Honors Biology

COURSE DESCRIPTION: This course provides students with a challenging honors-level biology curriculum, focusing on the chemistry of living things: the cell, genetics, evolution, the structure and function of living things, and ecology. The program consists of advanced online lessons including extensive animations, an associated reference book, collaborative explorations, and hands-on laboratory experiments students can conduct at home. Honors activities include debates, research papers, extended collaborative laboratories, and virtual laboratories.

PREREQUISITES: Middle school Life Science, or equivalent, success in previous science course, and teacher/school counselor recommendation

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

- Introduction
- Biology and Scientific Methods
- Scientific Processes
- Laboratory: Using a Microscope
- The Characteristics of Life
- 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
- 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
- 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
- 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 1 Review and Test

Unit 7: Honors Project 1: Research Paper

- Planning Your Research Paper
- Finding and Using Information for Your Paper

- Organizing Notes and Developing an Outline
- Writing Your Paper
- Creating a Works Cited Page
- Revising and Proofreading Your Paper

Unit 8: Honors Project 2: Laboratory: The Rate of Photosynthesis

- Laboratory: The Rate of Photosynthesis 1
- Laboratory: The Rate of Photosynthesis 2

Semester 2

Unit 1: Gene Expression

- Introduction
- Proteins Express DNA
- How Proteins Work
- Gene Expression
- 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
- Evolution and Earth History
- Laboratory: The Process of Natural Selection
- 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
- Waste Removal
- 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
- Fern Reproduction
- Flatworm Reproduction
- Human Reproduction
- How Organisms Defend Themselves
- Human Immune Response
- 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
- Laboratory: The Effects of Acidity on Seed Germination
- Natural Resources
- Environmental Challenges
- Global Temperatures
- Pollution

Unit 6: Semester 2 Review and Test

Unit 7: Honors Project 1: Virtual Lab: Antibiotic Resistance

- Virtual Lab: Antibiotic Resistance

Unit 8: Honors Project 2: Issues in Science: Online Debate

- Debates: A Different Way to Argue
- Gathering Evidence
- Building a Case
- Reasoning and Refutation
- Effective Debating Strategies
- Debate: Constructive Argument
- Debate: First Rebuttal
- Debate: Second Rebuttal
- Debate: Summary Argument