

Englewood Public School District

Science

Biology

First Marking Period

Unit 1: Cell Specialization, Homeostasis, Cell Division, and DNA

Overview: Students formulate an answer to the question “*How do the structures of organisms enable life’s functions?*” Students investigate explanations for the structure and functions of cells as the basic unit of life, of hierarchical organization of interacting organ systems, and of the role of specialized cells for maintenance and growth. The crosscutting concepts of *structure and function*, *matter and energy*, and *systems and system models* are called out as organizing concepts for the disciplinary core ideas. Students use *critical reading*, *modeling*, and *conducting investigations*. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Time Frame: 35 to 40 Days

Enduring Understandings:

Systems of specialized cells within organisms help them perform the essential functions of life.

All cells contain DNA molecules that code for the formation of proteins, which carry out most of the work of cells.

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.

Feedback (negative or positive) can stabilize or destabilize a system.

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.

Essential Questions:

How do the structures of organisms enable life’s functions?

How does the structure of DNA determine the structure of proteins, and what is the function of proteins?

What do you mean they say that people are made of a system of systems?

How do feedback mechanisms maintain homeostasis?

How do single cells form multicellular organisms?

Standards	Topics and Objectives	Activities	Resources	Assessments
HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.	<p>Topics</p> <p>The Chemistry of Life: Macromolecules, Enzymes</p> <p>Cell Structure and Function</p>	<p>Students will complete the investigations, labs, and activities:</p> <ol style="list-style-type: none"> Watch Untamed Science Chapter 2 video introduction via https://www.pearsonrealize. 	<p>Text:</p> <ul style="list-style-type: none"> Miller & Levine Biology <p>Materials:</p> <p><i>See investigations, labs and activities material lists</i></p> <p>For Pineapple Enzyme Lab</p>	<p>Formative Assessments:</p> <ul style="list-style-type: none"> Journals Learning/Response Logs Discussions Student portfolios

HS-LS1-6
Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Cellular Organization

Twenty-First Century Themes and Skills include:

- The Four C's
- Life and Career Skills
- Information and Media literacy

Objectives

Students will:

Conduct a detailed examination of the structure and function of the four basic biological molecules.

Develop and use a model to illustrate how organelles work together to meet a cell's needs.

Provide evidence that cell differentiation, specialization, and organization create tissues, organs, and systems that work together to support living things.

2. com
2. Build examples of biomolecules using molecular models
3. Biomolecules Poster/Chart
4. Lab - Testing for Identifying Organic Compounds
5. Build a model of an enzyme-substrate complex using the "lock and key" model
6. Paper or Clay enzyme model
7. Lab- pH and Enzyme Action
8. Lab - "What's in My Lunch"- investigation on macromolecules –
9. Macromolecule chart web quest
10. Building macromolecules molecule kit (HS-LS1-6, HS-LS1-2)

Students will watch the video Macromolecules: Definition, Types, Examples and complete the quiz that follows.

Students will explore the effect of temperature on enzyme activity in the Pineapple Enzyme Lab.

Students will explore interactive cell models and test their knowledge with cell games using the Cellsalive! Website.

Students will build plant and animal cell models and

- Fresh pineapple
- Canned pineapple
- Blender
- Gelatin powder
- Freezer
- Hot plate
- Glassware (beakers, bowls)
- Knife and scoop
- Thermometers

Websites:

- Cellsalive!
- What Do Cells Do?
- <https://www.pearsonrealize.com>

Videos:

- Macromolecules: Definition, Types, Examples
- Levels of Organization of Living Things

Enrichment Lesson Plans:

See *NGSS PBL Activity (pg 1a) Harnessing the Fear of Water* and Mr. Moore's Cells and the Question of Property Rights

will be used to monitor progress

Summative Assessments:

Student needs will be evaluated after completing the Macromolecules: Definition, Types, Examples quiz.

Students will receive a grade for the following lab activity conclusions: *Lab - Testing for Identifying Organic Compounds*, *Lab- pH and Enzyme Action*, *Lab - "What's in My Lunch"*, and *Pineapple Enzyme Lab*.
 Lab, Checklist, Rubrics

Student will demonstrate understanding of concepts by completing end of lesson quizzes via <https://www.pearsonrealize.com>.
 Online quiz

HS-LS1-3

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Topics

Cellular Transport

Homeostasis

Twenty-First Century Themes and Skills include:

- The Four C's
- Life and Career Skills
- Information and Media literacy

Objectives

Students will:

Use a model based on evidence to illustrate the role of cellular transport

Plan and conduct an

compare them using a Venn diagram in the What Do Cells Do? Simulation.

Students will be introduced to the Levels of Organization of Living Things by watching a narrated animation.

Enrichment Activities:

NGSS PBL Activity (Page 1a) Harnessing the Fear of Water.

Students will explore the issue of ownership rights for cells in the activity Mr. Moore's Cells and the Question of Property Rights. (8.2.12.C.4)

Students will complete the investigations, labs, and activities:

1. Watch Untamed Science Chapter 7 video introduction via <https://www.pearsonrealize.com>
2. Construct cell models (e.g., phenolphthalein-agar cubes, potato-iodine cubes) to investigate the relationship among cell size, surface area to volume ratio and the rates of diffusion into and out of the cell.
3. Lab: "Diffusion through a Membrane" (dialysis tubing)
4. Lab: "Quantitative Plasmolysis" or "Effect of Salt of Green Plant Cells"

Text:

- Miller & Levine Biology

Materials:

See investigations, labs and activities material lists

Websites:

- [Diffusion Activity](#)
- [Semipermeable Membrane](#)
- [Diffusion and Molecular Mass](#)
- [Diffusion and Temperature](#)
- [Diffusion of a Drop](#)
- [Diffusion, Osmosis, and Active Transport](#)
- [Membrane Channels Simulation](#)
- <https://www.pearsonrealize.com>

Videos:

Formative Assessments:

- Journals
- Learning/Response Logs
- Discussions
- Student portfolios will be used to monitor progress

Summative Assessments:

Student needs will be evaluated after completing Membrane Channels Simulation. Rubric, Check for Understanding, Summarize

Students will receive a grade for the following lab activity conclusions: *Lab: "Diffusion through a Membrane" (dialysis tubing)* and *Lab:*

<p>HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and</p>	<p>investigation individually and collaboratively to produce evidence that feedback mechanisms (negative and positive) maintain homeostasis.</p>	<p>(HS-LS1-3) Students will explore models of diffusion and cell transport in the <u>Diffusion Activity</u>, <u>Semipermeable Membrane</u>, <u>Diffusion and Molecular Mass</u>, <u>Diffusion and Temperature</u>, <u>Diffusion of a Drop</u>, and <u>Diffusion, Osmosis, and Active Transport</u> interactive websites. (NJSLSA.W8, NJSLSA.W7)</p> <p>Students will watch the videos <u>Osmosis: A Solute and Solvent Love Story</u>, <u>Plasma Membrane of a Cell</u>, <u>Cell Transport Song</u>, <u>Cell Membrane and Transport: Molecules like to Move it</u>, <u>Move it</u>.</p> <p>Students will complete the <u>Membrane Channels Simulation</u> to explore how different types of channels allow particles to move through the membrane.</p> <p><u>Enrichment Activity:</u> Students will explore diseases related to cell membranes and transport using the following websites and videos: <u>When Cell Communication Goes Wrong</u>, <u>Cell Membranes and Trafficking Disorders</u>, <u>Cell Membrane Diseases: Types and Causes</u>. (CRP5)</p>	<ul style="list-style-type: none"> • <u>Osmosis: A Solute and Solvent Love Story</u> • <u>Plasma Membrane of a Cell</u> • <u>Cell Transport Song</u> • <u>Cell Membrane and Transport: Molecules like to Move it, Move it</u> <p><u>Enrichment Lesson Plans:</u></p> <p>See <u>When Cell Communication Goes Wrong</u>, <u>Cell Membranes and Trafficking Disorders</u>, <u>Cell Membrane Diseases: Types and Causes</u></p>	<p><i>"Quantitative Plasmolysis" or "Effect of Salt of Green Plant Cells"</i>. Labs, Checklist, Rubric</p> <p>Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com. Online quiz</p>
	<p>Topics</p> <p>Cell Growth and Division</p> <p>Twenty-First Century Themes</p>	<p>Students will complete the investigations, labs, and activities:</p> <ol style="list-style-type: none"> 1. Watch Untamed Science Chapter 10 video 	<p><u>Text:</u></p> <ul style="list-style-type: none"> • Miller & Levine Biology <p><u>Materials:</u> <i>See investigations, labs and</i></p>	<p>Formative Assessments:</p> <ul style="list-style-type: none"> • Journals • Learning/Response Logs • Discussions

<p>maintaining complex organisms.</p>	<p>and Skills include:</p> <ul style="list-style-type: none"> • The Four C's • Life and Career Skills • Information and Media literacy <p>Objectives</p> <p>Students will:</p> <p>Use a model based on evidence to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.</p>	<p>introduction via https://www.pearsonrealize.com</p> <ol style="list-style-type: none"> 2. Mitosis Cut and Paste/Mitosis Diagrams/mitosis websites 3. Lab investigation- Onion Root Tips 4. Karyotyping activities 5. Mitosis plastic cell models (HS-LS1-4) <p>Student will be introduced to the cell cycle using the <u>Introduction the Cell Cycle Using Diagrams and Gestures</u> lesson and watching the <u>Mitosis Dance</u> Video. (F-BF.A.1, F-IF.C.7)</p> <p>Students will complete the virtual <u>Online Onion Root Tip Lab</u>.</p> <p>Enrichment Activity: Students will model the cell cycle in the <u>Twizzler Mitosis</u> activity. (MP.4)</p>	<p><i>activities material lists</i></p> <p>Websites:</p> <ul style="list-style-type: none"> • Online Onion Root Tip Lab • https://www.pearsonrealize.com <p>Videos:</p> <ul style="list-style-type: none"> • <u>Mitosis Dance</u> <p>Enrichment Lesson Plans: See <u>Twizzler Mitosis</u></p>	<ul style="list-style-type: none"> • Student portfolios will be used to monitor progress <p>Summative Assessments: Student needs will be evaluated after the <u>Introduction the Cell Cycle Using Diagrams and Gestures</u> lesson. Drawings, Visual Representations</p> <p>Students will receive a grade for the <i>Lab investigation- Onion Root Tips</i>. Labs, Drawings, Response Logs</p> <p>Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com. Online Quiz</p>
<p>HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.</p>	<p>Topics</p> <p>DNA</p> <p>Protein Synthesis</p> <p>Twenty-First Century Themes and Skills include:</p> <ul style="list-style-type: none"> • The Four C's • Life and Career Skills • Information and Media literacy <p>Objectives</p>	<p>Students will complete the investigations, labs, and activities:</p> <ol style="list-style-type: none"> 1. Watch Untamed Science Chapters 12 and 13 video introduction via https://www.pearsonrealize.com 2. Chromosomes/Genetic Mutations (paper strip models) 3. DNA Scavenger Hunt/DNA Code Hunt 4. Protein synthesis skit 	<p>Text:</p> <ul style="list-style-type: none"> • Miller & Levine Biology <p>Materials: <i>See investigations, labs and activities material lists</i></p> <p>Websites:</p> <ul style="list-style-type: none"> • <u>DNA to Protein</u> • <u>DNA Transcription and Translation Simulation</u> • https://www.pearsonrealize.com 	<p>Formative Assessments:</p> <ul style="list-style-type: none"> • Journals • Learning/Response Logs • Discussions • Student portfolios will be used to monitor progress <p>Summative Assessments: Student needs will be evaluated after completing <u>DNA Transcription and Translation Simulation</u>.</p>

	<p>Students will:</p> <p>Conduct a detailed examination of the structure and function of DNA.</p> <p>Construct an explanation for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells</p>	<ol style="list-style-type: none"> Cell City/Factory analogy activity Lab -Strawberry DNA extraction DNA origami project DNA model cut out DNA vertebrate transcription and translation Codon Strip activity Protein synthesis codon chart (F-IF.C.7, CRP5) <p>Student will explore the relationship between the genetic code on the DNA strand and the resulting protein in the simulation <u>DNA to Protein</u>.</p> <p>Student will create proteins and explore the factors that affect protein synthesis in a cell in the online simulation <u>DNA Transcription and Translation Simulation</u>. (SL.11-12.5, F-BF.A.1)</p> <p>Student will watch the video <u>What is DNA and How does it Work?</u> to review DNA and protein synthesis. (6.1.12.C.14.d, WHST.11-12.8)</p> <p><u>Enrichment Activity:</u> Students will explore the <u>Stretching DNA Simulation</u>. (CRP11, 8.2.12.C.4, WHST.9-10.7)</p>	<p><u>Videos:</u></p> <ul style="list-style-type: none"> <u>What is DNA and How does it Work?</u> <p><u>Enrichment Lesson Plans:</u></p> <p>See <u>Stretching DNA Simulation</u></p>	<p>Written Responses</p> <p>Students will receive a grade for the <i>Lab -Strawberry DNA extraction</i>. Following Directions, Lab Notes, Journals, Drawings</p> <p>Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com. Online quizzes and tests</p> <p>Benchmark Assessment: Common Formative Assessment</p> <p>Alternative Assessments: Students will use a model to illustrate the role of cellular division between systems of cells/organisms. Model/Project, Rubric, Checklist, Open-Ended Writing</p> <p>Students will develop and use a model based on evidence to illustrate the interaction of functions at the organism system level. Drawings, Written Response, Self-Assessments</p> <p>Students will conduct a detailed examination of the structure and function of DNA. Drawings, Computer/Internet, Discussion, Questioning,</p>
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Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for “can do’s” as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/

This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity. In planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	Special Education	At-Risk	Gifted and Talented
<ul style="list-style-type: none"> ● Pre-teach vocabulary ● Provide two sets of textbooks, one for home and one for school ● Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Give page numbers to help the students find answers ● Provide a computer for written work ● Provide two sets of textbooks, one for home and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers 	<ul style="list-style-type: none"> ● Provide two sets of textbooks, one for home and one for school ● Ask students to summarize key concepts frequently ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Provide concrete examples ● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). 	<ul style="list-style-type: none"> ● Using visual demonstrations, illustrations, and models ● Ask students to summarize key concepts frequently ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Increase one on one time ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. ● Review behavior expectations and make adjustments for personal space or other behaviors as needed. ● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. ● Provide opportunities for students to connect with people of similar backgrounds (e.g. 	<ul style="list-style-type: none"> ● Students can present information learned to the class or another grade level ● Curriculum compacting ● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. ● Use project-based science learning to connect science with observable phenomena. ● Structure the learning around explaining or solving a social or community-based issue. ● Collaborate with after-school programs or clubs to extend learning opportunities.

		conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	
Interdisciplinary Connections:			
ELA-NJSLS/ELA: WHST.9-10.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.(HS-LS1-3) WHST.11-12.8 : Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3) SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2)			
Mathematics: F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4) F-BF.A.1: Write a function that describes a relationship between two quantities. (HS-LS1-4)			
Career Ready Practices: CRP5: Consider the environmental, social and economic impacts of decisions. CRP11: Use technology to enhance productivity.			
Integration of Technology Standards NJSLS 8: 8.2.12.C.4: Explain and identify interdependent systems and their functions.			
Social Studies: 6.1.12.C.14.d: Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.			
Integration of 21st Century Standards NJSLS 9: 9.3.ST-ET.2: Display and communicate STEM information. 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.			

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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. (HS-LS1-1) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) 	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) Regions of DNA called genes determine the structure of proteins, which carry out the essential functions of life through systems of specialized cells. The sequence of genes contains instructions that code for proteins. (LS1.A) Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) Groups of specialized cells (tissues) use proteins to carry out functions that are essential to the organism. (LS1.A) 	<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. (HS-LS1-2) <p>Stability and Change</p> <ul style="list-style-type: none"> Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)