

# Paulsboro Schools



## Curriculum

**General Biology**

**Grade 10**

**2011 - 2012**

\* For adoption by all regular education programs  
Board Approved: June 2011  
as specified and for adoption or adaptation by  
all Special Education Programs in accordance  
with Board of Education Policy.

# PAULSBORO SCHOOL DISTRICT

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# Paulsboro Schools Mission Statement

The mission of the Paulsboro School District is to provide each student educational opportunities to assist in attaining their full potential in a democratic society.

Our instructional programs will take place in a responsive, community based school system that fosters respect among all people.

Our expectation is that all students will achieve the New Jersey Core Curriculum Content Standards (NJCCCS) at every grade level.

# INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

**Introduction/Philosophy:** “Today more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation”(Obama, 2008)

Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advance, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21<sup>st</sup> century, science education focuses on the practices of science that lead to a greater understand of the growing body of scientific knowledge that is required of citizens in an ever-changing world.

## **Educational Goals (taken from NJCCCS)**

The main goal of Biology is to help students gain an appreciation of science as a process. Due to the many advances in technology, Biology is an every changing subject matter. The primary emphasis in this course is to give students an overall understanding of larger Biological concepts rather than a narrow view of terms and processes that need to be memorized. Essential to this conceptual understanding of Biology is a grasp of science as a process rather than as an accumulation of facts. This conceptual understanding can be achieved through scientific inquiry and critical thinking assessments rather than rote memory skills. The goal of this course is to provide students with the knowledge of Biology by giving them the skills they need to conceptualize Biology rather than memorize Biology.

# General Biology

## Scope and Sequence Map

### Quarter 1

This unit will cover the concepts of water's characteristics and importance to living things, main types of organic molecules in organisms, free energy changes and the actions and limitations to enzymes ( Themes: Regulation, Energy transfer)

- I. Chemistry of Life
  - a. Review Basic Chemistry
  - b. Water
  - c. Organic Chemistry
  - d. Biological Macromolecules

This unit will cover the concepts of early evolution of life, evidence for evolution, and the mechanisms of evolution (Themes: Evolution, Continuity and change)

- III. Evolutionary Biology
  - a. Darwin's theory of Natural Selection
  - b. Population Genetics
  - c. Speciation

This unit will cover the concepts of population dynamics, communities and ecosystems, and global issues. Also included in this unit will be discussions on environmental concerns and possible solutions to these problems (Themes: Energy Transfer, Interdependence in Nature)

- II. Ecology
  - a. Interactions in the biosphere
  - b. Community Ecology
  - c. Population Ecology
  - d. Ecosystems

### Quarter 2

This unit will cover the concepts of early evolution of life, evidence for evolution, and the mechanisms of evolution (Themes: Evolution, Continuity and change)

- IV. Evolutionary Biology
  - a. Darwin's theory of Natural Selection
  - b. Population Genetics
  - c. Speciation

This unit will cover the concepts of the similarities, difference and evolutionary significance of prokaryotic and eukaryotic cells, sub-cellular organization, the cell cycle, its regulation and cell division (mitosis) (Theme: Relationship of structure to function)

- V. Cells
  - a. Cell Organelles
  - b. Cellular Energetics and Metabolism

# Scope and Sequence Map Page 2

## Quarter 3

This unit will cover the concepts of meiosis, gametogenesis, eukaryotic chromosomes, and inheritance patterns (Themes: Evolution, Continuity and change)

### VI. Heredity

- a. Mitosis
- b. Meiosis
- c. Mendelian Genetics
- d. Structure and Function of DNA/RNA
- e. Transcription and Translation

## Quarter 4

This unit will cover the concepts of fermentation, cellular respiration, photosynthesis and coupled reactions (Themes: Energy transfer, Regulation)

### VII. Cells

- a. Cellular Respiration
- b. Photosynthesis

This unit will cover the concepts of reproduction, growth and development of animals, evolutionary adaptations of animals, and animal response to the environment (Themes: Evolution, Relationship of Structure and Function).

### VIII. Animals

- a. Vertebrates vs. Invertebrates
- b. Animal Nutrition
- c. Circulation and Gas Exchange
- d. Immune System

**5.3 Life Science:** Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**A. Organization and Development:** Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.

**Essential Questions**

How does structure relate to function in living systems from the organismal to the cellular level?

**Enduring Understandings**

Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.

**Content Statements**

Cells are made of complex molecules that consist mostly of a few elements. Each class of molecules has its own building blocks and specific functions.

**Cumulative Progress Indicators**

Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. **(5.3.12.A.1)**

**Instructional Focus:**

- Modeling (using physical or digital tools) the four major categories of organic molecules (carbohydrates, fats, proteins, and nucleic acids) using unique characteristics and primary functions
- Determining how and why each major category of organic molecule is essential to life
- Identifying the six elements most common to biological organisms: carbon, hydrogen, oxygen, nitrogen, phosphorous and sulfur

**Desired Results**

Describe the unique properties, building block molecules and biological importance of the four major categories of organic molecules

Recognize the six most common elements in organic molecules and explain the significance of carbon to organic molecules

Provide examples of organic compounds

Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models

Explain the importance of both water and carbon to cells

**Investigations, Labs, and Sense Making Experiences**

- Detailed chapter outlines for each unit
- Literature review research papers based on current scientific articles
- Discussions and discussion analyses
- Corresponding worksheets
- Webquest: The chemistry of life and Biochemistry
- Constructing monomers of organic molecules Lab
- Properties of water Lab

<b>A. Organization and Development:</b> Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How does structure relate to function in living systems from the organismal to the cellular level?	Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes.	Demonstrate the properties and functions of enzymes by designing and carrying out an experiment. <b>(5.3.12.A.2)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Analyzing and explaining how cells carry out a variety of chemical transformations that allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones <ul style="list-style-type: none"> <li><i>Assessments will not include the molecular basis of enzyme function</i></li> </ul> </li> <li>Recognizing that most chemical transformations are made possible by protein catalysts called enzymes</li> <li>Identifying enzymes as proteins, and determining how they catalyze biochemical reactions <ul style="list-style-type: none"> <li><i>Assessments will not include the molecular basis of enzyme catalysis</i></li> </ul> </li> <li>Conducting experiments to demonstrate that the activities of enzymes are affected by the temperature, ionic conditions, and the pH of the surroundings</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
Describe the function of enzymes in biological systems and explain the relationship between enzyme structure and enzyme specificity	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> <li>- Rennin Lab (temperature)</li> <li>- Hydrogen peroxide lab (pH)</li> <li>- Urea Lab (concentration)</li> </ul>
Describe several mechanisms by which enzymes lower activation energy.	
Describe how energy changes are involved in chemical reactions	
Describe feedback mechanisms involved in maintaining homeostasis	



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How does structure relate to function in living systems from the organismal to the cellular level?	Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.	Predict a cell's response in a given set of environmental conditions. <b>(5.3.12.A.3)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Modeling how processes are regulated both internally and externally by environments in which cells exist</li> <li>Explaining how the fundamental life processes of organisms depend on a variety of chemical reactions that occur in specialized areas of the organism's cells <ul style="list-style-type: none"> <li><i>Assessments will not include the identification of cellular organelles</i></li> </ul> </li> <li>Modeling how cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings, including the transport of materials into and out of the cell <ul style="list-style-type: none"> <li><i>Assessments will not include the molecular basis of membrane transport</i></li> </ul> </li> </ul>	
<b>Desired Results</b>	
Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions  Formulate a scientific question about the movement of molecules across a membrane under differing conditions of temperature, starting concentration, pH, etc.  Explain why cells of organisms swell when placed in water and why they shrink when placed in a solution of salt water. Evaluate other student explanations of the same phenomenon. Construct a representation that generalizes the phenomenon to all organisms.  Describe the composition, structure, and function of the cell membrane and how it allows for cellular transport mechanisms to work  Describe the structure and function of cells and their organelles  Understands the three main tenets of the Cell Theory  Differentiate between passive and active transport  Construct a representation of a cell membrane undergoing passive and active transport, in terms of difference in concentration required energy and direction of molecule movement. Explain how the movement of molecules impacts the cell, and, as a result, impacts the organism as well.  Relate the structure of cellular organelles to their function	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussion and discussion analysis</li> <li>- Osmosis (dialysis tubing) lab</li> <li>- 3 D cell project</li> <li>- Webquest: Cells</li> <li>- Cell diagram</li> <li>- Corresponding worksheets</li> </ul>

<b>A. Organization and Development:</b> Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How does structure relate to function in living systems from the organismal to the cellular level?	Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.	Distinguish between the processes of cellular growth (cell division) and development (differentiation). <b>(5.3.12.A.4)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Explaining how the many cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions</li> <li>Tracing the general process where the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues and organs that comprise the final organism <ul style="list-style-type: none"> <li><i>Assessments will not include the details or graphic demonstration of each stage in mitosis</i></li> </ul> </li> <li>Present evidence that supports the concept that complex multicellular organisms are formed as a highly organized arrangement of differentiated cells</li> <li>Providing examples of how different parts of the genetic instructions are influenced by the cell's environment</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
Sequence the events of the cell cycle in which new somatic cells are produced  Describe how, through cellular division, cells can become specialized for specific functions  Compare the benefits and limitations of existing as a single-celled organism and as a multicellular organism  Distinguish between the processes of cellular growth and development  Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks	<ul style="list-style-type: none"> <li>Lab: Root tip</li> <li>Detailed chapter outlines for each unit</li> <li>Corresponding worksheets</li> <li>Literature review research papers based on current scientific articles</li> <li>Discussions and discussion analyses</li> </ul>

<b>A. Organization and Development:</b> Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How does structure relate to function in living systems from the organismal to the cellular level?	Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Cell differentiation is regulated through the expression of different genes during the development of complex multicellular organisms.	Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks (e.g. stem cells, sex determination). <b>(5.3.12.A.5)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>• Identifying genes as a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the names and structures of nucleotides or the individual detailed steps of the processes of transcription and translation</i></li> </ul> </li> <li>• Relating the specialization of cells in multicellular organisms to the different patterns of gene expression rather than to differences of the genes themselves</li> <li>• Applying these understandings to analyze, support and/or critique current and emerging biotechnologies <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis</i></li> </ul> </li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks</p> <p>Give examples, using information gathered from print and electronic resources, of situations in which errors that occur during gene activation or gene inactivation lead to errors in cell differentiation.</p> <p>Compare between embryonic stem cells and adult or body stem cells, and among different types of adult stem cells.</p> <p>Give examples, using information gathered from print and electronic resources, of traits that depend on the quantity of protein produced, which, in turn, is dependent on the number of copies of a particular version of a gene. Predict and justify how zero, one or two copies of a particular version of a gene might affect the expression of a particular trait.</p> <p>Describe how genes are segments of DNA molecules located in the chromosome of a cell. DNA molecules contain information that determines a sequence of amino acids, which results in a specific protein</p> <p>Describe the structure of nucleic acids and how DNA doubles itself before mitosis</p> <p>Differentiate between transcription and translation</p> <p>Identify functions performed by DNA segments that do not code for proteins.</p>	<ul style="list-style-type: none"> <li>- DNA webquest</li> <li>- Biotechnology Ethical Discussion (<u>science, technology, and society</u>)</li> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Corresponding worksheets</li> <li>- Discussions and discussion analyses</li> <li>- DNA structure and replication model</li> <li>- Protein synthesis model</li> </ul>

<b>A. Organization and Development:</b> Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How does structure relate to function in living systems from the organismal to the cellular level?	Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.	Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g. diabetes, cystic fibrosis, lactose intolerance). <b>(5.3.12.A.6)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>• Describing the relationships within multi-cellular organisms, where cells perform specialized functions as parts of sub-systems (e.g., tissues, organs, and organ systems), which work together to maintain optimum conditions for the benefit of the whole organism <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the identification of specific tissues, organs or body systems</i></li> </ul> </li> <li>• Recognizing that certain chemicals, pathogens, and high-energy radiation can seriously impair normal cell functions and the health of the organism <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the specific mechanisms of action of mutagens</i></li> </ul> </li> <li>• Identifying emerging biotechnology that shows promise in preventing and treating disease <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis or the molecular actions of specific treatments</i></li> </ul> </li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Describe the structure and function of at least one organ located in a plant and the analogous organ located in an animal (e.g., organs used for food storage, movement, reproduction, etc.). Description includes the types of cells, the structure of these cells, and the processes they perform to support the function of both the organ and the organism as a whole.</p> <p>Describe, using information gathered from print and electronic resources, the structure and function of at least two organs that are part of a human body system (e.g., circulatory, digestive, gas exchange). Description includes how the two organs differ regarding the types of cells that make up each organ. Explain, using knowledge of systems of cells, how the cells and organs coordinate and contribute to the overall essential functions of the organism.</p> <p>Describe possible causes of impaired cell function</p> <p>Describe how a disease is the result of a malfunctioning system, organ and cell, and relate this to possible treatment interventions</p> <p>Explain how the systems in a multicellular organism work together to support the organism</p> <p>Describe how human body systems help maintain relatively constant internal conditions</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Corresponding worksheets</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> </ul>

<p><b>5.3 Life Science:</b> Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.</p>	
<p><b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.</p>	
<p><b>Essential Questions</b></p>	<p><b>Enduring Understandings</b></p>
<p>How is matter transferred and energy transferred/ transformed in living systems?</p>	<p>All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.</p>
<p><b>Content Statements</b></p>	<p><b>Cumulative Progress Indicators</b></p>
<p>As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.</p>	<p>Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting. <b>(5.3.12.B.1)</b></p>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>• Tracing the cycling of atoms and molecules on Earth among the living and nonliving components of the biosphere</li> <li>• Explaining how molecules are used to assemble larger molecules with biological activity (including proteins, DNA, sugars and fats) <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)</i></li> </ul> </li> <li>• Following the transfer of matter (molecules) from one organism to another repeatedly and between organisms and their physical environment</li> <li>• Identifying how the total amount of matter in a system remains constant, even though its form and location change</li> </ul>	
<p><b>Desired Results</b></p>	<p><b>Investigations, Labs, and Sense Making Experiences</b></p>
<p>Give examples of chemical reactions (e.g., synthesis of glycogen, oxidation of glucose) involved in basic functions of organisms in which the reactants and products of the reaction are paired with reactions involving ATP and ADP and an inorganic phosphate. Construct an illustration, in terms of reactants and products, of the chemical reactions of basic functions and ATP and ADP with an inorganic phosphate.</p> <p>Construct a representation of the transfer of energy through an ecosystem, starting with the Sun and ending with increased motion of molecules in the environment. Representation should reflect the idea that energy is conserved. Explain, based on the transformation of chemical energy to thermal energy at various trophic levels and on the nature of reactions, the need for constant input of energy into an ecosystem.</p> <p>Construct a representation that links the movement of matter (i.e., carbon atom, water molecule) and the transfer of energy through the processes of photosynthesis and cellular respiration. Predict and justify, based on knowledge of energy transfer and matter cycling, what might happen to the mass of a biosystem if the source of energy were limited.</p> <p>Describe how dehydration and hydrolysis relate to organic compounds</p> <p>Explain how higher levels of organization results from specific complex interactions of smaller units and that their maintenance requires a constant input of energy as well as new materials</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> </ul>

<b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Each recombination of matter and energy results in storage and dissipation of energy into the environment as heat.	Use mathematical formulas to justify the concept of an efficient diet. <b>(5.3.12.B.2)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Explaining how food webs are limited and how pyramidal relationships exist</li> <li>Recognizing that all matter tends toward more disorganized states, and that living systems require a continuous input of energy to maintain their chemical and physical organizations</li> <li>Recognizing that the chemical bonds of food molecules contain energy, which is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed <ul style="list-style-type: none"> <li><i>Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)</i></li> </ul> </li> <li>Calculating the trends in production, use and transfer of energy from one trophic level to another using data</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Give examples of functions (e.g., removal of wastes, muscular activity, cell division) that are carried out by organisms and that involve the conversion of ATP to ADP (adenosine diphosphate) and an inorganic phosphate.</p> <p>Construct a model of a food chain that includes a quantification of the distribution and buildup of a potentially damaging chemical that is introduced into an ecosystem. Predict, using the model, consequences at each trophic level as the relative concentration of the chemical increases. Justification includes changes in the number of organisms at each trophic level, matter cycling, and energy transfer from one level to another.</p> <p>In Kcal analyze and quantify the movement of a given quantity of energy through an actual ecosystem</p> <p>Describe how dehydration and hydrolysis relate to organic compounds</p> <p>Explain how cells transform energy from one form to another through the process of photosynthesis and respiration. Identify the products and reactants in the general photosynthetic reaction</p> <p>Compare and contrast the transformation of matter and energy during photosynthesis and respiration</p> <p>Explain how higher levels of organization results from specific complex interactions of smaller units and that their maintenance requires a constant input of energy as well as new materials</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> <li>- Energy pyramid analysis</li> </ul>

<b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Continual input of energy from sunlight keeps matter and energy flowing through ecosystems.	Predict what would happen to an ecosystem if an energy source was removed. <b>(5.3.12.B.3)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Tracing the path that energy entering ecosystems as sunlight follows when being transferred by producers into chemical energy through photosynthesis, and then being passed from organism to organism through food webs <ul style="list-style-type: none"> <li><i>Assessments will not include the representations of specific detailed steps of photosynthesis and respiration (intermediate steps and products of the Calvin cycle, Krebs/citric acid cycle, and glycolysis)</i></li> </ul> </li> <li>Recognizing that living systems require a continuous input of energy to maintain their chemical and physical organizations and also understanding that with death (the cessation of energy input), living systems rapidly disintegrate</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
Describe how organisms acquire energy directly or indirectly from sunlight  Explain how cells transform energy from one form to another through the process of photosynthesis and respiration. Identify the products and reactants in photosynthesis and respiration  Write the chemical equation for photosynthesis and cellular respiration and explain in words what they mean  Describe energy transfer through an ecosystem, accounting for energy lost to the environment  Formulate a scientific question about the relationship between variables (e.g., type of food, temperature, process input, process output) that impact fermentation and/or cellular respiration.  Construct graphs and tables of data for changes in the different variable conditions.  Make a claim, based on evidence collected from all investigations, about real-world phenomena (e.g., ethanol production, wine or bread making, exercise).  Give examples of functions (e.g., removal of wastes, muscular activity, cell division) that are carried out by organisms and that involve the conversion of ATP to ADP and an inorganic phosphate	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Corresponding worksheets</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> </ul>

<b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Plants have the capability to take energy from light to form sugar molecules containing carbon, hydrogen, and oxygen.	Explain how environmental factors (such as temperature, light intensity, and the amount of water available) can affect photosynthesis as an energy storing process. <b>(5.3.12.B.4)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Recognizing the process of photosynthesis as providing a vital connection between the sun and the energy needs of living systems</li> <li>Describing how plants capture energy by absorbing light and use it to form strong chemical bonds between the atoms of carbon-containing molecules <ul style="list-style-type: none"> <li><i>Assessments will not include the representations of specific detailed steps of photosynthesis (intermediate steps and products of the light-dependent and light-independent reactions)</i></li> </ul> </li> <li>Designing independent investigations to determine the effects of changing environmental factors on photosynthesis</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Explain, based on the transformation of chemical energy to thermal energy at various trophic levels and on the nature of reactions, the need for constant input of energy into an ecosystem.</p> <p>Construct a representation that links the movement of matter (i.e., carbon atom, water molecule) and the transfer of energy through the processes of photosynthesis and cellular respiration. Predict and justify, based on knowledge of energy transfer and matter cycling, what might happen to the mass of a biosystem if the source of energy were limited.</p> <p>Describe how organisms acquire energy directly or indirectly from sunlight</p> <p>Explain how cells transform energy from one form to another through the process of photosynthesis and respiration. Identify the products and reactants in photosynthesis and respiration</p> <p>Explain how living organisms gain and use mass through the processes of photosynthesis and cellular respiration</p> <p>Write the chemical equation for photosynthesis and cellular respiration and explain in words what they mean</p> <p>Summarize the process of photosynthesis</p> <p>Predict what would happen to an ecosystem if an energy source was removed</p> <p>Explain how environmental factors can affect photosynthesis as an energy storing process</p>	<ul style="list-style-type: none"> <li>Detailed chapter outlines for each unit</li> <li>Literature review research papers based on current scientific articles</li> <li>Discussions and discussion analyses</li> <li>Corresponding worksheets</li> <li>Design experiment to measure the effect of light intensity on photosynthetic output</li> </ul>



<b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
In both plant and animal cells, sugar is a source of energy and can be used to make other carbon-containing (organic) molecules.	Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration. <b>(5.3.12.B.5)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>• Analyzing and describing how the process of photosynthesis provides a vital connection between the sun and the energy needs of living systems</li> <li>• Explaining how 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 <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the representations of specific detailed steps of photosynthesis and respiration (intermediate steps and products of the Calvin cycle, Krebs/citric acid cycle, and glycolysis)</i></li> </ul> </li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Explain, based on the transformation of chemical energy to thermal energy at various trophic levels and on the nature of reactions, the need for constant input of energy into an ecosystem.</p> <p>Construct a representation that links the movement of matter (i.e., carbon atom, water molecule) and the transfer of energy through the processes of photosynthesis and cellular respiration. Predict and justify, based on knowledge of energy transfer and matter cycling, what might happen to the mass of a biosystem if the source of energy were limited.</p> <p>Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis</p> <p>Relate plant structure and function to the process of photosynthesis and respiration</p> <p>Recognize the equations for photosynthesis and respiration and identify the products and reactants in both</p> <p>Illustrate and describe the energy conversions that occur during photosynthesis and respiration</p> <p>Compare and contrast the transformation of matter and energy during photosynthesis and respiration</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Plant hormone poster</li> </ul>

<b>B. Matter and Energy Transformations:</b> Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
All organisms must break the high-energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes.	Explain how the process of cellular respiration is similar to the burning of fossil fuels. <b>(5.3.12.B.6)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Examining how the breakdown of some food molecules enables the cell to store energy in specific molecules that are used to carry out the many functions of the cell</li> <li>Tracing the process in which nutrients are transported to cells to serve as building blocks for the synthesis of structures and as reactants for cellular respiration <ul style="list-style-type: none"> <li><i>Assessments will not include the representations of specific detailed steps of respiration (intermediate steps and products of the Krebs/citric acid cycle and glycolysis)</i></li> </ul> </li> <li>Recognizing that food molecules are taken into cells and react to provide the chemical constituents needed to synthesize other molecules, and knowing that the breakdown and synthesis are made possible by enzymes <ul style="list-style-type: none"> <li><i>Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)</i></li> </ul> </li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Recognize that all organisms must break the high energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life.</p> <p>Describe how individual cells break down energy rich molecules to provide energy for cell functions</p> <p>Describe how dehydration and hydrolysis relate to organic compounds</p> <p>Summarize the process of cellular respiration</p> <p>Explain how the process of cellular respiration is similar to the burning of fossil fuels</p> <p>Construct a graphical representation of the number of sugar molecules that are broken down into carbon dioxide and the amount of ATP (adenosine triphosphate) that is produced during fermentation (when oxygen is limited) and during cellular respiration (when oxygen is available).</p> <p>Give examples of functions (e.g., removal of wastes, muscular activity, cell division) that are carried out by organisms and that involve the conversion of ATP to ADP (adenosine diphosphate) and an inorganic phosphate.</p> <p>Give examples of chemical reactions (e.g., synthesis of glycogen, oxidation of glucose) involved in basic functions of organisms in which the reactants and products of the reaction are paired with reactions involving ATP and ADP and an inorganic phosphate. Construct an illustration, in terms of reactants and products, of the chemical reactions of basic functions and ATP and ADP with an inorganic phosphate.</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Corresponding worksheets</li> <li>- Discussions and discussion analyses</li> <li>- Respiration concept map</li> </ul>

**5.3 Life Science:** Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**C. Interdependence:** All animals and most plants depend on both other organisms and their environment to meet their basic needs.

Essential Questions	Enduring Understandings
How are organisms dependant on each other?	The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation.
Content Statements	Cumulative Progress Indicators
Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms.	Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem. <b>(5.3.12.C.1)</b>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>Analyzing the interactions between organisms that result from the ability to produce populations of infinite size in an environment where resources are finite</li> <li>Providing evidence of how organisms both cooperate and compete in ecosystems</li> <li>Using evidence to explain why interrelationships and interdependencies of organisms may generate stable ecosystems</li> </ul>	
Desired Results	Investigations, Labs, and Sense Making Experiences
<p>Distinguish between biotic and abiotic components of an ecosystem and explain how they cycle</p> <p>Describe the abiotic characteristics of an ecosystem: its boundaries, its components, its inputs and outputs, and its interactions, as well as the boundaries and other characteristics of overlapping ecosystems.</p> <p>Evaluate claims of possible relationships between the changes in the abiotic components and the biotic components of the environment.</p> <p>Provide examples of a population, community and ecosystem</p> <p>Predict how changes in one population might affect other populations based upon their relationships in the food web</p> <p>Graph changes in population growth, given a table</p> <p>Describe common relationships among organisms and provide examples of producer/consumer, predator/prey or parasite/host relationship</p> <p>Describe common ecological relationships between and among species and their environments</p> <p>Describe the role of decomposers in the transfer of energy in an ecosystem</p> <p>Explain how two organisms can be mutually beneficial and how that can lead to interdependency</p> <p>Identify the factors in an ecosystem that influences fluctuations in population size</p> <p>Predict the consequences of an invasive organism on the survival of native species</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Biome project</li> <li>- Corresponding worksheets</li> <li>- Prey/predator lab</li> <li>- Food chain project</li> <li>- Webquest: Ecosystem</li> </ul>

<b>C. Interdependence:</b> All animals and most plants depend on both other organisms and their environment to meet their basic needs.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How are organisms dependant on each other?	The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Stability in an ecosystem can be disrupted by natural or human interactions.	Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations. <b>(5.3.12.C.2)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Identifying situations where humans intentionally and unintentionally modify ecosystems as a result of population growth, technology, and consumption</li> <li>Providing evidence of how human destruction of habitats threatens current local and global ecosystem stability</li> <li>Predicting how direct harvesting, pollution, atmospheric changes, and other factors will affect population dynamics in a given ecosystem based on data and accepted mathematical models</li> <li>Predicting how natural disasters such as hurricanes, floods, volcanoes will affect population dynamics in a given ecosystem based on data and accepted mathematical models</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Predict what will happen to the number of organisms of a given species in an ecosystem following a temporary biotic or abiotic change in that ecosystem (e.g., a very cold winter or a disease that kills large numbers of one of the species in the ecosystem) and what will happen after conditions return to what they were before the disruption. Justification for the prediction is based on knowledge of how ecosystems typically respond to temporary changes in environmental conditions, how this particular ecosystem has responded to such changes in the past, and the scale of these particular changes.</p> <p>Recognize that, and describe how, human beings are part of the Earth's ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems</p> <p>Examine the negative impact of human activities</p> <p>Describe the greenhouse effect and list some possible causes</p> <p>List the possible causes and consequences of global warming</p> <p>Describe ecosystem stability. Understand that if a disaster such as a flood or fire occurs, the damaged ecosystem is likely to recover in stages of succession that eventually result in a system similar to the original one</p> <p>Recognize and describe that a great diversity of species increases the chance that at least some living organisms will survive in the face of cataclysmic changes in the environment</p>	<ul style="list-style-type: none"> <li>Detailed chapter outlines for each unit</li> <li>Literature review research papers based on current scientific articles</li> <li>Lab: Exponential population growth</li> <li>Corresponding worksheets</li> <li>Discussions and discussion analyses               <ol style="list-style-type: none"> <li>Discussion: Human Impact on Ecosystem</li> </ol> </li> </ul>

**5.3 Life Science:** Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

**D. Heredity and Reproduction:** Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.

Essential Questions	Enduring Understandings
How is genetic information passed through generations?	There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual).
Content Statements	Cumulative Progress Indicators
Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.	Explain the value and potential applications of genome projects. <b>(5.3.12.D.1)</b>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>• Recognizing that the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (adenine, thymine, guanine, and cytosine) <ul style="list-style-type: none"> <li>◦ <i>Assessments will not include the identification of the structure of specific nucleotides or the nature of bonding between DNA strands</i></li> </ul> </li> <li>• Explaining how the chemical and structural properties of DNA allow for genetic information to be both encoded in genes and replicated <ul style="list-style-type: none"> <li>◦ <i>Assessments will not include the individual detailed steps of the processes of transcription and translation</i></li> </ul> </li> <li>• Identifying that hereditary information is contained in genes, located in the chromosomes of each cell, and each gene carries a single unit of information</li> <li>• Providing specific examples of how an inherited trait of an individual can be determined by one or many genes and a single gene can influence more than one trait</li> <li>• Analyzing the current and potential impact of genome projects on human health (e.g. pathogenic bacteria or disease vectors) or species with commercial importance (e.g. livestock and crop plants)</li> </ul>	
Desired Results	Investigations, Labs, and Sense Making Experiences
<p>Recognize that every species has its own characteristic DNA sequence</p> <p>Describe the structure and function of DNA</p> <p>Describe how traits in organisms are the result of DNA structure..</p> <p>Analyze the primary structure (amino acid sequence) of specific proteins (e.g., insulin and hemoglobin). Create a table showing which amino acids make up each protein molecule, and the numbers of each amino acid that make up these proteins.</p> <p>Evaluate and, if necessary, revise representations that illustrate the processes of transcription and translation to show how the sequence of nucleotide bases produces a complementary strand of bases in RNA (ribonucleic acid), and how each sequence of three bases in RNA codes for specific amino acids that are linked together to make proteins.</p> <p>Give examples, using information gathered from print and electronic resources, of traits that result from specific proteins.</p> <p>Identify functions performed by DNA segments that do not code for proteins.</p> <p>Explain the value and potential application of genome projects</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> <li>- DNA candy replication model</li> <li>- Protein synthesis model</li> </ul>

<b>D. Heredity and Reproduction:</b> Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is genetic information passed through generations?	There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual).
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
<p>Inserting, deleting, or substituting DNA segments can alter the genetic code.</p> <p>An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.</p>	Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations. <b>(5.3.12.D.2)</b>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>Recognizing that changes in DNA (mutations) occur spontaneously at low rates, and some of these changes make no difference to the organism, whereas others can change cells and organisms</li> <li>Explaining that only mutations in germ cells can create the variation that changes an organism's offspring <ul style="list-style-type: none"> <li><i>Assessments will not include the specific detailed steps of meiosis</i></li> </ul> </li> <li>Tracing the progression of conditions that result from genetic mutation in a variety of different organisms</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Explain why an insertion, deletion or substitution of an individual nucleotide base affects not only the amino acid sequence of the proteins that are produced but also the protein structure that result from the altered amino acid sequence.</p> <p>Give examples, using evidence gathered from print and electronic resources, of genetic diseases (e.g., cystic fibrosis, sicklecell anemia, Tay-Sachs disease or phenylketonuria) that result from mutations to a single gene. Identify, for each example, the specific type of mutation that causes the change in amino acid sequence and ultimately the change in the protein that is produced.</p> <p>Propose possible effects (on the gene) of exposing an organism to radiation and toxic chemicals</p> <p>Explain that the traits of an individual are influenced by both the environment and the genetics of the individual</p> <p>Explain why only mutations occurring in gametes can be passed on to offspring and predict how mutations may be transferred to progeny</p> <p>Explain how it may be possible to identify genetic defects from just a karyotype of a few cells</p> <p>Explain that the sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations from the offspring of two parents</p> <p>Recognize that genetic variation can occur from such processes as crossing over, jumping genes, and deletion and duplication of genes</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> <li>- Disease pamphlet</li> <li>- Meiosis clay model</li> </ul>

<b>D. Heredity and Reproduction:</b> Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How is genetic information passed through generations?	There are predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction (sexual or asexual).
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.	Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization). <b>(5.3.12.D.3)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>• Explaining the process where an egg and sperm unite to begin the development of a new individual, and how that new individual receives genetic information from its parents <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the specific detailed steps of meiosis, fertilization and early embryological development</i></li> </ul> </li> <li>• Explaining how sexually produced offspring are never identical to either of their parents</li> <li>• Understanding how new heritable characteristics can result from new combinations of existing genes in reproductive cells</li> <li>• Recognizing how heritable characteristics can strongly influence what capabilities an organism will have, therefore influencing how likely it is to survive and reproduce</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Explain, based on knowledge of how sex cells form in sexually reproducing organisms, why there is variation among offspring, even within the same family.</p> <p>Construct a representation — or several representations — of sex cell formation, demonstrating that the DNA of the daughter cells is different from the DNA of the parent cell</p> <p>Observe the variation of traits among the individual organisms within a population. Explain, based on the transmission of genetic information, why there is so much variation within the population.</p> <p>Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring</p> <p>Draw and label a homologous chromosome pair with heterozygous alleles highlighting a particular gene locus</p> <p>Differentiate between dominant, recessive, co-dominant, polygenic and sex-linked traits</p> <p>Explain the genetic basis for Mendel's laws of segregation and independent assortment</p> <p>Determine the genotype and phenotype of monohybrid crosses using the Punnett Square</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> <li>- Demonstrate genetic recombination by creating own Punnett Square</li> </ul>

<p><b>5.3 Life Science:</b> Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.</p>	
<p><b>E. Evolution and Diversity:</b> Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.</p>	
<p><b>Essential Questions</b></p>	<p><b>Enduring Understandings</b></p>
<p>How does natural selection encourage inter and intra-specific diversity over time?</p>	<p>The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.</p>
<p><b>Content Statements</b></p>	<p><b>Cumulative Progress Indicators</b></p>
<p>New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.</p>	<p>Account for the appearance of a novel trait that arose in a given population. <b>(5.3.12.E.1)</b></p>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>Recognizing how heritable characteristics can strongly influence how likely an individual is to survive and reproduce</li> <li>Describing how evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organism</li> <li>Analyzing natural selection simulations and use the data generated to describe how environmentally favored traits are perpetuated over generations resulting in species survival, while less favorable traits decrease in frequency or may lead to extinction</li> </ul>	
<p><b>Desired Results</b></p>	<p><b>Investigations, Labs, and Sense Making Experiences</b></p>
<p>Explain how similarities and differences among organisms support the idea of descent with modification.</p> <p>Give examples of observations made by Charles Darwin of variation within species and of changes in environmental conditions that he used in the development of his theory of natural selection.</p> <p>Define a species and give examples</p> <p>Explain how extinction removes genes from the gene pool</p> <p>Summarize the major concepts of natural selection and describe how natural selection provides a mechanism for evolution</p> <p>Explain how a new species or variety originates through the evolutionary process of natural selection</p> <p>Explain how natural selection leads to organisms that are well suited for the environment</p> <p>Illustrate how genetic variation is preserved or eliminated from a population through natural selection resulting in biodiversity</p> <p>Explain how natural selection acts on individuals, but it is populations that evolve. Relate genetic mutations and genetic variety produced by sexual reproduction to diversity within a given population</p>	<ul style="list-style-type: none"> <li>Pro vs con evolution research paper</li> <li>Detailed chapter outlines for each unit</li> <li>Literature review research papers based on current scientific articles</li> <li>Discussions and discussion analyses</li> <li>Lab: Population genetics</li> <li>Corresponding worksheets</li> </ul>



<b>E. Evolution and Diversity:</b> Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.	
<b>Essential Questions</b>	<b>Enduring Understandings</b>
How does natural selection encourage inter and intra-specific diversity over time?	The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.
<b>Content Statements</b>	<b>Cumulative Progress Indicators</b>
Molecular evidence (e.g., DNA, protein structures, etc.) substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.	Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence). <b>(5.3.12.E.2)</b>
<b>Instructional Focus:</b> <ul style="list-style-type: none"> <li>Identifying, explaining and demonstrating how technology can be used to determine evolutionary relationships among species (gel electrophoresis, DNA/amino acid sequences) <ul style="list-style-type: none"> <li><i>Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis</i></li> </ul> </li> <li>Integrating scientific information from a variety of disciplines to provide evidence for the relatedness of species on Earth (geology, comparative anatomy, biochemistry, and taxonomy)</li> </ul>	
<b>Desired Results</b>	<b>Investigations, Labs, and Sense Making Experiences</b>
<p>Construct a simple model (e.g., phylogenetic tree), based on anatomical evidence (physical traits), of the degree of relatedness among various organisms. If necessary, revise the model based on the inclusion of new molecular (i.e., DNA and/or amino acid) evidence.</p> <p>Explain, in terms of preserved DNA sequences, why specific extinct or extant organisms within a line of descent are considered to be either closely or more distantly related (i.e., share a common ancestor).</p> <p>Estimate how closely related species are based on scientific evidence</p> <p>Explain the importance of the fossil record</p> <p>Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis)</p> <p>Explain how the fossil record, comparative anatomy and other evidence supports the theory of evolution</p> <p>Illustrate how genetic variation is preserved or eliminated from a population through natural selection resulting in biodiversity</p> <p>Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequence</p> <p>Interpret a cladogram or phylogenetic tree showing evolutionary relationships among organisms</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Biotechnology paper</li> <li>- Corresponding worksheets</li> </ul>

<p><b>E. Evolution and Diversity:</b> Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.</p>	
<p><b>Essential Questions</b></p>	<p><b>Enduring Understandings</b></p>
<p>How does natural selection encourage inter and intra-specific diversity over time?</p>	<p>The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.</p>
<p><b>Content Statements</b></p>	<p><b>Cumulative Progress Indicators</b></p>
<p>The principles of evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as evidenced in the fossil record and in the similarities that exist within the diversity of existing organisms.</p>	<p>Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.). <b>(5.3.12.E.3)</b></p>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>• Recognizing that a change in a species over time does not follow a set pattern or timeline</li> <li>• Explaining how the millions of different species on Earth today are related by common ancestry using evidence</li> <li>• Using natural selection and its evolutionary consequences to provide a scientific explanation for the fossil record of ancient life forms, and the molecular similarities observed among the diverse species of living organisms <ul style="list-style-type: none"> <li>○ <i>Assessments will not include the classification of organisms in taxa</i></li> </ul> </li> </ul>	
<p><b>Desired Results</b></p>	<p><b>Investigations, Labs, and Sense Making Experiences</b></p>
<p>Predict and justify, based on ideas about natural selection, what might happen to a population of organisms after many generations if the population becomes geographically isolated from another population of the same species, and if the two groups experience different <b>biotic</b> and/or environmental conditions.</p> <p>Explain that ecology studies the varieties and interactions of living things across space while evolution studies the varieties and interactions of living things across time</p> <p>Define a species and give examples</p> <p>Explain the importance of the fossil record</p> <p>Summarize the major concepts of natural selection and describe how natural selection provides a mechanism for evolution</p> <p>Explain how the fossil record, comparative anatomy, and other evidence supports the theory of evolution</p> <p>Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral and molecular similarities</p> <p>Explain how changes at the gene level are the foundation for changes in populations and eventually the formation of new species</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> </ul>

<p><b>E. Evolution and Diversity:</b> Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.</p>	
<p><b>Essential Questions</b></p>	<p><b>Enduring Understandings</b></p>
<p>How does natural selection encourage inter and intra-specific diversity over time?</p>	<p>The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.</p>
<p><b>Content Statements</b></p>	<p><b>Cumulative Progress Indicators</b></p>
<p>Evolution occurs as a result of a combination of the following factors:</p> <ul style="list-style-type: none"> <li>• Ability of a species to reproduce</li> <li>• Genetic variability of offspring due to mutation and recombination of genes</li> <li>• Finite supply of the resources required for life</li> <li>• Natural selection, due to environmental pressure, of those organisms better able to survive and leave offspring</li> </ul>	<p>Account for the evolution of a species by citing specific evidence of biological mechanisms. <b>(5.3.12.E.4)</b></p>
<p><b>Instructional Focus:</b></p> <ul style="list-style-type: none"> <li>• Discussing how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process</li> <li>• Predicting possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, pollution)</li> </ul>	
<p><b>Desired Results</b></p>	<p><b>Investigations, Labs, and Sense Making Experiences</b></p>
<p>Give examples of how, following a change in environmental conditions, variation in traits within a specific population of organisms might affect the survival and reproductive ability of some of the organisms in that population, but not other organisms in the same population. Give examples of other environmental changes that may not affect the survival and reproduction of any of these organisms. Describe the type of data needed to determine whether the survival or reproductive success of individual organisms was due to the genetic variation within the population.</p> <p>Compare the effects of a significant environmental change on a population with great genetic diversity and the effects of such a change on a population with little genetic diversity. In each instance, indicate the environmental change, the organisms within the species that were affected, and the organisms that were not affected. Explain why genetic variation among organisms within the species affected the survival of the species.</p> <p>Construct a model or run a simulation that represents natural selection in terms of how changes in environmental conditions can result in selective pressure on a population of organisms.</p> <p>Gather and record data from the model or simulation on the composition (e.g., distribution of traits, number of organisms, change in environmental conditions) of a population under varying environmental conditions. Complete multiple trials or use class data.</p> <p>Represent the data in a way that demonstrates the relationship, if any, between the environmental changes and the population.</p> <p>Trace the relationship between environmental changes and changes in the gene pool, such as genetic drift and isolation of subpopulation</p> <p>Describe the role of geographic isolation in speciation</p>	<ul style="list-style-type: none"> <li>- Detailed chapter outlines for each unit</li> <li>- Literature review research papers based on current scientific articles</li> <li>- Discussions and discussion analyses</li> <li>- Corresponding worksheets</li> </ul>

**5.1 Science Practices:** Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

**A. Understand Scientific Explanations:** Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.

**Essential Question**

How do we build and refine models that describe and explain the natural and designed world?

**Enduring Understanding**

Measurement and observation tools are used to categorize, represent and interpret the natural world.

**Content Statement**

Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles.

**Cumulative Progress Indicator**

Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. **(5.1.12.A.1)**

**Instructional Focus:**

- Learning facts, concepts, principles, theories and models; then
- Developing an understanding of the relationships among facts, concepts, principles, theories and models; then
- Using these relationships to understand and interpret phenomena in the natural world

**Content Statement**

Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.

**Cumulative Progress Indicator**

Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. **(5.1.12.A.2)**

**Instructional Focus:**

- Using tools, evidence and data to observe, measure, and explain phenomena in the natural world
- Developing evidence-based models based on the relationships among fundamental concepts and principals
- Constructing and refining explanations, arguments or models of the natural world through the use of quantitative and qualitative evidence and data

**Content Statement**

Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence.

**Cumulative Progress Indicator**

Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. **(5.1.12.A.3)**

**Instructional Focus:**

- Understanding that data differs in quality and strength of explanatory power based on experimental design
- Evaluating strength of scientific arguments based on the quality of the data and evidence presented
- Critiquing scientific arguments by considering the selected experimental design and method of data analysis

<b>5.1 Science Practices:</b> Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.	
<b>B. Generate Scientific Evidence Through Active Investigations:</b> Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.	
<b>Essential Question</b>	<b>Enduring Understanding</b>
What constitutes useful scientific evidence?	Evidence is used for building, refining, and/or critiquing scientific explanations.
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations.	Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. <b>(5.1.12.B.1)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Asking a question and deciding what to measure in order to answer the question</li> <li>Developing strategies for obtaining measurements, then systematically collecting data</li> <li>Structuring the gathered data, then interpreting and evaluating the data</li> <li>Using the empirical results to determine causal/correlational relationships</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Mathematical tools and technology are used to gather, analyze, and communicate results.	Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. <b>(5.1.12.B.2)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Using mathematics in the collection and treatment of data and in the reasoning used to develop concepts, laws and theories</li> <li>Using tools of data analysis to organize data and formulate hypotheses for further testing</li> <li>Using existing mathematical, physical, and computational models to analyze and communicate findings</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Empirical evidence is used to construct and defend arguments.	Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. <b>(5.1.12.B.3)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Making claims based on the available evidence</li> <li>Explaining the reasoning, citing evidence, behind a proposed claim</li> <li>Connecting the claim to established concepts and principles</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions.	Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. <b>(5.1.12.B.4)</b>

<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Analyzing experimental data sets using measures of central tendency</li> <li>Representing and describing mathematical relationships among variables using graphs and tables</li> <li>Using mathematical tools to construct and evaluate claims</li> </ul>	
<b>5.1 Science Practices:</b> Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.	
<b>C. Reflect on Scientific Knowledge:</b> Scientific knowledge builds on itself over time.	
<b>Essential Question</b>	<b>Enduring Understanding</b>
How is scientific knowledge constructed?	Scientific knowledge builds upon itself over time.
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Refinement of understandings, explanations, and models occurs as new evidence is incorporated.	Reflect on and revise understandings as new evidence emerges. <b>(5.1.12.C.1)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Reflecting on the status of one's own thinking and learning (i.e. uncovering how a student knows what they know and why)</li> <li>Understanding that scientific knowledge can be revised as new evidence emerges</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Data and refined models are used to revise predictions and explanations.	Use data representations and new models to revise predictions and explanations. <b>(5.1.12.C.2)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Recognizing that predictions or explanations can be revised on the basis of seeing new data and evidence</li> <li>Using data and evidence to modify and extend investigations</li> <li>Understanding that explanations are increasingly valuable as they account for the available evidence more completely</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Science is a practice in which an established body of knowledge is continually revised, refined, and extended as new evidence emerges.	Consider alternative theories to interpret and evaluate evidence-based arguments. <b>(5.1.12.C.3)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>Understanding that there might be multiple interpretations of the same phenomena</li> <li>Stepping back from evidence and explanations to consider whether another interpretation of a particular finding is plausible with respect to existing scientific evidence</li> <li>Considering alternative perspectives worthy of further investigations</li> </ul>	

<b>5.1 Science Practices:</b> Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.	
<b>D. Participate Productively in Science:</b> The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.	
<b>Essential Question</b>	<b>Enduring Understanding</b>
How does scientific knowledge benefit – deepen and broaden - from scientists sharing and debating ideas and information with peers?	The growth of scientific knowledge involves critique and communication - social practices that are governed by a core set of values and norms.
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work.	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. <b>(5.1.12.D.1)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>• Seeing oneself as an effective participant and contributor in science</li> <li>• Interacting with others to test new ideas, soliciting and providing feedback, articulating and evaluating emerging explanations, developing shared representations and models, and reaching consensus</li> <li>• Developing a sense of appropriate trust and skepticism when evaluating others' claims, evidence and reasoning</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Science involves using language, both oral and written, as a tool for making thinking public.	Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. <b>(5.1.12.D.2)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>• Constructing literal representations from empirical evidence and observations</li> <li>• Presenting and defending a scientific argument using literal representations</li> <li>• Evaluating others' literal representations for consistency with their claims, evidence and reasoning</li> <li>• Moving fluently between representations such as graphs, data, equations, diagrams and verbal explanations</li> </ul>	
<b>Content Statement</b>	<b>Cumulative Progress Indicator</b>
Ensure that instruments and specimens are properly cared for and that animals, when used, are treated humanely, responsibly, and ethically.	Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. <b>(5.1.12.D.3)</b>
<b>Instructional Focus:</b>	
<ul style="list-style-type: none"> <li>• Selecting and using appropriate instrumentation to design and conduct investigations</li> <li>• Understanding, evaluating and practicing safe procedures for conducting science investigations</li> <li>• Demonstrating appropriate digital citizenship (i.e., cyber-safety and cyber-ethics) when accessing scientific data from collaborative spaces. (See NJCCCS 8.1 and 9.1)</li> <li>• Ensuring that living organisms are properly cared for and treated humanely, responsibly, and ethically</li> </ul>	