Unit 07: Evolution

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **5-6 Weeks**
Status: **Published**

Summary

Introduction:

The focuses of this unit are the history of the origin of life on earth and the theory of evolution. First, students will explore the various theories about how life originated on earth, including the Oparin Haldane Hypothesis and the Miller Urey Experiment. Students will learn about the history of the theory of evolution, including how different ideas led to the current understanding of natural selection as a mechanism of evolution. Students will evaluate how anatomy, biochemistry, geography, embryology, and fossils can be used as evidence that modern species are descendants of ancestral species. Students will identify characteristics different species have in common as well as characteristics unique to modern species to construct cladograms that depict evolutionary relationships among species. Lastly, students will use their understanding of natural selection to explain how organisms must adapt to environments that are being affected by human activity and climate change.

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Standards

9.1.12.CFR	Civic Financial Responsibility
MA.S-ID	Interpreting Categorical and Quantitative Data
	Brainstorming can create new, innovative ideas.

MA.S-ID.A	Summarize, represent, and interpret data on a single count or measurement variable
9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.4.2.CT	Critical Thinking and Problem-solving
	Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
	Individuals should practice safe behaviors when using the Internet.
	Digital communities allow for social interactions that can result in positive or negative outcomes.
9.4.2.DC.6	Identify respectful and responsible ways to communicate in digital environments.
9.4.2.GCA	Global and Cultural Awareness
	Individuals from different cultures may have different points of view and experiences.
9.4.2.GCA.1	Articulate the role of culture in everyday life by describing one’s own culture and comparing it to the cultures of other individuals (e.g., 1.5.2.C2a, 7.1.NL.IPERS.5, 7.1.NL.IPERS.6).
9.4.2.IML	Information and Media Literacy
9.4.2.IML.1	Identify a simple search term to find information in a search engine or digital resource.
	Digital tools can be used to display data in various ways.
9.4.2.IML.2	Represent data in a visual format to tell a story about the data (e.g., 2.MD.D.10).
9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).
	Information is shared or conveyed in a variety of formats and sources.
LA.W.9-10.1.A	Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
9.4.2.TL.2	Create a document using a word processing application.
9.4.2.TL.3	Enter information into a spreadsheet and sort the information.
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.A-REI.B	Solve equations and inequalities in one variable
	Collaboration can simplify the work an individual has to do and sometimes produce a better product.

LA.W.9-10.2.E	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.W.9-10.2.F	Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
MA.A-REI.D	Represent and solve equations and inequalities graphically
	Comprehension and Collaboration
LA.SL.9-10.2	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.
LA.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.L.9-10	Language
	Obtaining, Evaluating, and Communicating Information
HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
LS1.A	Structure and Function
	Planning and Carrying Out Investigations
LS1.C	Organization for Matter and Energy Flow in Organisms
HS-LS3	Heredity: Inheritance and Variation of Traits
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
LS1.A	Structure and Function
LS3.A	Inheritance of Traits
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.
LS3.B	Variation of Traits
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
LS3.B	Variation of Traits
HS-LS4	Biological Evolution: Unity and Diversity
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
LS4.A	Evidence of Common Ancestry and Diversity
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.
LS4.C	Adaptation
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.
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation

	of populations.
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.
LS4.C	Adaptation

Essential Questions/ Enduring Understanding

Essential Questions:

How did Darwin's voyage on the HMS Beagle contribute to his theory of evolution?

How does a specific population demonstrate Darwin's observations and inferences?

How can the fossil record, biochemistry, anatomy, geography, and embryology be used as evidence of evolution or demonstrate common ancestry between species?

How can similar traits be used to construct a cladogram that shows common ancestry?

Enduring Understanding:

Darwin's observations and inferences about natural selection are the results of his travels in the Galapagos.

There are various methods that can be used as evidence of evolution.

Evolution occurs in populations, not individuals.

Cladograms show common ancestry based on similar characteristics.

Objectives

Students will know key vocabulary: natural selection, artificial section, evolution, homologous structure, vestigial structure, embryology, biogeography, fossil, the fossil record, adaptation, classification, taxonomy, binomial nomenclature, phylogeny, cladogram, domain, kingdom, species.

Students will know how anatomy, biochemistry, embryology, geography, and fossils are evidence of evolution.

Students will know the various ideas that lead to the theory of evolution.

Students will know how to relate Darwin's observations and inferences to examples of populations.

Students will know how to differentiate between how natural selection acts on a population.

Students will know how to explain that populations change, rather than individuals.

Students will know how to relate the patterns of evolution to real-world populations.

Students will know how the fossil record is used to show modern species descended from ancestral species.

Students will know how cladograms can be used to show common ancestry.

Students will know how the changing climate is impacting how living organisms adapt.

Students will be skilled at applying Darwin's observations and inferences to populations.

Students will be skilled at using anatomy, embryology, biochemistry, and geography as evidence of evolution.

Students will be skilled at classifying organisms based on derived and ancestral traits.

Students will be skilled at identifying which patterns of evolution explain real-world examples.

Students will be skilled at determining traits that would be adaptive to certain environments.

Students will be skilled at generating cladograms that show how species have descended from a common ancestor.

Learning Plan

Unit Notes: Students will record detailed notes in a notebook that cover the learning goals of the unit.

Theory of Evolution Timeline: Students will be assigned one of the naturalists who contributed to the theory of evolution (Aristotle, Lyell, Lamarck, Darwin, and Wallace) to research. Each student will summarize the naturalist's theory. Students will then pair up with students who researched and summarized other naturalists and teach each other about each theory that contributed to the theory of evolution and the evidence supporting each theory.

Charles Darwin WebQuest: Students will learn about how the voyage of Charles Darwin influenced his theory of evolution. Students will visit different websites to gather information from articles and videos they will use to answer questions about the observations Darwin made during his travels.

Evidence of Evolution Packet: Students will complete a packet on the different forms of evidence of evolution. The packet will explain each type of evidence, including anatomy, biochemistry, and geography. Throughout

the packet there are practice problems and scenarios for students to answer.

Antibiotic Resistance Activity: Students will complete an online assignment for which they will read about antibiotic resistance. Students will answer questions about what antibiotic resistance is, why it is a global problem, and what can be done to prevent it. Lastly, students will connect antibiotic resistance to Darwin's principles of natural selection.

Finch Beak Lab: Students will design a lab activity for which they will simulate the various morphologies of finch beaks. Students will be provided with different tools to use as beaks and food sources. They will hypothesize which beak will be best suited to each food source. To test the hypothesis, students will conduct their designed experiment and gather data. The data will be examined for trends to create a conclusion. Students will make connections between the results of the lab and their understanding of how natural selection acts on populations.

Rock Pocket Mouse Lab: Students will complete an online activity that examines how a population of rock pocket mice has adapted to different environments. During the activity students will collect and analyze data on the evolution of fur color in rock pocket mouse populations living on differently colored substrates. The data collected from images of rock pocket mouse populations living in different habitats over time will be analyzed to determine if the population has changed as a result of the changing environment. Students will place the images in order of most to least recent based on their understanding of natural selection acting on the rock pocket mouse populations. Students will graph their data and make evidence based claims about how the populations have changed over time.

Peppered Moth Lab: This activity is an online lab simulation that models how predation acts as a selective pressure on a population of peppered moths. Students will learn about how the industrial revolution impacted the habitat of the peppered moths, resulting in the population adapting to the changing environment. Students will run the simulation and gather data on the changing numbers of moths of two different color variations before and after the industrial revolution. Students will evaluate the data to determine if the moth population adapted to the changing environment, and if so how. Students will generate a claim which they will support with evidence from the data and reasoning from their knowledge on natural selection. Lastly, students will connect this activity to climate change by researching how another species is currently affected by climate change and how that species will have to adapt to survive.

Evolution Research Project: Each student will choose a topic related to evolution to write a research paper about. Possible topics include, but are not limited to, human evolution, the evolution of a certain species, adaptations. Online databases will be used for research on the topic. Each student will present the research to the class, followed by a class discussion on each topic.

The Great Fossil Find: Groups of students will be provided with envelopes containing paper fossils. The activity models how evidence is gathered and interpreted during a fossil hunt. Each group will follow instructions from a script read by the teacher, while they "find" paper "fossils" of some unknown creature.

Each time a fossil is removed from the envelope students will attempt to construct the unknown organism. Throughout the activity, student interpretations may change as new pieces are "found." The activity will demonstrate how new evidence may result in ideas to change.

Candy Cladistics Lab: For this activity groups of students will choose five candy brands they will evaluate for similarities and differences in characteristics. These similarities and differences will be used to create a poster of a cladogram that shows the evolutionary relationships between the candy species. Students will justify their created taxonomy using evidence from observations of the candy bars and reasoning from an understanding of common ancestry and evolution.

Evolution Prompts: As the unit progresses students will answer written prompts related to the topic of evolution. Each prompt will connect to a specific content idea covered in the unit and will be answered using words and/ or images. An example of a prompt is to research how a specific species is adapted to its environment.

Speciation Lab: For this activity, students will create adaptations that will help members of an original population survive in a new environment. At the start of the activity, students will evaluate how the original population is adapted to its original environment. Then, groups of students will be assigned a new habitat to which the original population must adapt to. Students will justify why each adaptation will increase the survival of the population and ultimately lead to speciation. Each group will draw an image of their new population.

Extinction CER Poster: Each student will choose an extinct or an endangered species to research. Students will learn about how the species is affected by human activity and create a poster to spread awareness of how the species is affected and what can be done to protect the species.

Assessment

Formative:

Do Now Questions

Exit Ticket Questions

Evolution Prompts

Participation in class discussions

Quizzes (Evidence of Evolution)

Summative:

Unit Assessment

Formal Lab Report - Rock Pocket Mouse Lab

Benchmark:

Honors Biology Final Exam

Alternative Assessments:

Evolution Research Project

Evolution of a species cartoon

Extinction CER Poster Project

Materials

Textbook: Biology Concepts and Connections (Pearson Education) by Campell, Reece, Taylor, Simon, Dickey (2009)

Unit Learning Outline

Technology: computers for student and teacher, SmartBoard projector

Teacher Slide Presentations

Whiteboard + Accessories

Guided Notes/Worksheets

Lab Report Outline and Rubric

Personal Protective Equipment: safety glasses, gloves

Lab Equipment: beakers, water, dice, beans, corn kernels, cups, spoons, toothpicks

Graphing paper, rulers, colored pencils/markers