Advanced Life Science

Course Outline

Life on Earth

What are some of the characteristics of life? What is the relationship between the chemicals that make up our world and living things? These and other question are asked and answered in this unit. Students will also do a laboratory on the chemical breakdown of proteins.

- Introduction to Life Science
- Diversity of Life
- Characteristics of Life
- Chemistry of Life
- Laboratory: Protein Breaks Down Protein

The Organisms in Their Worlds

This unit gives a big picture of life on earth by placing organisms in their environments. The study of ecology involves studying the interrelationships between an organism and its physical and biological surroundings. A laboratory involving testing for toxicity brings home the concept that the health of an organism is directly tied to the quality of its ecological world.

- The Organism and Its Environment
- Behavior and Symbiotic Relationships
- Food Chains and Food Webs
- The Ecosystem and Energy Flow
- Energy and Biomass Pyramids
- Populations and Biomes
- Laboratory: Toxicity Testing

History of Life on Earth

This unit deals with evolution and its relationship to life on earth. Students are introduced to the concept of natural selection and how it affects populations. Students learn that the modern view of evolution involves an understanding of genetics. A laboratory on the relationship between predator and prey helps students master some aspects of the concept of survival of the fit.

- Origin of Life on Earth
- Evidence for Change Over Time
- Natural Selection
- Types of Natural Selection
- Modern Views of Evolution
- Your Choice
- The Origin of New Species
- Laboratory: Natural Selection: Predator vs. Prey

Prokaryotes, Fungi, Protists, and Viruses

Students begin their study of life by examining microorganisms, including viruses, bacteria, protists, and fungi. They learn the characteristics of each group of organism and are given a primer on naming and organizing the many kinds of life on earth. They conduct an experiment involving nitrogen-fixing bacteria to give them hands-on experiments with one type of microorganism.

- Naming and Organizing Life
- Prokaryotes
- Protists and Fungi
- Viruses
- Laboratory: Nitrogen-Fixing Bacteria

Survey of Animals

When most students think of biology, the first idea that comes to their mind is the animals. This unit surveys animals, both invertebrates and vertebrates. Students do a clam dissection to get them in touch with the anatomy of an invertebrate. From sponges to mammals, the animal kingdom opens up to the students.

- Sponges and Flatworms
- Cnidarians, Roundworms, and Mollusks
- Annelids, Arthropods, and Echinoderms
- Fish and Amphibians
- Reptiles, Birds, and Mammals
- Lab: Clam Dissection

Comparing Animal Systems

In Unit 5 students surveyed animal systems. In this unit they will survey the various systems that make up living things. They will study circulatory, respiratory, digestive, nervous, and other systems and how they vary between groups. Students will dissect a chicken wing and draw its structure.

- Circulatory and Respiratory Systems
- Circulatory Systems
- Comparing Digestive Systems
- Comparing Nervous Systems
- Comparing Other Systems
- Laboratory: Chicken Wing Anatomy Laboratory

Plants

Plants are all around us and make up a large part of the biological world. Students will survey the plants of the world and learn about their biology. They will study how plants grow and reproduce. Students will perform botanical illustration as a way of taking a close look at plant structure.

- Survey of Plants
- Plant Reproduction

- Plant Growth and Responses
- Laboratory: Botanical Illustration

The Functional Cell

The cell is the fundamental building block of living things and in this unit students take a close look at the structure and inner workings of cells. Starting with the cell membrane and then moving inside the cell to study organelles, students explore the relationship of cell structure to its function. A laboratory follows that allows students to see the insides of cells.

- Cell and Boundary
- The Plasma Membrane
- Across the Plasma Membrane
- Inside the Cell
- Cell Communication
- Lab: Looking Inside a Cell

Cells and Energy

Where does a cell get the energy to carry out all of its functions? In this unit students trace the pathways of energy in the cellular world. Photosynthesis, cellular respiration, fermentation, and the role of ATP in the cell are all explored. A laboratory examining the process of photosynthesis gives students a hands-on experience with cell functions.

- Photosynthesis
- Phases of Photosynthesis
- Breaking Down Glucose
- Making ATP
- How ATP Works in the Cell Climates: Global Warming
- Laboratory: Fermentation

Cell Division and Heredity

In the previous units students learned about the structure of cells, their functions, and the role that sunlight and chemical energy plays in the energetics of cells. In this lesson students examine two closely related cellular phenomena—cell division and heredity. Students examine the processes of mitosis and meiosis with special emphasis on chromosome numbers. They then use this knowledge to work on problems involving heredity and even work a genetics problem in a laboratory on a genetic cross.

- Chromosomes
- Mitosis and Cell Division
- Meiosis and Gamete Formation
- Mendelian Genetics
- Mendelian Genetics II
- Lab: Incomplete Dominance Cross

How the Gene Works

Modern biology as practiced around the world in our century is often directed towards understanding the roles of RNA, DNA, and proteins in the cell. In this unit students learn about the relationships between genes and the functions of the cells, connecting the roles of DNA, RNA, and proteins and how they make the cell the central building block of life.

- Structure of DNA and RNA
- DNA Replication
- What Is a Gene?
- DNA Makes RNA Makes Protein
- What Proteins Do
- Gene Expression
- Differentiation in Cells
- Laboratory: Amino Acids and Proteins

Scientific Investigation

In this middle school program, students conduct a scientific investigation following scientific methods for each discipline. Students choose a research topic, develop a hypothesis, experiment, take and organize data, and develop a science presentation. This is a hands-on unit that gives students the feel of conducting scientific research.

- Scientific Process, Selecting a Topic, Research
- Making a Hypothesis and Experimental Design
- Step-by-Step Experimenting
- Data Collection
- Data Analysis
- Conclusions and Lab Reports
- Writing a Bibliography and Making a Display
- Complete Display Poster and Rehearse Oral Presentation
- Oral Presentations