Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provides instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

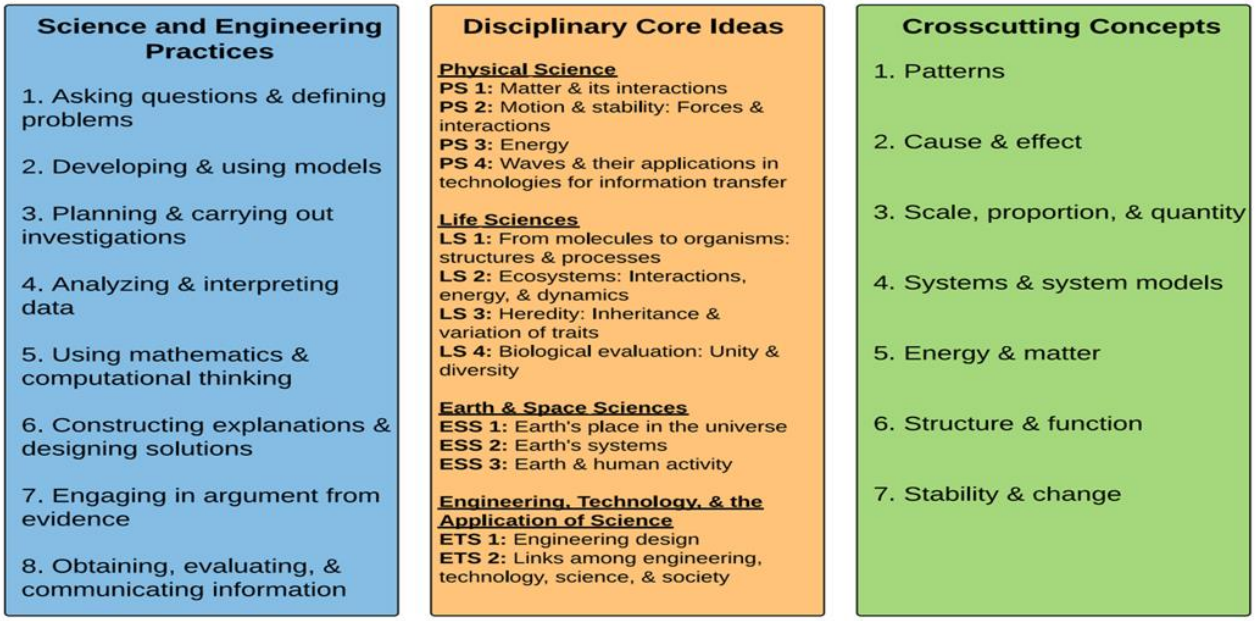
The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band**.** Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery.

Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.



Learning Progression

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.

Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

8th Grade Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback					
Quarter 1		Quarter 2		Quarter 3	**Quarter 4**
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	Unit 3 Waves	Unit 4 Our Universe	Unit 5 Restless Earth	**Unit 6 Change Over Time**
4 weeks	5 weeks	6 weeks	3 weeks	9 weeks	**9 weeks**

UNIT 6: Change Over Time (9 weeks)

Overarching Question(s)

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?
How does biodiversity affect humans?

Unit 6, Lesson 1	Lesson Length	Essential Question	Vocabulary
The Process of Natural Selection	1 week	What is the process of natural selection?	evolution, artificial selection, mutation, variation, natural selection, adaptation, extinction

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) LS4: Biological Change: Unity and Diversity **Standard(s)** 8.LS4.3 Analyze evidence from geology, paleontology, and comparative anatomy to support that specific phenotypes within a population can increase the probability of survival of that species and lead to adaptation. 8.LS4.4 Develop a scientific explanation of how natural selection plays a role in determining the survival of a species in a changing environment.	**Learning Outcomes** • Define evolution. • Describe Darwin's observations. • Define species, population, variation, adaptation, artificial selection, and natural selection. • Describe the four parts of natural selection. • Explain how descendants may become genetically different from their ancestors. • Define extinction. • Describe how environmental change can affect a species.	**Curricular Resources** HMH Tennessee Science TE, Unit 6, Lesson 2, pp. 354-371 Engage • Engage Your Brain #s 1 and 2, SE p. 277 • Active Reading #s 3 and 4, SE p. 277 • Modeling Bird Beaks Daily Demo, TE p. 356 Explore Natural Selection • Model Natural Selection Quick Lab, TE p. 357 • Natural Selection Virtual Lab, TE p. 357 Extinction and Environmental Change • Analyzing Survival Adaptations Quick Lab, TE p. 357

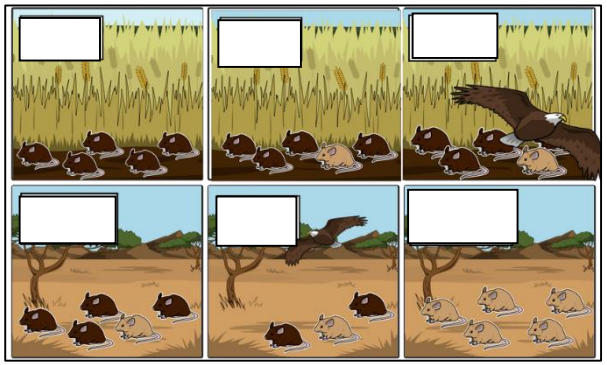
Explanation(s) and Support of Standard(s) from TN Science Reference Guide

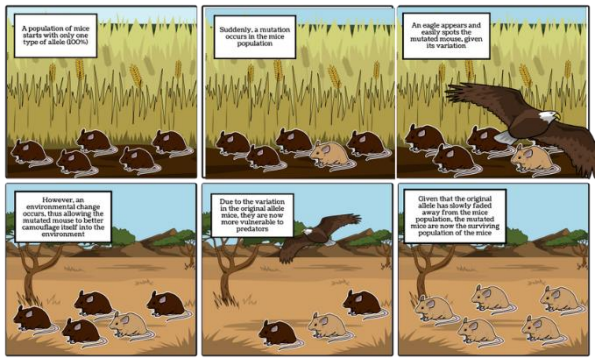
8.LS4.3 Natural selection occurs because there are variations in the phenotypes of a population. A conceptually accurate understanding of natural selection must recognize that variation precedes adaptation. Over-emphasizing the idea that a particular structure (phenotype) has proliferated because of natural selection can result in under-emphasis of the emergence of the phenotype as a part of variation. This inequity, favoring discussions of morphological adaption over genetic variation, perpetuates the incorrect idea that adaptation occurs in single organisms. A student should understand that adaptation occurs in populations over time. This standard should emphasize variability, not adaptation.

Student arguments (from data, information, simulations, etc.) should focus on a particular phenotype within a population of organisms, noting that there may be a number of phenotypes for a trait. Students should reconcile that these variations are an outcome of differences in the genetic information between individuals and are thus heritable.

Even though all organisms may live in the same environment, the variation within the species means that individual organisms may each interact

Suggested Phenomenon





The above storyboard displays natural selection within a population of mice. Display the storyboard with the captions covered for students to examine and complete a See Think Wonder Template.

- Environmental Change and Evolution Exploration Lab, TE p. 357

Explain

Darwin's Observations

- Think Outside the Book #5, SE p. 278
- Visualize It! #6, SE p. 279
- List #7, SE p. 280
- Active Reading #8, SE p. 281
- Apply #9, SE p. 281
- Visualize It! #10, SE p. 281
- Artificial Selection Activity, TE p. 356

Natural Selection

- Infer #11, SE p. 282
- Summarize #12, SE p. 283
- Explain #13, SE p. 283
- Active Reading #14, SE p. 284
- Visualize It! #15, SE p. 284

Extinction and Environmental Change

- Visualize It! #s16-17, SE p.

Extend

Reinforce and Review

- Natural Selection Graphic Organizer, TE p. 360
- Visual Summary, SE p. 292

Going Further

- Social Studies Connection, TE p. 360
- Earth Science Connection, TE p. 360

differently with the environment. Some interactions may favor the survival and reproduction of some individuals over others. Students should specifically identify how a given phenotype affects the probability of survival for an individual. 8.LS4.4 8.LS4.3 emphasizes that variation in a population of organisms can make it more or less probable that an individual organism survives and reproduces. Standard 8.LS4.4 examines how natural selection acts on the variation in an entire population to impact the survival of a species based on surviving members passing on their genetic information. In a single generation, environmental conditions (e.g. abiotic factors, competition, resource availability, etc.) may favor the survival and reproduction of some individuals over others. It is possible that mutations may lead to a new phenotype in an individual, making it more probable that the individual reproduces, and thus passes along this genetic information to their offspring (8.LS4.3). If environmental conditions continue to favor individuals with this phenotype, then over time (generations), the proportion of individuals with the phenotype will increase. The survival of a species is dependent on variation which permits adaptation. Without adaptation, a	Possible Guiding Question(s): Why did the eagle choose the lighter colored mouse? What happened to the population of mice when the environment changed?	Evaluate Formative Assessment • Reteach, TE p. 361 • Throughout TE • Lesson Review, SE p. 293 Summative Assessment • Evolving Activities Alternative Assessment, TE p. 361 • Lesson Quiz • Analyze It!, TE p. 286-287 • Explain It!, TE p. 288-291 **Additional Resources** • 99.99% Antibacterial Products and Natural Selection Activity • Making Sense of Natural Selection and accompanying article • Color Variation over Time in Rock Pocket Mouse Populations Activity • Natural Selection and the Development of Antibiotic Resistance-Middle School Sample Classroom Assessment • Environmental Change and Evolution: Which Mechanism of Microevolution Caused the Beak of the Medium Ground Finch Population on Daphne Major to Increase in Size from 1976 to 1978? (accompanying documents)

species cannot survive and changing environments can eliminate the species **Suggested Science and Engineering Practice(s)** Engaging in Argument from Evidence 8.LS4.3 Students present an argument based on empirical evidence, models, and invoke scientific reasoning. Constructing Explanations and Designing Solutions 8.LS4.4 Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to make predictions, and can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Cause and Effect 8.LS4.3 Students use cause and effect relationships to make predictions. Stability and Change 8.LS4.4 Students make explanations of stability and change discussing molecular components of a system.		• Stickleback Evolution Virtual Lab • Natural Selection PhET Interactive Science Simulation • Peppered Moth Simulation **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking, refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Visuals and games on natural selection Sample Language Objectives: (language domain along with a scaffold) Students will summarize a text that describes Darwin's observations and talk to a partner to explain their summary. To support students in summarizing: Write a summary narrative to communicate what was learned; ask questions and make predictions based on the newly acquired knowledge.

		Sentence stems and language: Answer the focus question by rewriting it as a statement and providing evidence from the text. Make a concluding statement. I learned….., therefore, I think The main idea from this text is that _____. In short _____, but actually _____. Vocabulary to use in explaining: as has been noted, in other words, indeed, as I have said, in short, on the whole, for example, in sum, to be sure, for instance, in brief, to sum up, in fact, in the event of

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UNIT 6: Change Over Time (9 weeks)

Overarching Question(s)

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?
How does biodiversity affect humans?

Unit 6, Lesson 2	Lesson Length	Essential Question	Vocabulary
Evidence of Common Ancestry	2 weeks	What evidence supports the concept of common ancestry?	fossil, fossil record

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) LS4: Biological Change: Unity and Diversity **Standard(s)** 8.LS4.1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change in life forms throughout Earth's history. 8.LS4.2 Construct an explanation addressing the similarities and differences of the anatomical structures and genetic information between extinct and extant organisms using evidence of common ancestry and patterns between taxa.	**Learning Outcomes** • Identify different types of fossils. • Describe how fossils form. • Describe the fossil record. • Describe how scientists use fossil evidence to determine relationships between organisms. • Define common ancestor. • Describe how unused body structures are evidence for evolution. • Describe how genetic evidence supports evolution. • Describe how similarities in developmental patterns provide evidence of evolution.	**Curricular Resources** HMH Tennessee Science TE, Unit 6, Lesson 3, pp. 372-384 Engage • Engage Your Brain #s 1 and 2, SE p. 295 • Active Reading #s 3 and 4, SE p. 295 Fossil Evidence • Archaeopteryx Discussion, TE p. 374 Structural Evidence • What's That For? Activity, TE p. 374 • Observing Structural Similarities Daily Demo, TE p. 375 Explore Genetic Evidence

Explanation(s) and Support of Standard(s) from TN Science Reference Guide 8.LS4.1 The fossil record is a powerful tool for understanding how living organisms have changed throughout Earth's history, assuming that Earth's processes and the physical laws governing these processes have remained constant. Whether or not an organism becomes fossilized is dictated by factors such as the nature of its body tissues and structures, its behavior, the organism's habitat, and the nature of the organism's death and burial. Fossils might also include preserved evidence from organisms interacting with their environment and leaving traces such as footprints. Some organisms (e.g. hard-shelled, sediment-dwelling organisms) are more likely to be found as fossils. A chronological history of life on Earth can be reconstructed using sedimentary evidence and radioactive dating. Students may compare structural similarities and differences of organic evidence in geological cross sections to determine evidence presence and changes in taxa on a geologic time scale. Students should examine data pertaining to the fossil record, looking for patterns within these data. Patterns might include proliferations or disappearances of life either of a single species, or a large number of species, as well as changes to	**Suggested Phenomenon** Introduce students to the statement, fossils can be found of organisms that look very different from any organisms alive today. Give students time to generate and record ideas.	• Genetic Evidence for Evolution Quick Lab, TE p. 375 Explain Fossil Evidence • Examine #5, SE p. 296 • Active Reading #6, SE p. 297 • Visualize It! #s7-8, SE p. 297 Structural Evidence • Active Reading #9, SE p. 298 • Visualize It! #10, SE p. 298 Genetic Evidence • Visualize It! #11, SE p. 299 Embryological Evidence • Visualize It! #s 12-13, SE p. 301 • Analyze #14, SE p. 301 • Snake Legs Probing Question, TE p. 374 • Cetacean Similarities Probing Questions, TE p. 374 Extend Reinforce and Review • Tar Pit Fossils Activity, TE p. 378 • Idea Wheel Graphic Organizer, TE p. 378 • Visual Summary, SE p. 302 Going Further • Fine Arts Connection, TE p. 378 • Earth Science Connection, TE p. 378 Evaluate Formative Assessment • Reteach, TE p. 379

the complexity of organisms throughout time. Analysis of the data should acknowledge law of superposition in geologic strata to determine relative ages of fossils or layers. 8.LS4.2 Comparisons of anatomical structures can be used as evidence to infer that organisms which appear similar to one another are more likely to be closely related, compared to an organism with vastly different anatomical structures. In 7.LS1 and 7.LS3, students come to understand that the appearance of an organism is dictated by actions of the proteins encoded in its genes. Therefore, organisms that appear more similar are also more likely to share similar genetic information. The rationale for determining relative relatedness based upon anatomical similarities and differences applies comparisons between both organisms living today, as well as those that once lived, but are no longer found on Earth. Students may compare and contrast examples of the skeletal structure of birds, reptiles and dinosaurs or embryonic forms of mammals compared to other kingdoms. Students may examine cladograms to infer relatedness. Students should recognize patterns seen in anatomical structures and embryonic development between time and taxa. Cladogram dissection as well as		• Throughout TE • Lesson Review, SE p. 303 Summative Assessment • Prove It! Alternative Assessment, TE p. 379 • Lesson Quiz • Scientific Debate, TE pp. 386-387 **Additional Resources** • 8.LS4.2 Teacher Guide, Student Activity, Student Investigation Cladogram and CER template, Student Activity (Fossils A-E), Student Investigation (Skeletal Images) • Earth History and Clues from Fossils cK-12 Resources • Fossil Record cK-12 Resources • The Mystery of the Far-flung Fossils Lesson • What Killed the Dinosaurs? Article • Explainer: How a Fossil Forms • An Origin of Species: Pollenpeepers • A Guide to Developing Literacy Practices in Science: Supporting Claims with Evidence by Using an Argumentation Card Sort: Fossils • Lab 20: Descent with Modification and Embryonic Development: Does Animal Embryonic Development Support or Refute the Theory of Descent with Modification? (accompanying documents)

construction should be utilized to deepen understanding of hierarchal relationships between the organisms. **Suggested Science and Engineering Practice(s)** Analyzing and Interpreting Data 8.LS4.1 Students should create and analyze graphical presentations of data to identify linear and nonlinear relationships, consider statistical features within data and evaluate multiple data sets for a single phenomenon. Constructing Explanations and Designing Solutions 8.LS4.2 Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to make predictions, and can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Patterns 8.LS4.1, 8.LS4.2 Students recognize, classify, and record patterns in data, graphs, and charts.		**ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking, refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Sample Language Objectives: (language domain along with a scaffold) Students will work with a partner to identify different types of fossils using a graphic organizer. Support students in identifying by: Making technical drawings: draw large, accurate, and detailed representations; identify parts of a system. Language for identifying: Label drawing, using science vocabulary. Recognize shapes, form, location, color, size, and scale. This is a _____fossil because_____.

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UNIT 6: Change Over Time (9 weeks)

Overarching Question(s)

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?
How does biodiversity affect humans?

Unit 6, Lesson 3	Lesson Length	Essential Question	Vocabulary
The History of Life on Earth	2 weeks	How has life on Earth changed over time?	fossils, extinction, fossil record, geologic time scale

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) LS4: Biological Change: Unity and Diversity ESS2: Earth's Systems **Standard(s)** 8.LS4.1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change in life forms throughout Earth's history. 8.ESS2.1 Analyze and interpret data to support the assertion that rapid or gradual geographic changes lead to drastic population changes and extinction events.	**Learning Outcomes** • Explain how scientists use fossils to gauge how long Earth had life. • Describe how to date a fossil. • Describe how the fossil record records extinctions and mass extinctions. • Describe the four major divisions of the geologic time scale. • Explain that divisions in the geologic time scale are based on mass extinction events.	**Curricular Resources** HMH Tennessee Science TE, Unit 6, Lesson 4, pp. 388-403 Engage • Engage Your Brain #s1 and 2, SE p. 307 • Active Reading #s 3 and 4, SE p. 307 Explore Explain Fossil Record • Visualize It! #5, SE p. 308 • Visualize It! #6, SE p. 308 • Visualize It! #7, SE p. 309 • Active Reading #8, SE p. 309 • Fossil Sequences Probing Question, TE p. 390

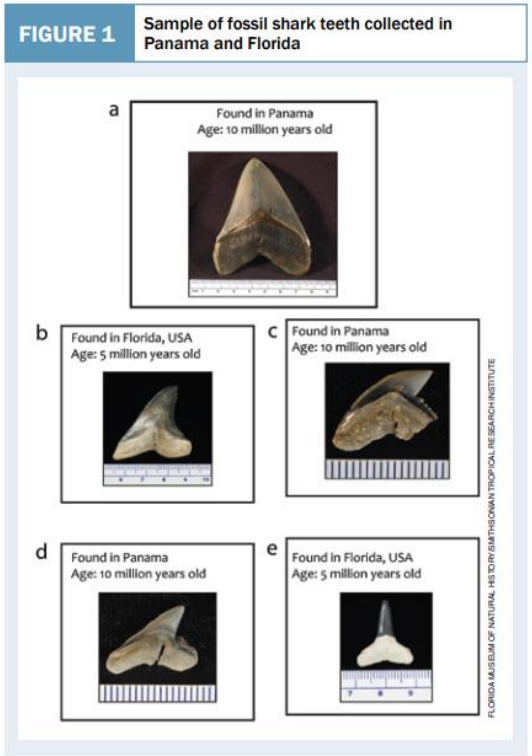
Explanation(s) and Support of Standard(s) [from TN Science Reference Guide]

8.LS4.1 The fossil record is a powerful tool for understanding how living organisms have changed throughout Earth's history, assuming that Earth's processes and the physical laws governing these processes have remained constant.

Whether or not an organism becomes fossilized is dictated by factors such as the nature of its body tissues and structures, its behavior, the organism's habitat, and the nature of the organism's death and burial. Fossils might also include preserved evidence from organisms interacting with their environment and leaving traces such as footprints. Some organisms (e.g. hard-shelled, sediment-dwelling organisms) are more likely to be found as fossils. A chronological history of life on Earth can be reconstructed using sedimentary evidence and radioactive dating. Students may compare structural similarities and differences of organic evidence in geological cross sections to determine evidence presence and changes in taxa on a geologic time scale.

Students should examine data pertaining to the fossil record, looking for patterns within these data. Patterns might include proliferations or disappearances of life either of a single species, or a large number of species, as well as changes to

Suggested Phenomena



Shark's teeth are common fossils that can be analyzed for information on shark evolution and biology. Student can complete a See Think Wonder Template while examining the picture above.

- Living Fossils Daily Demo, TE p. 391

Geologic Time Scale

- Active Reading #9, SE p. 310
- Visualize It! #10, SE p. 310
- Visualize It! #11, SE p. 311

The Precambrian and Paleozoic

- Summarize #12, SE p. 312
- Think Outside the Book #13, SE p. 313
- Visualize It! #14, SE p. 313

The Mesozoic and Cenozoic Eras

- Active Reading #15, SE p. 314
- Summarize #16, SE p. 314
- Hypothesize #17, SE p. 314
- Extinct in America Take It Home, TE p. 390

Extend

Reinforce and Review

- Layered Book FoldNote, TE p. 394
- Visual Summary, SE p. 320

Going Further

- Real World Connection, TE p. 394
- Earth Science Connection, TE 394

Evaluate

Formative Assessment

- Reteach, TE p. 395
- Throughout TE
- Lesson Review, SE p. 321

Summative Assessment

- The History of Life on Earth Alternative Assessment, TE p. 395

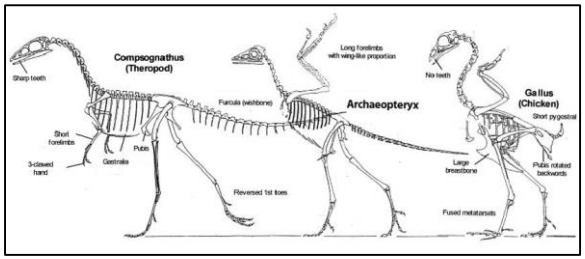
the complexity of organisms throughout time. Analysis of the data should acknowledge law of superposition in geologic strata to determine relative ages of fossils or layers 8.ESS2.1 The processes of natural selection and adaptation are driven by physical changes to Earth. This standard (8.ESS2.1) explores different types of geographic changes that can occur. When Earth undergoes sudden changes at a large scale, large amounts of variation in living organisms may be lost, however gradual processes may lead to gradual changes in populations over generations. The fossil record can be analyzed to gather data about the types of organisms that have lived on Earth. The geologic record can provide information about geographic changes that have occurred. Making inferences from either of these records assumes that geologic and physical processes (e.g. weathering and erosion) function the same way now and in the past. Data can be used to support that while rates may vary, a particular location is constantly experiencing either processes of erosion or deposition. Erosive processes remove layers from the geologic record, while sedimentation will add new layers in lower lying sites. Data may be drawn from rock strata, formation and erosion of	Possible Guiding Question(s): What happened to the teeth of sharks over the years? Why?	• Lesson Quiz • Analyze It!. TE pp. 401-402 **Additional Resources** • The Day the Mesozoic Died • Deep Thinking Over Geologic Time • Genetically Modified Animals Will Be on Your Plate in No Time **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science Fossils with visuals Geologic time video When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Sample Language Objectives: (language domain along with a scaffold) • Students will describe how the fossil record records extinctions and mass extinctions using pre-taught vocabulary and a graphic organizer.

Hawaiian Islands or Appalachian Mountains, glacial retreat, historic sea levels and elsewhere. Catastrophic events include meteor impacts, massive volcanic eruptions, tsunamis, and/or earthquakes. Gradual changes may include ice ages, warming periods, and or tectonic movements. **Suggested Science and Engineering Practice(s)** Analyzing and interpreting Data 8.LS4.1, 8.ESS2.1 Students should create and analyze graphical presentations of data to identify linear and nonlinear relationships, consider statistical features within data and evaluate multiple data sets for a single phenomenon. **Suggested Crosscutting Concept(s)** Patterns 8.LS4.1 Students recognize, classify, and record patterns in data, graphs, and charts. Scale, Proportion, and Quantity 8.ESS2.1 Students develop models to investigate scales that are beyond normal experiences.		Support students in describing by: Provide claims and evidence: write assertions about what was learned from the investigation, use the data as evidence to support those claims. Explain sentence stems: Use inferential logical connectors such as although, while, thus, therefore.

8th Grade Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback					
Quarter 1		Quarter 2		Quarter 3	**Quarter 4**
Unit 1 Motion and Forces	Unit 2 Electricity and Magnetism	Unit 3 Waves	Unit 4 Our Universe	Unit 5 Restless Earth	**Unit 6 Change Over Time**
4 weeks	5 weeks	6 weeks	3 weeks	9 weeks	**9 weeks**

UNIT 6: Change Over Time (9 weeks)			
Overarching Question(s)			
How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?			
Unit 6, Lesson 4	**Lesson Length**	**Essential Question**	**Vocabulary**
Classification of Living Things	2 weeks	How are organisms classified?	species, Bacteria, Protista, Plantae, genus, Archaea, Fungi, Animalia, domain, Eukarya, cladogram, dichotomous key

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) LS4: Biological Change: Unity and Diversity **Standard(s)** 8.LS4.2 Construct an explanation addressing the similarities and differences of the anatomical structures and genetic information between extinct and extant organisms using evidence of common ancestry and patterns between taxa. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.LS4.2 Comparisons of anatomical structures can be used as evidence to infer that organisms which	**Learning Outcomes** • Describe why and how scientists classify living things. • Explain Carolus Linnaeus's contribution to classification. • Describe the parts of a scientific name. • Define taxonomy. • Identify and compare the four kingdoms of domain Eukarya. • Describe the eight levels of classification. • Describe and analyze branching diagrams and dichotomous keys.	**Curricular Resources** HMH Tennessee Science TE, Unit 6, Lesson 5, pp. 406-423 Engage • Engage Your Brain #s1 and 2, SE p. 325 • Active Reading #s 3 and 4, SE p. 325 Explore • Similarities in Animals Virtual Lab, TE p. 409 Explain Classification • Visualize It! #5, SE p. 326 • Summarize #6, SE p. 326 • List #7, SE p. 327

appear similar to one another are more likely to be closely related, compared to an organism with vastly different anatomical structures. In 7.LS1 and 7.LS3, students come to understand that the appearance of an organism is dictated by actions of the proteins encoded in its genes. Therefore, organisms that appear more similar are also more likely to share similar genetic information. The rationale for determining relative relatedness based upon anatomical similarities and differences applies comparisons between both organisms living today, as well as those that once lived, but are no longer found on Earth. Students may compare and contrast examples of the skeletal structure of birds, reptiles and dinosaurs or embryonic forms of mammals compared to other kingdoms. Students may examine cladograms to infer relatedness. Students should recognize patterns seen in anatomical structures and embryonic development between time and taxa. Cladogram dissection as well as construction should be utilized to deepen understanding of hierarchal relationships between the organisms.	**Suggested Phenomenon**  The picture contains skeletons from organisms that chickens may have evolved from. Students can complete a See Think Wonder Template when examining the picture. Possible Guiding Question(s): What structures are similar in all of the organisms? What structures are different in all of the organisms?	• Apply #8, SE p. 328 Domains, Kingdoms, and Levels • Active Reading #9, SE p. 329 • Visualize It! #10, SE p. 329 • Active Reading #11, SE p. 330 • Visualize It! #12, SE p. 331 • Compare #13, SE p. 331 • Compare #14, SE p. 332 • Active Reading #15, Se p. 333 • Classify #16, SE p. 333 • Active Reading #17, SE p. 334 Branching Diagrams and Dichotomous Keys • Visualize It! #18, SE p. 334 • Apply #22, SE p. 336 • Visualize It! #23, SE p. 337 • Think Outside the Book #24, SE p. 337 <u>Extend</u> Reinforce and Review • Mind Map Graphic Organizer, TE p. 412 • Visual Summary, SE p. 342 <u>Evaluate</u> Formative Assessment • Reteach, TE p. 413 • Throughout TE • Lesson Review, SE p. 343 Summative Assessment • Classifying Alternate Assessment, TE p. 413 • Lesson Quiz • Explain It!, TE pp. 421-422

Suggested Science and Engineering Practice(s) Constructing Explanations and Designing Solutions 8.LS4.2 Students form explanations using source (including student developed investigations) which show comprehension of parsimony, utilize quantitative and qualitative models to make predictions, and can support or cause revisions of a particular conclusion. **Suggested Crosscutting Concept(s)** Patterns 8.LS4.2 Students recognize, classify, and record patterns in data, graphs, and charts.		**Additional Resources** • 8.LS4.2 Teacher Guide, Student Activity, Student Investigation Cladogram and CER template, Student Activity (Fossils A-E), Student Investigation (Skeletal Images) **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable - use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Classification of living things with visuals Classification of living things video Sample Language Objectives: (language domain along with a scaffold) • Students will talk with a partner to identify why and how scientists classify living things.

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UNIT 6: Change Over Time (9 weeks)			
Overarching Question(s)			
How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?			
Unit 6, Lesson 5	**Lesson Length**	**Essential Question**	**Vocabulary**
Biotechnology	2 weeks	How does biotechnology impact our world?	biotechnology, artificial selection, genetic engineering, clone

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) LS4: Biological change: Unity and Diversity **Standard(s)** 8.LS4.5 Obtain, evaluate, and communicate information about the technologies that have changed the way humans use artificial selection to influence the inheritance of desired traits in other organisms. **Explanation(s) and Support of Standard(s) from TN Science Reference Guide** 8.LS4.5 Natural selection is driven by the impact of interactions between individuals and their	**Learning Outcomes** • Define biotechnology. • Identify examples of biotechnology, including cloning, genetic engineering, and artificial selection (selective breeding). • Identify and explain biotechnology's impact on individuals, society, and the environment.	**Curricular Resources** HMH Tennessee Science TE, Unit 6, Lesson 6, pp. 424-439 Engage • Engage Your Brain #s 1 and 2, SE p. 345 • Active Reading #s 3 and 4, SE p. 345 Applications of Biotechnology • Fruit Fancies Discussion, TE p. 426 • History of Corn Activity, TE p. 426 Biotechnology and Society • Ethics Debate Discussion, TE p. 426 Explore Applications of Biotechnology

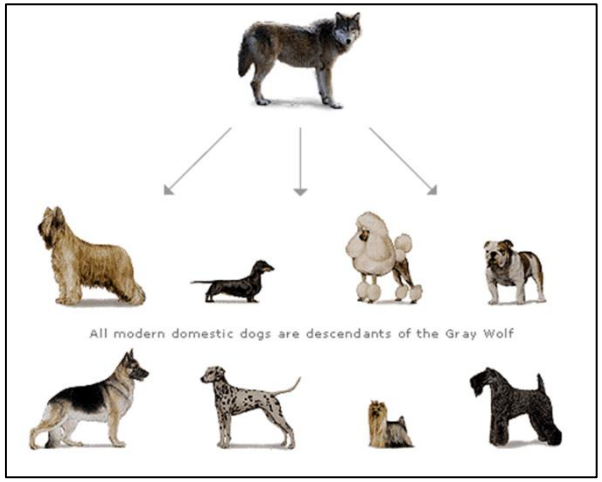
environment on variation within a population, over time.
In artificial selection, humans may attempt to deliberately introduce variation by attempting to cause new phenotypes that may favor human needs. When favorable phenotypes emerge, humans may attempt to preserve these desirable phenotypes, even if the impacted individuals might be less likely to survive in environments outside of human protection (natural environments).

Techniques for artificial selection might include selective breeding, genetic modification (change to genome by addition of a new gene), or gene therapy (introduction of a new allele for an existing gene).

Suggested Science and Engineering Practice(s)
Obtaining, Evaluating, and Communicating Information 8.LS4.5
(O/E) Students can evaluate text, media, and visual displays of information with the intent of clarifying claims and reconciling explanations. (C) Students can communicate scientific information in writing utilizing embedded tables, charts, figures, graphs.

Suggested Crosscutting Concept(s)
Cause and Effect 8.LS4.5

Suggested Phenomenon



Dogs were the first animals to selectively bred. They are descended from wild wolves. Aggressive wolves would have been killed by humans, but friendlier wolves were tolerated. These friendlier wolves were encouraged to breed together by separating friendly male and female wolves away from the aggressive wolves. Over many generations, this selective breeding led to domesticated dogs. Certain dogs were bred for different jobs like protection, companionship, or hunting. Some were even bred for appearances. This process led to the huge variety of dog breeds you can find today. Students can complete a See

- Genetically Engineered Plants Activity, TE p. 426
- Observing Selective Breeding Quick Lab, TE p. 427

Explain
Applications of Biotechnology
- Think Outside the Book #5, SE p. 346
- Active Reading #6, SE p. 346
- Visualize It! #7, SE p. 347
- Active Reading #8, SE p. 348
- Infer #9, Se p. 348
- Apply #10, SE p. 349

Biotechnology and Technology
- Evaluate #11, SE p. 350
- Think Outside the Book #12, SE p. 350
- Ethics Debate Discussion, TE p. 426
- Ancient DNA Discussion, TE p. 427

Extend
Reinforce and Review
- Booklet FoldNote, TE p. 430
- Visual Summary, SE p. 356

Evaluate
Formative Assessment
- Reteach, TE p. 431
- Throughout TE
- Lesson Review, SE p. 357

Summative Assessment
- Biotechnology Alternative Assessment, TE p. 431

Students begin to connect their explanations for cause and effect relationships to specific scientific theory	Think Wonder Template when examining the picture.	• Lesson Quiz • Evaluate It!, TE pp. 436-437 **Additional Resources** • 8.LS4.5 Teacher Guide, Student Activity Sheet, and Student Research Texts • BORN TO RUN • A New Breed Article • Genetic Modification of Fruits and Vegetables Article • Genetics of Dog Breeding • Dog Breeding Video • Science Today: From Wild Wolves to Man's Best Friend Video • How Dogs Work Article **ESL Supports and Scaffolds** WIDA Standard 4 - The Language of Science To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language to build vocabulary in concepts. Spanish Cognates Interactive Science Dictionary with visuals Biotechnology video

		Biotechnology activity book (this resource is for younger students but will support non-speakers with vocabulary. Sample Language Objectives: (language domain along with a scaffold) • Students will identify examples of biotechnology, including cloning, genetic engineering, and artificial selection (selective breeding) using a graphic organizer and sentence stems to describe each example. Support students in identifying by: Make technical drawings: draw large, accurate, and detailed representations; identify parts of a system. Language for identifying: Label drawing, using science vocabulary. Recognize shapes, form, location, color, size, and scale. This is a _____fossil because_____.