Virginia Western Community College
BIO 101
General Biology I

Prerequisites

MTE 1-5 or 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:
Biology. Hawkes Learning. 2024. ISBN: 978-1-64277-644-7; hard copies are optional, but an online subscription to the eText and homework platform is required.

Virginia Western Community College Biology 101 Lab Manual.

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: The Nature of Biology
- Thinking Like a Biologist
- Themes in Biology

Chapter 2: Basic Chemistry for Biology
- The Building Blocks: Atoms, Isotopies, Ions, and Molecules
- Properties of Water
- The Importance of Carbon

Chapter 3: Biological Macromolecules
- Synthesis of Macromolecules
- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids

Chapter 4: Cell Structure
- Prokaryotic Cells
- Eukaryotic Cells
- The Endomembrane System
- *(may want to incorporate 23.1-Endosymbiosis here)*
- The Cytoskeleton

Chapter 5: Structure and Function of Membranes
- Plasma Membrane Components and Structure
- Passive Transport and Diffusion
- Active Transport and the Sodium-Potassium Pump
- Transport of Multiple Molecules
- Cell Surface and Interaction

Chapter 6: Bioenergetics
- Energy and Metabolism
- Potential, Kinetic, Free, and Activation Energy
- The Laws of Thermodynamics
- ATP: Adenosine Triphosphate
- Metabolic Pathways and Enzymes

Chapter 7: Cellular Respiration
- Energy in Living Systems
- Glycolysis
- Pyruvate oxidation and the Citric Acid Cycle
- Electron Transport Chain and Oxidative Phosphorylation
- Fermentation
  (Skip sections 7.6 and 7.7)

Chapter 8: Photosynthesis

- Overview of Photosynthesis
- The Light-Dependent Reactions
- The Calvin Cycle and Glucose Synthesis
- Photorespiration, C4 and CAM photosynthesis *(this is not in the textbook and will need to be added by the instructor.)*

(Ch. 9: Cell Communication-this is not required by Transfer VA, but may be taught at the instructor's discretion)

Chapter 10: Cell Reproduction

- Components of Genomes
- The Cell Cycle and Mitosis
- Regulation of the cell cycle
- Prokaryotic Cell Division

Chapter 11: Meiosis and Sexual Reproduction

- The Process of Meiosis
- Sexual Reproduction

Chapter 12: Mendelian Genetics

- Mendel's Experiments and the Laws of Probability *(Skip Probability Basics pg. 321-22)*
- Characteristics and Traits
- Laws of Inheritance *(Skip Forked Line and Probability Methods pg. 334-35)*

Chapter 13: Modern Genetics and Inheritance

- Chromosomal Theory and Genetic Linkage
- Chromosomal Basis for Inheritance

Chapter 14: DNA: Deoxyribonucleic Acid

- A Modern Understanding of DNA
- DNA Structure and Sequencing
- DNA replication and Prokaryotes
- DNA Replication in Eukaryotes
- Mutations and DNA Repair *(may be moved to the end of ch. 15)*

Chapter 15: Genes and Proteins

- Genetic code
- Prokaryotic Transcription
- Eukaryotic Transcription
- RNA Processing in Eukaryotes
- Protein synthesis
- *(May move 14.5 Mutations here)*

(Ch. 16: Gene Expression - may be taught at instructor's discretion; 16.4 "What is Cancer" will be discussed in lab.)

(Ch. 17: Biotechnology and Genomics - may be taught at instructor's discretion; 17.1 "The Field of Biotechnology" will be discussed in lab.)

Chapter 18: Evolution and the Origin of Species

- 18.1: Understanding Evolution *(Skip 18.2 and 18.3)*

Chapter 21: Viruses

- Viral Evolution, Morphology, and Classification
- Virus Infections and Hosts
- Prevention and Treatment of Viral Infections *(skip prions and viroids)*

Chapter 22: Prokaryotes: Bacteria and Archaea

- Prokaryotic diversity
- Structure of Prokaryotes: Bacteria and Archaea *(skip pg. 586-88)*
- Prokaryotic Metabolism
- Bacterial Diseases in Humans
- Beneficial Bacteria

(A survey of Ch. 23: Protists and Ch. 24: Fungi will be covered in Lab.)

Laboratory Topics

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

Notes to Instructors

1. Making use of the "Evolution Connection" in each chapter will strengthen the concept of evolution.
2. Departmental policy dictates that instructors do not allow students to keep tests.
3. A comprehensive final exam counting 15%-20% of the total grade will be given at the end of the semester.
4. 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.
5. The VWCC Biology Department uses a 10-point grading scale.
6. 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.
7. Additional topics may be covered at the instructor's discretion.

ADA Statement (PDF)
Title IX Statement (PDF)