BIOL 1C: EVOLUTION, SYSTEMATICS & ECOLOGY

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2025
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) 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:

1. Identify and apply the steps of the scientific method to study questions.
2. Explain the theory of evolution and evaluate the evidence scientists use to support this theory.
3. Compare and contrast microevolution and macroevolution.
4. Determine gene frequencies in populations using the Hardy-Weinberg theorem.
5. Describe mechanisms of microevolutionary change.
6. Compare and contrast types of selection pressures.
7. Compare and contrast divergent and convergent evolution.
8. Define and contrast various definitions of species.
9. Compare and contrast mechanisms of speciation.
10. Describe the scope of macroevolution.
11. Describe the evolutionary history and relationships of major groups of organisms.
12. Explain ecological factors that influence population growth.
13. Compare and contrast models of population growth.
14. Discuss the structure and properties of biological communities.
15. Describe the major interactions of species within biological communities.
16. Describe energy flow in ecosystems.
17. Describe selected biogeochemical cycles.
18. Describe selected aquatic and terrestrial ecosystems.
19. Recognize major groups of organisms in the field and in the laboratory.
20. Master basic techniques of field biology.
21. Use elementary statistical methods to analyze data and perform significance tests.
22. Explore and discuss scientific issues related to the topics in evolution, ecology, and systematics, especially those impacting diversity, equity, inclusion, and social justice.

Course Content

1. Evolutionary theory
    a. Evolution as a unifying theme in biology
        i. Pre-Darwinian views
        ii. Darwin's and Wallace's theory
        iii. The evidence for evolution
    b. How populations evolve (microevolution)
        i. The theory of evolution by means of natural selection
        ii. Population genetics
            1. Hardy-Weinberg equilibrium
            2. Gene pool and microevolution
        iii. Agents of change
            1. Mutation
            2. Gene flow
            3. Genetic drift
            4. Nonrandom mating
            5. Natural selection
        iv. Preservation and promotion of variability
            1. Variability in natural populations
            2. Sexual reproduction
            3. Outbreeding mechanisms
            4. Balanced polymorphism
    c. Natural selection
        i. Fitness
        ii. Types of selection
            1. Stabilizing selection
            2. Directional selection
            3. Disruptive selection
            4. Sexual selection
        iii. Adaptation
        iv. Patterns of evolution
            1. Convergent evolution
            2. Divergent evolution
    d. The Origin of Species
        i. Definitions of species
        ii. Reproductive isolating mechanisms

1. Prezygotic mechanisms
2. Postzygotic mechanisms

iii. Mechanisms of speciation
1. Allopatric speciation
2. Sympatric speciation

iv. Tempo of speciation
1. Gradualism and punctuated equilibrium

e. Macroevolution
i. Definition of macroevolution
ii. Methods of studying macroevolution
1. The fossil record
2. Geological time-line
3. Phylogeny and systematics
4. Cladistic analysis

iii. Origins of macroevolutionary novelties
1. Evolution is not teleological
2. Exaptation
3. Heterochrony and paedomorphosis
4. Homeotic genes
5. Gene regulation

iv. Extinction

2. The diversity of life
a. Biological classification
i. The need for classification
ii. The major domains and kingdoms of life
iii. Taxonomic categories and biological nomenclature

b. Prebiotic chemical evolution

c. Prokaryotes and the origin of life
i. Characteristics of prokaryotes
ii. Bacteria and archaea
iii. Metabolic diversity
iv. Systematics and phylogeny of prokaryotes
v. Ecological importance of prokaryotes

d. Protists and the origin of eukaryotes
i. Characteristics of protists
ii. Origins of multicellularity
iii. Systematics and phylogeny of protists
iv. Ecological and medical importance of protists

e. Plants and the colonization of land
i. Characteristics of plants
ii. Origin of plants
iii. Adaptations to life on land
iv. Nonvascular plants
v. Vascular plants
1. Seedless vascular plants
2. Gymnosperms
3. Angiosperms

vi. Ecological importance of plants

f. Fungi
i. Characteristics of fungi
ii. Systematics and phylogeny of fungi
iii. Ecological and commercial importance of fungi

g. Invertebrates and the origin of animal diversity
i. Characteristics of animals
ii. Overview of animal phylogeny
iii. Development and body plans
1. The three primary germ layers
2. Radial and bilateral symmetry
3. Acoelomate and coelomate animals
4. Protostomes and deuterostomes

iv. Selected invertebrate phyla

h. Vertebrates
i. Origin of vertebrates
ii. Vertebrate characteristics
iii. Evolutionary history of vertebrate classes
iv. Selected vertebrate phyla

3. Ecology
a. Introduction to ecology
i. Definition and scope of ecology
ii. Biotic and abiotic factors

b. Population ecology
i. Density and dispersion
ii. Models of population growth
iii. Regulation of populations
iv. Human population growth
v. Life-history patterns

c. Communities
i. Properties of communities
ii. Community interactions
1. Predator/prey
2. Commensalism
3. Mutualism
4. Parasitism
5. Competition
6. Coevolution

iii. Succession

d. Ecosystems
i. Energy flow and trophic structure
ii. Selected biogeochemical cycles

e. Biosphere
i. Selected aquatic biomes
ii. Selected terrestrial biomes

Lab Content

1. Evolution
a. Problem solving
i. Hardy-Weinberg
ii. Population genetics

b. Cladogram construction and interpretation

c. Natural selection

d. Elementary statistical analysis

2. Diversity and systematics
a. Dichotomous keys

b. Identify major phyla

c. Explain ecological importance of major phyla

3. Ecology

a. Field techniques in ecology
b. Analyze and interpret ecological data
c. Examine population growth of real or computer modeled populations
d. Elementary statistical analysis

Special Facilities and/or Equipment

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

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

One or more midterm exam(s)
One or more practical lab exam(s)
Quizzes
One or more writing assignment(s)
Comprehensive final exam
Participation in the laboratory

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Cooperative learning exercises
Field work
Laboratory
Field trips

Representative Text(s) and Other Materials

Urry, Cain, Wasserman, Minorsky, and Reece. Campbell Biology with Mastering, 12th ed.. 2021.

This textbook is updated with each new edition, approximately every three years.

Laboratory exercises, provided to the students at no cost and updated on a regular basis.

Optional: One of the following photo guides:
Rust, Thomas. A Guide to Biology Lab, 3rd ed. 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. 2013. ISBN: 9781617310584.

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

1. Weekly reading assignments from college-level, lower division, biology majors text corresponding to lecture topics.
2. Biweekly lab exercises. Each lab exercise includes individual or group activities covering assigned readings in laboratory handouts.
3. 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