

# Virginia Western Community College

## BIO 101

### General Biology I

#### Prerequisites

MDE 10 or equivalent, or a high school GPA of 3.0 or higher if less than 6 years since graduation.

#### 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 I of a two-course sequence. Assignments require college-level reading fluency, coherent written communication, and basic mathematical skills. This is a Passport Transfer course. Lecture 3 hours. Recitation and laboratory 3 hours. Total 6 hours per week. 4 credits

#### Required Materials

##### **Textbooks:**

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

Virginia Western Community College Biology 101 Lab Manual. Fall 2023

#### Course Outcomes

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

- Describe the main themes in the study of life
- Explain the chemistry of life, including basic structure and properties of biological macromolecules
- Describe the structures within and surrounding the cell, giving their function
- Explain the cellular processes of cell respiration and photosynthesis
- Explain the processes of mitosis and meiosis
- Describe Mendel's laws and some of their variation
- Discuss some of the phenomena explained by the chromosomal basis of inheritance
- Describe the discovery and some of the properties of DNA
- Explain how a gene may ultimately produce a protein
- Understand the structure, function, and major classification of prokaryotes
- Be familiar with evolutionary trends of protists and fungi

## Topical Description

### Chapter 1: Introduction: Evolution and the Foundations of Biology

- Unifying themes in biology
- Evolution accounts for the unity and diversity of life
- The process of science

### Chapter 2: The Chemical Context of Life

- Elements, Atoms, and Compounds
- Chemical Bonds
- Water's Life Supporting Properties
- Acids and bases

### Chapter 3: Carbon and the Molecular Diversity of Life

- Introduction to Organic Compounds
- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids
- How genomics and proteomics have changed biological inquiry

### Chapter 4: A Tour of the Cell

- Cell theory
- Microscopy
- Comparing Prokaryotes and Eukaryotes
- Eukaryotic organelles

### Chapter 5: Membrane Transport and Cell Signaling

- Membrane Structure and Function
- Transport across membranes
- Osmosis
- Active transport across membranes
- Local and Long distance signaling
- Receptors
- Signal Transduction

### Chapter 6: Metabolism

- Thermodynamics
- ATP cycle
- Enzymes
- Regulation of enzyme activity

### Chapter 7: Cellular Respiration and Fermentation

- Redox reactions
- Glycolysis
- Pyruvate oxidation and the Krebs cycle
- Electron transport and chemiosmosis

- Fermentation and anaerobic respiration
- Additional metabolic pathways

#### Chapter 8: Photosynthesis

- Autotrophs and chloroplast structure
- Photosynthesis as a redox reaction
- Chlorophyll, light absorption, and photosynthesis
- Light-dependent reactions
- Calvin cycle
- Photorespiration and alternative methods of carbon fixation

#### Chapter 9: The Cell Cycle

- Eukaryotic chromosomes
- Cell Cycle
- Mitosis
- Binary fission
- Control of the cell cycle

#### Chapter 10: Meiosis and Sexual Life Cycles

- Sexual vs. asexual reproduction
- Chromosomes and alternating sexual life cycles
- Process of meiosis
- Meiosis vs. mitosis

#### Chapter 11: Mendel and the Gene Idea

- Principle of gene segregation
- Monohybrid and dihybrid crosses
- Extensions to Mendel's Laws
- Pedigree Analysis and common genetic disorders

#### Chapter 12: The Chromosomal Basis of Inheritance

- Sex chromosomes
- Linked genes
- Human chromosomal genetic disorders

#### Chapter 13: The Molecular Basis of Inheritance

- Discovery of DNA
- DNA Structure
- DNA replication
- DNA and genetic engineering

#### Chapter 14: Gene Expression: From Gene to Protein

- Central Dogma
- Genetic code
- Transcription
- Translation

- Protein synthesis in prokaryotes vs. eukaryotes
- Mutations

#### Chapter 15: Control of Gene Expression

- Prokaryotic regulation: Lac operon, Trp Operon
- Eukaryotic regulation
- Chromatin structure
- Posttranscriptional regulation
- Role of noncoding RNA in controlling gene expression

#### Chapter 17: Viruses

- Viral structure and genomes
- Viral replication
- Emerging viruses
- Prions

#### Chapter 19: Descent with Modification

- The development of the theory of evolution
- Descent with modification
- Evidence for natural selection
- Convergent evolution

#### Chapter 21: The Evolution of Populations

- Genetic variation within populations and formation of new alleles
- Hardy-Weinberg equation
- How natural selection, genetic drift, and gene flow affect allele frequencies
- Mechanisms of natural selection and why natural selection is not perfect

#### Chapter 24: Early Life and the Diversification of Prokaryotes

- Appearance of early life on Earth
- Prokaryotic structure and metabolism
- Prokaryotic reproduction
- Prokaryotic diversity
- Beneficial prokaryotes
- Human bacterial diseases

#### Chapter 25: The Origin and Diversification of Eukaryotes

- Endosymbiotic theory
- Origins of multicellularity
- Classification and diversity of Protists
- Protist ecology and effects on human health

#### Chapter 26: The Colonization of Land

- Origin, adaptations and diversification of fungi (26.2)

Laboratory Topics

- Scientific Measurements
- Scientific Method and Experimental Design
- Microscopy and Cells
- Biological Molecules
- Diffusion and Osmosis
- Enzymes
- Cellular Respiration
- Photosynthesis/Chromatography
- Mitosis, Meiosis, and Inheritance
- DNA Technology
- Protist and Fungal Diversity

Notes to Instructors

1. Departmental policy dictates that instructors do not allow students to keep tests.
2. A comprehensive final exam counting 15%-20% of the total grade will be given at the end of the semester.
3. The syllabus should state what the course grade will be based on, such as tests, quizzes, a comprehensive final exam, and any other assignments made by the instructor.
4. The VWCC Biology Department uses a 10-point grading scale.
5. Comprehensive study of the listed topics is beyond the reasonable expectations of a 15-week Biology 101 course. It is up to the discretion of the instructor to choose which topics are more detailed but each topic should be adequately covered.
6. Additional topics may be covered at the instructor's discretion.