

Life Science Benchmark 9-12

3.1a

<p>PreK – 12 EU: <u>Students will understand that all living organisms have certain needs and structures with unique functions that allow them to survive.</u></p>		
<p>PreK – 12 EQ: <i>What do living organisms need to survive?</i> <i>How does an organism’s physical structure enable it to survive?</i></p>		
<p>9-12 EU: Cellular processes are carried out by many different molecules and regulated both internally and externally by the environment in which cells exist to allow for survival. 9-12 EU: Organisms are made of complex systems that allow for survival and homeostasis.</p>		
Grade Benchmark	Grade Benchmark	Grade Benchmark
<p>Students will know: - The main functions of a cell: transport of materials energy transfer protein building information feedback movement reproduction</p> <p>Transport Students will know: -Cell membranes control the entrance and exit of all substances from the cell based on the following principles: size and charge of the substance, concentration gradient, permeability of the membrane, and potential for active transport -The mechanisms cells use to eliminate waste: exocytosis and diffusion</p> <p>Students will be able to: -Predict the direction a substance will move across a cell membrane</p>	<p>Energy Transfer Students will know: -The energy releasing reactions of cellular respiration take large, high energy molecules and release energy by breaking chemical bonds -ATP - The energy storing reactions of photosynthesis takes small, low energy molecules and stores energy by making chemical bonds within carbohydrates</p> <p>Students will be able to: -Create a model of energy storage and release within a cell including chemical stored potential energy</p> <p>Protein Building Students will know: Many organelles function together to produce proteins. -Proteins may be: structural, enzymatic, motor, transport, and regulatory</p>	<p>Students will be able to: Describe and compare structural, enzymatic, motor, transport, and regulatory proteins</p> <p>Information Feedback Students will know: -Cellular homeostasis is regulated internally by negative feedback</p> <p>Students will be able to: -Identify, describe, and compare the function of: carbohydrates, lipids, proteins, and nucleic acids</p> <p>Movement Students will know: -Cells have the internal components (such as actin and myosin) and the external components (such as cilia and flagella) which allow movement</p> <p>Students will be able to: -Describe the role of cellular structures in movement</p>

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<p>Reproduction Students will know: -Which organelles and molecules function together to allow cellular reproduction (nucleus, chromosome, spindle)</p> <p>Students will be able to: -Describe the role of cellular structures in reproduction</p>		
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3.2 a:

PreK – 12 EU: <u>Students will understand that species have changed, are changing and will continue to evolve over time.</u>		
PreK – 12 EQ: <i>How do species change over time?</i>		
9-12 EU: Natural selection leads to organisms well suited for survival in particular environments.		
9-12 EU: Modern ideas about evolution including natural selection and common descent provide a scientific explanation for the history of life on Earth.		
9-12 EU: The diversity of present-day organisms resulted from changes over time in many ancestral organisms.		
9-12 EU: The degree of kinship between organisms or species can be estimated from the similarity of their molecules (DNA/RNA/Proteins)		
Grade Benchmark	Grade Benchmark	Grade Benchmark
<p>Students will know:</p> <ul style="list-style-type: none"> -The drivers of natural selection are: overpopulation, genetic variability of offspring, a finite supply of resources, producing stress and competition, and the selection (survival and subsequent reproduction) of offspring best suited to a particular environment <p>Students will be able to:</p> <ul style="list-style-type: none"> Apply the theory of Natural Selection to a scenario depicting change within a given population over time (through many generations) 	<p>Students will know:</p> <ul style="list-style-type: none"> -Scientists organize the vast diversity of organisms by describing similarities and differences among living things. -Formal classification systems of organisms (Domain, Kingdom, Phylum...) are based upon molecular similarities and differences in structures among organisms <p>Students will be able to:</p> <ul style="list-style-type: none"> -Comparing and sorting organisms with similar characteristics into group based on internal and external structures - Develop a graphic representation that illustrates and compares the degree of molecular similarity among several species 	<p>Students will know:</p> <ul style="list-style-type: none"> -Life on earth is thought to have begun four billion years ago, as simple, one-celled organisms, there are modern variations of these ancestral organisms still living today <p>Students will be able to:</p> <ul style="list-style-type: none"> -Create a timeline detailing the major evolutionary steps leading to modern life <p>***SHOULD CLASSIFICATION BASED ON STRUCTURES BE ADDRESSED AT THE MIDDLE LEVEL???</p>

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3.2b:

PreK – 12 EU: <u>Students will understand that all living organisms have life cycles and reproduce.</u>		
PreK – 12 EQ: <i>How do living organisms change and reproduce throughout their life cycles?</i>		
9-12 EU: The sorting and recombining of genes in sexual reproduction results in a great variety and diversity of traits in offspring (mitosis/meiosis).		
Grade Benchmark	Grade Benchmark	Grade Benchmark
<p>Students will know: - Offspring receive pairs of alleles, one from each parent</p> <p>Students will be able to: -Model or diagram new gene combinations that result from sexual reproduction</p> <p>Students will know: -Meiosis produces haploid cells which are used for sexual reproduction -Mitosis clones cells</p> <p>Students will be able to: -Describe how mitosis and meiosis help organisms complete their life cycle</p>	<p>Students will know: -Organisms are formed from cells that contain homologous pairs of each chromosome</p> <p>Students will be able to: -Model and diagram new gene combinations that result from sexual reproduction</p>	

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3.2c:

PreK – 12 EU: <u>Students will understand that the characteristics of organisms are influenced by heredity and environment.</u>		
PreK – 12 EQ: <i>How do heredity and environment affect living organisms?</i>		
9-12 EU: Every cell in an organism contains DNA that determines inherited traits.		
9-12 EU: SWUT that DNA sequences (ATGC) determine proteins which, in turn, determine traits.		
Grade Benchmark	Grade Benchmark	Grade Benchmark
<p>Students will know: -The genetic information in a cell’s DNA is used to direct the synthesis of the thousands of proteins that each cell requires, however only portions of the genome are active in any one cell</p> <p>Students will be able to: -Explain how the cells of an organism have the same DNA, yet produce different proteins and have different functions</p> <p>Students will know: - The sequence of nucleotides in DNA specifies the traits in organisms</p> <p>Students will be able to: -Explain how alterations of a DNA sequence may affect physical characteristics of the human body</p>	<p>Students will know: -Both genetics and environment influence the expression of genes</p> <p>Students will be able to: -Explain how the environment of an organism can influence the expression of a specific gene</p>	

3.3 a:

Version 1c

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PreK – 12 EU: All living organisms depend on each other and their environment to meet their survival needs. Energy is transferred through interdependent systems within an organism and throughout ecosystems.

PreK – 12 EQ: *How do organisms obtain energy to survive?*
How does energy flow within an organism and throughout ecosystems?
How do organisms interact with each other and their environment?

9-12 EU: Students will understand that the energy of life enters the biosphere through the process of photosynthesis and passes through trophic levels until it is lost along the way as heat

~~9-12 The energy releasing reactions of cellular respiration take large, high-energy molecules and release energy by breaking chemical bonds~~

9-12 EU: At each link in the ecosystem some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual sunlight energy input is needed to keep the process going.

9-12 EU: *The stability of an ecosystem can be impacted by many different factors; (abiotic/biotic disturbance, changes in the environment, human interactions, etc.)*

**Refer to Earth 4.2c*

Grade Benchmark	Grade Benchmark	Grade Benchmark
<p>Students will know: -Plants are producers, and they create food by synthesizing the energy from the sun to form higher energy sugar molecules from carbon, hydrogen, and oxygen atoms</p> <p>Students will be able to: -Develop and explain a model that shows the recycling of inorganic materials within a natural ecosystem</p>	<p>Students will know: -Food passes through the ecosystem providing energy for organisms and materials to build structures</p> <p>Students will be able to: -Develop a model that compares the energy at different trophic levels in a given ecosystem</p>	<p>Students will know: -As matter cycles and energy flows through trophic levels, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy in the environment as heat. -Matter and energy are conserved at each stage, however, some energy is converted into heat and must be replaced by the sun</p> <p>Students will be able to: - Research and investigate the movement of a specific material through an ecosystem and describe the impacts and mitigation of that material (For Vermont look at phosphorous)</p>