



# SCHOOL DISTRICT OF MONROE

*Preparing for the Future, One Child at a Time*

## Biology

### Course Description:

The curriculum for this required course is developed from [Next Generation High School Life Science Standards](#). Biology is an introductory course that provides a comprehensive survey of life science. Over the duration of two trimesters students will cover the topics listed below:

- |                                  |              |             |
|----------------------------------|--------------|-------------|
| Biochemistry                     | Evolution    | Genetics    |
| Hierarchy of Interacting Systems | Cells        | Ecology     |
| Cell Energy                      | Biochemistry | Homeostasis |

The ability to work and study both independently and as a group is essential for this course. Grades are determined by quizzes, tests, projects, and daily work. The information in this course overview outlines what students should understand and be able to do by the end of the year.

### Mastery Standards:

NGSS Science Practice 2: Develop, revise and/or use a model to generate data to support explanations, predict phenomena, analyze systems, solve problems and/or predict the relationship between systems or components of a system.

NGSS Science Practice 7: Engage in argument from evidence by using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural world.

NGSS Science Practice 3: Analyze and Interpret data in order to make valid and reliable scientific claims.

NGSS Cross Cutting Concept 6: Analyze and investigate structures of components of a system and connect the components to reveal its function and/or solve a problem.

### ACT Science College and Career Readiness Standards:

IOD 403: Translate information into a table, graph or diagram.

IOD 503. Determine how the values of variables change as the value of another variable changes in a complex data presentation

SIN 401: Understand a simple experimental design

SIN 403: Identify a control in an experiment

EMI 402. Identify key assumptions in a model

EMI 403. Determine which models imply certain information

EMI 404. Identify similarities and differences between models

Unit	Description of Unit and Learning Targets
<b>Unit 1: Scientific Inquiry</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>What science practices allow for the systematic study of the biological world?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Identify the components of a scientific investigation</li> <li>Construct scientific explanations based on evidence (CER)</li> <li>Interpret and construct tables and graphs that illustrate scientific findings.</li> </ul>

	<ul style="list-style-type: none"> <li>Identify the six characteristics of life</li> </ul>
<p><b>Unit 2: Biochemistry</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>How can atoms of a few elements combine to form larger molecules necessary for life?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Model the structure of each of the four macromolecules and water.</li> <li>Connect the functions of biologic molecules to their structure.</li> <li>Apply the properties of water in relation to its structure.</li> <li>Describe how the structure of enzymes relates to its function</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul> <p>Extension:</p> <ul style="list-style-type: none"> <li>Model the role of enzymes in speeding up chemical reactions.</li> </ul>
<p><b>Unit 3: Cells</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>How does the structure of a cell determine its function?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Identify “cells” as a characteristic of life</li> <li>Compare and contrast models of prokaryotic and eukaryotic cells.</li> <li>Compare and contrast models of plant and animal cells.</li> <li>Describe the structure and function of the cell membrane, mitochondria, chloroplast, ribosome, nucleus, cytoplasm</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<p><b>Unit 4: Cell Transport</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>Why is maintaining homeostasis essential to cell life?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Identify “responding to environment/stimuli” as a characteristic of life.</li> <li>Model the structure of the cell membrane.</li> <li>Describe how the structure of the cell membrane determines its function.</li> <li>Explain the process of maintaining homeostasis within a cell.</li> <li>Predict how the cell membrane controls the movement of substances into and out of the cell through osmosis and diffusion.</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<p><b>Unit 5: Energy</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>How does energy move from the environment to organisms?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Identify “obtain and use energy” as a characteristic of life.</li> <li>Model the ATP cycle</li> <li>Use a model to illustrate how photosynthesis transforms light energy into a carbohydrate in the chloroplast</li> <li>Use a model to illustrate that cellular respiration is a chemical process that transforms carbohydrates into chemical energy in the mitochondria</li> <li>Explain the relationship between photosynthesis and cellular respiration</li> </ul>

	<ul style="list-style-type: none"> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<b>Unit 6: DNA and DNA Replication</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>What is the role of DNA in heredity?</li> <li>How does the structure of DNA relate to its function?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Identify “genetic material” (DNA/RNA) as a characteristic of life</li> <li>Analyze the Structure and function of DNA</li> <li>Model the Structure of DNA</li> <li>Model the process of DNA replication</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<b>Unit 7: Cell Cycle and Cancer</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>How does the process of cellular division aid in maintaining complex organisms?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Identify “reproduction and grow/develop” as characteristics of life</li> <li>Model and differentiate the role of interphase and mitosis in the cell cycle.</li> <li>Analyze the differences between cancer cells and normal cells.</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<b>Unit 8: RNA and Protein Synthesis</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>How does the structure of DNA determine the structure of proteins?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Identify “genetic material (DNA/RNA)” as a characteristic of life</li> <li>Differentiate between the structure and function of DNA and RNA</li> <li>Model transcription and translation</li> <li>Analyze the effect of point mutations on amino acid chains</li> <li>Analyze and interpret a graph/table that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<b>Unit 9: Genetics and Meiosis</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>How does DNA and cellular division lead to diversity among living things?</li> <li>How does DNA code for heritable traits?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Model how meiosis creates genetic diversity.</li> <li>Describe the role of genes in coding the instructions for inherited characteristics.</li> <li>Apply concepts of statistics and probability to explain the variation and distribution of expressed traits.</li> <li>Analyze and interpret a graph that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul> Extension: <ul style="list-style-type: none"> <li>Describe other patterns of inheritance.</li> </ul>
<b>Unit 10: Evolution</b>  <u>Essential Questions:</u> <ul style="list-style-type: none"> <li>How does life change genetically over long periods of time?</li> </ul>	<u>Learning Targets:</u>  Students will... <ul style="list-style-type: none"> <li>Describe the unity and diversity of life</li> </ul>

	<ul style="list-style-type: none"> <li>Analyze a model of how natural selection leads to adaptations which result in organisms that are well suited to survive and reproduce in specific environments</li> <li>Evaluate evidence and how it can be used to explain the process of evolution</li> <li>Analyze and interpret a graph that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul> <p>Extension:</p> <ul style="list-style-type: none"> <li>Describe additional mechanisms of evolution</li> </ul>
<p><b>Unit 11: Hierarchy of Interacting Systems</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>How do the individual systems interact to perform the essential functions of life?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Identify the increasing complexity of the structures of multicellular organisms</li> <li>Model the structures of the digestive, circulatory, and respiratory systems</li> <li>Describe how the structure of enzymes relates to its function</li> <li>Analyze the relationship between cellular processes and function of organ systems</li> <li>Analyze and interpret a graph that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>
<p><b>Unit 12: Ecology</b></p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> <li>How does the interaction of living and nonliving elements maintain the balance of an ecosystem?</li> <li>How does energy form the environment to organisms?</li> </ul>	<p><u>Learning Targets:</u></p> <p>Students will...</p> <ul style="list-style-type: none"> <li>Describe the importance of biodiversity</li> <li>Identify the challenges in conserving biodiversity</li> <li>Model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.</li> <li>Construct and revise an explanation based on evidence for the cycling of matter and flow of energy through biomes.</li> <li>Use mathematical and/or computational representations to describe the flow of energy through an ecosystem</li> <li>Analyze and interpret a graph that illustrates scientific findings.</li> <li>Construct scientific explanations (CER)</li> </ul>