

# Phoenixville Area School District UbD Science Unit Plan

**Grade Level:** 7<sup>th</sup> Grade

**Unit Name:** From Molecules to Organisms Structures & Processes

**Author:** A. Gottschall

Stage 1 Desired Results		
	<i>Transfer</i>	
<p><b>Overarching NGSS &amp; PA Standards:</b></p> <p><b>3.1.6-8.A</b> Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</p> <p><b>3.1.6-8.B</b> Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.</p> <p><b>3.1.6-8.C</b> Use argument supported by evidence for how the body is a system of interacting subsystems</p>	<p><i>Students will be able to independently use their learning to...</i></p> <ol style="list-style-type: none"> <li>1. Ask questions and/or define problems</li> <li>2. Develop and/or use models</li> <li>3. Plan and/or carry out investigations</li> <li>4. Analyze and interpret data using computational thinking</li> <li>5. Obtain, evaluate, and communicate information (supported by evidence)</li> <li>6. Construct explanations and design solutions</li> </ol>	
	<i>Meaning-Making</i>	
	<p><i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).</li> <li>• Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.</li> <li>• In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.</li> <li>• Animals engage in characteristic behaviors that increase the odds of reproduction.</li> <li>• Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.</li> <li>• Genetic factors as well as local conditions affect the growth of the adult plant.</li> <li>• Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.</li> <li>• Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.</li> </ul>	<p><b>ESSENTIAL QUESTIONS</b> <i>Students will keep considering...</i></p> <ul style="list-style-type: none"> <li>• What makes up all living things?</li> <li>• What allows for bodily functions within a multicellular organism?</li> <li>• How do plants and animals reproduce?</li> <li>• What affects the growth of plants and animals?</li> <li>• Where do plants, algae, and many microorganisms get their food?</li> <li>• How do organisms get energy?</li> </ul>

<p>composed of groups of cells.</p>		
<p><b>3.1.6-8.D</b></p>	<b><i>Knowledge and Skills Acquisition</i></b>	
<p>Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.</p> <p><b>3.1.6-8.E</b> Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p>	<p><i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• The cell is the smallest living unit.</li> <li>• All living things (biotic) are made up of cells, non-living things (abiotic) are not made of cells.</li> <li>• Organisms may consist of many different numbers and types of cells (multicellular) or one single cell (unicellular).</li> <li>• Some cells have membrane-bound organelles (eukaryotes), while others lack membrane-bound organelles (prokaryotes).</li> <li>• The organelles within cells have particular functions.</li> <li>• In multicellular organisms, the body is a system of multiple interacting systems.</li> <li>• Groups of cells work together to form tissues.</li> <li>• Groups of tissues form organs that are specialized for particular body functions.</li> <li>• Organisms reproduce either sexually or asexually and transfer their genetic information to their offspring.</li> <li>• Animals engage in characteristic behaviors that increase the odds of reproduction (e.g., protection of young through nest building and herding; attraction of mates through vocalizations and colorful plumage).</li> <li>• Plant reproduction can sometimes depend on animal behavior (e.g., transferring pollen or seeds to create conditions for seed germination and growth).</li> <li>• Plant reproduction can sometimes depend on specialized features (e.g., brightly colored flowers to attract butterflies, flower nectar odors to attract insects, hard shells on nuts for squirrels to bury).</li> <li>• Local environmental conditions can affect the size of an adult plant (e.g., availability of food [fertilizer increasing plant growth], light, space [fish growing larger in large ponds than small ponds], and water [droughts decreasing plant growth]).</li> <li>• Genetic factors can affect the growth of organisms (e.g., large breed cattle and species of grass affecting growth of organisms).</li> <li>• Plants conduct photosynthesis to produce food.</li> <li>• The process of photosynthesis produces sugars and oxygen using energy from light, carbon dioxide, and water.</li> <li>• The sugars produced by a plant can be stored for growth later or used immediately.</li> <li>• Organisms use cellular respiration to release energy from food.</li> <li>• During cellular respiration, food is broken down and rearranged into new molecules.</li> <li>• The molecules produced during cellular respiration are used to support growth or release energy.</li> </ul>	<p><i>Students will be skilled at...</i></p> <ul style="list-style-type: none"> <li>• Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.</li> <li>• Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</li> <li>• Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.</li> <li>• Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation.</li> <li>• Develop and use a model to describe phenomena.</li> <li>• Integrate multimedia and visual displays into presentations to clarify information, strengthen</li> </ul>

KEY VOCABULARY

**3.1.6-8.F**

Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

**3.1.6-8.G**

Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism

**Which branch(es) of science apply:**

**LS**

- Cell
- Biotic
- Abiotic
- Multicellular
- Unicellular
- Prokaryote
- Eukaryote
- Plant cell
- Animal cell
- Cell membrane
- Cell wall
- Nucleus

- Mitochondria
- Chloroplast
- Chlorophyll
- Tissues
- Organ
- Sexual reproduction
- Asexual reproduction
- Environmental factor
- Genetic factor
- Photosynthesis
- Cellular respiration

claims and evidence, and add interest.

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.
- Cite specific textual evidence to support analysis of science and technical texts.
- Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.
- Write arguments focused on discipline content.
- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
- Summarize numerical data sets in relation to their context.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources

		<p>(including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.</p> <ul style="list-style-type: none"> <li>• Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.</li> <li>• Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.</li> <li>• Draw evidence from informational texts to support analysis, reflection, and research.</li> <li>• Develop a model to describe unobservable mechanisms.</li> </ul>
--	--	---

**Stage 2 – Evidence**

<b>Evaluative Criteria</b>	<b><i>Assessment Evidence</i></b>
----------------------------	-----------------------------------

<b>Investigation Development Rubric</b>	<p><b>PERFORMANCE TASK(S):</b></p> <ol style="list-style-type: none"> <li>1. Conduct an investigation to collect and identify evidence that describes the idea that living things are made up of cells. Student investigations will include the following:             <ol style="list-style-type: none"> <li>a. Description of how tools and methods in experimental design will provide the evidence necessary to address the purpose of the investigation. (Due to small-scale size, cells are unable to be seen with the unaided eye and require engineered magnification devices to be seen)</li> </ol> </li> </ol>	<p><b>Differentiation Considerations:</b></p> <ul style="list-style-type: none"> <li>• Different modes of presentation             <ol style="list-style-type: none"> <li>a. PowerPoint</li> <li>b. Poster</li> <li>c. Physical model</li> <li>d. Other choice</li> </ol> </li> </ul>
---	--	---

<p>Cell City Poster Rubric</p>	<p>b. Description, collection, recording, and evaluation of data on the cellular composition of living things. Evidence collection should include data about:</p> <ol style="list-style-type: none"> <li>i. The presence or absence of cells in living and nonliving things</li> <li>ii. The presence or absence of any part of a living thing that is not made up of cells</li> <li>iii. The presence or absence of cells in a variety of organisms, including unicellular and multicellular organisms</li> <li>iv. Different types of cells within on multicellular organism</li> </ol> <p>2. Develop a model that identifies the following cell organelles as represented by parts within a city: chloroplast, nucleus, cell wall, mitochondria, cell membrane. Student models will include:</p> <ol style="list-style-type: none"> <li>a. Descriptions of organelle functions and their contributions to overall cellular functions including: <ol style="list-style-type: none"> <li>i. Maintaining a cell's internal processes, for which it needs energy</li> <li>ii. Maintaining the structure of the cell and controlling what enters and leaves the cell</li> <li>iii. Functioning together as parts of a system that determines cellular function</li> <li>iv. The key differences between plant and animal cells</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>• Use of notes and resources</li> <li>• Chunked Assignments/check lists</li> </ul>
<p>Scientific Argument Rubric</p>	<p>3. Given an explanation or model, develop and support a claim related to the idea that the body is a system of interacting subsystems composed of groups of cells. Student arguments will include evidence and reasoning that support the following:</p> <ol style="list-style-type: none"> <li>a. Specialized groups of cells work together to form tissues</li> <li>b. Specialized tissues comprise each organ, enabling the specific organ function to be carried out</li> <li>c. Different organs can work together as subsystems to form organ systems that carry out complex functions</li> <li>d. The body contains organs and organ systems that interact with each other to carry out all necessary functions for survival and growth of the organism</li> </ol> <p>4. Develop and support a claim with evidence and reasoning to explain how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. Student arguments should include the following:</p> <ol style="list-style-type: none"> <li>a. Characteristic animal behaviors that increase the probability of reproduction</li> </ol>	

<p>Scientific Argument Rubric</p>	<ul style="list-style-type: none"> <li>b. Specialized plant and animal structures that increase the probability of reproduction</li> <li>c. Cause-and-effect relationship: Plant reproduction and the animal behaviors related to plant reproduction.</li> </ul>	
<p>Scientific Argument Rubric</p>	<ul style="list-style-type: none"> <li>5. Develop an argument that describes how genetic and environmental influences affect the growth of an organism. Student arguments should include evidence and reasoning that explains the following: <ul style="list-style-type: none"> <li>a. Environmental factors (availability of light, space, water, size of habitat) and their influence on growth</li> <li>b. Genetic factors (specific breeds of plants and animals and their typical sizes) and their influence on growth</li> <li>c. Changes in the growth of organisms as specific environmental and genetic factors changes</li> </ul> </li> </ul>	
<p>Scientific Argument Rubric</p>	<ul style="list-style-type: none"> <li>6. Develop an argument that explains the idea that photosynthesis results in the cycling of matter and energy into and out of organisms. Student argument should include evidence and reasoning that explain the following: <ul style="list-style-type: none"> <li>a. Plants, algae, and photosynthetic microorganisms require energy and must take in carbon dioxide and water to survive</li> <li>b. Energy from sunlight is used to combine simple nonfood molecules into food molecules and oxygen, which can be used immediately or stored by the plant</li> <li>c. Animals take in food and oxygen to provide energy and materials for growth and survival</li> <li>d. Some animals eat plants, algae, and photosynthetic microorganisms, and some animals eat other animals, which themselves eaten photosynthetic organisms</li> <li>e. Because animal acquire their food from photosynthetic organisms, all food and most of the oxygen animals use for life processes are the results of energy from the sun</li> </ul> </li> <li>7. Develop a model that describes how food molecules are rearranged as matter moves through an organism. Student models should include the identification and description of the following: <ul style="list-style-type: none"> <li>a. Molecules of food undergoing chemical reactions with oxygen to release stored energy during cellular respiration</li> </ul> </li> </ul>	

Cellular Respiration Model Rubric	<ul style="list-style-type: none"> <li>b. Atoms in food rearranging through chemical reactions to form new molecules that comprise the organism</li> <li>c. The number and type of each atom being the same before and after the chemical reactions</li> <li>d. All matter used by the organism form growth comes from the products of the chemical reactions</li> </ul>	
<p>Content Criteria</p> <p>Content Criteria</p> <p>Graded Quiz</p> <p>Flower Model Rubric</p>	<p style="text-align: center;">OTHER EVIDENCE:</p> <ol style="list-style-type: none"> <li>1. Biotic vs. Abiotic Lab <ul style="list-style-type: none"> <li>a. Observe and identify the characteristics of biotic things in an outdoor setting</li> <li>b. Observe and identify the characteristics of abiotic things in an outdoor setting</li> </ul> </li> <li>2. Cell Organelle Matching <ul style="list-style-type: none"> <li>a. Identify and match organelle names, functions, and memory items</li> </ul> </li> <li>3. Organs and Tissues Quiz <ul style="list-style-type: none"> <li>a. Identify the difference between cells and tissues</li> <li>b. Identify the difference between tissues and organs</li> <li>c. Identify how organs work to carry out specific bodily functions</li> </ul> </li> <li>4. Flower Model <ul style="list-style-type: none"> <li>a. Sketch of student flower model that shows its reproductive structures</li> <li>b. 3D model of flower showing it reproductive structures</li> <li>c. Conclusion to explain how the model is similar and different from assigned living flower, cause-and-effect relationship that describes how the plants structure affects the probability of successful reproduction, explanation of how flower structures can increase the odds of successful reproduction using evidence from model</li> </ul> </li> <li>5. Lima Bean Lab <ul style="list-style-type: none"> <li>a. Form a hypothesis about what affects the direction of root growth</li> <li>b. Gather evidence through observation of lima bean plant growing upright vs. upside down</li> </ul> </li> </ol>	<p>Differentiation Considerations:</p> <ul style="list-style-type: none"> <li>• Modified Quizzes</li> <li>• Flexible grouping</li> <li>• Guided/Cloze Notes</li> <li>• Pictures and videos to support vocabulary</li> <li>• Sentence Starters</li> <li>• Product modification in place of writing: <ul style="list-style-type: none"> <li>a. Drawing</li> <li>b. Verbal explanation</li> </ul> </li> </ul>

Lab Report Rubric	<ul style="list-style-type: none"> <li>c. Construct a lab report, using evidence from the lab, that explains what environmental factor the plant root growth responded to</li> </ul>	
Content Criteria	<ul style="list-style-type: none"> <li>6. Photosynthesis Model <ul style="list-style-type: none"> <li>a. Model the movement of radiant energy from the sun to photosynthetic organisms</li> <li>b. Model how sunlight is used to combine carbon dioxide and water into glucose to be stored or used</li> </ul> </li> </ul>	
Lab Report Rubric	<ul style="list-style-type: none"> <li>7. Cellular Respiration Lab (Yeast and Balloon Lab) <ul style="list-style-type: none"> <li>a. Explain the process of cellular respiration</li> <li>b. Observe and research the products and reactants of cellular respiration</li> <li>c. Write a lab report explaining cellular respiration, its location, its products, and its reactants</li> </ul> </li> <li>8. Science Notebook Entries <ul style="list-style-type: none"> <li>a. Concept maps</li> <li>b. Vocabulary/Glossary entries</li> <li>c. Guided Research</li> <li>d. Lab Reports described above</li> <li>e. Daily Journal Entries</li> </ul> </li> <li>9. Checklists of collaborative behaviors in labs and activities</li> <li>10. Checklists of collaborative behaviors in class discussions</li> <li>11. Self-assessments for Performance Tasks</li> <li>12. TO CONSIDER FOR LATER: UNIT TEST(S)</li> </ul>	