

Unit 3-4 Life Science

Content Area: **Science**
Course(s): **Science 8**
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Essential Questions

- What are cells made of?
- Why don't offspring always look like their parents?
- What does DNA do?
- How can genetic information be used?
- How do life forms change over time?
- How does your body sense and react to your surroundings?

Big Ideas

- Living things are made of cells.
- Genetic information passes from parent to offspring.
- Living things change over time.
- Structures in living things are related to their functions.

CRLKs- Career Education

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection:

Instruct students to include a section about career options that go along with their research project topic. Example, if the research topic is high cholesterol and its harmful effects, students should connect careers in food science and/or in the medical field.

Cross-Curricular Integration

Integration Area: Language Arts

W.6.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Activity:

Students will use CERs (Claim, Evidence & Reason) to explore Climate Change to show if students are able to convey their thinking and decision making in written form.

- Students will be answering the question, “What are causes of cancer and mutations?”
- Students provide evidence that supports their claim.
- Students will then write a reasoning that explains what their claim is, state knowledge they have on the topic, evidence to prove their topic, and close their reasoning with their claim again.

Integration Area: Math

8.EE.C.7.a Give linear equations in one variable.

Activity:

Students will take notes on a lesson about Punnett Squares which relates to probability, fractions, and percentages. Once Punnett Squares is taught, the students will work in groups to complete a worksheet on different scenarios relating to the possible outcomes of the offspring of varied traits of sexual reproductive parents: homozygous recessive and dominant as well as heterozygous.

Language Arts Companion Standards:

WHST 6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

RST 6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST 6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST 6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

Activity:

Water on Earth: One way in which NJ residents could help control the mosquito population is to eliminate or decrease the amount of standing water around their homes. Using evidence from one or more credible sources, explain why this procedure might be effective to reduce the mosquito population? Be sure to explain how this evidence supports your claim.

Crosscutting Concepts

Energy and Matter

Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)

Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-5), (MS-LS4-6)

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 and designed structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Patterns

Patterns can be used to identify cause and effect relationships. (MS-LS4-2)

Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1), (MS-LS4-3)

Disciplinary Core Ideas

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. (MS-LS1-6)
- 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. (MS-LS1-7)

LS1.B: Growth and Development of Organisms

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS- LS3-2)

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. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits

- 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. (MS-LS3-2)
- 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. (MS-LS3-1)

LS4.A: Evidence of Common Ancestry and Diversity

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

LS4.B: Natural Selection

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others.(MS-LS4-4)
- 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. (MS-LS4-5)

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. (MS-LS4-6)

Diversity

Race and Ethnicity

Objective:

- Students should be able to identify the genetic diversity within the classroom.
- Students should be able to explain how genetic diversity relates to biodiversity.
- Students should be able to gather the information from their survey to find the population of students who carry specific traits.
- Students should be able to graph this information in a pie chart.

Activity:

Students will obtain a list of traits they need to look for within their class. They are to mingle and record the data on the phenotypes of the students.

They must determine if the traits they are recording are acquired or genetic.

They will use a tool to create polls and/or pie chart on their findings.

Science and Engineering Practices

MS. Structure, Function and Information Processing

Developing and Using Models

- Develop and use a model to describe phenomena. (MS-LS1-2)
- Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Planning and Carrying Out Investigations

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

Constructing Explanations and Designing Solutions

- 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. (MS-LS1-6)

Engaging in Argument from Evidence

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

Obtaining, Evaluating, and Communicating Information

- 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. (MS-LS1-8)

MS. Growth, Development, and Reproduction of Organisms

Developing and Using Models

- Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2)

Obtaining, Evaluating, and Communicating Information

- 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. (MS-LS4-5)

MS. Natural Selection and Adaption

Analyzing and Interpreting Data

- Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1)
- Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)

Constructing Explanations and Designing Solutions

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

Using Mathematics and Computational Thinking

- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

Science and Society

Robert Hooke

The cell was first discovered and named by Robert Hooke in 1665. He remarked that it looked strangely similar to 'cellula' or small rooms which monks inhabited, thus deriving the name.

Theodor Schwann

Schwann demonstrated that animal tissues contained cells, and in 1839 concluded that all tissues are made up of cells: this laid the foundations for the cell theory. Combined with Schleiden's findings of plant tissue containing cells, they concluded that all living things are made up of cells and that cells are the basic units of life.

Robert Virchow

Concluded that all cells come from pre-existing cells

Antonie Van Leeuwenhoek

The first to observe living bacteria and protista.

Gregor Mendel

Discovered the basic principles of genetics concerning dominant and recessive traits within pea plants. He also proved that traits undergo independent assortment; traits are able to separate from each other.

Rosalind Franklin

Rosalind Franklin was a chemical physicist (1920–1958), who used x-ray diffraction to determine the structure of DNA.

Francis Crick and James Watson

Crick and Watson, together with Maurice Wilkins, won the 1962 Nobel Prize in Medicine for their discovery of the structure of DNA. Watson and Crick created the first accurate 3D model of DNA.

Charles Darwin

English naturalist whose scientific theory of evolution by natural selection became the foundation of modern

evolutionary studies. Darwin stated that animals and humans shared a common ancestor.

CSDT Technology Integration

8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product

Action: Students will identify, compare, and contrast the evolution of the microscope. Students will work with the compound light microscope, identify the parts, and explain how it works.

Service Learning

Community Issue: Students will choose between one of these issues to research, create a presentation on how they can help with this issue in Milltown, and then make a pamphlet to be posted.

Focus Areas:

- **Mosquito Pathogens:** Investigate the diseases and viruses mosquitoes carry. Determine the most prevalent pathogens as well as their effects on humans and other organisms. Using the internet, library, and other resources, students can create a PowerPoint or brochure to share with the community.
- **Mosquito Population Control:** Learn about the breeding grounds of mosquitoes and how to reduce their population. Using the internet, library, and other resources, students can create a PowerPoint or brochure to share with the community.
- **Natural Predators:** Use the internet and other resources to gather information about mosquito predators and the predator's ideal environments. Students will research the cost, the materials needed, and the placement of these objects in the environment. The information can be shared with the public.
- **Natural Pest Control:** Learn alternative methods of pest control and the different impacts that these methods have on the environment. Create a brochure to demonstrate how everyone in town can do this and not use harmful pesticides.

Activity:

- **Pre-Reflection:**
 - Students in their groups, will look over the list of types of projects they can do their project on.
 - They will talk about what they already know about mosquitos, their breeding seasons, and what they can do to share their information with the community in the most effective way. Using their previous knowledge, they will choose the best project for their group.
- **Research:**
 - Students will research their topic. They will brainstorm and come up with a concept map of how they want to create their presentation Google Slides and their pamphlet in Google Docs.
- **Presentation & Pamphlet:**
 - Students will take all of their research on their chosen topic and create a presentation in Google Slides. This presentation will be presented to the class.
 - Students will also come up with a pamphlet summarizing their presentations that can be shared on Parent Square to help bring awareness to the Milltown Community.

- **Reflection:**

- Students will then reflect (in a Google Doc) on how they think their project went, and how they will use the suggestions they provided to help the environment.

Enduring Understandings

MS. From Molecules to Organisms: Structures and Processes

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers or types of cells.

MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and the ways parts of cells contribute to the function of a whole cell.

MS-LS1-3 Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-6 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-LS1-7 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-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS. Heredity: Inheritance and Variation of Traits

MS-LS3-1 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-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring results with identical genetic information and sexual reproduction results in offspring with genetic variation.

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MS. Biological Evolution: Unity and Diversity

MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

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

relationships.

MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

MS-LS4-4 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-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Focus Areas

Introduction to Cells

- Cells are the basic units of structure and function in living things.
- All living things are composed of cells, and all cells come from other cells.
- Some microscopes focus light through lenses to produce a magnified image, and other microscopes use beams of electrons.
- Each kind of cell structure has a different function within a cell.
- In multicellular organisms, cells are organized into tissues, organs, and organ systems.
- Elements are the simplest substances. Compounds form when elements combine.
- Important compounds in living things include carbohydrates, lipids, proteins, nucleic acids, and water.
- Substances move into and out of a cell by of two processes: passive transport or active transport.

Cell Processes and Energy

- Cell division allows organisms to grow, repair damaged structures, and reproduce.
- During the cell cycle, a cell grows, prepares for division, and divides into two new cells, which are called "daughter cells".
- Cellular Respiration is essential in the cycling of matter and flow of energy into and out of an organism.
- Most cells exchange oxygen and carbon dioxide with their surroundings by diffusion across the outer coverings, or membranes of cells.

Genetics: The Science of Heredity

- In all of his crosses, Mendel found that only one form of the trait appeared in the F1 generation. However, in the F2 generation, the "lost" form of the trait always reappeared in about one fourth of the plants.
- An organism's traits are controlled by the alleles it inherits from its parents. Some alleles are dominant, while other alleles are recessive.
- In a genetic cross, the combination of alleles that parents can pass to an offspring is based on probability.
- An organism's phenotype is its physical appearance, or visible traits. An organism's genotype is its genetic makeup, or alleles.
- Most traits are the result of complex patterns of inheritance.
- Environmental factors can influence the way genes are expressed.
- The chromosome theory of inheritance states that genes pass from parents to their offspring on

chromosomes.

- Meiosis produces sex cells that have half as many chromosomes as body cells.

DNA: The Code of Life

- The order of the nitrogen bases along a gene forms a genetic code that specifies what type of protein will be produced.
- During protein synthesis, the cells use information from a gene on a chromosome to produce a specific protein.
- Mutations can cause a cell to produce an incorrect protein during protein synthesis. As a result, the organism's trait may be different from what it normally would be.
- Cancer begins when mutations disrupt the normal cell cycle, causing cells to divide in an uncontrolled way.

Human Genetics and Genetic Technology

- Some human traits are controlled by single genes with two alleles, and others by single genes with multiple alleles. Still other traits are controlled by many genes that act together.
- The sex chromosomes carry genes that determine whether a person is a male or female. They also carry genes that determine other traits.
- Some genetic disorders are caused by mutations in the DNA of genes. Other disorders are caused by changes in the overall structure or number of chromosomes.
- Today, doctors use tools such as pedigrees, karyotypes, and genetic testing to help trace and diagnose genetic disorders. People with genetic disorders are helped through medical care, education, and job training.
- Selective breeding, cloning, and genetic engineering are three methods for developing organisms with desired traits.
- Genetic information can be used positively to identify individuals and to learn about health and disease, or negatively to discriminate against people.

Change Over Time

- Darwin hypothesized that species change over many generations and become better adapted to new conditions.
- Darwin proposed that, over a long time, natural selection can lead to change. Helpful variations may accumulate in a species, while unfavorable ones may disappear.
- Fossils, patterns of early development, similar body structures, and similarities in DNA and protein structures all provide evidence that organisms have changed over time.
- A new species can form when a group of individuals remain isolated from the rest of its species long enough to evolve different traits that prevent reproduction.
- The Nervous System
- Your nervous system receives information about what is happening both inside and outside your body. It directs how your body responds to this information and helps maintain homeostasis.
- Cells that carry information through your nervous system are called neurons, or nerve cells.
- Each sense receptor responds to different inputs (electromagnetic, mechanical, and chemical).
- The signals are then processed in the brain, resulting in immediate behaviors or memories.

*See Appendix E for Cross Content

Resources

Scientific Inquiry

MS-LS1-1	<i>Plant, Animal, Bacteria Lab</i>
MS-LS1-2	<i>Cell Organelle Project</i>
MS-LS3-1	<i>Strawberry DNA Lab</i>
MS-LS4-5	<i>Stem Cell Station Activities</i>
MS-LS4-1	<i>Geological Timeline Project</i>
MS-LS4-3	<i>Comparative Embryology</i>