COLORADO
Department of Education

Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

1. All living things are made up of cells, which is the smallest unit that can be said to be alive.

Evidence Outcomes

Students Can:

a. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (MS-LS1-1) *(Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and nonliving things, and understanding that living things may be made of one cell or many and varied cells.)*

b. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. (MS LS1-2) *(Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.) (Boundary Statement: Organelle structure/function relationships is limited to the cell wall and cell membrane. Function of the other organelles is limited to their relationship to the whole cell. Does not include the biochemical function of cells or cell parts.)*

c. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3) *(Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.) (Boundary Statement: Does not include the mechanism of one body system independent of others. Limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (Planning and Carrying Out Investigations) (Entrepreneurial: Inquiry/Analysis)
2. Develop and use a model to describe phenomena. (Developing and Using Models) (Civic/Interpersonal: Collaboration/Teamwork)
3. Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving)
4. Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: How do the structures of organisms enable life's functions?
2. LS1.A Structure and Function: All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).

Cross Cutting Concepts:

1. Scale, Proportion, and Quantity: Phenomena that can be observed at one scale may not be observable at another scale.
2. Structure and Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures/systems can be analyzed to determine how they function.
3. Systems and System Models: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

COLORADO Department of Education

Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

2. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.

Evidence Outcomes

Students Can:

a. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4) *(Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.)*

b. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5) *(Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large-breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.)*

(Boundary Statement: Does not include genetic mechanisms, gene regulation or biochemical processes.)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use an oral and written argument supported by empirical evidence and scientific reasoning to support and refute an explanation or a model for a phenomenon or a solution to a problem. (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving)
2. Construct a scientific explanation base on valid and reliable evidence obtained from sources and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Creativity/Innovation)

Elaboration on the GLE:

1. Students can answer the question: How do organisms grow and develop?
2. LS1:B Growth and Development of Organisms: Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. Genetic factors as well as local conditions affect the growth of the adult plant.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships may be used to predict phenomena in natural systems.

COLORADO
Department of Education

Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

3. Sustaining life requires substantial energy and matter inputs.

Evidence Outcomes

Students Can:

a. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (MS-LS1-6) *(Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.) (Boundary Statement: Does not include the biochemical mechanisms of photosynthesis.)*

b. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. (MS-LS1-7) *(Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.) (Boundary Statement: Assessment does not include details of the chemical reactions for photosynthesis or respiration.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving)
2. Develop and use a model to describe phenomena and unobservable mechanisms. (Developing and Using Models) (Personal: Initiative/Self-direction)

Elaboration on the GLE:

1. Students can answer the question: How do organisms detect, process, and use information about the environment?
2. LS1:C Organization for Matter and Energy Flow in Organisms: Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.
3. PS3:D Energy in Chemical Processes and Everyday Life: The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.

Cross Cutting Concepts:

1. Energy and Matter: Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

4. Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain.

Evidence Outcomes

Students Can:

a. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LS1-8)*(Boundary Statement: Does not include mechanisms for the transmission of this information.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence (Obtaining, Evaluating, and Communicating Information) (Professional: Information Literacy)
2. Connections to Nature of Science: Scientific Knowledge is Based on Empirical Evidence. Science knowledge is based upon logical connections between evidence and explanations.

Elaboration on the GLE:

1. Students can answer the question: How do organisms detect, process, and use information about the environment?
2. LS1:D Information Processing: Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

Cross Cutting Concepts:

1. Cause and Effect: Cause and effect relationships may be used to predict phenomena in natural systems and phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.
2. Connections to Engineering, Technology and Applications of Science: Interdependence of Science, Engineering, and Technology. Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.
3. Connections to Nature of Science: Science is a Human Endeavor. Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

Prepared Graduates:

6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

5. Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving

Evidence Outcomes

Students Can:

a. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1) *(Clarification Statement: Emphasis is on cause - and - effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.)*
b. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2) *(Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyze and interpret data to provide evidence for phenomena. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving)
2. Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Creativity/Innovation)

Elaboration on the GLE:

1. Students can answer the question: How do organisms interact with the living and nonliving environments to obtain matter and energy?
2. LS2:A Interdependent Relationships in Ecosystems: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Growth of organisms and population increases are limited by access to resources.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships may be used to predict phenomena in natural or designed systems.
2. Patterns: Patterns can be used to identify cause and effect relationships.
3. Connections to Engineering, Technology, and Applications of Science
4. Influence of Science, Engineering, and Technology on Society and the Natural World: The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.
5. 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. Science Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

COLORADO Department of Education

Prepared Graduates:

6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

6. Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and the recycling of matter and nutrients within the system.

Evidence Outcomes

Students Can:

a. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3) *(Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.) (Boundary Statement: Assessment does not include the use of chemical reactions to describe the processes.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a model to describe phenomena (Developing and Using Models) (Personal: Initiative/Self-direction)
2. Connections to Nature of Science: Scientific Knowledge is Based on Empirical Evidence. Science disciplines share common rules of obtaining and evaluating empirical evidence.

Elaboration on the GLE:

1. Students can answer the question: How do matter and energy move through an ecosystem?
2. LS2:B Cycle of Matter and Energy Transfer in Ecosystems: Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

Cross Cutting Concepts:

1. Energy and Matter: The transfer of energy can be tracked as energy flows through a natural system.
2. 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.
3. Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World. The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

Prepared Graduates:

6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

7. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem

Evidence Outcomes

Students Can:

a. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4) *(Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.)*
b. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5) *(Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem and evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving)
2. Connections to Nature of Science: Scientific Knowledge is Based on Empirical Evidence. Science disciplines share common rules of obtaining and evaluating empirical evidence.

Elaboration on the GLE:

1. Students can answer the question: What happens to ecosystems when the environment changes?
2. LS2:C Ecosystem Dynamics, Functioning, and Resilience: Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Cross Cutting Concepts:

1. Stability and Change: Small changes in one part of a system might cause large changes in another part.
2. Connections to Nature of Science: Science Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

COLORADO
Department of Education

Prepared Graduates:

7. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how genetic and environmental factors influence variation of organisms across generations.

Grade Level Expectation:

8. Heredity explains why offspring resemble, but are not identical to, their parents and is a unifying biological principle. Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes.

Evidence Outcomes

Students Can:

a. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. (MS-LS3-1) *(Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.) (Boundary Statement: Does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.)*

b. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. (MS-LS3-2) *(Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause - and - effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop and use a model to describe phenomena. (Developing and Using Models) (Personal: Initiative/Self-direction)
2. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (Obtaining, Evaluating, and Communicating Information) (Professional: Information Literacy)

Elaboration on the GLE:

1. Students can answer the questions: How are the characteristics of one generation related to the previous generation? Why do individuals of the same species vary in how they look, function, and behave?
2. LS3:A Inheritance of Traits: Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.
3. LS3:B Variation of Traits: In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships may be used to predict phenomena in natural systems.
2. Structure and Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.
3. Interdependence of Science, Engineering, and Technology: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.
4. Connections to Nature of Science: Science Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not make the decisions that society takes.

COLORADO
Department of Education

Prepared Graduates:

8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

9. Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.

Evidence Outcomes

Students Can:

a. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. (MS-LS4-1) *(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.) (Boundary Statement: Does not include the names of individual species or geological eras in the fossil record.)*

b. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (MS-LS4-2) *(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.)*

c. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. (MS-LS4-3) *(Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.) (Boundary Statement: Comparisons are limited to gross appearance of anatomical structures in embryological development.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyzing data progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis and analyze and interpret data to determine similarities and differences in findings. (Analyzing and Interpreting Data) (Entrepreneurial: Inquiry/Analysis)
2. Constructing explanations and designing solutions to include constructing explanations and designing solutions supported by multiple sources. (Constructing Explanations and Designing Solutions) (Civic/Interpersonal: Civic engagement)

Elaboration on the GLE:

1. Students can answer the question: What evidence shows that different species are related?
2. 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. Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.

Cross Cutting Concepts:

1. Patterns: Graphs, charts, and images can be used to identify patterns in data.
2. 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.

COLORADO
Department of Education

Prepared Graduates:

8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

10. Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment.

Evidence Outcomes

Students Can:

a. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. (MS-LS4-4) *(Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.)*
b. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. (MS-LS4-5) *(Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.)*
c. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6) *(Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.) (Boundary Statement: Does not include Hardy-Weinberg calculations.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Creativity/Innovation)
2. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (Obtaining, Evaluating, and Communicating Information) (Professional: Information/Communication Technology)

Elaboration on the GLE:

1. Students can answer the question: What evidence shows that different species are related?
2. LS4:B Natural Selection: Natural selection leads to the predominance of certain traits in a population, and the suppression of others. In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.

Cross Cutting Concepts:

1. Cause and Effect: Phenomena may have more than one cause, and some cause - and - effect relationships in systems can only be described using probability.
2. Connections to and Interdependence of Engineering, Technology, and Applications of Science: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.
3. Connections to Nature of Science: Science Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

COLORADO Department of Education

Prepared Graduates:

8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

11. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions.

Evidence Outcomes

Students Can:

a. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6) *(Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.) (Boundary Statement: Does not include Hardy Weinberg calculations.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. Use mathematical representations to support scientific conclusions and design solutions. (Using Mathematics and Computational Thinking) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: How does genetic variation among organisms affect survival and reproduction?
2. LS4:C Adaptation: Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

Cross Cutting Concepts:

1. Cause and Effect: Phenomena may have more than one cause, and some cause - and - effect relationships in systems can only be described using probability.
2. 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

COLORADO
Department of Education

Prepared Graduates:

8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

12. Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems.

Evidence Outcomes

Students Can:

a. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5) *(Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction)

Elaboration on the GLE:

1. Students can answer the question: How does the environment influence populations of organisms over multiple generations?
2. LS4:D Biodiversity and Humans: Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on — or example, water purification and recycling.

Cross Cutting Concepts:

1. Patterns: Patterns can be used to identify cause and effect relationships. - Graphs, charts, and images can be used to identify patterns in data.
2. Energy and matter: Matter is conserved because atoms are conserved in physical and chemical processes.-Within a natural system, the transfer of energy drives the motion and/or cycling of matter.
3. Interdependence of Science, Engineering, and Technology: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.
4. 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. Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.