

Shenandoah Community School District

Biology

Grade - 10

10.2 (SCSD) Life Science

10.2.1 (SCSD) Understand and apply knowledge of the cell (I,D,M)

- Know the structures and functions of the cell (I,D,M)
 - Cell structures underlie functions (I,D,M)
 - Cells have particular structures that underlie their functions (I,D,M)
 - ✚ Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures, notably the:
 - ❖ Nucleus (I,D,M)
 - ❖ Mitochondria (I,D,M)
 - ❖ Ribosomes (I,D,M)
 - ❖ Chloroplasts (I,D,M)
 - ❖ Endoplasmic reticulum (I,D,M)
 - ✚ Some cells have external structures facilitating movement (cilia and flagella) (I,D,M)
 - Cell Membranes (I,D,M)
 - Absorption (I,D,M)
 - Diffusion (I,D,M)
 - Every cell is surrounded by a membrane that separates it from the outside world (I,D,M)
 - Basic cell processes (I,D,M)
 - Molecule transport (Explain) (I,D,M)
 - Reproduction (I,D,M)
 - Energy Conversion (Metabolism) (I,D,M)
 - DNA Replication (I,D,M)
 - Protein Synthesis (I,D,M)
 - Cellular Signaling (I,D,M)
 - Different types of cell (prokaryotic/ eukaryotic; animal/plant) (I,D,M)
 - Understands that cells differentiate (I,D,M)
 - Development regulated by genes (I,D,M)
 - Differentiation allows for the development of specialized cells, tissues, and organs that make up multi-cellular organisms (I,D,M)
 - Understand the relationship of functions and chemical reactions (I,D,M)
 - Enzymes catalyze reactions -- Food molecules (macromolecules) break down to provide molecules for synthesis (I,D,M)
 - Most cell functions involve chemical reactions (I,D,M)
 - Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules (I,D,M)
 - Both breakdown and synthesis are made possible by protein catalysts, called enzymes (I,D,M)
 - Cell respiration break down complex molecules to provide energy (I,D,M)
 - The chemical bonds of food molecules contain energy (I,D,M)
 - Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed (I,D,M)
 - Cells temporarily store this energy in phosphate bonds of a small High-energy compound called ATP (I,D,M)
 - Know that cells grow and divide (I,D,M)
 - Cells grow and divide in a cell cycle (I,D,M)
 - Cell regulation allows cells to respond to their environment and control and coordinate cell growth and division (I,D,M)

- Environmental factors can influence cell division (I,D,M)
 - Process of Cell division (I,D,M)
 - Mitosis (I,D,M)
 - Meiosis (I,D,M)
- Understand photosynthesis (I,D,M)
 - Photosynthesis links sun energy to usable energy—Basic process of photosynthesis (I,D,M)
 - Plant cells contain chloroplasts as sites of photosynthesis (I,D,M)
 - Plants and many microorganisms use solar energy to combine molecules of carbon dioxide and water into complex, energy rich organic compounds and release oxygen to the environment (I,D,M)

10.2.2 (SCSD) Understand and apply knowledge of the molecular basis of heredity (I,D,M)

- Know the genetic information in cells (I,D,M)
 - In all organisms, the instruction for specifying the characteristics organism are carried in DNA (I,D,M)
 - A large polymer formed from subunits of four kinds (A, G, C, and T)(I,D,M)
- Know that the DNA structure specifies genetic information in genes (I,D,M)
 - The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both:
 - Encoded in genes (as a string of molecular “letters”)(I,D,M)
 - Replicated (by a templating mechanism)(I,D,M)
- Know that genes direct and control protein synthesis (I,D,M)
- Understand DNA mutations (I,D,M)
 - DNA mutations occur spontaneously at low rates (I,D,M)
 - Some of these changes make no difference to the organism, whereas others can change cells and organisms (I,D,M)
 - Some mutations can be caused by environmental factors (I,D,M)
- Understand the relationship of DNA, chromosomes, and sexual reproduction (I,D,M)
 - DNA forms chromosomes (I,D,M)
 - Each DNA molecule in a cell forms a single chromosome (I,D,M)
 - Organisms have two copies of each chromosome (I,D,M)
 - Humans have 22 pairs plus two sex chromosome (I,D,M)
 - Most of the cells in a human contain two copies of each of 22 different chromosomes plus two chromosomes that determine sex (I,D,M)
 - ✚ A female contains two X chromosomes (I,D,M)
 - ✚ A male contains one X and one Y chromosome (I,D,M)
 - Sex cells (sperm and egg) transmit genetic information through the processes of meiotic cell division and fertilization (I,D,M)
 - Transmission of genetic information to offspring occurs through meiosis that produces egg and sperm cells that contain only one representative from each chromosome pair (I,D,M)
 - ✚ An egg and a sperm unite to form a new individual (I,D,M)
- Understand the basic Inheritance Patterns (I,D,M)
 - Variability occurs as a result of fertilization (I,D,M)
 - The fact that an organism is formed from cells that contain two copies of each chromosome, and therefore two copies of each gene, explains many features of heredity (I,D,M)
 - ✚ How variations that are hidden in one generation can be expressed in the next (I,D,M)
 - Basic patterns of inheritance can be identified (I,D,M)
 - Different genes coding for the same feature code for it in different ways thus leading to identifiable patterns in heritable traits (I,D,M)
 - ✚ These patterns of inheritance can be identified and predicted (I,D,M)

- Mendelian genetics (I,D,M)
- Patterns and mechanisms of inheritance (I,D,M)
 - Codominance (I,D,M)
 - Multiple allele (I,D,M)
 - Incomplete dominance (I,D,M)
 - Sex linked inheritance (I,D,M)

10.2.3 (SCSD) Understand and apply knowledge of biological evolution (I,D,M)

- Recognizes and analyzes the history of evolutionary thought (I,D,M)
- Understand species evolution (I,D,M)
 - Species evolve over time and speciation occurs (I,D,M)
 - Evolution is supported by scientific evidence from:
 - Fossils (scientist study the remains of organism and make predictions) (I,D,M)
 - Genetics (use molecular genetics, use DNA to encode genes)(I,D,M)
 - In actions today (use comparative anatomy, perform experiments)(I,D,M)
 - Evolution is consequence of the interactions of :
 - Population potential (I,D,M)
 - ✚ The potential for a species to increase its numbers (I,D,M)
 - Genetic variability (I,D,M)
 - ✚ The genetic variability of offspring due to mutation and recombination of genes (I,D,M)
 - Finite resources (I,D,M)
 - ✚ A finite supply of the resources required for life (I,D,M)
 - Environmental selection (I,D,M)
 - ✚ The ensuing selection by the environment of those offspring better able to survive and leave offspring (I,D,M)
- Know that natural selection:
 - Scientifically explains the fossil record (I,D,M)
 - Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms (I,D,M)
 - Explains molecular similarity of diverse species (I,D,M)
 - There are striking molecular similarities observed among the diverse species of living organisms (I,D,M)
 - Is a mechanism for evolution leading to organism diversity (I,D,M)
 - The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms (I,D,M)
 - Current diverse species are related by descent from common ancestors (I,D,M)
- Understand the relationship of species to common ancestor (I,D,M)
 - Current diverse species are related by descent from the common ancestors (I,D,M)
 - Millions of different species that live are Earth today are related by descent from common ancestors (I,D,M)
 - ✚ Plants (I,D,M)
 - ✚ Animals (I,D,M)
 - ✚ Microorganism (I,D,M)
- Understand biological classifications (I,D,M)
 - Based on evolutionary relationships (I,D,M)
 - How they are related (I,D,M)
 - Organisms are classified into a hierarchy of groups and subgroups based on
 - ✚ Similarities in development (I,D,M)
 - ✚ DNA sequences which reflect their evolutionary relationship (I,D,M)
 - Species is the most fundamental classification unit (I,D,M)

10.2.4(SCSD) Understand and apply knowledge of the interdependence of organisms (I,D,M)

- Understand what is meant by Material Cycling (I,D,M)
 - Atom and molecules cycle (e.g. water, carbon, nitrogen, oxygen cycles) (I,D,M)
 - The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere (I,D,M)
- Know that energy transforms from producers through levels of consumers and decomposers (I,D,M)
 - Energy flows through ecosystem in one direction (I,D,M)
 - From photosynthetic (I,D,M)
 - To herbivores (I,D,M)
 - To carnivores (I,D,M)
 - Then decomposers (I,D,M)
 - These trophic levels can be illustrated by:
 - Food Chain (I,D,M)
 - Food Webs (I,D,M)
- Understand the interrelationships of organisms (I,D,M)
 - Within ecosystems organisms:
 - Cooperate (I,D,M)
 - Compete (I,D,M)
 - Interrelationships and interdependency lead to long-term stable systems (I,D,M)
 - May generate ecosystems that are stable for hundreds or thousands of years (I,D,M)
- Know that humans modify ecosystems (I,D,M)
 - Humans modifications of ecosystem (I,D,M)
 - Humans' beings live within the world's ecosystems (I,D,M)
 - Humans modify ecosystems as a results of:
 - ✚ Population growth (I,D,M)
 - ✚ Technology (I,D,M)
 - ✚ Consumption (I,D,M)
 - Habitat destruction threatens global stability (I,D,M)
 - Human destroy habitats through:
 - ✚ Direct harvesting (I,D,M)
 - ✚ Pollution (I,D,M)
 - ✚ Atmospheric changes (I,D,M)
 - ✚ And other factors are threatening current global stability (I,D,M)
 - If not addressed, ecosystems will be irreversibly affected (I,D,M)

10.2.5 (SCSD) Understand and apply knowledge of the interdependence of matter, energy, and organization of living systems (I,D,M)

- Understand sunlight energy conversion (I,D,M)
 - Living systems require continuous energy input, derived primarily from the sun, to maintain their organization (I,D,M)
 - Chemical (I,D,M)
 - Physical (I,D,M)
 - Sunlight serves as the original energy source for life (I,D,M)
 - Plants photosynthesize, producing building blocks for making macromolecules and storing energy in chemical bonds (I,D,M)
 - Plants capture energy by absorbing light and using it to form strong chemical bonds between the atoms of carbon containing molecules (I,D,M)
 - ✚ These molecules can be used to assemble larger molecules (I,D,M)
 - ❖ Protein(I,D,M)
 - ❖ DNA (I,D,M)
 - ❖ Sugars(I,D,M)
 - ❖ Fats (I,D,M)

- The chemical energy stored in bonds between the atoms can be used as sources of energy for life processes (I,D,M)
 - Cell respiration releases chemical bond energy stored during photosynthesis (I,D,M)
 - Understand the limiting factors of Ecosystems (I,D,M)
 - Ecosystem and Population (I,D,M)
 - Living organism have the capacity to produce populations of infinite size (I,D,M)
 - Environments and resources are finite (I,D,M)
 - Ecosystem have finite resources (I,D,M)
 - Environmental factors and finite resources influence ecosystems interactions (I,D,M)
 - The distribution and abundance of organisms and populations in ecosystems are limited by the availability of :
 - ✚ Matter (I,D,M)
 - ✚ Energy (I,D,M)
 - ✚ The ability of the ecosystem to recycle materials (I,D,M)
 - Understand matter and energy flow and conservation (I,D,M)
 - Living things require continuous energy input (I,D,M)
 - To maintain their chemical and physical organization (I,D,M)
 - Matter and energy are conserved as they flow through and between organisms (I,D,M)
 - All matter tends toward more disorganized states (I,D,M)
 - As matter and energy flow through different levels of organizations of living systems (cells, organs, organ systems, organisms) and between living systems and the physical environment, chemical elements are recombined in different ways (I,D,M)
 - Some energy dissipates into the environment as heat (I,D,M)
 - Each chemical recombination results in storage and dissipation on energy into the environment as heat (I,D,M)
 - Matter and energy are conserved in each change (I,D,M)
 - Explore the chemistry for life (I,D,M)
 - Understand the Six Kingdoms (plants, animals, protists, fungi, archaeobacteria, eubacteria) (I,D,M)
 - Understand the essential characteristics of life (cell, organization, energy use, homeostasis, growth, reproduction, and adapt to the environment) (I,D,M)

10.2.6(SCSD) Understand and apply knowledge of the interdependence of the behavior of organisms (I,D,M)

- Understand the nervous systems and their behavior (I,D,M)
 - Nerve cell structure and function (I,D,M)
 - Multicellular animals have nervous systems that generate behavior (I,D,M)
 - Nervous system are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves (I,D,M)
 - Nerve cell communications through neurotransmitter (chemicals that allow the transmission of signals) (I,D,M)
 - The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules (I,D,M)
 - Sensor organs are specialized cells detecting environmental input (I,D,M)
 - In sense organs, specialized cell detect:
 - ✚ Light (I,D,M)
 - ✚ Sound (I,D,M)
 - ✚ Specific chemicals (I,D,M)
 - Sense organs enable animals to monitor what is going on in the world around them (I,D,M)

- Understand the human organisms and their basic functions (I,D,M)
 - The human immune system protects against:
 - Microscopic and foreign substance entering the body (I,D,M)
 - Cancer cell arising within the body (I,D,M)
 - The hormonal system exerts its influence by chemicals circulating in the blood (I,D,M)
 - Necessary for locomotion are the coordinated systems:
 - Nervous (I,D,M)
 - Muscular (I,D,M)
 - Bone (I,D,M)

10.4 (SCSD) Science as Inquiry

10.4.1 (SCSD) Identify questions and concepts that guide scientific investigations (D)

- Understand hypothesis and formulate a testable Hypothesis, demonstrating;
 - Logical connections between the scientific concepts guiding:
 - A hypothesis (D)
 - The design of an experiment (D)
- Understand scientific investigations and demonstrate:
 - Appropriate procedures (D)
 - A knowledge base (D)
 - Conceptual understanding (D)

10.4.2 (SCSD) Design and conduct scientific investigations (D)

- Requires:
 - Understanding of the major concepts in the area being investigated (D)
 - Proper equipment (D)
 - Safety precautions (D)
 - Understanding of methodological problems (D)
 - Use of technologies (D)
 - Scientific knowledge obtained from sources other than the actual investigation (D)
 - Clarification of :
 - Ideas that guide the inquiry (D)
 - Question (D)
 - Method (D)
 - Controls (D)
 - Variables (D)
 - Organization and display of data (D)
 - Revision of methods and explanations (D)
 - Public presentation of the results with a critical response from peers (D)
- Must:
 - Use evidence (D)
 - Apply logic (D)
 - Construct an argument for their proposed explanations (D)

10.4.3 (SCSD) Use technology and mathematics to improve investigations and communications (D)

- A variety of technologies are an integral component of scientific investigations (D)
 - Hand tools (D)
 - Measuring instruments (D)
 - Calculators (D)
 - Computers for data (D)
 - Collection (D)
 - Analysis (D)
 - Display (D)
- Mathematics plays an essential role in all aspects of an inquiry investigation (D)

- Measurement (D)
 - Posing questions (D)
 - Formulas are used for developing explanations (D)
 - Charts and graphs are used for communicating results (D)

10.4.4 (SCSD) Formulate and revise scientific explanations and models using logic and evidence (D)

- Inquiries culminate in formulating an explanation or model (D)
 - Model
 - Physical (D)
 - Conceptual (D)
 - Mathematical (D)
- Process of answering the questions involves:
 - Discussions (D)
 - Arguments (D)
 - Revisions of explanations (D)
 - Based on:
 - Scientific knowledge (D)
 - Use of logic (D)
 - Evidence from investigation (D)

10.4.5 (SCSD) Think critically and logically to make the relationship between evidence and explanations (D)

- Think critically about evidence includes:
 - Deciding what evidence should be used (D)
 - Accounting for anomalous data (D)
- Process
 - Review data from a simple experiment (D)
 - Summarize the data (D)
 - Form a logical argument about the cause-and-effect relationship in the experiment (D)

10.4.6 (SCSD) Recognize and analyze alternative explanations and predictions (D)

- Develop critical abilities of analyzing an argument by reviewing:
 - Current scientific understanding (D)
 - Weighing the evidence (D)
 - Examining the logic (D)
- Develop the ability to decide which explanations and models are best (D)
 - There may be several plausible explanations, they do not all have equal weight (D)
 - Use scientific criteria to find the preferred explanations (D)
- Know that scientific knowledge is based on repeatable standards to ensure accuracy of the information. This knowledge may be constantly updated or corrected as the world tests and makes new advances in science (D)

10.4.7 (SCSD) Communicate and defend scientific procedures and explanations

- Develop the abilities associated with accurate and effective communication these include:
 - Writing and following procedures (D)
 - Expressing concepts (D)
 - Reviewing information (D)
 - Summarizing data (D)
 - Using language appropriately (D)
 - Developing diagrams and charts (D)
 - Explaining statistical analysis (D)
 - Speaking clearly and logically (D)

- Constructing a reasoned argument (D)
- Responding appropriately to critical comments (D)

10.4.8 (SCSD) Use mathematics in all aspects of scientific inquiry (D)

- Use mathematics to ask and answer questions about the natural world (d)
- Mathematics is used to:
 - Ask questions (D)
 - Gather data (D)
 - Organize data (D)
 - Present data (D)
 - Structure convincing explanations (D)

10.4.9 (SCSD) Know that a code of ethics governing testing, funding, and the disclosure of scientific information bind progress in science and technology (D)

10.4.10 (SCSD) Know that advances in science involve technology and research that are bound by the laws of our society (D)