

Unit 3: Growth, Development and Reproduction of Organisms

Theme: Cell Division - Mitosis

Big Idea: Organisms grow and maintain systems by undergoing cell division. This process has a logical sequence of events that can be supported with evidence. When cells divide, the information needed to make more cells is encoded in the arrangement of molecules within DNA. The structure of DNA allows for fast and accurate replication.

Essential Questions for this Unit:

1. What are the events and the significance of mitosis? cytokinesis?
2. How are chromosomes important to cell division?

AZ Standard	Core Ideas	Student Friendly Objectives	Assessment	Resources	Vocabulary
<p>Essential HS.L1U1.22 Construct an explanation for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.</p> <p>Plus HS+B.L1U1.9 Develop and use a model to communicate how a cell copies genetic information to make new cells during asexual reproduction (mitosis). <i>Note: Students do not need to memorize the stages of mitosis, only to understand them as the cycle of organism growth, repair, and asexual reproduction.</i></p> <p>Plus HS+B.L1U1.4 Develop and use models to explain the interdependency and interactions between cellular organelles. <i>Note: This standard should cover the S-Phase of the Cell Cycle and how DNA replication is a semi-conservative process. Students do not need to memorize the stages of mitosis, only to understand them as the cycle of organism growth, repair, and asexual reproduction.</i></p>	<p>L1: Organisms are organized on a cellular basis and have a finite life span.</p> <ul style="list-style-type: none"> • In multi-cellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. • Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. • Most cells are programmed for a limited number of cell divisions. • Organisms die if their cells are incapable of further division. 	<p>-I can carry out an investigation to explore the role of mitosis and differentiation in producing and maintaining complex organisms. Note: Memorization of the stages of mitosis is not required.</p> <p>-I can use a model to explain how cells go through the process of replication in the S-phase of the cell cycle and construct an explanation that includes:</p> <ol style="list-style-type: none"> a. All cells contain DNA. b. DNA contains regions that are called genes. c. The sequence of genes contains instructions that code for proteins. d. Groups of specialized cells (tissues) use proteins to carry out functions that are essential to the organism. <p>-I can illustrate and explain that the pattern of mitotic cell division results in more cells that allow growth of the organism, can then differentiate to create different cell types, and can replace dead cells to maintain a complex organisms and organism systems.</p> <p>-I can analyze and connect ideas about the S-phase that supports the relationship between the DNA structure, the semi-conservative and accurate process of replication.</p>	<p>Summative Assessments: CANVAS Benchmark Tests APEX UNIT Tests Research Report: Explain from evidence the similarities and differences between lipid and cartilage cells from the same organism.</p> <p>Formative Assessments: APEX Lesson Quizzes Q & A during lectures Text Based – review/reinforcement Q's Labster - lesson questions</p> <p>Short Performance Assessment: Create a model to show how a parent cell gives rise to daughter cells with the same number of chromosomes.</p>	<ul style="list-style-type: none"> • APEX Lesson Assignments • CANVAS: supplementary lessons lab worksheets, and student email communication: -cell growth and the rates of cell growth and do surface area to volume ws -chromosomes & cell division ws -cell cycle label and draw ws -four phases of mitosis label and color code ws -draw the different phases ws -web quest or interactive website the cell cycle and mitosis ws • Lab: Why are Cells So Small? https://www.biologycorner.com/worksheets/cell-size.html • Real Microscopic Mitosis: https://www.youtube.com/watch?v=L61Gp_d7evo - Illustrate two different models for mitosis, explain which one is better for explaining how two daughter cells are genetically identical. • LABSTER: Identify the stages of mitosis Stages of mitosis slides using onion root or of animal cells. 	<p>cell division asexual reproduction sexual reproduction cell cycle centriole centromere chromatid chromatin chromosome histone protien replicate nuclear envelope spindle fibers cytokinesis DNA Interphase S-Phase Mitosis Synthesis Replication Daughter cells</p>

Crosscutting Concepts	Science and Engineering Practices
<p>Patterns:</p> <ul style="list-style-type: none"> ● Empirical evidence is needed to identify patterns. <p>Systems and System Models:</p> <ul style="list-style-type: none"> ● Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. ● Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. <p>Structure and Function:</p> <ul style="list-style-type: none"> ● The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. 	<p>Planning and Carrying Out Investigations:</p> <ul style="list-style-type: none"> ● Use investigations to gather evidence to support explanations or concepts. <p>Constructing Explanations and Designing Solutions:</p> <ul style="list-style-type: none"> ● Construct and revise explanations based on evidence obtained from a variety of sources (e.g., scientific principles, models, theories, simulations) and peer review. ● Apply scientific reasoning, theory, and models to link evidence to claims to assess the extent to which the reasoning and data support the explanation or conclusion. <p>Developing and Using Models:</p> <ul style="list-style-type: none"> ● Develop, revise, and use models to predict and support explanations of relationships between systems or between components of a system. ● Use multiple types of models to represent and support explanations of phenomena, and move flexibly between model types based on merits and limitations. ● Evaluate the merits and limitations of two different models of the same proposed tool, process, or system in order to select or revise a model that best fits the evidence or design criteria.
Anchoring Phenomenon	Investigative Phenomenon
<p>Mitosis https://youtu.be/ZeW8HaCUtOQ</p>	<p>The Inner Life of the Cell: https://thewonderofscience.com/phenomenon/2018/7/8/the-inner-life-of-the-cell</p>

Unit 3: Growth, Development and Reproduction of Organisms

Theme: Cell Growth

Big Idea: Our understanding of the cell cycle and genetics allows humans to manipulate/influence abnormal cell function. Decisions about whether certain actions should be taken will require ethical and moral judgments which are not provided by knowledge of science.

Essential Questions for this Unit:

1. What factors limit and control cell growth?
2. How is cell growth controlled?
3. What are the consequences of uncontrolled cell growth?

AZ Standard	Core Ideas	Student Friendly Objectives	Assessment	Resources	Vocabulary
<p>Essential HS.L1U3.23 Obtain, evaluate, and communicate the ethical, social, economic and/or political implications of the detection and treatment of abnormal cell function</p> <p>Plus HS+B.L1U1.4 Develop and use models to explain the interdependency and interactions between cellular organelles. Note: Relevant organelles such as the lysosome should be taught to understand how cells deal with abnormal cell function</p>	<p>L1: Organisms are organized on a cellular basis and have a finite life span.</p> <ul style="list-style-type: none"> Given a suitable medium, cells from a variety of organisms can be grown in situ, that is, outside the organism. These cell cultures are used by scientists to investigate cell functions and have medical implications such as the production of vaccines, screening of drugs, and in vitro fertilization. Diseases, which may be caused by invading microorganisms, environmental conditions or defective cell programming, generally result in disturbed cell function 	<p>-I can ask questions that arise from observations that seek additional information for what caused cancer</p> <p>-I can ask questions about the symptoms and mechanism of the abnormal cell function that cause disease.</p> <p>-I can ask questions about medical implications of gene therapies, DNA profiling, the screening of drugs, and in vitro fertilization.</p> <p>-I can analyze and draw conclusions by critically reading and summarizing multiple sources concerning the causes and effects of a cellular disease (abnormal cell function) including the current prevention and/or treatment of abnormal cell function and the ethical, social, economic and/or political implications and challenges of the treatment.</p> <p>-I can analyze a model and use it to describe cellular processes that relate to abnormal cell function and division including the interactions between cellular organelles that contribute to this process</p>	<p>Summative Assessments: CANVAS Benchmark Tests APEX UNIT Tests GROUP PROJECT: Research, present and discuss within groups the diseases and disorders that occur due to the mis-function of various enzymes (i.e., diabetes, malnutrition, sickle cell, and mitochondrial disease.) PowerPoint will be submitted as one.</p> <p>Formative Assessments: APEX Lesson Quizzes Q & A during lectures Examine images and ask Q's: Why two heads? Planarians (cell division/differentiation) Animal Tissue Regeneration Text Based review & reinforcement Q's Labster - lesson questions</p> <p>Short Performance Assessment: • Create a PowerPoint to present information on how malfunctioning cells in the pituitary gland have effects of bone and muscle cells in such diseases as gigantism.</p>	<ul style="list-style-type: none"> APEX Lesson Assignments CANVAS: supplementary lessons lab worksheets, and student email communication: <i>Driving Q: What are the effects of abnormal cells?</i> <i>Each ws will have a series of questions for students in preparation of a group discussion.</i> <ul style="list-style-type: none"> - Cancer cells v Normal Cells ws - Rapid cell growth and rates of cell growth ws -Chromosomes & cell division ws -web quest or interactive website abnormal cells ws Skin Cancer: https://www.youtube.com/watch?v=Zj4Bbu0xwRY&feature=youtu.be Killer T Cell – The Cancer Assassin https://thewonderofscience.com/phenomenon/2018/7/9/killer-t-cell-the-cancer-assassin • Develop questions and explain possible mechanisms causing cancerous tissues to have different patterns of growth than normal tissues. https://youtu.be/vKIRWY-LMYc White Blood Cell Chases Bacteria: https://thewonderofscience.com/phenomenon/2018/7/8/white-blood-cell-chases-bacteria Malaria and Sickle Cell Anemia https://thewonderofscience.com/ 	<p>Detection Abnormal Implications Ethical Moral Social Economic Political Medical Cellular division Differentiation Complex Medium In situ In vitro Cell functions Cell cultures Cellular Disease Abnormal cell function Defective cell Growth factor Apoptosis Cancer Regulatory protein Gene Therapy DNA profiling Vaccination</p>

				phenomenon/2018/7/5/malaria-and-sickle-cell-anemia <ul style="list-style-type: none"> Engage in argument for which type of cell, cord blood stem cells or red bone marrow, would be best for a bone marrow transplant to stabilize a patient's immune system. Ethical, social, and challenges of treatments: <ul style="list-style-type: none"> Communicate how adult cells from belly fat could potentially be used to produce and replace an injured knee ligament to restore proper function. 	
Crosscutting Concepts				Science and Engineering Practices	
Cause and Effect: <ul style="list-style-type: none"> Changes in systems may have various causes that may not have equal effects. Structure and Function: <ul style="list-style-type: none"> Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. 				Asking Questions and Defining Problems: <ul style="list-style-type: none"> Ask and evaluate questions that challenge the premise of an argument, the interpretation of a data set, or the suitability of a design. Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations. Obtaining, Evaluating, and Communicating Information: <ul style="list-style-type: none"> Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. Compare, integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) in order to address a scientific question or solve a problem. Developing and Using Models: <ul style="list-style-type: none"> Use multiple types of models to represent and support explanations of phenomena, and move flexibly between model types based on merits and limitations. Develop, revise, and use models to predict and support explanations of relationships between systems or between components of a system. 	
Anchoring Phenomenon				Investigative Phenomenon	
Why two heads? Why Two Heads? (biointeractive.org)				The Immortal Cells of Henrietta Lacks https://thewonderofscience.com/phenomenon/2018/7/8/the-immortal-cells-of-henrietta-lacks	