Totowa Public Schools

Science

Grade 7

Aligned to NJSLS 2020 Standards

BOE Adopted: 08/31/2022

Revised 12/14/2022

Units of Study & Pacing Guide

Unit of Study	Timeline	Notes
Unit 1: Microbiome	4 Weeks	
Unit 2: Metabolism/Metabolism Engineering Internship	8 Weeks	
Unit 3: Matter and Energy in Ecosystems	4 Weeks	
Unit 4: Populations and Resources	4 Weeks	Lessons in the unit satisfy the Climate Change mandate
Unit 5: Traits and reproduction	4 Weeks	
Unit 6: Natural Selection	6 Weeks	
Unit 7: Evolutionary history	6 Weeks	
		Curricular Mandate List

Title	Microbiome
Unit Duration	4 Weeks
Unit Summary & Rationale	***In this unit, students take on the role of student researchers as they work out and explain the anchor phenomenon for the unit—a fecal transplant cured a patient suffering from a potentially deadly C. difficile infection. They make arguments that justify continued research of this new treatment. By engaging in sense-making about the same types of data that professional scientists use, they work to understand how having 100 trillion microorganisms on and in the human body can keep a person healthy. In the process, they learn to examine living things at multiple scales, from molecules to single-celled organisms to the overall human body.***
Unit Goals	
Essential Questions	• How can having 100 trillion microorganisms on and in the human body keep us healthy? • How small are the microorganisms that live on and in the human body? • How do microscopic things vary in size?
Enduring Understandings	• Many organisms are microscopic—so small that they cannot be seen with the naked eye. • All living things are made of cells. • Even though they are both too small to see, cells are much bigger than molecules. • The human body provides an environment (food and space) for bacteria to survive. • A healthy microbiome has various helpful types of bacteria.
Learning Outcomes	• Many organisms are microscopic—so small that they cannot be seen with the naked eye. • All living things are made of cells. • Almost all cells are microscopic. • Even though they are both too small to see, cells are much bigger than molecules. • view images of microscopic organisms. Use a digital Scale Tool, and work to create scale models of cells and molecules, glimpsing the very small world of microorganisms and laying a lifelong foundation for understanding issues of scale in life science

- read an article titled The Human Microbiome and are introduced to the practice of Active Reading—annotating text with their own questions and connections.
- analyze data about a patient's microbiome at different stages of an infection and treatment—with antibiotics and later a fecal transplant.
- evaluate the relevance of different pieces of evidence about antibiotics and analyze data from experiments with mice.
- Create evidence-based arguments to explain how fecal transplants work to cure infections. These arguments are used to address a fictional senator's attempts to eliminate funding for fecal transplant research.
- Career Exploration – Students will explore careers in biology.

Assessment Evidence	
Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. • MS-LS1-2. 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. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. • MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes.
Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes.

	Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	
NJ 2020 SLS: Science	
Standards	

- MS-LS1-1., Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]

- MS-LS1-2., 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. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]

- MS-LS1-3., Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the

mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

Science and Engineering Practices

Planning and Carrying Out Investigations

- Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.
- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop and use a model to describe phenomena.

Engaging in Argument from Evidence

- Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.

Disciplinary Core Ideas (DCI)

LS1.A: Structure and Function:

- All living things are made up of cells. A cell 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). (MS-LS1-1)

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

- 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. (MS-LS1-3)

Crosscutting Concepts

Scale, Proportion, and Quantity	Phenomena that can be observed at one scale may not be observable at another scale. Connections to Engineering, Technology and Applications of Science Interdependence of Science, Engineering, and Technology • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.
Systems and System Models	Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Connections to Nature of Science Science is a Human Endeavor • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.
Structure & Function	• Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.

NJ: 2016 SLS: English Language Arts & Companion Standards

- NJSLA.W.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- NJSLA. W.2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.
- RST.6-8.10: By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.
- RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

- RST.6-8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
- RST.6-8.6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
- RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- WHST.6-8.1.A: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- WHST.6-8.1: Write arguments focused on discipline-specific content.
- WHST.6-8.10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- WHST.6-8.1b: Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.7: 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.
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.
- NJLA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- NJSLA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLA.SL.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

- NJSLA. SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- NJSA SL.7: Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate. clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized references materials, as appropriate.
- NJSLA.L.7: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

NJ: 2016 SLS: Mathematics

- 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.
- 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

2020 SLS: Computer Science & Design Thinking

NJSLS Performance Expectations (By the end of 8th Grade)

- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJSLS Performance Expectations (By the end of 8th Grade)

- 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas.
- 9.4.8.TL.4 Synthesize and publish information about a local or global issue or event.
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Interdisciplinary/21st Century Connections

Math	See Above

21st Century Connections	• Creativity and Innovation • Information and Media Literacy • Critical Thinking and Problem Solving • Technology Literacy
SEL	• Self-Awareness • Responsible Decision-Making • Self-Management New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Title	Matter and Energy in Ecosystems
Unit Duration	6 Weeks
Unit Summary & Rationale	***The Matter and Energy in Ecosystems unit builds on the understanding developed in the Populations and Resources unit where students learned that the transfer of energy storage molecules, such as starches and fats, is determined by the interactions between consumer and resource populations. While the previous focus was on consumers, this unit expands students' understanding of ecosystems by considering both living and nonliving components—how its producers, consumers, and decomposers meet their energy needs through the processes of photosynthesis and cellular respiration; how carbon, a key component of those processes, moves between nonliving and living matter; and how sunlight and the atmosphere function within the overall system.***
Unit Goals	
Essential Questions	• How do all the organisms in an ecosystem get the resources they need to release energy? • Where do the energy storage molecules in an ecosystem come from? • What factors affect how many energy storage molecules producers are able to make • Where does the carbon dioxide in abiotic matter come from? • How do organisms give off carbon dioxide? • If the amount of carbon changed in one part of a closed ecosystem, what happened to the carbon in the rest of the ecosystem?

Enduring Understandings	• During the process of photosynthesis, producers make energy storage molecules, using carbon from carbon dioxide and energy from sunlight. • If one part of a system changes, this affects the rest of the system. • When there is more carbon (in the form of carbon dioxide) in abiotic matter, more carbon is available to producers for making energy storage molecules. When there is less carbon (in the form of carbon dioxide) in abiotic matter, less carbon is available to producers for making energy storage molecules. • When there is more sunlight, producers can make more energy storage molecules from the carbon in carbon dioxide. When there is less sunlight, producers cannot make as many energy storage molecules from the carbon in carbon dioxide. • As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy storage molecules. This process moves carbon from biotic to abiotic matter. • Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change. If the amount of carbon increased in abiotic matter, then it also decreased in biotic matter. If the amount of carbon decreased in abiotic matter, then it also increased in biotic matter
Learning Outcomes	• Carbon is part of carbon dioxide, which is abiotic matter. Carbon is also part of energy storage molecules, which are biotic matter. • During the process of photosynthesis, producers make energy storage molecules, using carbon from carbon dioxide and energy from sunlight. This moves carbon from abiotic to biotic matter. • If one part of a system changes, this affects the rest of the system. • When there is more carbon (in the form of carbon dioxide) in abiotic matter, more carbon is available to producers for making energy storage molecules. • When there is less carbon (in the form of carbon dioxide) in abiotic matter, less carbon is available to producers for making energy storage molecules. • When there is more sunlight, producers can make more energy storage molecules from the carbon in carbon dioxide. • When there is less sunlight, producers cannot make as many energy storage molecules from the carbon in carbon dioxide.

- As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy storage molecules. This process moves carbon from biotic to abiotic matter.
- Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change.
- If the amount of carbon increased in abiotic matter, then it also decreased in biotic matter. If the amount of carbon decreased in abiotic matter, then it also increased in biotic matter.
- Read articles about photosynthesis. Investigate photosynthesis, energy-storage molecules, and carbon in the Sim.
- View a video of a photosynthesis experiment and analyze data about the biodome and model their ideas about its collapse.
- Get evidence from the Sim and from a video of an experiment to determine which organisms do cellular respiration.
- Read a short article about decomposers and dead matter. Students model more complete ideas about the biodome collapse, using evidence about decomposers and dead matter.
- Read about carbon dioxide in the whole Earth system.
- Use a game-like physical model to investigate carbon cycling.
- Create a visual model and write their final explanation of the biodome collapse.

Assessment Evidence	
Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS 1-6: 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. • MS-LS1-7: 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. • MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

	• MS-LS 2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. • MS-LS 2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes
Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	
NJ 2020 SLS: Science	
Standards	
• MS-LS1-6 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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.] • MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]	

- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions - Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (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. (MS-LS1-5), (MS-LS1-6)

Developing and Using Models - Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS-LS2-3)

Engaging in Argument from Evidence - Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct 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. (MS-LS2-4)

Disciplinary Core Ideas (DCI)

LS1.C: Organization for Matter and Energy Flow in Organisms:

- 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. (MS-LS1-6)

LS2.A: Interdependent Relationships in Ecosystems.

- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across

ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.(MS-LS2-2)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems:

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience:

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

PS3.D: Energy in Chemical Processes and Everyday Life:

- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)
- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)

ESS3.D: Global Climate Change:

- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

Crosscutting Concepts

Energy & Matter	Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change	Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5)
Connections to Nature of Science	Scientific Knowledge is Based on Empirical Evidence • Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) Scientific Knowledge Assumes an Order and Consistency in Natural System • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3) Scientific Knowledge is Based on Empirical Evidence • Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)

NJ: 2016 SLS: English Language Arts & Companion Standards

- NJSLA.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- NJSLA.W.2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- RI.6.8, 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. (MS-LS1-3)
- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1), (MS-LS2-2), (MS-LS2-4)
- RST.6-8.10: By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.
- RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5), (MS-LS1-6)

- RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
- RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- WHST.6-8.1, Write arguments focused on discipline content. (MS-LS1-3)
- WHST.6-8.1.a: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- WHST.6-8.1.b: Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- WHST.6-8.1.c: Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence
- WHST.6-8.1: Write arguments focused on discipline-specific content.
- WHST.6-8.2.d: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.9: Draw evidence from informational texts to support analysis reflection, and research.

NJ: 2016 SLS: Mathematics

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- 6.RP.3: Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- 7.RP.2: Recognize and represent proportional relationships between quantities.

- 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.
- 8.F.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

2020 SLS: Computer Science & Design Thinking

NJSLS Performance Expectations (By the end of 8th Grade)

- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJSLS Performance Expectations (By the end of 8th Grade)

- 9.4.8.IML.8 Apply deliberate and thoughtful search strategies to access high-quality information on climate change.
- 9.2.8.CAP.20: Identify the items to consider when estimating the cost of funding a business

Interdisciplinary/21st Century Connections

Math	See Above
21st Century Connections	• Creativity and Innovation • Information and Media Literacy • Critical Thinking and Problem Solving • Technology Literacy
SEL	• Self-Awareness • Responsible Decision-Making • Self-Management • Relationship Skills • Social Awareness • New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Title	Populations and Resources
Unit Duration	4Weeks
Unit Summary & Rationale	***In the role of student ecologists at a research center near the fictional Glacier Sea, students investigate what may have caused a puzzling increase in the size of the moon jelly population there, which serves as the anchor phenomenon for the unit. Using a fictional scenario, based on real jelly increases all over the world, students are motivated to find out more about how the ecosystem is connected, and how changes to one population in the food web might cause changes to another population. Using the Populations and Resources Simulation to gather evidence about how ecosystems work, students learn how different populations affect each other, both directly and indirectly. Students use this newfound knowledge and data from Glacier Sea to determine the most likely cause of the moon jelly population increase as well as engage in scientific argumentation as they model and explain their claim.***
Unit Goals	
Essential Questions	• Why do populations change size in an ecosystem? • How do births and deaths in a population affect its size? • What can change the number of births in a population? • What can change the number of deaths in a population? • What can affect the size of a population besides its resource or consumer populations?
Enduring Understandings	• Within a population, organisms are always being born and dying. A system can be stable even as things are being added to and removed from it. If the amounts being added and being removed are not equal, then the system will change. If the number of births and deaths in a given time are equal, then the population size will be stable. If there are more births than deaths in a given time, then the size of the population will increase. If there are fewer births than deaths, then the size of the population will decrease. • Organisms need to release energy from energy storage molecules in order to reproduce. Organisms in consumer populations get energy storage molecules from eating organisms in resource populations. • The larger the consumer population, the more energy storage molecules it will need. Therefore, it will eat more, causing more deaths in the resource population.

	• Two populations can compete for the same resource population. A change to one of these populations affects the size of the other. The size of a population can be affected by any population that is connected to it in a food web, even if they are not directly connected.
Learning Outcomes	• Within a population organisms are always being born and dying. • A system can be stable even as things are being added to and removed from it. If the amounts being added and being removed are not equal, then the system will change. • If the number of births and deaths in a given time are equal, then the population size will be stable • If there are more births than deaths in a given time, then the size of the population will increase. If there are fewer births than deaths, then the size of the population will decrease. • Organisms need to release energy from energy storage molecules in order to reproduce. • Organisms in consumer populations get energy storage molecules from eating organisms in resource populations. • The more energy storage molecules available to a population, the more the organisms in that population can reproduce. • The larger the resource population, the more energy storage molecules are available for its consumer populations. • The larger the consumer population, the more energy storage molecules it will need. Therefore, it will eat more, causing more deaths in the resource population. • Two populations can compete for the same resource population. A change to one of these populations affects the size of the other. • The size of a population can be affected by any population that is connected to it in a food web, even if they are not directly connected. • Explore the Simulation and read about other populations that are part of the moon jelly ecosystem. • Model births and deaths in a population using tokens and watch a video about stability and change. • Evaluate evidence about the jelly population and create a visual model showing two possible reasons the jelly population may have increased. • Read an article about why organisms need energy in order to reproduce. • Test ways of changing the amount of reproduction and ways of changing the amount of deaths in the Sim.

- Create visual models showing possible reasons for the increase in moon jellies.
- Evaluate and analyze evidence about other populations in the ecosystem.
- Read about two real populations of moon jellies, one that increased and one that remained stable.
- Investigate competition and other indirect effects in the Sim.
- Evaluate and analyze evidence about different populations in the ecosystem and write final arguments about the cause of the moon jelly increase.
- Examine how shifts in populations within an ecosystem effect the climate. (Climate Change)

Assessment Evidence	
Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem • MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. • MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. • MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. • MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes
Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments

	Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	
NJ 2020 SLS: Science	
Standards	
MS-LS-2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.] MS-LS1-4 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. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]	

MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

Science and Engineering Practices

Developing and Using Models - Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS1-2)

Engaging in Argument from Evidence - Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- 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. (MS-LS1-4)
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Constructing Explanations and Designing Solutions - Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (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. (MS-LS1-5), (MS-LS1-6)
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Developing and Using Models - Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS3-1), (MS-LS3-2)

Obtaining, Evaluating, and Communicating Information - Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

Disciplinary Core Ideas (DCI)

LS1.A Structure and Function:

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

LS1.B Growth and Development of Organisms:

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)

LS3.A Inheritance of Traits:

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)

- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B Variation in Traits:

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)

- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

LS4.B Natural Selection:

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

Crosscutting Concepts	
Cause and Effect	• Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4), (MS-LS1-5) • Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2) • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-5), (MS-LS4-6)
Connections of Engineering, Technology, and Applications of Science	• Interdependence of Science, Engineering, and Technology • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)
Science Addresses Questions about the Natural and Material World	• Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

Structure & Function	• Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2) • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)
NJ: 2016 SLS: English Language Arts & Companion Standards	
• NJSLA.W.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. • NJSLA. W.2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. • RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. • RST.6-8.10: By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently. • RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. • RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. • RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. • RST.6-8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic. • RST.6-8.6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. • RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). • RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. • RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	

- RI.6.8 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. (MS-LS1-3), (MS-LS1-4)
- WHST.6-8.1.A: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- WHST.6-8.1: Write arguments focused on discipline-specific content.
- WHST.6-8.10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- WHST.6-8.1b: Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.7: 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.
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.
- NJLA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- NJSLA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLA.SL.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
- NJSLA. SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- NJSLA.SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2, (MS-LS1-7)
- NJSA SL.6: Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate. clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized references materials, as appropriate.

• NJSLA.L.6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
NJ: 2016 SLS: Mathematics
• 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. • 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers. • 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. • MP.4 Model with mathematics. (MS-LS3-2)
2020 SLS: Computer Science & Design Thinking
NJSLS Performance Expectations (By the end of 8th Grade)
• 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies. • 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.
2020 SLS: Career Readiness, Life Literacies, and Key Skills
NJSLS Performance Expectations (By the end of 8th Grade)
• 9.4.8.TL.4 Synthesize and publish information about a local or global issue or event. • 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. • 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
Interdisciplinary/21st Century Connections

21st Century Connections	• Creativity and Innovation • Information and Media Literacy • Critical Thinking and Problem Solving • Technology Literacy
Math	• See Above

SEL	• Self-Awareness • Relationship Skills • Social Awareness • New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Title	Traits and reproduction
Unit Duration	4 Weeks
Unit Summary & Rationale	***In the Traits and Reproduction unit, students take on the role of student genetic researchers, working with the fictional bioengineering firm, Bay Medical Company. Bay Medical Company is attempting to breed spiders with the type of silk that can be used for medical applications (e.g., to create artificial tendons). The student genetic researchers are faced with the challenge of explaining how the silk flexibility traits of closely related spiders can vary, which serves as the anchor phenomenon for the unit. To explain this mystery, students create physical models, read articles, and observe genetics in action, using the Traits and Reproduction Simulation. This powerful and engaging digital tool allows students to observe and breed spiders, making connections between what happens inside cells and how this affects the traits of an organism. Through their research, students learn about the role proteins, genes, and sexual reproduction play in trait variation. They are able to apply what they have learned about spiders to a human context.***
Unit Goals	
Essential Questions	• The traits of an organism are determined by the structure of protein molecules and the interactions of those protein molecules in cells. • Genes are instructions for producing proteins. • Through sexual reproduction, an organism inherits a random combination of gene versions from its parents.
Enduring Understandings	• Why do traits vary, and why do they vary even between parents and offspring and among siblings? • What determines an organism's traits at the molecular scale? • How can organisms make different protein molecules for a particular feature?

	• Why do some organisms make one type of protein for a feature and other organisms make two? • How do organisms get their genes? • How does sexual reproduction result in variation among offspring?
Learning Outcomes	• By the end of this unit, students will know: • The function of a protein molecule depends on its structure and how it interacts with other protein molecules. • Differences in the structure of protein molecules affect how they connect to other protein molecules. This can result in different traits. • The structure of molecules determines how they function at a molecular scale, which determines the properties of the object they make up. • Organisms can have different proteins in their cells for a particular feature. • Genes are instructions for proteins. • Each gene version provides a unique instruction to make a specific protein molecule in an organism's cells. • An organism has two copies of a gene for each feature. • The two copies of a gene for each feature can be the same version (homozygous) and provide instructions for only one type of protein. • The two copies of a gene for each feature can be different versions (heterozygous) and provide instructions for two types of proteins. • Organisms inherit their genes through sexual reproduction. • Each parent randomly passes on one of its two copies of each gene to its offspring. Each offspring, therefore, receives two copies of each gene, one from each parent. • Through sexual reproduction, each offspring can inherit a different combination of gene versions. Therefore, siblings can have different traits from each other and even from their parents. • Explore traits and proteins in the Sim and test the effect of changing protein molecules. • Read short articles about different kinds of spiders and how their silk traits are related to the protein molecules that make up the silk. • Build physical models of connected protein molecules to make silk with different levels of flexibility.

- Read about the genes and proteins involved in hemophilia.
- Use the Sim to investigate genes and their outcomes by making changes to genes and observing the effect on proteins and traits.
- Engage in a physical model that highlights genes as instructions and introduces mutations.
- Create visual models showing their explanations for how the spider offspring have different traits.
- Read about identical and fraternal twins to learn how genes are passed on in sexual reproduction.
- Investigate how genes are passed on when spiders in the Sim reproduce, and test the effects of random mutations during reproduction.
- Model their understanding of how genes were passed on in the Darwin's bark spider family.

Assessment Evidence	
Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS1-2: Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function • MS-LS1-4: 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. • MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. • MS-LS3-1: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. • MS-LS3-2: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. • MS-LS4-5: Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms

	Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes
Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	
NJ 2020 SLS: Science	
Standards	
MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]	

MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

MS-LS1-4 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. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]

MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

Science and Engineering Practices

Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS3-1), (MS-LS3-2)

Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS1-2)

Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- 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. (MS-LS1-4)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (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. (MS-LS1-5), (MS-LS1-6)

Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

Disciplinary Core Ideas (DCI)

LS1.A Structure and Function:

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

LS1.B Growth and Development of Organisms:

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)

- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)

LS3.A Inheritance of Traits:

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B Variation in Traits:

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

LS4.B Natural Selection:

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

Crosscutting Concepts

Structure and Function	• Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1) • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2) • Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)

Cause and Effect	• Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4), (MS-LS1-5) • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-5), (MS-LS4-6)
Interdependence of Science, Engineering, and Technology	• Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)
Science Addresses Questions About the Natural and Material World	• Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

NJ: 2016 SLS: English Language Arts & Companion Standards

- NJSLA.W.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- NJSLA. W.2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.
- RST.6-8.10: By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.
- RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
- RST.6-8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
- RST.6-8.6: Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

- RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- RI.6.8 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. (MS-LS1-3), (MS-LS1-4)
- WHST.6-8.1.A: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- WHST.6-8.1: Write arguments focused on discipline-specific content.
- WHST.6-8.10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- WHST.6-8.1b: Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.7: 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.
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.
- NJLA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- NJSLA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLA.SL.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
- NJSLA. SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

- NJSLA.SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2, (MS-LS1-7)
- NJSA SL.6: Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate. clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized references materials, as appropriate.
- NJSLA.L.6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

NJ: 2016 SLS: Mathematics

- 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.
- 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- MP.4 Model with mathematics. (MS-LS3-2)

2020 SLS: Computer Science & Design Thinking

NJSLS Performance Expectations (By the end of 8th Grade)

- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJSLS Performance Expectations (By the end of 8th Grade)

- 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas.
- 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect.
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Interdisciplinary/21st Century Connections

21st Century Connections	• Creativity and Innovation • Information and Media Literacy

	• Critical Thinking and Problem Solving • Technology Literacy
Math	• See Above
SEL	• Relationship Skills • Social Awareness New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Title	Natural Selection
Unit Duration	6 Weeks
Unit Summary & Rationale	***In this unit, students connect ideas about how the environment determines which traits are adaptive and non-adaptive, and how this affects the likelihood of survival and reproduction, to form an understanding of natural selection. The rough-skinned newt phenomenon motivates students to figure out concepts, such as variation, differential rates of survival and reproduction, adaptive traits, and mutations. By relating these ideas to changes in populations, students are challenged to think more deeply about why the distribution of traits in a population can change over time. Students' hands-on role as student biologists adds a sense of responsibility and curiosity to this unit and inspires active, student-led learning in the classroom.***
Unit Goals	
Essential Questions	• Why do populations change over time? • How can we describe a population? • What makes the distribution of traits in a population change? • How do individuals in a population get their traits? • How do some traits become more common over many generations while others become less common? • How do new traits appear in populations? • What determines whether a new trait will become more common in the population?
Enduring Understandings	• A population can be described by the traits present and by the number of individuals who have each trait. The number of individuals with each trait in a population can change over time.

	• Over many generations, individuals with adaptive traits become more common in a population, while individuals with non- adaptive traits become less common. Whether or not a trait is adaptive depends on the environment. • Genes are instructions for making protein molecules and protein molecules determine an organism's traits. Individuals inherit their genes from their parents. Genes, and therefore traits, in a population are passed down from generation to generation. • Mutations are changes to genes that can lead to changes to protein molecules, which can result in changes to traits. Mutations to genes can sometimes introduce new traits into a population. A new trait will only become more common in a population if it is adaptive.
Learning Outcomes	• A population can be described by the traits present and by the number of individuals who have each trait. • The number of individuals with each trait in a population can change over time. • Over many generations, individuals with adaptive traits become more common in a population, while individuals with non-adaptive traits become less common. • The traits that exist in a population determine which traits can become more common over many generations. • Whether or not a trait is adaptive depends on the environment. • Biologists analyze data about environmental conditions (the causes) to explain changes in the distribution of traits in populations (the effects). • Genes are instructions for making protein molecules and protein molecules determine an organism's traits. • Individuals inherit their genes from their parents. Genes, and therefore traits, in a population are passed down from generation to generation. • Individuals with adaptive traits are more likely to live longer and have offspring; individuals with non-adaptive traits are more likely to die without having offspring. • Mutations are changes to genes that can lead to changes to protein molecules, which can result in changes to traits. • Mutations to genes can sometimes introduce new traits into a population. • A new trait will only become more common in a population if it is adaptive. • Use the Sim and explore variation in populations and test when traits will become common.

- Use a physical model of variation in a population, and analyze histogram evidence about the newt population.
- Correct alternate conceptions represented in a short comic strip and represent their own ideas by creating visual models.
- Use a physical model to investigate reproduction and traits, and use the Sim to investigate how adaptive traits affect survival and reproduction.
- Read an article that describes scientists' research on poisonousness as an adaptive trait.
- Correct the explanations in two more short comic strips and create visual models to represent their explanations.
- Read about mutations and how they can cause new traits to appear in populations.
- Investigate mutations in the Sim and correct one more misconception in a comic.
- Make a final visual model and write a final explanation of what made the newts become so poisonous.

Assessment Evidence	
Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. • MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increases some individuals' probability of surviving and reproducing in a specific environment • MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes

Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	
NJ 2020 SLS: Science	
Standards	
MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]	
Science and Engineering Practices	

Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS3-1), (MS-LS3-2)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

Disciplinary Core Ideas (DCI)	
Crosscutting Concepts	
Structure and Functions	Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)
Cause and Effect	Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-5), (MS-LS4-6)

NJ: 2016 SLS: English Language Arts & Companion Standards

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- WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.7: 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.

- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
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- NJSLA.SL.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
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- NJSLA.SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2, (MS-LS1-7)
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- NJSLA.L.7: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

NJ: 2016 SLS: Mathematics

- 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.
- 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-LS4-4), (MS-LS4-6)
- MP.4 Model with mathematics. (MS-LS3-2)

2020 SLS: Computer Science & Design Thinking

NJSLS Performance Expectations (By the end of 8th Grade)

• 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies. • 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.
2020 SLS: Career Readiness, Life Literacies, and Key Skills
NJSLS Performance Expectations (By the end of 8th Grade)
• 9.4.8.TL.4 Synthesize and publish information about a local or global issue or event. • 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. • 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
Interdisciplinary/21st Century Connections

Math	See Above
21st Century Connections	• Creativity and Innovation • Information and Media Literacy • Critical Thinking and Problem Solving • Technology Literacy
SEL	• Responsible Decision-Making • Self-Management • Relationship Skills • Social Awareness New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Title	Evolutionary History
Unit Duration	6 Weeks

Unit Summary & Rationale	***In the Evolutionary History unit, students will take on the role of student paleontologists investigating a Mystery Fossil, which serves as the anchor phenomenon for the unit. This fossil is based on a real cetacean (whale) fossil excavated in Pakistan in 2000. The students' task is to determine the Mystery Fossil's evolutionary history so that they can accurately place the specimen in a museum exhibit. To gain an understanding of how paleontologists determine relationships between species, students use the Evolutionary History Simulation to analyze real fossil evidence and explore relationships on an interactive evolutionary tree. With a fossil collection at their fingertips, students identify similarities and differences among the skeletal structures of both extinct and living species. Students also use the Natural Selection Simulation to revisit principles of natural selection, applying this concept to understanding how one species becomes two. They read several articles about evolution, speciation, and natural selection, and they create models to show their thinking. By the end of the unit, students can use their analysis of skeletal structures to determine where they should place the Mystery Fossil in the museum, according to what type of organism the evidence shows it to be most closely related to—whales or wolves.***
Unit Goals	
Essential Questions	• Why do species, both living and extinct, share similarities and also have differences? • Why do different species share similar structures? • How does an ancestor population evolve into descendant species with differences in their shared structures? • How did descendant species from a common ancestor become very different from one another? • When you compare different species, how can you tell which species are more closely related than others?
Enduring Understandings	• Species inherit their body structures from their ancestor populations. • In populations separated into different environments, natural selection causes different changes to happen to each population. When the environment is mostly the same over time, body structures stay stable. When the environment changes over time, body structures may change due to natural selection. • Over many generations and very long periods of time, many small changes can build up to large differences in body structures. • Among any three species, the two species that separated most recently are the most closely related to each other.

Learning Outcomes	• Species inherit their body structures from their ancestor populations. • Body structures that are shared between two species are evidence that these two species inherited the shared structures from a common ancestor population. • In populations separated into different environments, natural selection causes different changes to happen to each population. This causes descendant species to end up with differences in their shared structures. • When the environment is mostly the same over time, body structures stay stable. When the environment changes over time, body structures may change due to natural selection. • Over many generations and very long periods of time, many small changes can build up to large differences in body structures. • Among any three species, the two species that separated most recently are the most closely related to each other. • When two species share a structure that is not shared with a third species, this can be evidence that the first two species are more closely related to each other than to the third species. • Sort species using similarities and differences • Read an article about related species and common ancestors, and trace similar structures back to common Ancestors in the Simulation. • Analyze similarities among the Mystery Fossil, wolves, and whales, and show their understanding in a visual model. • Revisit the Natural Selection Simulation, read articles about examples of speciation, and model speciation in the Natural Selection Simulation. • Explore evolution and deep time through a card sort and in the Sim. • Create models to show how small changes can add up to larger changes over deep time, and apply their understanding to the evolutionary history of the Mystery Fossil species. • Investigate evolutionary relationships using a physical model. • Explore the key common features of whales and wolves in the Sim, then analyze evidence about the Mystery Fossil to draw a final conclusion about the Mystery Fossil.
Assessment Evidence	

Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: • MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. • MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships • MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes
Alternative and Benchmark	Alternative - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, portfolios of student work, orally administered assessments, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments Formative, Summative, Alternative and Benchmark Assessments
Resources to Promote Learning	
Resources & Equipment Needed	Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Approved Class Resource List, Amplify Readings, Labs, Simulations
Content & Interdisciplinary Standards	

NJ 2020 SLS: Science
Standards
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.] MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.] MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]
Science and Engineering Practices
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3) • Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
Disciplinary Core Ideas (DCI)
LS4.A: Evidence of Common Ancestry and Diversity:

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

Crosscutting Concepts	
Patterns	Patterns can be used to identify cause and effect relationships. (MS-LS4-2) Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1), (MS-LS4-3)
Scientific Knowledge is Based on Empirical Evidence	Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)
Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1), (MS-LS4-2)

NJ: 2016 SLS: English Language Arts & Companion Standards

- NJSLA.W.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
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- RST.6-8.10: By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.
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- RST.6-8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
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- RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- RI.6.8 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. (MS-LS1-3), (MS-LS1-4)
- WHST.6-8.1.A: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- WHST.6-8.1: Write arguments focused on discipline-specific content.
- WHST.6-8.10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- WHST.6-8.1b: Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic.
- WHST.6-8.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.7: 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.
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

- WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.
- NJLA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- NJSLA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- NJSLA.SL.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
- NJSLA. SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- NJSLA.SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2, (MS-LS1-7)
- NJSA SL.6: Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate. clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized references materials, as appropriate.
- NJSLA.L.6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

NJ: 2016 SLS: Mathematics

- 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.
- 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- MP.4 Model with mathematics. (MS-LS3-2)

2020 SLS: Computer Science & Design Thinking

NJSLS Performance Expectations (By the end of 8th Grade)

- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJSLS Performance Expectations (By the end of 8th Grade)	
• 9.4.8.TL.4 Synthesize and publish information about a local or global issue or event. • 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. • 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.	
Interdisciplinary/21st Century Connections	
21st Century Connections	• Creativity and Innovation • Information and Media Literacy • Critical Thinking and Problem Solving • Technology Literacy
Math	• See Above
SEL	• Self-Awareness • Responsible Decision-Making New Jersey Social and Emotional Learning Competencies and Sub Competencies.docx

Accommodations & Modifications		
Special Education Students, 504 students, English Language Learners, Students at-Risk Based on Students' Individual Needs		
Time/General	**Processing**	**Comprehension**
• Allow extra time • Repeat and clarify directions • Provide breaks in between tasks • Have student verbalize directions • Provide timelines/due dates for reports and projects	• Provide extra response time • Have student verbalize steps • Repeat directions • Provide small group instruction • Include partner work	• Provide reading material on student's level • Have student underline important points • Assist student on how to use context clues to identify words/phrases • Ensure short manageable tasks

Tests/Quizzes/Grading • Provide extended time • Provide study guides • Limit number of responses	**Behavior/Attention** • Establish classroom rules • Write a contract with the student specifying expected behaviors • Provide preferential seating • Re-focus student as needed • Reinforce student for staying on task	**Organization** • Monitor the student and provide reinforcement of directions • Verify the accurateness of homework assignments • Display a written agenda
ELL, Enrichment, Gifted & Talented Strategies		
Accommodations Based on Students' Individual Needs ELL Strategies • Provide explicit, systematic instruction in vocabulary. • Ensure that ELLs have ample opportunities to talk with both adults and peers and provide ongoing feedback and encouragement. • Expose ELLs to rich language input. • Scaffolding for ELLs language learning. • Encourage continued L1 language development. • Alphabet knowledge		

- Phonological awareness
- Print awareness
- Design instruction that focuses on all of the foundational literacy skills.
- Recognize that many literacy skills can transfer across languages.
- English literacy development by helping ELLs make the connection between what they know in their first language and what they need to know in English.
- Graphic organizers
- Modified texts
- Modified assessments
- Written/audio instruction
- Shorter paragraph/essay length
- Homogeneously grouped by level

Accommodations Based on Students' Individual Needs:

Enrichment Strategies

- Evaluate vocabulary
- Elevate Text Complexity
- Incorporate inquiry based assignments and projects
- Extend curriculum
- Balance individual, small group and whole group instruction
- Provide tiered/multi-level activities
- Include purposeful learning centers
- Provide open-ended activities and projects
- Offer opportunities for heterogeneous grouping to work with age and social peers as well as homogeneous grouping to provide time to work with individual peers
- Provide pupils with experiences outside the ‘regular’ curriculum
- Alter the pace the student uses to cover regular curriculum in order to explore topics of interest in greater depth/breadth within their own grade level

- Require a higher quality of work than the norm for the given age group
- Promote higher level of thinking and making connections.
- Focus on process learning skills such as brainstorming, decision making and social skills
- Use supplementary materials in addition to the normal range of resources.
- Encourage peer to peer mentoring
- Integrate cross-curricular lessons
- Incorporate real-world problem solving activities
- Facilitate student-led questioning and discussions

Gifted & Talented Strategies

- More elaborate, complex, and in-depth study of major ideas, problems, and themes that integrate knowledge within and across systems of thought.
- Development and application of productive thinking skills to enable students to reconceptualize existing knowledge and/or generate new knowledge.
- Explore constantly changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world.
- Encourage exposure to, selection, and use of appropriate and specialized resources.
- Promote self-initiated and self-directed learning and growth.
- Provide for the development of self-understanding and the understanding of one's relationship to persons, societal institutions, nature, and culture.
- Flexible pacing
- Use of more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace. If they master a particular unit, they need to be provided with more advanced learning activities, not more of the same activity.
- Questions that require a higher level of response and/or open-ended questions that stimulate inquiry, active exploration, and discovery.
- Encourage students to think about subjects in more abstract and complex ways
- Activity selection based on student interests, that encourage self-directed learning
- Group interaction and simulations

- Guided self-management
- Encourage students to demonstrate what they have learned in a wide variety of forms that reflect both knowledge and the ability to manipulate ideas.
- Engage students in active problem-finding and problem-solving activities and research.
- Provide students opportunities for making connections within and across systems of knowledge by focusing on issues, themes, and ideas.