Evolution and the Diversity of Life

Content Area: **Science**
Course(s): **Biology**
Time Period: **Fourth Marking Period**
Length: **6 Weeks**
Status: **Published**

Unit Overview

Evolution and the Diversity of Life

Evolutionary theory provides the best scientific explnation for the unity and diversity of life. It unites all living things in a single tree of life. The diversity of life is the result of ongoing evolutionary change. Species alive today have evolved from ancient common ancestors.

STAGE 1- DESIRED RESULTS

Standards- 2020 New Jersey Student Learning Standards- Science

SCI.9-12.HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
SCI.9-12.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.9-12.HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
SCI.9-12.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.9-12.HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
SCI.9-12.HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
SCI.9-12.HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
SCI.9-12.HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

SCI.9-12.HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
SCI.9-12.HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
SCI.9-12.HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

Cross Cutting Concepts

- Cause and Effect
- Energy and Matter
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

Disciplinary Core Ideas

Life Sciences

- LS1A: Structure and Functions
- LS1B: Growth and Development of Organisms

- LS1C: Organization for Matter and Energy Flow in Organisms
- LS1D: Information Processing
- LS2A: Interdependent Relationships in Ecosystems
- LS2B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2C: Ecosystems Dynamics, Functioning, and Resilience
- LS2D: Social Interactions and Group Behavior
- LS3A: Inheritance of Traits
- LS3B: Variation of traits
- LS4A: Evidence of Common Ancestry and Diversity
- LS4B: Natural Selection
- LS4C: Adaptation
- LS4D: Biodiversity and Humans

Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution

Essential Questions

What patterns of biodiversity did Darwin observe while traveling aboard the Beagle?

How did other scientists' work help Darwin develop his theory of natural selection?

What is Darwin's theory of evolution by natural selection?

How do genes make evolution possible?

What causes a population's gene pool to change?

How do new species form?

What can genes tell us about an organism's evolutionary history?

Why do scientists classify organisms?

How do evolutionary relationships affect the way scientists classify organisms?

What are the major groups within which all organisms are currently classified?

Enduring Understanding

The diversity of life is the result of ongoing evolutionary change.

Species alive today have evolved from ancient common ancestors.

Students will know...

Evolution, fossil, artificial selection, adaptation, natural selection, fitness, biogeography, homologous and analogous structures, vestigial structures, gene pool, allele frequency, selection, genetic drift, founder effect, sexual selection, Hardy-Weinberg principle, species, speciation, isolation.

Predictable misconceptions.

Evolution produces perfect organisms.

Students ay believe that challenges to details of Darwin's view mean that scientists no longer accept Evolutionary Theory.

Natural Selection and Evolution are often used interchangeably.

Students often believe that gaps in the fossil record disprove Evolution.

Students sometimes think that evolution cannot be observed therefore it cannot be proved.

Students may think that all mutations are harmful, making it difficult to understand why they are necessary for evolution.

Students may think that Natural Selection is the only mechanism for Evolution.

Students may beleive that complete unbroken linear chains of fossils must exist to prove Evolution occurs.

Students may think dinosaurs were not successful since they are extinct.

Students will be able to...

State Charles Darwin’s contribution to science.

Describe the three patterns of biodiversity noted by Darwin.

Identify the conclusions drawn by Hutton and Lyell about Earth’s history.

Describe Lamarck's hypothesis of evolution.

Describe Malthus's view of population growth.

Explain the role of inherited variation in artificial selection.

Describe the conditions under which natural selection occurs.

Explain the principle of common descent.

Explain how geologic distribution of species relates to their evolutionary history.

Explain how fossils and the fossil record document the descent of modern species from ancient ancestors.

Describe what homologous structures and embryology suggest about the process of evolutionary change.

Explain how molecular evidence can be used to trace the process of evolution.

Explain the results of the Grants' investigation of adaptation in Galápagos finches.

Define evolution in genetic terms.

Identify the main sources of genetic variation in a population.

State what determines the number of phenotypes for a trait.

Explain how natural selection affects singlegene and polygenic traits.

Describe genetic drift.

Explain how different factors affect genetic equilibrium.

Identify the types of isolation that can lead to the formation of new species.

Describe the current hypothesis about Galápagos finch speciation.

Explain how molecular clocks are used.

Explain how new genes evolve.

Describe how Hox genes may be involved in evolutionary change.

Describe the goals of binomial nomenclature and systematics.

Identify the taxa in the classification system devised by Linnaeus.

Explain the difference between evolutionary classification and Linnaean classification.

Describe how to make and interpret a cladogram.

Explain the use of DNA sequences in classification.

Name the six kingdoms of life as they are currently identified.

Explain what the tree of life represents.

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions & Answers
- Quiz
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

Students will:

follow lab procedures

collect and graph data

form conclusions

complete assignments

develop and utilize models

cooperate in groups and with partners

complete a written science journal

maintain class notes and vocabulary in MacBook Airs

complete data tables

complete and interpret graphs

complete a project

complete quizzes

Benchmark Assessments

Chapter/Unit Tests

STAGE 3- LEARNING PLAN

Instructional Map

Unit 5: Evolution

- Evolution of Populations
    - Darwin's Voyage of Discovery
    - Ideas That Shaped Darwin's Thinking
    - Darwin Presents His Case
    - Evidence of Evolution
    - Genes and Variation

- Evolution as Genetic Change in Populations
- The Process of Speciation
- Molecular Evolution
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    - Finding Order in Diversity
    - : Modern Evolutionary Classification
    - Building the Tree of Life

Modification/Differentiation of Instruction

Modification Strategies

DI = ppt/air mac, co-operative learning (mixed ability)

ESL students: speaking, reading, writing, peer tutoring

SPEDs: restating, reading aloud, quided questions, additional problems and teacher's observations

Rephrase/Clarify/Repeat Directions

Study Guides

Extended Time on Tests / Assignments

Modify Tests / Assignments

Visual Aides

Word Bank

Use a Calculator

Repeated Drill and Practice

Teacher Notes

Preferential Seating

Oral Directions

Use of Additional Reference Materials

Break Down Assignments into Smaller Tasks

Academic Ability

1. Struggling: Think--Pair-- Share with gifted students.

2. Gifted: Think-- Pair-- Share with struggling students.

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Tutorials

- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills

- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

Horizontal Intergration- Interdisciplinary Connections

See Appendix

Vertical Integration- Discipline Mapping

Students will have been exposed to the Performance Expectations for Life Sciences and Engineering Design outlined in the Next Generation Science Standards (NGSS) starting in 1st grade through Biology, which is offered during the Freshman year of High School. Science classes are designed around the Performance Expectations, Science and Engineering Practices, Discplinary Core Ideas, and Croscutting Concepts in the NGSS. In grade 6, students complete a unit on "Diversity of Life". This leads into "Populations and Ecosystems" in grade 7. In grade 8 students study "Human Systems Interactions" and "Heredity and Adaptations." Biology, being a full year recquired course, will focus on having students gain a deeper understanding of the Performance Expectations outlined in the NGSS, particulary in Life Sciences and Engineering Design. Following Biology in 9th grade students will take Chemistry. After students will be able to chose from Physics, Anatomy and Physiology, Human Impact on the Environment, Forensics and Zoology.

Additional Materials

Pearson Successnet

Newsela