



# SCI202: Biology

In this course, students focus on the chemistry of living things: the cell, genetics, evolution, the structure and function of living things, and ecology. Students follow a program of online study days alternating with review-and-assessment days. Lessons include extensive animations, hands-on laboratory activities, reference book study, and collaborative activities with virtual classmates.

**COURSE LENGTH:** Two semesters

**MATERIALS: BIOLOGY:** *A Reference Guide*; materials for laboratory experiments, including a compound microscope

**PREREQUISITES:** K<sup>12</sup> middle school Life Science, or equivalent

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## SEMESTER ONE

### Unit 1: The Science of Biology

Students explore biology as one of the sciences and confront the concepts of scientific methods. After exploring scientific processes as they apply to biology, students examine what “life” means as they investigate the characteristics that all living things share. Students then look at the importance of energy, what kinds of energy are significant when considering living things, and the relationship of structures of living things to their functions.

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

### Unit 2: The Chemistry of Life

Students explore the chemical basis for life by examining the most important groups of organic compounds: carbohydrates, proteins, lipids, and nucleic acids. Students then examine water and how it is important for living things. In each case, students focus on the relationship of the molecular structure of compounds to its function in living things.

- Chemistry Review
- Chemical Bonds
- Review: Chemical Bonds
- Carbon and Life
- Review: Carbon and Life
- Water
- Review: Water

- Laboratory: Investigating Biological Compounds 1
- Laboratory: Investigating Biological Compounds 2
- Simple Carbohydrates
- Complex Carbohydrates
- Review: Carbohydrates
- Lipids
- Review: Lipids
- Amino Acids and Proteins
- Proteins as Enzymes
- Review: Proteins
- Nucleic Acids
- Review: Nucleic Acids
- ATP
- Review: ATP

### Unit 3: Cell Biology

Students now are able to begin looking at the structure and function of living things. They begin with an exploration of the cell. They confront the structure of the cell, its membranes and organelles. In particular, they look at the processes by which cells gather and make energy available, focusing on the activities of the mitochondrion and the chloroplast. Students then proceed to look at cellular reproduction and study the processes of meiosis and mitosis.

- The Cell and Life
- Cell Structure
- Cell Organelles
- Review: Cell Life, Structure, and Organelles
- Two Types of Cells
- Review: Two Types of Cells
- Cell Membrane Structure
- Movement Across Membranes
- Review: Cell Structure and Movement
- Laboratory: Determining the Rate of Diffusion 1
- Laboratory: Determining the Rate of Diffusion 2
- Chemical Energy and Life
- Review: Chemical Energy
- Respiration and Photosynthesis
- Review: Respiration and Photosynthesis
- Laboratory: The Rate of Photosynthesis 1
- Laboratory: The Rate of Photosynthesis 2
- Reproduction and Development
- Mitosis
- Review: Reproduction, Development and Mitosis
- Laboratory: Observing Mitosis
- Cell Differentiation
- Review: Cell Differentiation
- Cell Specialization
- Review: Cell Specialization

- Sexual Reproduction
- Meiosis I
- Meiosis II
- Review: Sexual Reproduction and Meiosis

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

Students learn about the work of Gregor Mendel as a way of studying modern genetics. They perform genetic crosses and begin to see how traits are inherited. As they examine Mendelian genetics more closely, they see the relationship between inheritance and chromosomes and between genes and alleles. This unit prepares students to go deeper into genetics at the molecular level. Then students learn how the process of proteins synthesis is controlled, a process called gene expression.

- The Work of Gregor Mendel
- Mendelian Inheritance
- Review: Mendel and Mendelian Inheritance
- Laboratory: Genetic Crosses 1
- Laboratory: Genetic Crosses 2
- Chromosomes and Genes
- Genes and Alleles
- Review: Chromosomes, Genes, and Alleles
- Proteins Express DNA
- Review: Proteins Express DNA

#### **Unit 5: Semester Review and Test**

- Semester Review
- Semester Test

### **SEMESTER TWO**

#### **Unit 1: Molecular Genetics**

The chemical basis for genetics is one of the cornerstones of modern biology. In this unit, students explore the relationship between DNA, RNA, and proteins—and what this has to do with genes and inheritance. After establishing a firm basis in molecular genetics, students are able to understand modern applications of genetics, including biotechnology and genetic engineering.

- Semester Introduction
- DNA, RNA, and Proteins
- Structure of DNA
- Review: Structure of DNA
- Structures of RNA
- Review: Structures of RNA
- DNA Replication
- Review: DNA Replication
- Laboratory: Modeling DNA
- Laboratory: Modeling DNA Replication
- DNA Makes RNA
- Review: DNA Makes RNA
- RNA Makes Protein

- Review: RNA Makes Protein
- The Genetic Code
- Review: The Genetic Code

## Unit 2: Evolution

Evolution is the central organizing principle of biology. Students learn about the concept of evolution and the underlying principles of natural selection. Once they have mastered the fundamental principles, they learn how modern evolution is a science that includes gene changes over time as the underlying mechanism for evolution.

- Evolution and Biology
- Evolution of Populations
- Review: Evolution Biology and Populations
- Variation in Populations
- Types of Natural Selection
- Review: Variation and Types of Natural Selection
- Evidence for Evolution 1
- Evidence for Evolution 2
- Evolution and Earth History
- Review: Evidence for Evolution and Earth History
- Laboratory: Process of Natural Selection 1
- Laboratory: Process of Natural Selection 2
- Genetic Basis of Evolution
- Review: Genetic Basis for Evolution
- Classification and Taxonomy
- Modern Classification
- Review: Classification, Taxonomy
- Laboratory: Dichotomous Key

## Unit 3: Systems of Living Things

Students learn about the structure and function of living things by examining systems of living things, focusing on human biology. They explore the digestive, respiratory, nervous, reproductive, and muscular systems and see how these systems aid in responding to the organism's environment.

- Getting Energy
- Review: Getting Energy
- Digestion in Humans
- Laboratory: Human Digestion Actions 1
- Review: Digestion in Human
- Laboratory: Human Digestion Actions 2
- Oxygen and the Human Body
- Review: Oxygen and the Human Body
- Human Nervous System
- Review: Human Nervous System
- Muscular Systems
- Review: Muscular Systems
- How Muscles Contract

- Review: How Muscles Contract
- Laboratory: Chicken Muscles 1
- Laboratory: Chicken Muscles 2
- Fern Reproduction
- Review: Fern Reproduction
- Human Reproduction
- Review: Human Reproduction
- Human Immune Response 1
- Human Immune Response 2
- Review: Human Immune Response

#### **Unit 4: Ecology and the Environment**

As students have moved through this curriculum, they have learned about living things, their structure, and functions. In this unit, they confront organisms in relationship to their environments. Students study living things and the ecosystems in which they live, examining both the biotic and abiotic components of the world in which organisms exist.

- Ecosystems
- Biomes
- Review: Ecosystems and Biomes
- Energy Flow in Ecosystems
- Food Chains and Food Webs
- Review: Energy Flow, Food Chains, and Webs
- Succession
- Review: Succession
- Laboratory: Patterns of Succession
- Laboratory: The Effects of Acidity on Seed Germination 1
- Water and Nitrogen Cycles
- Review: Water and Nitrogen Cycles
- Laboratory: Fixation in Root Nodules 1
- Laboratory: Fixation in Root Nodules 2
- Laboratory: The Effects of Acidity on Seed Germination 2

#### **Unit 5: Semester Review and Test**

- Semester Review
- Semester Test