**General Biology 142 (BI142)**

**Proposed Course Description:**

This course is a continuation of BI141 covering the central concepts of biology. Topics include evolutionary processes, speciation, organismal biology, and ecology. Laboratory exercises mirror lecture topics and include opportunities for the student to practice the scientific method, data collection, and lab report writing. Prerequisite: General Biology 1 (BI141) or permission from the Dean.

**Student Learning Outcomes Lecture:**

A. The student will be able to define evolution and describe the different sources of evidence for evolution (e.g. fossil record/transitional forms, vestigial traits, biogeography, homologies, molecular data).

B. The student will be able to describe the different mechanisms of evolution (mutation, natural selection, gene flow, genetic drift) and explain how each can influence genetic variation in a population.

C. The student will be able to describe and identify the different forms of natural selection (e.g. directional, stabilizing, diversifying), and compare and contrast the forms of selection in terms of their effect on a population's variance and average phenotype.

D. The student will be able to describe how genetic drift differs from natural selection.  The student will also be able to compare and contrast genetic bottlenecks and founder effects as two sources of genetic drift, and explain the relationship between genetic drift and population size.

E. The student will be able to determine whether a population is experiencing evolutionary forces using Hardy Weinberg equilibrium.

F. The student will be able to describe the main processes by which new species arise, including both allopatric and sympatric speciation.  The student will also be able to describe the different mechanisms of reproductive isolation, and the role of gene flow in speciation.

G. The student will be able to interpret evolutionary relationships using phylogenetic trees.

H. The student will be able to describe the major characteristics of different prokaryote and protist lineages.

I. The student will demonstrate comprehension of the evolution of land plants, and will be able to differentiate between seedless and seed-bearing plants in terms of morphology, adaptations, & reproductive life cycles.

J. The student will be able to describe the anatomy of land plants and how the organization of angiosperm plant tissues is related to the physiology of angiosperm plant organs.

K. The student will be able to describe the major characteristics, life cycle, and ecological role of different fungal lineages.

L. The student will be able to describe the major evolutionary trends seen in the evolution of the animal kingdom.  The student will also be able to describe the major characteristics of different animal lineages.

M. The student will be able to describe how abiotic environmental factors (temperature, water) can act as selective agents and how this influences population and species distributions.

N. The student will be able to describe how biotic interactions such as competition, predation, parasitism, and mutualism can act as selective agents and how this influences population and species distributions.

O. The student will be able to describe and use simple population growth models (density independent and dependent).  The student will also be able to define carrying capacity and explain how it limits population growth.

P. The student will be able to describe how biodiversity maintains ecosystem function.  The student will also be able to describe how human activities are affecting the environment, and the corresponding effects on the abundance and distribution of specific taxonomic groups.

**Student Learning Outcomes Lab:**

A. The student will engage in simulations of evolutionary forces to investigate how different mechanisms of evolution influence a population’s genetic variation and average phenotype.

B. The student will manipulate a simulated breeding population to demonstrate the Hardy-Weinberg Principle and the effects of different evolutionary forces.   Students will learn how to solve population genetics problems.

C. The student will use character matrices to construct parsimonious phylogenetic trees.  The student will be able to interpret phylogenetic trees to answer questions about evolutionary relationships.

D. The student will demonstrate the skills of observation, data collection, and data analysis while conducting an ecological experiment.

E. The student will write formal laboratory reports or data reports on the results of the above investigative laboratories.

F. The student will make direct observations of several protist lineages and will be able to describe their major characteristics.

G. The student will be able to define the life cycle stages of both seedless and seed-bearing land plants.  The student will also be able to describe the reproductive strategies and structures of both groups.

H. After microscopic examination, the student will be able to explain how the structure of plant organs is related to their function.

I. The student will learn the basic differences in structure that are used to separate the fungal kingdom into its different phylum.  They will then assign unknown specimens to their proper phylum based upon morphological traits.

J. The student will be able to assign animal specimens to their respective phyla based upon their morphological traits.

K. The student will perform or observe dissections of selected animals.  The student will also sketch specimens of increasingly complex animal phyla illustrating the major grades in body plans which have driven the evolutionary trends of the animal world.

L. The student will investigate the impact of humans on the biosphere, including how climate change is altering species interactions, distribution, and abundance.

***General Biology 142***

***Lecture Topic Schedule***

**Week # Topic Chapter**

1 Introduction to Course

Evolution and the Origin of Species 18

2 The Evolution of Populations 19

Population Genetics Problems

3 The Evolution of Populations 19

Population Genetics Problems

4 Phylogenies and the History of Life 20

5 Prokaryotes: Bacteria and Archaea 22 and 23

Protists

6 Seedless and Seed Plants 25 and 26

7 Plant Form, Physiology, and Reproduction 30 and 32

8 Fungi 24

9 Introduction to Animal Diversity 27

10 Invertebrates 28

11 Vertebrates 29

12 Ecology and the Biosphere 44

13 Population and Community Ecology 45

14 Conservation Biology and Biodiversity 47

***General Biology 142***

***Lab Schedule***

**Week # Topic**

1 Evidence for Evolution

2 Mechanisms of Evolution

3 Evolution: Hardy Weinberg Equilibrium

4 Phylogenetic Trees

5 Introduction to Protist

6 Seedless vs. Seed Plants (Life Cycles and Reproduction)

7 Plant Tissues and Anatomy (Angiosperms)

8 Introduction to the Fungi

9 Introduction to the Animal Phyla

10 Invertebrate Dissection

11 Vertebrate Dissection

12 Ecology Experiment Week 1

13 Ecology Experiment Week 2

14 Conservation Project/ Citizen Science