Grade 7 Science Standards

Domain: Life Science - From Molecules to Organisms: Structures and Function			
Code:	**Strand:**	**Rating**	**Completed**
DMS.LS1.1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	Priority	
DMS.LS1.2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.	Support	
DMS.LS1.2.1	Describe how single-celled and multi-celled organisms carry on basic life processes. Ex... osmosis, diffusion.	Priority	
DMS.LS1.3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	Support	
DMS.LS1.4	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	Support	
DMS.LS1.6.1	Relate the following structures to their functions for plants.	Priority	

Catholic Identity

- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress:
  - Embryonic Stem Cells
  - Human Genetic Modification
  - Cloning
- Demonstrate a respect for the human body through personal choices such as:
  - Refraining from the ingestion of harmful chemicals;
  - Practicing regular exercise, healthful eating and proper hygiene;
  - Practicing chastity;
  - Getting adequate amounts of sleep.

Science and Engineering Practices

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

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

Planning and Carrying Out Investigations

Disciplinary Ideas

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). (MS.LS1.1)
- Within cells, special structures are responsible for particular functions, and the cell

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS.LS1.8)

Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale. (MS.LS1.1)

Systems and System Models

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS.LS1.3)

Planning and carrying out investigations in 6-8 builds on K- 5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. • Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS.LS1.1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • 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** Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. • 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)	membrane forms the boundary that controls what enters and leaves the cell. (MS.LS1.2) • 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. (MS.LS1.3) **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. (MS.LS1.8)	**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. (MS.LS1.2) --- ***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. (MS.LS1.1) --- ***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. (MS.LS1.3)

Domain: Life Science - Matter and Energy in Organisms and Ecosystems			
Code:	**Strand:**	**Rating**	**Completed**
DMS.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.	Priority	
DMS.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.	Supporting	Refer to the carbon cycle
DMS.LS2.1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	Priority	
DMS.LS2.3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Priority	
DMS.LS2.4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	Supporting	

Catholic Identity

- Appreciate God's Creation through the vigilant care of our surroundings.
- Practice the virtue of temperance through the moderate use of resources.
- Discuss the sense of order, balance, biological diversity and interconnectedness of God's Universe i.e. food webs, nitrogen cycle, carbon cycle.
- Perform acts of good stewardship.

Science and Engineering Practices

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS.LS2.3)
- Develop a model to describe unobservable mechanisms. (MS.LS1.7)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Disciplinary 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)

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. (MS.LS2.1)

Crosscutting Concepts

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.LS1.4),(MS.LS1.5),(MS.LS4.5)

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and use 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. (MS.LS3.1)

- Analyze and interpret data to provide evidence for phenomena. (MS.LS2.1)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- 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 Engaging in argument from evidence in 6–8 builds on K– 5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- 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. (MS.LS2.4)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical connections between evidence and explanations. (MS.LS1.6)
- Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS.LS2.4)

- 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. (MS.LS2.1)
- Growth of organisms and population increases are limited by access to resources. (MS.LS2.1)

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. (MS.LS2.3)

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. (MS.LS2.4)

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

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. (MS.LS4.5)

Connections to Nature of 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. (MS.LS4.5)

Domain: Life Science - Interdependent Relationships in Ecosystems			
Code:	**Strand:**	**Rating**	**Completed**
DMS.LS2.2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	Priority	
DMS.LS2.2.1	Compare the symbiotic and parasitic relationships in organisms within an ecosystem.	Priority	
DMS.LS2.5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	Supporting	

Catholic Identity

- Discuss the sense of order, balance, biological diversity and interconnectedness of God's Universe, e.g. food webs, symbiotic relationships.
- Accept God's creation with gratitude by moderating usage of resources.

Science and Engineering Practices

Constructing Explanations and Designing
Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS.LS2.2)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS.LS2.5)

Disciplinary Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. 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. (MS.LS2.2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earths terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS.LS2.5)

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— for example,

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS.LS2.2)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS.LS2.5)

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. (MS. LS2.5)

Connections to Nature of Science

	water purification and recycling. (secondary to MS.LS2.5) **ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS.LS2.5)	**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. (MS.LS2.5)

Domain: Life Science - Growth, Development, and Reproduction in Organisms			
Code:	**Strand:**	**Rating**	**Completed**
DMS.LS1.4	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.	Priority	
DMS.LS1.5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	Supporting	Change to nature versus nurture
DMS.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.	Priority	
DMS.LS3.2	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.	Priority	
DMS.LS3.2.1	Explain the purposes of cell division: growth and repair and reproduction	Priority	
DMS.LS3.2.2	Explain basics of mitosis and meiosis.	Priority	
DMS.LS3.2.3	Explain the basic principles of heredity using the human examples of eye color, widows peak, blood type	Priority	
DMS.LS3.2.4	Distinguish between the nature of dominant and recessive traits in humans.	Priority	
DMS.LS4.5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.	Supporting	
DMS.LS4.5.1	Discuss the Church's stance regarding: immorality of artificial insemination, contraception, sterilization, and bioengineering including: cloning, embryonic stem cell research, genetic engineering.	Priority	

Catholic Identity

- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress such as:
  - Embryonic Stem Cells
  - Human Genetic Modification
  - Cloning
- Demonstrate a respect for the human body through personal choices such as:
  - Refraining from the ingestion of harmful chemicals;
  - Practicing regular exercise, healthful eating and proper hygiene;
  - Practicing chastity;
  - Getting adequate amounts of sleep;
  - Limiting exposure to radiation (solar and x-rays).

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

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

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- 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.LS1.5)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed.

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)
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS.LS1.4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS.LS1.4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS.LS1.5)

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

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.LS1.4),(MS.LS1.5),(MS.LS 4. 5)

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. (MS.LS3.1)

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. (MS.LS4.5)

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. (MS.LS4.5)

	organism. (MS.LS3.1) **LS4.B: Natural Selection** • 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. (MS.LS4.5)	

Domain: Life Science - Natural Selection and Adaptations			
Code:	**Strand:**	**Rating**	**Completed**
DMS.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.	Priority	
DMS.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.		
DMS.LS4.3	Analyze images to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.	Priority	replace pictorial data with pictures
DMS.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.	Priority	
DMS.LS4.6	Use Punnett square to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Priority	Say punnett square instead of math rep.

Catholic Identity

- Reference St. John Paul II's 1996 message to the Pontifical Academy of Sciences & Pope Pius XII's 1950 encyclical Humani Generis on evolution.
- Use argument supported by evidence to discriminate between life-affirming technology and reckless technological progress such as:
  - Embryonic Stem Cells
  - Human Genetic Modification
  - Cloning
  - Eugenics

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K– 5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

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

Disciplinary Ideas

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

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and affect relationships. (MS.LS4.2)
- Graphs, charts, and images can be used to identify patterns in data. (MS.LS4.1), (MS.LS4.3)

Cause and Effect

- 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.LS4.6)

(MS.LS4.1) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to 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. (MS.LS4.6) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS.LS4. 2) • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS.LS4.4)	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) **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)	--- ***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. (MS.LS4.1),(MS.LS4.2)