SUBJECT: SCIENCE/Life Science

BOE APPROVAL: August 2016

Cliffside Park Public Schools

GRADE: 8

Unit 1: Evidence of a Common Ancestry

CONTENT AREA: General Life Science	GRADES: 8	UNIT: 1 of 8
Pacing: Approx. 1 Month		

Science and Engineering Practices

Analyzing and Interpreting Data

· Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)

· Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1)

Constructing Explanations and Designing Solutions

· Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)

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Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)

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)

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-LS4-4),(MS-LS4-5),(MS-LS4-6)

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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)

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Performance Expectations: MS-LS4-1, MS-LS4-2, MS-LS4-3
Evidence Statement(s): MS-LS4-1, MS-LS4-2, MS-LS4-3
Essential Question: How do we know when an organism (fossil) was alive? How do we know that birds and dinosaurs are related?
21st Century Skills: 9.2.8.B.3, 9.2.8.B.4
Career Ready Practices: CRP4, CRP6, CRP7
Technology:HS-ETS1-1 HS-ETS1-3

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
Geologic Time Scale Rock Formations Fossils Strata Relative Dates Extinction Evolution Fossil Record Time Relative Fossil Dating ** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**	MS-LS4-1 - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard. MS-LS4-2- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard. MS-LS4-3- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.	*Students who understand the concepts can:* ● Use graphs, charts, and images to identify patterns within the fossil record. ● Analyze and interpret data within the fossil record to determine similarities and differences in findings. ● Make logical and conceptual connections between evidence in the fossil record and explanations about the existence, diversity, extinction, and change in many life forms throughout the history of life on Earth. *Students who understand the concepts can:* ● Apply scientific ideas to construct explanations for evolutionary relationships. ● Apply the patterns in gross anatomical structures among modern organisms and between modern organisms and fossil organisms to construct explanations of evolutionary relationships. ● Apply scientific ideas about evolutionary history to construct an explanation for evolutionary relationships evidenced by similarities or differences in the gross appearance of anatomical structures. *Students who understand the concepts can:*

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		• Use diagrams or pictures to identify patterns in embryological development across multiple species. • Analyze displays of pictorial data to identify where the embryological development is related linearly and where that linear nature ends. • Infer general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.

Modifications

English Language Learners	Special Education	At Risk	Gifted & Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair-share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

5E Model

Performance Expectation: 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.

Engage: Anticipatory Set	What Are Fossils http://www.ck12.org/biology/Fossils/lecture/user:13IntC/What-are-fossils/?referrer=concept_details&conceptLevel=&conceptSource=all

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	Show several different fossils or pictures of fossils (diverse types of fossils and fossils from different time periods) and ask students what characteristics the fossils have and how they compare to organisms that still exist today – identify names of present day organisms similar to the fossilized organisms How is the present day organism SIMILAR to the extinct species? WHY are the two species similar? How is the present day organism DIFFERENT than the extinct species? WHY are the two species different? http://www.fossilmuseum.com/ http://www.bbc.co.uk/nature/fossils
Exploration: Student Inquiry	Fossil Evidence for Evolution http://www.pbslearningmedia.org/resource/tdc02.sci.life.evo.lp_fossilevid/the-fossil-evidence-for-evolution/ In this lesson, students will learn how scientists find evidence of evolution and piece together the history of life. Students will learn about the fossil record, the primary form of evidence, as well as the fossil formation process and the evolution of animals.
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (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.
Elaboration: Extension Activity	Related Activities Better Lessons: MS-LS4-1
Evaluation: Assessment	Assessment Task A: Whale Evolution Timeline (Part 3 Step 10 of lesson plan from PBS learning website) Ask each team of two to prepare an Eocene epoch timeline on paper, using the same scale as the classroom model (one inch equals one million years). Their timelines should be twenty-one inches long, with each million years labeled. Whales in the Making Using the images provided on the Whales in the Making worksheet, students will create timeline which represents the evolution of whales. Assessment Task B: Discussion Questions

	Analyze and interpret data to determine similarities and differences in findings. After creating the timeline, students should use the following discussion questions to interpret and analyze the data collected. What typical whale like traits were apparently the earliest to appear? What apparently evolved much later? As each "missing link" was found, how many new gaps were formed? What is the relationship between gaps and fossils? To find fossil evidence to fill the largest remaining gap in whale evolution, what age sediments would you search? What distinguishing traits would you expect to find in whale fossils of that age? Explain why the absence of transitional fossils does not mean that evolution didn't take place.

5E Model	
Performance Expectation: **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.**	
Engage: Anticipatory Set	Students will compare images of an elephant shrew, an elephant, and a shrew to predict which two are most closely related based on observable anatomical characteristics https://www.sciencenews.org/article/elephant-shrews-are-oddly-related-actual-elephants
Exploration: Student Inquiry	Cladistics Students will infer evolutionary relationships using a cladogram. http://betterlesson.com/lesson/638611/cladistics Evolution - Homologous Structures & Embryology Students will be able to identify similarities is morphology and early embryo development as evidence for evolution http://betterlesson.com/lesson/638268/evolution-homologous-structures-embryology
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS4.A: Evidence of Common Ancestry and Diversity

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	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.
Elaboration: Extension Activity	Additional Cladogram Activities http://www.isd622.org/cms/lib07/MN01001375/Centricity/Domain/718/Learning_Target_4.6_Cladograms.pdf http://www.biologycorner.com/worksheets/cladogram.html#.VXBu00a8qSo http://chapin.episd.org/common/pages/DisplayFile.aspx?itemId=3070611
Evaluation: Assessment	Assessment Task A: Evaluate the accuracy of the completed Cladogram that student built in the Cladisitics activity. Assessment Task B: Closing Explanation Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. At the end of the lesson, pose the following question to students In your opinion, what is the most compelling evidence for evolution. Why? Encourage students to use the ACE strategy to answer. See link below. ACE Strategy

5E Model	
Performance Expectation: 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.	
Engage: Anticipatory Set	Guess the Embryo Interactive http://www-tc.pbs.org/wgbh/nova/assets/swf/1/embryo/embryo.swf
Exploration: Student Inquiry	Embryo Comparison Activity Given pictorial data, students will compare patterns of similarities in embryos to identify relationships across multiple species Which of the identified characteristics are still present in the fully formed anatomy of each species? Exploration Questions

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	What does the presence or absence of embryological characteristics in the fully formed anatomy suggest about relationships among these species? Embryonic Development- Evidence for Evolution In this activity, students will 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. http://betterlesson.com/lesson/637398/embryonic-development-evidence-for-evolution
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS4.A: Evidence of Common Ancestry and Diversity Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.
Elaboration: Extension Activity	Related Activities http://www.ck12.org/search/?q=MS-LS4-3&referrer=top_nav&autoComplete=false
Evaluation: Assessment	Assessment Task A: Embryonic Development Exit Slip Analyze displays of data to identify linear and nonlinear relationships. Students complete an Exit Slip, where they are required to write a scientific explanation on how embryo development across species is evidence for evolution.

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How do we know when an organism (fossil) was alive? How do we know that birds and dinosaurs are related?

In this unit of study, students analyze graphical displays and gather evidence from multiple sources in order to develop an understanding of how fossil records and anatomical similarities of the relationships among organisms and species describe biological evolution. Students search for patterns in the evidence to support their understanding of the fossil record and how those patterns show relationships between modern organisms and their common ancestors. The crosscutting concepts of cause and effect, patterns, and structure and function are called out as organizing concepts for these disciplinary core ideas. Students use the practices of analyzing graphical displays and gathering, reading, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-LS4-1, MS-LS4-2, and MS-LS4-3.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
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. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]	(MS-LS4-1)
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. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]	(MS-LS4-2)
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. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]	(MS-LS4-3)

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The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
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 determine similarities and differences in findings. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. **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	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. **LS4.A: Evidence of Common Ancestry and Diversity** 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.	**Patterns** Graphs, charts, and images can be used to identify patterns in data. 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. **Patterns** Patterns can be used to identify cause and effect relationships. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems

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consistent with scientific ideas, principles, and theories. **Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events.** **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 displays of data to identify linear and nonlinear relationships.**		**Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.** **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.

Connections to other DCIs in this grade-band: **MS.ESS1.C ; MS.ESS2.B; MS.LS3.A ; MS.LS3.B ; MS.ESS1.C; MS.LS3.A ; MS.LS3.B ; MS.ESS1.C**
Articulation of DCIs across grade-bands: **3.LS4.A ; HS.LS4.A ; HS.ESS1.C; 3.LS4.A ; HS.LS4.A ; HS.ESS1.C; 3.LS4.A ; HS.LS4.A ; HS.ESS1.C**

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NJSLS Connections:

ELA: RST.6-8.1, RST.6-8.7, RST.6-8.1, WHST.6-8.2, WHST.6-8, SL.8.1, SL.8.4, RST.6-8.1, WHST.6-8.2, WHST.6-8, SL.8.1, SL.8.4
Math: 6.EE.B.6, 6.EE.B.6, 6.EE.B.6