BIOL C185: DIVERSITY OF ORGANISMS

Item	Value
Curriculum Committee Approval Date	04/13/2012
Top Code	040700 - Zoology, General
Units	5 Total Units
Hours	162 Total Hours (Lecture Hours 54; Lab Hours 108)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)
Local General Education (GE)	• Area 5B Life Sciences (CB2)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5B Biological Sciences (5B) • Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5B Biological Sciences (5B) • IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B2 Life Science (B2) • CSU B3 Laboratory Activity (B3)

Course Description

This course is a survey of the basic biology and diversity of unicellular and multicellular organisms designed to satisfy the major requirements for an Associate or Baccalaureate degree in the Biological Sciences. It emphasizes general biological principles, such as phylogeny, classification, structure, function, evolution, and environmental interactions by focusing on ecological, evolutionary, anatomical and physiological relationships among major taxa of bacteria, archaeans, protists, fungi, plants, and animals. The laboratory portion of this course emphasizes hands-on learning through hypothesis development, data collection and analysis in the field and laboratory; dissection, microscopy, and identification of living and non-living specimens. PREREQUISITE: BIOL C180. Transfer Credit: CSU; UC. C-ID: BIOL 140, BIOL 135 S.**C-ID:** BIOL 140, BIOL 135 S.

Course Level Student Learning Outcome(s)

1. Compare and contrast anatomy, physiology, life cycles, metabolic pathways, and development of major taxa of organisms from Domains Archaea and Bacteria, and supergroups of eukaryotes that classify protists fungi, plants, and animals based on key characteristics of representative specimens.
2. Construct phylogenic relationships between taxa of bacteria, arachaeans, protists, fungi, plants, and animals using genetic, morphological, and fossil record data.
3. Apply the principles of sustainability to ecological and biological systems.
4. Describe interactions between populations in communities and ecosystems by identifying processes such as competition, mutualism, parasitism, energy flow and transfer between trophic levels, and nutrient cycling through biogeochemical cycles.
5. Demonstrate an understanding of the process of natural selection, genetics and evolution at the molecular, cellular and population levels by identifying factors that influence population growth rates, including intraspecific and interspecific interactions.

Course Objectives

- 1. Explain the theories of the history of life and its evolution on Earth using phylogenic relationships established from genetic and morphological data and the fossil record.
- 2. Evaluate ecological and medical relevance of the major taxa of organisms classified as prokaryotes, protists, fungi, plants, and animals.
- 3. Explain the role of symbioses in the evolution of eukaryotic cells, the transition of plants to land, and evolution of multicellular forms of life on Earth.
- 4. Classify representative bacteria and archaeans as belonging to the major lineages of prokaryotes by identifying key characteristics of each taxa.
- 5. Classify representative plants, fungi, animals, and animal-like versus photosynthetic protists as belonging to one of the seven supergroups and major phyla of each eukaryotic Kingdom based on characteristics of each taxa.
- 6. Classify land plants into major phyla based on structures related to reproduction, photosynthesis, transportation of water and nutrients, and development.
- 7. Explain the evolution of nonvascular compared to vascular plants and seed production through phylogeny of related morphological structures.
- 8. Identify the characteristics of animals found in the invertebrate versus chordate phyla and vertebrate subphyla, including specific adaptations in circulatory, excretory, reproductive, integumentary, digestive and nervous systems, and embryological development of animal lineages of amphibians, birds and reptiles, and mammals, and the evolutionary significance of differences between them.
- 9. Use taxonomic keys and/or field guides for identification.
- 10. Describe the role of adaptation, natural selection, species ranges, niche realization, and Hardy-Weinberg equilibrium to the processes of speciation and extinction in the evolution of populations.
- 11. Identify the factors regulating population growth and construct population life tables.
- 12. Explain the roles of interspecific and intraspecific interactions among populations of organisms and their relationship to the transfer of energy through trophic levels in communities and ecosystems.
- 13. Explain the relevance of biogeochemical cycling and human activity to ecosystem sustainability and global climate change.
- 14. Apply critical thinking and analytical skills to correctly interpret data generated in class and as encountered via peer-review scientific literature.

Lecture Content

Evolution Evolutionary theory and evidence the fossil record and relative vs radiometric dating constructing phylogenetic trees using morphological, genetic analysis, and fossil record evidence whale evolution case study Mechanisms of evolution including mutation, natural selection, genetic drift, gene flow, and speciation Microevolution Macroevolution Taxonomy and Phylogeny Evaluate molecular phylogenies of Domain Bacteria, Archaea, and Eukarya Prokaryotes Major lineages and examples Ecological and medical relevance of Eubacteria and Archaea Eukaryotes Endosymbiosis and the evolution of the eukaryotic cell Nonmutually exclusive hypotheses for the Cambrian explosion Characteristics of Eukaryotic Supergroups, Excavata, SAR, Archaeplastida, Opisthikonta, Amoebozoa Ecological, economic, and medical relevance of protists Ecological, economic, and medical relevance of Kingdom Fungi morphological forms Characteristics of Phylum Chitridomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota Ecological, economic, and medical relevance of Kingdom Plantae Transition of plants to land, related strutuctures and symbioses with fungi Evolution of vascular tissue and the seed Phylogeny and characteristics of Embryophytes, Bryophytes, in Phylum Hepatophyta, Anthocerophyta, Bryophyta Phylogeny and characteristics of Embryophytes, Seedless Tracheophytes, in Phylum Psilophyta, Pteridophyta, and Equisetophyta Phylogeny and characteristics of Embryophytes, Seed producing Tracheophytes, in Phylum Gnetophyta, Pinophyta, Gingkophyta, Cycadophyta, Anthophyta Class Magnoliop sida Class Liliopsida Ecological, economic, and medical relevance of Kingdom Animalia Origins of multicellularity and animal body plans Phylogeny and characteristics of Diploblasts in Phylum Porifera, Cnidaria, and Cnetophora Phylogeny and characteristics of Protostomes (Triploblasts) in Superphylum Lophotrochozoa and Ecdysozoa Phylum Platyhelminthes Phlyum Mollusca Class Gastropoda Class Bivalva Class Cephalopoda Class Polyplacophora Phylum Annelida Phylum Arthropoda Subphylum Crustacea Phylum Nemotoda Phylogeny and characteristics Deuterostomes (Triploblasts) in Phylum Echinodermata and Chordata, Subphylum Urochordata and Vertebrata Class Agnatha, Chondricthye, Osteichthyes, Reptilia (Aves), and Mammalia including Monotremes, Marsupials, and Eutherians Case study Cetacea Case study Primates Anatomy and Physiology of Living Organisms Major metabolic pathways of heterotrophs and autotrophs, including chemotrophs, phototrophs, chemolithotrophs and chemoorganotrophs Comparative and functional anatomy and physiology of major plant and animal taxa Organization of life from cellular, tissue, organ, organ systems, to organisms Circulatory, sensory, cell signaling, nutrient acquisition, gas exchange, and excretory systems for plants and animals Anatomic and physiological adaptation to terrestrial vs marine and freshwater environments Organismal Life Cycles and Development Asexual vs sexual reproduction, life cycles, and alternation of generations in protists, fungi, plants, and animals Genetic regulation of plant and animal development Ecology: Interactions of Organisms with the Environment Range of tolerance and adaptation Biogeochemical cycles Populations Life Tables Demography Hardy-Weinberg Equilibrium Functional unit of evolution Intraspecific interactions including mate choice, sexual dimorphism, density dependent versus density independent factors that regulate population growth Allopatric vs sympatric speciation and prezygotic isolation vs postzygotic isolation Communities Interspecific interactions including commensalism, mutualism, parasitism, predation Niche differentiation and fundamental vs realized niches Ecosystems Primary production, NPP, and GPP Transfer of energy through trophic levels in food chains, webs and pyramids Biomagnification and bioaccumulation Classification of terrestrial and aquatic ecosystems Global climate change due to global warming due from greenhouse gas emissions, and ocean acidification, eutrophication, and anoxia in the water column that has lead to habitat loss and a biodiversity crisis

Lab Content

Evolution Construction of Phylogenetic Trees Case Study whale evolution and artiodactyls Identifying types of fossils and processes leading to formation of fossils Tiny Earth Microbiome project Collecting and culturing sponge and soil microbiomes Identifying antibiotic activity in isolates from cultured microbiomes Illustrates competition between bacterial species Illustrates microbiomes from different environments Comparative anatomy Microscopy Morphology of bacteria using Gram and simple staining Slides of Lineage Proteobacteria, Firmicute, Cyanobacteria representative species Comparing structures found in representatives of each supergroup, Excavata, SAR, Archaeplastida, Opisthikonta, Amoebozoa Comparing structures in Kingdom Fungi yeasts versus hyphal morphology spore arrangement and structure in Phylum Zygomycota, Ascomycota, Glomeromycota-mycorrhizal fungi, and Basidiomycota Comparing structures in Kingdom Plantae spores versus seeds microsporangia versus megasporangia sporophytes versus gametophytes archaegonia vs antheridia, and ovules vs pollen vascular tissues in roots, stems, and leaves stomata and guard cells rhizomes versus roots monocot versus dicot vascular structures Comparing animal tissues using histology of epithelial, connective, nervous, and muscle tissue Gross anatomy and field and lab identification of members of representative Phyla including bacteria, protists, fungi, plants, and animals Collection and culture of sponge microbiome (bacteria and fungi) Protists including phytoplankton vs zooplankton and multicellular members of Chlorophyta, Het erokontaphyta (Phaeophycea), and Rhodophyta Fruiting bodies of representatives of Phylum Basidiomycota Identification of local bryophytes and gymnosperms and native angiosperms Identification of local marine animals in situ using scientific and common names from Phylum Cnidaria, Porifera, Mollusca, Arthropoda, (Subphylum Crustacea), Osteichthyes, Chondricthyes, Reptilia (Aves), Echinodermata, Chordata, including tunicates and marine mammals such as seals and dolphins Representative organisms, living or preserved Bacterial cultures using different media Fruiting bodies of Basidiomycetes and Ascomycetes Preserved bryophytes, ferns, gymnosperms and angiosperms Preserved examples of each phyla of animal Dissection of Organisms from Representative Phyla Flowers dissection to identify stamen, pistils, ovules, fruits and seeds Male vs female cones Moss sporophytes vs gametophytes Spore prints of basidiomycetes Dissections of the lancelet, clam, grasshopper, crayfish, perch, fetal pig, sheep brain, eye, heart, and pig kidney Functional Morphology of Representative Organisms by comparing dissections, and model illustrations of organs and organ systems Physiology of Representative Organisms Comparative physiology of select dissection of animal systems to investigate the respiratory, nervous, circulatory, protective/outercovering, and reproduction features Illustrate comparative physiology of major organ systems through animations Developmental Stages of Representative Organisms Embryology of plants identifying the gametophyte vs sporophyte generations of plants and development of seeds, cones, and flowers using collected field samples and models Embryology of chordates using a model of a developing fetus and pres erved specimen of a chicken embryo larval versus adult specimens of plankton collected from the field Research and experimental design 3D printing Semester research project identifying antibiotic compounds created by microbiomes from sponge and soil samples microbiome serial dilution and plating microbiome cultures grown on plates streaking and isolation of bacterial colonies testing of isolates against pathogens (modified Kirby-Bauer) Hypothesis development and testing regarding seasonal variability in sponge microbiomes Hypothesis development and testing regarding

variability in soils collected from different topographical locations Hypothesis development and testing regarding effectiveness of bacteria in producing antibiotic activity against known pathogens Identification of microbial isolates based on morphology and genetic sequencing Ecosystems and Ecology Field identification and delineation of local plant communities Field identification of organisms commonly found in estuaries Field identification of benthic communities from collected samples Identification of pelagic organisms in aquariums Measurement of environmental variables (soils and aquatic) including dissolved O2, pH, temperature, organic fraction of soils, visibility in the water column in situ (Secchi Disk), salinity, available nitrogen and phosphorus in water column and soils Comparison of microbiomes collected from habitats with different measured environmental conditions

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

Lecture, lab assignments, field trips, research projects, presentations and discussions

Reading Assignments

Assigned textbook chapters, research project, identification of organisms in the field and laboratory

Writing Assignments

Essay exam, poster presentation, short answer questions

Out-of-class Assignments

Research projects, discussions, presentations

Demonstration of Critical Thinking

Research project, classroom experiments, data analysis

Required Writing, Problem Solving, Skills Demonstration

Research project, classroom experiments, data analysis, poster presentation, essay exam questions

Eligible Disciplines

Biological sciences: Master's degree in any biological science OR bachelor's degree in any biological science AND master's degree in biochemistry, biophysics, or marine science OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Freeman, S. Biological Science, 7th ed. Benjamin Cummings, 2019 2. Required Clark, M.A.; Douglas, M.; Choi J. Biology 2e, ed. OpenStax, 2018

Manuals Resources

1. Hernandez, S., Tsang, T., Bascom-Slack, C., Broderick, N., Handelsman, J. Tiny Earth: A Research Guide to Studentsourcing Antibiotic Discovery, XanEdu , 01-01-2020 2. Cass-Dudley, V.L., Dudley, G, Sumich, J.L. Laboratory and Field Investigations in Marine Life Eleventh Edition, Jones and Bartlett Learning , 01-01-2018

Other Resources

1. Coastline Library 2. California Native Plant Society Open Source Field Guides California Native Plant Society. All rights reserved. https://www.cnps.org/ 3. California Natural Diversity Database. California Department of Fish and Wildlife. https://wildlife.ca.gov/Data/CNDDB/Plants-and-Animals