EAST PENN SCHOOL DISTRICT

Grade 7 Science
DATE OF APPROVAL

Grade 7 Science : Unit 1 - Cells & Systems, and Metabolic Reactions

STAGE 1 | DESIRED RESULTS
Context and relevance for student learning

Standards

3.1.6-8.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.

3.1.6-8.B - Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function

3.1.6-8.C - Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

3.1.6-8.H - Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

3.2.6-8.A - Develop models to describe the atomic composition of simple molecules and extended structures.

3.2.6-8.D - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, “How do living things heal?”
- ☐ Answer the question, “How do things inside our bodies work together to make us feel the way we do?”

Meaning

UNDERSTANDINGS
Students will understand that...

- ☐ All forms of matter exist as a result of the combination or rearrangement of atoms.
- ☐ The atoms of some substances combine or rearrange to form new substances that have different properties.
- ☐ The characteristic structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. (through the life cycle)
- ☐ The structures, functions, and behaviors of organisms allow them to obtain, use, transport, and remove the matter and energy needed to live.
- ☐ Organisms have characteristic structures that enable functions and behaviors that allow them to grow, reproduce, and die.
- ☐ Animals have external and internal sensory receptors that detect different kinds of information that then gets processed by the brain.

ESSENTIAL QUESTIONS
Students will keep considering...

- ☐ How do particles combine to form the variety of matter one observes?
- ☐ How do substances combine or change (react) to make new substances?
- ☐ How does one characterize and explain these reactions and make predictions about them?
- ☐ How do organisms grow and develop?
- ☐ How do organisms obtain and use the matter and energy they need to live and grow?
- ☐ How do the structures of organisms enable life’s functions?
- ☐ How do organisms detect, process, and use information about the environment?

Acquisition(need to align with above and standards)

Students will know...
Disciplinary Core Ideas

Students will be skilled at...
Science and Engineering Practices

reaction has occurred. 3.2.6-8.C - Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. 3.1.6-8.G - 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. 3.1.6-8.E - Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	☐ LS1.A: 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). ☐ LS1.A: Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. ☐ LS1.A: In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. ☐ LS1.B: The growth of an animal is controlled by genetic factors,* food intake, and interactions with other organisms, and each species has a typical adult size range. ☐ LS1.C: Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. ☐ PS3.D Cellular respiration in plants and* animals involves 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. ☐ PS1.A Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. ☐ PS1.B Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. ☐ 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 pro	☐ Apply scientific ideas and evidence to construct an explanation for how systems of the body interact to support the healing process in the foot at different scales. ☐ Analyze and interpret data from a video and microscopic images at varying spatial and time scales to conclude that new cells come from old cells following a predictable pattern of repeated steps. ☐ Plan an investigation and construct an argument using evidence from the microscopic scale that all things are not made of cells. ☐ Gather and synthesize information from scientific text and other sources to describe the basic structure of nerves and nerve cells and explain how its structure supports both the function of those cells within the nervous system and the interactions that occur between nerves and other parts of the body (e.g., skin, bone, muscle). ☐ Develop models based on evidence to predict the relationships between components of a system (organs and body systems) to explain a cause and effect. ☐ Analyze and interpret data to identify patterns in how the structures of the digestive system and relative amounts of substances in a food sample appear in a healthy person as compared to another case study ☐ Argue from evidence to revise a model to show how the results of an investigation and graphs of different types of food molecules traveling through the small intestine explain how the structure of the walls impacts the function of the small intestine. ☐ Analyze and interpret data to identify patterns in the amount that certain food molecules (complex carbohydrates, proteins, and fats) decrease and other food molecules (glucose, amino acids, and fatty acids) increase as they move through different organs in the digestive system. ☐ Develop a model based on multiple lines of evidence to represent the inputs, processes, and outputs of the digestive system and the role that the system, and the subsystems within it, play in breaking down matter inputs through chemical reactions, absorbing food, and excreting unused matter. ☐ Analyze and interpret data to identify the relationship that taller villi (structure) have more cells that work

		together to impact the rate of absorption (function) of food molecules into the bloodstream. ☐ Ask questions to gather more information about how problems in one body system interact with other systems ☐ Analyze and interpret data to identify spatial and temporal relationships in order to determine causes for changes to blood glucose, oxygen, and carbon dioxide levels in the body. ☐ Obtain, evaluate, and communicate information to clarify a claim that a chemical reaction that produces energy in the body is occurring in different parts of the body and that the body uses more glucose and oxygen to provide energy to cells (effect) during exercise (cause) than while resting

Grade 7 Science : Unit 2 - Matter Cycling & Photosynthesis

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

3.2.6-8.C - Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

3.1.6-8.F - 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.

3.1.6-8.K - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

3.4.6-8.A - Develop a model to describe how agricultural and food systems function, including the sustainable use of natural resources and the production, processing, and management of food, fiber, and energy.

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, “Where does food come from and where does it go next?”

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ The atoms of some substances combine or rearrange to form new substances that have different properties.
- ☐ The structures, functions, and behaviors of organisms allow them to obtain, use, transport, and remove the matter and energy needed to live.
- ☐ The cycling of matter and the flow of energy within ecosystems occur through interactions among different organisms and between organisms and the physical environment.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do substances combine or change (react) to make new substances?
- ☐ How does one characterize and explain these reactions and make predictions about them?
- ☐ How do organisms obtain and use the matter and energy they need to live and grow?
- ☐ How do matter and energy move through an ecosystem?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ LS1.A. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.
- ☐ LS1.C. 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.
- ☐ LS2.B. 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

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop and use models based on multiple sources of evidence to show that plants use energy from light to make sugars (food) from carbon dioxide and water through the process of photosynthesis and release oxygen as an output and that energy is transferred from the sunlight to the plant through this process.
- ☐ Develop and revise a model to describe the cycling of matter and flow of energy among living and nonliving parts of a system.
- ☐ Construct an explanation based on evidence for the necessary role of photosynthesis in the cycling of matter and flow of energy in a system into and out of organisms.
- ☐ Analyze and interpret data to identify patterns that show that in the dark, plants take in oxygen and release carbon dioxide and water.
- ☐ Construct an explanation based on evidence about how plant cells (and animal cells) use food for energy

	environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. ☐ PS1.A. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it ☐ PS1.B. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. ☐ PS3.D. 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. (secondary)	and growth and how food molecules are rearranged through chemical reactions. ☐ Construct an explanation to describe the cycling of atoms (matter) into and out of organisms within a system, and respectfully provide and receive feedback on respective explanations with a partner. ☐ Analyze and interpret data and graphs to identify patterns to show that plants are taking in (inputs) carbon dioxide and releasing water and oxygen (outputs). ☐ Engage in argument from evidence about what plants need to make food molecules using evidence from the computer simulation and scientific reasoning to support an explanation for why decreasing the amount of water, carbon dioxide, light, or chloroplasts (cause) in a plant cell decreases the amount of sugar and oxygen it produces (effect). ☐ Develop and revise a model to describe the cycling of matter and flow of energy among living and nonliving parts of a system. This LLPE serves as the culminating summative assessment for the entire unit, requiring students to synthesize all learned concepts into a comprehensive model of matter and energy flow within an ecosystem, including producers, consumers, and decomposers, and nonliving components. ☐ Analyze and interpret data to identify patterns that show that in the dark, plants take in oxygen and release carbon dioxide and water. ☐ Construct an explanation based on evidence about how plant cells (and animal cells) use food for energy and growth and how food molecules are rearranged through chemical reactions. ☐ Construct an explanation to describe the cycling of atoms (matter) into and out of organisms within a system, and respectfully provide and receive feedback on respective explanations with a partner. ☐ Construct an explanation based on evidence for the necessary role of photosynthesis in the cycling of matter and flow of energy in a system into and out of organisms.

Grade 7 Science : Unit 3 - Ecosystem Dynamics

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

3.1.6-8.I - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

3.1.6-8.J - Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

3.1.6-8.L - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

3.1.6-8.U - Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

3.3.6-8.M - Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

3.4.6-8.F - Obtain and communicate information on how integrated pest management could improve indoor and outdoor environments.

3.4.6-8.G Obtain and communicate information to describe how best resource management practices and environmental laws are designed to achieve environmental sustainability.

3.4.6-8.A Develop a model to describe how agricultural and food systems function, including the sustainable

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, “How does changing an ecosystem affect what lives there?”

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Ecosystems are complex systems that include both living (biotic) and non-living (abiotic) components that interact with each other.
- ☐ Ecosystems are complex systems that include both living (biotic) and non-living (abiotic) components that interact with each other.
- ☐ As the environment and populations of species change, there are resulting changes in ecosystems.
- ☐ Humans depend on biodiversity, the variety of species and ecosystems, for resources. Human actions can impact the diversity of species.
- ☐ Human activities in agriculture, industry, and everyday life have an impact on the land, rivers, ocean, and air.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do organisms interact with the living and nonliving environments to obtain matter and energy?
- ☐ How do organisms interact with the living and nonliving environments to obtain matter and energy?
- ☐ How does a change in environment impact ecosystems?
- ☐ How do humans affect biodiversity, and how does it affect humans? Mutually impact?
- ☐ How do humans change the planet?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ LS2.A. Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- ☐ LS2.A. 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.
- ☐ LS2.A. Growth of organisms and population increases are limited by access to resources.
- ☐ LS2.A. Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms.

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop an initial system model to describe a phenomenon in which changes to one living component of an ecosystem (cause) affect the other living parts of the ecosystem (effect).
- ☐ Define a pattern of design problems for systems that provide food resources that humans need (cause) but transform the land and the biosphere once occupied by native plants and animals (effect).
- ☐ Define a problem in which oil palm is dependent upon the same environmental interactions with non living factors as other tropical rainforest plants (pattern).
- ☐ Define a problem that can be solved through designing a palm farm that will maintain the stability of orangutan populations and support farmers who depend on the farms for their livelihoods (criteria).

use of natural resources and the production, processing, and management of food, fiber, and energy. *3.4.6-8.B Analyze and interpret data about how different societies (economic and social systems) and cultures use and manage natural resources differently.*	Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. ☐ LS2.C. 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. ☐ LS2.C. Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. ☐ LS4.D. Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. ☐ ESS3.C. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ☐ ETS1.A. The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.	☐ Apply mathematical concepts (ratio) to find patterns in numerical relationships about the number of orangutans that can live in a 1 km2 or 100 hectare area. ☐ Analyze measures of central tendency and range in class-constructed histograms to make claims about how populations of orangutans responded to three different environmental conditions and the ways in which the environmental conditions contributed to the stability of the population or changes in the population. ☐ Use mathematical representations to draw conclusions about trends in orangutan population sizes over time, depending upon resource availability. ☐ Develop a system model to explain how populations in a complex rainforest ecosystem interact to keep populations stable, compared to interactions in an agricultural system where some of the same populations are increasing. ☐ Use a model to make predictions and test ideas about how disruptions, or changes, to one part of the system affect populations throughout the system. ☐ Evaluate competing design solutions for supporting and/or increasing a stable orangutan population and meeting people's income needs. ☐ Apply all their learned knowledge to evaluate practical solutions that balance the needs of both the environment and human communities

Grade 7 Science : Unit 4 - Natural Selection & Common Ancestry

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

3.1.6-8.D - Use arguments 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.

3.1.6-8.O - 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.

3.1.6-8.P - 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.

3.1.6-8.Q - 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.

3.1.6-8.S - 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.

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, "How could things living today be connected to the things that lived long ago?"

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ The characteristic structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. (the life cycle)
- ☐ Comparisons between species provides evidence that species evolved from common ancestors which explains the similarities and differences between species.
- ☐ Comparisons between species provides evidence that species evolved from common ancestors which explains the similarities and differences between species.
- ☐ In any environment individuals with particular traits may be more likely than others to survive and produce offspring
- ☐ When the environment changes, some individuals in a population may have traits that provide a reproductive advantage which over many generations can change the make-up of a population.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do organisms grow and develop?
- ☐ What evidence supports that different species are related?
- ☐ What evidence supports that different species are related?
- ☐ How does genetic variation among organisms affect survival and reproduction?
- ☐ How does the environment influence populations of organisms over multiple generations?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ LS1.B. Growth and Development of Organisms: Animals engage in characteristic behaviors that increase the odds of reproduction.
- ☐ 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

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop an explanation that predicts what the variation in a chosen body structure or behavior of Galápagos penguins and king penguins looks like at different scales (between species versus between individuals within a population).
- ☐ Analyze and interpret data from images to identify patterns of similarities and differences in modern organisms and the fossil record and use the patterns to reconstruct relationships between fossil (ancient) and extant (modern) organisms.

3.1.6-8.T - Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Earth. Anatomical similarities and differences between various organisms living today, and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully formed anatomy ☐ LS4.B. Natural selection leads to the predominance of certain traits in a population and the suppression of others. ☐ 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 and those that do not become less common. Thus, the distribution of traits in a population changes.	☐ Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support an explanation for whether the types of things that lived long ago are ancestors to the modern organisms we see today (stability and change). ☐ Communicate and evaluate scientific information about a system of cause and effect relationships to explain how traits that support successful survival and reproduction become more common and those that do not become less common. ☐ Use a model that includes unobservable mechanisms describing more than one cause and effect relationship between different parts and components in a system to make predictions about how natural selection leads to a change in the distribution of traits in a population over time, while heritable traits of each individual remain stable. ☐ Construct an argument that changes in environmental conditions may increase or decrease the probability of specific trait variations being passed on in a population, using evidence derived from analysis of graphical data representations generated from an investigation using a computer simulation. ☐ Construct explanations based on evidence collected from running a simulation and using science ideas included in our General Model for Natural Selection for how and why small changes in an environment may cause large changes in trait variations in a population over long periods of time. ☐ Construct and revise an explanation using a model to explain why a change to the environment (cause) leads to a predominance of certain genetic variations of traits in a green lizard population that increase some individuals' probability of surviving and reproducing (effect). ☐ Construct a scientific explanation for how natural selection acting over generations has caused organisms' body structures to change over time in response to changes in environmental conditions. ☐ Construct an explanation using a model to explain how populations of descendants that look very different from each other can emerge from a common ancestor due to gradual, accumulated changes over time (adaptation)

Grade 7 Science : Unit 5 - Genetics

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

3.1.6-8.B - Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

3.1.6-8.D - Use arguments 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.

3.1.6-8.M - 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.

3.1.6-8.N - 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.

3.1.6-8.R - Gather and synthesize information about the technologies that have changed the way humans influence the

Transfer

Students will be able to independently use their learning to...

- ☐ Answer the question, “Why are living things different from one another?”

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Organisms have characteristic structures that enable functions and behaviors that allow them to grow, reproduce, and die.
- ☐ The characteristic structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. (the life cycle)
- ☐ Offspring resemble, but are not identical to, their parents due to traits being passed from one generation to the next via genes.
- ☐ Variation among individuals of the same species can be explained by both genetic and environmental factors.
- ☐ In any environment individuals with particular traits may be more likely than others to survive and produce offspring.
- ☐ The characteristic structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. (through the life cycle)

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do the structures of organisms enable life’s functions?
- ☐ How do organisms grow and develop?
- ☐ 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?
- ☐ How does genetic variation among organisms affect survival and reproduction?

Acquisition(need to align with above and standards)

Students will know...

Disciplinary Core Ideas

- ☐ LS1.B. Genetic factors as well as local conditions affect the growth of the adult plant.
- ☐ LS1.B. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring
- ☐ LS3.A. Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes.

Students will be skilled at...

Science and Engineering Practices

- ☐ Develop and/or use a model to predict what is causing these animals to have extra-big muscles.
- ☐ Develop and use a model to construct a scientific explanation based on evidence for how different environmental factors (cause) influence variation in a trait (effect).
- ☐ Develop and use a model to describe the unobservable mechanism of fertilization, in which parents each

inheritance of desired traits in organisms. 3.1.6-8.E - Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	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. ☐ LS3.A. Variations of inherited traits between parent and offspring arise from genetic differences that result from the sub-set of chromosomes (and therefore genes) inherited. ☐ LS3.B. 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 are harmful, and some are neutral to the organism. ☐ LS3.B. In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. ☐ LS4.B. 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 onto offspring. ☐ LS1.B. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. ☐ LS1.A. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	contribute half of the chromosomes an offspring has, by discerning patterns in the number and types of chromosomes in the sex cells of parents and the body cells of offspring. ☐ Critically read scientific texts to obtain evidence that a distinct gene is the cause for the production of a specific protein related to the trait of musculature. ☐ Develop a model to show how genetic factors influence (cause) variation in a trait (effect) by controlling the production of specific proteins. ☐ Use mathematics and computational thinking to find patterns about genotypic and phenotypic outcomes resulting from crossing individuals with specific genotypes. ☐ Use mathematics and computational thinking to determine the beneficial and harmful effects of selective breeding in sexually reproducing organisms by examining the frequency of certain trait variations and combinations in a population over time. ☐ Critically read scientific texts and construct an explanation using models and math to describe how sexual reproduction results in offspring with genetic variation in the context of goldfish coloration. ☐ Obtain, evaluate, and communicate information about how organisms reproduce asexually and transfer their genetic information to their offspring, which results in offspring with identical genetic information. ☐ Construct an explanation about how environmental and genetic factors influence the growth of organisms and how organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.