

COURSE OUTLINE**Biology 102 (C-ID Number: BIOL 140)
General Biology (C-ID Title: Organismal Biology)****I. Catalog Statement**

Biology 102 provides a continuation of the study of fundamental biological concepts and processes introduced in Biology 101. The course includes the anatomy and physiology of plants and animals, animal development, population genetics, evolutionary theory, origin of life, ecological principles, conservation biology, and systematics. The course also includes an extensive survey of biodiversity covering the evolution, anatomy and physiology of the three domains of life and the eukaryotic phyla.

Total Lecture Units: 3.0

Total Laboratory Units: 2.0

Total Course Units: 5.0

Total Lecture Hours: 48.0

Total Laboratory Hours: 96.0

Total Faculty Contact Hours: 144.0

Prerequisite: BIOL 101.

II. Course Entry Expectations

Prior to enrolling in the course, the student should be able to:

Upon successful completion of the required course work, the student will be able to:

1. identify the properties of lipids, carbohydrates, proteins, and nucleic acids;
2. describe the structure of prokaryotic and eukaryotic cells;
3. explain cell respiration and photosynthesis;
4. describe the relationships between meiosis and Mendelian genetics;
5. solve Mendelian genetics and pedigree problems;
6. describe the processes of deoxyribonucleic acid (DNA) replication, transcription, and translation;
7. describe techniques and applications of biotechnology;
8. explain the basic mechanisms of gene regulation in prokaryotes and eukaryotes;
9. demonstrate proper use of laboratory equipment including the microscope, spectrophotometer, and micropipettes;
10. demonstrate proficiency with data collection, analysis, and graphical representation;
11. summarize the main points of a scientific article.

III. Course Exit Standards

Upon successful completion of the required course work, the student will be able to:

1. discuss the evolution of land plants from chlorophyte ancestors and their adaptations to a terrestrial existence;
2. describe the anatomy and physiology of vascular plants in relation to nutrition, transport, hormonal control, and reproduction;
3. describe the anatomy and physiology of the major organ systems of animals: respiratory, circulatory, digestive, nervous, reproductive, and excretory/osmoregulatory;
4. explain the basic principles of animal developmental biology;
5. describe the phylogenetics of the major phyla of living organisms;
6. explain the historical background leading to the development of the theory of evolution by natural selection;
7. discuss the evidence for both microevolution and macroevolution;
8. describe the historical background leading to our current ideas regarding the origin of life;
9. explain the major principles of population genetics including Hardy-Weinberg equilibrium, natural selection, non-random mating, genetic drift, gene flow, and mutation;
10. describe important ecological principles including population growth, competition, and predation, ecosystems, and island biogeography.

IV. Course Content

Total Faculty Contact Hours = 144

- | | |
|---|-----------------|
| A. Anatomy and Physiology of Vascular Plants | 9 hours |
| 1. Vascular system and transport mechanisms | |
| 2. Nutrition and growth | |
| 3. Hormones | |
| 4. Photoperiodism | |
| 5. Reproduction | |
| B. Anatomy and Physiology of Vertebrates | <u>19</u> hours |
| 1. Homeostasis | |
| 2. Hormones | |
| 3. Circulatory and respiratory systems | |
| 4. Excretory and osmoregulatory systems | |
| 5. Digestive systems | |
| 6. Nervous systems | |
| 7. Support and muscular systems | |
| 8. Sensory systems | |
| 9. Reproductive systems | |
| C. Animal Development | 1.5 hours |
| 1. Processes of embryogenesis | |
| 2. Cell potency, determination, and differentiation | |
| 3. Cytoplasmic determinants and morphogens | |
| 4. Induction, organogenesis, and apoptosis | |
| 5. Homeotic genes | |
| 6. Gametogenesis and fertilization | |
| 7. Early cleavage and gastrulation | |

- D. Population Genetics 3 hours
1. Populations and gene pools
 2. Hardy-Weinberg model
 3. Genetic drift
 4. Gene flow
 5. Non-random mating
 6. Mutation
- E. Evolutionary Theory 6.5 hours
1. Historical perspective leading to the theory of evolution by natural selection
 2. Modes of natural selection
 3. Sexual selection
 4. Origin and maintenance of variation
 5. Clines
 6. Micro versus macroevolution
 7. Species concepts
 8. Mechanisms of reproductive isolation
 9. Allopatric and sympatric speciation
 10. Polyploidy
 11. Resource partitioning
 12. Adaptive landscapes
 13. Hybrid zones
 14. The fossil record
 15. Gradualism versus punctuated equilibrium
 16. Mass extinctions and adaptive radiations
 17. Molecular clocks
- F. Origin of Life 1.5 hours
1. Models of early abiotic Earth
 2. Polymerization in the early Earth
 3. Protobionts
 4. Origin of information molecules
 5. Panspermia
- G. Ecological Theory 7.5 hours
1. Structural levels - populations, communities, ecosystems
 2. Principles of demography
 3. Survivorship curves
 4. Semelparity versus iteroparity
 5. Population growth - logistic versus exponential
 6. Population density, K and r selected traits
 7. Disturbance, species diversity, and ecological succession
 8. Competition, symbiosis, and predation
 9. Niches and competitive exclusion
 10. Energy flow through ecosystems

11. Net and gross primary productivity
12. Island biogeography
13. Man's impact on the environment

H. Laboratory Topics	96 hours
1. Phylogenetic systematics, introducing species concepts, the principles of hierarchical classification and exercises in cladistic methodology	4.5 hours
2. Prokaryote biodiversity and evolution	4.5 hours
3. An extensive survey of biodiversity including the phylogeny, anatomy, and physiology of the major eukaryotic phyla (including protists, algae, basal land plants, seed plants, fungi, and invertebrate animals)	51.5 hours
4. Vertebrate phylogeny, anatomy, and physiology, including dissections of a shark, frog, turtle, snake, pigeon, and fetal pig (data collection in vertebrate physiology)	13 hours
5. Vascular plant and vertebrate animal tissues	9 hours
6. Population genetics	4.5 hours
7. Ecology (data collection/analysis)	4.5 hours
8. Conservation biology	4.5 hours

V. **Methods of Instruction**

The following instructional methodologies may be used in the course:

1. lectures;
2. multi-media;
3. online (tutorials and/or homework exercises);
4. laboratory demonstrations.

VI. **Out of Class Assignments**

The following out of class assignments may be used in the course:

1. assigned reading from popular science articles and blogs (e.g. write a summary of “The Erotic Endurance of Whale Hips” by Carl Zimmer, National Geographic Phenomena: The Loom);
2. written assignments based on research on a local native plant species or endangered animal, to be presented in lab;
3. homework problems in population genetics;
4. homework problems in constructing cladograms.

VII. **Methods of Evaluation**

The following methods of evaluation may be used in the course:

1. lecture examinations (including multiple choice and essay questions);
2. laboratory practical examinations;
3. completion of a laboratory manual and pre-lab questions;

4. laboratory written assignments and presentations.

VIII. Textbook

Sadava, David E., et al. *Life: The Science of Biology*. 10th ed. New York: W.H. Freeman, 2014. Print.
13th Grade Textbook Reading Level. ISBN #978-1429298643

IX. Student Learning Outcomes

Upon successful completion of the required coursework, the student will be able to:

1. describe the anatomy and physiology of one or more of the major physiological systems in angiosperms;
2. describe the anatomy and physiology of one or more of the major organ systems of vertebrates;
3. explain the historical perspective leading to Charles Darwin's work on evolution by natural selection, as well as micro- and macro-evolutionary processes, and to predict outcomes of population genetics models;
4. diagram and/or explain the major models of population growth, ecosystem ecology, and island biogeography;
5. analyze and develop hypotheses of evolutionary relationships using cladistics, as well as identify characteristics of all major groups of living organisms.