

Montgomery County Community College  
 BIO 122  
 General Biology II  
 4-3-3

**COURSE DESCRIPTION:**

This course emphasizes evolution as it applies to the development, adaptation and taxonomy of organisms. The five kingdoms of organisms are discussed in terms of their structure, function, reproduction and adaptation. This course is subject to a course fee. Refer to <http://mc3.edu/adm-fin-aid/paying/tuition/course-fees> for current rates.

**REQUISITES:***Previous Course Requirements*

- BIO 121 General Biology I

*Concurrent Course Requirements*

None

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Describe the basic features of evolution and the mechanisms by which populations of organisms evolve.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams
2. Explain the basic concepts of taxonomy and how phylogenetic relationships are determined.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams
3. Discuss the evidence for the major theories associated with the origin of life on earth.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
4. Describe the differences between the three domains of life, and relate how the eukaryotes likely evolved from prokaryotic ancestors.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams
5. Characterize the major phyla of Protists, Fungi, Plants, and Animals, and their likely evolutionary relationships with each other and with other eukaryotes.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams
6. Characterize the major classes of Chordates, and the likely evolutionary trends in the phylum.	Lectures Class Discussion Videos Laboratory Exercises Field Trips Exams Quizzes	Laboratory Exercises and Reports Quizzes and Exams
7. Demonstrate the ability to set up and utilize microscopes and other basic laboratory apparatuses	Laboratory Exercises Quizzes Tests Lectures and Demonstrations	Lab Quizzes Lab Exercise Reports
8. Describe the important chemical and biotic influences in maintaining a stable biosphere.	Lectures Class Discussions Field Trips Class Presentations Laboratory Activities Videos	Laboratory Exercises and Reports Quizzes and Exams
9. Describe the important influences on human and non-human population dynamics.	Lectures Class Discussions Field Trips Class Presentations Laboratory Activities Videos	Laboratory Exercises and Reports Quizzes and Exams

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
10. Support opinions concerning contemporary biological and human sustainability issues utilizing relevant scientific arguments.	Lectures Class Discussions Field Trips Class Presentations Laboratory Activities Videos	Quizzes and Exams Class Discussions

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria.*

SEQUENCE OF TOPICS to include:

I. Evolution

- A. Defined
- B. Charles Darwin and the Origin of Species
- C. Natural selection and genetic drift as mechanisms
- D. Evidence used to infer phylogenetic relationships

II. Population Genetics and Hardy-Weinberg Equilibrium

- A. Defined
- B. Simple models of change

III. Speciation

- A. Allopatric and Sympatric models
- B. Reproductive Isolation Mechanisms
  - 1. Importance in maintaining species isolation
  - 2. Prezygotic and Postzygotic barriers
- C. Microevolution vs. Macroevolution

IV. Origin of Life and history of life on Earth

- A. Contrast Biogenesis theory and Abiogenesis theories
- B. Search for non-earth life?
- C. Early earth physical and chemical conditions
- D. Natural Abiogenesis theory
  - 1. Energy requirement
  - 2. Evidence for abiotic monomer synthesis, e.g., Miller-Urey
  - 3. Evidence for potential for polymerization and aggregation
  - 4. Potential for self-replication of chemical aggregates
- E. approximate dates for origins of the various important taxonomic groupings

V. Taxonomy/Systematics

- A. Defined. Artificial vs. phylogenetic classification concepts.
- B. History/Linnaeus, origin of binomial nomenclature
- C. Hierarchical scheme and utility of formal scientific names
- D. Monophyletic vs. polyphyletic groupings

## VI. Viruses

- A. Living/Non-Living
- B. Characteristics, DNA vs. RNA, reverse transcriptase, enveloped, etc.
- C. Infection pathways, lytic vs. lysogenic cycles, provirus concept

## VII. Prokaryotes

- A. Contrast typical cell with eukaryotic cell type
  - 1. Structure (wall, genetics, etc.) and shape (bacillus, spirillum, coccus, etc.)
  - 2. biochemical complexity, energy sources, other unique pathways
- B. Archaea vs. Eubacteria, and major groupings within each
- C. Difficulty of phylogenetic classification, esp. horizontal gene transfer
- D. Ecological importances

## VIII. Kingdom Protista

- A. Endosymbiotic Origins
- B. Diversity
  - 1. Algae (Protophyta)
    - a. characters differentiating the major photosynthetic phyla
    - b. likely evolutionary relationships and adaptations
    - c. effects on, or utility for, humans
  - 2. Protozoans, contrasting the major animal-like phyla
    - a. characters differentiating the major phyla
    - b. likely evolutionary relationships and adaptations
    - c. effects on, or utility for, humans
  - 3. Molds (Protomycota), contrasting the major fungus-like phyla
    - a. characteristics of the major mold phyla
    - b. likely evolutionary adaptations and relationships
    - c. effects on, or utility for, humans
- E. Origins of Multicellularity

## IX. Kingdom Mycota (Fungi)

- A. characters differentiating the major phyla / taxonomy
- B. Reproduction by Spores, dikaryotic stage of lifecycle
- C. Economic Importance and other effects on humans
- D. Lichens and Mycorrhizal relationships
  - 1. Symbiotic relationship
  - 2. Nutrition

## X. Kingdom Plantae

- A. Evolution of adaptations for land existence, desiccation resistance
- B. Likely origin of from Chlorophyta, important homologies
- C. Generalized lifecycle: alternation of generations
- D. Important distinguishing characteristics, evolutionary innovations, and importance to humans of the major plant phyla
  - 1. Bryophytes (non-vascular plants), typified by the mosses
    - a. General characteristics and reproduction / lifecycle
    - b. Characters requiring close ties with water

2. Seedless vascular plants, typified by the ferns
  - a. Evolutionary importance of vascular tissue
  - b. Evolution of increased sporophyte importance in the lifecycle
  - c. General characteristics and reproduction / lifecycle
3. Gymnosperms, typified by the conifers
  - a. General characteristics and reproduction / lifecycle
  - b. Evolution and ecological importance of seeds
4. Angiosperms
  - a. Evolutionary innovations resulting in recent ecological dominance
  - b. typical Monocot vs. Dicot characteristics
  - c. Vegetative Structure
    - 1). Roots structures and function
    - 2). Stems structures and function, herb vs. woody
    - 3). Leaves structures and function, ecological modifications
  - d. Sexual Reproduction
    - 1). Flower structure
    - 2). Pollen, seed and fruit development
    - 3). Dispersal structures

## XI. Kingdom Animalia

- A. Likely origin from multicellular flagellates, important homologies
- B. Typical lifecycles
- C. Important distinguishing characteristics, evolutionary innovations, and importance to humans of the major animal phyla
  1. Sponges
  2. Cnidaria
  3. Flatworms (Platyhelminthes)
  4. Roundworms (Nematodes)
  5. Segmented worms (Annelids)
  6. Molluscs, including major classes of bivalves, gastropods, cephalopods
  7. Arthropods, including major classes of arachnids, insects, crustaceans, millipedes and centipedes
  8. Echinoderms
  9. Chordates
    - a. Invertebrate subphyla characteristics
    - b. Evolutionary trends and characteristics of Vertebrate classes--  
Agnatha, Chondryichthyes, Osteichthyes, Amphibians, Reptiles, Mammals, Birds
    - c. Origin of land chordates
    - d. Primate evolutionary trends
    - e. Cultural evolution

- XII. Evolutionary Comparisons of Phyla
  - A. Body shape and Symmetry
  - B. Evolution of three tissue layers (ectoderm, mesoderm, endoderm)
  - B. Mechanisms for gas exchange
  - C. Adaptations for nutrition, digestive system
  - D. Utility of body cavity (coelom)
  - E. Protostome vs. Deuterostome embryology
- XIII. Population Ecology
  - A. Characteristics of Populations--influences on density, dispersion, growth,
  - B. Population Size and Exponential Growth--birth and death rates
  - C. Limits on Growth of Populations
    - 1. Density-dependent and density-independent controls
    - 2. Carrying capacity concepts
  - D. Life History Patterns
  - E. Human Population Growth and future implications
  - F. Community interactions: symbioses, mutualisms, competition, commensalism, predator-prey, herbivory, parasitism, amensalism
- XIV. Ecosystems
  - A. The nature of Ecosystems--producers, consumers, decomposers,
  - B. Energy Flow through Ecosystems-
    - 1. productivity and respiration
    - 2. 10% "law"
    - 3. Importance of 2<sup>nd</sup> Law of Thermodynamics
  - C. Biogeochemical Cycles--nitrogen, phosphorus, carbon, sulfur
    - 1. natural cycling
    - 2. human alterations of cycling--important environmental issues
      - a. climate change theory
      - b. eutrophication
      - c. air pollution issues
      - d. acid rain
  - D. Hydrologic Cycle and perturbations
  - E. Natural succession, primary and secondary, from colonizers to climax
  - F. Biodiversity and influences on current extinction rates
  - G. Types and importance of disturbance on community development
- XV. The Biosphere
  - A. Effects of air circulation patterns, the ocean, and topography on regional climates
  - B. Characteristics of the world's major terrestrial Biomes
  - C. Characteristics of Freshwater and Marine Biomes
  - D. Global climate change theory

**LEARNING MATERIALS:**Textbook:

To ensure breadth and depth of topic coverage, and to provide well-illustrated examples to reinforce material covered in lecture, an appropriate general textbook will be selected and assigned. Normally the book will be selected in conjunction with BIO 121, to provide continuity for the students continuing from that course. The book in current use is: Reece et al., *Campbell Biology: Concepts and Connections*, 8<sup>th</sup> ed., Pearson, 2013.

Other materials (especially current articles of relevance) may be made available directly to the student or via the College's library reserve or its computer network.

Lab Manual:

None (lab handouts will be provided), but a recommended laboratory supplement is: Rust, *A Guide to Biology Lab*, Southwest Educational Enterprises, 1983.

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

**COURSE APPROVAL:**

Prepared by: Thao Tran	Date: 4/21/1998
Revised by: Christopher J. Harendza, Ph.D. Associate Professor and Coordinator of Biology	Date: 10/22/2004
Revised by: Jerry Coleman, Ph.D.	Date: 11/15/2013
VPAA/Provost or designee Compliance Verification: Dr. Victoria Bastecki-Perez	Date: 2/24/2014
Revised by: Debbie Dalrymple	Date: 6/27/2016
VPAA/Provost or designee Compliance Verification: Dr. Victoria Bastecki-Perez	Date: 6/27/2016

*This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.*