

Englewood Public School District

Science

Biology

Fourth Marking Period

Unit 6: Natural Selection and Evolution

Overview: Students *constructing explanations* and *designing solutions*, *analyzing and interpreting data*, and *engaging in argument from evidence* to make sense of the relationship between the environment and natural selection. Students also construct explanations for the processes of natural selection and evolution and then communicate how multiple lines of evidence support these explanations. Students evaluate evidence of the conditions that may result in new species and understand the role of genetic variation in natural selection. Additionally, students can apply concepts of probability to explain trends in population as those trends relate to advantageous heritable traits in a specific environment. Students demonstrate an understanding of these concepts by *obtaining, evaluating, and communicating information* and *constructing explanations and designing solutions*. The crosscutting concepts of patterns and cause and effect support the development of a deeper understanding.

Time Frame: 40 to 45 Days

Enduring Understandings:

Natural selection leads to adaptation; the traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

Changes in the physical environment have contributed to the expansion of some species, the emergence of new species, and the decline and the extinction of some species.

Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.

Genetic information provides evidence of evolution.

Essential Questions:

How does natural selection lead to adaptations of populations?

How are species affected by changing environmental conditions?

Why do some species live in groups and others are solitary?

What evidence shows that different species are related?

What is the relationship between natural selection and evolution?

Standards	Topics and Objectives	Activities	Resources	Assessments
(HS-LS4-4) Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	Topics Natural Selection Selective Pressures	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science Chapters 16-19 video	<u>Text:</u> Miller & Levine Biology <u>Materials:</u> <i>See investigations, labs and</i>	Formative Assessments: <ul style="list-style-type: none"> Journals Learning/Response Logs

<p>(HS-LS4-3) Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.</p> <p>(HS-LS4-5) Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p> <p>(HS-LS2-8) Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.</p> <p>(HS-LS4-1) Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.</p>	<p>Evolution</p> <p>Twenty-First Century Themes and Skills include:</p> <ul style="list-style-type: none"> • The Four C's • Life and Career Skills • Information and Media literacy • Environmental Literacy • Global Awareness <p>Objectives</p> <p>Students will:</p> <p>Use data to make claims about how specific biotic and abiotic differences in ecosystems contribute to change in gene frequency over time, leading to adaptation of populations.</p> <p>Use evidence to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.</p> <p>Determine cause-and-effect relationships for how changes to the environment affect distribution or disappearance of traits in species.</p> <p>Evaluate the evidence for the role of group behavior on individual and species' chances to survive and</p>	<p>introduction via https://www.pearsonrealize.com.</p> <ol style="list-style-type: none"> 2. Bird beak simulation 'Hide and Seek' lab during pre- and post- Industrial Revolution. 3. Relating structure and function of the adaptations of various specimens in jars and models lab. 4. Analyzing Charles Darwin's 'Origin of Species' original text-summary and questions. 5. Whale evolution periodical investigation and analysis to natural selection concepts in biology textbook. 6. Embryology diagram and models critical thinking investigation. 7. DVD: PBS Evolution - "Darwin's Dangerous Idea", "Great Transformations." 8. Investigation 9.2 "Natural Selection - A Simulation" Biological Science A Statistical Ecological Approach (paper clip and tablecloths lab). 9. Population dynamics and equilibrium lab. 10. Student made PowerPoint presentations on 5 types of evidence of evolution: - anatomical, embryological, paleontological, genetics, and geographic. 11. Geographic map study South America vs. Africa. 	<p><i>activities material lists</i></p> <p>Websites:</p> <ul style="list-style-type: none"> • Bunny Population Growth Activity • Pocket Mouse Evolution • Evolution WebQuest • https://www.pearsonrealize.com <p>Videos:</p> <ul style="list-style-type: none"> • The Biology of Skin Color • The Myths and Misconceptions of Evolution • The Five Fingers of Evolution <p>Enrichment Lesson Plans:</p> <p>See Conflicting Selection Pressures</p> <p>Additional Resources:</p> <p>https://evolution.berkeley.edu/evolibrary/article/evo_25</p> <p>https://www.livescience.com/474-controversy-evolution-works.html</p> <p>https://www.youtube.com/watch?v=aTftyFboC_M</p> <p>https://creation.com/natural-selection-evolution</p>	<ul style="list-style-type: none"> • Discussions • Student portfolios will be used to monitor progress <p>Summative Assessments: Student needs will be evaluated after completing the quizzes and discussions for the videos The Myths and Misconceptions of Evolution and The Five Fingers of Evolution.</p> <p>Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com.</p> <p>Students will show evidence for evolution by creating a PowerPoint presentations on 5 types of evidence of evolution: - anatomical, embryological, paleontological, genetics, and geographic. Rubric</p> <p>Benchmark Assessment: Common Formative Assessment</p> <p>Alternative Assessments: Students will use data to support their explanation of natural selection after completing the Bunny</p>
---	--	---	---	--

<p>(HS-LS4-2) Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p>	<p>reproduce.</p> <p>Communicate scientific information that multiple lines of empirical evidence support common ancestry and biological evolution.</p>	<p>12. Genetic distribution graph analysis.</p> <p>13. Evolutionary biological impacts research project brochure.</p> <p>14. PBS Sex and the Single Guppy computer simulation.</p> <p>15. Endosymbiont Hypothesis Research Paper</p> <p>16. Ancient human lineages periodical articles- jigsaw activity.</p> <p>(6.1.12.C.1.14.D, WHST.9-10.2, WHST.9-10.7)</p> <p>Students will watch the video <u>The Biology of Skin Color</u> to introduce the concept of adaptations.</p> <p>(WHST.9-10.9, SL.11-12.5)</p> <p>Students will read the <u>Survival of the Sneakiest</u> cartoon and discuss the “survival of the fittest” concept.</p> <p>(HS-LS2-8)</p> <p>Students will collect data during the <u>Bunny Population Growth Activity</u> simulation and use it to support their explanation of natural selection in a rabbit population.</p> <p>(MP.4, HS-LS4-2, RST.11-12.1)</p> <p>Students will watch the videos <u>The Myths and Misconceptions of Evolution</u> and <u>The Five Fingers of Evolution</u> and participate in online</p>	<p>https://www.questia.com/library/science-and-technology/life-sciences-and-agriculture/natural-selection</p> <p>https://www2.palomar.edu/anthro/evolve/evolve_2.htm</p> <p>Books: https://www.goodreads.com/list/show/9417.Best_Books_on_Evolution</p> <p>https://fivebooks.com/best-books/evolution-jerry-coyne/</p> <p>https://sciencing.com/abiotic-biotic-factors-ecosystems-7146052.html</p> <p>http://samples.jbpub.com/9780763761578/03ch_pg029-032_Wiles.indd.pdf</p> <p>https://biologos.org/blogs/jim-stump-faith-and-science-seeking-understanding/10-misconceptions-about-evolution</p> <p>https://www.goodreads.com/shelf/show/genetics</p> <p>https://www-tc.pbs.org/wgbh/evolution/educators/teachstuds/pdf/bird_beak_hdt.pdf</p>	<p><u>Population Growth Activity</u> simulation.</p> <p>Paragraph Writing, Response Log, Checklist</p> <p>Use data to differentiate between cause and correlation and to make claims about how specific biotic and abiotic differences in ecosystems contribute to change in gene frequency over time, leading to adaptation of populations.</p> <p>Research, Questioning, Discussion, Journals, Reading text, Games</p>
--	---	---	---	--

quizzes and discussions.
(HS-LS4-5)

Students explain how variation, selection, and time fuel the process of evolution in the **Pocket Mouse Evolution** simulation.
(HS-LS4-1)

Teams of students investigate evidence for evolution during the Evolution WebQuest.
(CRP5, 9.3.ST-ET.2, 9.3.ST.2)

Enrichment Activity:
Students will simulate Conflicting Selection Pressures and observe how heredity and natural selection allow a population to adapt to a changing environment.
(MP.2, HS-LS4-3, HS-LS4-4, CRP11, 8.2.12.C.4)

Accommodations and Modifications:

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

ELL/ESL students: Students will be supported according to the recommendations for “can do’s” as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

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

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

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

			with a project, journal articles, and biographies).	
Interdisciplinary Connections:				
ELA-NJSLS/ELA: WHST.9-10.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-5) SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2) RST.11-12.1: Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. (HS-LS4-1),(HS-LS4-2) WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 2(HS-LS4-1),(HS-LS4-2) WHST.9-10.9: Draw evidence from informational texts to support analysis, reflection, and research. WHST.9-12.9 (HS-LS4-1),(HS-LS4-2)				
Mathematics: MP.2: Reason abstractly and quantitatively. (HS-LS4-5) (HS-LS4-1), (HS-LS4-2) MP.4: Model with mathematics. (HS-LS4-2)				
Career Ready Practices: CRP5: Consider the environmental, social and economic impacts of decisions. CRP11: Use technology to enhance productivity.				
Social Studies: 6.1.12.C.14.d: Relate the changing manufacturing, service, science, and technology industries and educational opportunities to the economy and social dynamics in New Jersey.				
Integration of Technology Standards NJSLS 8: 8.2.12.C.4: Explain and identify interdependent systems and their functions.				
Integration of 21st Century Standards NJSLS 9: 9.3.ST-ET.2: Display and communicate STEM information. 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.				

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS4-3) Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS4-4) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS4-5) 	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1) <p>LS4.B: Natural Selection</p> <ul style="list-style-type: none"> Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-3) The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3) Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3) <p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and 	<p>Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4-4)</p> <p>Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-LS4-3)</p>

	<p>reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-4)</p> <p>LS2.D: Social Interactions and Group Behavior</p> <ul style="list-style-type: none"> • Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HSL2-8) 	
--	--	--