Miami Dade College

Course Description

PCB4674 | Evolution | 3.00 credits

Students will learn the theory of evolution as it pertains to different fields of modern biology including the theory of natural selection, the evidence for evolution, microevolution, speciation, macroevolution, the origin of life on Earth, major evolutionary trends, and the evolution of humans. Prerequisites: BSC 2010, 2010L, 2011, 2011L, PCB 3060, 3060L.

Course Competencies:

Competency 1: The student will demonstrate knowledge of the origins of hereditary variations by:

1. Describing the role played by the rediscovery of Mendel's work, as well as the contributions of other geneticists, in strengthening Darwin's theory of natural selection
2. Explaining the significance of the chromosomal theory of inheritance to the emergence of Neo-Darwinism

Competency 2: The student will demonstrate knowledge of the relationships among processes of change and the time element by:

Describing examples where evolution in both the short-term and long-term has been identified

Competency 3: The student will demonstrate knowledge of processes of macroevolution, mutation, genetic drift, and natural selection by:

1. Describing the meaning of macroevolution and its significance to modern evolutionary theory
2. Identifying the mechanisms that change the allele frequencies of populations (mutation, genetic drift, gene flow, nonrandom mating, and natural selection) and evaluating their relative significance
3. Explain how the various mechanisms of microevolution function to change the allele frequencies of populations.

Competency 4: The student will demonstrate knowledge of processes that influence diversity in molecular, anatomical, and behavioral characteristics of different organisms by:

1. Describing how the external environment and genetic processes determine the characteristics of organisms

Competency 5: The student will demonstrate knowledge of the relationship between population genetics and evolution by:

1. Evaluating the importance of population genetics to developing the "New Synthesis"
2. Identifying the significance of the Hardy-Weinberg theorem to population genetics and our present-day understanding of macroevolution

Competency 6: The student will demonstrate knowledge of the concept of speciation and of the factors that may contribute to the development of new species by:

1. Describing and discussing the limitations of the biological species concept and distinguishing among the several alternative species concepts (e.g. ecological, pluralistic, morphological, and genealogical)
2. Defining and differentiating the processes of allopatric and sympatric speciation
3. Identifying and understanding the various types of barriers that may arise and act as reproductive isolating mechanisms in the process of speciation
4. Comparing and contrasting artificial and natural selection;; describing and giving examples of the different modes of natural selection

Competency 7: The student will demonstrate knowledge of macroevolution and of the significant environmental factors affecting it by:

1. Comprehending the irreversible nature of macroevolution

2. Understanding the significance of biogeography in tracing the history of life on the planet and describing how plate tectonics and continental drift have influenced biological diversity
3. Describe and give examples of major macroevolutionary patterns, such as divergence, adaptive radiation, convergence, and co-evolution
4. Recognizing that developmental studies offer insights into phylogenetic relationships
5. Defining and explaining the significance of extinction, understanding that evolution is not goal-oriented, and discussing the terms success, progress, primitive, and derived as they relate to evolution
6. Comparing and contrasting the two schools of thought regarding the tempo of evolution, i.e., "gradualism" and "punctuated equilibrium"

Competency 8: The student will demonstrate knowledge of the theories of origin and development of early life on Earth by:

1. Identify and discuss the scientific merits of the various theories that attempt to account for the diversity of life on the planet, such as evolution, creationism, intelligent design, and cosmic origin.
2. Demonstrating understanding of the hierarchy of life and its relationship to the abiotic world.
3. Discuss the main theories that address the mechanisms by which life is believed to have first evolved from non-life on Earth (e.g., Francesco Ready's refutation of the theories of spontaneous generation and the oparin-miller theory)
4. Describing the origin of self-replicating systems and protocells
5. Describe the significant landmarks in the evolution of the earliest life forms, including the endosymbiotic origin of eukaryotes and photosynthetic organisms
6. Demonstrating knowledge of the significant trends in the evolution of life on Earth, such as multicellularity and sexual reproduction
7. Identifying and analyzing the effects of organic evolution on the planet, such as the oxygen revolution, the creation of fossil fuels, and soil formation

Competency 9: The student will demonstrate knowledge of hominid evolution by:

1. Tracing the evolution of hominids, beginning with the first primates and explaining their relationship to prosimians, monkeys, and hominoids
2. Discussing the australopithecines and their relationship to humans
3. List and describe the species of the genus homo, characterize their phylogenetic relationships, and identify those characteristics that distinguish homo sapiens from other hominids
4. Comparing and contrasting the two major hypotheses that have been proposed to explain the origin of modern humans (i.e., the "out of Africa" hypothesis and the "multiregional" hypothesis)
5. Defining cultural evolution and identifying and discussing the major landmarks of this process
6. Explaining the relationship of cultural evolution to society's ability to alter its environment

Competency 10: The student will demonstrate knowledge of the history of evolutionary thinking and the evidence for evolution by:

1. Defining evolution and discussing why evolutionary theory was not widely accepted when it was first proposed
2. Explaining how the intellectual climate of Darwin's day was influenced by philosophers and scientists such as Plato, Aristotle, Carolus Linnaeus, Georges Cuvier, James Hutton, Charles Lyell, Jean Baptiste Lamarck, and Thomas Malthus
3. Relating events in Darwin's early life that prepared him to become a naturalist, describing the voyage of the H.M.S Beagle and identifying the types of information gathered by Darwin on that voyage that helped him formulate his theory of natural selection
4. Outlining the theory of natural selection proposed by Charles Darwin and Alfred Wallace, discussing its significance as a mechanism of evolutionary change, and describing the initial reaction to it by scientists and the general public
5. Describe how natural selection adapts populations to their environment by citing and explaining several examples
6. Identifying and analyzing the evidence gathered by Darwin and others that supports the idea that species change over time has led to evolutionary theory becoming central to all fields of modern biology

Competency 11: The student will demonstrate knowledge of nature and applications of scientific processes, limitations, and the inquiry based nature of science as it relates to the study of evolution by:

1. Describing It states the basic principles of the scientific method and describes how they are applied to evolutionary theory and investigation

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Solve problems using critical and creative thinking and scientific reasoning
- Demonstrate knowledge of ethical thinking and its application to issues in society