

## Comprehensive Biology

**COURSE DESCRIPTION:** In this comprehensive course, students investigate the chemistry of living things: the cell, genetics, evolution, the structure and function of living things, and ecology. The program consists of in-depth online lessons including extensive animations, an associated reference book, collaborative explorations, virtual laboratories, and hands-on laboratory experiments students can conduct at home.

**PREREQUISITES:** Middle School Life Science, or equivalent

**COURSE LENGTH:** Two Semesters

**REQUIRED TEXT:** Biology: A Reference Guide

**MATERIALS LIST:** No required materials for this course

### COURSE OUTLINE:

#### Semester 1

##### Unit 1: The Science of Biology

- Semester Introduction
- Biology and Scientific Methods
- Scientific Processes 1
- Scientific Processes 2
- Laboratory: Using a Microscope
- The Characteristics of Life 1
- The Characteristics of Life 2
- The Characteristics of Life 3
- Energy and Life
- Structure and Function

##### Unit 2: The Chemistry of Life

- Chemistry Review
- Chemical Bonds
- Carbon and Life
- Organic Compounds and Trace Elements

- Ions in Living Things
- Useful Chemicals from Living Things
- Water
- Laboratory: Investigating Biological Compounds 1
- Laboratory: Investigating Biological Compounds 2
- Simple Carbohydrates
- Complex Carbohydrates
- Lipids
- Amino Acids and Proteins
- Levels of Protein Structure
- Proteins as Enzymes
- Nucleic Acids
- ATP

### **Unit 3: Cell Biology**

- The Cell and Life
- Cell Structure
- Cell Organelles
- Two Types of Cells
- Cell Membrane Structure
- Movement Across Membranes
- Passive Transport
- Active Transport
- Laboratory: Determining the Rate of Diffusion 1
- Laboratory: Determining the Rate of Diffusion 2
- Glycolysis and Fermentation
- The Krebs Cycle
- The Electron Transport System
- Light and Photosynthesis
- Photosynthesis and Glucose
- Chemical Energy and Life
- Respiration and Photosynthesis
- Laboratory: The Rate of Photosynthesis 1
- Laboratory: The Rate of Photosynthesis 2

- Reproduction and Development
- Mitosis
- Laboratory: Observing Mitosis
- Cell Differentiation
- Cell Specialization
- Sexual Reproduction
- Meiosis I
- Meiosis II

#### **Unit 4: Mendelian Genetics**

- The Work of Gregor Mendel
- Mendelian Inheritance
- Laboratory: Genetic Crosses 1
- Laboratory: Genetic Crosses 2
- Pedigrees
- Laboratory: Gene Mapping
- Chromosomes and Genes
- Genes and Alleles
- Genetic Variation

#### **Unit 5: Molecular Genetics**

- DNA, RNA, and Proteins
- Structure of DNA
- Structures of RNA
- DNA Replication
- Transcription
- Laboratory: Modeling DNA
- Laboratory: Modeling DNA Replication
- DNA Makes RNA
- RNA Makes Protein
- The Genetic Code

#### **Unit 6: Semester Review and Test**

- Semester Review

- Semester Test

## **Semester 2**

### **Unit 1: Gene Expression**

- Semester Introduction
- Proteins Express DNA
- How Proteins Work
- Gene Expression 1
- Gene Expression 2
- Biotechnology
- Genetic Engineering

### **Unit 2: Evolution**

- Evolution and Biology
- Evolution of Populations
- Multiplying Variation in Populations
- Types of Natural Selection
- History of Evolutionary Thought
- Evidence for Evolution 1
- Evidence for Evolution 2
- Evolution and Earth History
- Laboratory: Process of Natural Selection 1
- Laboratory: Process of Natural Selection 2
- Genetic Basis of Evolution
- The Hardy-Weinberg Equation
- Geographic Isolation
- Genetic Isolation

### **Unit 3: Survey of Living Things 1**

- Classification and Taxonomy
- Modern Classification
- Laboratory: Dichotomous Key
- Viruses and Prokaryotes

- Protists and Fungi
- Animals
- Plants
- Three Representative Organisms
- Getting Energy
- Digestion
- Digestion in Humans
- Laboratory: Human Digestion Actions 1
- Waste Removal
- Laboratory: Human Digestion Actions 2
- Waste Removal in Humans
- Obtaining Oxygen
- **Oxygen and the Human Body**

#### **Unit 4: Survey of Living Things 2**

- How Organisms Monitor Their Environments
- Human Nervous System
- Feedback Mechanisms
- How Living Things Respond to Their Environments
- Muscular Systems
- How Muscles Contract
- Laboratory: Chicken Muscles 1
- Laboratory: Chicken Muscles 2
- Fern Reproduction
- Flatworm Reproduction
- Human Reproduction
- How Organisms Defend Themselves
- Human Immune Response 1
- Human Immune Response 2
- Plant Defenses

#### **Unit 5: Ecology and the Environment**

- Individuals and Populations
- **Communities**

- Ecosystems
- Ecosystem Stability
- Biomes
- Biodiversity
- Energy Flow in Ecosystems
- Food Chains and Food Webs
- Succession
- Laboratory: Patterns of Succession
- Changes in Ecosystems
- Water and Nitrogen Cycles
- Carbon and Oxygen Cycles
- Laboratory: Fixation in Root Nodules 1
- Laboratory: Fixation in Root Nodules 2
- Laboratory: The Effects of Acidity on Seed Germination 1
- Natural Resources
- Environmental Challenges
- Global Temperatures
- Pollution
- Laboratory: The Effects of Acidity on Seed Germination 2

#### **Unit 6: Semester Review and Test**

- Semester Review
- Semester Test