

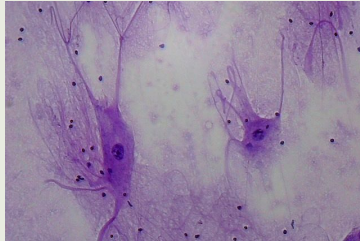
LESSON 5: What do nerves do and why are they in different parts of the body?

PREVIOUS LESSON We used microscopes to investigate blood on pre-prepared slides. We observed that blood is composed of several different smaller structures that cannot be seen without a microscope. We read an article to make sense of the patterns we saw, and considered how the structures of the blood and its components support their functions in the body.

THIS LESSON

INVESTIGATION

2 days



Nerves, like blood vessels, are found throughout the body. In Lesson 3, we observed nerves in the cross section of the foot injury and wondered why they are present. We investigate nerves by first observing them under a microscope, and we notice that nerves have a unique and intricate structure. We read about nerves and learn that the nerve cell's structure suits its function. We engage in a few quick experiences that help us understand the role that nerves play in our bodies. Then we revisit the foot injury and think about how we can leverage what we now know about the function of nerves to better understand how the foot works and to better understand the healing process of the skin, muscles, and bones affected by the injury to the foot.

NEXT LESSON We will use microscopes to help us figure out what makes up skin, bone, and muscle. We will investigate pre-prepared slides and use our observational data to come to consensus around how cells' unique structures support their functions in the body.

BUILDING TOWARD NGSS

MS-LS1-1, MS-LS1-2, MS-LS1-3,
MS-LS1-8



WHAT STUDENTS WILL DO

5.A Gather and synthesize information from scientific text and other sources to describe the basic structure of nerves and nerve cells and explain how the structure supports both the function of those cells within the nervous system and the interactions that occur between nerves and other parts of the body (e.g., skin, bone, muscle).

WHAT STUDENTS WILL FIGURE OUT

- There are nerve endings in skin, bones, muscles, and other parts of the body.
- Nerve cells have a very unique structure - they have long, thin "branches" or "tentacles" extending from a central portion.
- Nerve cells branch out and connect to other nerve cells, forming a network of nerves that carry signals between all parts of the body and the brain.
- The structure of nerve cells is perfectly suited for their function - they branch out and connect with all parts of the body so that they can carry signals back and forth between the body and the brain.

Lesson 5 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	8 min	NAVIGATION Revisit what we have figured out about the role of blood in the body.	A-B	
2	7 min	DETERMINE NEXT STEPS Determine if the same tools and processes used to investigate blood can be used to figure out the role of nerves in the body.	C	sticky notes, markers, chart paper
3	25 min	OBSERVE MICRO-SCALE NERVE SAMPLES Use microscopes and pre-prepared slides to observe the basic structure of nerve cells. Document and share observations, and make comparisons to the structure of blood cells.	D-H	
4	5 min	NAVIGATION Summarize what we have observed and determine next steps.	I	
End of day 1				
5	4 min	NAVIGATION Review our observations of nerves and motivate the need to obtain additional information about nerves and their role in the body.	J	
6	18 min	OBTAIN INFORMATION FROM TEXT Use a scaffolding tool to help gather information from a reading about the structure and function of nerves and the nervous system.	K	<i>Reading: The Body's Nervous System</i> or <i>The Body's Nervous System</i> in student editions, <i>Obtaining Information from Scientific Text</i> , chart paper, markers
7	16 min	CONDUCT A BUILDING UNDERSTANDINGS DISCUSSION Use information from the reading to make sense of the structure of the nerves we observed and consider how the structure supports the function of nerves in the body. Add to the Word Wall.	L-M	<i>Reading: The Body's Nervous System</i> or <i>The Body's Nervous System</i> in student editions, <i>Obtaining Information from Scientific Text</i> , chart paper, markers, 6x8 sticky notes, tape
8	7 min	UPDATE PROGRESS TRACKER AND REVISIT DRIVING QUESTION BOARD Reflect on and record what we figured out about nerves and how that helps us understand healing. Revisit the Driving Question Board to determine which questions we have answered and add new questions.	N-O	Driving Question Board, 3x3 sticky notes, 6x8 sticky notes or 5x8 index cards, markers
End of day 2				

Lesson 5 • Materials List

	per student	per group	per class
Lesson materials	<ul style="list-style-type: none">• science notebooks• sticky notes• markers• <i>Reading: The Body's Nervous System</i> or <i>The Body's Nervous System</i> in student editions• <i>Obtaining Information from Scientific Text</i>		<ul style="list-style-type: none">• chart paper• markers• science notebooks• 6x8 sticky notes• tape• Driving Question Board• 3x3 sticky notes• 6x8 sticky notes or 5x8 index cards

Materials preparation (30 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

This lesson is one of a number of lessons in this unit in which students use microscopes to look at different pre-prepared slides. The unit resources (slides, handouts, discussion prompts) assume your microscopes have a 10x eyepiece lens and 4x, 10x, and 40x objective lenses. If the microscopes your class will be using are different, modify the materials accordingly or call students' attention to the differences.

If you do not have microscopes, some options for doing this lesson include:

- A partner high school may have microscopes that you could borrow for this unit. Order the slides included in the unit materials list.
- We have included images of what students would see when zooming in on nerve cells under the microscope in *Microscopic Images of Nerves*.
- Access the Virtual Microscope interactive at <https://www.teachersopensciencedfieldtest.org/healing> . From there, copy the link for viewing **nerve smear** and share it with your students so they can access it on their own devices. By sharing this direct link, your students will only have access to the images needed for this lesson.

Be sure you have materials (e.g., blank piece of paper, sticky note, or note card) ready to add the following term to the Word Wall: **nervous system**. Do not post this term on the wall until after your class has developed a shared understanding of its meaning.

Investigate Nerves with a Microscope

- **Group size:** Divide your class by the number of microscopes available.
- **Setup:** Be sure all microscopes have access to an outlet (or other power source for their light).
- **Notes for during the lab:** Students should plug in the microscope. Have students sanitize microscopes between turns.
- **Safety:** Glass slides are fragile. Have ready an appropriate receptacle to dispose of broken glass as well as a broom and dustpan specifically reserved for cleanup of broken glass. Remind students to handle the slides carefully and ask you for help if one happens to break.
- **Disposal:** Keep all materials for future use.
- **Storage:** Unplug or turn off and cover microscopes when not in use to avoid dust.

Lesson 5 • Where We Are Going and NOT Going

Where We Are Going

In Lesson 3, students observed blood vessels and nerves in the cross section of the foot, which motivated further investigation of the role of both blood and nerves in the body. In Lesson 4, students observed blood using microscopes or microscopic images and engaged in activities to figure out the blood's function within the body.

In *OpenSciEd Unit 6.1: Why do we sometimes see different things when looking at the same object? (One-way Mirror Unit)*, students explored the role of the brain in processing inputs or signals from the body. They investigated the structures that make up the human eye, how those structures receive light inputs and change those inputs into electrical signals, then send those signals along the optic nerve to the brain, where they are processed into what we see.

In this lesson, students further explore the relationship between the structure and function of nerves to understand the role of nerves in the body. They use microscopes and/or microscopic images to observe nerves, discovering that nerve cells have a unique structure. As students model what they observe, they wonder about the structure of nerve cells. Using a scaffolding tool for SEP 8 Obtaining, Evaluating, and Communicating Information, students read scientific text to obtain additional information about nerve cells, which helps them figure out that the nerve cells' distinctive structure makes them perfectly suited for their functions. Students learn that nerve cells branch out and connect with all parts of the body and with one another to create a system allowing signals to flow to and from the brain. This enables the brain to keep track of processes throughout the body, including voluntary processes, like movement of the arms and legs, and involuntary processes, like breathing and the continuous beating of the heart.

Where We Are NOT Going

This lesson focuses on building a strong understanding of the relationship between structure and function without focusing on memorizing the parts of nerve cells or nervous system. In addition, the lesson does not focus on describing the exact process by which signals move between the body and the brain.

In *OpenSciEd Unit 8.1: Why do things sometimes get damaged when they hit each other? (Collisions Unit)*, students will learn more about the role of nerves in the body and the structural components of nerve cells. They will learn how nerves help us learn about the world around us through our senses and the relationship between nerve cells, nerves, the spinal cord, and the brain. They will model the component parts of nerve cells while describing the processes that allow information to flow between nerves and the brain.

LEARNING PLAN for LESSON 5

1 · NAVIGATION

8 min

MATERIALS: science notebooks

Revisit what we figured out and determine next steps. Say, *Let's take a few minutes to think about what we have figured out over the last few lessons. Feel free to look at your notes and Progress Trackers in your science notebooks to help you.*

ADDITIONAL GUIDANCE

Although this conversation may take a few minutes longer than just reviewing what students figured out, it is critically important that students drive the discussion, even if it is a review of what they have already figured out. This will serve a number of important purposes:

- Students can solidify their understanding of concepts and terms from previous lessons.
- The teacher can assess students' understanding by listening to their partner or small group conversations and to the information shared with the whole group.
- The teacher can plan instruction and scaffolding, if needed, based on the responses that students share. For example, the teacher can use questions to help students make connections between what they know to the bigger picture of healing.
- The teacher can also help students continue to make explicit connections between structure and function, which should occur throughout this unit.

Show slide A and say, *In Lesson 3, we looked at a cross section of the foot. What did we notice? What did we decide that we needed to figure out?*

Give students a minute to turn and talk with a partner, then call on a few students to respond.

Suggested prompt	Sample student response
<i>In Lesson 3, we looked at a cross section of the foot. What did we notice?</i>	<i>We saw blood vessels scattered throughout the foot.</i> <i>We also saw nerves scattered throughout the foot.</i>
<i>Based on what we saw, what did we decide we needed to figure out?</i>	<i>We decided that we needed to figure out why blood vessels and nerves are found throughout the foot.</i> <i>We decided that we needed to figure out the nerves' role in the body.</i>

Show slide B and ask, *What did we do to figure out the blood's function in the body? What did we figure out?*

Give students another minute to talk to a partner, then ask for responses.

Suggested prompt	Sample student response
<p><i>What did we figure out last class about what the blood is made up of? What did we figure out about what the structures in the blood do?</i></p>	<p><i>We figured out that blood is a mixture made up of different substances. We learned that the cells are floating around in a liquid called plasma.</i></p> <ul style="list-style-type: none"> <i>Red blood cells carry oxygen throughout the body.</i> <i>White blood cells fight disease and infection.</i> <i>Platelets clot the blood so that it doesn't continue to leak from injured blood vessels.</i> <i>Plasma brings water, food particles, vitamins, and electrolytes to the body parts and carries waste away.</i> <p><i>We also learned that blood moves through tubes called blood vessels.</i></p>
<p><i>After gathering some information about blood from the reading, we used the microscope to see what more we could figure out about these different structures in the blood. How did the microscope help us?</i></p>	<p><i>Using the microscopes, we observed three different structures in blood--red blood cells, white blood cells, and platelets. We noticed some similarities in the structure of these blood cells. We noticed that they are all round.</i></p>
<p><i>How is the structure of these different parts of the blood related to the function, or job it does for the body?</i></p>	<p><i>The round shapes of the red blood cells, white blood cells, and platelets allow them to move easily through the tube-shaped blood vessels as they float in the liquid plasma.</i></p> <p><i>Blood travels throughout the body carrying many things that the body needs, so its structure (flowy, liquid mixture) allows it to do that.</i></p>
<p><i>So we know blood goes everywhere in the body and we saw that there was blood on the opened skin of the injured foot. We also figured out what is in the blood and what these structures do. What are some predictions of the role the blood plays in helping the body heal?</i></p>	<p><i>Not sure... but it seems like the platelets in the blood help to make a scab so the bleeding stops.</i></p> <p><i>Yeah... and if plasma has food and vitamins in it, then maybe it somehow helps the injury heal.</i></p> <p><i>We also read that the plasma helps to take waste away.</i></p>

2 · DETERMINE NEXT STEPS

7 min

MATERIALS: science notebooks, sticky notes, markers, chart paper

Show **slide C** and say, *So, in addition to the parts of the injured foot that we have been investigating, we said we wanted to figure out more about the blood and the nerves because we saw that blood and nerves were found in the muscles, bones and skin. Could we use the same tools and processes to help us figure out the function of nerves in the body? What are your thoughts?*

Give students a minute or two to turn and talk with a partner to discuss this question on the slide. Remind them that they can use their notes and Progress Trackers in their science notebooks.

When students come back to the whole group, call on a few pairs to share out. Listen for the following ideas:

* SUPPORTING STUDENTS IN ENGAGING IN ASKING QUESTIONS AND DEFINING PROBLEMS

Although asking questions is not a focal practice for *OpenSciEd Unit 6.6: How do living things heal? (Healing Unit)*, this is an opportunity for students to generate questions that can guide investigations,

Suggested prompts	Sample student responses	Follow-up questions
<i>Could we use the same tools and/or processes to help us figure out the structure and function of nerves in the body?</i>	<p><i>We could use microscopes to take a zoomed-in look at nerves. This would help us see what nerves look like and that might give us an idea about the function of nerves.</i></p> <p><i>We could also look at zoomed-in pictures of nerves. That might also help us see the structure of nerves.</i></p> <p><i>Maybe we could do some research--we could read about nerves to get more information about nerves and what they do in the body.</i></p> <p><i>We could talk to people who know about nerves and how they work--maybe a doctor or a scientist.</i></p>	<i>What are some questions you have about nerves?</i>

As students share how they might investigate nerves, encourage them to share questions they have about nerves. Document their questions on chart paper, and use those questions to help students think about additional ways they might investigate their questions. In addition, make sure the chart remains visible for students to reference during the lesson.

Sample student questions might include:

- Why are nerves found in the muscles, bones, and skin?
- Are nerves found everywhere in the body like we saw with the blood?
- What do nerves do?
- What do nerves look like under the microscope?
- Are nerves tubes, like blood vessels, with cells inside?
- Are nerves made up of different kinds of cells, like those we observed in blood?
- Will the structure of the nerves help us figure out what they do in the body?
- Are nerves related to pain somehow?

Give students sticky notes and markers so that they can add their questions to the Driving Question Board, and let them know that we will revisit their questions at the end of the lesson.*

Propose using a similar process to investigate nerves as blood. Say, *Listening to your responses and looking at the questions we have generated makes it seem as though you think we could use the microscope to help us learn about nerves and to figure out their function in the body. Some of you also mentioned that we might want to do some research on nerves. Let's begin by looking at nerves under the microscope and see what we can figure out.*

observations, and student thinking. Encourage students to ask questions about the nerves they observed in Lesson 3 when examining the cross section of the foot and use what they learned in Lesson 4 about blood, blood cells, and blood vessels to generate even more questions. These questions should be written on sticky notes and added to the Driving Question Board as time permits.

In addition, when you acknowledge and document students' questions, you are validating their thinking and positively promoting equity in your classroom.

ALTERNATE ACTIVITY

If no microscopes are available, you have these options:

- Use the images provided on *Microscopic Images of Nerves*.
- Access the Virtual Microscope interactive at <https://www.teachersopencsiedfieldtest.org/healing>. From there, copy the link for viewing **nerve smear** and share it with your students so they can access it on their own devices. By sharing this direct link, your students will only have access to the images needed for this lesson.

Students can document their observations on *Investigating Skin, Bone, and Muscle with a Microscope* while using either of these materials.

Alternately, you could print consumable copies of *Microscopic Images of Nerves*, and direct students to annotate the images with their thoughts about patterns and scales. If you choose to have students annotate images, it will likely take less time than if students are recording observations on the handout.

3 · OBSERVE MICRO-SCALE NERVE SAMPLES

25 min

MATERIALS: None

Share what we know about nerves. Show **slide D** and say, *Before we look at nerve samples, let's share some things we think we already know about nerves.* Give students a few moments to think about the question on the slide, then ask them to share out their ideas.

Make predictions. Show **slide E**, and say, *Now that we have shared what we know about nerves, take a few moments to make a prediction. When we look at nerves under the microscope, do you think we will see the same structures we saw in blood? Write your prediction in your notebook, and explain your thinking.*

Give students time to write down their predictions along with their reasoning. When students finish, call on a few to share.

Transition by saying something like, *Whether we think we will see similar structures or not when we observe nerves in the microscope, it seems that some of us think that the structures we will see might give us a better idea of how nerves work in the body. We figured out that the structure of each component of blood plays an important role in the function of blood in the body, so maybe the structures found in nerves will be important for their function. Let's look at nerves under the microscope and see what we can discover.*

Investigate nerves using a microscope. Show **slide F** and remind students that a microscope is a tool that we can use to see things at a much smaller scale than our eyes alone can see. Tell them that we will be observing nerves at three different magnifications, just like when we observed blood. Have them take a minute or two to follow the directions on the slide to set up their notebooks. They should make sure to have enough room in each row to draw a circle for the field of view of what they will see. Remind them of our lesson question, so that it focuses their attention to what we are trying to figure out.

When students are ready, show **slide G**, and review the following procedures for using the microscope and slides:

1. Hold slides by the edges and handle them gently.
2. Put the slide under the clips to hold it still.
3. Start at the lowest objective (40x, red).
4. Focus slowly until the object(s) are not blurry.
5. Adjust the amount of light coming in through the slide to help you see better.
6. Draw what you see in the whole field of view in the corresponding part of your data table.
7. Be sure everyone in your group has a chance to see (and adjust the focus if needed).
8. When everyone is ready, switch to the next highest objective and repeat the process at step 4 (and then again for the highest objective).

Tell students that they will be working in small groups to observe nerves using the microscope. Remind them that these are the same directions that they followed in Lesson 4 when they observed blood under the microscope. Also, point out that when they draw what they see in the microscope, they should draw inside the circle that represents their field of view.

Ask if there are any questions about the procedure. After answering any questions, pass out slides to groups, and give them time to complete the investigation. Let students know they will be observing a nerve smear slide, which means a small chunk of the part of the body the slide came from squashed and spread out on the slide.

As small groups work, walk around the room and listen in on their conversations and observations. Make note of the things that you hear and see them documenting in their notebooks. Use questions, such as the following, to guide their observations, thinking, and small group discussions:

- What do you see when you look at nerves at 40x magnification?
- Does what you see change when you change the magnification to 100x or 400x? If so, how?
- What structures do you see?
- How does the structure of nerves compare to the structure of red blood cells? White blood cells? Platelets?
- How might the structure that you see support the nerves' function?

As you listen to students, remind them to revisit the list of questions we documented to see if they can answer any of their questions about nerves as they make their observations, and document what they see using pictures and words because we will revisit the chart after they finish their observations.

ADDITIONAL GUIDANCE

If students are struggling with using the microscope, you can provide guidance in the following ways:

- Prompt groups to begin at the lowest objective on the microscope. The magnification may differ, depending upon the type of microscopes you use, but every group should start at the lowest magnification.
- Guide students in focusing the lens of the microscope, if needed. Remind them to move the focus knob slowly and a little at a time to focus the image.
- Point out how to hold the glass slides gently using the edges and to call you for assistance if one breaks.
- Assure students that it is okay to need multiple views of the slide at a given magnification in order to document what they see in the whole field of view.

ALTERNATE ACTIVITY

If you have a classroom microscope whose view can be projected (rather than a class set of microscopes for students to use themselves), you may carry out this lab as a whole-class demonstration. You can invite different students to focus the microscope while everyone records what they see in their data tables. It is important for students to record their own observations so they can compare across magnifications.

During the class discussion, it may be helpful to have a microscope plugged into a computer to project what is observed to allow students to point out what they found or refer to the images while explaining their ideas.

Share initial observations. When students finish documenting their observations, bring everyone back to the whole group. Show **slide H** and ask them to read the questions on the slide. Use the questions to guide students in sharing their initial observations before moving to the next activity. Possible student responses are found below. During this discussion, you may want to add any additional questions students have about nerves and place a check mark next to those we can now answer on the chart started earlier in the lesson.

Suggested prompts	Sample student responses	Follow-up questions
What did you notice about the structure of nerves?	<p>We noticed that there were small structures that resembled blood cells, but had an unusual shape.</p> <p>They did not look round like red blood cells. They looked more like platelets, which had tentacle-like arms that stretched out.</p> <p>There was a center portion that had a darker spot in the middle.</p> <p>Nerves also had what looked like fingers reaching out. They were long and thin, and reached out from the middle part, similar to platelets.</p> <p>They were longer than fingers, though. Almost like the branches on a tree. Some of the branches split into even more branches.</p> <p>They reminded me of jellyfish with lots of thin long tentacles floating around them!</p> <p>Yeah, but the tentacles spread out, they didn't hang down like a jellyfish in the ocean.</p> <p>We also noticed a number of smaller, dark spots outside the nerves, but we are not sure what those might be.</p>	<p>Do you think the structures you saw might be cells, too?</p> <p>Why might they be shaped the way they are?</p>
In what ways did changing the magnification of the microscope affect what you observed?	<p>As we changed the magnification from 40x to 100x to 400x, we could see more details in the nerves.</p> <p>We could also better describe and draw what we saw as we increased the magnification.</p> <p>Nerves are really small, just like blood cells!</p>	<p>What does this tell you about nerves?</p>
How does the structure of nerves compare to blood?	<p>Nerves are very small like blood cells. Their shape is more like platelets than like red or white blood cells.</p> <p>Nerves have a cool structure. It's similar to platelets, but the tentacle-like arms are really long and branch out farther, just like the branches on a tree.</p>	<p>What does this make you wonder, now?</p>

4 · NAVIGATION

5 min

MATERIALS: science notebooks

Summarize our thinking and share next steps. Show slide I and say, *Who would like to summarize what we have figured out today and what our next step will be?* Call on a few students, and look for the following responses:

- We have figured out the nerves have a unique structure that doesn't look like red blood cells or white blood cells. They have a center portion and tentacles that stretch out from the center portion like branches on a tree.
- Next we need to figure out what nerves do in the body and if the structure of nerves is related to their function.

Thank students for their work today and ask them to return their slides and to clean and cover their microscopes.

End of day 1

5 · NAVIGATION

4 min

MATERIALS: None

Review previous observations of nerves and motivate our next steps. Show Slide J and say, *What did we observe about the structure of nerves when we looked at them under the microscope? And what do we know about the relationship between the structure of something and the function, or job it does? Take a minute or two to talk to a partner, and be prepared to share with the class.*

When students come back to whole group, call on some to share what they discussed with their partners. Listen for students to share that the structure of nerves is very unique. They have tentacle-like arms that branched out from the center portion. Also listen for students to say that an object's structure often helps it carry out its function. They may give examples, such as the shape of blood cells enabling them to move easily through blood vessels, and the shape of blood vessels suited for transporting blood throughout the body.

Remind students that our next step is to figure out what nerves do and how their structure helps them carry out their function. If we can figure this out, then we can think about why nerves are everywhere in the body and what role they play in the process of healing.

6 · OBTAIN INFORMATION FROM TEXT

18 min

MATERIALS: science notebooks, *Reading: The Body's Nervous System* or *The Body's Nervous System* in student editions, *Obtaining Information from Scientific Text*, chart paper, markers

Examine a tool for obtaining information from scientific text.* Distribute *Obtaining Information from Scientific Text*. Show slide K and ask students to look at the handout. Tell them that this is a tool that will help them find key information to answer our questions as they read about nerves. Direct them to look at the left column of the table. Explain that in the left column, there are strategies that we can use to help us find the information we need when we read text to get information. These strategies include:

- Read for the gist (or central idea) by skimming the title, headings, and captions on images.
- Markup the text by keeping track of questions we have in the margins, circling key words, putting question marks by words we want to learn more about, and underlining main ideas.
- Examine images, graphs, and tables and look for the central point of each.
- Identify the ideas from the text that support what you've figured out so far.

Point out that there is space on the handout to fill in the information students find in the text as they read.



Read about the structure and function of the nervous system. Distribute *Reading: The Body's Nervous System* (printed for students so they can mark up the text), or alternately direct students to *The Body's Nervous System* in their student edition book.

* ATTENDING TO EQUITY

Some students, particularly students with learning differences, below grade-level reading, or students who are emergent multilingual learners may require more support to successfully gather information from the reading. *Obtaining Information from Scientific Text* is a tool that provides the kind of support these students may need. In addition, you could read the titles, subtitles, and image captions together and allow students to ask clarifying questions. You

Ask, *What are we trying to figure out from the information we get from this reading?* Look for students to say that we are trying to figure out what nerves do and why they are in different parts of the body. Students might also say that we are trying to figure out if the structure of nerve cells plays a role in their function.

Remind students to follow the strategies outlined in *Obtaining Information from Scientific Text*, since they will be asked to share where they found the information used to support their thinking. Also, remind them that they can refer to the observations documented in their notebooks as they read. Give students 10–12 minutes to read while following the strategies outlined in *Reading: The Body's Nervous System*.

ADDITIONAL GUIDANCE

When discussing the reading, keep in mind that it is not important for students to know the names of different types of nerve cells or even to distinguish the different specialized functions of each. Students should note that all nerve cells share the same basic structure and that the structure is well suited for the basic function that all nerve cells carry out—receiving and transmitting signals between the body and the brain.

ASSESSMENT OPPORTUNITY

Building towards 5.A: Gather and synthesize information from scientific text and other sources to describe the basic structure of nerves and nerve cells and explain how the structure supports both the function of those cells within the nervous system and the interactions that occur between nerves and other body systems (e.g., skin, bone, muscle).

What to look for: As students use the prompts and strategies outlined on *Obtaining Information from Scientific Text* while reading *Reading: The Body's Nervous System*, they should highlight and document information in the reading that supports the following ideas:

- There are nerves in skin, bones, muscles, and other parts of the body.
- Nerve cells have a very unique structure - they have long, skinny “branches” or “tentacles” protruding from a central portion.
- The structure of nerve cells is perfectly suited for their function.
- Nerve cells branch out and connect to other nerve cells throughout the body, forming a network of nerves that carry signals between all parts of the body and the brain.

What to do: If students struggle to find the information they need in the reading, call attention to the strategies and prompts in *Obtaining Information from Scientific Text*. *Remind them to:

- Read for the gist (or central idea) by skimming the title, headings, and captions on images.
- Markup the text by keeping track of questions we have in the margins, circling key words, putting question marks by words they want to learn more about, and underlining main ideas.
- Examine images, graphs, and tables and look for the central point of each.
- Identify the ideas from the text that support what we have figured out so far.

If students are struggling with the reading, allow students to read with a partner.

might also consider providing extra time for students to read or allow students to read with a partner.

If you have students who need these kinds of additional support, they will benefit from using *Reading: The Body's Nervous System*, which is a handout, rather than *The Body's Nervous System* in the Student Edition so that they can annotate the text in ways that are meaningful to them.

* SUPPORTING STUDENTS IN ENGAGING IN OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

As students move into higher grade levels, they are increasingly expected to obtain information from scientific text. Students often need support as they learn to engage in science practices in an authentic way. *Obtaining Information from Scientific Text* provides support by giving students strategies that they can use to read scientific text, gather relevant information, and document what they find using the strategies outlined in the tool. The tool can be adjusted to include strategies, such as examining the sources that the author cites or writing a short summary of the reading. These types of strategies help students learn to critically read and analyze the information in scientific text to determine if it is valid and reliable.

7 · CONDUCT A BUILDING UNDERSTANDINGS DISCUSSION

16 min

MATERIALS: science notebooks, *Reading: The Body's Nervous System* or *The Body's Nervous System* in student editions, *Obtaining Information from Scientific Text*, chart paper, markers, 6x8 sticky notes, tape

Lead a Building Understandings Discussion about nerves. Ask students to gather together in a Scientists Circle. They should each bring the reading, handout, and their science notebook. As students are getting settled (and not necessarily watching you), slam a heavy book onto a desk or table to make a loud noise. After students settle down, ask them to raise their hand if they flinched, jumped, blinked, or reacted to the noise in a similar way. Say something like, *I wonder if we can find evidence from today's reading that can help explain why so many of us reacted to that loud noise? Let's take our seats and share what we've figured out.*

Show **slide L** and use the prompts on the slide, as well as the additional prompts below to surface information that students gathered from the reading and discuss the structure and function of nerves. As students share, make sure to ask them to refer to where they found the information that they are using to support their thinking. Update the Parts of a Body poster during and/or after this discussion to summarize these ideas. (A sample updated poster is shown below the discussion prompts.)

KEY IDEAS

Purpose of this discussion: Students share what they figured out as they gathered information from the reading about the function of nerves in the body and made connections to the unique structure of the nerve cells they observed in the microscope. They also identify parts of the nervous system and describe the basic interactions that occur between the components of the nervous system and across other systems in the body.

Listen for these ideas:

- There are nerves in every part of the body.
- Nerve cells have a very unique structure - they have long, skinny “branches” or “tentacles” protruding from a central portion.
- The structure of nerve cells is suited for their function.
- Nerve cells branch out and connect to other nerve cells throughout the body, forming a network of nerves that carry signals between all parts of the body and the brain.

Suggested prompt

What did you find out from the reading that helped you make sense of what you observed when looking at nerve cells under the microscope?

Sample student response

Nerves are a part of the nervous system, along with the spinal cord and the brain.

Nerves, the spinal cord, and the brain are made up of billions of nerve cells.

The nervous system is like the electrical system in a house--it connects every part of the body with the brain, and signals travel along the system between the body and the brain.

The signals travel so fast, we don't even notice any delay between a signal coming from the body to the brain and back to the body.

The nervous system takes in signals from our senses so that we can see, smell, taste, and feel the things around us.

The nervous system also controls body processes that we don't even have to think about, like breathing, blinking, and the beating of the heart.

Does the structure of a nerve cell help us better understand and describe its function? Explain your thinking.

The “branches” or “tentacles” that spread out from each nerve cell allows them to branch out in the body and toward other nerve cells.

Since there are billions of these cells, they form a network of connections that spreads throughout the body.

Suggested prompt	Sample student response
<p><i>So, what is the function of nerve cells? And how does the structure of a nerve cell support its function as well as the function of the nervous system?</i></p>	<p><i>Nerve cells branch out to form connections between one another and with all parts of the body. Signals are picked up from the body by the nerve cells, then the signals travel along the network of nerve cells to the spinal cord and brain.</i></p> <p><i>The brain also sends signals back along the same network of nerves to the body.</i></p> <p><i>That must be how the brain communicates with every part of the body.</i></p>
<p><i>How does what we have figured out about nerves help us understand healing?</i></p>	<p><i>Nerve cells branch out to all parts of the body and help the brain keep track of how the body is doing.</i></p> <p><i>If there is an injury in the body, the nerve cells will immediately let the brain know what has happened.</i></p> <p><i>The brain would get a signal that the skin has been cut open, bones have been broken, and muscles have been damaged because nerves are found throughout all these areas of the body.</i></p>

ALTERNATE ACTIVITY

As an extension to the learning, you can choose to engage students in a few quick experiences that will help them better understand how nerves work in the body.

1. **Sensing Touch** - To help students understand how the nervous system senses stimuli, have them work in pairs. One student closes their eyes while the other touches the ends of two paper clips to the back of the first student's hand, about 1 cm apart. If the first student senses two points, move the paper clips a bit closer together and touch again. Continue to do this until the first student cannot distinguish two points. Students should repeat the experience on their forearms and cheeks. (Have students wear safety goggles for this.) Share with students that some parts of the body have more nerves than other parts. Engage students in a discussion about the areas that were most sensitive and why they think this is.
2. **Nerve Speed** - To help students understand how quickly their nervous system can transmit information, students join hands and stand in a line. The first student holds a stopwatch and the last student holds a whistle. Have the first student start the watch in their right hand, then squeeze the next person's hand with their left hand. The next student squeezes the hand of the next one in line and so on. When the last student's hand is squeezed, they should blow the whistle. The first student should then stop the watch. Have students think about how far and how fast the "message" traveled, and what might happen if we had more (or fewer) students in line.

Connect these activities back to students' reactions to the book you slammed on the desk. Share with students that reflex reactions are controlled by the nervous system. They are used by the body to protect itself automatically. Reflexes cause us to move away from anything that might hurt us.

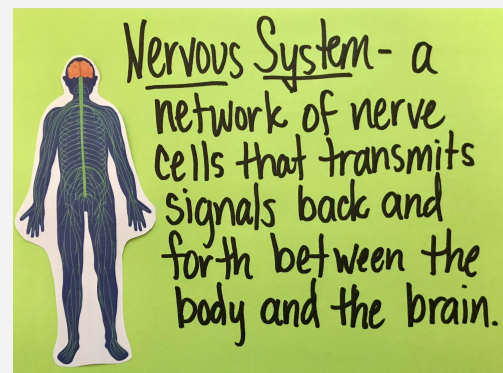
For example, if you put your hand on a hot stove, you immediately remove your hand. You don't wait to think "Hey, my hand is on a hot, burning stove. I think I better move it!" When the nerves in your fingers feel that heat, the signal that transfers to your brain and the response signal from your brain to your hand happens so fast, your response is immediate.

This is similar to how quickly light signals that enter our eyes are changed to electrical signals by the retina, then travel along the optic nerve to the brain, and are interpreted by the brain into what we "see." This also happens so quickly that we don't even notice the process.

Source: Nervous System Experiments for Kids. (2016, February 6). Retrieved November 9, 2020, from <https://study.com/academy/popular/nervous-system-experiments-for-kids.html>.

Add to the Word Wall. Tell students, *We have investigated the structure and function of nerves in the body. As we have done this, we have earned a new science term. Let's add this to our Word Wall.* Show slide M.

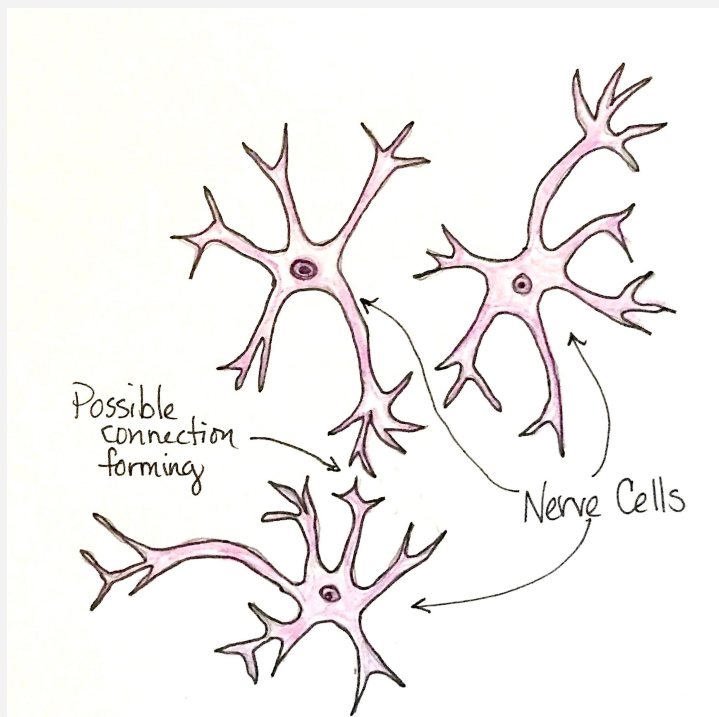
The *nervous system* is a network of billions of nerve cells that transmits signals back and forth between the body and the brain. As you share and co-construct the definition of the science term, write it on a 6x8 sticky note or piece of paper to tape on the Word Wall, along with its definition and a simple diagram. Place the sticky note on the Word Wall in the classroom.



Update the Parts of a Body poster. If you have not already done so, update the Parts of a Body poster.

Parts of the body ^{a body}		
structures	The job in the body (Function)	Structure related to function
skin	It covers the muscles and bones. It protects the parts inside.	connected to muscle with a thin layer stretchy moves with parts its attached to
muscle	It contracts to move different parts of the body, like arms and legs. It is attached to the bones somehow.	stretchy contracts to move
bone	It gives the body structure and shape so it can stay up.	solid and hard attached to muscles somehow
blood (also found in other structures)	<ul style="list-style-type: none"> Red blood cells carry oxygen from lungs around the body & carbon dioxide out of lungs. white blood cells help fight infection. platelets help clog damaged parts to stop bleeding. plasma carries food, water, waste and nutrients around the body 	The shape of the blood cells allow them to flow around the body. Blood is a mixture of things the body needs everywhere.
nerves (also found in other structures)	Nerves take in signals from our senses so we can see, smell, taste and feel things around us.	The branches or tentacles that spread out from each nerve cell allow them to branch out in the body and towards other nerve cells.

Add to the class consensus model. Add a “zoom in” drawing of nerve cells to the class consensus model. See the labeled example shown below.



8 · UPDATE PROGRESS TRACKER AND REVISIT DRIVING QUESTION BOARD

7 min

MATERIALS: science notebooks, Driving Question Board, 3x3 sticky notes, 6x8 sticky notes or 5x8 index cards, markers



Update Progress Trackers. Show **slide N**. Direct students to the Progress Tracker section of their notebooks. Have them turn their notebooks to landscape orientation and draw a 3-column progress tracker like the one on the slide. Remind students that the Progress Tracker is a space for them to process and record their thoughts while we're working to figure out how an injury can heal. Give students time to add to their Progress Trackers. See the sample student responses shown on the next page.

Question	What we figured out in words/pictures	This makes me think or wonder about healing...
What do nerves do and why are they in different parts of the body?	<ul style="list-style-type: none"> • There are nerve endings in skin, bones, muscles, and other parts of the body. • Nerve cells have a very unique structure - they have long, skinny "branches" or "tentacles" protruding from a central portion. • Nerve cells branch out and connect to other nerve cells, forming a network of nerves that carry signals between all parts of the body and the brain. • The structure of nerve cells is perfectly suited for their function - they branch out and connect with all parts of the body so that they can carry signals back and forth between the body and the brain. 	<p>The nervous system is able to help the brain keep track of what is happening throughout the body because the smallest components--nerve cells--branch out into all parts of the body and transmit signals along the network of nerves to the brain. So I wonder...</p> <ul style="list-style-type: none"> • When an injury happens, what signals do nerves send to the brain? • How does the brain respond? • Does the brain signal different parts of the body (like the blood) to do certain things when an injury happens? If so, what? • What happens if nerves are damaged in the injury? • Do nerves heal? How? • If nerves are damaged, how do signals get back to the brain from the injured area?

ASSESSMENT OPPORTUNITY

Building towards 5.A: Gather and synthesize information from scientific text and other sources to describe the basic structure of nerves and nerve cells and explain how the structure supports both the function of those cells within the nervous system and the interactions that occur between nerves and other body systems (e.g., skin, bone, muscle).

What to look for: Students' completed Progress Trackers give an opportunity to assess what they have figured out during this lesson. Look for the ideas called out in the sample Progress Tracker above.

What to do: If students have incomplete or missing ideas in their Progress Trackers, remind them to review the reading *Reading: The Body's Nervous System* and the *Obtaining Information from Scientific Text* handout to look for and document the information they found in the reading. They can also revisit the classroom consensus model and the Parts of the Body poster for additional support.

Revisit the Driving Question Board. If your students added questions about nerves to the Driving Question Board that they are now able to answer, take a few minutes to revisit the DQB. Read through the questions we added, as well as those in other categories that we have worked through in previous lessons, and mark those that we can answer with a checkmark. When time allows, either this day or another day, have students work in groups to document answers to these questions on 5x8 index cards or 6x8 sticky notes.

Are nerves made up of different kinds of cells, like those we observed in blood?

There are a few types of nerve cells, but all nerve cells have the same basic structure and function.

What do nerves look like under the microscope?

Nerve are not round like red blood cells. They have a central part that has a small dark spot in the middle. They also have what looks like "tentacles" that are long and thin. These "tentacles" branch out from the central part of the nerve.

It is also likely that students have additional questions to add to the DQB from their reading today or about the role of nerves in the process of healing. Take time to let students add these questions now.

Discuss possible next steps. Show slide O and say, *We have figured out that the structure of nerve cells is perfectly suited for the function that they carry out in the body. But, as we think about the role of nerves in healing, we know that there is more that we need to figure out. If we revisit the doctors' notes, we know that feeling in the foot doesn't completely return, even when the skin, muscle, and bone have healed. So, there is more we need to figure out about the process of healing and the role of nerves and the nervous system in this process. In addition, what more do we need to figure out about the parts of the body that were injured, the bones, skin and muscles? How could we investigate this?*

Sample student responses:

- We need to figure out more about what the muscles, bones, and skin are made up of.
- We should look at them under the microscope too!

Additional Lesson 5 Teacher Guidance

SUPPORTING STUDENTS IN MAKING CONNECTIONS IN ELA

CCSS.ELA-Literacy.SL.6.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

There are a number of opportunities in this lesson for students to engage in discussions in pairs, small groups, and as a class. Some discussions are teacher-led, but not all. Students should be encouraged to share their prior understandings, observations, and current thinking while working collaboratively with their peers to figure out the role of nerves and nerve cells in the body and how their function is served by the unique structure of nerve cells and the network they create throughout the body to receive and send signals between the body and brain. As much as possible, questions and prompts are used by the teacher to allow students to lead discussions, giving students multiple opportunities to share their current thinking and build on the thinking of others. Additional strategies that can be used include:

- Strategically pair and group students, keeping individual student needs in mind.
- Provide numerous opportunities for students to respond to questions and share their thinking (in pairs before class discussion, for example).
- Allow students to use drawings, symbols, writing, and gestures to express their ideas.

CCSS.ELA-Literacy.SL.6.1.A Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

In this lesson, students obtain information from a reading and are expected to use that information to support their thinking. During a Building Understandings Discussion, students are asked to specifically show where they found information in that text to support their ideas as they work together to figure out whether or not the structure of nerve cells supports the function of those cells. To support students in this process, they are given a tool, *Obtaining Information from Scientific Text*, that gives strategies for annotating the text, which will help them quickly find and use the information they need to support their thinking during the class discussion and while updating their Progress Trackers at the end of the lesson.

CCSS.ELA-Literacy.SL.6.2 Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

The focal practice for this lesson is SEP 8 Obtaining, Evaluating, and Communicating Information. Students obtain information from a reading and use that information to figure out how the structure of nerve cells supports their function in the body. *Obtaining Information from Scientific Text* is provided to support students in obtaining information from scientific text. The tool includes strategies, such as skimming the title, subtitles, and captions to get the gist of the reading, marking up the text in a number of ways, and documenting the ideas that support our purpose for engaging in text. Additional suggestions are provided in the lesson, such as paired reading of the text, to further support students in obtaining the information they need.