basin with special emphasis on Mono Lake and the Mono Basin. Examines physical, biological, historical, and ecological aspects that make the Mono Basin unique. Emphasis on biological and ecological aspects of the Mono Basin. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016J. Ecology of Point Reyes National Seashore
Unit: 1
Hours: 26 (14 lecture, 12 laboratory)
Field study exploring the coastal mosaic of Point Reyes National Seashore and vicinity. Using the ecological communities present (forests, shoreline, pond and prairie), this area provides a rich biological "laboratory" to study its unique organisms and natural ecosystems, including grasslands, mudflats, forests, marshes, cliffs, beach, and dune sites. Depending on season offered, emphasis may be on wildflowers, mushrooms, owls, elk, reptiles or other life forms. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016K. Foothill Ecology of the Sierra Nevada
Unit: 1.5
Hours: 39 (21 lecture, 18 laboratory)
Field study investigating the ecology of the foothills to mid-montane zones of the Sierra Nevada. Focus on major terrestrial and aquatic ecosystems and ecological islands from 500 to 6000 feet elevation. This class may require ability to hike moderate distances on uneven ground. This class may involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016L. Aquatic and Riparian Environments of California Waterways
Unit: 1.5
Hours: 39 (21 lecture, 18 laboratory)
Field study of the biological diversity and ecology of aquatic environments and the biology of water life. Focuses on the water cycle and its biological importance and human interactions. Ponds, vernal pools, streams, rivers, lakes, springs, meadows, bogs, marshes (fresh and salt), shorelines, deltas, and/or bay/estuary environments may be investigated. Study sites may include Lake Tahoe, the American River, San Francisco Bay and other aquatic locations. Hiking or boat travel may be necessary. This class may require ability to hike moderate distances on uneven ground. Boat travel may be necessary. This class may involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016M. Marine Mammals and Birds
Unit: 1.5
Hours: 39 (21 lecture, 18 laboratory)
Field study of the biology of marine mammals and marine birds. Shore and pelagic organisms are studied, emphasizing California-associated species and their habitats. Field and lecture topics include: ecology, evolution, behavior, reproduction, distribution, anatomy, physiology, identification, and population status of whales, true and eared seals, sea otters, shore, bay and pelagic birds. This class may require ability to hike moderate distances on uneven ground. Boat travel may be necessary. This class may involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016N. Ecology of the Modoc Plateau
Unit: 1.5
Hours: 39 (21 lecture, 18 laboratory)
Field ecology of volcanic and cold desert landscapes found in the Modoc Plateau region of California/Oregon. Ecosystems and environmental relationships stressed. Areas of emphasis include forest ecology, fresh water marsh/watershed, environmental factors, volcanic geology, plant succession, and human influences. Study sites include Lava Beds National Monument and Tule Lake Wildlife Refuge. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016O. Ecology of the High Sierra and White-Inyo Mountains
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field study which examines high-elevation mountain ecosystems using the high Sierra Nevada and White-Inyo Mountain Range of California as specific study sites. Observation and study of sub-alpine and alpine ecosystems like forests, montane chaparral, meadows, aquatic habitats, alpine tundra, and fell-fields. This class requires the ability to hike moderate to long distances on uneven ground at high elevations. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016P. Ecology of Death Valley and Desert Ecosystems
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field study that explores the unique desert ecosystems of Death Valley National Park and nearby areas. Extreme differences of elevation from high mountains to below sea level provide a rich variety of desert environments, plants, and animals. Field work emphasizes identification of animals and plants (many unique to these exotic desert habitats), their special physical and behavioral adaptations to the harsh desert climate and habitats, and the effects of human activities upon the fragile desert ecosystems. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016Q. Ecology of Mid-Western North America
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field introduction to ecology of the major biomes, communities and life zones of the Midwestern and Western regions of the United States, emphasizing plains grasslands, montane forests, desert badlands, alpine zones, and aquatic habitats. Topics explored in each ecological area include climate, common plants and animals, species relationships, geology, historical changes, paleoecology and other environmental factors. Fossil and other evidence of past environments compared to present communities. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016R. Canyon Lands of the Southwest
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field biology and ecology of the southwestern canyonlands and semi-arid regions, such as the areas in and around the Grand Canyon, Zion Canyon, Bryce Canyon, or other similar areas in the Southwest. Local plants, animals, microenvironments, river systems, human impacts and resource management and special biotic relationships with the canyon landscapes emphasized. This class requires the ability to hike moderate to long distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016T. Ecology of the Northern California Coast
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field course exploring the unique biological and ecological features of the California north coast. Coastal ecosystems studied include redwood forest, coastal grassland, rocky tidepools, marshes, stream, bog, coastal strand, and mixed-evergreen forest. Topics covered include climate, geology, ecology, plant and animal diversity, and human impacts. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016U. Ecology of the Central California Coast
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field study of the unique features of the central California coast between Morro Bay, Big Sur, Monterey Bay, and Point Reyes National Seashore. Coastal habitats explored, identifying coastal plants, animals, and geologic processes, and emphasizing the interrelationships characteristic of coastal environments. Environments studied include sandy beach, ocean bay, tidepool, mudflat, coastal forest, oak woodland, grassland and coastal scrub. Areas are contrasted with other coastal regions. Human impacts and living styles viewed as they affect the natural environments. This class requires the ability to hike moderate distances on uneven ground. Boat travel may be necessary. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016V. Ecology of Southern California Deserts
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Explore and study the "hot" deserts of southern California, such as the Mojave, Sonoran/Colorado, or other arid locations, discovering the unique animals and plants which are adapted to these extreme and beautiful environments. Deserts compared to nearby coastal habitats or the desert ecosystems in Arizona (depending on local conditions). California study sites visited may include Joshua Tree National Park, Mojave Desert, Salton Sea, and Anza-Borrego State Park. Focus on the interdependency between the physical environments and the biological inhabitants that live there.This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016W. Ecology of the Klamath and Southern Cascade Ranges
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field study that explores ecology and unique features of the Klamath and southern Cascade mountain ranges. Study sites include a variety of locations such as Mt. Lassen, Crater Lake, and/or the Marble Mountains. Topics include conifer forest ecosystems, lake ecosystems, ecological succession, montane biogeography, volcanic history and geology. This class requires the ability to hike moderate distance on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016Y. Ecology of National Parks and Wilderness Ecosystems
Units: 2
Hours: 54 (27 lecture, 27 laboratory)
Field study exploring the ecology of selected wilderness ecosystems in and/or around national parks. Observation and study of the various habitats (forest, chaparral, riparian, etc.), including the physical and biological factors shaping these ecosystems, and the management techniques, history, and objectives of wilderness preservation and resource use in these areas. This class requires the ability to hike moderate distances on uneven ground. This class will involve camping in either developed campsites or in undeveloped wilderness areas. (CSU)

BIOL 0016Z. Ecology of the American River
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study of the aquatic, riparian, and associated ecosystems of Sierra Nevada river systems with specific attention on the American River system. This class may require the ability to hike moderate distances on uneven ground. (CSU)

BIOL 0017B. Ecology of the Sutter Buttes
Units: 0.5
Hours: 13 (7 lecture, 6 laboratory)
Field study that introduces the ecology of the Sutter Buttes. The area is investigated in the field to identify and study the characteristic plants and animals and discover their relationships with the physical environment. This class may require ability to hike moderate distances on uneven ground. (CSU)

BIOL 0021. Introduction to Plant Science
Units: 4
Also known as AGRI 156
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
Emphasizes structure, growth, physiology and reproduction of flowering plants and their responses to modifications and environment; including propagation, media, soil and plant nutrition. Explores the interrelationship of plant science with other life sciences and technology. Applies principles of plant science to agricultural systems. (CSU, UC)

BIOL 0023. Wildflower Identification
Unit: 1
Hours: 26 (13 lecture, 13 activity)
Plant identification, terminology, keying, uses, and ecology. Field trips may require ability to hike moderate distances on unlevel ground. (CSU)

BIOL 0024. Wildland Trees and Shrubs (Dendrology)
Units: 4
Also known as AGRI 163
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
A study of botanical characteristics, taxonomy, and physiology of the major trees and shrubs in the Western United States with emphasis on California. Discussion of plant community relationships, geographical ranges, and human impact on forest ecosystems. Identifying specimens under field conditions and using herbarium specimens. (CSU)

BIOL 0028. Independent Study
Units: 1-3
Designed for students interested in furthering their knowledge at an independent study level in an area where no specific curriculum offering is currently available. Independent study might include, but is not limited to, research papers, special subject area projects, and research projects. See Independent Study page in catalog. (CSU, UC-with unit limitation)

BIOL 0030. Introduction to Ornithology
Units: 3
Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Introduction to the general ecology, evolution, and physiology of birds, with an emphasis on northern California avifauna. (CSU, UC)

BIOL 0033. Introduction to Zoology
Units: 4
Advisory: Eligibility for ENGL 1A
Hours: 108 (54 lecture, 54 laboratory)
A survey of the animal kingdom emphasizing the evolution, structure, function, ecology, and natural history of major groups of animals. Designed for nonscience majors. (CSU, UC-with unit limitation)

BIOL 0035. Introduction to Entomology
Units: 3
Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Introduction to the general ecology, evolution, and physiology of insects, with examples from the insect fauna of northern California. Describes the key relationships (medical, agricultural, etc.) insects have with humans. Recommended for general education students or other majors interested in entomology. (CSU, UC)

BIOL 0036. Introduction to Mammalogy
Units: 3
Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Introduction to the general ecology, evolution, and physiology of mammals, with an emphasis on species of northern California. Topics include: identifying characteristics, local species, ecological relationships, human interactions, and behavioral, structural, and physiological adaptations. Recommended for general education students or other majors interested in mammals. (CSU)

BIOL 0055. General Human Anatomy and Physiology
Units: 4
Advisory: Eligibility for ENGL 11 strongly recommended
Hours: 108 (54 lecture, 54 laboratory)
An overview of the basic anatomy and physiology of all body systems. Designed for non-science majors and those interested in human anatomy and physiology. Experiments and observations performed on models, nonliving systems, and oneself. (CSU, UC-with unit limitation)

BIOL 0056. Biology: A Human Perspective
Units: 3
Advisory: Eligibility for ENGL 11 strongly recommended
Hours: 54 lecture
Principles of biology and how they relate to humans. Emphasis on the human organism, including anatomy, physiology, medicine, research, genetics, evolution, ecology and human impacts on the environment. Not recommended for Biological Sciences majors or students who have completed BIOL 10 or BIOL 11. (CSU, UC-with unit limitation)

BIOL 0056L. Biology: A Human Perspective Laboratory
Unit: 1
Corequisite: Concurrent enrollment in BIOL 56
Advisory: Eligibility for ENGL 11 strongly recommended
Hours: 54 laboratory
Optional laboratory course to be taken with BIOL 56. Topics parallel lecture course, including anatomy, physiology, medicine, research, genetics, evolution, ecology and human impacts on the environment. Not recommended for students who have completed BIOL 11. (CSU, UC-with unit limitation)

BIOL 0095. Internship in Biological Sciences
Units: 0.5-4
Designed for advanced students to work in an area related to their educational or occupational goal. Provides new on-the-job technical training under the direction of a worksite supervisor, allowing students to expand knowledge and skills in the chosen field. Mandatory orientation session and faculty approval to determine eligibility. One unit of credit is equal to 54 hours of work. Students may earn up to a total of 16 units in internship courses (any course numbered 95 and PDEV 94). (CSU-with unit limitation)

BIOL 0140. Organismal Biology
Units: 4.5
Prerequisite: Completion of intermediate algebra or higher with grade of "C" or better or appropriate placement
Advisory: Eligibility for ENGL 1A
Hours: 144 (54 lecture, 90 laboratory)
Part of the BIOL 1/BIOL 140 course series for life science majors. Introduction to the principles of ecological and evolutionary processes that shape biodiversity with an emphasis on evolutionary relationships among major groups of organisms, their distinguishing structural and functional traits, the function and evolution of major organ systems, and ecological interactions among organisms. Through lecture and lab activities the diversity of life on Earth is covered, including animals, plants, fungi, and unicellular organisms. Field trips may be required; transportation will be provided. Recommended for biology majors and students in related programs. Non-life science majors see BIOL 14. Not recommended for students taking BIOL 2 and BIOL 3. (CSU, UC)

Program Student Learning Outcomes (PSLOs)

- Apply the scientific method to design, conduct experiments, and test hypotheses.
- Conduct scientific literature review, critically evaluate, and interpret biological information.
- Outline the organization and integration of biological systems.
- Apply laboratory and/or field skills necessary to answer biological questions.
- As an informed and responsible individual, evaluate contemporary biological issues that have social and/or ethical implications.