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:

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
LA.W.7	Writing
LA.W.7.1	Write arguments to support claims with clear reasons and relevant evidence.
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.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.
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical

	problems.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
PFL.9.1.2.CR	Civic Responsibility
PFL.9.1.2.FP	Financial Psychology
SCI.MS.LS1.B	Growth and Development of Organisms
SCI.MS.LS1.B	Growth and Development of Organisms
SCI.MS.LS1.B	Growth and Development of Organisms
SCI.MS.LS2.A	Interdependent Relationships in Ecosystems
SCI.MS.LS2.A	Interdependent Relationships in Ecosystems
SCI.MS.LS2.B	Cycles of Matter and Energy Transfer in Ecosystems
SCI.MS.LS2.C	Ecosystem Dynamics, Functioning, and Resilience
SCI.MS.LS2.C	Ecosystem Dynamics, Functioning, and Resilience
SCI.MS.LS3.A	Inheritance of Traits
SCI.MS.LS3.A	Inheritance of Traits
SCI.MS.LS3.B	Variation of Traits
SCI.MS.LS3.B	Variation of Traits
SCI.MS.LS4.A	Evidence of Common Ancestry and Diversity
SCI.MS.LS4.A	Evidence of Common Ancestry and Diversity
SCI.MS.LS4.A	Evidence of Common Ancestry and Diversity
SCI.MS.LS4.B	Natural Selection
SCI.MS.LS4.B	Natural Selection
SCI.MS.LS4.C	Adaptation
SCI.MS.LS4.D	Biodiversity and Humans
SCI.MS-ESS2	Earth's Systems
SCI.MS-ESS3	Earth and Human Activity
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.
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.
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.
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.
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.
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-LS1	From Molecules to Organisms: Structures and Processes

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.
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.
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.
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-LS1-6	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.
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-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
SCI.MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
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.
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.
SCI.MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
SCI.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
SCI.MS-LS3	Heredity: Inheritance and Variation of Traits
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-LS4	Biological Evolution: Unity and Diversity
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.
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
	Using Mathematics and Computational Thinking

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.

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.

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.

Cause and Effect

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

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

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.

Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events.

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.

Analyzing and Interpreting Data

Constructing Explanations and Designing Solutions

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

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.

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

Analyze and interpret data to determine similarities and differences in findings.

Analyzing and Interpreting Data

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

Constructing Explanations and Designing Solutions

Cause and Effect

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.

Analyzing and Interpreting Data

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.

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.

Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.

Use mathematical representations to support scientific conclusions and design solutions.

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.

Analyzing and Interpreting Data

Analyze displays of data to identify linear and nonlinear relationships.

Analyze and interpret data to determine similarities and differences in findings.

Animals engage in characteristic behaviors that increase the odds of reproduction.

Analyzing and Interpreting Data

Analyzing data in 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.

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.

Analyze and interpret data to provide evidence for phenomena.

Patterns

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.

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.

Obtaining, Evaluating, and Communicating Information

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.

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.

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.

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

Analyze and interpret data to determine similarities and differences in findings.

Patterns can be used to identify cause and effect relationships.

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.

Constructing Explanations and Designing Solutions

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

Patterns

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.

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

Cause and Effect

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.

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

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.

An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.

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.

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

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.

Patterns

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.

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

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