



Biology Frameworks Curriculum Pacing Guide

Patterns in Living Systems

Crosscutting Concepts: Patterns; Matter and Energy; Structure and Function

Topics: Modeling Evolution; Endosymbiosis; Photosynthesis and Cellular Respiration; Kingdoms to Clades; Structure and Function of Cell Membrane; Cell Transport; Macromolecules

8-week Instructional Segment

Anchoring Phenomenon	GSE	Sample Instructional Segments	Disciplinary Core Ideas	Science and Engineering Practices	Instructional Notes
<p>Protists have always been a challenging group to classify. An amazing variety of structure and function patterns are found in these organisms.</p> <p>Resources: CK12: Autotrophs and Heterotrophs. This Real-World Application gives an overview of NASA’s OMEGA Project (2009-2012) that uses algae as biofuel.</p> <p>CK12: Protist Evolution. This is an article with videos titled “Are You Going To Eat That?” that describes the</p>	<p>SB1. a, c, e SB4. a, b</p>	<p>Clades and Evolutionary Relationships: All in the Family Tree Clades model evolutionary relatedness of structure and function among organisms grouped in a kingdom.</p>	<p>From A Framework for K-12 Science Education: <i>By the end of grade 12</i></p> <p>LS4A: Evidence of Common Ancestry and Diversity</p> <ul style="list-style-type: none"> Genetic information, like the fossil record, also provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Common ancestry is derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. <p>LS1A: Structure and Function</p> <ul style="list-style-type: none"> Systems of specialized cells within organisms help them perform the essential functions of life, which 	<p>Asking questions and defining problems</p> <p>Constructing explanations</p> <p>Engaging in argument from evidence</p> <p>Planning and carrying out investigations</p> <p>Analyzing and interpreting data</p>	<p>Additional notes on topic, focus, and phenomena can be found within instructional segments.</p> <p>By the end of this unit, students are using the following language in their speaking and writing during EXPLAIN or ELABORATE:</p> <ul style="list-style-type: none"> Structure and function Cells Organelles System Homeostasis Macromolecules Cellular transport Photosynthesis and cellular respiration Energy and matter Clades Endosymbiosis Cladograms and phylogenetic trees

<p>diversity of protists and their evolution through the endosymbiosis.</p> <p>By the end of this unit, students will explain the phenomenon using the following concepts:</p> <p>Protists are eukaryotic and are thought to have evolved through the process of endosymbiosis.</p> <p>Algae, amoebas, and slime molds are commonly grouped together as protists but vary greatly in structure and function:</p> <p>--Algae are plant-like because they have a cell wall and can perform photosynthesis.</p> <p>--Slime molds are fungal-like because they have a cell wall but cannot perform photosynthesis.</p> <p>--Amoebas are</p>			<p>involve chemical reactions that take place between different types of molecules (water, proteins, carbohydrates, lipids, and nucleic acids).</p> <ul style="list-style-type: none"> ● Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. ● Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. ● Outside that range, the organism cannot survive. <p>LS1C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> ● The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars. ● The sugar molecules formed contain carbon, hydrogen, and oxygen and are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules. ● As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. ● As a result of chemical reactions, energy is transferred from one system 	<ul style="list-style-type: none"> ● Common ancestry ● Evolutionary relationships ● Ecosystems ● Food webs and energy pyramids ● Cycling of biochemical elements
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<p>animal-like because they lack a cell wall and cannot perform photosynthesis.</p> <p>Protists share a few common structures and function:</p> <ul style="list-style-type: none"> --Nucleus that differentiates them from prokaryotes --Obtain ATP energy for required cellular processes through respiration --Plasma cell membrane that regulates the passage of material in and out of the cell 			<p>of interacting molecules to another.</p> <ul style="list-style-type: none"> ● Aerobic cellular respiration breaks the bonds of food molecules and oxygen molecules and new compounds are formed that can transport energy to muscles. ● Anaerobic cellular respiration follows a different and less efficient chemical pathway to provide energy in cells. ● Cellular respiration releases the energy needed to maintain body temperature despite ongoing energy loss to the surrounding environment. ● Matter and energy are conserved in each change. This is true of all biological systems, from individual cells to ecosystems. 		
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This instructional segment will segue into SB1 in Structure and Function of Molecular Genetics by connecting the Cell Theory (all living organisms are composed of cells that are the basic unit of structure and function with all cells arise from preexisting cells) and into SB1/SB2 by connecting the structure and function of nucleic acids and proteins to the structure and function of the carbohydrates and lipids. Also, it will connect to SB5 in Stability and Change in Ecosystems by connecting the cycling of carbon and water through the environment. It will also connect to SB6 as the history of the Earth shaped the evolution of organisms.