BIOL 1C: EVOLUTION, SYSTEMATICS & ECOLOGY

Foothill College Course Outline of Record

Heading	Value
Units:	6
Hours:	4 lecture, 6 laboratory per week (120 total per quarter)
Prerequisite:	BIOL 1B.
Advisory:	Students taking the biology majors' sequence (BIOL 1A, 1B, 1C, 1D) are strongly advised to take the sequence in its entirety.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will be able to demonstrate an understanding of the ecological relationships between organisms and their environment.
- Students will be able to describe an ecosystem in terms of the flow of energy and cycling of matter between the abiotic to the biotic components of that ecosystem.
- Students will explain natural selection of populations under different selective pressures.
- Students will explain the phylogenetic relationships of all living things in terms of derived and ancestral traits.

Description

Principles of evolutionary theory, classification of organisms, and basic ecology. Phylogenetic survey of the major groups of organisms (bacteria, archaea, protistans, plants, animals and fungi) and their evolutionary history. Intended for biology majors.

Course Objectives

The student will be able to:
A. identify and apply the steps of the scientific method to study questions.
B. explain the theory of evolution and evaluate the evidence scientists use to support this theory.
C. compare and contrast microevolution and macroevolution.
D. determine gene frequencies in populations using the Hardy-Weinberg theorem.
E. describe mechanisms of microevolutionary change.
F. compare and contrast types of selection pressures.
G. compare and contrast divergent and convergent evolution.
H. define and contrast various definitions of species.
I. compare and contrast mechanisms of speciation.
J. describe the scope of macroevolution.
K. describe the evolutionary history and relationships of major groups of organisms.
L. explain ecological factors that influence population growth.
M. compare and contrast models of population growth.
N. discuss the structure and properties of biological communities.
O. describe the major interactions of species within biological communities.
P. describe energy flow in ecosystems.
Q. describe selected biogeochemical cycles.
R. describe selected aquatic and terrestrial ecosystems.
S. recognize major groups of organisms in the field and in the laboratory.
T. master basic techniques of field biology.
U. use elementary statistical methods to analyze data and perform significance tests.

Course Content

A. Evolutionary theory
1. Evolution as a unifying theme in biology
a. Pre-Darwinian views
b. Darwin's and Wallace's theory
c. The evidence for evolution
2. How populations evolve (microevolution)
a. The theory of evolution by means of natural selection
b. Population genetics
1) Hardy-Weinberg equilibrium
2) Gene pool and microevolution
c. Agents of change
1) Mutation
2) Gene flow
3) Genetic drift
4) Nonrandom mating
5) Natural selection
d. Preservation and promotion of variability
1) Variability in natural populations
2) Sexual reproduction
3) Outbreeding mechanisms
4) Balanced polymorphism
3. Natural selection
a. Fitness
b. Types of selection
1) Stabilizing selection
2) Directional selection
3) Disruptive selection
4) Sexual selection
c. Adaptation
d. Patterns of evolution
1) Convergent evolution
2) Divergent evolution
4. The Origin of Species
a. Definitions of species
b. Reproductive isolating mechanisms
1) Prezygotic mechanisms
2) Postzygotic mechanisms
c. Mechanisms of speciation
1) Allopatric speciation
2) Sympatric speciation
d. Tempo of speciation
1) Gradualism and punctuated equilibrium
5. Macroevolution
a. Definition of macroevolution
b. Methods of studying macroevolution
1) The fossil record
2) Geological time-line
3) Phylogeny and systematics

4) Cladistic analysis
c. Origins of macroevolutionary novelties
1) Evolution is not teleological
2) Exaptation
3) Heterochrony and paedomorphosis
4) Homeotic genes
5) Gene regulation
d. Extinction
B. The diversity of life
1. Biological classification
a. The need for classification
b. The major domains and kingdoms of life
c. Taxonomic categories and biological nomenclature
2. Prebiotic chemical evolution
3. Prokaryotes and the origin of life
a. Characteristics of prokaryotes
b. Bacteria and archaea
c. Metabolic diversity
d. Systematics and phylogeny of prokaryotes
e. Ecological importance of prokaryotes
4. Protists and the origin of eukaryotes
a. Characteristics of protists
b. Origins of multicellularity
c. Systematics and phylogeny of protists
d. Ecological and medical importance of protists
5. Plants and the colonization of land
a. Characteristics of plants
b. Origin of plants
c. Adaptations to life on land
d. Nonvascular plants
e. Vascular plants
1) Seedless vascular plants
2) Gymnosperms
3) Angiosperms
e. Ecological importance of plants
6. Fungi
a. Characteristics of fungi
b. Systematics and phylogeny of fungi
c. Ecological and commercial importance of fungi
7. Invertebrates and the origin of animal diversity
a. Characteristics of animals
b. Overview of phylogeny
c. Development and body plans
1) The three primary germ layers
2) Radial and bilateral symmetry
3) Acoelomate and coelomate animals
4) Protostomes and deuterostomes
d. Selected invertebrate phyla
8. Vertebrates
a. Origin of vertebrates
b. Vertebrate characteristics
c. Evolutionary history of vertebrate classes
d. Selected vertebrate phyla
C. Ecology
1. Introduction to ecology
a. Definition and scope of ecology
b. Biotic and abiotic factors
2. Population ecology
a. Density and dispersion
b. Models of population growth
c. Regulation of populations
d. Human population growth
e. Life-history patterns
3. Communities
a. Properties of communities
b. Community interactions
1) Predator/prey
2) Symbiosis
3) Commensalism
4) Mutualism
5) Parasitism
6) Competition
7) Coevolution
c. Succession
4. Ecosystems
a. Energy flow and trophic structure
b. Selected biogeochemical cycles
5. Biosphere
a. Selected aquatic biomes
b. Selected terrestrial biomes

Lab Content

A. Evolution
1. Problem solving
a. Hardy-Weinberg
b. Population genetics
2. Cladogram construction and interpretation
3. Natural selection
4. Elementary statistical analysis
B. Diversity and systematics
1. Dichotomous keys
2. Identify major phyla
3. Explain ecological importance of major phyla
C. Ecology
1. Field techniques in ecology
2. Analyze and interpret ecological data
3. Examine population growth of real or computer modeled populations
4. Elementary statistical analysis

Special Facilities and/or Equipment

A. Multimedia lecture room and fully equipped biology laboratory with student and instructional computers.
B. Students need internet access.

Method(s) of Evaluation

A. One or more midterm exam(s)
B. One or more practical lab exam(s)
C. Quizzes
D. One or more writing assignment(s)
E. Comprehensive final exam
F. Participation in the laboratory

Method(s) of Instruction

A. Lecture
B. Cooperative learning exercises
C. Field work
D. Laboratory
E. Field trips

Representative Text(s) and Other Materials

Urry, Cain, Wasserman, Minorsky, and Reece. Campbell Biology. 11th ed. with MasteringBiology. San Francisco: Pearson/Benjamin Cummings, 2017. ISBN: 9780134082318

One of the following photo guides:

Rust, Thomas. A Guide to Biology Lab. 3rd ed. Boerne, TX: Southwest Educational Enterprises, 1983. ISBN: 9780937029015 (The photographs and labels in this guide are excellent. A newer edition is not available.)

Adams, B.J., and J.L. Crawley. Van De Graaff's Photographic Atlas for the Biology Laboratory. 7th ed. Englewood, CO: Morton Publishing, 2013. ISBN: 9781617310584

Schultheis, Lisa. Laboratory exercises. Los Altos Hills, CA: Foothill College, 2018. (The lab exercises are updated on a regular basis; author may vary based on which faculty member updated it most recently.)

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

A. Reading Assignments: Weekly reading assignments from college-level, lower division, biology majors text corresponding to lecture topics.

B. Laboratory Exercises: Biweekly lab exercises. Each lab exercise includes individual or group activities covering assigned readings in laboratory handouts.

C. Writing Assignment: Each student prepares a written report of 1-2 pages describing and analyzing the results of a several week experiment that uses bacteria to study natural selection.

Discipline(s)

Biological Sciences