



Science Shepherd Life Science Curriculum, 2nd Edition

Scope & Sequence

Chapter 1 – Introduction

In this chapter we will discuss:

- The focus of life science as a study.
- Life science as a scientific pursuit that follows the scientific method.
- The scientific method.
- The International System of Measurements (“SI units”) and understand how they fit into scientific experimentation.
- The common methods of acquiring data during scientific experiments.

Chapter 2 – Characteristics of Life

In this chapter we will discuss:

- The meaning of "organism."
- The properties that all living things share.
- The common things that almost all organisms on earth require to live.

Chapter 3 – The Chemistry of Life and Light Energy

In this chapter we will discuss:

- The concepts of matter and mass.
- The structure of atoms, elements and molecules.
- The structure of the organic molecules: carbohydrates, proteins, lipids and nucleic acids.
- The properties of the electromagnetic spectrum and visible light.

Chapter 4 – The Cell’s Outer Layers: Cell Membrane and Transport Mechanisms

In this chapter we will discuss:

- Cell theory.
- Common cell properties.
- The difference between eukaryotic and prokaryotic cells—the two basic cell types that make up all organisms.
- Cell membrane structure and function.
- Passive and active membrane transport processes.

Chapter 5 – Cell Interior: Structure and Function

In this chapter we will discuss:

- The structure and function of the common eukaryotic organelles:
 - cytoplasm
 - nucleus
 - nucleoplasm
 - nucleolus
 - ribosome
 - endoplasmic reticulum
 - Golgi apparatus and vesicles
 - lysosomes
 - mitochondria
 - vacuoles
 - chloroplasts
- Photosynthesis, the set of chemical reactions plants perform to make glucose from carbon dioxide using sunlight energy.
- Cellular respiration, the set of chemical reactions plants and animals use to make their energy molecules by breaking down glucose.
- The relationship between photosynthesis and cellular respiration.

Chapter 6 – From DNA to Gene to Protein

In this chapter we will discuss:

- How DNA is organized into smaller units of chromosomes and genes.
- Chromosomes, genes and their properties.
- The genetic code.
- The pathway that is taken for a protein to be made from a gene.
- DNA replication.
- Genetic mutations.

Chapter 7 – Cell Reproduction

In this chapter we will discuss:

- The differences between sexual and asexual cell division processes.
- The asexual cell division processes of binary fission and budding.
- The eukaryotic asexual cell division process of mitosis and sexual cell division process of meiosis in detail.

Chapter 8 – Heredity

In this chapter we will discuss:

- New terms related to the study of heredity and genetics.
- Gregor Mendel's experiments in heredity as an example of both excellent science and ground-breaking results.
- Dominant and recessive traits and the genes that code for them.
- The use of Punnett squares.
- Inheritance patterns.
- The process of mutation relating to genetic diseases.
- Autosomal recessive and sex-linked genetic diseases.
- Genetic engineering.

Chapter 9 – Origins: Evolution and Creation

In this chapter we will discuss:

- Evolution and creation, the two most common origin and diversity of life models.
- How evolution and creation are faith-based philosophies through which scientific facts are interpreted.
- Charles Darwin's contribution to evolutionary thought.
- Natural selection, which both the creation and evolution models interpret as scientific.
- Whether neo-Darwinism can properly explain how new kinds of organisms arise.
- The biblical and scientific basis for the creation model.
- Geological processes necessary for fossil formation.
- The diverse ways fossils are interpreted through the evolution and creation models.
- Transitional forms in the fossil record; specifically, *Archaeopteryx*.

Chapter 10 – Scientific Classification I: Overview, Archaea, Bacteria, and Viruses

In this chapter we will discuss:

- Concepts of classifying all living organisms into the seven-level classification system.
- Taxonomy and the six Kingdoms in the seven-level classification system.
- Binomial nomenclature.
- The use of a dichotomous key.
- The properties of the organisms classified into Archaea and Bacteria.
- Viruses.

Chapter 11 – Scientific Classification II: Protista and Fungi

In this chapter we will discuss:

- The basic groups that make up Protista (the organisms of which are “protists”).
- The properties of the following protist groups:
 - plant-like protists (“algae”)
 - animal-like protists (“protozoa”)
 - fungus-like protists (“slime molds”)
- The basic structure and functions of Fungi.
- Important history of Fungi as it relates to the discovery of antibiotics.
- The structure and function of mushrooms and molds.
- Mycorrhizae and their importance to plants and fungi.
- Lichens.

Chapter 12 – Scientific Classification III: Plantae I

In this chapter we will discuss:

- Kingdom Plantae classification using a dichotomous key.
- The following plant traits:
 - vascular tissue
 - spore-producing and seed-producing
 - gymnosperm
 - angiosperm
 - monocot
 - dicot
- Characteristics and examples of:
 - nonvascular seedless plants
 - vascular seedless plants
 - gymnosperms
 - angiosperms
- Angiosperms and divide them into monocots and dicots.
- Root, stem and leaf structure and function.

Chapter 13 – Scientific Classification IV: Plantae II

In this chapter we will discuss:

- Methods of asexual plant reproduction.
- The two phases of the plant life cycle-sporophyte and gametophyte.
- Specific reproductive cycles for nonvascular plants, seedless vascular plants, gymnosperms, and angiosperms (monocots and dicots).
- Flower structure and how it relates to angiosperm reproduction.
- Pollination, fertilization and germination.
- The specific roles water has in maintaining plant life.
- Nastic and tropic plant movements and how they occur.
- The processes responsible for transporting materials in xylem.
- Photoperiodism.

Chapter 14 – Scientific Classification V: Kingdom Animalia I

In this chapter we will discuss:

- Technical terms related to the classification of organisms in Animalia.
- A dichotomous key prepared to classify all animal phyla discussed in this course.
- The features of the following phyla:
 - Porifera
 - Cnidaria
 - Platyhelminthes
 - Annelida
 - Mollusca
 - Arthropoda
 - Echinodermata

Chapter 15 – Scientific Classification VI: Kingdom Animalia II

In this chapter we will discuss:

- The features of the following Chordata classes:
 - Chondrichthyes, the cartilage fish
 - Osteichthyes, the boney fish
 - Amphibia, the amphibians
 - Reptilia, the reptiles
- The terms endothermic and ectothermic and apply them to the chordate classes.
- Capillary function.
- One-loop and two-loop circulatory systems.

Chapter 16 – Scientific Classification VII: Kingdom Animalia III

In this chapter we will discuss:

- The features of Class Aves, birds, and of Class Mammalia, mammals.
- The categorization of Mammalia into placental mammals, marsupials and monotremes.
- The placental mammals of the following Orders:
 - Rodents (Rodentia)
 - Insect-eating mammals (Insectivora)
 - Toothless mammals (Edentata)
 - Flying mammals (Chiroptera)
 - Hoofed mammals (Artiodactyla and Perissodactyla)
 - Trunk-nosed mammals (Proboscidea)
 - Carnivores (Carnivora)
 - Aquatic mammals (Cetacea and Sirenia)
 - Primates (monkeys, apes, and humans)

Chapter 17 – Human Anatomy and Physiology: Control, Support, and Movement

In this chapter we will discuss:

- The structure and function of the nervous system, with attention to:
 - the nerve cell (neuron)
 - motor neurons, sensory neurons and interneurons
 - the central and peripheral nervous systems
 - the connection between the central and peripheral nervous systems
 - reflexes
- How our special senses of hearing, taste and vision are structured and function.
- Anatomy of the endocrine system.
- How the nervous and endocrine systems interact to chemically control the body.
- Endocrine system function by studying the diseases diabetes and hypothyroidism.
- Integumentary system (skin) structure and function.
- The structure and function of the three types of muscles-skeletal, cardiac and smooth.
- How muscles attach to bones and move joints.
- Bone structure and function.
- The function of ligaments and tendons.
- Joint types.

Chapter 18 – Nutrition, Circulation, Respiration, and Protection

Goals

In this chapter we will discuss:

- Components of the digestive system.
- Digestive system structure and function with attention to:
 - mechanical digestion
 - chemical digestion
 - peristalsis
 - villi, microvilli, and absorption
- The circulatory system.
- A two-loop circulatory system.
- Internal heart anatomy with attention to the valves.
- How the heartbeat and blood pressure are generated.
- The structure and function of blood.
- The respiratory system.
- Alveoli function.
- How inhalation and exhalation occur.
- The components and function of the excretory system.
- How the kidney filters waste from blood and spares nutrients, ions, and water.
- The immune system.
- Pathogens.
- Autoimmune diseases and organ transplantation as they relate to the immune system.

Chapter 19 – Earth Studies

In this chapter we will discuss:

- Basic concepts and terms of ecology.
- The biosphere.
- Ecosystems with attention to:
 - abiotic and biotic mass
 - water, carbon and oxygen cycles
 - pollution
 - energy transfer within predator-prey relationships
 - camouflage and mimicry
- Marine and freshwater biomes.
- Terrestrial biomes.