Unit 05: Evolution and Classification (Weeks 25-30)

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **6 weeks**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

Practice 1. Asking questions (for science) and defining problems (for engineering)
Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

Practice 3. Planning and carrying out investigations
Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Practice 8. Obtaining, evaluating, and communicating information
Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Connections to the Nature of Science: Most Closely Associated with Practices
Scientific Investigations Use a Variety of Methods

New technologies advance scientific knowledge.

Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

Scientific Knowledge is Based on Empirical Evidence

Science knowledge is based on empirical evidence.

Science disciplines share common rules of evidence used to evaluate explanations about natural systems.

Science includes the process of coordinating patterns of evidence with current theory.

Science arguments are strengthened by multiple lines of evidence supporting a single explanation.

Scientific Knowledge is Open to Revision in Light of New Evidence

Most scientific knowledge is quite durable but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that has been repeatedly confirmed through observation and experiment, and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.

Models, mechanisms, and explanations collectively serve as tools in the development of a scientific theory.

Crosscutting Statements
3. Scale, Proportion, and Quantity – In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly.

Connections to the Nature of Science: Most Closely Associated with Crosscutting Concepts
Science is a Way of Knowing

Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge.

Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

Science is a Human Endeavor

Scientific knowledge is a result of human endeavor, imagination, and creativity.

Individuals and teams from many nations and cultures have contributed to science and to advances in engineering.

Scientists' backgrounds, theoretical commitments, and fields of endeavor influence the nature of their findings.

Technological advances have influenced the progress of science and science has influenced advances in technology.

LS1: From Molecules to Organisms: Structures and Processes
LS1.A: Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)(secondary to HS-LS3-1)

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself acomponent of the next level. (HS-LS1-2)

Feedback mechanisms maintain a living system's internal conditions withincertain limits and mediate behaviors, allowing it to remain alive andfunctional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) ordiscourage (negative feedback) what is going on inside the living system.(HS-LS1-3)

LS2: Ecosystems: Interactions, Energy, and Dynamics
LS2.D: Social Interactions and Group Behavior

Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HSLS2-8)

LS3: Heredity: Inheritance and Variation of Traits

LS3.A: Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used(expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory orstructural functions, and some have no as-yet known function. (HS-LS3-1)

LS3.B: Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sectionsduring the process of meiosis (cell division), thereby creating new geneticcombinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmentalfactors can also cause mutations in genes, and viable mutations areinherited. (HS-LS3-2)

Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)

LS4: Biological Evolution: Unity and Diversity
LS4.A: Evidence of Common Ancestry and Diversity

Genetic information provides evidence of evolution. DNA sequences varyamong species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred bycomparing the DNA sequences of different organisms. Such information isalso derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)

LS4.B: NaturalSelection

Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3)

The traits that positively affect survival are more likely to be reproduced,and thus are more common in the population. (HS-LS4-3)

LS4.C: Adaptation

Evolution is a consequence of the interaction of four factors: (1) thepotential for a species to increase in number, (2) the genetic variation ofindividuals in a species due to mutation and sexual reproduction, (3)competition for an environment's limited supply of the resources thatindividuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)

Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, thedifferential survival and reproduction of organisms in a population thathave an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4)

Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)

Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species,the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5),(HS-LS4-6)

Species become extinct because they can no longer survive andreproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species'evolution is lost. (HS-LS4-5)

LS4.D: Biodiversityand Humans

Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HSLS2-7)

SCI.1-LS1	From Molecules to Organisms: Structure and Processes
SCI.1.LS1.A	Structure and Function
SCI.3-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.1-LS3	Heredity: Inheritance and Variation of Traits
SCI.3.LS2.D	Social Interactions and Group Behavior
SCI.1.LS3.A	Inheritance of Traits
SCI.2.LS4.D	Biodiversity and Humans
SCI.1.LS3.B	Variation of Traits
SCI.3-LS4	Biological Evolution: Unity and Diversity
SCI.3.LS4.A	Evidence of Common Ancestry and Diversity
SCI.3.LS4.B	Natural Selection
SCI.3.LS4.C	Adaptation
SCI.HS-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
SCI.HS-LS3	Heredity: Inheritance and Variation of Traits
SCI.HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
SCI.HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
SCI.HS-LS4	Biological Evolution: Unity and Diversity
SCI.HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
SCI.HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
SCI.HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
SCI.HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
SCI.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.
2-LS2	Ecosystems: Interactions, Energy, and Dynamics
2-LS4	Biological Evolution: Unity and Diversity

Integration of Career Readiness, Life Literacies and Key Skills

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.

CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
CAEP.9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.

Technology / Integration of Computer Science and Design Thinking

CS.9-12.8.2.12.EC.1	Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
CS.9-12.8.2.12.ETW.1	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

ELA.W.AW.9–10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.
ELA.W.AW.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.
ELA.W.AW.9–10.1.B	Develop claim(s) and counterclaims using sound reasoning, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate manner that anticipates the audience's knowledge level and concerns.
ELA.W.AW.9–10.1.C	Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
ELA.W.AW.9–10.1.D	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.
ELA.W.AW.9–10.1.E	Provide a concluding paragraph or section that supports the argument presented.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

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Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

DNA codes for traits, which are passed on through the process of reproduction. An organism's ability to survive in its environment depends on those inherited characteristics. When mutations in DNA occur, they can increase or decrease the rate of survival. Overtime, organisms evolve due to those mutations and changing environmental pressures. Our current planet and the organisms that inhabit it are the result of this process.

Meaning

Essential Questions

Essential Questions

- **What is the connection between DNA, traits, and the evolutionary process?**
- **What environmental factors influence natural selection and the rate of survival of organisms?**
- **How has Charles Darwin's discoveries and theories impacted how we study Biology today?**
- **How does the process of speciation occur?**

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- **When DNA mutations occur, it can bring about a new trait.**
- **Natural selection is the process of promoting traits that increase the rate of survival and eliminating traits that do not.**
- **Charles Darwin proposed his theory of Evolution, which has reshaped how Biologist study living things.**
- **A single organism doesn't evolve, rather populations of organisms.**

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- **Earlier scientists, such as Redi, Pasteur, and Lamarck challenged the notion of abiogenesis**
- **Darwin's findings in the Galapagos**
- **Darwin's 6 points of Evolution: Speciation, Adaptation, Competition, Overproduction, Variation, and Natural Selection.**
- **Evidence that supports Evolution include the fossil record, comparative anatomy, and DNA and molecular evidence**
- **Evolution can be observed in real time by studying the quick changing process of bacteria.**
- **Evolution occurs within populations due to natural selection of polygenic traits.**
- **A bell curve shows the types of selection, including disruptive, stabilizing, and directional selection. Genetic drift, Hardy Weinber**
- **The process of speciation**
- **Classification: (Binomial nomenclature and levels of taxonomy**
- **Derived characteristics, Cladograms, and Dichotomous keys are used to show relationships**
- **Kingdoms**

Skills

Skills

Student will be skilled at …

- **Demonstrate how natural selection occurs using a model and explain the process using proper terminology**
- **Analyze amino acid sequences to explain several organisms evolutionary relationships**
- **Predict potential outcomes in a lab simulation and then write a proper lab report.**

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Teacher derived notes**
- **Powerpoint/Google Slides presentation**
- **Worksheets**
- **Articles**
- **Lab materials**

Formative Assessment Strategies

Formative Assessment Strategies

- **Informal assessments (All call, thumbs up, Kahoot)**
- **Daily Do-Nows**
- **Exit tickets (Short answer responses, feedback forms)**
- **Quizzes**

- **Lab reports**

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- **Create-a-creature**
- **Bird beak natural selection lab**
- **Practice worksheets**
- **Amino Acid Sequence activity**
- **Genetic drift simulation**
- **Cosmos: Evolution video and questions**
- **Evolution webquest (extended)**
- **Bacteria evolution article and explanation**
- **Survival of the Sneakiest comic and questions**
- **Concept map**
- **Classification practice worksheets**

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project

work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.