Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Natural Selection and Adaptations**	Module: **Evidence of Evolution**
MS-LS3-1	●	
MS-LS4-1		●
MS-LS4-2		●
MS-LS4-3		●
MS-LS4-4	●	
MS-LS4-5	●	
MS-LS4-6	●	

Correlations by Module to the NGSS

MODULE: Natural Selection and Adaptations

MS-LS3	Heredity: Inheritance and Variation of Traits	
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.]*	65–72
SEP 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)		*13–14*, 65–72
DCI Disciplinary Core Ideas		
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)		11, 15–17, 18–21, 23, 26, 65–72

Labs and investigations are in italics.

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LS3.B: Variation of Traits • 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)	19–22, *22,* 23, 25, *32–33,* 33–34, *34–36,* 36, 38–40, 65–72
CCC 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 and designed structures/systems can be analyzed to determine how they function. (MS-LS3-1) *Other aspects of this CCC are integrated throughout this module and are listed in the *Also Integrates* section.	*18,* 65–72
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 30–31, 40, 52–53, 58, Literacy Skill Handbook (online)
ELA RST.6–8.4	*16,* 58, Literacy Skill Handbook (online)
ELA RST.6–8.7	*22,* 63, Literacy Skill Handbook (online)
ELA SL.8.5	*22,* 59, Literacy Skill Handbook (online)

MS-LS4	Biological Evolution: Unity and Diversity	
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.]	*34–36,* 39, 46, 65–72
SEP 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 ideas, principles, and theories. • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)		8–9, 30–31, *32–33*, *34–36*, 39, 42, *43–44,* 46, 52–53, 56, 65–72, 73
DCI Disciplinary Core Ideas		
LS4.B: Natural Selection • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)		37–41, 65–72, PhET Interactive Simulation *Natural Selection* (online), Animation *Natural Selection* (online)

Labs and investigations are in italics.

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CCC 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-LS4-4)	38–39, *54–55,* 56, 65–72, PhET Interactive Simulation *Natural Selection* (online), Animation *Natural Selection* (online)
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 30–31, 40, 52–53, 58, Literacy Skill Handbook (online)
ELA RST.6–8.9	*43–44,* 65–72, Literacy Skill Handbook (online)
ELA WHST.6–8.2	20, 23, 41, 62, Literacy Skill Handbook (online)
ELA WHST.6–8.9	41, Literacy Skill Handbook (online)
ELA SL.8.1	3, 40, Literacy Skill Handbook (online)
ELA SL.8.4	*60–61,* 65–72, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.RP.A.1	65–72, Math Skill Handbook (online)
Math 6.SP.B.5	65–72, Math Skill Handbook (online)
Math 7.RP.A.2	*32–33*, 65–72, Math Skill Handbook (online)

MS-LS4	Biological Evolution: Unity and Diversity	
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.]	*54–55, 60–61*
SEP Science and Engineering Practices		
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)		50, 58–59, *60–61*

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
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)	51, 54, *54–55,* 56, *60–61,* 62–63, 65–72
CCC 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-LS4-5)	38–39, *54–55*, 56, 65–72, PhET Interactive Simulation *Natural Selection* (online), Animation *Natural Selection* (online)
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. (MS-LS4-5)	56–59, *60–61*
Connections to Nature of Science **Science Addresses Questions About the Natural and Material World** • Science knowledge can describe consequences of actions but does not make the decisions that society takes. (MS-LS4-5)	58–59
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	6–7, 28–29, 38, 50–51, 56, Literacy Skill Handbook (online)
ELA WHST.6–8.8	57, *58–59, Literacy Skill Handbook (online)*

MS-LS4	Biological Evolution: Unity and Diversity	
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.]*	65–72
SEP Science and Engineering Practices		
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)		*54–55,* 65–72

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
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. (MS-LS4-6)	37–43, *43–44,* 45–47, 65–72, 73, PhET Interactive Simulation *Natural Selection* (online), Animation *Natural Selection* (online)
CCC 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-LS4-6)	38–39, *54–55,* 56, 65–72, PhET Interactive Simulation *Natural Selection* (online), Animation *Natural Selection* (online)
CCSS Math Connections	
Math MP.4	65–72, Math Skill Handbook (online)
Math 6.RP.A.1	65–72, Math Skill Handbook (online)
Math 6.SP.B.5	*32–33*, 65–72, Math Skill Handbook (online)
Math 7.RP.A.2	65–72, Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	73
SEP Planning and Carrying Out Investigations	*60–61*, 73
SEP Analyzing and Interpreting Data	47
CCC Cause and Effect	22, 24, 26
CCC Structure and Function	25, 46–48
CCSS ELA RST.6–8.2	23
CCSS ELA RST.6–8.3	7, *13–14, 18, 32–36, 43–44, 54–55*
CCSS ELA WHST.6–8.6	20
CCSS ELA WHST.6–8.7	*60–61*

Labs and investigations are in italics.

MODULE: Evidence of Evolution

MS-LS4	Biological Evolution: Unity and Diversity	
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.]*	111–116
SEP 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 and interpret data to determine similarities and differences in findings. (MS-LS4-1)		*103,* 104, *105,* 107, 111–116
Connections to Nature of Science **Science Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)		*84,* 85–87, 89–90, 101–102, *102–103,* 104, *105,* 106–107, 111–116, Virtual Lab *How can fossil and rock data determine when an organism lived?* (online)
DCI Disciplinary Core Ideas		
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)		*84*, 84–87, *88–89*, 90, 92–94, 111–116
CCC Crosscutting Concepts		
Patterns • Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1)		*84,* 86–87, 89, 101, *103,* 104, *105*
Connections to Nature of Science **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)		*84,* 85, 89, Virtual Lab *How can fossil and rock data determine when an organism lived?* (online)
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		80–81, 90, 98–99, Literacy Skill Handbook (online)
ELA RST.6–8.7		92, Literacy Skill Handbook (online)
CCSS Math Connections		
Math 6.EE.B.6		Math Skill Handbook (online)

Labs and investigations are in italics.

MS-LS4	Biological Evolution: Unity and Diversity	
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.]	111–116, 117
SEP 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 ideas, principles, and theories. • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)		80–81, 87, 94, 98–99, *102–103,* 110, 111–116
DCI Disciplinary Core Ideas		
LS4.A: Evidence of Common Ancestry and Diversity • 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)		89–90, 94, 101–102, *102–103*, 104, 107–108, 110, 111–116
CCC Crosscutting Concepts		
Patterns • Patterns can be used to identify cause and effect relationships. (MS-LS4-2)		89–90, 101, *103*
Connections to Nature of Science **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-LS4-2)		101, *103,* 104
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		80–81, 90, 98–99, Literacy Skill Handbook (online)
ELA WHST.6–8.2		102, 111–116, Literacy Skill Handbook (online)
ELA WHST.6–8.9		90, Literacy Skill Handbook (online)
ELA SL.8.1		75, 87, 90, Literacy Skill Handbook (online)
ELA SL.8.4		111–116, Literacy Skill Handbook (online)
CCSS Math Connections		
Math 6.EE.B.6		Math Skill Handbook (online)

Labs and investigations are in italics.

MS-LS4	Biological Evolution: Unity and Diversity	
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.]*	*130,* 104, 111–116
SEP 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)		*103,* 104
DCI Disciplinary Core Ideas		
LS4.A: Evidence of Common Ancestry and Diversity • Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully formed anatomy. (MS-LS4-3)		*103*, 104, 109, 111–116
CCC Crosscutting Concepts		
Patterns • Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-3)		*84*, 86–87, 89, 101, *103*, 104, *105*
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		80–81, 90, 98–99
ELA RST.6–8.7		92
ELA RST.6–8.9		111–116

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	117
SEP Planning and Carrying out Investigations	117
SEP Obtaining, Evaluating, and Communicating Information	90
CCC Scale, Proportion, and Quantity	85–86, Virtual Lab *How can fossil and rock data determine when an organism lived?* (online)
CCC Stability and Change	87, *88–89,* 89, 93
CCSS ELA RST.6–8.3	*82, 88–89, 100*
CCSS ELA RST.6–8.9	111–116
CCSS ELA WHST.6–8.7	90, *102,* 107, 111–116
CCSS ELA WHST.6–8.8	90, *102,* 107, 111–116
CCSS ELA SL.8.5	91, 107

Labs and investigations are in italics.