7th Grade Unit 2 - Structure and Function of Body Systems

Content Area: **Science**
Course(s): **Science Grade 7**
Time Period: **MP2**
Length: **45 days**
Status: **Published**

NJSLS - Science

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.
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.
MS-LS1-3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
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-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science and Engineering Practices

Developing and Using Models

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

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)

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)

Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-

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-LS1-8)

Asking Questions and Defining Problems

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Analyzing and Interpreting Data

Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Disciplinary Core 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 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)

ETS1.A: Defining and Delimiting Engineering Problems

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. (MS-ETS1-1)

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. (MS-ETS1-2, MS-ETS1-3)

Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MSETS1-3)

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)

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)

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)

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)

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)

Influence of Science, Engineering, and Technology on Society and the Natural World

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)

The uses of technologies and 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. (MS-ETS1-1)

Rationale and Transfer Goals

Students demonstrate age appropriate abilities to plan and carry out investigations to develop evidence that living organisms are made of cells. Students gather information to support explanations of the relationship between structure and function in cells. They are able to communicate an understanding of cell theory and understand that all organisms are made of cells. Students understand that special structures are responsible for particular functions in organisms. They then are able to use their understanding of cell theory to develop and use physical and conceptual models of cells. Students then develop a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. Students will construct explanations for the interactions of systems in cells and organisms. Students understand that special structures are responsible for particular functions in organisms, and that for many organisms, the body is a system of multiple-interaction subsystems that form a hierarchy, from cells to the body. Students construct explanations for the interactions of systems in cells and organisms and how organisms gather and use

information from the environment. The crosscutting concepts of scale, proportion, quantity, structure and function, systems and system models, and cause and effect provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in planning and carrying out investigations, analyzing and interpreting data, developing and using models, engaging in argument from evidence and obtaining, evaluating, and communicating information. Students are also expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Enduring Understandings

All living things are made up of cells, either one cell or many different numbers and types of cells.

In multicellular organisms, the body is a system of multiple, interacting subsystems.

Essential Questions

How will astrobiologists know if they have found life elsewhere in the solar system?

How do the functions of cells support an entire organism?

What is the evidence that a body is actually a system of interacting subsystems composed of groups of interacting cells?

How do organisms receive and respond to information from their environment?

Content - What will students know?

- Distinguish between living and nonliving things.
- Cells are the smallest unit of life that can be said to be alive.

- All living things are made up of cells, either one cell or many different numbers and types of cells.
- Organisms may consist of one single cell (unicellular).
- Nonliving things can be composed of cells.
- Organisms may consist of many different numbers and types of cells (multicellular).
- Cells that can be observed at one scale may not be observable at another scale.
- Engineering advances have led to important discoveries in the field of cell biology, and scientific discoveries have led to the development of entire industries and engineered systems.
- The cell functions as a whole system.
- Identify parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.
- Within cells, special structures are responsible for particular functions.
- Within cells, the cell membrane forms the boundary that controls what enters and leaves the cell.
- Complex and microscopic structures and systems in cells can be visualized, modeled, and used to describe how the function of the cell depends on the relationships among its parts.
- Complex natural structures/systems can be analyzed to determine how they function.
- A model can be used to describe the function of a cell as a whole.
- A model can be used to describe how parts of cells contribute to the cell's function.
- The structures of the cell wall and cell membrane are related to their function.
- In multicellular organisms, the body is a system of multiple, interacting subsystems.
- Subsystems are groups of cells that work together to form tissues.
- Organs are groups of tissues that work together to perform a particular body function.
- Tissues and organs are specialized for particular body functions.
- Systems may interact with other systems.
- Systems may have subsystems and be part of larger complex systems.
- Interactions are limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.
- Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.
- Sense receptors respond to different inputs (electromagnetic, mechanical, chemical).

- Sense receptors transmit responses as signals that travel along nerve cells to the brain.
- Signals are then processed in the brain.
- Brain processing results in immediate behaviors or memories.
- Cause-and-effect relationships may be used to predict response to stimuli in natural systems.

Skills - What will students be able to do?

- Conduct an investigation to produce data that provides evidence distinguishing between living and nonliving things.
- Conduct an investigation to produce data supporting the concept that living things may be made of one cell or many and varied cells.
- Distinguish between living and nonliving things.
- Observe different types of cells that can be found in the makeup of living things.
- Develop and use a model to describe the function of a cell as a whole.
- Develop and use a model to describe how parts of cells contribute to the cell's function.
- Develop and use models to describe the relationship between the structure and function of the cell wall and cell membrane.
- Use an oral and written argument supported by evidence to support or refute an explanation or a model of how the body is a system of interacting subsystems composed of groups of cells.
- Gather, read, and synthesize information from multiple appropriate sources about sensory receptors' response to stimuli.
- Assess the credibility, accuracy, and possible bias of each publication and methods used.
- Describe how publications and methods used are supported or not supported by evidence.

Activities - How will we teach the content and skills?

- Inspire Science Life Science Unit 2 Module 1: Lesson 1 Exploring Life
- Inspire Science Life Science Unit 2 Module 1: Lesson 2 Cell Structure and Function
- Inspire Science Life Science Unit 2 Module 2: Lesson 1 Levels of Organization

- Inspire Science Life Science Unit 2 Module 2: Lesson 2 Structure and Support
- Inspire Science Life Science Unit 2 Module 2: Lesson 3 Obtaining Energy and Removing Waste
- Inspire Science Life Science Unit 2 Module 2: Lesson 4 Moving Materials
- Inspire Science Life Science Unit 2 Module 2: Lesson 5 Control and Information Processing
- MS-LS1-1 Lesson Examples
- MS-LS1-2 Lesson Examples
- MS-LS1-3 Lesson Examples
- MS-LS1-8 Lesson Examples

Evidence/Assessments - How will we know what students have learned?

- Inspire Science Labs
- Inspire Science STEM Module Projects
- Inspire Science Life Science Unit 2 Module 1 Assessment
- nspire Science Life Science Unit 2 Module 2 Assessment
- Daily Warm Ups
- Daily Exit Tickets
- Grade 7 Unit 2 Benchmark Assessment

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• In multicellular organisms, the body is a system of multiple, interacting subsystems.	By the end of Grade 5, students understand that: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	4-LS1-1 Activities

Key Resources

Inspire Science

Let’s Talk Science: Seeding Argumentation About Cells and Growth

Movement of Molecules Into or Out of Cells

Engineering and the Human Body - Unit - TeachEngineering

Organ Systems Exploration - Science World

Living vs Nonliving

Heart and Circulatory System (for Teens) - Nemours KidsHealth

Your Brain & Nervous System (for Kids) - Nemours KidsHealth

Movie: Bones & Skeletal System (for Kids) - Nemours KidsHealth

Your Digestive System (for Kids) - Nemours KidsHealth

Your Lungs & Respiratory System (for Kids) - Nemours KidsHealth

21st Century Life and Careers

9.2.8.CAP.8	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.

Career Readiness, Life Literacies, & Key Skills

9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.IML.3	Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
9.4.8.IML.4	Ask insightful questions to organize different types of data and create meaningful visualizations.
9.4.8.IML.5	Analyze and interpret local or public data sets to summarize and effectively communicate the data.
9.4.8.TL.1	Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

Interdisciplinary Connections/Companion Standards

NJSLS ELA

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3)

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). (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2, MS-ETS1-3)

RI.6.8 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)

WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-3)

WHST.6-8.7 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, MS-ETS1-2)

WHST.6-8.8 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, MS-ETS1-1)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2)

NJSLS Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1, MS-ETS1-2, MS-ETS1-3)

6.EE.C.9 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)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1, MS-ETS1-2, MS-ETS1-3)