Unit 4: Biological Evolution: Unity and Diversity

Content Area: **Science**
Course(s):
Time Period: **Trimester 3**
Length: **8-9 weeks**
Status: **Published**

Summary

Students will explore how genetic variation within populations provides the foundation for natural selection, allowing species to adapt and survive as environmental conditions change. Traits that enhance survival and reproduction become more common over generations, while less advantageous traits diminish. Mutations and changes in DNA contribute to this variation, sometimes resulting in the development of new traits or entirely new species. Students analyze multiple forms of evidence for evolution, including fossils, comparative anatomy, embryology, DNA, and observed adaptations. The concepts of gradualism and punctuated equilibrium are used to describe the pace of evolutionary change. Fossil records, along with relative and radioactive dating methods, help reconstruct the timeline of life on Earth. Students investigate how environmental factors, such as climate change, influence natural selection and evolutionary outcomes. Classification systems are examined to organize organisms based on shared physical and genetic characteristics, reflecting the diversity of life. Students compare Aristotle's early classification system with Linnaeus's model and modern DNA-based classification, using domains, kingdoms, and distinctions between prokaryotic and eukaryotic organisms to categorize life.

Revision Date: July 2025

Essential Questions

Essential Questions:

How does genetic variation in populations lead to adaptations and influence the process of natural selection?

In what ways do environmental factors, such as climate change, drive evolutionary changes in species over time?

How do fossils, comparative anatomy, embryology, DNA, and observed adaptations provide evidence for the theory of evolution?

Why do scientists classify organisms, and how have classification systems evolved from Aristotle to modern DNA-based systems?

How do classification systems help us organize and better understand the diversity of living organisms on Earth?

Enduring Understandings:

Genetic variation within a population provides the raw materials for natural selection, allowing species to adapt and survive as environmental conditions change.

Over time, traits that improve survival and reproduction become more common in populations, while less beneficial traits decrease in frequency.

Environmental factors, including climate change, influence natural selection and can drive the evolution of new species.

Multiple lines of evidence, including fossils, comparative anatomy, embryology, DNA, and observed adaptations, support the scientific theory of evolution.

Classification systems are used and have evolved to organize living organisms based on shared characteristics and genetic information, helping scientists understand the diversity of life on Earth.

Objectives

Students will know…

Natural selection is a key mechanism driving evolution and adaptations over generations.

That variation exists in populations, and some traits provide advantages for survival and reproduction.

Those traits that increase survival become more common, while traits that do not become less common.

That genetic variation allows organisms to survive and reproduce, passing on favorable traits.

Adaptations can shift as environmental conditions change.

Natural selection is influenced by multiple causes, and some outcomes involve probability.

That changes in DNA can result in the evolution of new species over time.

Environmental factors such as climate change can drive natural selection.

That fossil evidence helps document the history of life and supports evolutionary theory.

That relative and radioactive dating are methods used to date fossils and reconstruct timelines of life on Earth.

That evolution is supported by multiple forms of evidence, including fossils, comparative anatomy, embryology, DNA, and observed adaptations.

Organisms are classified based on physical characteristics and genetic information (DNA).

The differences between Aristotle's system of classification and Linnaeus's modern system.

The domains and kingdoms of life, and the differences between prokaryotic and eukaryotic organisms.

Students will be skilled at…

Explaining the role of genetic variation and natural selection in evolution.

Using examples to explain how adaptations improve survival and reproduction.

Describing how environmental factors influence the evolution of species.

Analyzing fossil evidence to support claims about evolution.

Using relative dating and radioactive dating to determine the age of fossils.

Identifying multiple lines of evidence that support the theory of evolution.

Comparing classification systems used historically and today.

Identifying organisms by kingdom, domain, and major characteristics.

Using dichotomous keys to classify organisms.

Participating in hands-on labs and simulations related to natural selection and classification.

Learning Plan

Classification

Introduce the purpose and importance of classification systems.

Compare Aristotle's and Linnaeus classification systems.

Review domains and kingdoms of living organisms.

Identify general characteristics and members of each kingdom.

Discuss the differences between prokaryotes and eukaryotes.

Perform Dichotomous Key Activities to practice classification.

Conduct Shoe Classification Lab as a hands-on introduction to classification concepts.

Natural Selection & Changes Over Time

Preview essential questions and connect to previous genetics content.

Explain the importance of variations in populations.

Direct instruction on natural selection, genetic variation, and adaptations.

View Galapagos Videos to explore real-world examples of variation and adaptation.

Perform Natural Selection of Bean Hunters Lab to simulate natural selection and trait distribution changes.

Explain gradualism vs. punctuated equilibrium to describe evolutionary rates.

Describe the fossil record as evidence of evolution.

Explain how relative and radioactive dating are used.

View Walking with Cavemen and discuss human evolutionary evidence.

Conduct Skulls Lab to compare anatomical evidence for evolution.

Complete Tell Tell-Tale Signs Activity to explore vestigial structures, homologous structures, and embryology..

View Animal Adaptation Video to observe real-world adaptations.

Participate in Adaptations Activity to explore how organisms survive environmental changes.

Perform "The Nature at Work" Lab as a practical investigation of environmental influence on survival.

Discuss the role of environmental factors such as climate change in driving evolution.

Reinforce how genetic variation, mutations, and natural selection lead to evolutionary change.

Lab Safety will be reviewed before all Lab Activities

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

Summative:

Unit Tests:

Evolution/Natural Selection unit test

Bench Marks:

Formal Lab Reports/Lab Write-ups:

Nature at Work Lab

Alternative:

Shoe Classification Activity

Dichotomous Key Activities

Materials

Elevate Life Science - Savvas

Safety Equipment

Computer(s)

Smartboard

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

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

Standards

9.2.8.CAP	Career Awareness and Planning
LA.RL.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.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
9.2.8.CAP.2	Develop a plan that includes information about career areas of interest.
TECH.K-12.1.1.c	use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
TECH.K-12.1.1.d	understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.
TECH.K-12.1.2.b	engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
TECH.K-12.1.3	Knowledge Constructor
TECH.K-12.1.3.c	curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
TECH.K-12.1.5.b	collect data or identify relevant data sets, use digital tools to analyze them, and represent

	data in various ways to facilitate problem-solving and decision-making.
MA.7.SP.A	Use random sampling to draw inferences about a population.
LA.SL.7.1.A	Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
LA.SL.7.5	Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
MS-LS1	From Molecules to Organisms: Structures and Processes
MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
LS1.A	Structure and Function
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.
LS1.B	Growth and Development of Organisms
	Animals engage in characteristic behaviors that increase the odds of reproduction.
	Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
LS1.B	Growth and Development of Organisms
	Genetic factors as well as local conditions affect the growth of the adult plant.
	Cause and Effect
MS-LS2	Ecosystems: Interactions, Energy, and Dynamics
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.
	Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.
	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.
LS2.A	Interdependent Relationships in Ecosystems
	Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
	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.
	Cause and Effect
	Cause and effect relationships may be used to predict phenomena in natural or designed systems.
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
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.
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. Assessment does not include the use of chemical reactions to describe the processes.
LS2.B	Cycles of Matter and Energy Transfer in Ecosystems Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. Energy and Matter
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.
LS2.C	Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. Stability and Change Small changes in one part of a system might cause large changes in another part.
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
LS2.C	Ecosystem Dynamics, Functioning, and Resilience Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health.
LS4.D	Biodiversity and Humans
LS4.A	Evidence of Common Ancestry 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.

LS4.A	Evidence of Common Ancestry 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.
LS4.B	Natural Selection
	Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
MS-LS4-5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.
LS4.B	Natural Selection
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.
LS4.C	Adaptation
MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused climate change over the past century.
ESS3.D	Global Climate Change
	Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.

Modifications/Accommodations

This link includes content specific accommodations and modifications for the populations listed below the link

https://docs.google.com/spreadsheets/d/1QL15CF_i_gwqtoPintFW-FmY85ALeKv4J1PQQxb-vbM/edit?usp=sharing