Cells and Body Systems Unit Overview

ESSENTIAL QUESTION

How do body systems interact with each other to communicate and collaborate?

Introduction to Culminating Project and Individual Project Organizer

Lift-Off Task: Communication and Collaboration between Players

Formative Assessment—Individual Project Organizer Lift-Off Task

Task 1: The Different Types of Cells in Your Body

Formative Assessment—Individual Project Organizer Task 1

Task 2: Model Structures and Functions within a Cell

Formative Assessment—Individual Project Organizer Task 2

Task 3: The Body and Its Interacting Systems

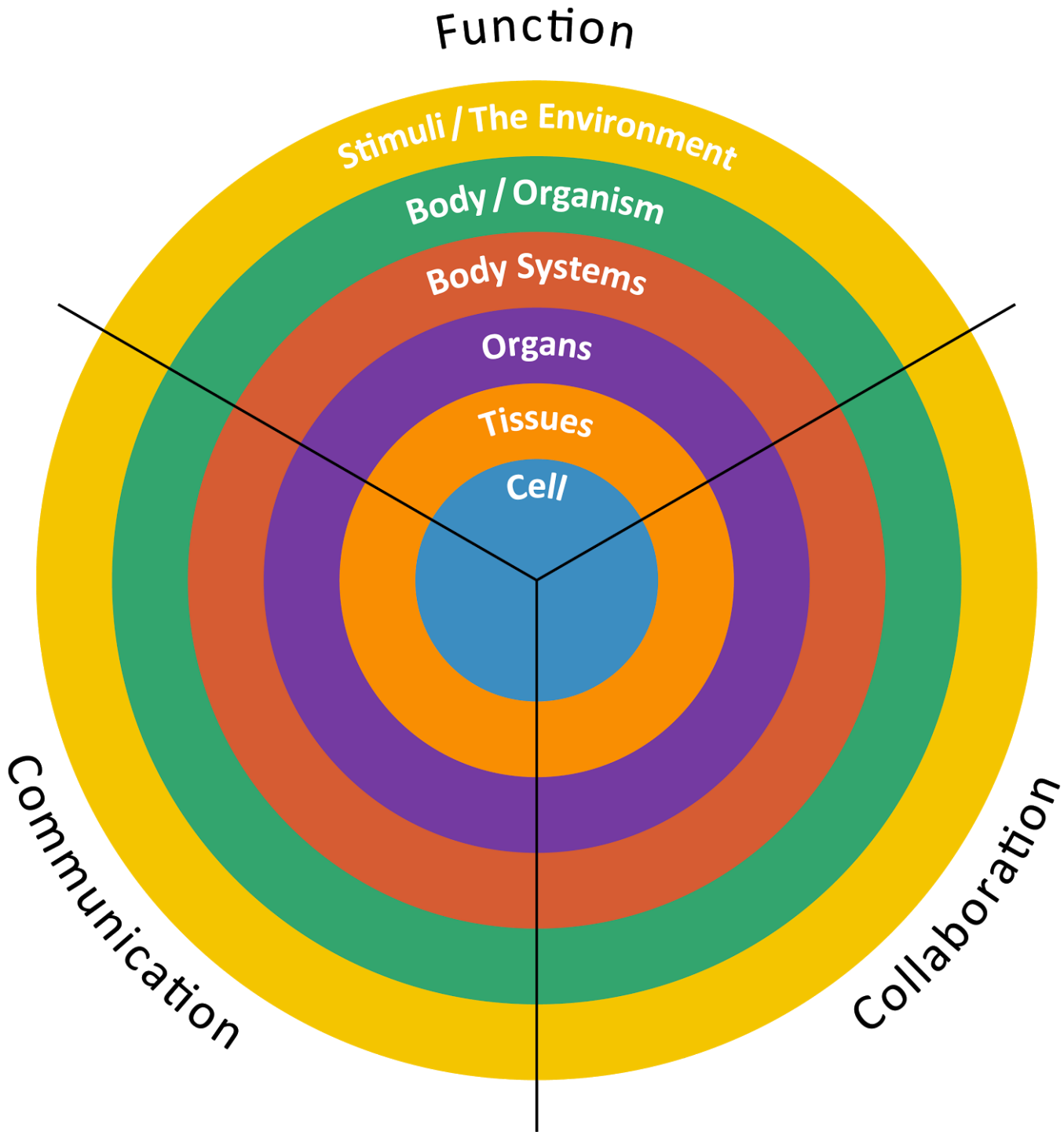
Formative Assessment—Individual Project Organizer Task 3

Task 4: Your Senses—Communicating with the Outside World

Formative Assessment—Individual Project Organizer Task 4

Culminating Project: Design an Activity Brochure

Group and Individual Assessment


Function
Stimuli / The Environment
Body / Organism
Body Systems
Organs
Tissues
Cell
Communication
Collaboration

Connect the 6th Grade Cells and Body Systems Unit with Prior Knowledge

This summary is based on information found in the NGSS Framework.

Core Idea LS1 From Molecules to Organisms: Structures and Processes

The performance expectations in LS1: From Molecules to Organisms: Structures and Processes help students formulate an answer to the question, "How can one explain the ways cells contribute to the function of living organisms." This unit on Body Systems focuses on two of the four NGSS sub-ideas: Structure and Function and Information Processing. It is the goal of this 6th grade Body Systems Unit to look at the human body with a systems approach, by first zooming in on individual cells, then tissues, and then finally on all the body systems working together as one functioning unit. By the end of this unit, students can gather information and use this information to support explanations of the structure and function relationship of cells. They can communicate understanding of cell theory. They will have a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism.

In this 6th grade Body Systems unit, students conduct an investigation to provide evidence that living things are made up of cells, focusing on the observation that different cells have different structures to fit their functions. They then model the structures and functions of parts within a cell. At this point, they zoom outward, gathering data about how exercise affects two body systems to help them make connections on how different body systems interact. At the end of the unit, students diagram a neural pathway to show how humans are able to sense and respond within their environment. Moving into 6th grade curriculum, it is important to know that students have not yet defined the word ***cell***, as well as much of the other anatomical vocabulary. Students may also have a broader understanding of the need for certain body parts for survival as well as the fact that humans interact with their environment, but knowledge of the internal processes for these phenomena has not been taught yet.

The following are the sixth-grade performance expectations.

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 (*including Bacteria, Archaea, and Eukarya) 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.]

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***.]

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***.]

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

* Viruses, while not cells, have features that are both common with, and distinct from, cellular life.

Although students have not specifically discussed the inner workings of the human body, the first mention of related content appears in kindergarten. In kindergarten, students begin to think about living things and what these living things need in order to survive. This is limited to substances such as food and water for animals, or sunlight for plants. However, this sets the stage for later discussions in 6th grade about what defines a living thing and how these are essential substances used by living things. In particular, students will use this idea in the 6th Grade Body Systems Unit as they learn what substances a cell needs in order to function.

The following are the Kindergarten performance expectations.

K-LS1-1 **Use observations to describe patterns of what plants and animals (including humans) need to survive.** [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Students revisit the concept of survival of living things in first grade. The focus is still on survival, but the ideas become more specific to particular structures and their function. Students form the foundation of the concept of structure and function by examining how plants and animals use their external parts to help them survive, grow, and meet their needs—a concept that arises again in this unit when analyzing types of cells.

The following are the first grade performance expectations.

1-LS1-1 **Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.** [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

In fourth grade, students move to more specific body structures. They build off earlier foundations of structure and function to develop a basic understanding that animals are made up of certain parts, such as the heart, stomach, lung, brain, and skin. While body parts are not discussed in detail, this introduces students to structures and functions of human body parts that they will build upon in this 6th grade unit. Students also explore the basic process of sensing, processing, and responding to the environment. This sets the stage for students to learn the full neural pathway in the 6th Grade ***Cell and Body Systems*** unit.

The following are the fourth grade performance expectations.

4-LS1-1 **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.]

4-LS1-2 **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** [Clarification Statement: Emphasis is on systems of information transfer.]

It must be noted that some of the performance expectations from LS-1 From Molecules to Organisms: Structures and Processes have been omitted from the descriptions above because they are not directly related to the Body Systems unit. These omitted performance expectations will serve as prior knowledge for other life science units.

Connect Core Ideas, Scientific Practices, and Crosscutting Concepts from K–6

	First Grade	Fourth Grade	Sixth Grade
Core Idea LS1.A Structure and Function	• All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1).	• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)	• 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)
Core Idea LS1.D Information Processing	• Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)	• Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)	• 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)
Science and Engineering Practices	• Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information	• Developing and Using Models • Engaging in Argument from Evidence	• Carrying out Investigation • Developing and Using Models • Constructing Explanations • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information
Crosscutting Concepts	• Patterns • Structure and Function	• System and System Models	• Cause and Effect • Scale, Proportion, and Quantity • System and System Models • Structure and Function

Standards and Objectives

Cells and Body Systems Standards

NGSS Performance Expectations

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.]

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.***]

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***.]

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

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)

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

Planning investigation 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.

- Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

Other 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 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)

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.

- Analyze and interpret data to provide evidence for phenomena.

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)

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)

Standards by Task

Tasks	Descriptions of Tasks	Performance Expectations*	Disciplinary Core Ideas and Crosscutting Concepts	Science and Engineering Practices
Lift-Off Task: Communication and Collaboration between Players	• Students play soccer or kickball. • Students discuss how they communicated and collaborated to be a team. • Students create a model for how small parts contribute to the larger whole.			• Developing and Using Models
Task 1: The Different Types of Cells in Your Body	• Students make a claim about what they think makes up living things. • Students collect evidence from closeup photos of animals, plants, bacteria, and non-living material. • Students make a claim, gather evidence, and reason about whether living organisms are made up of one or many types of cells.	• 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-LS1-1)	**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)	• Carrying Out Investigations • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions
Task 2: Model Structures and Function within a Cell	• Students read about and gather facts about cells and organelles. • Students plan and present a cell drama.	• 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-LS1-2)	**LS1.A: Structure and Function** • 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)	• Developing and Using Models • Obtaining, Evaluating, and Communicating Information
Task 3: The Body and Its Interacting Systems	• Students gather data about how exercise affects the respiratory and circulatory system. • Students individually learn about one body system and then share what they have learned with their groups. • Students create a poster showing how all the body systems interact during physical activities. • Students explain the importance of the respiratory and circulatory system during exercise.	• Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3)	**LS1.A: Structure and Function** • 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)	• Carrying Out Investigations • Developing and Using Models • Engaging in Arguments from Evidence

*The three dimensions of the Performance Expectations are formatively assessed in the unit tasks. The Culminating Project only assesses parts of each Performance Expectation.

Tasks	Descriptions of Tasks	Performance Expectations*	Disciplinary Core Ideas and Crosscutting Concepts	Science and Engineering Practices
Task 4: Your Senses—Communicating with the Outside World	• Students gather information about the nervous system and about what a stimulus/ response pathway is made up of. • Students create their own stimulus/response pathway.	• Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LS1-8)	**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)	• Obtaining, Evaluating, and Communicating Information • Developing and Using Models
Culminating Project: Design an Activity Brochure	• Students design an activity brochure. • Students write a letter to a client to promote the informational and educational value of the brochure.	• 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-LS1-1) • 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-LS1-2) • Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3) • Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LS1-8)	**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)	• Constructing Explanations and Designing Solutions • Developing and Using Models • Obtaining, Evaluating, and Communicating Information

*The three dimensions of the Performance Expectations are formatively assessed in the unit tasks. The Culminating Project only assesses parts of each Performance Expectation.

Misconceptions

Knowing what is wrong is as important as knowing what is right.

Lift-Off Task: Communication and Collaboration between Players

Misconceptions	Accurate Concept
Collaboration and communication are completely separate categories.	In order to collaborate, one must almost always communicate. Some of the examples from the dodgeball game for collaboration will overlap with examples of communication.

Task 1: The Different Types of Cells in Your Body

Misconceptions	Accurate Concept
There are no single-celled organisms.	Bacteria are examples of single-celled organisms.
Bigger organisms have bigger cells.	Bigger organisms have more cells.
Some living parts of organisms are not made of cells. For example, hair is dead so it is not made up of cells.	All parts of living things are composed of one or more cells, though the cells in that particular part may be dead.
Living things are made up of one type of cell because there is only one type of cell.	Multicellular living things are made up of many types of cells. Cells show differentiation in structure depending on the function of that cell. For example, nerve cells have dendrites that extend from the cell body to receive signals while red blood cells are round to easily maneuver through arteries.
There are only two types of cells: animal and plant. All animal cells look alike and all plant cells look alike. (This misconception comes from common diagrams in science textbooks.)	There are many different types of cells. Cells show differentiation in structure depending on the function of that cell. For example, nerve cells have dendrites that extend from the cell body to receive signals while red blood cells are round to easily maneuver through arteries.
Nerve cells are the cells that connect your outer body parts to your brain.	This is true, but the brain and spinal cord are filled with nerve cells as well.

Task 2: Model Structures and Function within a Cell

Misconceptions	Accurate Concept
Food is “eaten” by cells to make energy.	Food is broken down into different monomers during the digestive process. One of those monomers, glucose, is able to be used by cells to make energy.
Food and energy are two words for the same thing.	Food is potential energy stored in chemical bonds. This food needs to be eaten, broken down into smaller pieces, and then converted into energy within the cells.

The nucleus is in charge of the cell and tells every other part of the cell what to do.	The nucleus holds the DNA instructions to create proteins in the ribosomes. Other cell parts have their own functions that do not require "direction" from the nucleus. For example, the mitochondria make energy and the cell membrane selectively allows certain molecules in and out.
Organelles "float" inside a cell.	Organelles are suspended in a jelly-like fluid called cytoplasm.
The cell membrane has tunnels and doors that allow all of the necessary substances in and out.	Some molecules, such as water, are small enough to pass directly through the cell membrane.
Plants do not do cellular respiration.	Plants need to convert the food they make into energy, just like animals do. Thus, they need mitochondria and they still do cellular respiration.
Water only exits animal cells as a byproduct of cellular respiration.	Water is essential to the functioning of the cell because without it, cells would not be able to remove waste, bring in nutrients, or transport oxygen. Thus, water often enters a cell when necessary.

Task 3: The Body and Its Interacting Systems

Misconceptions	Accurate Concept
Each body system does its own job independently.	Each body system is connected to another system in some way. If one system fails, it can lead to failure of other systems.
The body is a series of one-way systems. For example, oxygen is taken from the lungs to the cells and dead ends there.	The body is really more of a cycle. Oxygen is taken from the lungs to the cells, where it is used to make energy and converted into carbon dioxide. This is then taken back out to the lungs to be exhaled.
Breathing rate increases during exercise because more oxygen is needed. That is just what happens.	More oxygen is needed because exercise requires more energy and the process to make energy in cells requires oxygen.
The heart beats faster during exercise to match the breathing rate.	The heart beats faster during exercise in order to pump more oxygen to cells in need of energy and pump more carbon dioxide waste to the lungs to be exhaled.
Oxygen enters the lungs and is used there before being breathed back out.	Oxygen is inhaled into the lungs, where it is passed to the blood to be circulated throughout the body. It is used by cells, which in turn create carbon dioxide to be released back out through the lungs. This is how the circulatory and respiratory systems are connected.
Digestion starts in the stomach.	Digestion starts in the mouth, where an enzyme begins to break down starches in the food.

The muscles are not related to the main systems: digestive, circulatory, and respiratory.	Many of the organs in these systems are made up of muscles.
The nervous system is a separate system that functions on its own and controls all other systems.	The nervous system, like any other, needs oxygen and nutrients in order to function.

Task 4: Your Senses—Communicating with the Outside World

Misconceptions	Accurate Concept
Sensing a stimulus is a one-step process; that's why it happens so quickly.	A signal must travel through a chain of connected neurons in order to get to your brain for processing.
When you encounter a stimulus, the message is sent straight to the brain.	A signal must travel through a chain of connected neurons in order to get to your brain for processing.
Human eyes look "out" into the world.	Information from the outside world in the form of a stimulus enters the eye; thus, we actually see "in."
All neural pathways follow the same order.	Not all neural pathways are the same. Some signals, known as a reflex arc, do not travel to the brain, but rather only through the spinal cord. This allows for a quick response.
The spinal cord is only used once on the neural pathway.	In most sense-and-respond neural pathways, a signal passes through the spinal cord as it is passed from sensory neuron to the brain as well as when it is passed from the brain to the motor neuron.
All neural pathways start with the sensory neuron and end with the motor neuron.	Sometimes a stimulus can be received by a sensory neuron and processed within the brain as a memory or a thought, but will not result in an action that requires a motor neuron.
Nerve cells are directly connected to each other to transmit messages.	Nerve cells actually have a small gap between them known as a synapse. The message crosses the gap by use of small chemical messengers known as neurotransmitters.

Resources

Body Systems Web Resources

Body Systems

- At this site students can pick a system and click through all the organs at their own pace.
  http://www.innerbody.com/

Digestive System

- This movie might be for a slightly younger audience, but it's kind of fun—same idea as Magic School Bus.
  http://kidshealth.org/kid/htbw/DSmovie.html
- This is a more advanced animation, also includes interactive bit where you can click on the organs to learn more.
  http://highered.mheducation.com/sites/0072495855/student_view0/chapter26/animation__organs_of_digestion.html
- Kind of fun interactive that lets kids click on each organ to learn facts about it
  http://www.childrensuniversity.manchester.ac.uk/interactives/science/bodyandmedicine/digestivesystem/
- Another interactive where you can feed a body different foods and click through the steps of digestion
  http://kitses.com/animation/swfs/digestion.swf

Respiratory System

- Cartoon interactive that lets you select each organ to see it in action
  http://www.e-learningforkids.org/health/lesson/respiratory-system/
- Video of the respiratory and circulatory system
  http://schoolmediainteractive.com/view/object/clip/1D6530372B1463F3BBACEAAD4729C1EE

Circulatory System

- Same as the silly digestive video but with circulatory system
  http://kidshealth.org/kid/htbw/CSmovie.html
- Basic Video
  http://www.neok12.com/video/Circulatory-System/zX5d7d0e41705968036a4351.htm
- 3D movie
  http://www.sciencekids.co.nz/videos/humanbody/circulatorysystem.html
- Nice simple animation of blood flow
  http://www.kscience.co.uk/animations/heart.swf
- Simple animation of heart blood flow
  http://www.pbs.org/wgbh/nova/body/map-human-heart.html
- Map of the human heart step through
  http://www.pbs.org/wgbh/nova/body/map-human-heart.html

Nervous System

- General overview for kids (video)
  https://www.youtube.com/watch?v=sjyI4CmBOA0
- Video
  https://youtu.be/sjyI4CmBOA0

Group Culminating Project

Essential Question: How do body systems interact with each other to communicate and collaborate?

Introduction

In today's busy world, hobbies, special activities, and exercise have been promoted as healthy additions to everyone's life. People also like getting information that helps them understand their activities and their bodies better so they can be the best that they can be. Student groups will create an informational brochure that describes and teaches a person all about their bodies during their favorite activity. The Activity Brochure should help individuals understand how the parts in their bodies work together as a system so they can do their activity well.

The Activity Brochure will communicate information about the body and a specific activity, including:

- The types of cells used and what they are used for
- The organelles found in the cells and what the cells need to survive
- The importance of the collaboration of the body systems required to do the activity
- The senses and the neurological pathways required for the activity

Unit Performance Expectations

- Provide evidence that living things are made of many and different types of cells.
- Develop and use a model to describe the function of a cell and its parts.
- Understand that the body is a system of interacting subsystems composed of groups of cells.
- Identify how sensory receptors respond to stimuli by sending messages to the brain for memory and behavior.

Group Culminating Project Instructions

NOTE

Because this is a group project, groups may prefer using a larger size paper—for example, 11" x 17".

Students may use a bifold or trifold layout for the activity brochure.

Bifold Layout

Outside

Back Cover	Front Cover (Title)

Inside

Inside Left	Inside Right

Trifold Layout

Outside

Outside Right Flap	Back Cover	Front Cover (Title)

Inside

Inside Left Flap	Inside Middle	Inside Right Flap

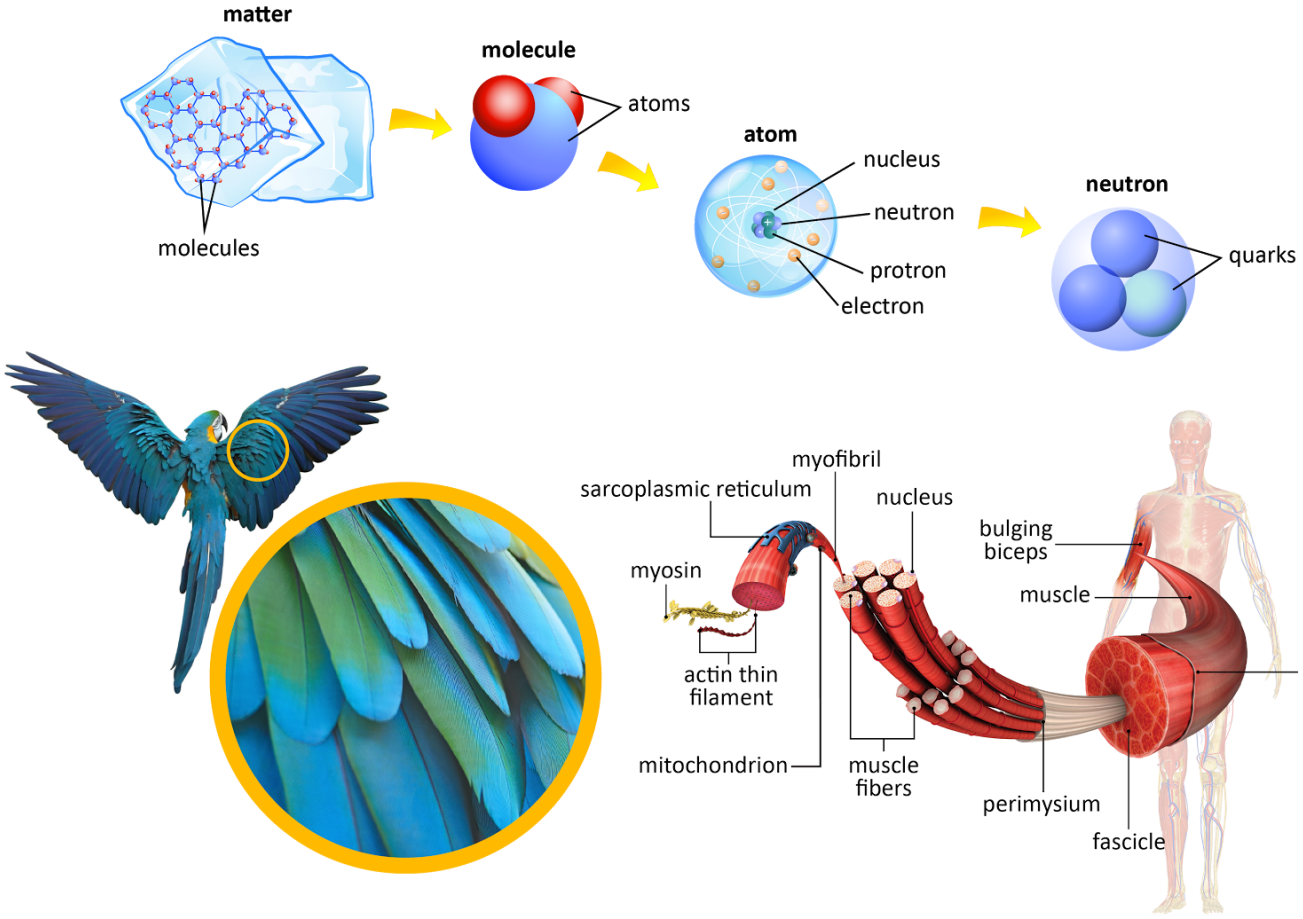
1. Introduce the Culminating Project at the end of the Lift-Off Task.
2. Read over the student Instructions and the criteria for the Culminating Project with students.
3. Show students some sample brochure designs. You can find good examples if you Google “trifold brochures” or “bifold brochures.”
4. Remind students that each section of the Activity Brochure does not have to be independent of the other sections. Some sections can be tied together if students choose to do so.
5. Make sure that students fill out the Individual Project Organizer after each task. Doing so will start students thinking about this project from the very beginning of the unit. The table below summarizes how the Individual Project Organizer connects to the Culminating Project.

LANGUAGE SUPPORT STRATEGIES

- Pair English Language Learners with students of higher English proficiency to go over their Individual Project Organizer. Alternatively, if any ELLs share the same home language, invite them to share their Individual Project Organizer with a partner in their native language first and then follow with a description in English.

Task	Connections between the Individual Project Organizer and the Culminating Project
Lift-Off Task: Communication and Collaboration between Players	Identify the activity and parts of the body used in the activity. Highlight body parts that collaborate. The theme of communication, collaboration, and specific functions is followed throughout the Culminating Project.
Task 1: The Different Types of Cells in Your Body	Diagram three cell types used in your activity. Draw the cells and describe the functions.
Task 2: Model Structures and Functions within a Cell	Draw a model of how cell parts work together. Explain your cell model. Diagram a cell in the body of a person doing the activity.
Task 3: The Body and Its Interacting Systems	Make a diagram of the activity that shows and explains how the body systems interact.
Task 4: Your Senses—Communicating with the Outside World	Make a diagram of the neural pathway of the senses used in the activity

6. It is recommended that you show students ways to include "zoomed-in" pictures in their diagram. Some examples are found below.



7. After students have finished all the learning tasks and completed their Individual Project Organizer for each task, students can start planning their Activity Brochure. Students should use their Individual Project Organizer as a reference to help them design the Activity Brochure.

8. Have students plan the Activity Brochure.
   - Students should create a planning grid for their Activity Brochure. An example is included in the Group Culminating Project Instructions above. Note that the planning grid may look different for different groups, depending on each group's decision about format (trifold or bifold).
   - Give students time to brainstorm individually and then as a group about the design and layout of their Activity Brochure.
   - Recommend that each group assign individual student jobs and/or Activity Brochure sections to work on. Students may be assigned multiple sections, and they will need to collaborate with other students to tie the sections together.

9. Have students make a rough draft or mock-up of the Activity Brochure.
   - Give students time to record their individual assigned sections on a sectional piece of paper that is proportional in size to one that would fit in the final brochure.

- Then have students put their individual portions of the Activity Brochure together (cut and glue) to make a rough draft of the brochure.

10. Have students engage in a peer review of other groups' Activity Brochures.
    - Ask students to fill out a Peer Feedback for Activity Brochure form for each brochure they review. (The form is found at the end of Group Culminating Project in the Student Edition.)
    - Have the groups trade Activity Brochures.
    - Advise each group to give one positive comment and one constructive comment for each section of the form.
11. Have students revise their Activity Brochure.
    - Give groups time to discuss and implement revisions.
12. Tell students to make a final draft of their Activity Brochure.
13. Have the groups share their final Activity Brochure.

Individual Culminating Project

Students' Individual Culminating Project should be written after the group brochure is complete to prepare them for their group presentation.

Student Instructions

Your students will be presenting their activity brochures to an audience. In order to get prepared, they must write a script for their presentation. Their script should include a discussion of all parts of the brochure.

The Student Edition contains an Activity Brochure Graphic Organizer to help them prepare for the presentation. Have students write the script in the form of an essay.

Assess the Individual Culminating Project

The Individual Culminating Project will be assessed using:

- The Science and Engineering Practices Rubric
    - "Constructing Explanations and Designing Solutions" row (nervous system explanation)
    - "Developing and Using Models" row (IPO Task 3)
- The Science Content Rubric

Science Content Rubric

Assess Using Individual Culminating Project Script

SCIENCE CONTENT RUBRIC				
THE STUDENT DEMONSTRATES THEIR SCIENTIFIC KNOWLEDGE OF THE FOLLOWING CONTENT STANDARD	EMERGING	DEVELOPING	PROFICIENT	ADVANCED
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)	Defines cells and describes the types of cells used in the activity with major errors.	Defines cells and describes the types of cells used in the activity with minor errors.	Accurately defines cells and describes the types of cells used in the activity.	Accurately defines cells and provides a detailed description of the types of cells used in the activity.
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)	Constructs an explanation of the main cell parts and what they do (function) with major errors or missing elements.	Constructs an explanation of the main cell parts and what they do (function) with minor errors.	Constructs an accurate explanation of the main cell parts and what they do (function).	Constructs an accurate and detailed explanation of the main cell parts and what they do (function).
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)	Uses the model to describe how the body (tissues, organs, and body systems) interact to complete a specific activity with major errors or missing elements.	Uses the model to describe how the body (tissues, organs, and body systems) interact to complete a specific activity with minor errors.	Uses the model to accurately describe how the body (tissues, organs, and body systems) interact to complete a specific activity.	Uses the model to provide a detailed and accurate description of how the body (tissues, organs, and body systems) interact to complete a specific activity.
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)	Constructs an explanation that includes how the nervous system transmits information (initial stimuli, neural pathway, and response) with major errors or missing elements.	Constructs an explanation that includes how the nervous system transmits information (initial stimuli, neural pathway, and response) with minor errors.	Constructs an explanation that accurately demonstrates mastery of how the nervous system transmits information (initial stimuli, neural pathway, and response).	Constructs an explanation with detailed evidence that accurately demonstrates mastery of how the nervous system transmits information (initial stimuli, neural pathway, and response).

Science and Engineering Practices Rubric

The Cells and Body Systems Unit will be assessed using the highlighted rows.

SCIENCE AND ENGINEERING PRACTICES RUBRIC				
SCORING DOMAIN	**EMERGING**	**DEVELOPING**	**PROFICIENT**	**ADVANCED**
ASKING QUESTIONS AND DEFINING PROBLEMS ❑ No Evidence*	Asks general questions that cannot be investigated. Writes a problem or design statement but it does not match the intent of the problem or the need of the client.	Asks specific questions that can be investigated but do not require empirical evidence. Writes a problem or design statement that matches the intent of the problem or the need of the client with minor errors.	Asks questions that require empirical evidence to answer. Writes a problem or design statement that accurately matches the intent of the problem or the needs of the client.	Asks questions that require empirical evidence to answer and evaluates the testability of the questions. Writes a problem or design statement that accurately and completely matches the intent of the problem or the need of the client.
DEVELOPING AND USING MODELS ❑ No Evidence*	Makes models (drawings, diagrams, or other) with major errors. Explains the limitations of the model with major errors.	Makes models (drawings, diagrams, or other) to represent the process or system to be investigated with minor errors. Explains the limitations of the model with minor errors.	Makes accurate and labeled models (drawings, diagrams, or other) to represent the process or system to be investigated. Explains the limitations of the model as a representation of the system or process.	Makes accurate and labeled models (drawings, diagrams, or other) to represent the process or system to be investigated and explains the model. Explains the limitations of the model as a representation of the system or process and discusses how the model might be improved.
PLANNING INVESTIGATIONS ❑ No Evidence*	Plans an investigation that will not produce relevant data to answer the empirical question(s). Plans a design that does not match the criteria, constraints, and intent of the problem.	Plans an investigation that will produce some relevant data to answer the empirical question(s). Plans a design and writes an explanation that partially matches the criteria, constraints, and intent of the problem.	Plans an investigation that will produce relevant data to answer the empirical question(s) and identifies the dependent and independent variables when applicable. Plans a design and writes an explanation that accurately and adequately matches the criteria, constraints, and intent of the problem.	Plans an investigation that will completely produce relevant and adequate amounts of data to answer the empirical question(s) and identifies the dependent and independent variables when applicable. Plans a design and writes a detailed explanation that accurately and completely matches the criteria, constraints, and intent of the problem.
CARRYING OUT INVESTIGATIONS ❑ No Evidence*	Writes procedures that lack detail so the procedures cannot be duplicated by another person.	Writes procedures with enough detail that another person can duplicate (replicable) but does not conduct a sufficient number of trials.	Writes detailed replicable procedures with descriptions of the measurements, tools, or instruments and conducts adequate number of trials.	Writes detailed replicable procedures with descriptions of the measurements, tools, or instruments and conducts adequate number of trials with an explanation for the proposed data collection.

* If there is no student response then check the No Evidence box.

The Cells and Body Systems Unit will be assessed using the highlighted rows.

SCIENCE AND ENGINEERING PRACTICES RUBRIC				
SCORING DOMAIN	**EMERGING**	**DEVELOPING**	**PROFICIENT**	**ADVANCED**
ANALYZING AND INTERPRETING DATA ***Accurately labeled" means inclusion of title, column titles, description of units, proper intervals.*** ❑ No Evidence*	Makes spreadsheets, data tables, charts, or graphs that are not accurately labeled or do not display all the data. Uses inappropriate methods or makes major errors analyzing the data.	Makes accurate and labeled spreadsheets, data tables, charts, or graphs to summarize and display data but does not arrange the data to examine the relationships between variables. Uses appropriate methods but makes minor errors analyzing the data.	Makes accurate and labeled spreadsheets, data tables, charts, and/or graphs to summarize and display data and arranges the data to examine relationships between variables. Uses appropriate methods to accurately and carefully identify patterns **or** explains possible error or limitations of analyzing the data.	Makes accurate and labeled spreadsheets, data tables, charts, and/or graphs and uses more than one of these methods to summarize and display data; arranges the data to examine relationships between variables. Uses appropriate methods to accurately and carefully identify patterns **and** explains possible error or limitations of analyzing the data.
CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS	Constructs an explanation that includes an inappropriate claim, inaccurate evidence, and/or unclear reasoning.	Constructs or evaluates an explanation consisting of minimal claim(s), limited sources of accurate evidence, and/or minimal reasoning.	Constructs or evaluates an explanation that includes a claim, multiple sources of accurate evidence, and reasoning using accurate and adequate scientific ideas or principles.	Constructs, evaluates, or revises an explanation that includes a claim, multiple sources of accurate evidence, and reasoning using accurate and adequate scientific ideas or principles.
❑ No Evidence*	Uses no data to evaluate how well the design answers the problem and the redesign of the original model or prototype is inappropriate or incomplete.	Uses minimal data to evaluate how well the design answers the problem and describes an appropriate redesign of the original model or prototype with minor errors.	Uses adequate data to evaluate how well the design answers the problem and accurately explains an appropriate redesign of the original model or prototype.	Uses adequate data to evaluate how well the design answers the problem and accurately provides a detailed rationale for the appropriate redesign of the original model or prototype.
ENGAGING IN ARGUMENTS FROM EVIDENCE ❑ No Evidence*	Constructs an argument that includes an inappropriate claim, inaccurate evidence, and/or unclear reasoning.	Constructs or evaluates an argument consisting of minimal claim(s), limited sources of evidence, **or** minimal reasoning.	Constructs and/or evaluates an argument consisting of appropriate claim(s), multiple sources of evidence, and reasoning using accurate and adequate scientific ideas or principles.	Constructs, evaluates, or revises an argument consisting of appropriate claim(s), multiple sources of evidence, and reasoning using accurate and adequate scientific ideas or principles.
OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION ❑ No Evidence*	Communicates information that is inaccurate and/or inconsistent with the evidence.	Communicates accurate but minimal information consistent with the evidence but does not explain the implications **or** limitations of the investigation or design.	Communicates accurate, clear, and adequate information consistent with the evidence and explains the implications and/or limitations of the investigation or design.	Communicates accurate, clear, and complete information consistent with the evidence and provides a rationale for the implications and limitations of the investigation or design.

* If there is no student response then check the No Evidence box.

Materials

Lift-Off: Communication and Collaboration between Players

Student Materials

- Soccer or kickball ball
- Soccer or kickball game materials (cones for goals, bases, team identifiers)
- Poster paper (1 sheet per group)
- Colored markers or pencils (1 set per group)

Task 1: The Different Types of Cells in Your Body

Student Materials

- Cell Type and Tissue Type Resource Cards

Teacher Materials

- "What Are All Living Things Made Of" digital slide presentation
- Optional: Microscopes

Task 2: Model Structures and Functions within a Cell

Student Materials

- Introduction to Cells video: https://youtu.be/gFuEo2ccTPA
- Bill Nye the Science Guy—Cells video: http://www.schooltube.com/video/f7c3e5bb9bc0881ba287/Bill%20Nye%20the%20Science%20Guy%20-%20Cells
- Cardstock
- Pieces of string or yarn
- Manila envelopes
- Pieces of ribbon
- Sticky notes

Task 3: The Body and Its Interacting Systems

Student Materials

- Timer
- Body Systems Resource Cards
- Poster paper
- Colored markers or pencils
- Sticky notes

Task 4: Your Sense—Communicating with the Outside World

Student Materials

- String, yarn, or rope
- Blank white paper
- Colored pencils or pens
- Tape
- Nerve Cells Resource Cards
- Computer or tablet
- Videos about the five senses:
  - Sense of taste: https://youtu.be/j7GibFhuBmE
  - Sense of touch: https://youtu.be/8IEaW0ofKiI
  - Sense of hearing: https://youtu.be/fm7t5S09iUg
  - Sense of smell: https://youtu.be/mFm3yA1nslE (2:10–5:20)
  - Sense of sight: https://youtu.be/ZH8L3i-qxuE

Teacher Materials

- "Nervous System" digital slide presentation
- ***Nervous System*** video: https://youtu.be/sjyI4CmBOA0
- ***The Five Senses Human Body*** Part 1 video: https://www.youtube.com/watch?v=Qh5XsItAhuA&feature=youtu.be
- ***The Five Senses Human Body*** Part 2 video: https://www.youtube.com/watch?v=uU4lgbG_YEY&feature=youtu.be
- Vocabulary Flashcards

Culminating Project: Design an Activity Brochure

Student Materials

- Colored pens and pencils to make a brochure