

## Grade 7 Science, Unit 5

# Body Systems

### Overview

#### Unit abstract

Upon the completion of this unit, students 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. Students will construct explanations for the interactions of systems in cells and organisms. Students will 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 will also be able to construct explanations for the interactions of systems in cells and organisms and for how organisms gather and use information from the environment. Students are expected to demonstrate proficiency while engaging in argument from evidence and obtaining, evaluating, and communicating information. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas. The crosscutting concepts of systems and system models and cause and effect will support student understanding across the unit of study.

#### Essential questions

- How can one explain the ways in which cells contribute to the function of living organisms?
- How do the structures of organisms contribute to life's functions?

## Written Curriculum

### Next Generation Science Standards

<b>MS. Structure, Function, and Information Processing</b>		
Students who demonstrate understanding can:		
<p><b>MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.</b> [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.]</p>		
The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
<p><b>Science and Engineering Practices</b></p> <p><b>Engaging in Argument from Evidence</b></p> <p>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).</p> <ul style="list-style-type: none"> <li>Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)</li> </ul>	<p><b>Disciplinary Core Ideas</b></p> <p><b>LS1.A: Structure and Function</b></p> <ul style="list-style-type: none"> <li>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)</li> </ul>	<p><b>Crosscutting Concepts</b></p> <p><b>Systems and System Models</b></p> <ul style="list-style-type: none"> <li>Systems may interact with other systems; they may have subsystems and be a part of larger complex systems. (MS-LS1-3)</li> </ul> <hr style="border-top: 1px dashed black;"/> <p><b>Connections to Nature of Science</b></p> <p><b>Science is a Human Endeavor</b></p> <ul style="list-style-type: none"> <li>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)</li> </ul>
<i>Connections to other DCIs in this grade-band:</i> N/A		
<i>Articulation to DCIs across grade-bands:</i> <b>HS.LS1.A</b> (MS-LS1-3)		
<i>Common Core State Standards Connections:</i>		
<i>ELA/Literacy –</i>		
<b>RST.6-8.1</b>	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)	
<b>RI.6.8</b>	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)	
<i>WHST.6-8.1</i>		
<b>WHST.6-8.1</b>	Write arguments focused on discipline content. (MS-LS1-3)	
<i>Mathematics –</i>		
<b>6.EE.C.9</b>	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-LS1-3)	

<b>MS. Structure, Function, and Information Processing</b>		
Students who demonstrate understanding can: <b>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.</b> [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]		
The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
<p><b>Science and Engineering Practices</b></p> <p><b>Obtaining, Evaluating, and Communicating Information</b></p> 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. <ul style="list-style-type: none"> <li>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)</li> </ul>	<p><b>Disciplinary Core Ideas</b></p> <p><b>LS1.D: Information Processing</b></p> <ul style="list-style-type: none"> <li>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)</li> </ul>	<p><b>Crosscutting Concepts</b></p> <p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)</li> </ul>
Connections to other DCIs in this grade-band: <b>N/A</b>		
Articulation to DCIs across grade-bands: <b>4.LS1.D</b> (MS-LS1-8); <b>HS.LS1.A</b> (MS-LS1-8)		
Common Core State Standards Connections: ELA/Literacy – <b>WHST.6-8.8</b> Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-LS1-8)		

## Clarifying the standards

### *Prior learning*

The following disciplinary core ideas are prior learning for the concepts in this unit of study. By the end of Grade 5, students know that:

- Different sense receptors are specialized for particular kinds of information, which may then be processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

### *Progression of current learning*

#### **Driving question 1**

How are cells organized into systems and subsystems that make up the body?

##### Concepts

- 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.

##### Practices

- 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.

**Driving question 2**

How do sensory receptors respond to stimuli and what is the result of this response?

**Concepts**

- 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.

**Practices**

- 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.

**Integration of content, practices, and crosscutting concepts**

Within this unit, students will use informational text and models to support their understanding that the body is a system of interacting subsystems. Instruction should begin with students understanding that the cell is a specialized structure that is a functioning system. Students will need to understand that different types of cells have different functions; therefore, each cell system is specialized to perform its particular function. Building on this understanding, students learn that different types of cells serve as subsystems for larger systems called tissues. Groups of specialized tissues serve as subsystems for organs that then serve as subsystems for body systems such as the circulatory, excretory, digestive, respiratory, muscular, and nervous systems. Students need to understand how each body system interacts with other body systems. Emphasis is on the conceptual understanding that each system and subsystem is specialized for particular body functions; it does not include the mechanisms of one body system independent of others.

As part of their investigation of how body systems are interrelated, students should use variables to represent two quantities that describe how the inputs or outputs of one system change in relationship to another. They should 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 using graphs and tables; and relate these to the equation. For example, students can find the relationship between increased activity of the muscular system and the related increase in the activity of the circulatory or respiratory system and express this relationship as an equation.

Students will demonstrate their understanding of this concept by writing an argument, supported by evidence, to support an explanation of how the body is a system of interacting subsystems. As part of their preparation for this written argument, students will read science resources and analyze the evidence used to support arguments in these resources. While gathering evidence, it is important that students connect to the nature of science by demonstrating scientific habits. They should be sure to display intellectual honesty by ensuring that whenever they cite specific textual information and quote or paraphrase the data and conclusions of others, they avoid plagiarism and provide basic bibliographic information for sources.

Students will deepen their understanding of subsystems by gathering and synthesizing information about sensory receptors. Students will understand that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. Each sensory receptor responds to different inputs

Bristol-Warren, Central Falls, Cranston, Segue Institute for Learning, Tiverton, and Woonsocket, with process support from The Charles A. Dana Center at the University of Texas at Austin

(electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. Each response can be examined as a cause-and-effect relationship that can be used to predict response to stimuli in natural systems. Each step in the stimulus/response pathway can be connected to students' previous study of systems and subsystems. For example, the nervous system includes receptors that are subsystems that respond to stimuli by sending messages to the brain. Using multiple appropriate sources, students will read and synthesize information and will assess the credibility, accuracy, and possible bias of publications and methods used, and describe how the information they read is or is not supported by evidence. For example, students could participate in class discussions in which they can investigate whether information they have read in publications agree with scientific findings or seem to be biased in order to advertise a product or support a position.

### Integration of engineering

There are no engineering standards included in this unit of study; however, advances in engineering and technology have made it possible for the discoveries that make up our current understanding of the processes involved in how body systems function.

### Integration of DCI from prior units within this grade level

The content from LS1.A: Structure and Function was introduced in Unit 4. Content within this unit will build on this prior learning.

### Integration of mathematics and/or English language arts/literacy

#### *Mathematics*

- Use variables to represent two quantities that describe the interrelated nature of body systems that change in relationship to one another. Write an equation to express one quantity, thought of as the depending 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.

#### *English language arts/literacy*

- Cite specific textual evidence to support analysis of science and technical texts that provide evidence for how the body is a system of interacting subsystems composed of cells.
- Trace and evaluate a text's argument that the body is a system of interacting subsystems composed of cells, distinguishing claims that are supported by reasons and evidence from claims that are not.
- Write arguments, supported by evidence, for how the body is a system of interacting subsystems composed of groups of cells.
- Gather relevant information concerning how sensory receptors function by responding to stimuli, then sending messages to the brain, which responds immediately through some form or behavior or by storing the messages as memory. Quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

***Future learning******Life science***

- Systems of specialized cells within organisms help the organisms perform the essential functions of life.
- All cells contain genetic information in the form of DNA molecules. Genes are regions in DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.
- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing the living systems to remain alive and functional even as external conditions change, within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (through negative feedback) what is going on inside the living system.

**Number of Instructional Days**

*Recommended number of instructional days: 15 (1 day = approximately 50 minutes)*

**Note**—The recommended number of days is an estimate based on the information available at this time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

