



Biology Course Syllabus

Course Description

In Biology, students will be introduced to the living world by studying structure, function, and processes at both the macro-level and the micro-level. Students will begin their study at the micro-level, learning about biological chemistry, cell biology, and genetics. By the end of the course students will focus their learning on explaining the diversity of life as a result of evolution and how those living organisms interact within ecosystems. Laboratory investigations incorporate procedures and develop students' ability to synthesize and analyze information. Students will continue to develop their skills in reading and writing through lab reports and research projects. Technology is utilized throughout the course through virtual labs, videos, activities, and readings about each area of study.

Part 1: 5 credit hours

Part 2: 5 credit hours

Course Outline

Unit 1: The Study of Life

- 1.1 The Nature of Science
- 1.2 What is Biology?
- 1.3 The Chemistry of Life

Lab Activity

Experimental Design with Radish Seeds
Enzyme Buster

Unit 2: The Basic Unit of Life

- 2.1 Basic Cell Structure
- 2.2 Photosynthesis
- 2.3 Cellular Respiration
- 2.4 Mitosis

Lab Activity

Egg Osmosis
Photosynthetic Plant Pigments

Next Generation Science Standards

Biology, Part 1

In Unit 1 students will be introduced to the nature of science. They will think critically about what science is and what science is not. Students will use science and engineering practices to design their own lab about plant growth. Students will analyze the characteristics of life. Students will examine the chemical building blocks of life, including the importance of carbon, and discuss how these elements combine to form important macro-molecules.

HS-LS1-6, Nature of Science (Scientific Investigations Use a Variety of Methods) and Science and Engineering Practices (Planning and Carrying Out Investigations).

In Unit 2 students will use multiple sources to examine cells, the basic unit of life. The structures and functions of the cell organelles in prokaryotic and eukaryotic organisms will be compared. Key cell processes, including photosynthesis, respiration, and mitosis will be modeled.

HS-LS1-4, HS-LS1-5, HS-LS1-7, Science and Engineering Practices (Developing and Using Models)



Unit 3: Molecular Genetics

- 3.1 Introduction to DNA
- 3.2 Replication
- 3.3 Transcription and Translation
- 3.4 Genetic Advances

Lab Activity

DNA – From Replication to Transcription and Translation to Mutation
DNA Extraction

Unit 4: Heredity

- 4.1 Meiosis
- 4.2 Inherited Human Traits
- 4.3 Punnett Squares

Lab Activity

Inherited Human Traits

Unit 5: Explaining Biodiversity

- 5.1 A Brief History of Life
- 5.2 Darwin's Theory
- 5.3 Speciation

Lab Activity

Woolybooger Competition
Lizard Evolution

In Unit 3 students will begin their study of molecular genetics by studying the structure and function of DNA. Using this knowledge, students will learn about the complex processes of replication, transcription, and translation. Students will be able to explain how the structure of DNA determines the structure of proteins that carry out essential functions. Students will analyze ethical, moral, and legal issues surrounding genetic advances.

HS-LS1-1, Science and Engineering Practices (Constructing Explanations and Designing Solutions)

In Unit 4 students will gain an appreciation for genetics and the inheritance of organisms' traits from their ancestors. Connections between the role of DNA and the coding of inherited traits will be examined. Students will compare the process of meiosis to mitosis. The causes of genetic variation, including nature vs. nurture, will be discussed. Students will use Punnett squares to determine the probability of expressed traits in a population.

HS-LS3-1, HS-LS3-2, HS-LS3-3, Science and Engineering Practices (Asking Questions and Defining Problems, Analyzing and Interpreting Data, Engaging in Argument from Evidence), Nature of Science (Science is a Human Endeavor)

In Unit 5 students will examine various sources of information describing the diversity of life on Earth and construct an explanation based on evidence which explains the process of evolution by natural selection. Students will apply their knowledge of heredity to explain advantageous heritable traits in populations and how these populations change over time. Students will explain how changes in environmental conditions, including human activity, can result in changes to biodiversity.

HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6, Science and Engineering Practices (Analyzing and Interpreting Data, Using Mathematical and Computational Thinking, Constructing Explanations and Designing Solutions), Nature of Science (Scientific Knowledge Assumes and Order and Consistency in Natural Systems)



Unit 6: Bacteria, Viruses, & Protists

6.1 Classification

6.2 Viruses

6.3 Bacteria

6.4 Protists

Lab Activity

Making a Cladogram

Investigating Protists

In Unit 6 students will create cladograms in order to demonstrate evolutionary relationships between organisms. They will be able to explain how organisms are classified. Students will examine the distinguishing characteristics of bacteria, viruses, and protists. The ecological importance of these simple organisms will be examined.

HS-LS4-6, Disciplinary Core Idea LS4.D: Biodiversity and Humans

Course Outline

Unit 1: Fungi

- 1.1 Characteristics and Classification of Fungi
- 1.2 Fungal Diseases
- 1.3 Cool Fungi Adaptations

Lab Activity

Exploring Fungi

Unit 2: Plants

- 2.1 Plant Cell Review and Introduction to Kingdom Plantae
- 2.2. Non-Vascular Plants
- 2.3 Vascular Plants
- 2.4 Cool Plant Adaptations

Lab Activity

Exploring Plants

Flower Dissection

Unit 3: Invertebrates

- 3.1 Sponges
- 3.2 Cnidarians
- 3.3 Worms
- 3.4 Arthropods
- 3.5 Molluscs and Echinoderms

Lab Activity

Virtual Earthworm Dissection

Invertebrate Survey

Unit 4: Chordates

- 4.1 Non-vertebrate Chordates
- 4.2 Fish
- 4.3 Reptiles and Birds
- 4.4 Amphibians
- 4.5 Mammals
- 4.6 Animal Behavior

Next Generation Science Standards

Biology, Part 2

In Unit 1 students will learn about the biodiversity of fungi, including their distinguishing characteristics and adaptations they have to various environments.

Interactions between humans and fungi will be examined through common fungal diseases.

Disciplinary Core Idea LS4.D: Biodiversity and Humans

In Unit 2 students will begin their study of plants with a review of plant cells. Non-vascular and vascular plants will be compared, including their distinguishing characteristics, methods of reproduction, and anatomy

and physiology. Students will examine how plants are adapted to various environments.

Disciplinary Core Idea LS4.D: Biodiversity and Humans

In Unit 3 students will examine the distinguishing characteristics of the different groups of invertebrates.

Students will learn about adaptations of each group of organisms as well as their role in the natural world. Relationships between invertebrates and other groups of organisms will be studied. Students will take an in-depth look at the anatomy and physiology of an earthworm.

Disciplinary Core Idea LS4.D: Biodiversity and Humans

In Unit 4 students will learn about the distinguishing characteristics of vertebrate organisms.

The basic anatomy and physiology of chordates as well as their ecological role will be examined. Students will take an in-depth look at the anatomy and physiology of a frog for a comparison to the earthworm. Students will compare different types of animal behavior and



Lab Activity

Virtual Frog Dissection
Animal Behavior

Unit 5: Human Anatomy

- 5.1 Skeletal and Muscular Systems
- 5.2 Integumentary and Nervous Systems
- 5.3 Circulatory and Respiratory Systems
- 5.4 Digestive and Excretory Systems
- 5.5 Endocrine and Reproductive Systems
- 5.6 The Immune System

Lab Activity

Heart Rate
Reaction Rate

Unit 6: Ecology

- 6.1 The Biosphere
- 6.2 Ecosystems and Communities
- 6.3 Populations
- 6.4 Human Impacts

Lab Activity

Modeling Populations
Exploring Trophic Cascades

consider their costs and benefits.

Disciplinary Core Idea LS4.D: Biodiversity and Humans

In Unit 5 students will learn about each major system within the human body, including the major organs and their functions. Disorders and diseases will be researched by students for each system. An emphasis will be placed on how these systems maintain homeostasis.

Disciplinary Core Idea LS1-2: Molecules to Organisms – Structures and Processes

In unit 6 students will learn about Ecology. They will begin their study at the biosphere level and progress to population interactions. Students will use models to examine a variety of concepts, including carrying capacity, the flow of energy within an ecosystem, the carbon cycle, and the cycling of matter. The complex interactions within ecosystems will be studied through a variety of sources. Finally, students will evaluate evidence for human impacts on the environment and biodiversity.

HS-LS2-1, HS-LS2-2, HS-LS2-3, HS-LS2-4, HS-LS2-5, HS-LS2-6, HS-LS2-7, HS-LS2-8. Science and Engineering Practices (Developing and Using Models, Using Mathematics and Computational Thinking, Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence), Connections to Nature of Science (Scientific Knowledge is Open to Revision in Light of New Evidence).