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 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)
MS.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)

MS.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)

MS.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. (MS-LS3-1)
**MS.LS1.B: Growth and Development of Organisms**

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

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**MS.LS3.A: Inheritance of Traits**

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)

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**MS.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)
Performance Expectation

**MS-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.

**Clarification Statement:** Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.

**Assessment Boundary:** none

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Performance Expectation

**MS-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.

**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.

**Assessment Boundary:** Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.

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Performance Expectation

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

**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.

**Assessment Boundary:** Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.
Performance Expectation

**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.

**Clarification Statement:** none

**Assessment Boundary:** Assessment does not include mechanisms for the transmission of this information.

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Performance Expectation

**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.

**Clarification Statement:** Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.

**Assessment Boundary:** Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.

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Performance Expectation

**MS-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.

**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.

**Assessment Boundary:** none
Science and Engineering Practice

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-LS1-2)

Science and Engineering Practice

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

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

Science and Engineering Practice

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)

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)

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-LS3-2)
Crosscutting Concept

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

Crosscutting Concept

**Scale, Proportion, and Quantity**
Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

Crosscutting Concept

**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)
**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)

**Cause and Effect**

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

Connection 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)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.6.8 - Integration of Knowledge and Ideas

Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3)
Common Core State Standards for ELA/Literacy

Reading in Science
RST.6-8.1 - Key Ideas and Details
Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)

Common Core State Standards for ELA/Literacy

Speaking & Listening
SL.8.5 - Presentation of Knowledge and Ideas
Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2)

Common Core State Standards for ELA/Literacy

Writing in Science
WHST.6-8.1 - Text Types and Purposes
Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)
**Writing in Science**

**WHST.6-8.7 - Research to Build and Present Knowledge**

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)

**Writing in Science**

**WHST.6-8.8 - Research to Build and Present Knowledge**

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-LS1-8)

**Common Core State Standards for Mathematics**

**Expressions & Equations**

**6.EE.C.9 - Represent and analyze quantitative relationships between dependent and independent variables.**

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-1), (MS-LS1-2), (MS-LS1-3)