

Virginia Western Community College

BIO 102

General Biology II

Prerequisites

A passing grade of D or higher in BIO 101 or equivalent.

Course Description

Focuses on diversity of life, anatomy and physiology of organisms, and ecosystem organization and processes 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 process of science, interdisciplinary approach, and relevance of biology to society. Explores fundamental characteristics of living matter from the molecular level to the ecological community with emphasis on general biological principles. Introduces the diversity of living organisms, their structure, function, and evolution. Part II of II.

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, ecosystems, and behavior.
- 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.

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

Protostomes:

- Phylum Porifera
 - Describe the different types of cell in the sponge body and their function
- Phylum Cnidaria
 - Explain the defining features of cnidarians
- Phylum Platyhelminthes
 - List the distinguishing features of flatworms
 - Describe representatives of the 3 best-known groups of flatworms
- Phylum Mollusca
 - List the defining features of phylum Mollusca
 - Describe representatives of the 4 best-known groups of mollusks
- Phylum Annelida
 - Explain how circular and longitudinal muscles in a segmented body facilitate movement
 - 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 advantages and disadvantages of an exoskeleton
 - Describe key differences in and list examples of the 4 classes of arthropods
 - Describe ecological roles of key examples of arthropods
 - Demonstrate an understanding of Arthropods and *Hox* genes

Deuterostomes:

- Phylum Echinodermata
 - List the specific characteristics of echinoderms
 - Describe the five classes of and list examples from the five classes of echinoderms
- Nonvertebrate chordates
 - Recognize the 4 characteristics of all Chordates
 - Describe the nonvertebrate chordates and their characteristics
- Vertebrate chordates
 - Distinguish vertebrates from other 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
 - Identify the types of tissues found in vertebrates – the following animal tissues should be included, along with their characteristic structures and their functions
 - Epithelial Tissue – Simple Versus Stratified, Squamous, Cuboidal, Columnar
 - Connective Tissue – Blood, Adipose, Dense Fibrous, Hyaline Cartilage, Bone
 - Muscle Tissue – Skeletal, Cardiac, and Smooth (Visceral)
 - Nervous Tissue
 - Overview of Organ Systems – identify and explain overall functions
- The endocrine system and its role in homeostasis
 - Describe homeostasis and explain how it works 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

- 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

- 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

- Animal reproductive strategies
- Structure and Function of Human Male Reproductive System
- Structure and Function of Human Female Reproductive System
- Hormonal feedback regulation of male and female reproductive systems
- Vertebrate fertilization and development; contraception
- Cleavage and the Blastula Stage
- Gastrulation
- Organogenesis

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: Motor Mechanisms and Behavior

- Structure of muscle fibers; types of vertebrate muscle
- Sarcomere function and muscle contraction
- Nervous control of muscle tension
- Types of Skeletons
- The Structure of Bone
- Joints and Skeletal Movement
- How sensory inputs stimulate simple and complex behaviors; behavioral ecology
- Vertebrate learning and behavior, including foraging and mating behavior

EcologyChapter 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 -protostomes and deuterostomes
- Animal tissues
- Human skeletal system
- Fetal pig and human anatomy
- Animal development
- Immunology
- Forest ecology – Fishburn field trip
- Water resources – Crystal Springs field trip

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.