

# Virginia Western Community College

## BIO 102

### General Biology II

#### Prerequisites

A passing grade of C or higher in BIO 101 or equivalent, or departmental permission.

#### Course Description

Focuses on biological processes with a chemical foundation, including macromolecules, cellular structure, metabolism, and genetics in an evolutionary context. Explores the core concepts of evolution; structure and function; information flow, storage and exchange; pathways and transformations of energy and matter; and systems biology. Emphasizes the process of science, interdisciplinary approach, and relevance of biology to society. Part II of a two-course sequence. Lecture 3 hours. Recitation and laboratory 3 hours. Total 6 hours per week. 4 credits

**Semester Credits: 4**

**Lecture Hours: 3**

**Laboratory Hours: 3**

#### Required Materials

##### **Textbooks:**

Campbell Biology in Focus. Urry, Cain, Wasserman, Minorsky & Reece. 3rd Edition. Pearson Publishing. ISBN: 9780135686027

Exploring Biology in the Laboratory Core Concepts. Pendarvis & Crawley. Custom Edition. Morton Publishing. ISBN: 9781617316371

#### Course Outcomes

**At the completion of this course, the student should be able to:**

- Demonstrate an understanding of the diversity of animal life, both invertebrate and vertebrate.
- Demonstrate a knowledge of the basic morphology, physiology, and evolution of the organ systems of animals, with emphasis on human anatomy and physiology, including respiration, circulation, digestion, endocrine, excretion and the reproductive system. While the emphasis will be on the human body, adaptations characteristic of other types of animals will also be discussed.
- Demonstrate a basic understanding of ecological concepts, such as biomes, population ecology, communities, and ecosystems.
- Demonstrate a knowledge of ecosystem energetics and man's impact on ecosystems.
- Demonstrate knowledge of the concepts of evolution, natural selection and the origin of species.
- Be familiar with evolutionary trends of plants.
- Discuss anatomical structures and physiological processes that occur in the flowering plants

## **Topical Description**

### **Animal Diversity**

#### **Chapter 27: The Rise of Animal Diversity**

- What is an Animal?
  - Differentiate between a pseudocoelom and a coelom
  - Explain the difference between protostomes and deuterostomes
  - Explain the evolution of the animal body plan in terms of symmetry,
  - Tissues and organ systems
  - Identify the characters that distinguish the major phyla
  - Identify the placement of humans among the animal phyla
  - Discuss human evolution

#### Protostomes:

- Phylum Porifera
  - Describe the different types of cell in the sponge body and their function
- Phylum Cnidaria – defining features
- Phylum Platyhelminthes – defining features
- Phylum Mollusca
  - List the defining features of phylum Mollusca
  - Describe representatives of the 4 best-known groups of mollusks
- Phylum Annelida
  - Distinguish between polychaetes, earthworms, and leeches
- Phylum Nematoda
  - Describe how musculature relates to the characteristic movement of nematodes
  - Explain the life cycle of a nematode and how it produces disease in humans
- Phylum Arthropoda
  - Name 4 key features of arthropods
  - Describe key differences in and list examples of the 4 classes of arthropods

#### Deuterostomes:

- Phylum Echinodermata
  - List the specific characteristics of echinoderms
- Nonvertebrate chordates
  - Recognize the 4 characteristics of all Chordates
- Vertebrate chordates
  - Distinguish vertebrates from invertebrate chordates
  - Describe the major groups of fishes and the evolutionary innovations of fishes
  - Describe the characteristics and major groups of amphibians
  - Explain the challenges of moving from an aquatic to a terrestrial environment and how various vertebrate groups have dealt with these challenges
  - Describe the characteristics of reptiles and compare examples of the major groups of reptiles
  - Explain the significance of the evolution of the amniotic egg
  - Name the key characteristics of birds
  - Explain why some consider birds to be one type of reptiles
  - Describe the characteristics of mammals and compare the 3 living groups

## Animal Organs and Organ Systems

### Chapter 32: The Internal Environment of Animals: Organization and Regulation

- Animal form and function
  - List the levels of organization in the vertebrate body
  - Overview of Organ Systems – identify and explain overall functions
- The endocrine system and its role in homeostasis
  - Compare and contrast positive feedback and negative feedback controls and how they maintain homeostasis in the human body, in particular temperature regulation
  - Endocrine glands, hormones, endocrine signaling pathways
  - Positive and negative feedback mechanisms in thermoregulation
- Osmoregulation and the excretory system
  - Comparisons among Animals
  - The Mammalian Kidney

### Chapter 33: Animal Nutrition – This chapter will be covered in the Fetal Pig and Human Anatomy labs.

- Obtaining and Processing Food
- Human Digestive System
- Comparisons among Animals
- Feedback circuits regulating digestion, energy allocation, and appetite

### Chapter 34: Circulation and Gas Exchange

- Invertebrate and Vertebrate Circulatory Systems
  - The Human Cardiovascular System
  - Blood Vessels – Arteries, Veins, and Capillaries
  - Blood Pressure and feedback mechanisms of pressure regulation
- Structure and Function of Blood
- Cardiovascular disease
- Mechanisms of Gas Exchange
- Comparison among Animals
- Transport of Gases in the Human Body
- Regulation and feedback mechanisms in gas exchange

### Chapter 35: The Immune System – This chapter will be covered in the Immunology Lab.

- Innate Defenses against Infection
  - Comparison among animals
  - Barrier defenses and Phagocytes
- Acquired Immunity
  - Antigens; B cell and T cell development and functions
  - Cell Mediated Immunity
  - Humoral Immunity and Antibody Protection
  - Active and passive immunity
  - Autoimmunity and Hyper sensitivity
  - Antibodies and ABO Blood Typing
  - Defeating Vertebrate Defenses – HIV

Chapter 36: Reproduction and Development – *Reproductive anatomy will be covered in the Fetal Pig and Human Anatomy labs.*

- Animal reproductive strategies
- Hormonal feedback regulation of male and female reproductive systems
- Vertebrate fertilization; contraception

Chapter 37: Neurons, Synapses, and Signaling

- Neuron structure and function
- Membrane potential and action potentials
- Conduction of action potentials and transmission across synapses
- Neurotransmitters

Chapter 39.1: Motor Mechanisms

- Structure of muscle fibers; types of vertebrate muscle
- Sarcomere function and muscle contraction
- Nervous control of muscle tension

Chapter 26: The Colonization of Land

- Origin and adaptations of plants
- Plant diversification
- Reproduction and development in the four major plant groups

Chapter 29: Plant Form and Function

- Transport structures in plants
- How transpiration drives water and mineral transport
- Transport of sugars

**Ecology**

Chapter 40: Population Ecology and the Distribution of Organisms

- Ecosystem effects of sun, wind and water
- Earth's biomes: terrestrial and aquatic habitats
- How interactions between organisms and the environment limit the distribution of species; biotic and abiotic factors
- Population density and dispersion; demographics
- Exponential and logistic growth of populations; life history traits and population dynamics

Chapter 41: Species Interactions

- Biological communities; species living together
- Ecological niches and natural selection
- Predator-prey relationships; the many types of species interactions
- Species diversity and trophic structures; bottom-up vs. top-down models
- Ecological succession, disturbance and biogeography
- Effects of disease on community structure

Chapter 42: Ecosystems and Energy

- Biogeochemical Cycles
- The Flow of Energy in Ecosystems
- Trophic-Level Interactions
- Restoration ecology; bioremediation and biological augmentation

Chapter 43: Global Ecology and Conservation Biology

- Human activities threaten Earth's biodiversity
  - Three levels of diversity
  - Biodiversity and human welfare; ecosystem services
  - Threats to biodiversity
- Population conservation focuses on population size, genetic diversity, and critical habitat
- Landscape and regional conservation help sustain biodiversity
- Human-caused nutrient enrichment, toxins, greenhouse gases and climate change
- Human population growth forecasts
- Sustainable development can improve human lives while conserving biodiversity

Lab Topics

- Understanding evolution and taxonomy
- Animal Diversity -basal animals, protostomes and deuterostomes (3 lab sessions)
- Animal tissues and the tissue characteristics
- Human skeletal system
- Fetal pig and human anatomy
  - Anatomy of the
    - digestive system
    - excretory system
    - respiratory system
    - human heart
  - Structure and Function of Human Male Reproductive System
  - Structure and Function of Human Female Reproductive System
- The immune system
- Tragedy of the Commons
- Plant Diversity
- Forest ecology – Fishburn field trip
- Ecosystems semester project

Notes to Instructors

1. Comprehensive study of the listed topics is beyond the reasonable expectations of a 15-week Biology 102 course. It is up to the discretion of the instructor to choose which topics are more detailed but each topic should be adequately covered.
2. Additional topics may be covered at Instructor's discretion.