Unit Essential Question

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

Introduction

Students now know that all the cells, tissues, organs, and systems in the body communicate with one another and work together to perform the functions they are supposed to. In this task, students will look more specifically at one body system—the nervous system. By analyzing this system, students can determine how the body communicates with and gets information from the environment.

Objectives

Students will be able to

Content

• Understand that the sensory receptors respond to a stimuli, which results in a response.

Science and Engineering Practices

• Gather information and use the information to develop a model of the neural pathway.

Equity and Groupwork

• Share their understanding of the nerve to produce one neural pathway.

Language

- Write down and discuss facts from a video.
- Describe evidence and give examples to communicate their ideas.

Assessment

- 1. Have students independently complete the Task 4 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
- 2. Collect Individual Project Organizers and assess them using these criteria:
 - "Obtaining, Evaluating, and Communicating Information" row of the Science and Engineering Practices Rubric
 - "Developing and Using Models" row of the Science and Engineering Practices Rubric
- 3. Return the Individual Project Organizers, and give students time to make revisions. ELLs may need additional time.

string

Language of Instruction

Academic Vocabulary

- neuron
- neural pathway
- memory
- stimulus (plural stimuli)
- sensory organs
- receptor
- response

Optional

You can review this academic vocabulary using the Vocabulary Flashcards found at the end of Task 4.



LANGUAGE SUPPORT STRATEGIES

Add the new vocabulary terms to the poster currently displayed in the classroom.

Timing

This task can be completed in 5 class periods (based on 45-minute periods).

- Part I Gather Information about the Nervous System (1 class period)
- Part II Become an Expert on One Sense (3 class periods)
- Part III Connect to the Culminating Project and Assessment (1 class period)

Student Materials

- 10 feet of string, yarn, or rope (per group)
- Blank white paper (5–10 sheets per group)
- Colored pencils or pens
- Tape
- Nerve Cells Resource Cards found at the end of Task 4 (1 per group)
- Computer or tablet (1 per group)
- Videos about the five senses:
 - Sense of taste: <u>https://youtu.be/j7GibFhuBmE</u>
 - Sense of touch: <u>https://youtu.be/8IEaW0ofKil</u>
 - Sense of hearing: <u>https://youtu.be/fm7t5S09iUg</u>
 - Sense of smell: <u>https://youtu.be/mFm3yA1nslE</u> (2:10–5:20)
 - Sense of sight: <u>https://youtu.be/ZH8L3i-qxuE</u>

Preparation of Nerve Cells Resource Cards

• Print several copies of the Nerve Cells Resource Cards found at the end of Task 4.

Teacher Materials

- "Nervous System" digital slide presentation
- Nervous System video: <u>https://youtu.be/sjyl4CmBOA0</u>
- The Five Senses Human Body Part 1 video: <u>https://www.youtube.com/watch?v=Qh5XsItAhuA&feature=youtu.be</u>
- The Five Senses Human Body Part 2 video: <u>https://www.youtube.com/watch?v=uU4lgbG_YEY&feature=youtu.be</u>
- Vocabulary Flashcards found at the end of Task 4 (optional)

Background Knowledge

The Disciplinary Core Idea (DCI) for this Performance Expectation reads as follows:

• 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.

To address the DCI, this task starts by having students watch a video to help them develop a conceptual understanding of the whole nervous system in the body and the parts of the nervous system. Understanding the whole system helps students understand the small parts. Because the DCI goes all the way down to the electromagnetic, mechanical, and chemical receptors, it helps to understand the bigger picture. The following table summarizes the relationships among the senses, sense organs, type of sensory input, and sensory receptors.

Sense	Sense Organ	Type of Sensory Input	Sensory Receptor
Smell	Nose	Responds to chemicals in the air	Olfactory receptors
Hearing	Ears	Respond to mechanical sound waves	Tiny vibrating bones and hairs and bones inside the ear
Sight	Eyes	Respond to electromagnetic light waves	Specialized nerve cells (rods and cones) in the back of the eye
Taste	Tongue	Responds to chemicals, often in combination with one another	Taste buds
Touch	Skin	Responds to mechanical touch, pressure, pain, heat, and cold. For the purpose of this activity, this sense will simply be called "touch."	 Mechanoreceptors: Free nerve endings detect pain and temperature change Meissner's Corpuscle responds to sensitive touch Ruffini's ending detects pressure Pacinian corpuscle responds to pressure Merkel disks detect touch

The brain is a command center for the whole body that

- Interprets information sensed from outside the body
- Controls the body's movements and actions
- Stores memories to be retrieved at a later time

Part I • Gather Information about the Nervous System

- 1. Present the first two slides of the "Nervous System" digital slide presentation.
- 2. When presenting Slide 3, tell students that they will watch a video about the nervous system. They should add notes and labels on the Nervous System Diagram in the Student Edition to help them remember facts.
- 3. Show the *Nervous System* video. The video moves quickly. Start the video at 2:50 and show the video clip more times as needed.



4. The four parts of the video are:

Main Ideas	Learning Goal
Main Parts of the Nervous System	The purpose of this picture is to help students understand that the nervous system is made up of the brain, spinal cord, and nerves. Emphasize the continuous nature of these parts.
Main Parts of the Brain	The purpose of this picture is to introduce students to the fact that the brain has specific areas that specialize in different functions. Make the connections that the medulla controls many of the internal organs for the body systems, and that the cerebrum does most of our thinking (ask students if they can feel it working right now!) and processes all our senses.
Neural Pathway	There is no specific picture of the neural pathway, but this concept is very important. The full body picture can be used to show a pathway from the finger to the spinal cord to the brain back to the spinal cord and back out to the hand. The purpose is to introduce students to the fact that there is a pathway from the outside (the stimulus) toward the brain and a pathway from the brain to the place in the body that responds.
Nerve and Neuron	The purpose of this picture is to reintroduce students to a nerve (they saw one in the cells task and the body system task) and to a neuron. The key purpose of this picture is to reinforce the idea that a nerve impulse only goes one way in a nerve and that a nerve to the brain is really many tiny nerves all put together to make one long pathway.

NOTE

Optional: You can prepare students for the video by briefly reviewing the Vocabulary Flashcards found at the end of Task 4.

- 5. After the *Nervous System* video, instruct students to work in groups to analyze the pictures in the Nervous System Data Table of the Student Edition. Ask them to record their answers as a group on the Nervous System Data Table.
- 6. Continue presenting the "Nervous System" digital slide presentation to discuss the video and the pictures. At the end of the presentation you will show the students two videos about the five senses.

The following table demonstrates the learning goals for the student discussion in the Nervous System Data Table.

Main Ideas	Learning Goal
1	The purpose of this picture is to help students understand that there is a continuous pathway from the stimulus to the response; to start using the terms <i>sensory neuron</i> and <i>motor neuron</i> ; and to reiterate that the spinal cord and brain are between the sense and the response.
2	The purpose of this picture is to once again help students identify that there is a neural pathway from the stimulus to the response. A possible pathway is provided in the digital slide presentation.

Part II • Become an Expert on One Sense



NOTE

It is optimal that each group have access to a computer in order to access videos that will help them understand their chosen sense. Each Nerve Cells Resource Card provides a video link.



NOTE

If computers are not available for student use, then first show *The Five Senses Human Body* video (parts 1 and 2) to all students. (The links are in the materials list.) The videos say they are for toddlers, but they are actually a great introduction to the five senses. During the videos there are a few pop-ups, so stay close to the computer to close them out. The purpose of these videos is to introduce students to the senses and to the fact that each sense has a receptor of some sort, and to show how information is passed to the brain. The video does not do a good job of showing the nerves to the brain, so that concept can be a point of conversation. Actually, the fact that there is no representation to the brain in some senses is a limitation of the model. After watching the videos as a class, students can then use the Nerve Cells Resource Cards to help them create their neural pathway.

1. Review the description and instructions for the activity Show the Neural Pathway in the Student Edition.



LANGUAGE SUPPORT STRATEGIES

Have ELLs restate or paraphrase the task instructions and sequence using academic vocabulary. Clarify any misunderstanding and recast their statements as needed.

- 2. Ask students to assume their groupwork roles.
- 3. After groups decide on the sense that they want to research, hand them the appropriate Nerve Cells Resource Cards.
- 4. Rotate through the room to check on the groups to make sure their drawings are clear and labeled. Ask individuals and groups what they are drawing and how a picture may relate to the neural pathway for their stimuli and response.
- 5. After students draw their pictures, guide students to tape the pictures on the string in order and then start practicing their presentation.
- 6. Check in with the groups to identify individual jobs for the presentation. There should be at least one narrator; the other students in the group should hold the string and move along the string with the narration.
- 7. Have students present their neural pathways to the class.

Part III • Connect to the Culminating Project and Assessment

- 1. Have students independently complete the Task 4 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
- 2. Collect the Individual Project Organizers and assess them using these criteria:
 - The "Obtaining, Evaluating, and Communicating Information" row of the Science and Engineering Practices Rubric
 - The "Developing and Using Models" row of the Science and Engineering Practices Rubric
 - A criterion of your choice
- 3. Return the Individual Project Organizers and give students time to make revisions.