LESSON 1: What happened in the foot so that the person could walk again?

PREVIOUS LESSON *There is no previous lesson.*

THIS LESSON

ANCHORING PHENOMENON

4 days

We share our experiences moving our bodies and also times where we were unable to move our bodies. We read doctors notes and see images of an injury and the healing process. We create a timeline of important events that show evidence of healing. We develop models to explain how parts of the foot work together to allow the patient to walk. We brainstorm related phenomena of other times we have seen healing in humans and other living things. We develop questions for our Driving Question Board (DQB) and possible investigations to answer these questions.

NEXT LESSON *We will investigate how the parts of a chicken wing work together when moving. We will map the parts of the chicken wing to the parts of the foot to compare functions. We will revise the investigation to figure out how the wing's function is affected due to an injury.*

BUILDING TOWARD NGSS

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

WHAT STUDENTS WILL DO

1.A Obtain information from images and doctors notes to identify patterns between the relationship of important events (effect) that could be evidence of interacting subsystems healing (cause).

1.B Develop an initial model of the healing process within multiple interacting systems and subsystems that restores the foot's function.

1.C Ask questions that arise from observations of injuries to multiple subsystems resulting in loss of a particular body function to the larger complex system of the foot.

WHAT STUDENTS WILL FIGURE OUT

- A student that was previously able to walk was injured in an accident and can no longer walk.
- In the foot injury, more than one part was injured from the same incident.
- Some of the different parts of the foot that were injured needed outside supports during the healing process.
- Over time, the different parts of the foot that were injured, were able to heal; some took longer than others to heal.
- There are gaps between the structures in the foot that were damaged.

Lesson 1 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	10 min	**NAVIGATION** Share about experiences when students were moving their bodies and times when they were unable to move their bodies.	A-B	
2	15 min	**EXPLORE AN INTERESTING (SIMILAR) PHENOMENON** Introduce a similar phenomenon to notice and wonder about--a middle school student injured in PE and his journey to recovery.	C-F	*Hospital Emergency Room Report*, *Post Operation Report*, *Recovery Report #1*, tape
3	10 min	**RECORD EVIDENCE FOR HEALING** Co-construct what it means to heal and identify events in the healing process.	G-H	*Evidence for Healing*, sticky notes, marker, tape, Word Wall poster, What is Healing? poster
4	10 min	**CREATE A TIMELINE FOR HEALING** Facilitate a Building Understandings Discussion to organize our ideas about important events in the healing process that provide evidence that the foot is healing.	I	Healing Timeline, markers
				End of day 1
5	3 min	**NAVIGATION** Revisit the Healing Timeline to recall the parts of the foot impacted by the injury.	J	Parts of the Foot poster, Healing Timeline, markers
6	10 min	**DEVELOP AN INITIAL MODEL OF HEALING** Students individually develop models of the injured and healed foot to explain what they think happens during the healing process.	K	*Healing Initial Model*
7	5 min	**REVISIT CLASSROOM NORMS/COMMUNITY AGREEMENTS** Students review the classroom norms and set expectations for their work together on a consensus model. Prompt students to pick one norm to focus on for today.	L-M	Classroom Norms poster or slide
8	5 min	**COMPARE INITIAL MODELS** Explain the purpose of comparing initial models-and have students work in small groups.	N	*Healing Initial Model*, chart paper, markers
9	20 min	**DEVELOP AN INITIAL CONSENSUS MODEL OF HEALING** Facilitate a Consensus Discussion among students to develop the initial classroom consensus model of healing.	O	Healing Timeline, Initial Consensus Model poster, markers, 2 copies of *Printouts of the Foot*
10	2 min	**PREPARE FOR HOME LEARNING ABOUT RELATED PHENOMENA** Prepare students to brainstorm related phenomena that may be similar to or help them explain the healing case they just observed.	P	*Related Healing Phenomena Stories*
				End of day 2
11	30 min	**EXPLORE DIFFERENT ASPECTS OF VISIBLE AND INVISIBLE DISABILITY** Create lists of ways people complete everyday tasks in different ways. Share about adaptive equipment that can assist in daily tasks. Revise the definition of healing.	Q-BB	*Related Healing Phenomena Stories*, markers, Word Wall poster

Part	Duration	Summary	Slide	Materials
12	10 min	**SHARE RELATED PHENOMENA OF HEALING** Record students' ideas of related phenomena and experiences they have had, such as what they saw happen in the doctor's notes and also any other phenomena that they think might happen due to similar causes.	CC-DD	*Related Healing Phenomena Stories*, chart paper, markers
13	5 min	**DEVELOP QUESTIONS FOR THE DRIVING QUESTION BOARD** Students develop questions for the Driving Question Board (DQB) individually.	EE	sticky notes, marker, DQB Poster, Healing Timeline
				End of day 3
14	30 min	**BUILD OUR DRIVING QUESTION BOARD** Gather students in a Scientists Circle to construct a Driving Question Board (DQB) about what is causing the phenomena students have been thinking about over the previous days.	FF	sticky notes, tape, chart paper, markers
15	10 min	**DEVELOP INITIAL IDEAS FOR FUTURE INVESTIGATIONS** Develop ideas for future investigations that could help us figure out our questions. Make a public record of them as they are shared with the whole class.	GG-HH	Ideas for Future Investigations and Data We Need poster, markers
16	5 min	**NAVIGATION** Anticipate where we are headed next to investigate this phenomenon.	II	
				End of day 4

Lesson 1 • Materials List

	per student	per group	per class
Lesson materials	• science notebook • *Hospital Emergency Room Report* • *Post Operation Report* • *Recovery Report #1* • *Evidence for Healing* • sticky notes • marker • *Healing Initial Model* • *Related Healing Phenomena Stories*	• tape	• Word Wall poster • What is Healing? poster • Healing Timeline • markers • Parts of the Foot poster • Classroom Norms poster or slide • chart paper • Initial Consensus Model poster • 2 copies of *Printouts of the Foot* • DQB Poster • sticky notes • tape • Ideas for Future Investigations and Data We Need poster

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.

Review *Disability and Inclusion Awareness* before teaching the lesson and send the *Pre-Unit Letter Home*.

Prepare chart paper for posters. The posters you will make in this lesson are as follows:

- Noticings and Wonderings about the Injury
- Noticings and Wonderings-Post Operation
- What do we mean by healing?
- Word Wall
- Parts of the Foot
- Healing Timeline: Prepare 2 large pieces of chart paper for the timeline. Create the timeline on the bottom two-thirds of the chart because the consensus model will go above the timeline.On the left write "When injury happened" and on the right write "Foot Healed". Just above the line write Recovery Report 1, Recovery Report 2, Recovery Report 3, and Recovery Report 4, evenly spaced out.
- Initial Consensus Model:
    - On a separate sheet of paper, write the question "What happens during the healing process so the student was able to use his foot again to walk, run, jump, and dance?" You will tape this at the top of the Healing Timeline chart papers.
    - Print two large copies of *Printouts of the Foot*. You will tape these on each side of the chart paper above the Healing Timeline.
- Driving Question Board
- Ideas for Future Investigations and Data We Need

Download the *Communicating in Scientific Ways* file from the website and use it in your classroom as a poster or add it to students' science notebooks as a handout.

Determine where to set up the Driving Question Board and posters so that students can gather around them. Make and post a classroom norms poster near your DQB space.

Be sure you have materials, like a blank piece of paper or sticky note or note card, ready to add the following words to the Word Wall: healed/healing. Do not post this/these word(s) on the wall until after your class has developed a shared understanding of its/their meaning.

Lesson 1 • Where We Are Going and NOT Going

Where We Are Going

In this lesson, students begin with a phenomenon that is directly connected to a personal experience: a time when a part of their body was hurt or injured, which prevented them from being able to do a favorite activity, for a short or long period of time. They are next presented with a case study of a middle school student who had a multisystem foot injury and they analyze through doctors notes and images to follow their healing journey.

In this lesson, students will develop an initial biological definition for the word *healing* based on their prior experiences. Over the course of the unit, the definition for healing will be expanded and revised as students figure out more about the structure and function of different parts of the body and whether functions return to the what they were prior to the injury. Students will explore different ways in which individuals experience or achieve daily tasks and begin to develop social emotional skills around how some people have different abilities than themselves, and sometimes these abilities are a result of an injury, but it doesn't mean the person isn't healed. While this unit builds off the systems thinking in other units, this is the first life science unit in OpenSciEd where living systems are considered.

Because injury can result in disability, this unit will introduce students to the concept of disability as a natural and expected part of human diversity. The language used in the unit will reflect the idea that disability is neutral, neither tragic or bad nor inspirational. More information about disability to support teachers' instruction can be found in *Disability and Inclusion Awareness*

Where We Are NOT Going

This unit will focus on how the parts of the body work together as a system to function (heal, move, grow, etc.) and how both the macro and microlevel structures (and their corresponding functions) are involved. In this lesson, students will begin this exploration through analyzing a case study of an injury to a middle school student who broke their foot. Students will remain at the macroscopic level in the first three lessons and consider the different parts of the foot at different scales, orientations, and interactions. In Lesson 4, students will shift to looking at microscopic images or slides of these different parts of the body. This unit does not explore the mechanisms of the immune system in greater detail than the different components of blood (in Lesson 4). Additionally, the focus of Lesson 1 is not on how the injury occurred nor on the surgical procedure or supports that the patient had. These are shared so students can deduce what parts of the foot were injured, how the injury affected the foot's function, and retrieve data that could be evidence of healing over time.

LEARNING PLAN for LESSON 1

1 · NAVIGATION

10 min

MATERIALS: science notebook

Elicit students' experiences moving their bodies ✱. Display **slide A.** Begin by asking students to Stop and Jot in their notebooks about their favorite activities that involve moving their body and what parts of the body they use when doing that activity. The images on slide A are meant to elicit an array of student experiences moving from diverse backgrounds. This is an opportunity to localize this phenomenon by revising the images on the slide with activities that may engage your students more. However, be mindful to include students with different abilities and interests.✱

After giving students a couple of minutes to write and process their ideas, have them share out with the class.

Suggested prompts	Sample student responses	Follow-up questions
What is your favorite activity that involves moving your body?	*Dancing* *Riding a bike* *Painting* *Playing video games* *Jumping on a trampoline* *Climbing a tree* *Yoga* *Accept all answers*	*Are there any different types of activities that involve moving your body?*
What parts of the body do you use when doing this activity?	*Hands* *Feet* *Arms* *Leg(s)* *Head* *Eyes* *Nose and mouth* *Accept all answers related to parts of the body*	*How is this body part useful for supporting the activity?*
Are there other body parts of your body that we can't see that support you doing this activity?	*Muscles* *Bones* *Joints* *Tendons* *Ligaments* *Brain* *Heart* *Core or abs* *Lungs*	*How are these body parts we can't see useful for supporting the activity?*

✱ ATTENDING TO EQUITY

When selecting images to include in slide A, be sure that individuals with disabilities are represented. This will be helpful for students with and without disabilities to understand that disability is an aspect of human diversity and that individuals with disabilities have a range of interests and participate in a variety of activities.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Keeping a science notebook allows students a space in which to reflect and communicate their developing understandings about science ideas and to track changes in their understanding. Students should be encouraged to record their ideas using linguistic (e.g., written words) and nonlinguistic modes (e.g., photographs, drawings, tables, graphs, mathematical equations, measurements). This is especially important for emerging multilingual students because making connections between written words and nonlinguistic representations helps students generate richer explanations of scientific phenomena.

✱ STRATEGIES FOR THIS INITIAL IDEAS DISCUSSION

Middle school students are learning a lot about science, but it is important to honor the fact that they are already experts in their own experiences and that these are legitimate ways of knowing about the world. During this discussion, validate and encourage students as they share meaningful observations from their own lives by saying things like, *That is very perceptive, has anybody else noticed that?*

Suggested prompts	Sample student responses	Follow-up questions
How do these parts of the body work together in order to do your activity?	*Accept all answers* *For example:* *When I dance, I use my core and my arms and my feet to move around. I use my mouth, nose and lungs to breath and my eyes to see where I am moving.*	*Can anyone else think of how other body parts might be helpful for _____'s activity?*

SCIENCE NOTEBOOK

This is the first use of the science notebook for the unit. You may need time to organize a new section in the notebook. How to set up the section will vary depending on how you've structured the components of your notebooks, such as the table of contents and how to note the start of a new unit. It is recommended to have students do the following:

- Reserve a blank page at the start of the unit where students will write the unit question on day 3 of this lesson.
- After the title page, reserve 2 pages (4 pages front-to-back) for the table of contents (unless all table of contents are at the front of the notebook).
- Reserve 10 pages (20 pages front-to-back) for the Progress Tracker pages.
- After the Progress Tracker pages, begin numbering pages (start with 1) so everyone begins the first investigation of the unit on the same page number.

Remind students that the notebook is their tool for recording their observations, evidence, and ideas to share with the classroom community. They should see it as a space to brainstorm and record their thinking, as well as a place to show how their thinking changes as they learn more.

ADDITIONAL GUIDANCE

Be mindful that sharing or hearing stories of past injuries can bring up past or recurring trauma for students. You may or may not be privy to information about students' past experiences with injury, so it may be helpful to send home communication to parents letting them know the topic of conversation in advance so that they can let you know of any topics that may be sensitive for students. We also recommend seeking the support of a school psychologist, social worker, or counselor to support discussions that may be challenging for some students.

Share out as a class about when you were unable to do an activity. ✱✱ Display **slide B.** Use the prompts below and slide B to elicit student experiences when something happened that caused them not to be able to use part of their body. As students are sharing, ask follow up questions pushing them to think deeper about what was happening inside their bodies during the time they describe and whether other parts of their bodies were impacted, even if not directly affected by the injury.

Suggested prompt	Sample student response
Why was your body not physically able to do this activity?	*I broke my leg.* *I sprained my ankle.* *I had stitches.* *I was swollen.* *It hurt too much.*

✱ ATTENDING TO EQUITY

Emergent Multilingual Learners: For students who are learning English or who need support following a whole-group discussion, it can be helpful to use gestures in addition to talking. For example, as students describe their injuries, have them point to the body part and move their body to describe what they were unable to do. And, you may have some students who currently have injuries. Ask them to explain what they can't do currently with their body. If students are not doing this on their own, you can try to revoice their idea and move your body to demonstrate.

Suggested prompt	Sample student response
How long was it before you could do these activities again?	*Days* *Weeks* *Months* *Never*
What were some things you had to do so your body could heal and you could use your body for this activity?	*I had to rest.* *I healed.* *I had to do certain exercises or stretches.*

Ask, *When your body was able to do the activity again, were you able to engage in the activity in the same way you could before the injury? Or was there anything different about how you could engage in the physical activity again? Talk with an elbow partner about this briefly.*

Let a few students share their experiences. Some possible student responses:

- *I couldn't lift as much for a long time.*
- *I was slower.*
- *I still hurt a little bit.*
- *I had to wear a brace.*

ADDITIONAL GUIDANCE

Connections to Me and My Community: Inclusion
As students are sharing their experiences, be mindful of ability-diversity. Disabled students may experience injury and healing in different ways than their non-disabled peers, so it is important to welcome and honor all experiences. Listen for students who use language that may construe disability in a negative light, reminding students that individuals that become disabled after an injury learn to adapt to their body's new way of functioning and are able to complete the daily tasks of life, if a little differently. It is important that students understand that individuals with disabilities often take a great deal of pride in their disability and consider it a key part of their identity.

2 · EXPLORE AN INTERESTING (SIMILAR) PHENOMENON

15 min

MATERIALS: science notebook, *Hospital Emergency Room Report*, *Post Operation Report*, *Recovery Report #1*, tape

Introduce the phenomenon.✱ Display **slide C.** *Say, I am going to tell you the story of a middle school student. Today, this middle school student can walk, run, and jump! However, four months ago, this middle school student had an injury that prevented him from being able to do these things. He dropped a heavy weight on his foot during PE/gym class. After this happened, he was not able to stand, walk, or run and had lots of pain.*

Use the prompts below to elicit experiences and ideas about what happened from student volunteers. Accept all responses.

- Have you ever experienced something like this where you dropped something on your foot or another part of your body?
- Why do you think he was not able to do these activities with his body after the injury?
- What happened in the body to allow him to get back to these activities?
- What are you wondering about with his injury and journey to recovery?

Say, *I had lots of questions as well. Let's take a look at some of the notes his doctor took along the way. We are going to notice and wonder about several time points, including when the patient was injured and during the student's recovery. Once we have all had a chance to record our noticings and wonderings, we will share our ideas as a class.*

Notice and wonder about the injury. Display **slide D.** Have students create a notice and wonder t- chart on the left-hand page of their notebook. As students make their charts, hand out *Hospital Emergency Room Report* to each student. Instruct students to tape *Hospital Emergency Room Report* onto the right-hand page of their science notebook. Give students 2 minutes to annotate and mark up *Hospital Emergency Room Report* and record their noticings and wonderings in the chart. If time permits, ask students to share out about what they noticed or wondered about. If students ask what the word metatarsal refers to or what metatarsals are, ask them what they think that is based on what they read in the doctor's note. They should say that since it says there are two metatarsals that are broken, and there are two bones broken in the x-ray, that metatarsals are two of the bones in the foot. After two minutes, bring the class together to share out what they noticed and wondered. Record this on chart paper titled "Noticings and Wonderings about the Injury".

Notice and wonder about what was done to the foot. Display **slide E.** Have students create a second Notice and Wonder chart. As students are making their charts, hand-out *Post Operation Report* and instruct students to tape *Post Operation Report* opposite their t-chart. Give students 2 minutes to annotate and mark-up *Post Operation Report* and record their notice and wonders in the chart. After two minutes, bring the class together to share what they noticed and wondered about the Post Operation Report. Add these noticings and wonderings to the chart paper titled "Noticings and Wonderings-Post Operation Report".

ADDITIONAL GUIDANCE

The images on *Post Operation Report* could be traumatic for some students. Please use at your discretion. They are purposely not on the slide and have been printed in black and white to make them less shocking. Please discuss the unit topic with a school social worker, psychologist, or counselor and send home *Pre-Unit Letter Home* before starting the unit.

Notice and wonder about the recovery process for the foot. Display **slide F.** Have students create a third Notice and Wonder chart in their notebook and pass out *Recovery Report #1* for students to tape opposite the T-chart. Give students 4 minutes to annotate and mark up *Recovery Report #1* for noticings about steps in the healing process over time for this person's foot. Then ask students to record their noticings and wonderings in the T-chart in their notebook. Ask students to share out about what they notice or wonder. Do not worry about recording these for the whole class since you will be using some of these noticings in the next activity.

✱ SUPPORTING STUDENTS IN ENGAGING IN ASKING QUESTIONS AND DEFINING PROBLEMS

Initial questions about a phenomenon are intended to clarify what information is known and not known, and, as is often the case, there are more questions than answers when scientists begin their investigations. Develop a safe and supportive space for students' uncertainty, and focus on the need to ask and answer questions in order to address the uncertainty that may require the entire unit to resolve.

3 · RECORD EVIDENCE FOR HEALING

10 min

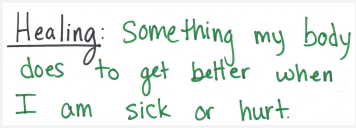
MATERIALS: science notebook, *Evidence for Healing*, sticky notes, marker, tape, Word Wall poster, What is Healing? poster

Co-construct what healing means to us in this class.✱ Display **slide G.** *Say, I keep hearing you use the word healing and we saw this word in the doctor's notes to describe what happened to the student's foot over time. What do we mean by that? Grab a sticky note and write your ideas about what you think healing is.*

Title a piece of chart paper "What do we mean by healing?" and have students post their sticky notes on it. As students are posting their stickies, read off some of their responses. Once all students are back in their spots, facilitate a discussion around what currently they think it means to heal. See prompts and possible responses, below.

Suggested prompts	Sample student responses	Follow-up questions
Are there any other words in English or other languages that we also use to mean healed or healing?	*Accept all answers.* *Repair* *Recovered* *Restored* *Mended* *Cure* *Curar or sanar (Spanish)*	*So, when we use these words do they mean the same thing as when we use the word heal?*
Can someone explain to me what we think it means to heal?	*Fixing the broken parts.* *The process that happens when your body puts itself back together.* *How the body fixes itself.* *What happens in the body when it fixes the parts that are injured or hurt.*	*Can you say more about why you think that?* *What is evidence of healing from your own life?*

Add healing and the co-constructed class definition to the Word Wall. Your definition might be something like "the body trying to return to doing the things it was able to do before."✱ Remind students that the Word Wall is a place where we can record our growing understanding of the word and we will come back to it frequently to add more words or revise our understanding of words based on what we figure out in class.



ALTERNATE ACTIVITY

If you have enough space in your classroom, consider keeping the What do we mean by healing? poster displayed during the unit and post your healing definition there. The definition of healing will be developed at this moment in Lesson 1, revised later in Lesson 1, and then revised again in Lessons 8 and 13. Using a specific poster for healing rather than the typical Word Wall entry will give you space to document each of these revisions as your class deepens their understanding of healing. If you choose to post your definition of healing on the What do we mean by healing? poster, you can start the Word Wall in Lesson 2 rather than now.

✱ ATTENDING TO EQUITY

The term "healed" can have a loaded meaning in the English language. In this unit, when we refer to healing, we are referring to the biological process that takes place in the body in response to an injury. Sometimes injuries result in permanent disability that remains well after the biological healing process has concluded in the body. A person who becomes disabled as a result of an injury is no less healed than a person whose body fully returns to prior functionality.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals: When developing new vocabulary, strategies that may benefit emergent multilingual learners are to use student-friendly definitions, make connections to cognate words when possible, and include a visual representation of the word. Use these strategies throughout the unit for both "words we earn" and "words we encounter."

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
During moments when students are tasked with expressing their ideas, allow them to do so through linguistic (oral and written language) and nonlinguistic (e.g., drawings, graphs, symbols, gestures) modes. For example, you might suggest sketching a picture on the sticky note to a student who is having trouble articulating evidence they obtained from the images and doctor's notes. Providing emerging multilingual students with such opportunities allows them to use all their resources to express meaning.

Record important events that could be evidence of healing.✱ Display **slide H**. Distribute *Evidence for Healing* to each student and have them tape it into their science notebook. Assign each pair of students one of the four recovery reports to read. Pairs will work together to record clues they notice in their assigned report that could serve as evidence that the foot was healing. Explain to students that some clues will be observations from the doctor about what is happening with the patient's body, such as that swelling went down or the description of an x-ray image. Other clues will be the actions the doctor took in their care of the patient, such as removing stitches.

Walk around and push students to think about how each clue is supported by evidence of something happening related to healing in the body. After each pair has completed the *Evidence for Healing* for their assigned recovery report, we will share out as class and combine all four reports to make a timeline of the healing process.

ASSESSMENT OPPORTUNITY

Building towards: 1.A Obtain information from images and doctor's notes to identify patterns between the relationship of important events (effect) that could provide evidence of interacting subsystems healing (cause).

What to look/listen for: Look for students who are including parts or interactions in their system that are evidence from events in the doctor's notes and images, such as stitches being removed as evidence for the skin healing or the cast coming off as evidence for the bones' healing.

What do to: If students struggle to identify events or evidence, ask students to compare *Hospital Emergency Room Report* with *Post Operation Report* and *Recovery Report #1*. Ask them what was different about the foot, what was done to the foot, or the activities the student was able to do. Prompt students for evidence that healing was happening in the body and to describe what happened that led to the milestone.

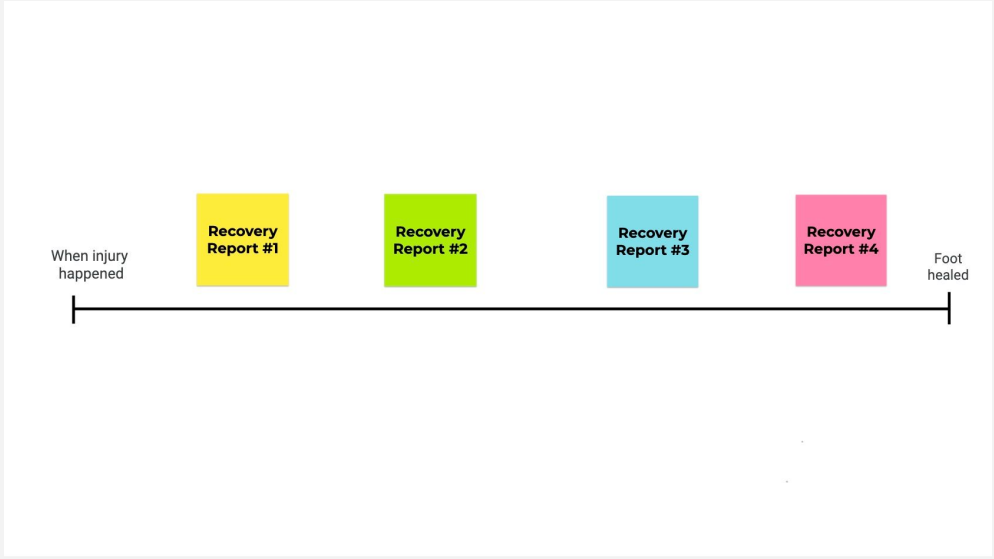
4 · CREATE A TIMELINE FOR HEALING

10 min

MATERIALS: science notebook, Healing Timeline, markers

Create a timeline of the foot's healing process. Display **slide I**. Gather students in a Scientists Circle. Begin discussing Recovery Report # 1. Ask students to share out a clue from *Evidence for Healing* that their partner shared in the previous activity. As students share, scribe the event on a sticky note in large or bold writing. Next, ask them and/or the class to explain what evidence supports that clue being an indicator for healing happening in the body, and record that evidence in a different color or smaller text on the sticky note. Affix the sticky note onto the Healing Timeline under Recovery Report #1. Continue adding clues with evidence for Recovery Report #1, and after you have added those events and evidence, repeat this process for Reports 2 through 4.✱

See one suggested way to set up your timeline below.



The table below shows the clues and evidence that you will likely collect on your timeline. Note that the exact words your students use will likely be slightly different and that is okay. The gist of the timeline is that healing takes time and that not everything healed at the same rate. If, when sharing, a partnership suggests adding a clue that is not one of these key clues, ask how that is evidence of healing. For example, if students suggest an important clue is that the patient could wiggle their toes, you might push back by referring to the *Post Operation Report* and ask, *How is the wiggling toes evidence of healing happening? Do we know if the student could wiggle his toes before surgery? It could be something but we don't know.*

Include on your timeline only the clues we have evidence for - the timeline should not include every note on the reports. If students feel adamant that an event from the report needs to be included but you feel that the evidence is insufficient, you might choose to include it with a question mark. See one some suggested events and evidence on the following page.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING SCALE, PROPORTION, AND QUANTITY

Creating a timeline in this first lesson helps to begin mapping out the different points in the healing process of the foot. Over the course of the unit students will realize that different parts of the body take differing amounts of time to heal. In addition, they will figure out what is happening at a microscopic scale during the healing process for each of these parts of the body. Students will begin to connect the crosscutting concept of Scale, Proportion, and Quantity in regard to time and scale. Students will continue to develop this crosscutting concept throughout the unit through additional investigations, models they develop, and explanations they construct.

Recovery Report #1	Recovery Report #2	Recovery Report #3	Recovery Report #4
Stitches removed- *Since the stitches were removed, the skin must have been closed up enough that the stitches aren't needed* ***Swelling went down****- Since the swelling began when the injury happened, the swelling going down seems to indicate that the area is less injured* ***X ray shows bones lined up*** *- If the bones are lined up, it seems they are on the way to healing and/or functioning*	***Skin closed*** *- no more opening in the skin, so it is healed.* ***Minimal swelling -*** *not sure what swelling does, but it is mentioned in almost all the notes so it must be a clue of healing if the doctor was paying such careful attention to it.* ***Pins removed*** *- bones are lined up, so they are on the way to healing and/or functioning* ***Cast removed and post-op shoe used*** *- this must mean the bone is stronger and healed.* ***X-ray image*** *- shows it is hard to see the fracture site - if we can't see the break anymore, it's probably healing*	***Minimal swelling -*** *not sure what swelling does, but it is mentioned in almost all the notes so it must be a clue of healing.* ***More range of motion*** *- the foot can move more which might also be related to swelling and that it has healed more.* ***Bones lined up*** *- fracture lines are harder to see so the bone had been put back together somehow.* ***Adequate blood flow*** *- this wasn't mentioned before, but we saw it bleed when injured so the amount of blood flow in the area must be important*	***No swelling -*** *since there isn't any swelling anymore the foot must be healed and whatever the swelling did for the injury isn't needed.* ***Improved range of motion*** *- the foot can move even more which is a sign of healing.* ***Fracture no longer visible*** *- if the fracture can't be seen then the bone must be back together again* ***Strong blood flow*** *- Maybe because some blood got out of the body, the blood had to somehow come back, and now it is "strong" where before it was just "adequate."*

To ensure that all pieces of evidence that are clues of healing are included on the timeline, use prompts such as these:

- *Take a moment and look back at the recovery report your group analyzed, do we have everything from that report up on our timeline?*
- *Are there any other clues from our recovery reports that we want to make sure are included on our timeline?*
- *Are we missing any pieces of the progression for any types of events, like changes in swelling, etc?*

ADDITIONAL GUIDANCE

Make sure to leave the top two-thirds of the Healing Timeline posters open for the class to build their consensus model on day 2 of the lesson. You will print out two copies of *Printouts of the Foot* and tape them above the timeline along with the question for the model when you make the consensus model.

Navigation. Say, *now that we have captured the different clues we think are part of the healing process, let's try to figure out what is happening within the body that could explain these events.*

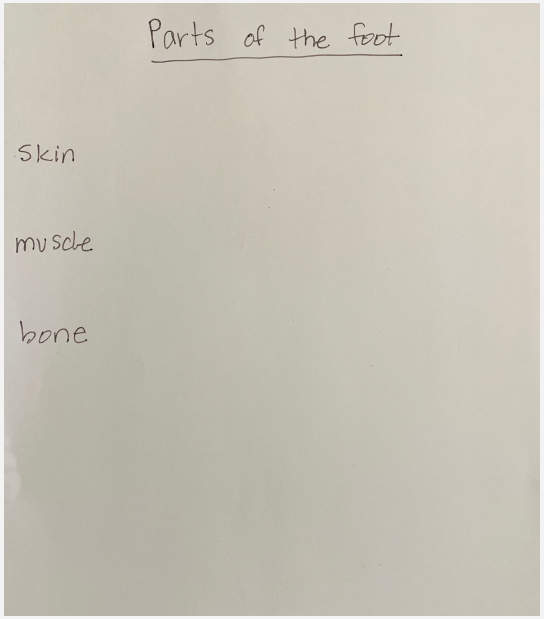
End of day 1

5 · NAVIGATION

3 min

MATERIALS: science notebook, Parts of the Foot poster, Healing Timeline, markers

Revisit the timeline for healing. Display **slide J.** Walk over to the timeline and ask students to remind you of the parts of the foot that were impacted by the injury and need to heal. On the Parts of the Foot poster you created before class, add the parts of the foot that were impacted and needed to heal (skin, bone, muscle). This is an important move to help support students developing their models in the next step. Say, *it is important for us to remember all of the parts were damaged and need to heal so that we can explain what happens during the healing process so the student was able to use his foot again to walk, run, jump, and dance.*



ADDITIONAL GUIDANCE

The purpose for adding the parts of the foot that were impacted to the timeline is to help students think about the large parts of the foot that were impacted. You do not need to press them to think beyond the large structures (bone, skin and muscle) of the foot that were impacted. In subsequent lessons they will continue to investigate more about these parts of the foot, including how each of these parts interact for a part of the body to move (Lesson 2), common structures that are in each of these parts (blood vessels and nerves in Lesson 3), structures in blood (Lesson 4), structures in nerves (Lesson 5) and structures that make up the skin, muscle and nerves (Lesson 6). At this point, students just need to identify that there are large structures that were impacted as a starting place. If students suggest that nerves or blood (or blood vessels) were also impacted and need to heal, you might add them to the poster with question marks, because we don't have so much evidence about those as we have for the bones, skin, and muscle.

After students share out about the parts of the foot needed to explain healing in the foot, say, *We just identified that in order for the foot to have healed so the student can start doing activities again, the bone, skin and muscle of the foot need to be repaired. Let's start thinking about what is happening with these different parts and the interactions between them during the healing process.*

6 · DEVELOP AN INITIAL MODEL OF HEALING

10 min

MATERIALS: science notebook, *Healing Initial Model*

Develop an initial model of the student's healing process. Say, *Let's try to develop a model to explain "What happens during the healing process so he was able to use his foot again to walk, run, jump, and dance?"* Display **slide K.**✱

Distribute a copy of *Healing Initial Model* to each student. Tell students that they should put their name on their handout but don't add it to their notebooks yet, as you want to collect it at the end of the period to get a sense of what they are thinking. Remind your students that they can draw other perspectives of the foot and zoom in bubbles, as needed to explain their thinking.✱

At the end of the class period, have students hand in *Healing Initial Model* as a formative assessment. If students have constructed the initial models in their notebooks, have students hand in their notebooks.

ASSESSMENT OPPORTUNITY

Building towards: 1.B Develop an initial model of the healing process within and between multiple interacting systems and subsystems that restores the foot's function.

What to look for: These first models students develop on *Healing Initial Model* are more representative of what they see happening with the foot at a macroscopic level. Do not worry if students are not including cells or microscopic interactions at this time. Later in the unit they will be investigating the structure and function for each part at a cellular level.

Look for students who are including parts or interactions within the foot system that explain how the foot is healing itself and not just external factors that can aid in healing such as the cast and pins.
Look for the following elements across their models and explanations of their models to see if they bring these ideas to the table with the prompts for the task as written:

- Parts of the foot (system): bone, skin, muscle
    - Students might also include: blood and nerves
- How the parts of the foot (system) worked together (interacted) to heal so the student could walk

What do to: If students need support choosing what to put in their models, refer them back to the Healing Timeline and Parts of the Foot posters we developed as a class. Ask them what they think might be happening with each part of the foot, from when the injury happened until the student could walk again. Ask students what was different in the structures or parts of the foot right after the injury and when it was healed. Prompt students to include how the parts (of the foot/system) were interacting during the events we recorded in the healing timeline.

Students' *Healing Initial Model* can be collected (at the end of the day) and used as a formative pre-assessment. They can help identify what science ideas students are bringing into this unit and where students are at in their development of the practice of modeling.

✱ SUPPORTING STUDENTS IN ENGAGING IN DEVELOPING AND USING MODELS

Remind students that in this classroom, a *model* is a picture and/or description that helps us explain something that happens in the world. Like their work in previous OpenSciEd units, such models should be trying to do more than just show what we can see, they should also try to represent any unobservable mechanisms and interactions that we think might be at work in the system to explain what we observe happening. Also, remind students that it's OK if they don't know the "right" answer when drawing models. At this stage, there are no "correct" ideas to think or questions to ask. All ideas and questions are welcome. The goal of making an initial model is to make their thinking visible to others. Have students try to put any ideas they are thinking down on paper. They can use labels, pictures, symbols, and/or words.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING SYSTEMS AND SYSTEM MODELS

Systems and systems models are a focal crosscutting concept for this unit. A system is an organized group of related objects or components. Here we refer to the different parts of the foot that are injured as parts. Scientists use models to understand and predict the behavior of systems. The first step in modeling a system in order to understand it, is to figure out the important parts of the system. This allows scientists to study how the parts interact to produce the emergent behavior of the system as a whole. Help students set up their initial models as systems models by identifying the important parts of each system and thinking about how those parts work together (interact).

7 · REVISIT CLASSROOM NORMS/COMMUNITY AGREEMENTS

5 min

MATERIALS: science notebook, Classroom Norms poster or slide

Revisit classroom norms established in previous units.✱ Display **slide L.** Take this opportunity to remind the class how we listen to one another, press on one another's ideas, and ask questions of one another. Remind students that it's OK to disagree with ideas but it's important to be respectful.

Remind students it will be particularly important for us to be mindful of language we use when describing individual people's bodies, experiences, and differences. Say, *Let's take a look back at our norms to see which one will help us most to create a classroom culture where we can share different experiences openly, make each other feel safe and respect everyone's personal experiences.*

You can use **slide M** to remind students of the classroom norms (if you have developed your own set of norms, replace this slide with your norms). Ask students to choose one classroom norm that they will personally work on for the rest of the class period.

ADDITIONAL GUIDANCE

Establishing norms is an important focus early in the school year. The brief reminder about norms that happens in this moment assumes that your classroom norms have already been established in a previous unit. For more information about OpenSciEd norms and how to establish them in your classroom, refer to the *OpenSciEd Teacher Handbook*.

✱ ATTENDING TO EQUITY

Universal Design for Learning
Use classroom norms to support *engagement* by fostering an equitable learning community that promotes trusting and caring relationships. The norms should reinforce to students the value of (1) the diversity of thought among all classroom community members in pushing our learning forward and (2) providing a safe learning environment that ensures fair participation. In addition, classroom norms should interrupt cultural norms or stereotypes that could make science experiences feel uncomfortable for some students (e.g., someone may feel not intelligent enough to think like a scientist or unable or unconfident with sharing their thinking).

8 · COMPARE INITIAL MODELS

5 min

MATERIALS: science notebook, *Healing Initial Model*, chart paper, markers

Share initial models of the healing process of the foot. Show **slide N**. Students should make a table in their notebooks to record similarities and differences, and title it "Comparing our Models."✱

Have students explain their own model to an elbow partner at their table.

- Each student talks for one minute.
- Then, in their science notebooks, students record similarities and differences they notice about the ideas represented.
- Students should be prepared to share their or their partners' ideas with the class.

✱ ATTENDING TO EQUITY

Universal Design for Learning: It is important to organize activities in ways that create opportunities to support student *engagement* in meaningful, accountable talk by emphasizing socially safe activity structures (e.g., small-group or partner work before a whole-class discussion). This is especially beneficial to emergent multilingual students. For this reason, partner talk or small-group talk should precede whole-group sharing to give students an opportunity to share their ideas with one or two peers before going public with the whole class.

9 · DEVELOP AN INITIAL CONSENSUS MODEL OF HEALING

20 min

MATERIALS: science notebook, Healing Timeline, Initial Consensus Model poster, markers, 2 copies of *Printouts of the Foot*

Form a Scientists Circle. Ask students to assemble their chairs in a circle and bring their science notebooks and something to write with. Students will remain in the circle for the remainder of class. Ideally, they will need to be able to see the slide, the timeline, and have access to a whiteboard, but if that is not possible, use only the whiteboard (or chart paper), which is where the more critical sensemaking will occur for the rest of the class.

SCIENTISTS CIRCLE

Your students may be familiar with the Scientists Circle from previous units. If this is your first time forming one, you will need longer than 15 minutes to coordinate it. If your class is familiar with the Scientists Circle, the movement in and out of the circle should happen fairly quickly. Setting up the norms and logistics for forming, equitably participating in, and breaking down that space is important to do if this is your first time forming such a space. A Scientists Circle includes these important features:

- students sitting so they face one another to build a sense of shared mission and a community of learners working together
- celebrating progress toward answering students' questions and developing more-complete explanations of phenomena
- focusing on where students need to go next and how they might go about the next steps in their work

Returning to this Scientists Circle throughout the unit to take stock of what the class has figured out and where students need to go next will be an important tool in helping the class take on greater agency in steering the direction of their learning. This circle will also help build a sense of pride in their work. You may want to inform students that professional scientists also collaborate with one another to brainstorm, discuss, and review their work.

Remind students of the Communicating in Scientific Ways sentence starters.✱ Make certain a Communicating in Scientific Ways poster or handout is visible. Emphasize that each individual has contributions to make to their community of learners. Ask them which sentence starters they might want to use to help them talk to one another.

Think of an idea, claim, prediction, or model to explain your data and observations:

- My idea is ....
- I think that ....
- We could draw it this way .... to show ....

Give evidence for your idea or claim:

- My evidence is ....
- The reason I think that this evidence supports this is ....

Other examples could come from (1) listening to others' ideas and asking clarifying questions, (2) agreeing or disagreeing with others' ideas, and (3) adding onto others' ideas.

Let students know that the class is now ready to have a Consensus Discussion.✱ Tell students, *Remember that the goal of this discussion is to figure out areas of agreement and disagreement in our initial models. Knowing where we agree and disagree will help us to figure out what is happening in the healing foot phenomenon. We also want to use this time to practice our norms with one another.*

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Scaffolds such as sentence starters can model and facilitate particular oral or written language production skills such as formulating questions, hypotheses, explanations, or arguments based on evidence (see Communicating in Scientific Ways poster). Such scaffolds may be of particular benefit for emerging multilingual students to help them develop language skills to write or communicate their ideas to peers. It is important that scaffolds be used purposefully and removed when no longer needed.

✱ STRATEGIES FOR THIS CONSENSUS DISCUSSION

Since this is our initial consensus model, we want to capture our competing ideas. For example, what is happening in between the gap in the bone and skin as the foot heals or how is each part of the foot is connected? Use question marks to help show that this is where we have some different ideas. Be careful not to favorably respond to any one idea over others so as not to give away what might be going on in the phenomenon. The class can return to the model and evaluate their initial competing ideas as they gather more evidence throughout the unit.

ADDITIONAL GUIDANCE

You will make the consensus model above the timeline the class created on day 1. Print out *Printouts of the Foot* and tape one copy above the right and left sides of the timeline. You will add the consensus model to each foot and if prompted by students can add more feet in between to show how the healing process progresses.

Capture similarities and differences in our models of healing. Display **slide O.** Use prompts such as the ones below to develop an initial consensus model. ✱

KEY IDEAS

Purpose:

- Develop an initial class consensus model to capture the ideas we agree and disagree on, or are more uncertain about, to explain what happened as the foot went from being injured with non-functioning parts to being healed and able to walk again.
- This initial model lays the groundwork for what students want to figure out not only about what is going on with the structures of the foot and their function, but also supports and encourages students to want to look closer at how the parts of the foot interact and work together as a complex system for both healing and walking.

Listen For:

- Possible areas of agreement:
    - There are many parts to the foot that were involved in the injury:
        - skin
        - bone
        - muscle
        - Students may also add nerve and blood, etc.
    - There is a break/cut/opening in between the skin and bone.
    - There is swelling.
    - Something happens to stop the bleeding.
    - The foot is not working and the bone/skin/muscle has to come back together before it can work again.
- Possible areas of disagreement/controversy:
    - What is happening between the gaps in the bone and skin as the foot heals?
    - How are the parts of the foot working together?
    - Where is the new skin/bone/muscle coming from?

Consider using a round-robin format to give every student a chance to either share something they wrote, or comment respectfully on something someone else has shared. As students share out, use their ideas to draw an initial consensus model above the timeline using the two feet printouts.

Work through the locations in the model in this strategic order by starting with the healed foot and/or an uninjured foot:

Suggested prompts	Sample student responses	Follow-up questions
Let's start by modeling the healed foot first to see what might be different in the injured foot. What parts, or structures, should we include on the healed foot?	*Skin, bone, muscle* *(Students might also add blood and nerves.)*	*Are there any other parts of the foot or body we might need to include?*

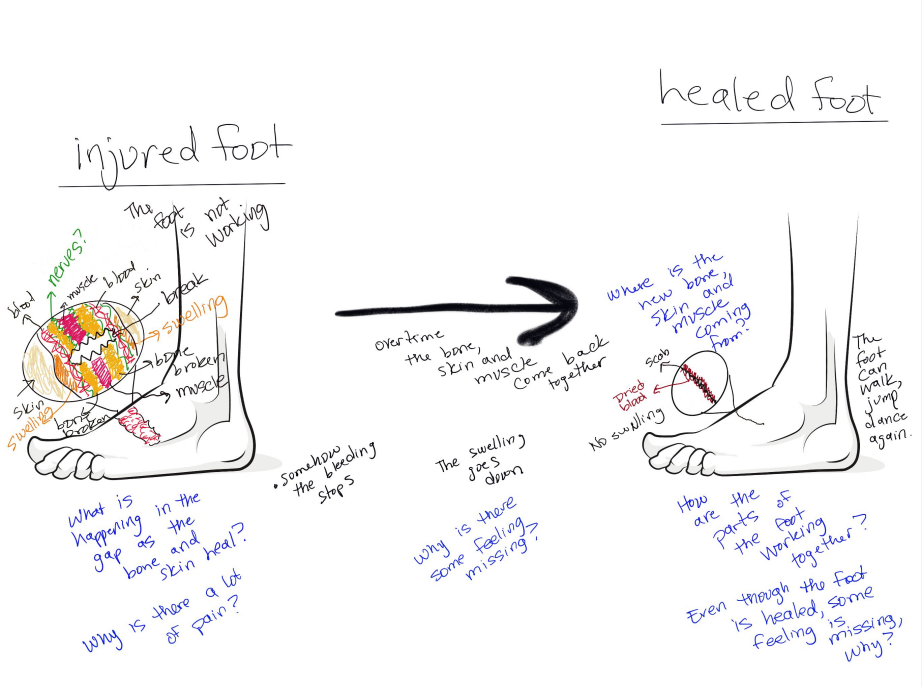
✱ ATTENDING TO EQUITY

Universal Design for Learning: Use *representations* like color coding and/or letter or number coding to foreground parts of the model. Create a key to track what colors, symbols, or letter or number codes represent different parts of the system. While color coding is a useful way to quickly reference the parts of the model, letter or number coding helps ensure accessibility for any student who may be color blind. If color coding is used, consider a color palette that uses orange, blue, black, or dark brown.

Suggested prompts	Sample student responses	Follow-up questions
If we could see inside the foot, what would we see?	*We would see the bone.* *We would see the muscle.* *We wouldn't see dried blood on the skin, but there should be blood inside the foot.* *The skin would not be opened up anymore, but might have scar on the skin.*	*What about the skin? Does the skin count as inside the foot?*
How would we represent each of these parts of the foot in our model?	*Well, when I touch what I think is my bone it feels kind of hard, what I think is my muscles feels kind of squishy, and my skin is flexible but we don't really know.* *Yeah, I think the skin should be closer to the outline of the foot, then the muscle and the bone on the inside. It feels like the bone is more inside than the skin or muscle.*	*Great! Let's mark that down as something we want to know about and we can leave it as a question mark in our model.*
How do these parts look different on the injured foot right after the injury occured? *NOTE: The three parts of the foot that should be on the consensus model include: skin, bone, and muscle. Feel free to include other parts that the class agrees upon and any parts that there might be disagreement about or that students want to find out more about. For example, some students may mention nerves, so your model might include nerves with a question mark.*	*The skin was opened up from the injury and there was dried blood on the skin.* *The x-rays showed two of the bones in the foot broken and crooked (not lined up anymore).* *There was a lot of swelling too so maybe the skin is puffy or something happened to the muscle in the foot. Muscle: was stitched back together but we don't really know how it looked.* *There was dried blood on the skin of the foot, so blood must have come out of the foot.*	*Do you think that if we were to zoom in on the injured and uninjured foot we would see anything different than with just our eyes?*
What did you notice was common in how other people represented the different parts of the foot and their interactions in the injured foot compared to the healed/injured foot?	*We had gaps/holes/breaks in between the bone/skin/muscle in the injured foot but connected on the healed foot.*	*Is this something everyone showed?*

Suggested prompts	Sample student responses	Follow-up questions
OK, we have a model for the foot right after the injury and a model for the foot when fully healed. If we could see what happens over the 3 months it took for this person's foot to heal, what interactions do you think you would see during the healing process?	*We saw that there was swelling but we don't really know why.* *We would see the skin growing back together or closing up somehow.* *We would see the bone lined back up and the crack in the bone would be filled in.* *We would see something happening with the muscle that was opened up, growing back so that it was together but we don't really know how.* *We think we would maybe see a scab or scar.*	*What do you think was happening inside the body to cause those events?*
Were there areas where you disagreed with your partners?	*Yes! We didn't agree about what was happening in between the injury and the healed foot in the gap!* *We know there is blood but we do not know how it is there or why it is there!* *We were not sure how the nerves are involved.*	*It sounds like we have some questions about what is happening as the foot heals! Let's write those down on the side of our notebook and we can come back to them.*

See a sample consensus model below:



10 · PREPARE FOR HOME LEARNING ABOUT RELATED PHENOMENA

2 min

MATERIALS: *Related Healing Phenomena Stories*

Prepare for a home learning about related phenomena.✱ Display **slide P**. The purpose is to have students think of experiences that they have had related to healing that was similar to what happened in the healed foot. Distribute *Related Healing Phenomena Stories* to each student.

Say, *You are going to ask trusted members of your community about their stories of healing or stories they have heard from others. Use the question prompts on Related Healing Phenomena Stories to help you ask questions as they tell their stories.*

✱ ATTENDING TO EQUITY

Framing students' families and communities as legitimate funds of knowledge can serve multiple purposes. It can (1) help students feel like they belong in the science classroom by situating their family and community knowledge as productive resources for science, (2) engage students' families in conversations about what is happening in the classroom, and (3) help students make connections between the science classroom and their everyday lives.

End of day 2

11 · EXPLORE DIFFERENT ASPECTS OF VISIBLE AND INVISIBLE DISABILITY

30 min

MATERIALS: *Related Healing Phenomena Stories*, science notebook, markers, Word Wall poster

Navigation. Display **slide Q**. Have students reflect independently on their responses to *Unknown material with identifier: op.cl.l1.ho6*, but do not ask them to share their ideas of related phenomena with the class yet (they will do that in the next step). Ask, *As you were coming up with examples of healing and other related phenomena in your home learning, did you have any questions about whether or not someone was healed?*

Individually read each prompt on the slide (and below) and listen for student responses. Accept all responses.

- *Did you have any questions about whether or not something counted as healed?*
- *Did you have any questions about people whose bodies might work or function differently after their injury?*
- *Did you have any questions about how healing might be similar or different for individuals?*

Say, *Everyone is different in different ways and all of us can function to complete the daily tasks of life. Let's explore some of these things that we all do and think about the different ways people do them. Open up your notebook and set up a T-chart.*

Display **slide R.** Have students title the left side of their T-chart "Task." This slide is where students will write each aspect of daily life, such as communicating, seeing, sensing, eating, and moving, as you discuss them. Have students title the right side "How it is completed." Here, students will brainstorm different ways a person could achieve communicating, seeing, sensing, eating, and moving.

ADDITIONAL GUIDANCE

Avoid using the word "normal" in this discussion. If you want to refer to the ways that non-disabled people complete tasks, state how the task is completed without a qualifier. For example, when listing ways people see, state simply "with their eyes" rather than "normally." If a student uses the word "normal" during this discussion, ask them what they mean by "normal" and guide them toward more accurate/precise language.

Explore differences in how people experience the world. Say, *We'll think about and discuss a few examples to help us explore the wide variety of ways that people complete the daily tasks of life. People with and without disability complete these tasks, sometimes with the help of adaptive equipment.*

ADDITIONAL GUIDANCE

The word disability carries a great deal of stigma in our society, but the word disability or disabled is a neutral word associated with the rights and protections provided by laws such as the Americans with Disabilities Act (ADA) and the Individuals with Disabilities Education Act (IDEA). Disability is the term preferred by adults who are fighting for disability rights. It's important to note that the words disability and disabled are generally preferred over euphemisms such as "special needs" or "differently abled" which stigmatize that which is different. "Special needs" fell out of fashion when advocates pointed out that there's nothing "special" about needing health care, education, safety, and access to public accommodations.

Explain that for each daily task, you will give students 1 minute to brainstorm in their notebook about the ways that a person might complete that task in their daily life. Then you will have students share out what they wrote. After students share their ideas, move to the next slide to show images of adaptive equipment that may be used by individuals with disabilities as they complete that task.

Brainstorm ways in which people communicate. Display **slide S.** Give students 1 minute to write in their notebooks about different ways people might communicate.

Share out ways people communicate. Have students share their ideas about different ways people complete the task of communicating. Then display **slide T** to see images of some different ways people communicate, including some types of adaptive equipment for communicating. Some of these images will be similar to what the students shared about ways a person can communicate. Explain how the different adaptive equipment works and ask students if they have any questions.

Adaptive Equipment	Purpose
AAC device	AAC device stands for augmentative and alternative communication device. It is a piece of technology or even an ipad that has software (or an app) that contains a variety of words such as verbs, nouns, and adverbs. The person using the device selects the word (or picture) they want and the device says the word out loud. This can be done by physically selecting the buttons or with eye gaze technology. They can communicate single words, phrases, and even full sentences. An AAC device may be used by individuals who do not use verbal speech or who need language support. Other communication tools, such as letter boards, can also be used to communicate.
American Sign Language	American Sign Language (ASL) is a complete, natural language that has the same linguistic properties as spoken languages, with grammar that differs from English. ASL is expressed by movements of the hands and face. It is the primary language of many North Americans who are deaf and hard of hearing and is used by many hearing people as well.
Gestures	Gestures are woven into the fabric of our daily lives. You may wave, point, beckon, or use your hands when arguing or speaking animatedly, often expressing yourself with gestures without thinking. However, the meaning of some gestures can be very different across cultures. While the "OK" sign made with the hand, for example, usually conveys a positive message in English-speaking countries, it's considered offensive in countries such as Germany, Russia, and Brazil. So, it's important to be careful of how you use gestures to avoid misinterpretation.
Facial expression	The human face is extremely expressive, able to convey countless emotions without saying a word. And unlike some forms of nonverbal communication, facial expressions are universal. The facial expressions for happiness, sadness, anger, surprise, fear, and disgust are the same across cultures.

Brainstorm ways in which people perceive the environment around them.. Display **slide U.** Give students 1 minute to write in their notebooks about different ways that people might see, hear, or understand their surroundings.

Share out ways people perceive/sense the environment around them. Have students share their ideas about different ways people perceive the environment around them. Then display **slide V** to see images of some different ways people might perceive the environment around them, including some adaptive equipment for this purpose Some of these images will be similar to what the students shared about ways a person can see, hear, or understand their surroundings. Explain how the different adaptive equipment works and ask students if they have any questions.

Adaptive Equipment	Purpose
Eye glasses or contacts	People who experience near-sightedness, far-sightedness, or astigmatism may use eye glasses or contact lenses to correct their vision.
Magnifier	A magnifier is a tool that makes things appear larger. There are physical handheld magnifying tools as well as digital tools that magnify text on a screen. People with low vision who may not be able to make things out at a typical distance even with glasses or contact lenses may benefit from a magnifier.
Cane	People who are blind may not see using their eyes, but they do use tools and other senses to perceive their environment. A cane is a tool that blind people can use to perceive any obstacles or hazards in front of them as they move from place to place.
Hearing aids	Hearing aids are devices used by deaf and hard of hearing individuals to regain a portion of hearing by amplifying sound.
Cochlear implants	A cochlear implant is a small electronic device that electrically stimulates the cochlear nerve (nerve for hearing). The implant has external and internal parts. The external part sits behind the ear and it picks up sounds with a microphone. It then processes the sound and transmits it to the internal part of the implant.
Braille	Braille is a system of raised bumps that allow blind individuals to read text with their fingers. Braille is a code of language and not a language in itself.
Alerting devices	Alerting devices are assistive devices that connect with door bells, telephones, and other alarming devices. These devices add a specific alarm based on one's disability. For instance, a deaf individual can have a doorbell that blinks a light instead of a noise to indicate someone is at the door.

Brainstorm ways in which people eat. Display **slide W.** Give students 1 minute to write in their notebooks about different ways people eat.

Share out ways people eat. Have students share their ideas about different ways people complete the task of eating. Display **slide X** to see images of adaptive equipment for eating. Some of these images will be similar to what the students shared about ways a person eats. Explain how the different adaptive equipment works and ask students if they have any questions.

Adaptive Equipment	Purpose
G tube	"G-Tube" is a nickname for a gastronomy tube. It is a small tube that goes from the outside of the body directly to the stomach. It's a way to make sure someone gets all the fluid and nutrients they need.
Adaptive plates, bowls, spoons, forks, knives	Adaptive feeding tools like specialized mugs, plates, utensils, and more make it possible for individuals to eat with increased independence. This includes things like plate guards, partitioned plates, and weighted utensils to help with tremors or weak grip strength, rocker knives to decrease wrist strain, and many types of cups.

Brainstorm ways in which people move. Display **slide Y.** Give students 1 minute to write in their notebooks about ways people move around.

Share out ways people move. Have students share their ideas about different ways people complete the task of moving. Display **slide Z** to see images of adaptive equipment for moving. Some of these images will be similar to what the students shared about ways a person moves. Explain how the different adaptive equipment works and ask students if they have any questions.

Adaptive Equipment	Purpose
Wheelchair	A wheelchair is a tool individuals use to move from place to place. People use wheelchairs for many different reasons. Some individuals use manual wheelchairs where they are pushed or they propel the chair themselves using their hands and arms. Power wheelchairs have motors and joysticks and are controlled by switches. Some wheelchair users control their chairs with switches near their heads or by using other body parts. Some wheelchair users use their wheelchairs exclusively to get around. Other wheelchair users occasionally walk or use other adaptive equipment to move from place to place in addition to using a wheelchair.
Stander	A stander is a piece of equipment that helps muscles and bones stay strong. Typically, individuals who use wheelchairs for all of their movement would use a stander for some time during the day to give them a change of position and help keep their bones and muscles from weakening. The person gets into the stander (with or without help) and safety straps are engaged and tightened.
Braces	Braces are worn on different parts of the body that need extra support or positioning.
Prosthetics	Prosthetics are devices that simulate a body part that a person may not have like an arm or a leg. Prosthetics often work similarly to the body part they simulate.
Crutches or walkers	Crutches or walkers are devices used to transfer the body's load from the lower body to the upper body. Crutches and walkers are used when one's lower body is not completely immobilized, but impaired.

ALTERNATE ACTIVITY

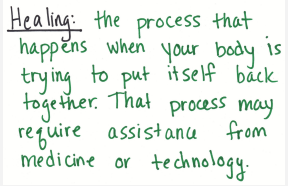
If time permits, hang 4 pieces of chart paper in different places in your classroom. At the top of each piece write the title "Brainstorm different ways people..." and complete the title on each page with a different task: communicate, eat, sense/perceive, and move).Have students move around the room in a silent carousel activity where they each write one idea on each poster. Then you or a student can read aloud each list before you show and discuss the images of adaptive technology for each daily task.

Synthesize and expand our understanding of healing and body function. Display **slide AA.** Say, Now that we have expanded our knowledge of many different ways all people complete the daily tasks of life, let's take some time to refine our definition of healing.

Have students begin by doing a quick write in their notebook. These prompts are shown on **slide AA**: *I used to think healing was*_____. *Now I think healing is* _____.

Ask students to share out their ideas with a partner and then share out with the class.

Revise the Word Wall with our new definition of healing. Add a definition similar to this but created by your class: *Healing is the process that happens when your body is trying to put itself back together. That process may require assistance from medicine or technology.*



Connect what we have figured out about disability to the *Related Healing Phenomena Stories*. Display **slide BB** Say, *Thinking about how we just expanded our understanding of the ways people can function in different ways, look back at what you wrote on your home learning. Is there anything you would want to change or share differently? How might our revised definition of healing change what you were going to share about related phenomenon?*

Sample student responses may include:

- *Healing is more complicated than we might have thought at first!*
- *We have more and/or different ideas to add to our related phenomena.*

12 · SHARE RELATED PHENOMENA OF HEALING

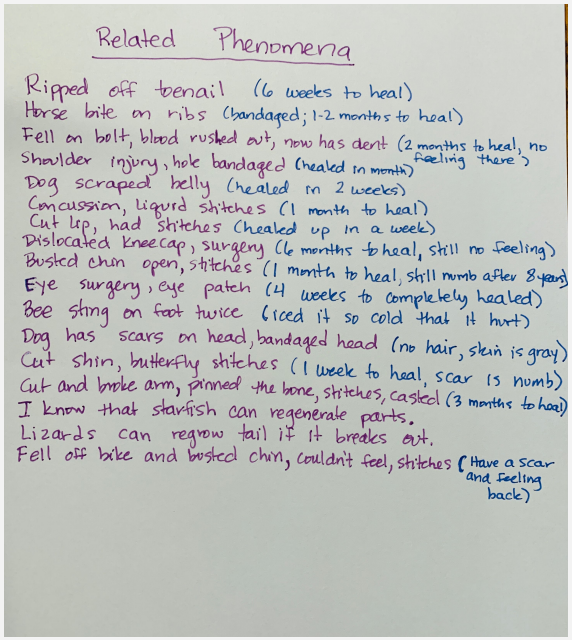
10 min

MATERIALS: *Related Healing Phenomena Stories*, chart paper, markers

Share related phenomena and experiences. Display **slide CC.** Have students take out *Related Healing Phenomena Stories*. Start the conversation by having students share with the whole group. Encourage students to snap their fingers if someone mentions a phenomenon that they also have observed.

- What other experiences have you or the members of your community had that this students' journey to recovery reminds you of? What parts were impacted? How long did it take to heal?
- What other phenomena might heal due to the same sorts of things that caused the student's body to do what it did?
- When have you seen or heard of other body parts completely healing after they were injured?
- When have you ever seen or heard of healing from injuries that affected the ability to sense (smell, feel, taste) something in one's surroundings?
- When have you ever seen or heard of other living things, besides humans, healing from an injury?

Record a bulleted list of what students share on chart paper like the one shown to the right. After making this list, link it back to the classroom consensus model. Display **slide DD.** Say, *As we revise and refine our model, try to explain what is happening with the student's recovery in future investigations. Let's keep in mind these other phenomena too, so that we can see if the model we develop can be used to explain any of these as well.*



Ask students to tape *Related Healing Phenomena Stories* into their science notebooks or collect it at the end of the lesson.

13 · DEVELOP QUESTIONS FOR THE DRIVING QUESTION BOARD

5 min

MATERIALS: sticky notes, marker, science notebook, DQB Poster, Healing Timeline

Write initial questions for the DQB. Make sure the Healing Timeline poster, along with the class's initial consensus model are located at the front of the room where students can see them. Present **slide EE**. Say, *We have been looking at the foot injury healing and other instances of injuries healing. What kinds of questions could we ask about these systems and interactions of the parts of the systems that cause them to heal them that we could investigate as a class?* Look for students to suggest asking questions about other things healing, other parts of the body healing, what is happening in the different parts of the system where the healing is happening, how the parts are connected, etc.

Then pass out 3-4 sticky notes and a marker to each student. Ask students to write at least three questions, one per sticky note, about healing and at least one about other related phenomena. They should write their questions big and bold--we want to be able to see the questions clearly.

Have students stick their questions temporarily on the inside cover of their science notebook so they can keep them safe until we share them next time.

ADDITIONAL GUIDANCE	Students may have these kinds of questions: Why did the skin heal first? Why did he have to have stitches? Why did he have a pin or a cast? These questions are valid and acceptable, but in order to keep the focus on natural phenomena happening within the body systems rather than external supports for healing, remind students to think about what was happening inside the student's body or other living things' bodies.

End of day 3

14 · BUILD OUR DRIVING QUESTION BOARD

30 min

MATERIALS: science notebook, sticky notes, tape, chart paper, markers

Gather in a Scientists Circle around the DQB. Project **slide FF**. Instruct students to bring their sticky notes and science notebooks to a Scientists Circle around the DQB. The Healing Timeline with initial consensus model, and Related Phenomena posters should be visible.

ADDITIONAL GUIDANCE	The Driving Question Board will be central to the sensemaking that happens in the unit. There are a variety of ways to set up the DQB depending on your classroom resources, use of technology, and the number of students you see each day. What works for some will not work for others. Most important is that the DQB is visible to students each day and represents "our shared mission." Students will be using the DQB to assess what they've figured out and identify next steps. You can choose to have students put their sticky notes directly onto the timeline or make a poster just for the Driving Question Board.

Instruct students to share their questions, one by one, with the whole group.✱ Explain to students how you will create the DQB:

- The first student reads their question aloud to the class then posts it on the DQB.
- Students who are listening should raise their hand if one of their questions relates to the question that was just read aloud.
- The first student selects the next student whose hand is raised.
- The second student reads their question, says why or how it relates, and posts it near the question it most relates to on the DQB.
- That student selects the next student, who may have a related question or a new question.
- We will continue until everyone has at least one question on the DQB.

If the question is a new question and doesn't fit with any questions that are already on the board, students should create a new cluster.

Organize questions into categories. As students share, questions will naturally cluster into similar areas. Once students have finished their sharing, ask students to look at the questions for any additional organization that can be done. Use larger stickies to label these clusters. Some clusters that may emerge include: the parts of the foot (e.g. bone, skin, blood, nerves, etc.), recovery, things done to the foot after the injury, healing/repair, timeline, etc.

Develop an initial driving question. Point out that many of the questions are connected to how and why certain things happened in the healing process. Suggest that including these questions under a single driving question could remind us of how the work on any one question is in the service of all our questions. Say, *Now that we have written our questions, what question should we put at the top of our DQB?*

Feel free to suggest tweaks to students' wording or combine multiple questions. For example, if one student suggests, "How do the parts of the foot work together to heal?" and another student suggests, "What is happening inside the foot so the student can walk again?" you can say, *I heard one person asking about how the parts of the foot work together and one person asking about what is happening we can't see. Can someone combine these into a single question?* Once an idea is on the table that meets the criteria and/or looks like one of the examples above, revoice this question.

Propose the question,**"How does the foot (or body) heal?"** as a single driving question that most of our questions could fit under. Then ask, *Does everyone agree on this for our initial driving question?*

Once the class agrees to the question, write it in large letters on a half-piece of chart paper and hang this banner over the top of the entire DQB. Remind students that we can revise this question as we continue to figure out new things in future lessons.

ASSESSMENT OPPORTUNITY

Building towards: 1.C Ask questions that arise from observations of injuries to multiple subsystems resulting in loss of a particular body function to the larger complex system of the foot.

What to look/listen for: day 3: When students generate questions on sticky notes with their initials on back. You may also want to look through student notebooks to see their individual ideas for future investigations to pursue.

What to do: It is important that *all* questions posed by students be placed on the DQB regardless of whether they are open-ended or close-ended. As students ask questions, have them reflect on any related phenomena about other living things or important events or evidence in the healing timeline that have few or no questions posted on the DQB. Prompt students to generate more questions in this space so that we are motivated to investigate several subsystems of the body and other living things.

ADDITIONAL GUIDANCE

If your DQB is not already in a digital form that's easily referenced by all students, you will want to type up the questions and share them so students can see them. This list will be first used in Lesson 7, and several lessons thereafter.

15 · DEVELOP INITIAL IDEAS FOR FUTURE INVESTIGATIONS

10 min

MATERIALS: science notebook, Ideas for Future Investigations and Data We Need poster, markers

Stay in a Scientists Circle to brainstorm investigations and data we need. Show **slide GG**. Now that the class has created a DQB, tell students that it is time to really dig into the hard work of figuring out what is going on!

Ask students, *What kind of information or data will we need to be able to figure out what is going on inside our body when:*

- *it is performing a specific function,*
- *when it is injured, and*
- *as it heals?*

Give students about five minutes to individually record in their notebooks some ideas for future investigations or data we need. As students are doing this, create a new poster titled "Ideas for Investigations and Data We Need." Put this right next to the DQB.

Tell students that you are going to record their ideas and that you want everyone's idea to be represented. Have students turn and talk about their ideas before sharing out with the whole group.

Make a class record of future investigations. Display **slide HH.** Have small groups share out their ideas with the whole group. Make sure that all groups get to share at least a few ideas. As students share, create a class record of the ideas. You may also want to prompt students to keep a record of proposed investigations in their science notebooks. As students are sharing their ideas, underline repeated statements to keep track of common ideas among students. Emphasize that the list is what we want to do that we think might help us answer our questions and that we may need to add to this list and update our DQB throughout the unit as we go.

Some possible investigations or data might include:

- Look more closer at the foot using magnifying glasses
- Zoom in using microscopes or pictures
- Looking more closely at x rays
- Getting more information from a doctor or surgeon
- See more pictures over time of injuries healing
- Look at some other injuries

SCIENTISTS CIRCLE

One way to ensure that all student ideas are shared and get up on the board or poster is to pass a marker to the first person nearest you in the circle. The student with the marker should share one idea. Write it on the board or poster. Once that student sees that you have almost finished writing it, that student should pass the marker to the next student. The second student then shares an idea. If the idea is on the poster already, the student should say which idea is similar and how it is similar. Put a tally mark next to that idea. In this way, the marker is passed all around the circle and all students have a chance to have their thinking represented on this poster. Remind students that if they have additional ideas that don't end up on the poster, they should jot them down now and then raise a hand to share only after the marker makes it all the way around the circle.

16 · NAVIGATION

5 min

MATERIALS: None

Prioritize what to investigate first to begin making progress on our questions. Display **slide II.**
Say, *We have a lot of questions about how his foot healed. We saw from the doctor's notes that the parts of his foot that were impacted were the bone, muscle and skin. How might investigating how these different parts in our own body function or work help us make progress on some of our questions?*

Sample student responses:

- *Because that is how it was beforehand and if we can figure out how it was beforehand, we can figure out what changed during the injury.*

Say, *Great, we will start with our investigations there first and then use what we figure out to decide which investigation idea we should pursue next.*

Additional Lesson 1 Teacher Guidance

SUPPORTING STUDENTS IN MAKING CONNECTIONS IN ELA

CCSS.ELA-Literacy.RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

On day 1, students gather additional information from doctor's reports and images of the injury which they record important events and evidence that those events indicate healing is happening on *Evidence for Healing* and then add to a whole class timeline.

CCSS.ELA-Literacy.SL.6.1.c: Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.

When the class is building the Driving Question Board, if a student forgets to explain why or how their question is linked to someone else's question, press that student to try to talk through their own thinking. This is a key way to emphasize the importance of listening to and building off of one another's ideas and to help scaffold student thinking.

If students can't figure out which question to connect to theirs, encourage them to ask the class for help. After an idea is shared, ask the original presenter if there is agreement and why, and then post the question.

Today's activities rely on students communicating and articulating their thinking. One tool that may support classroom discussion is the *Communicating in Scientific Ways* sentence starters. This 1-page document can be blown up and printed as a class poster, printed on 8.5x11 paper, and posted near students' desks, and/or scaled down and taped into students' science notebooks. To support discussion, reference the sentence starters on the poster and encourage students to use those sentence starters to help them communicate. The sentence starters can be especially useful for helping students engage in scientific talk, particularly students who may feel reluctant to contribute.