

Unit 4: Biological Evolution: Unity and Diversity

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **8-9 weeks**
Status: **Published**

Summary

Living things are classified based upon physical characteristics and DNA. 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. Students will 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. The crosscutting concepts of patterns and structure and function are called out as organizing concepts that students use to describe biological evolution.

Revision Date: July 2020

Standards:

PFL.9.1.2.CR	Civic Responsibility
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
PFL.9.1.2.FP	Financial Psychology
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
LA.RI.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.W.7	Writing
LA.W.7.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.SL.7	Speaking and Listening
LA.SL.7.5	Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
SCI.MS-LS1	From Molecules to Organisms: Structures and Processes
SCI.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.
SCI.MS-LS1.B	Growth and Development of Organisms
	Animals engage in characteristic behaviors that increase the odds of reproduction.
SCI.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
	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.

SCI.MS.LS1.B

Growth and Development of Organisms

SCI.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.

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.

SCI.MS-LS1-8

Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

SCI.MS-LS2

Ecosystems: Interactions, Energy, and Dynamics

SCI.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.

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.

SCI.MS.LS2.A

Interdependent Relationships in Ecosystems

In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.

Growth of organisms and population increases are limited by access to resources.

SCI.MS-LS2-2

Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

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.

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.

SCI.MS.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.

SCI.MS-LS2-3

Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

SCI.MS.LS2.B

Cycles of Matter and Energy Transfer in Ecosystems

SCI.MS-LS2-4

Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

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.

SCI.MS.LS2.C	Ecosystem Dynamics, Functioning, and Resilience
SCI.MS.LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
SCI.MS.LS2.C	Ecosystem Dynamics, Functioning, and Resilience
SCI.MS.LS4.D	Biodiversity and Humans
SCI.MS.LS3	Heredity: Inheritance and Variation of Traits
SCI.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.
SCI.MS.LS3.A	Inheritance of Traits
SCI.MS.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.
SCI.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. 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.
SCI.MS.LS1.B	Growth and Development of Organisms
SCI.MS.LS3.A	Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
SCI.MS.LS3.B	Variation of Traits
SCI.MS.LS4	Biological Evolution: Unity and Diversity
SCI.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. 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.
SCI.MS.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. Patterns Graphs, charts, and images can be used to identify patterns in data.
SCI.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.

Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.

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.

SCI.MS.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.

Patterns

Patterns can be used to identify cause and effect relationships.

SCI.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.

Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.

Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.

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.

SCI.MS.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.

Patterns

Graphs, charts, and images can be used to identify patterns in data.

SCI.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.

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.

SCI.MS.LS4.B

Natural Selection

Natural selection leads to the predominance of certain traits in a population, and the suppression of others.

Cause and Effect

Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

SCI.MS-LS4-5

Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

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.

SCI.MS.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 onto offspring.

Cause and Effect

Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

SCI.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.

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.

SCI.MS.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.

Cause and Effect

Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

SCI.MS-ESS2

Earth's Systems

SCI.MS-ESS2-3

Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

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 provide evidence for phenomena.

SCI.MS-ESS3

Earth and Human Activity

SCI.MS-ESS3-2

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Analyzing and Interpreting Data

Analyzing data 6–8 builds on grades K–5 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.

SCI.MS-ETS1

Engineering Design

SCI.MS-ETS1-3

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

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.

CS.6-8.8.1.8.AP.2	Create clearly named variables that represent different data types and perform operations on their values.
CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
CS.6-8.8.1.8.DA.2	Explain the difference between how the computer stores data as bits and how the data is displayed.
CS.6-8.8.1.8.DA.3	Identify the appropriate tool to access data based on its file format.
CS.6-8.8.1.8.DA.4	Transform data to remove errors and improve the accuracy of the data for analysis.
CS.6-8.8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
CS.6-8.8.2.8.ETW.2	Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).
CS.6-8.AP	Algorithms & Programming
CS.6-8.CS	Computing Systems
CS.6-8.DA	Data & Analysis
CS.6-8.ED	Engineering Design
WRK.9.2.8.CAP	Career Awareness and Planning
WRK.9.2.8.CAP.9	Analyze how a variety of activities related to career preparation (e.g., volunteering, apprenticeships, structured learning experiences, dual enrollment, job search, scholarships) impacts post-secondary options.
WRK.9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
WRK.9.2.8.CAP.11	Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
TECH.9.4.8.CI	Creativity and Innovation
TECH.9.4.8.CT	Critical Thinking and Problem-solving
	An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

Essential Questions

Essential Questions:

How does natural selection drive evolution?

Why do organisms often produce more offspring than can survive?

Why are variations within a species important?

What proof is there that populations of organisms can change over time?

What is the evidence that evolution has occurred?

How are organisms classified?

Enduring Understandings:

Natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions.

In nature, traits in a population that support successful survival and reproduction in a new environment will become more common; those that do not will become less common.

Changes in a genetic code can be driven by environmental factors and can lead to the evolution of a new species.

Objectives

Students will know that natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions.

Students will know that the distribution of traits in a population changes.

Students will know that traits that support successful survival and reproduction in the new environment become more common; those that do not become less common.

Students will know that natural selection may have more than one cause, and some cause-and effect relationships in natural selection can only be described using Probability.

Students will know that students construct explanations based on evidence to support fundamental understandings of natural selection and evolution.

Students will know that genetic variation in a population explains how organisms survive and reproduce, thus passing on the traits of the species.

Students will know that traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

Students will know that adaptation also means that the distribution of traits in a population can change when conditions change.

Students will know that changes in a genetic code can lead to the evolution of a new species.

Students will know that natural selection is driven by environmental factors, such as climate change.

Students will know that organisms are classified based upon physical characteristics and DNA.

Learning Plan

Preview the essential questions and connect to the learning throughout the unit.

Explain the importance of variations in organisms.

Relate how gradualism and punctuated equilibrium describe the rate of evolution.

Describe the importance of fossils as evidence of evolution.

Explain how relative and radioactive dating is used to date the fossil record.

Give five examples of evidence for evolution.

View Video: Walking With Cavemen

Perform The Nature at Work lab

Conduct Natural Selection of Bean Hunters lab

View Galapagos Videos from the internet

Complete Tell Tale Signs activity

Perform Skulls Lab

View Evolution Video on united streaming (streamingdiscovery.com)

View Video: Animal Adaptation.

Participate in Adaptations Activity

Demonstrate the need for classification systems.

Compare and contrast Aristotle's system of classification with Linnaeus's system of classification.

Discuss the domains and kingdoms of living things.

Identify general characteristics and members of each kingdom.

Identify the differences between prokaryotes and eukaryotes.

Perform Dichotomous Key Activities

Conduct Shoe Classification Lab

Assessment

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The

teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

Worksheets

Exit Tickets

Class Discussion

Quizzes:

Classification Quiz

Bench Marks:

Formal Lab Reports/Lab Write-ups:

Nature at Work Lab

Alternative:

Shoe Classification Activity

Dichotomous Key Activities

Summative:

Unit Tests:

Evolution/Natural Selection unit test

Materials

Prentice Hall Life Science - Science Explorer

newsela

Computer(s) .

Smartboard .

Powerpoints .

Relevant worksheets/notes .

Relevant videos .

Relevant virtual activities .

Relevant interactive programs .

Safety Equipment .

Dichotomous key examples

Fossils/Fossil Models

Darwin Finch Pictures

Tools to simulate bird beaks

Bird Feed

Dried beans of varying sizes

Images of organisms in each kingdom

Shoes