



SCI203: Biology

This course, for students who have been introduced to biology topics in middle school, focuses on topics in cell chemistry and biology, genetics, evolution, the biology of living things, and ecology. Students use a combination of online instruction with animations, hands-on laboratory activities, reference book study, and collaborative activities with virtual classmates. This course prepares students to take AP® Biology or any beginning-level college biology course.

COURSE LENGTH: Two semesters

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

PREREQUISITES: K¹² middle school Life Science, or equivalent

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
- 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

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
- 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

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
- 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

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.

- 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

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.

- 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 TWO

Unit 1: Gene Expression

In this unit, students explore the process by which the DNA–RNA relationship builds proteins. Then students learn how the process of proteins synthesis is controlled, a process called gene expression. Students then are able to understand modern applications of genetics, including biotechnology and genetic engineering.

- Semester Introduction
- Proteins Express DNA
- How Proteins Work
- Gene Expression 1



- Gene Expression 2
- Biotechnology
- Genetic Engineering

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
- 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

Students learn about the structure and function of living things by examining three representative organisms: a flatworm, a fern, and a human. In doing so, students examine processes such as digestion and respiration—comparing and contrasting how living things obtain food, break down food, eliminate waste, and obtain and use oxygen.

- 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

Students continue their examination of living things, focusing on three representative organisms. They explore the nervous and muscular systems and see how these systems aid in responding to the organism's environment. Students then examine various aspects of reproduction among living things and finish with a study of defense.

- 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

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.

- 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