

Unit 2: Selection and Adaptation

CONTENT AREA: General Life Science	GRADES: 8	UNIT: 1 of 8
Pacing: Approx. 1 Month		
<p style="text-align: center;"><u>Science and Engineering Practices</u></p> <p><u>Constructing Explanations and Designing Solutions</u></p> <ul style="list-style-type: none"> Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4) <p><u>Obtaining, Evaluating, and Communicating Information</u></p> <ul style="list-style-type: none"> 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) <p><u>Using Mathematics and Computational Thinking</u></p> <p>Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)</p>	<p style="text-align: center;"><u>Disciplinary Core Ideas</u></p> <p><u>LS4.B: Natural Selection</u></p> <ul style="list-style-type: none"> Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) 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) <p><u>LS4.C: Adaptation</u></p> <ul style="list-style-type: none"> Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6) 	<p style="text-align: center;"><u>Crosscutting Concepts</u></p> <p><u>Cause and Effect</u></p> <ul style="list-style-type: none"> 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) <p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p><u>Interdependence of Science, Engineering, and Technology</u></p> <ul style="list-style-type: none"> 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) <p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p>Science Addresses Questions About the Natural and Material World</p> <ul style="list-style-type: none"> Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)
Performance Expectations: MS-LS4-4, MS-LS4-5, and MS-LS4-6		
Evidence Statement(s): MS-LS4-4, MS-LS4-5, and MS-LS4-6		
Essential Question: Are Genetically Modified Organisms (GMO) safe to eat?		
21st Century Skills: 9.2.8.B.3, 9.2.8.B.4		

Technology:HS-ETS1-1 HS-ETS1-3

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
<p>Fossils Extinction Evolution Fossil Record Time Relative Fossil Dating Natural Selection Adaptations Genetics Selective Breeding Inheritance Traits</p> <p>** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**</p>	<p><u>MS-LS4-4</u> - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard.</p> <p><u>MS-LS4-5</u>- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.</p> <p><u>MS-LS4-6</u>- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.</p>	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"> ● Construct an explanation that includes probability statements regarding variables and proportional reasoning of how genetic variations of traits in a population increase some individuals’ probability surviving and reproducing in a specific environment. ● Use probability to describe some cause-and-effect relationships that can be used to explain why some individuals survive and reproduce in a specific environment. <p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"> ● Explain some causes of natural selection and the effect it has on the increase or decrease of specific traits in populations over time. ● Use mathematical representations to support conclusions about how natural selection may lead to increases and decreases of genetic traits in populations over time. <p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"> ● Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection) from multiple appropriate sources. ● Describe how information from publications about technologies and methods that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection) used are supported or not supported by evidence. ● Assess the credibility, accuracy, and possible bias of publications and they methods they used when gathering information about technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection).

Modifications			
English Language Learners	Special Education	At Risk	Gifted & Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair-share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

5E Model	
Performance Expectation: 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.	
Engage: Anticipatory Set	Peppered Moth Simulation http://peppermoths.weebly.com/ Peppered Moth Activity http://betterlesson.com/lesson/637464/peppered-moths
Exploration: Student Inquiry	<u>What is Evolution</u> In this activity, students will construct an explanation based on evidence that describes how genetic variation of traits in a population increase some individual's probability of surviving and reproducing in a specific environment. http://betterlesson.com/lesson/636016/what-is-evolution
Explanation: Concepts & Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS4.B: Natural Selection Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
Elaboration: Extension Activity	Related Lessons http://betterlesson.com/next_gen_science/browse/2239/ngss-ms-ls4-6-use-mathematical-representations-to-support-explanations-of-how-natural-selection-may-lead-to-increases-and-decrea

<p>Evaluation: Assessment</p>	<p>Assessment Task A: <u>Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.</u> <u>To end the lesson I go through Recipe For Evolution: Variation, Selection & Time which is a resource from Learn. Genetics Genetic Science Learning Center which is a wonderful resource on a large variety of biology topics. This reinforces some of the things the students should have learned by doing the simulations.</u></p> <p><u>To assess student learning, I have students write a response to the following prompt in their journal: explain how genetic variation of traits in a population increase some individual's probability of surviving and reproducing in a specific environment. Use evidence from your investigations to support your answer. As this is a formative assessment I just use a 3 point scale to assess this journal entry:</u></p> <p><u>3 - Demonstrates strong understanding of the concept.</u> <u>2 - Demonstrates good understanding of the concept with only minor misunderstandings</u> <u>1 - Demonstrates poor understanding of the concept with major misunderstandings</u> <u>I make sure to meet with students who scored a 1 to ensure that their misunderstandings are cleared up before moving on to the next lesson.</u></p>
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5E Model	
<p>Performance Expectation: MS-LS4-5 <u>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.</u></p>	
<p>Engage: Anticipatory Set</p>	<p><u>Video: Classical vs. Transgenic Breeding</u> <u>http://www.pbslearningmedia.org/resource/tdc02.sci.life.gen.breeding/classical-vs-transgenic-breeding/</u></p> <p>For what kind of characteristics have food crops been selectively bred? What are some examples of harmful effects of selective breeding?</p>
<p>Exploration: Student Inquiry</p>	<p><u>Artificially Selecting Dogs</u></p> <p><u>Students learn how artificial selection can be used to develop new dog breeds with characteristics that make the dogs capable of performing a desirable task. Students begin by examining canine features and their functions. They are then given a scenario that describes the type of task they need a new breed of dog to perform. They then select two existing breeds they feel will most likely produce a successful new breed and determine the resulting offspring's characteristics. This lesson emphasizes variation, inheritance, selection, and time (number of generations) to help students develop a clear understanding of artificial selection and, ultimately, natural selection.</u></p>

	<p>http://www.ucmp.berkeley.edu/education/lessons/breeding_dogs/</p> <p>Genetic Technology Students will conduct research to determine the similarities, differences , applications and potential impacts of genetic technologies. http://betterlesson.com/lesson/636020/genetic-technology</p>
<p>Explanation: Concepts & Practices</p>	<p><u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.</p> <p><u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> 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.</p>
<p>Elaboration: Extension Activity</p>	<p><u>Genetic Engineering Debate</u> <u>Objective: To research the genetic engineering of food and create a public service announcement from the perspective of either the farmer or consumer.</u></p> <p><u>Questions for students to address:</u> <u>What type of technology is used in your type of genetic engineering?</u> <u>What are the benefits and risks of this type of technology?</u> <u>Who should be in charge of regulating and monitoring this type of genetic engineering to make sure that no one is abusing this technology?</u> <u>Research- positions must be based on facts</u></p>
<p>Evaluation: Assessment</p>	<p><u>Assessment Task A: Artificially Selecting Dogs- Written Response</u> <u>Following this activity, students will write a paragraph describing the process of artificial selection in their own words, using dogs or another organism as their example. Encourage students to use and underline the VIST terms (variation, inheritance, selection, time) in their explanation.</u></p> <p><u>Assessment Task B:</u> Clone Video Reflection <u>Following the activity part of the Genetic Technology lesson, students should synthesize information learned by completing the reflection activity.</u></p> <p><u>Assessment Task C:</u> <u>Students will create an illustration that sums up their feelings/viewpoint on the genetic technologies they just learned about. Students can hand draw this or create it on the computer but either way it must be neat, colorful and their position (for or against) must be obvious. Students can then compare their wordle created in the warm-up to their illustration to see if their perspective has changed.</u></p>

[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.](#)

5E Model

Performance Expectation: 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.

Engage: Anticipatory Set	<p>Natural Selection Video http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation</p>
Exploration: Student Inquiry	<p>Nature at Work Mice Lab https://d2ct263enury6r.cloudfront.net/dQOQjAOu34mWuVJ625rTV9mYlBqflasfeqyDrQZten4WDa0h.pdf</p> <p>If the events in the game occurred in nature, how would the group of mice change over time? How did the results for the white sand environment differ from those of the brown forest floor environment? Students should use their numerical data to explain how natural selection leads to increases or decreases of specific traits in populations over time.</p>
Explanation: Concepts & Practices	<p><u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.</p> <p><u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS4.C: Adaptation Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.</p>
Elaboration: Extension Activity	<p><u>Related Lessons</u> http://betterlesson.com/next_gen_science/browse/2239/ngss-ms-ls4-6-use-mathematical-representations-to-support-explanations-of-how-natural-selection-may-lead-to-increases-and-decrea</p>
Evaluation: Assessment	<p><u>Assessment Task A: Lab Analysis Questions</u> <u>Assessment Task B: Lab Graph</u> Use mathematical representations to support scientific conclusions and design solutions.</p>

Student graphs should:

- compare the population changes of mice in both environments across all three generations

- included a title, labels and a key if necessary

Are Genetically Modified Organisms (GMO) safe to eat?

Students construct explanations based on evidence to support fundamental understandings of natural selection and evolution. They will use ideas of genetic variation in a population to make sense of how organisms survive and reproduce, thus passing on the traits of the species. The crosscutting concepts of *patterns* and *structure and function* are called out as organizing concepts that students use to describe biological evolution. Students use the practices of *constructing explanations, obtaining, evaluating, and communicating information*, and *using mathematical and computational thinking*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-LS4-4, MS-LS4-5, and MS-LS4-6.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
1	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-LS4-4)	(MS-LS4-4)
2	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.] (MS-LS4-5)	(MS-LS4-5)
3	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	(MS-LS4-6)

	<p><i>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.] (MS-LS4-6)</i></p>	
		(MS-ESS2-3)

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p>Evidence Statements: MS-LS4-4</p> <p><u>Constructing Explanations and Designing Solutions</u></p> <p><u>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.</u></p> <p><u>Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.</u></p> <p>Evidence Statements: MS-LS4-5</p> <p><u>Obtaining, Evaluating, and Communicating Information</u></p> <p><u>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.</u></p> <p><u>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.</u></p>	<p><u>LS4.B: Natural Selection</u></p> <p><u>Natural selection leads to the predominance of certain traits in a population, and the suppression of others.</u></p> <p><u>LS4.B: Natural Selection</u></p> <p><u>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.</u></p> <p><u>LS4.C: Adaptation</u></p> <p><u>Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.</u></p>	<p>Crosscutting Concepts</p> <p><u>Cause and Effect</u></p> <p><u>Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</u></p> <p><u>Cause and Effect</u></p> <p><u>Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</u></p> <p>Connections to Engineering, Technology, and Applications of Science</p> <p><u>Interdependence of Science, Engineering, and Technology</u></p> <p><u>Engineering advances have led to important discoveries in virtually every field of science, and scientific</u></p>
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<p>Evidence Statements: MS-LS4-6</p> <p><u>Using Mathematics and Computational Thinking</u></p> <p><u>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.</u></p> <p><u>Use mathematical representations to support scientific conclusions and design solutions.</u></p>		<p><u>discoveries have led to the development of entire industries and engineered systems.</u></p> <p>Connections to Nature of Science</p> <p>Science Addresses Questions About the Natural and Material World</p> <p>Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.</p> <p><u>Cause and Effect</u></p> <p><u>Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</u></p>
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<p><i>Connections to other DCIs in this grade-band:</i></p> <p>MS.LS2.A ; MS.LS3.A ; MS.LS3.B, MS.LS2.C, MS.ESS1.C</p>
<p><i>Articulation of DCIs across grade-bands:</i></p> <p>3.LS3.B ; 3.LS4.B ; HS.LS2.A ; HS.LS3.B ; HS.LS4.B ; HS.LS4.C, 3.LS4.C ; HS.LS2.A ; HS.LS2.C</p>
<p><i>Common Core State Standards Connections:</i></p> <p>CCSS- ELA: RST.6-8.1, RST.6-8.9, WHST.6-8.2, WHST.6-8.9, SL.8.1, SL.8.4, WHST.6-8.8</p> <p>CCSS- Math: 6.RP.A.1, 6.SP.B.5, 7.RP.A.2, MP.4</p>

