Unit 4 Evolution and Natural Selection

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 4**
Length: **8-10 Weeks**
Status: **Published**

Unit Overview

In this unit students will analyze and interpret data in order to decipher and locate patterns pertaining to diversity, extinction, and the existence of life. Students will observe the change of life forms throughout the history of life on Earth to understand the concept of uniformitarianism. Students will apply scientific ideas in order to construct an explanation for the differences and similarities between modern and ancient organisms through anatomical structures and embryology. Students will learn to use math in order to analyze populations and support the theory of natural selection.

Performance Expectations

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.
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.
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.
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.

Three Dimensions

Science and Engineering Practices

SEP.1	Asking Questions and Defining Problems
SEP.2	Developing and Using Models
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.5	Using Mathematics and Computational Thinking
SEP.6	Constructing Explanations and Designing Solutions
SEP.7	Engaging in Argument from Evidence

Disciplinary Core Ideas

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. (MS-LS4-1)
- 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. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

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. (MS-LS4-6)

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4- 3)

Cause and Effect

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. ((MS-LS4-6)

Connections to Nature of Science

- ***Scientific Knowledge Assumes an Order and Consistency in Natural Systems***
    - Science assumes that objects and events in natural systems occur in consistent patterns that are

understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Knowledge, Skills, and Assessment

Essential Insights and Understandings/Guiding Questions	Critical Knowledge and Skills	Activities, Assessı
How do Plate Tectonics Create the Structures of the Earth? How do rock layers dictate the age of a fossil? How can the fossil record be used to analyze similarities and differences in organisms throughout time?	**Plate tectonics has lead to the continuous change of the earth's plates over time leading to various landforms below and on the surface. Due to this movement of the Earth's crust many fossils have formed within sedimentary rock layers being preserved. The top layer of the sedimentary rock layer is the newest while the lowest layer is the oldest. Charles Darwin first looked at fossils as evidence to support his theory noting similarities between organisms at different locations. Fossils are also able to show scientists clues as to when life began, how it evolved over time, and provides links between organisms living today and extinct organisms.** Skill; SWBAT • explain how sedimentary fossils are formed • analyze fossil data in order to support diversity, extinction, and change in life over time • interpret uniformitarianism as it relates to evidence for evolution	**Activity:** Students should take notes via teache **Activity:** Great Fossil Find. In this activity, stu envelope. In teams students will act as paleonto compare their creations and decide which is bes **Activity:** Stories from the Fossil Find. In this a create their fossil in order to decide which is the transitional fossil of Archaeopteryx. **Formal Assessment:** Teacher made assessmen interpreting the data of the fossil record.
How can scientific ideas be used to compare similarities	**Evolution can be supported by many factors that have been**	**Activity**: Teacher made online walk through of provides sites and videos while students comple

among modern organisms anatomically?	**discovered throughout time. Fossils show changes in structures, while embryology provides evidence in similarities as species growth prior to birth, and anatomical similarities that are inherited from a common ancestor. Homologous structures, such as a bird's wing, dolphin's flipper, and a dog's leg, help to understand the theory of evolution and how species have changed through time, mutations leading to favorable adaptations, which supports the theory of natural selection.**	information. Students come together to share th small groups, or jigsaw.
How can scientific ideas be used to compare similarities among modern organisms and fossils anatomically? Can an explanation to similarities be constructed from the evidence found?	Skill; SWBAT • provide evidence for evolution (embryology, fossils, and homologous structures) • explain in detail using visual evidence evolution	**Activity:** Similarities and differences: understa students will visually look at different species th structures. **Activity:** Student article writing on natural sele audience. **Activity:** PBS Evidence for Evolution. Evoluti types of evidence for evolution. Each team will structural evidence, and genetic evidence for ev class. http://www.pbs.org/wgbh/evolution/educ **Activity:** Discovery Education Recognizing Co evaluate how the various evidences of evolutio organisms. http://gtm-media.discoveryeducation.com/videos/dsc/data/ **Assessment:** Teacher made assessment on the v following http://bieldshs.weebly.com/uploads/3
How does a species population change over time? Can math be used to support these changes within the data collected or provided?	**Through time, populations decrease or increase due to natural selection. Species that are better adapted to the environment are more likely to survive and therefore pass along favorable traits to their offspring. Species that are ill-suited for the environment are less likely to survive and therefore their population will decrease over time and eventually might die off. Using graphs, mathematical analysis (specific formulas), and data, a species rate of change can be calculated and represented. Gradualism occurs when only small**	**Activity:** Bio in Motion Evolution Lab: Interac adaptations leading to species variations. **Activity:** A Peek at the Past lab activity with fo arrange two fossils on a time scale in order to d other shows "punctuated equilibria". **Activity:** Punctuated Equilibrium a Practical Si the process of evolution using a hypothetical fo https://sbi3us.files.wordpress.com/2013/12/pur **Activity:** Butterfly coloring and placement. (in students will color and design butterflies that w

changes occur over time leading to larger changes. Punctuated equilibrium occurs during a short period of time (rapidly after not much change).

Skill; SWBAT:

- explain how new species form
- describe the patterns that support the rate of evolution in regards to population
- decipher between gradualism and punctuated equilibrium
- model gradualism, punctuated equilibrium, and pollution changes

student is placed outside will return and try to f

Formal/Informal Assessment: Teacher can vi assessment. Teacher can create assessment bas

Suggested Resources

Uniformitarianism

- http://study.com/academy/lesson/uniformitarianism-definition-principles-examples.html
- http://www.indiana.edu/~ensiweb/lessons/gr.fs.fd.html
- http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?type_id=12&thisaudience=9-12&resource_id=29
- http://evolution.berkeley.edu/evolibrary/search/lessonsummary.php?type_id=12&thisaudience=9-12&resource_id=50
- http://www.prehistoricplanet.com/news/index.php?id=48
- http://www.amnh.org/ology/features/layersoftime/
- http://www.ck12.org/biology/Fossils/

Evidence for Evolution

- https://www.youtube.com/watch?v=lIEoO5KdPvg
- http://necsi.edu/projects/evolution/evidence/evidence_intro.html
- http://www.talkorigins.org/faqs/comdesc/
- http://evolution.berkeley.edu/evolibrary/article/similarity_ms_01
- http://www.nuffieldfoundation.org/science-society/activities-evolution
- http://gtm-media.discoveryeducation.com/videos/dsc/data/BIO_TX_Evolution_HOL_Ancestry_final.pdf

- http://www.pbslearningmedia.org/resource/tdc02.sci.life.div.lp_evid/evidence-for-evoflution/http://www.ck12.org/biology/Evidence-for-Evolution/
- http://www.ck12.org/life-science/Structural-Evidence-for-Evolution-in-Life-Science/
- http://www.ck12.org/life-science/Molecular-Evidence-for-Evolution-in-Life-Science/

Population Change

- http://www.indiana.edu/~ensiweb/lessons/peek.html
- https://sbi3us.files.wordpress.com/2013/12/punctuated-equilibrium-lab.pdf
- https://kaiserscience.wordpress.com/biology-the-living-environment/evolution/gradualism-vs-punctuated-equilibrium/
- https://www.uvm.edu/perkins/evolution/darwin/?Page=record/plas.html&SM=record/recordmenu.html
- http://www.ck12.org/biology/Macroevolution/rwa/I-Thought-This-Happened-Gradually/?referrer=concept_details

Technology Integration

- Ck-12 Flexbook
- Chromebooks
- i-Pads
- Cellular Devices
- internet
- SmartBoard
- Google Docs
- Google Apps
- Google Classroom
- quizlet

Differentiation

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher

    - Anticipate where needs will be
    - Break tests down in smaller increments
- Content specific modifications may include:
    - modified lab assignments
    - article readings highlighted or underlined
    - graphic organizers
    - copy of notes
    - leveled reading and math work

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: adaptations, fossil, homologous, structure, bone, embryo, embryology, fossil record, gradualism, punctuated equilibrium, species, population, sedimentary, uniformatarianism,natural selection, and rock.

Differentiation to extend learning for gifted students may include:

Make a Fossil Students create fossils of their own modeling various types.

Mathematical Analysis using online program

Selective Breeding Students research selective breeding methods and try to develop a new method.

Design an Experiment Groups of students design an experiment to demonstrate that trait's acquired during an organism's lifetime are not passed on to the next generation.

Oral Report Students describe similarities in living species that indicate evolutionary relationships not within the learning.

Development of Live Species Students study of specific species over time (research project over course of unit via plants)

Timeline Students create an interactive timeline of a chosen genus and describe species change over time in relation to gradualism or punctuated equilibrium.

Turtles or Spiders Students research turtles (live species) both land and sea in order to discover adaptations of each.

21st Century Skills

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the

	workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.