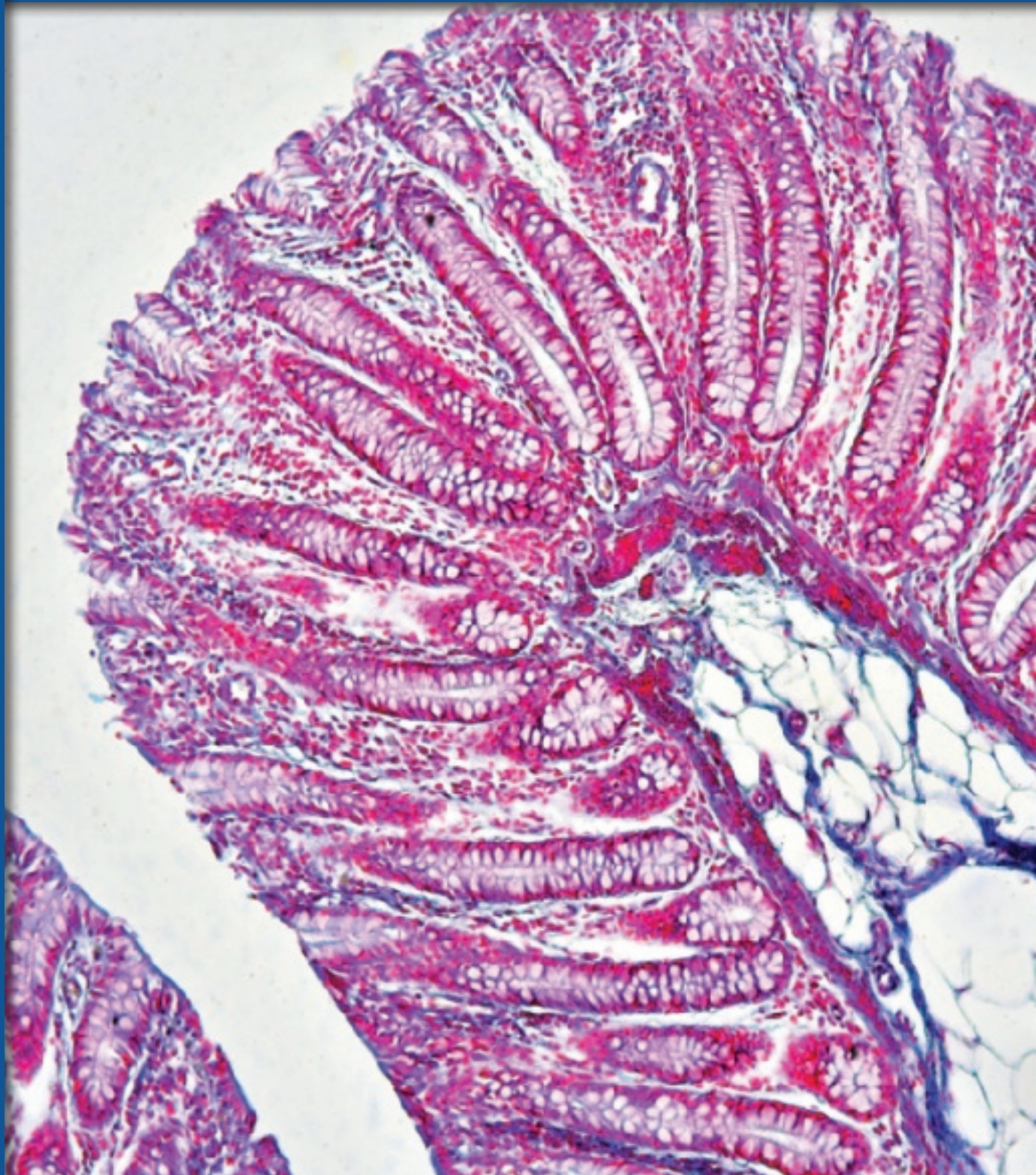


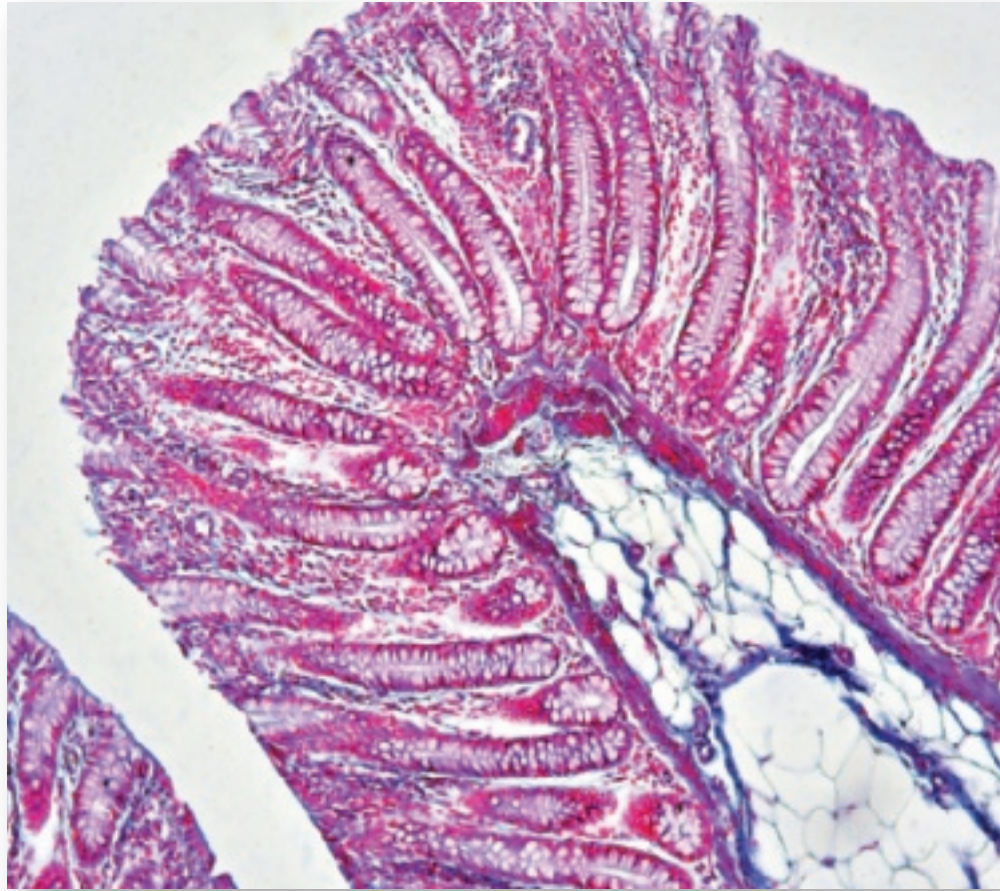
Unit 6

Cells and Systems:

How do living things heal?

Student Work Pages





Cells and Systems:

How do living things heal?

Student Work Pages

Core Knowledge Science



Creative Commons Licensing

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.



You are free:

to Share—to copy, distribute, and transmit the work

to Remix—to adapt the work

Under the following conditions:

Attribution—You must attribute the work in the following manner:

CKSci 6–8 was originally developed and authored by OpenSciEd, <https://www.openscienced.org>, Copyright 2019. It is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0). The OpenSciEd 6–8 Science Curriculum is available at:*

<https://www.openscienced.org/access-the-materials/>

Additions to the OpenSciEd 6–8 Science Curriculum are marked as “Core Knowledge Science Literacy”. This additional content is the work of the Core Knowledge® Foundation (www.coreknowledge.org) made available through licensing under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

Noncommercial—You may not use this work for commercial purposes.

Share Alike—If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

With the understanding that:

For any reuse or distribution, you must make clear to others the license terms of this work. The best way to do this is with a link to this web page:

<https://creativecommons.org/licenses/by-nc-sa/4.0/>

Copyright © 2022 Core Knowledge Foundation

www.coreknowledge.org

All Rights Reserved.

*Please see full attribution at the back of this book for credited contributors to the development and field testing of the OpenSciEd unit.

Core Knowledge®, Core Knowledge Curriculum Series™, Core Knowledge Science Literacy™, and CKSciLit™ are trademarks of the Core Knowledge Foundation.

Trademarks and trade names are shown in this book strictly for illustrative and educational purposes and are the property of their respective owners. References herein should not be regarded as affecting the validity of said trademarks and trade names.

Cells and Systems:

How do living things heal?

Table of Contents

Lesson 1: Emergency Room Report	1	Lesson 9: Observations to Evaluate Claims . .	43
Lesson 1: Post-Operation Report	3	Lesson 9: Microscopic Images of Cells	
Lesson 1: Recovery Reports	5	Splitting	47
Lesson 1: Evidence for Healing	9	Lesson 10: Obtaining Information from	
Lesson 1: Healing Initial Model	11	Scientific Text	49
Lesson 1: Healing Phenomena Stories	13	Lesson 10: Reading: Algae	51
Lesson 2: Mapping the Chicken Wing to the		Lesson 10: Reading: Archaea	53
Human Foot	15	Lesson 10: Reading: Bacteria	55
Lesson 2: Skin, Muscle, and Bone Systems . .	17	Lesson 10: Reading: Yeast	57
Lesson 3: Reference: A Medical Professional's		Lesson 11: Data from Investigating Red Onion	
View Inside the Body	19	Cells	59
Lesson 3: Reference: Close-Up Diagrams of Skin,		Lesson 12: Lizard and Sea Star Injury Cases . .	65
Muscle, and Bone	21	Lesson 13: Home Learning: How do we support	
Lesson 3: Reference: Interpreting MRI	23	healing?	69
Lesson 4: Guidance for Reading about Blood	25	Lesson 14: Transcript: Interview with Student	
Lesson 4: mm Graph Paper	27	from Lesson 1	71
Lesson 4: Reading: What Is Blood?	29	Lesson 14: Wheelchair Icons	73
Lesson 5: Under the Microscope: Images of		Lesson 14: Transcript of Rosie King's	
Nerves	31	TED Talk	75
Lesson 5: Obtaining Information from Scientific		Lesson 14: Transcript of Sinéad Burke's	
Text	33	TED Talk	77
Lesson 5: Reading: The Body's Nervous		Science Literacy Exercise Pages	
System	35	Collection 1 Exercise Page 1	79
Lesson 6: Investigating Skin, Bone, and Muscle		Collection 2 Exercise Page 2	81
with a Microscope	37	Collection 3 Exercise Page 3	83
Lesson 7: DQB Questions or Parts of Questions		Collection 4 Exercise Page 4	85
We Have Answered	39		
Lesson 8: Time-Lapse Video of Skin Healing			
Observations	41		

Emergency Room Report

Name: _____

Date: 2/26/2018

Time: 2:30 pm

Location of incident: middle school weight room during PE class

Type of injury:

- The left foot has lacerations (cuts) on the top.
- The skin is broken open and it appears there are broken bones.

Examination:

- The patient cannot put any weight on the foot.
- There is swelling around the injury.
- When different areas were tested for feeling, the patient had no feeling on the top of the foot.
- The bottom, sides, toes, and heel of the injured foot have feeling.

Testing:

X-rays



Diagnosis:

2nd and 3rd metatarsal bones are fractured and shifted to the right. Surgery is needed to reduce the gap between bones, and to stabilize and realign them.

Post-Operation Report

Name: _____

Date: 2/26/2018

Time: 8:00 PM

Vitals:

Heartbeat - 69 bpm

BP (blood pressure) - 110/62

Temperature - 99.1°F

Procedure:

- Patient was put under anesthetic.
- Patient's wound was irrigated with water and the skin was scrubbed with antibacterial soap.
- An incision was cut in the top of the foot aligned with the surgeon's initials (P).
- Internal dissolvable stitches were used to suture the muscle in the top of the foot.
- Two 4-inch, stainless steel pins were inserted to reduce gap and realign 2nd and 3rd metatarsals.
- Outer skin on top of foot realigned, closed, and stitched up.
- Plaster cast put on after surgery.

Post-Operative Diagnosis:

2nd and 3rd metatarsal bones fractured. Surgery needed to stabilize bones.

- Patient is to stay overnight in the hospital to watch for swelling and control pain.
- Patient has no feeling on the top of the foot, prior to and after surgery.
- In the morning, a physical therapist will aid the patient in walking with crutches and uninjured foot.
- Patient to return for evaluation in 1 week.
- Physical therapy will be recommended after the cast is removed.

**Image of left foot
pre-surgery**



**Image of left foot
post-surgery**



**Bottom view of left foot
post-surgery**



Recovery Report #1

Name: _____

Date: 3/19/2018

Time: 12:30 PM

Type of injury:

On 2/26/2018, the left foot had lacerations on the top. The skin was broken open, and it appeared there were broken bones.

Examination Notes:

- The swelling is down.
- The patient can wiggle toes.
- The patient still does not have feeling on the top of the foot.
- The patient is not in any pain.
- There is a diminished range of motion of the left ankle and toes.

Testing:

X-rays show the bones are lined up and the distance between bones [gap] at the fracture sites is smaller in size.

Procedure:

- We cleaned the pin sites and found they are clean and dry.
- We removed the stitches and put on Steri-Strips.
- A new cast was put on after examination.

Diagnosis:

- The patient will have a new cast put on and will continue to use crutches for 4 weeks.
- The patient should return for re-evaluation in about 2 weeks.
- Once the cast is no longer needed, we will schedule physical therapy.

Follow-up appointment on: 4/2/18

Recovery Report #2

Name: _____

Date: 4/2/2018

Time: 12:30 PM

Examination Notes:

- There is minimal swelling.
- The patient has more range of motion in the left ankle and toes.
- The patient has some tingling on the top of foot, but not full feeling.
- The patient is not in any pain.
- The skin where stitches were removed last time is closed and shows further signs of healing.

Testing:

X-rays show the bones aligned and the distance between broken bones [gap] at the fracture sites has continued to decrease in size.

Procedure:

- We removed the cast.
- We removed pins because bones are aligned. We placed bandages over the sites of the pins.

Diagnosis:

- The patient is placed in a post-op shoe for the next 2 weeks.
- Re-evaluation in about 2 weeks to determine whether the patient can return to wearing regular shoes.

Follow-up appointment on: 4/16/18

Recovery Report #3

Name: _____

Date: 4/16/2018

Time: 12:30 PM

Examination Notes:

- There is minimal swelling.
- The patient has more range of motion in the left ankle and toes.
- The patient has no tenderness on the foot.

Testing:

- X-rays show the bones are lined up and fading of the fracture lines.
- There is adequate blood flow in the area of the injury.

Procedure:

Took x-rays and tested range of motion.

Diagnosis:

The patient should return on 5/16/2018.

Recovery Report #4

Name: _____

Date: 5/16/2018

Time: 12:30 PM

Examination Notes:

- There is no swelling.
- The patient has improved range of motion in the left ankle and toes.
- The patient has no tenderness on the foot.

Testing:

- X-rays show fracture no longer visible in the bones.
- There is strong blood flow in the area of the injury.

Procedure:

Took x-rays and tested the range of motion.

Diagnosis:

The patient does not need to return.

The patient can return to engaging in physical activities.

Evidence for Healing

Look back through the doctor’s notes and your noticings about them. Find and highlight clues indicating that healing was happening. Some clues will be observations from the doctor about what was happening inside the patient’s body, while other clues let us zoom in and look closely at the injury site. Some clues may also be found in the doctor’s actions in their care of the patient. In the table below, record important clues that you think indicate that healing was occurring in the foot, and why you think each clue could be evidence of healing.

Important clue that you think could indicate healing	Why do you think this clue could be evidence that healing is happening?

Name: _____

Date: _____

Healing Initial Model

Develop an initial model to explain, "What happens during the healing process so the student was able to use his foot again to walk, run, jump, and dance?" You can use words, pictures, symbols, and/or close-ups to represent the relevant parts and interactions that occur in the injured foot and healed foot. Be sure to capture what you think is happening within the body that helps the foot heal over time.

- a. Begin to develop your model by adding the parts of the foot impacted by the injury. Show how these parts would be different in the injured and healed foot.
- b. Now go back and add to your model to explain what you think happened in the body between the time the foot was injured and when it healed (as represented by the arrow).



Injured Foot



Healed Foot

Name: _____

Date: _____

Healing Phenomena Stories

Talk with trusted members of your community and ask them to tell you their stories of healing or stories they have heard from others. As you listen, think about the questions below, and then write your responses to bring to our next class.

- When have you ever seen or heard of someone's body parts completely healing after they were injured? What parts were impacted? How long did it take to heal?

- When have you ever seen or heard of someone healing from injuries that affected their ability to sense (smell, feel, taste, hear, see) things in their surroundings?

- When have you ever seen or heard of other living things, besides humans, healing from an injury?

Name: _____

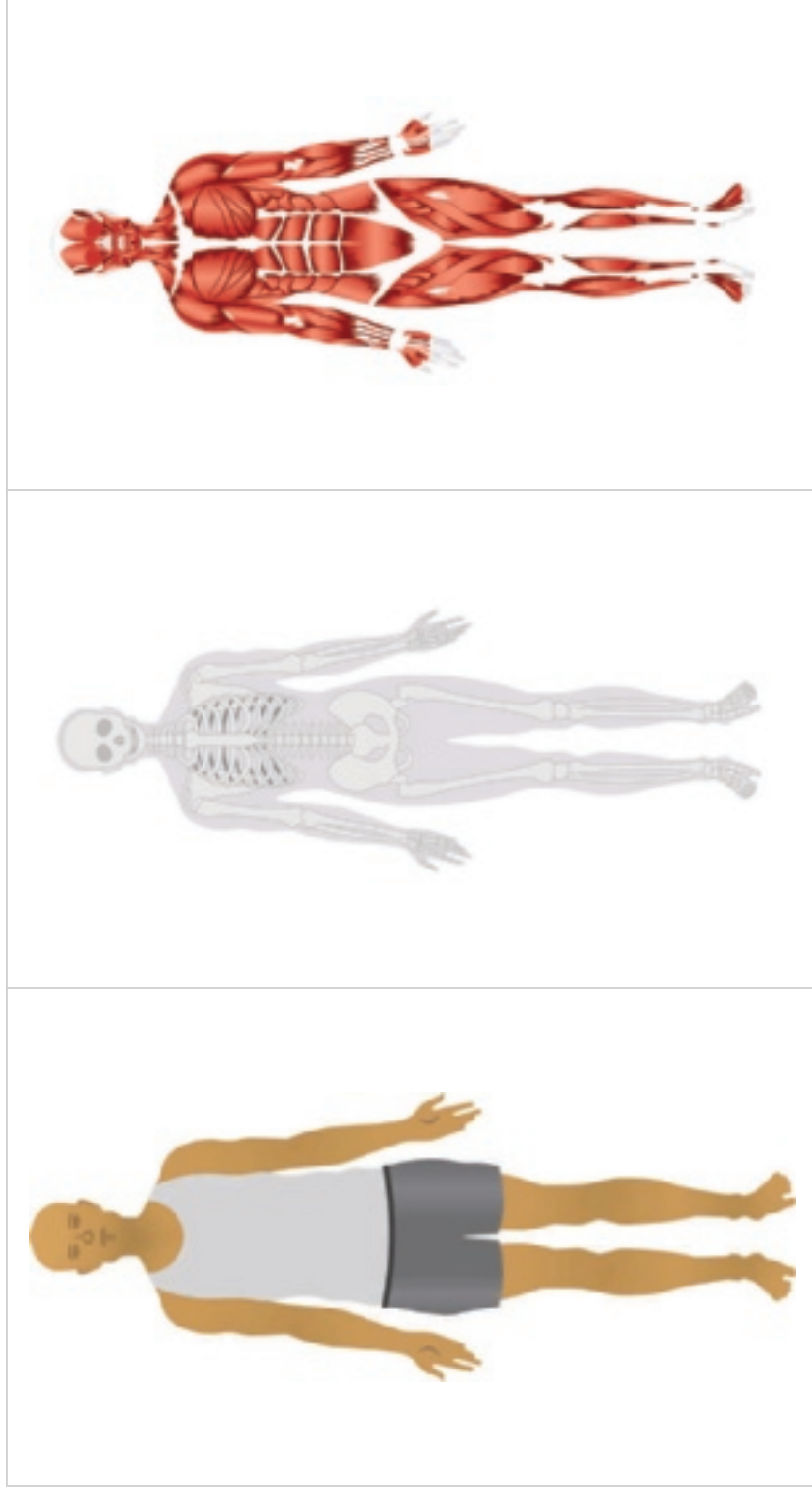
Date: _____

Mapping the Chicken Wing to the Human Foot

This part of the chicken wing ...	is like this part of the human foot ...	because ...	and not like it because ...

Skin, Muscle, and Bone Systems

Cut each image of the three body systems prior to the discussion toward the end of day 2.



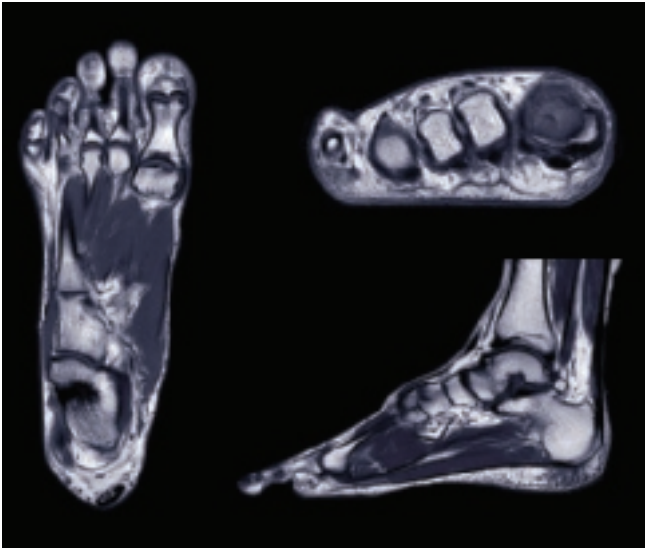
Name: _____

Date: _____

Reference: A Medical Professional's View Inside the Body

Directions: Compare these x-ray and MRI images. What body parts are visible (or not) in each image? Annotate the images to show your thinking.

- Observe each pair of x-rays and MRIs.
- Draw arrows to label the parts you can identify. (Refer to our "Our Body as a System" poster if that's helpful.)
- Circle parts of the images you have questions about.

X-ray of Foot	MRI of Foot
 An X-ray image of a human foot, showing the skeletal structure. The metatarsals and phalanges of the toes are clearly visible, along with the tarsal bones at the base of the foot. The image is in grayscale, with bones appearing white against a dark background.	 An MRI image of a human foot, showing soft tissue structures. The image is in grayscale, with soft tissues appearing in various shades of gray. It includes a sagittal view of the foot, showing the internal structures like the arch and the heel, and a cross-sectional view of the foot, showing the internal organs and structures.

X-ray of Knee



MRI of Knee



X-ray of Hand

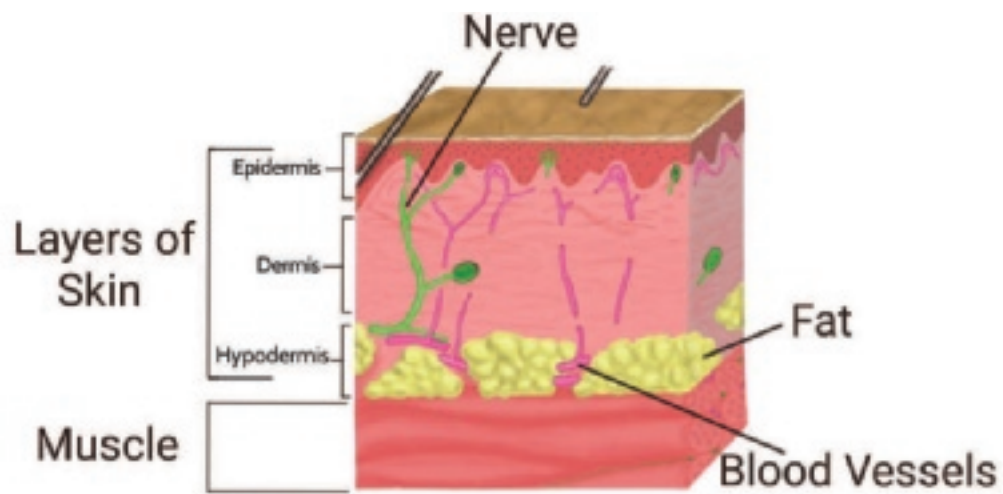


MRI of Hand

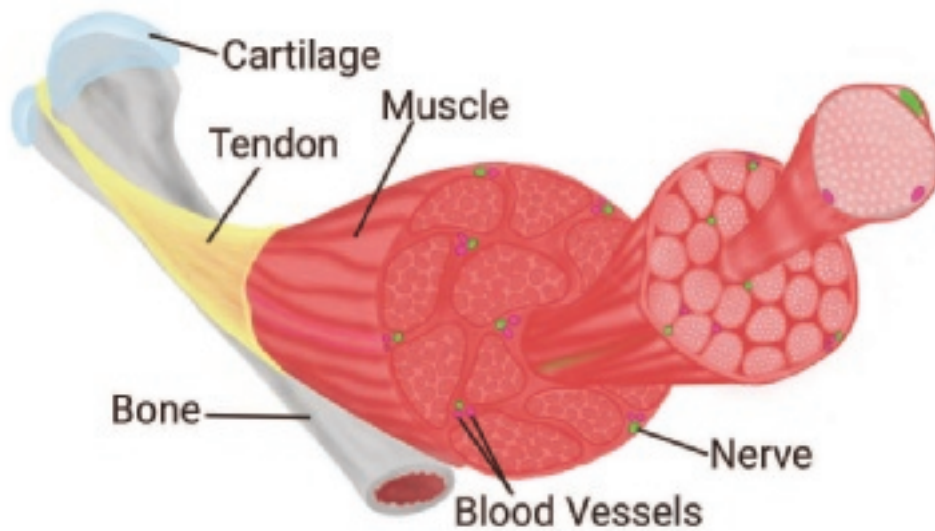


Reference: Close-Up Diagrams of Skin, Muscle, and Bone

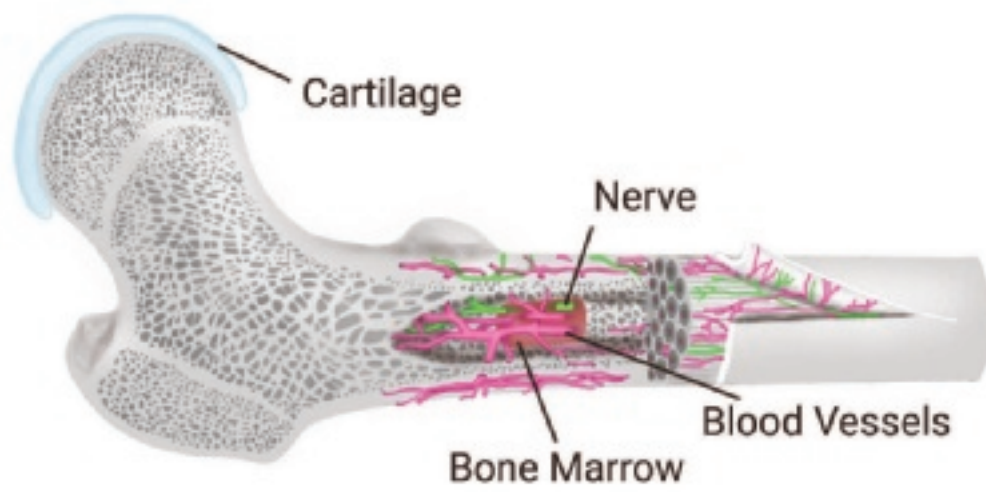
Skin



Muscle



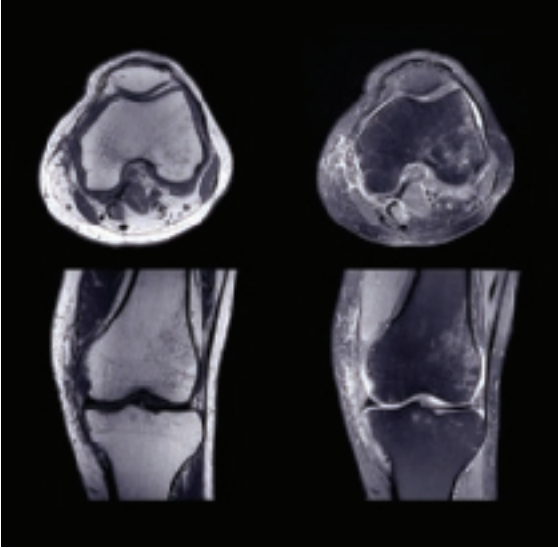
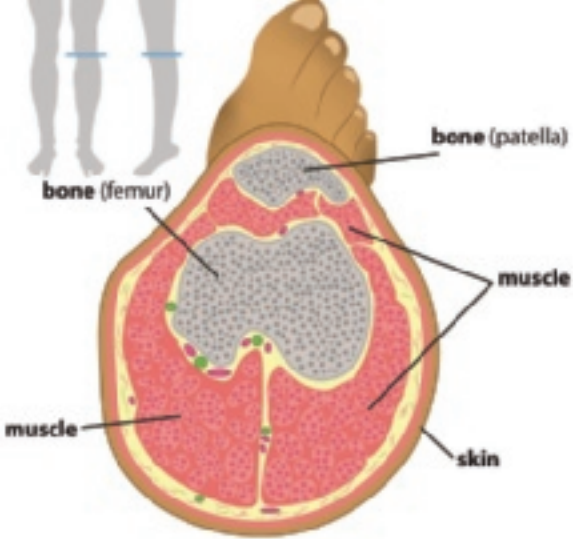
Bone



Name: _____

Date: _____

Reference: Interpreting MRI

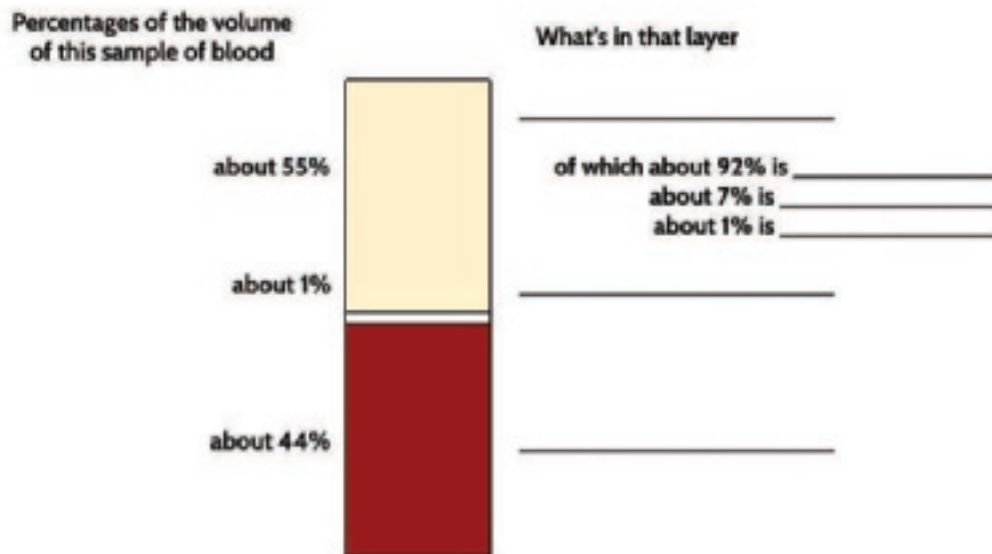
Horizontal MRI of Knee	Horizontal Diagram of Knee
	
Vertical MRI of Knee	Vertical Diagram of Knee
	

Name: _____

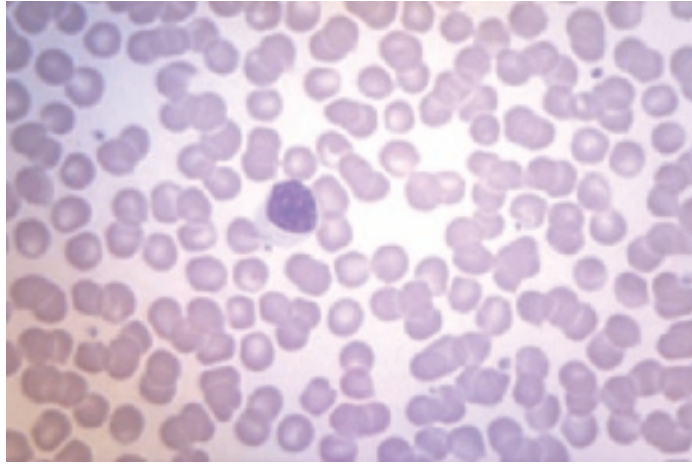
Date: _____

Guidance for Reading about Blood

1. As you read *What Is Blood?*, use the following strategies to read closely:
 - Keep in mind the questions we are trying to answer: What are all those parts of the mixture doing for the body? Why is blood so important that it goes everywhere?
 - Underline or highlight key ideas in the text that help you answer these questions about the structures of the blood and their functions.
 - Jot down any questions that come up during your reading. If we don't get them answered today, we can add them to our Driving Question Board.
2. The bar below represents the different layers in a test tube of settled blood. Using information from the article, annotate the right side of the bar to show what is found in each layer.



3. Use what you read to help make sense of the patterns you observed in blood at the microscopic scale. Write labels on the following photo to name each of these parts of the blood and tell its function in the body: *red blood cells, white blood cells, platelets, and blood plasma*.



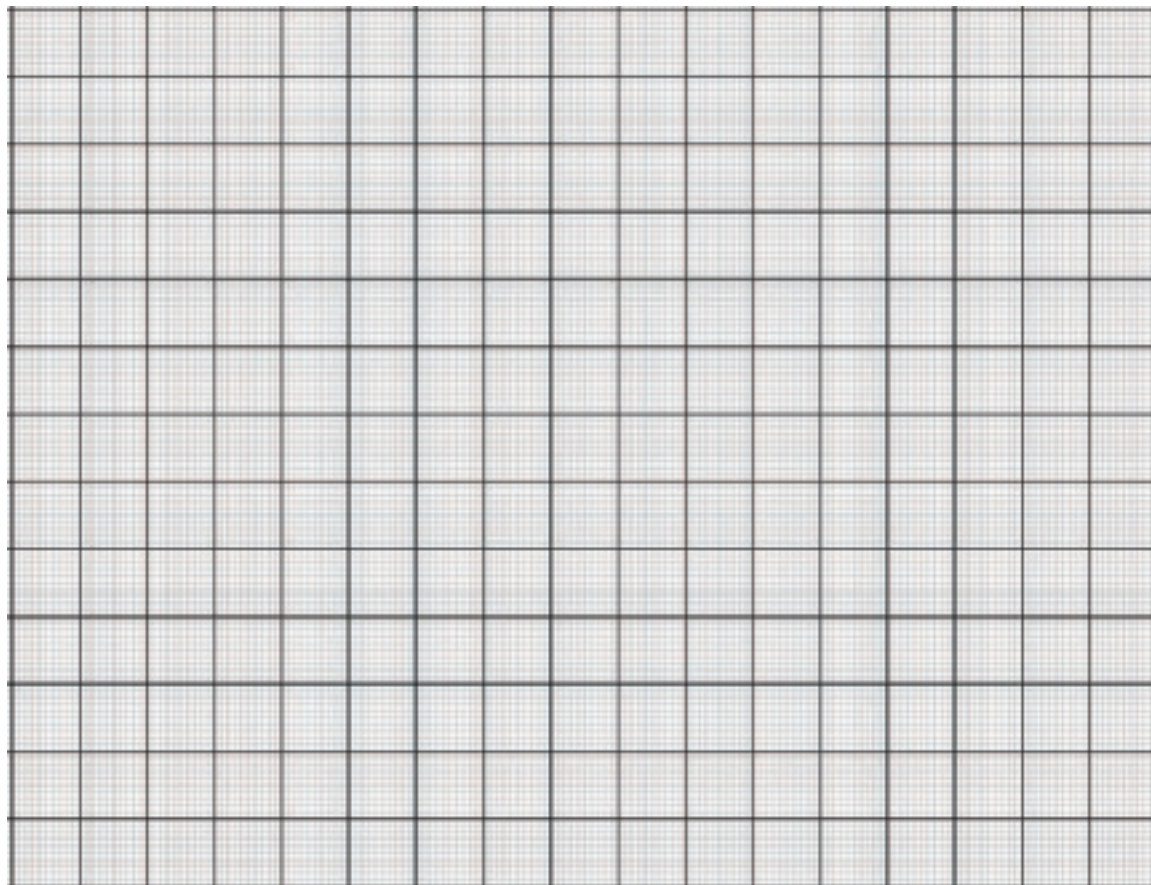
4. How does the shape or structure of a part in the blood help it carry out its function? Provide one example and explain.

Name: _____

Date: _____

mm Graph Paper

One sheet of paper will work for multiple classes. Print the graph paper and then cut 4 cm x 2 cm rectangles for each group.



Reading: What Is Blood?

It's red and a little thicker than water. Blood is a fluid that has several vital functions for any animal whose body contains it. The heart pumps blood through blood vessels that are found all over the body. As blood travels through these vessels, it brings all the different parts of the body what they need, such as oxygen, water, and nutrients (food particles, vitamins, and electrolytes). Blood also helps the body to support and respond to illness and injury.

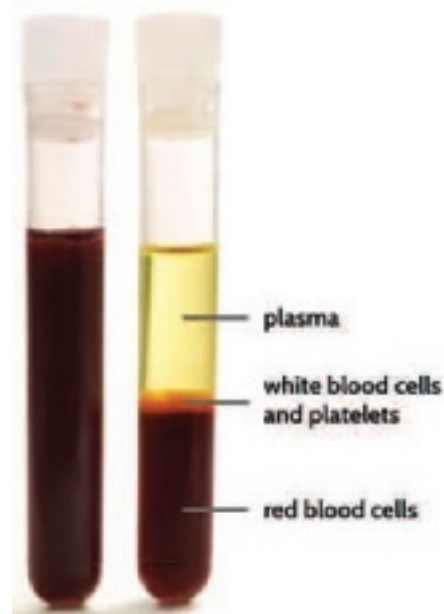
Blood is a mixture of blood cells, water, food particles, vitamins, and electrolytes (different types of salts a body needs). In humans, blood cells make up about 45 percent of the volume of blood. The other 55 percent is blood plasma. The blood plasma itself is a yellowish liquid that is about 92 percent water. About 7 percent of blood plasma is food particles. Vitamins and electrolytes make up the other 1 percent of blood plasma. One of the most important jobs of the blood plasma is to transport nutrients to various parts of the body. Blood plasma also carries waste products away from parts of the body.

When blood is drawn from a body, all its parts are mixed together. However, after it sits still for a while, the less dense blood plasma rises to the top and the denser blood cells settle toward the bottom.

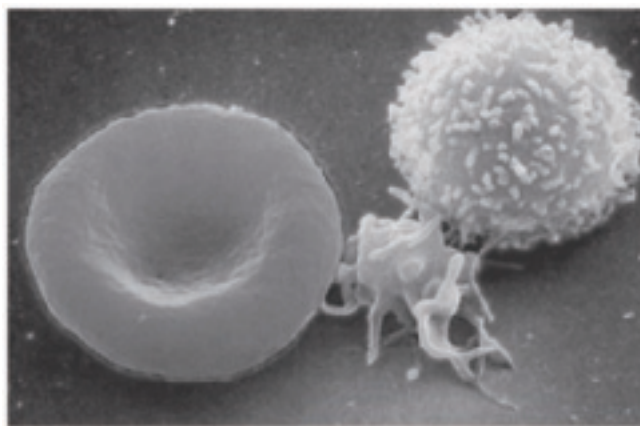
There are three main components found in the denser part of the blood that each serve different functions: red blood cells, white blood cells, and platelets. Most of the blood cells are red blood cells. Red blood cells have a round, flat, flexible shape with a dent in the middle on each side. They carry oxygen from the lungs throughout the body, and they can bend to fit in the smallest blood vessels. The blood also contains white blood cells, which aid in responding to diseases and infections. White blood cells generally have a sphere-like shape and are often, but not always, larger than red blood cells. The stain used on most slide preparations of blood makes the insides of white blood cells appear dark purple.

Finally, the job of the platelets is to help the blood clot—to help it form a “plug” when a blood vessel has been broken open or injured. Platelets stretch out tentacle-like arms and stick together on and around a damaged area. This helps prevent the blood from leaking out. When blood forms a clot on the surface of wounded skin and dries out to cover and protect the wound, it's called a scab. By volume, red blood cells make up much more of the blood than white blood cells or platelets. Altogether, white blood cells and platelets make up only about 1 percent of the blood's volume.

In the body, through the blood vessels, blood cells move around freely in the blood plasma. The food particles and other components of the plasma which are too small to see, even with a microscope, also move freely around the body through the blood vessels.



Nixx Photography, rights reserved



This image was taken with a high-powered electron microscope. OpenStax College CC BY 3.0

Sources:

- American Society of Hematology (2020). *Blood basics*. Retrieved from <https://www.hematology.org/education/patients/blood-basics>
- Hirsch, L. (2019, January). *Blood (for teens)*—Nemours KidsHealth. Retrieved from <https://kidshealth.org/en/teens/blood.html>
- Dean, L. (2005). *Blood and the cells it contains*. In *Blood Groups and Red Cell Antigens*. Bethesda, MD: National Center for Biotechnology Information. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK2263/>
- American Red Cross. (2020). *Blood components*. Retrieved from <https://www.redcrossblood.org/donateblood/how-to-donate/types-of-blood-donations/blood-components.html>
- James, G. N. (2016). *Platelets*. Retrieved from <https://www.ouhsc.edu/platelets/Platelets/platelets%20intro.html>
- American Red Cross. (2020). *Blood components*. Retrieved from <https://www.redcrossblood.org/donateblood/how-to-donate/types-of-blood-donations/blood-components.html>
- James, G. N. (2016). *Platelets*. Retrieved from <https://www.ouhsc.edu/platelets/Platelets/platelets%20intro.html>

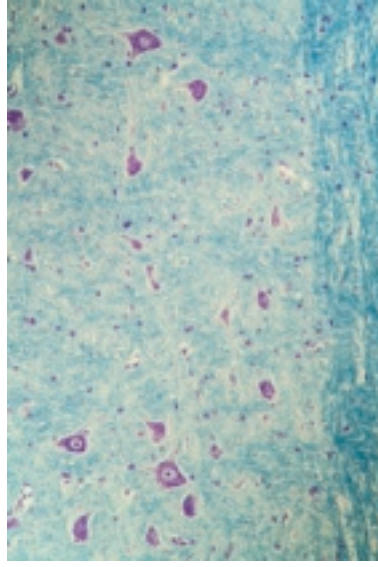
Name: _____

Date: _____

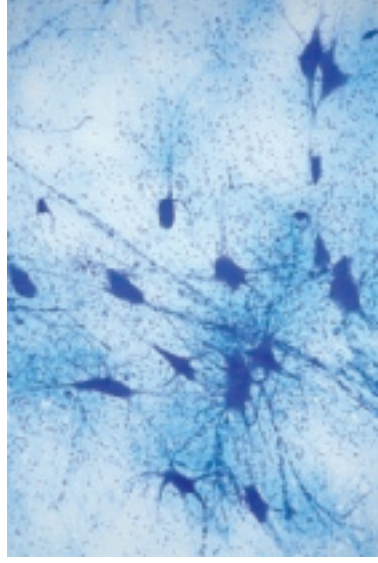
Under the Microscope: Images of Nerves

Investigation Question:

Images of nerves from a human:



Nerve smear at low magnification

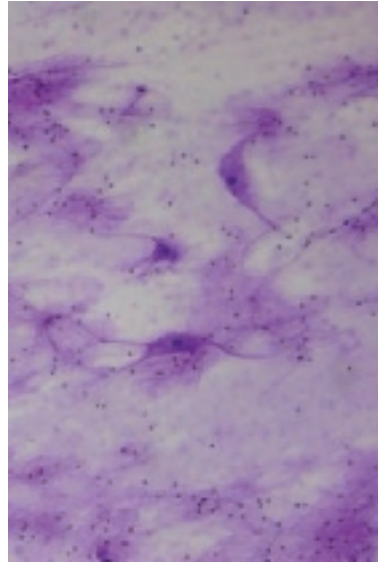


Nerve smear at medium magnification

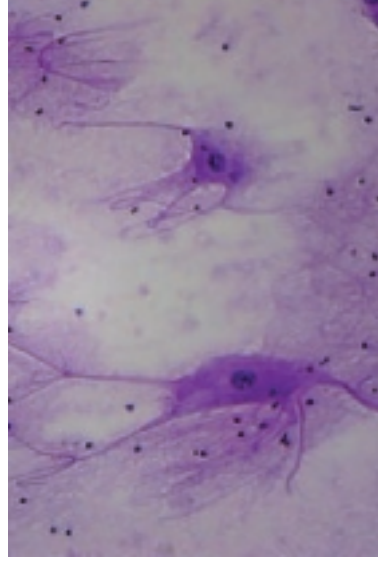


Nerve smear at high magnification

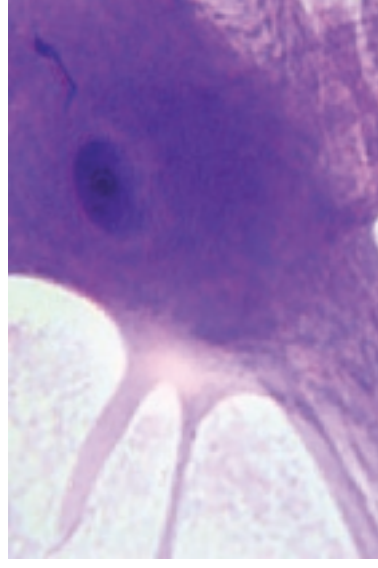
Images of nerves from an ox:



Nerve smear at low magnification



Nerve smear at medium magnification



Nerve smear at high magnification

Name: _____

Date: _____

Obtaining Information from Scientific Text

When reading to obtain information from scientific text...	
Read for the gist—skim the title, headings, and captions on images.	What is the central idea of the reading?
Markup the text.	Select methods for marking the text. For example... • Keep track of questions you have in the margins. • Circle key words. • Put question marks by words you want to learn more about. • Underline main ideas.
Examine any images, graphs, or tables.	Write one sentence about the central point of each image, graph, or table.
Identify the ideas from the text that support what you've figured out so far.	What are the supporting ideas?

Reading: The Body's Nervous System

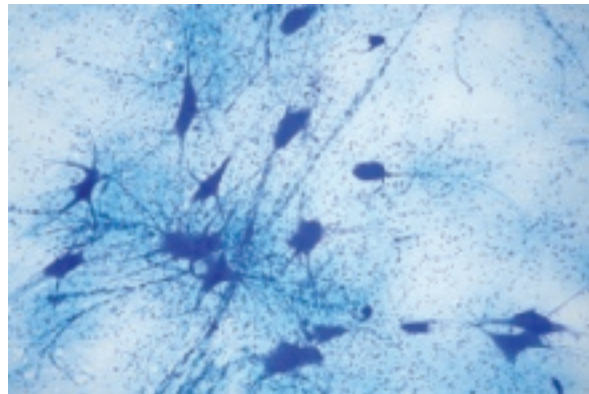
Whenever you feel the softness of a kitten's fur or taste the buttery goodness of a fresh cinnamon roll, your nerves are hard at work. Nerves are found all over the body, where they connect and transmit signals to different areas. In general, nerves behave much like the electrical wiring in a house, as they function to transmit—or pass along—signals between different parts of the body and the brain. The brain and spinal cord are parts of the body that help control different processes in the body. They are made up of billions of nerves that work together to contribute to their function.

How do nerves work?

Nerves are made up of a series of nerve cells that form connections between one another, forming a network of nerves that reach every part of the body. Their unique structure supports their function, which allows the brain to receive and send signals throughout the body. Signals that originate in the body are detected by the parts of nerve cells that branch out from the center. If we look closely at images of nerve cells, we notice that they don't actually touch one another. Instead, it appears as though there is a gap between the branches of neighboring nerve cells. If the signal that reaches this gap is strong enough, it gets transmitted or sent across the gap to branches of the next nerve cell. This process continues as signals pass through nearby nerve cells until they reach the spinal cord and eventually the brain. In a similar way, signals from the brain move back out into the body. This happens so quickly that we are not even able to notice any time passing between when a signal travels from the body to the brain and back to the body again.



Nerve cells forming connections



Nerves in the Body

Nerves in the Body

The spinal cord is a cylinder-shaped bundle of nerves that connects the brain to other bundles of nerves that are spread throughout the body. If nerves were like roads, and signals were like cars traveling on that road, then the spinal cord would be like a giant highway. The various nerve bundles that branch out from the spinal cord are like the highway exits and smaller roads that allow signals to travel to and from the brain to all parts of the body.

The basic function of the nerves is to take in signals from the body and pass those signals between nerve cells, all the way to the spinal cord and on to the brain. The brain processes those signals and sends signals back out to the body. This process leads to a response or a reaction. For example, signals from the brain along the nerves tell muscles to move when you chew food, walk to school, or wave hello to your friends. If you fall and scrape your knee, the nerves in your skin send a signal to the brain that allows you to feel pain in the area of the scrape. This pain reaction makes us pay attention to the area that is injured, which usually leads us to be careful with the injured area and look for ways to protect it and help it heal.

Types of Nerve Cells

There are different types of nerve cells that work with different parts of the body. One type of nerve cell transmits messages from the brain to muscles, which cause parts of the body to move. A second type of nerve cell detects light, sound, odor, taste, touch, and heat, and sends signals about these inputs to the brain.

When you smell a delicious meal or feel someone holding your hand, this second type of nerve cell is at work. A third type of nerve cell helps control processes in your body that work automatically. For example, the beating of your heart, breathing in and out, and blinking are some of the body processes that happen automatically. The brain keeps track of these kinds of processes through this third type of nerve cell. Regardless of the type, all nerve cells have the same basic structure and carry out the same basic function.

Sources:

Eunice Kennedy Shriver National Institute of Child Health and Human Development. *What Are the Parts of the Nervous System?* October 1, 2018. Retrieved October 23, 2020, from <https://www.nichd.nih.gov/health/topics/neuro/conditioninfo/parts>

Zimmermann, K. *Nervous System: Facts, Function & Diseases*. February 14, 2018. Retrieved October 23, 2020, from <https://www.livescience.com/22665-nervous-system.htm>



Nerve bundles connected to the brain and spinal cord



Nerve bundles under low magnification



A single nerve cell

Name: _____

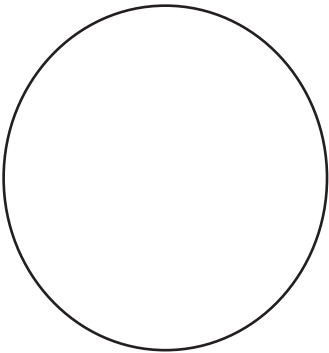
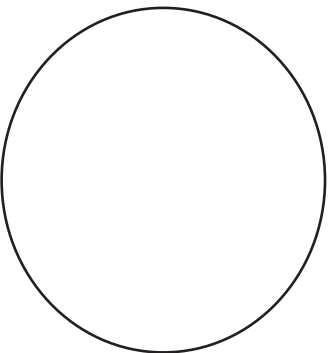
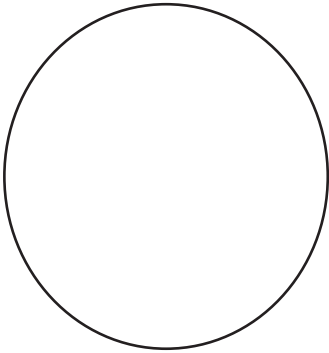
Date: _____

Investigating Skin, Bone, and Muscle with a Microscope

What investigation question(s) are you trying to answer?

Procedure:

1. Slides are fragile, so handle them gently and hold them by the edges.
2. Put the slide under the clips to hold it still.
3. Start with the lowest/shortest objective (4x, red, 40x total magnification).
4. Focus slowly! If you only see a blur of one color across your view, that's not what you're looking for.
5. Adjust the amount of light coming in through the slide so you can see better.
6. Observe what you can at this objective.
7. Change objectives to the next highest. Refocus, adjust the light, and observe.
8. Change to the highest objective. Refocus, adjust the light, and observe.
9. Choose the objective where you think you had the best view of the structures that make up this sample.
10. Looking at the sample with the best objective, record your observations in the data table.
11. When everyone in your group has seen and recorded observations of the first slide, follow your teacher's directions to observe another slide with this same procedure.

Sample	Total magnification	Draw what you observe at the best magnification	Use words and/or drawings to describe any patterns you see
			
			
			

Name: _____

Date: _____

DQB Questions or Parts of Questions We Have Answered

- 1. Read through the list of our Driving Question Board questions on the handout provided by your teacher.
- 2. Choose 2-4 from the list that you can answer or partially answer with evidence, and fill out the table below.

Question/part of question	Answer to question	Evidence

- 3. Highlight or circle the questions on the list that we have not yet answered.

Time-Lapse Video of Skin Healing Observations

With words and/or pictures, describe what happens as the injury heals in <https://youtu.be/2TywB7xxYd8>. As you notice what you can see with your eyes, remember to think about what might be happening with the cells at the microscopic scale as the skin heals.

	Beginning	Middle	End
Still image from time-lapse			
What I can see with my eyes			
What I think might be happening at the microscopic scale			

Name: _____

Date: _____

Observations to Evaluate Claims

Part 1: We will watch a short video and look at microscopic images to see what might be happening with cells when they fill the gap from an injury.

1. Record your class's claims that align with our How Does Skin Fill the Gap? poster in the left column.
2. Record what evidence you would expect to see that would support each claim in the right column.

Claims	Evidence that would support this claim

Part 2: Answer the following questions using the video, <https://youtu.be/9cg6xz0Y64k>.

3. Use words and/or drawings to record your observations of the cells over time in the video.

Draw the cells at the beginning of the video.	Draw what you see the cells doing during the video.	Draw the cells at the end of the video.

Use the space below to explain what you see happening over time with the cells.

4. How does this video connect to the skin healing video we watched in Lesson 8?

Part 3: Answer the following questions using *Alternate: Still Images from Cell Videos*.

5. In the table below, record similarities and differences you notice about the cells of the whitefish embryo.

Similarities between the cells of the whitefish embryo	Differences between the cells of the whitefish embryo

6. In the table below, record similarities and differences you notice about the cells of the onion root tip.

Similarities between the cells of the onion root tip	Differences between the cells of the onion root tip

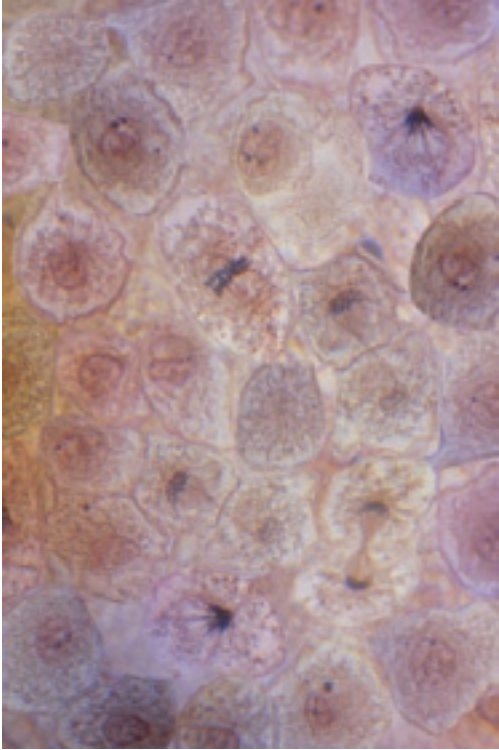
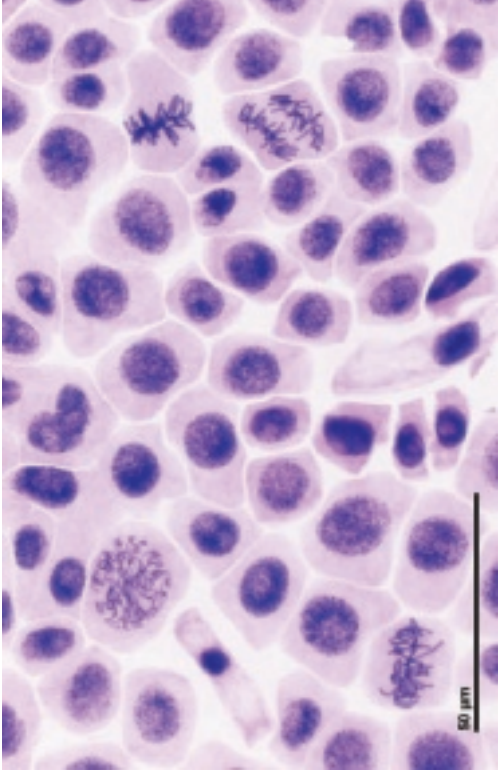
7. Use the space below to describe the similarities and differences you notice between the cells of the whitefish embryo and the onion root tip.

Similarities between the cells of the whitefish embryo and the onion root tip	Differences between the cells of the whitefish embryo and the onion root tip

Part 4: Consider how making observations at different scales has helped us in our learning.

8. How did zooming in help us collect the evidence we needed?
9. What are some things you noticed in these videos that reminded you of previous lessons where we zoomed in and out to examine cells at varying scales?

Microscopic Images of Cells Splitting

Organism: Whitefish Embryo	Organism: Onion Root Tip
 A light micrograph of a whitefish embryo section. The tissue is stained with hematoxylin and eosin (H&E), showing a variety of cell types and structures. Several cells are in different stages of mitosis, with visible chromosomes and spindle fibers. The overall color palette is dominated by pinks and purples from the stain.	 A light micrograph of an onion root tip section. The cells are large and polygonal, stained with H&E. Several cells are in different stages of mitosis, with visible chromosomes and spindle fibers. A scale bar in the bottom right corner indicates 50 μm.

Name: _____

Date: _____

Lesson 10: Obtaining Information from Scientific Text

When reading to obtain information from scientific text...	
Read for the gist—skim the title, headings, and captions on images.	What is the central idea of the reading?
Markup the text.	Select methods for marking the text. For example... • Keep track of questions you have in the margins. • Circle keywords. • Put question marks by words you want to learn more about. • Underline main ideas.
Examine any images, graphs, or tables.	Write one sentence about the central point of each image, graph, or table.
Identify the ideas from the text that support what you've figured out so far.	What are the supporting ideas?

Name: _____

Date: _____

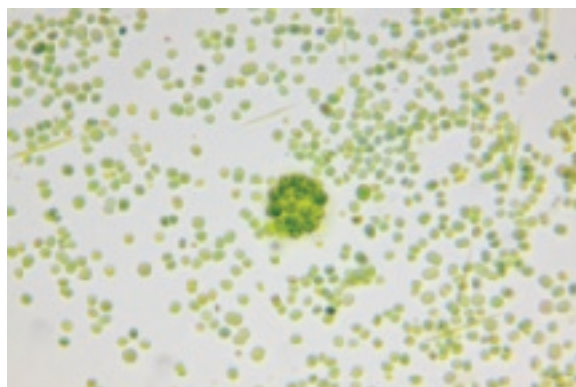
Reading: Algae

You just got a new fish tank, and you promised to clean it and take good care of the fish. But after just a few weeks, it has started to get cloudy and green. You can barely see the fish in the tank! Since you've been cleaning the tank, you're wondering why it still seems so dirty. However, the green color you see is not dirt. If you observe just a drop of that green water under a microscope, you will discover the reason for the green color. There are millions of microscopic organisms called algae living in your fish tank.



Is algae a plant?

Though most of the algae in a fish tank is unicellular, or single-celled, algae can also be multicellular and resemble a plant. Like plants, all algae use light plus air, water, and minerals to help them make more cells. Unlike multicellular plants, unicellular algae do not have roots, stems, and leaves.



Where does algae live?

Since every cell of algae requires water, you often find it in freshwater ponds and lakes or in saltwater oceans. However, if there is enough moisture available, you can also find algae growing on rocks or in soil. Because algae is found in or near every ocean around the world, different algae have very different appearances. Not all algae are green! Some can be golden, brown, or red in color. One type of algae called *diatoms* have hard cell walls containing silica, which is sometimes crushed and put into toothpaste or other cosmetics! Diatoms can live anywhere from 24 hours to about 6 days!

Amazingly, there is another type of single-celled algae that you can actually see without a microscope. The *Valonia ventricosa*, known commonly as bubble algae, is nearly 9cm across and is one the largest single-celled organisms in the world!



Think about the following questions as you complete this reading:

- What do you notice about this organism that's similar to or different from the other organisms and cells we've seen?
- How does this organism's structure and function relate to where it lives? Why do you think it lives where it does?
- Do they relate to our healing story? If so, how?

Sources:

- Gooding, E. (2011). *Algae vs. plants*. Retrieved from <http://simply-science-nbep.blogspot.com/2011/06/algae-vs-plants.html>
- Crew, B. (2019). *This bizarre bubble creature is a single living cell*. Retrieved from <https://www.australiangeographic.com.au/blogs/creatura-blog/2019/04/this-bizarre-bubble-creature-is-a-single-living-cell>
- Encyclopedia.com. (2018). *Algae*. Retrieved from <https://www.encyclopedia.com/plants-and-animals/microbes-algae-and-fungi/moneran-and-protistan/algae>

Name: _____

Date: _____

Reading: Archaea

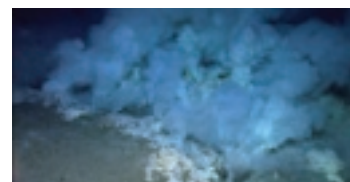
It's midday in the summer. The Sun is up, the sky is clear, and it feels like an oven outside! You are anxious to find some shade, a breeze, or get inside with some air conditioning. How could anyone live full-time in this heat? Now imagine that it's over 100°F every day, and that you live near a pool of acid! If you think this sounds harsh, welcome to the world of archaea. These single-celled organisms enjoy living in some of the most extreme environments on Earth. Whether by boiling hot springs surrounding a volcano or the deepest vents on the ocean floor (where temperatures can reach 236°F and the pressure is great enough to crush a car), archaea thrive where most other organisms cannot survive. Though the average lifespan of archaea is still being studied, some of the most common types reproduce every 3-6 hours.



What do archaea eat?

In such inhospitable conditions, there is little or no food available for most organisms to survive. However, archaea aren't like most organisms. They don't eat what we think of commonly as food. Instead, these tiny organisms can eat iron and sulfur from hot springs, ammonia from the soil, carbon dioxide from the air, uranium from deep in the Earth's crust, and other poisons found near toxic waste sites.

Their diet seems strange compared to other organisms, but archaea lived on Earth nearly 4 billion years ago when the atmosphere and oceans were likely filled with these poisonous substances.



NOAA



NASA

World changers

Scientists who study early life on Earth often identify archaea as one reason why we see such a diversity of bacteria, plants, and animals today. When consuming large quantities of carbon dioxide, iron, and sulfur, which were more common in Earth's early history, archaea turned them into nontoxic substances like oxygen. In this way, archaea changed the surface of Earth to make it more habitable for other organisms. Today, we find archaea living in nearly every habitat imaginable, including inside our own mouth, where they protect us by eating some of the toxic substances that we unknowingly ingest.



Think about the following questions as you complete this reading:

- What do you notice about this organism that's similar or different to the other organisms and cells we've seen?
- How does this organism's structure and function relate to where it lives? Why do you think it lives where it does?
- Do they relate to our healing story? If so, how?

Sources:

- No author. (2020). *Archaea*. Retrieved from <https://en.wikipedia.org/wiki/Archaea>
- Rowland, T. (2010) *Archaea: The third domain of life*. Retrieved from <https://www.independent.com/2010/02/05/archaea-third-domain-life/>
- No author. (n.d.). *Introduction to the archaea: Life's extremists*. Retrieved from <https://ucmp.berkeley.edu/archaea/archaea.html>
- Lundgren, M. (2007). *Exploring the cell cycle of archaea*. Retrieved from <https://www.diva-portal.org/smash/get/diva2:170194/FULLTEXT01.pdf>

Name: _____

Date: _____

Reading: Bacteria

What do a pinch of dirt, a spoonful of pond water, and a square inch of your skin have in common? They are all home to millions of bacteria! In fact, if we could travel to nearly anywhere on Earth and look with a microscope, we'd find bacteria. If we compare bacteria from all around our planet, they have some similarities. Bacteria are all microscopic, one-celled, or unicellular organisms. However, bacteria come in different shapes. Some are round like balls, others are long, and some are twisted like a corkscrew. Some have parts that look like tails and act like a motor to help them move. Unlike the cells in our body, bacteria do not have a nucleus.



Are bacteria helpful or harmful?

When we think of bacteria, we often worry about living creatures entering our body and making us sick. Though some bacteria cause disease and are harmful to humans, most don't affect us at all. Actually, there are bacteria that help us! For example, our intestines contain some bacteria that help us digest certain foods and other bacteria that kill germs in the food we eat. That helps us avoid getting sick! People in many cultures worldwide eat foods prepared with the help of bacteria, such as yogurt, cheese, or kimchi.



What do bacteria need to survive?

We are lucky to have some bacteria living inside us that help keep us healthy. But these bacteria are also lucky because our bodies give them a safe home with lots of food. Just like our own cells, bacteria need food to make energy to live and grow. However, many bacteria do not live inside humans or other living organisms. How do they get the food they need? Some bacteria, like those in soil, eat animals or plants that die and fall to the ground. Others don't need to find food at all because they can just use light and other substances in their environment like water, oxygen, carbon dioxide, ammonia, or sulfur to help them make more cells. Once bacteria have the proper nutrients available, they can grow and make copies of themselves very quickly. In fact, some bacteria can make new cells in as little as 20 minutes, which means that in just 12 hours, a single bacteria cell can form a group of nearly 70 billion cells. The average bacterium cell can live about an average of 12 hours. It's no wonder we find bacteria everywhere!

Think about the following questions as you complete this reading:

- What do you notice about this organism that's similar to or different from the other organisms and cells we've seen?
- How do this organism's structure and function relate to where it lives? Why do you think it lives where it does?
- Do they relate to our healing story? If so, how?

Sources:

- Yttri, J. (2017). *Bacteria: The good, the bad, and the ugly*. Retrieved from <https://www.center4research.org/bacteria-good-bad-ugly/>
- National Human Genome Research Institute. (n.d.). *Bacteria*. Retrieved from <https://www.genome.gov/genetics-glossary/Bacteria>
- Microbiology Society. (n.d.). *Bacteria: What is microbiology?* Retrieved from <https://microbiologysociety.org/why-microbiology-matters/what-ismicrobiology/bacteria.html>

Name: _____

Date: _____

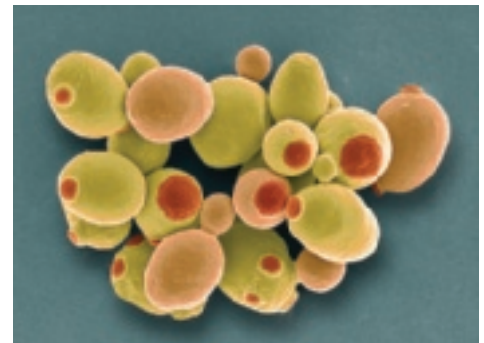
Reading: Yeast

Imagine pulling apart a soft, warm loaf of fresh sourdough bread. As you break through the crust, you notice little holes and empty pockets inside the bread. The outside of the loaf is not damaged—no mice or bugs have burrowed into it. So what could cause these holes inside a loaf of bread? It turns out that a single-celled organism called *yeast* creates those holes.



What is yeast?

Yeast is a type of fungus that is often found on plant leaves, flowers, and fruits. It can also be found in soil and in the intestines of some animals. Yeast is related to other types of multicellular fungi like mushrooms. However, yeast is a microscopic egg-shaped single-celled organism. Like human cells, yeast cells contain a nucleus and are more complex than most bacteria. Also like humans, yeast must digest food in order to get the energy they need to grow.



What does yeast eat?

If you have a sweet tooth, you have something in common with yeast! Yeast likes to eat all kinds of sugars, like those found in honey, maple syrup, fruits, cane sugar, and baking flour. Yeast cells digest sugar through a process called fermentation, which produces carbon dioxide. When making bread, yeast in the dough eats the sugars in the flour. As it digests the flour, the yeast makes carbon dioxide. This gas expands but remains trapped inside the stretchy dough. The carbon dioxide forms little bubbles, which then make the dough rise higher. The dough hardens as it bakes, and the bubbles burst, leaving behind empty pockets or holes throughout the loaf. Although the lifespan of yeast cells varies greatly depending on their environment, on average they live for one week, and double every 100 minutes.



Think about the following questions as you complete this reading:

- What do you notice about this organism that's similar to or different from the other organisms and cells we've seen?
- How does this organism's structure and function relate to where it lives? Why do you think it lives where it does?
- Do they relate to our healing story? If so, how?

Sources:

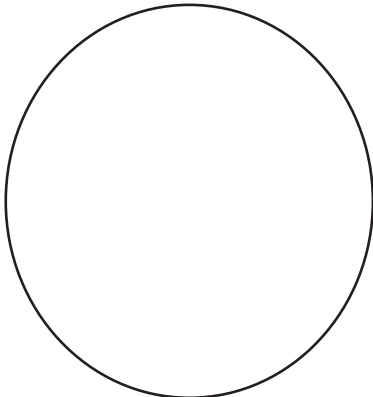
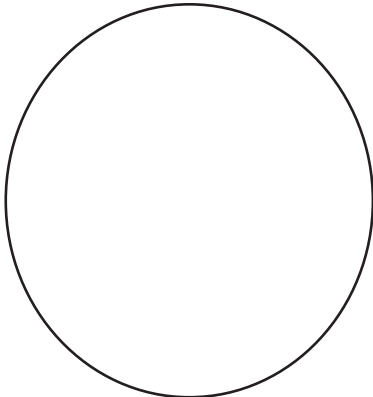
- Castro, J. (2013). *What is yeast?* Retrieved from <https://www.livescience.com/42140-what-is-yeast-candida.html>
- Red Star (n.d.) *What is Yeast?* Retrieved from <https://redstaryeast.com/science-yeast/what-is-yeast/>
- University of Southern California. (2008). *Life expectancy of yeast extended to 800 in yeast years, No apparent side effects.* Retrieved from <https://www.sciencedaily.com/releases/2008/01/080111123319.htm>

Name: _____

Date: _____

Data from Investigating Red Onion Cells

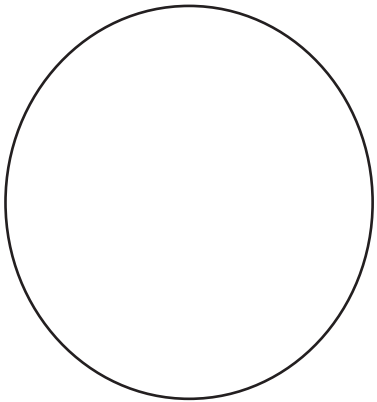
Follow the *Procedure to Investigate Structures in Red Onion Cells* for steps 1 to 8. Collect your data on this page and answer the questions on the following page.

Sample	Draw what you observe	Describe in words what you observe
Red onion skin + plain water at _____ total magnification		
Red onion skin + salt water at _____ total magnification		

1. What did you observe when you added plain water to the plant cells? What was different when you added the salt water?

2. Based on your observations so far, make a prediction: What do you think will happen if you now replace the salt water with plain water?

Follow the *Procedure to Investigate Structures in Red Onion Cells* for steps 9 through 16. Collect your data and answer the questions on this page.

Sample	Draw what you observe	Describe in words what you observe
Red onion skin + plain water again at _____ total magnification		

3. What changes did you observe after you added plain water again?

4. Explain using evidence from above what is happening to cause the changes you've observed in these cells.

5. What do you notice about how the cells of this plant are structured compared to the cells of animals we've already seen? What similarities and differences did you observe?

Name: _____

Date: _____

Directions: Look back at the data and science ideas you’ve recorded in your science notebook, Progress Tracker, and the posters we’ve made as a class. In the chart below, construct an explanation of how healing happened for these events on our Healing Timeline. Include evidence to support each of your explanations so that you can defend them when you share.

Event on the Timeline	Stitches removed and dissolved	Swelling lessened and gone
What we can explain about how healing happened for this event to occur	The stitches were no longer needed because	The swelling went away because
Evidence		

Pain gone and feeling returns to the foot	Cast no longer needed and pins removed	Regular shoe, no crutches needed
The pain was gone because	The cast and pins were removed because	The student could wear a regular shoe and walk without crutches because

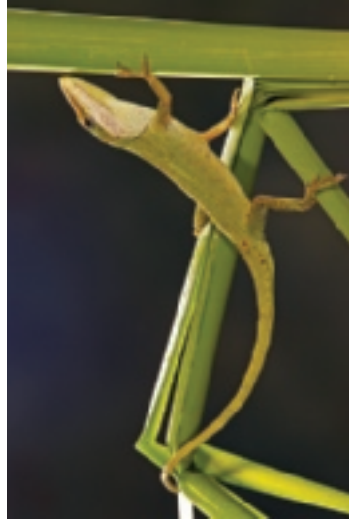
Name: _____

Date: _____

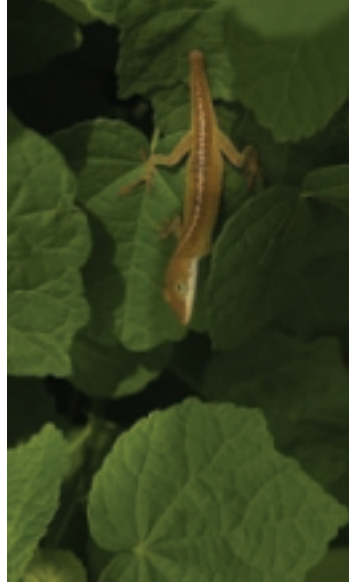
Lizard and Sea Star Injury Cases

Some types of lizards get injured and lose their tail as a result of being attacked by a predator. This is meant to happen as a way to protect the lizard from being caught by the predator and allows them to get to safety while the predator is distracted by their tail. Depending on the type of lizard, it can take anywhere from about 2 months to a year for the lizard's body to heal and have a tail again. Look at the images below of a type of lizard called a green anole to see what their tail looks like before this injury happens, after the injury has occurred and the tail is healing, and once the tail is healed. Then answer the questions below the images.

Green Anole Lizard before injury



Lizard tail healing



Lizard tail healed



Thinking about what we have figured out about how healing happens in our body, how do you think the process is similar and different for the healing of the lizard tail?

Similar to the healing process in our body	Different from the healing process in our body

Another organism, the sea star (or you might have heard it called a starfish), can also be injured in a similar way to the lizard. Sometimes sea stars will lose one of its arms if attacked by a predator, and other times they can voluntarily shed one of its arms to evade being caught by a predator. Over about a year, the sea star's body is able to heal so that it has the original number of arms. Analyze the images below and then answer the question.

Sea Star before injury 	Sea Star healing 	Sea Star healed 
---	--	--

Thinking about what we have figured out about how healing happens in our body, how do you think the process is similar and different for the healing of the sea star's arm?

Similar to the healing process in our body	Different from the healing process in our body

If the process for healing in our body is the same for other living things, like the green anole and the sea star, what additional data would we need in order to figure out if the healing process is the same for all of these living things?

Name: _____

Date: _____

Home Learning: How do we support healing?

Directions: Go home and ask people in your community about some of their healing experiences. Use the prompts as you ask them about these experiences and record their responses below. Bring this back next time to share with the class.

1. Ask whether they have ever experienced using any of the supports we have talked about to help their body heal from an injury.
2. Ask how these supports helped their body heal and allowed them to participate in everyday life.
3. Ask about additional types of supports the people in your community have used to help their body heal from an injury that we haven't looked at in class.

Transcript: Interview with Student from Lesson 1

Post Injury Interview

Part one:

Interviewer: Can you tell us a little bit about what you remember about your injury? What happened and how you felt after it happened?

Student: Yeah, so my injury was from dropping a weight on my foot that started to spook me out. And then a little bit of pain came in and I remember trying to go directly to the nearest chair. Trying to run quickly. And it kind of became a hobble. Then I realized that I had injured my foot and the circumstances, um, that I was in was terrible. It caused me to miss my last basketball game. So, it was sad, obviously. I have never been in surgery. I didn't know if I needed surgery or if it was just a normal break. I had broken bones before. And as time went on from getting onto a stretcher to an ambulance, to going to the hospital, the pain increased immensely.

Interviewer: Can you tell us a little bit more about what your daily life was like after surgery?

Student: Yeah. So, after I had surgery, I had to stay in the hospital for a day. And it was just kind of like an observatory process for the hospital. I vaguely remember the surgeon saying something like, if you weren't here within the hour, we could have had to take your toes off or something scary. So, I was at the hospital for a day, which included getting used to using crutches and a very makeshift cast.

And they had done something to make that a little easier for me too, considering I couldn't put any pressure on my foot. They put a heel in the cast—in every cast that I had throughout the process, and it was just something for me to be able to put pressure on without hurting the foot. So it was a difficult process.

Interviewer: How did it affect getting around at school? Like, did it make it harder?

Student: Yeah, well, I had disability accommodations. I had someone I got to choose to walk around the school with me, carry my things and get out of class early, which for a student, it was great. But as a person kind of sucked because it just meant it was another thing to worry about. Because it was difficult to move between classes when the hallways were crowded at the typical times. And then missing out on other opportunities, like playing sports or doing really any other physical activity. If you're walking, running, whatever, it requires your legs.

Part two:

Interviewer: I know you had mentioned that it led to you missing a basketball game when this happened. Were you, or are you, able to play basketball again?

Student: Yes, totally. At first, the expectation was that it was going to take 50% longer. It was supposed to be like three months longer. And the transition into playing sports again was supposed to take a lot longer, too. Thanks to physical therapy, doing things that helped build muscle primarily in my foot, I think part of the benefit is having experience with being active and being engaged in physical activity prior to my injury cause it was easy then for me to go through physical therapy and get back to like walking on my foot again.

After getting my cast off, I remember shooting baskets, not jumping and stuff. But eventually, yeah, about a year after the injury itself, I was back to playing basketball almost fully. I don't know if that was like a good thing or a bad thing. It was more so like, "I'd like to do this and I'm going to do this." So I tried it and it ended up being OK. The only difference physically was jumping and my confidence in the amount of weight that I could sustain after my injury and going back into physical activity. I remember it was about a half a year or so until I was comfortable doing all the physical activities I was engaged in. For that half year-ish, I was really afraid to take full jumps or strides and leaps and stuff on my foot. For basketball, yes, I was able to get back into it. It was a slow transition because of the fear of injuring myself again.

Interviewer: Why did you like playing basketball? Or why do you like playing basketball?

Student: I liked playing basketball because it gave me a "no choice" commitment to a purpose. When you're going through school, there's all of these different things that you're doing in your day to day activities that almost

becomes a blur from whatever 8:00 AM till whenever the bell rings. And after that, I found if I wasn't filling that time with something meaningful and purposeful, I'd get bored. And so joining a basketball team or playing sports is a commitment that isn't based off of a grade. Everything I did in basketball or in certain sports was in a sense decided by me.

I had, like, breakfast and shower before school. I had my family. Go to school and it's like a blur of classes. And then there's a section after school and it's my choice of how I want to fulfill that. And what gave me the most fulfillment was choosing to fill it with another family or camaraderie-based extracurricular activity.

Interviewer: Do you find that with activities you do now?

Student: My activities I do now, I still skateboard. I play basketball when I can. But I don't know.

I mean, I get the same thing out of what I'm pursuing—totally—out of studying design, out of being in a creative field, because it's almost like I'm working with a team in everything that I'm doing. In a creative field, there's thousands of different jobs—of positions—that come together to orchestrate a final product, whatever it is from start to finish. Delegating my tasks to other people or trusting other people to do certain things...it's very similar to being on a basketball court and trusting my teammates to perform the same way that I would be, or to put in the same effort that I would be to perform. So, totally. I get the same camaraderie feeling and the team feeling from it.

Part three:

Interviewer: This happened years ago, if I were to ask you about your foot, how does it look today, does it look the same as before your injury?

Student: The incision point, which is still very visible, it's a scar on top of my foot in a—almost like the inside of a peace sign, like a Y. And I can see that now; it's still physically there. Like, I don't think it'll go away for years. I didn't have much hair on my foot. I have a lot of hair on that foot specifically, which is really interesting. It was like, almost like, not only was my bone regrowing and regenerating, my cells and my skin and my muscle and tissue around my bone was also regenerating, which is weird because when I took the cast off, my calf went skinnier, you could see physically that there was less tissue around my bones. Now, there's no physical difference between my legs besides on the foot where it was injured. For a long time up until recently I could feel the spots where the pins had been pulled out and I could feel what I thought on the bottom, it was almost like knobs there.

Interviewer: Well, thank you so much for sharing your story with us and telling us about how your injury has healed.

Name: _____

Date: _____

Wheelchair Icons

Below are two icons used to indicate spaces for someone with a wheelchair. Analyze the two icons and answer the questions below:



Based on Susanne Koefoed/Federal Highway Administration - MUTCD and The Accessible Icon Project

1. What things do you notice are similar between these icons?
2. What do you notice that is different between the two icons?
3. What do each of these icons suggest about people with disabilities?
4. How could each sign affect people's perception about people who use wheelchairs? (Consider both the perspectives of people who use wheelchairs and people who do not.)

Transcript of Rosie King's TED Talk

How Autism Freed Me To Be Myself TED Talk Transcript from Rosie King

Rosie King

(00:12) I haven't told many people this, but in my head, I've got thousands of secret worlds all going on all at the same time. I am also autistic.

(00:23) People tend to diagnose autism with really specific check-box descriptions, but in reality, it's a whole variation as to what we're like. For instance, my little brother, he's very severely autistic. He's nonverbal. He can't talk at all. But I love to talk. People often associate autism with liking maths and science and nothing else, but I know so many autistic people who love being creative. But that is a stereotype, and the stereotypes of things are often, if not always, wrong.

(00:57) For instance, a lot of people think autism and think "Rain Man" immediately. That's the common belief, that every single autistic person is Dustin Hoffman, and that's not true. But that's not just with autistic people, either. I've seen it with LGBTQ people, with women, with POC people. People are so afraid of variety that they try to fit everything into a tiny little box with really specific labels.

(01:27) This is something that actually happened to me in real life: I googled "autistic people are ..." and it comes up with suggestions as to what you're going to type. I googled "autistic people are ..." and the top result was "demons." That is the first thing that people think when they think autism. They know. (Laughter)

(01:56) One of the things I can do because I'm autistic — it's an ability rather than a disability — is I've got a very, very vivid imagination. Let me explain it to you a bit. It's like I'm walking in two worlds most of the time. There's the real world, the world that we all share, and there's the world in my mind, and the world in my mind is often so much more real than the real world.

(02:19) Like, it's very easy for me to let my mind loose because I don't try and fit myself into a tiny little box. That's one of the best things about being autistic. You don't have the urge to do that. You find what you want to do, you find a way to do it, and you get on with it. If I was trying to fit myself into a box, I wouldn't be here, I wouldn't have achieved half the things that I have now.

(02:43) There are problems, though. There are problems with being autistic, and there are problems with having too much imagination. School can be a problem in general, but having also to explain to a teacher on a daily basis that their lesson is inexplicably dull and you are secretly taking refuge in a world inside your head in which you are not in that lesson, that adds to your list of problems. (Laughter)

(03:12) Also, when my imagination takes hold, my body takes on a life of its own. When something very exciting happens in my inner world, I've just got to run. I've got to rock backwards and forwards, or sometimes scream. This gives me so much energy, and I've got to have an outlet for all that energy. But I've done that ever since I was a child, ever since I was a tiny little girl. And my parents thought it was cute, so they didn't bring it up, but when I got into school, they didn't really agree that it was cute.

(03:55) It can be that people don't want to be friends with the girl that starts screaming in an Algebra lesson. And this doesn't normally happen in this day and age, but it can be that people don't want to be friends with the autistic girl. It can be that people don't want to associate with anyone who won't or can't fit themselves into a box that's labeled normal. But that's fine with me, because it sorts the wheat from the chaff, and I can find which people are genuine and true and I can pick these people as my friends.

(04:13) But if you think about it, what is normal? What does it mean? Imagine if that was the best compliment you ever received. "Wow, you are really normal." (Laughter) But compliments are, "you are extraordinary" or "you step outside the box." It's "you're amazing." So if people want to be these things, why are so many people striving to be normal? Why are people pouring their brilliant individual light into a mold? People are so afraid of variety that they try and force everyone, even people who don't want to or can't, to become normal. There are camps for LGBTQ people or autistic people to try and make them this "normal," and that's terrifying that people would do that in this day and age.

(05:02) All in all, I wouldn't trade my autism and my imagination for the world. Because I am autistic, I've presented documentaries to the BBC, I'm in the midst of writing a book, I'm doing this — this is fantastic — and one of the best things that I've achieved, that I consider to have achieved, is I've found ways of communicating with my little brother and sister, who as I've said are nonverbal. They can't speak. And people would often write off someone who's nonverbal, but that's silly, because my little brother and sister are the best siblings that you could ever hope for. They're just the best, and I love them so much and I care about them more than anything else.

(05:43) I'm going to leave you with one question: If we can't get inside the person's mind, no matter if they're autistic or not, instead of punishing anything that strays from normal, why not celebrate uniqueness and cheer every time someone unleashes their imagination?

(06:00) Thank you. (Applause)

Name: _____

Date: _____

Transcript of Sinéad Burke's TED Talk

Access a video of Sinéad's TED Talk at: https://youtu.be/RD_SLJG7oi8

Why Design Should Include Everyone **TED Talk Transcript from Sinéad Burke**

Sinéad Burke

(00:12) I want to give you a new perspective. That sounds grandiose, and it is. I left Ireland yesterday morning. I traveled from Dublin to New York independently. But the design of an airport, plane and terminal offers little independence when you're 105 and a half centimeters tall. For Americans, that's 3' 5".

(00:39) I was whisked through the airport by airline assistants in a wheelchair. Now, I don't need to use a wheelchair, but the design of an airport and its lack of accessibility, means that it's my only way to get through. With my carry-on bag between my feet, I was wheeled through security, preclearance, and I arrived at my boarding gate. I use the accessibility services in the airport because most of the terminal is just not designed with me in mind.

(01:11) Take security, for example. I'm not strong enough to lift my carry-on bag from the ground to the carousel. I stand at eye level with it. And those who work in that space for safety purposes cannot help me and cannot do it for me. Design inhibits my autonomy and my independence. But traveling at this size, it isn't all bad. The leg room in economy is like business class. (Laughter)

(01:44) I often forget that I'm a little person. It's the physical environment and society that remind me. Using a public bathroom is an excruciating experience. I walk into the cubicle but I can't reach the lock on the door. I'm creative and resilient. I look around and see if there's a bin that I can turn upside down. Is it safe? Not really. Is it hygienic and sanitary? Definitely not. But the alternative is much worse. If that doesn't work, I use my phone. It gives me an additional four-to six-inch reach, and I try to jam the lock closed with my iPhone. Now, I imagine that's not what Jony Ive had in mind when he designed the iPhone, but it works.

(02:36) The alternative is that I approach a stranger. I apologize profusely and I ask them to stand guard outside my cubicle door. They do and I emerge grateful but absolutely mortified, and hope that they didn't notice that I left the bathroom without washing my hands. I carry hand sanitizer with me every single day because the sink, soap dispenser, hand dryer, and mirror are all out of my reach.

(03:10) Now, the accessible bathroom is somewhat of an option. In this space, I can reach the lock on the door, the sink, the soap dispenser, the hand dryer, and the mirror. Yet, I cannot use the toilet. It is deliberately designed higher so that wheelchair users can transfer across with ease. This is a wonderful and necessary innovation, but in the design world, when we describe a new project or idea as accessible, what does that mean? Who is it accessible to? And whose needs are not being accommodated for?

(03:51) Now, the bathroom is an example of where design impinges upon my dignity, but the physical environment impacts upon me in much more casual ways too, something as simple as ordering a cup of coffee. Now, I'll admit it. I drink far too much coffee. My order is a skinny vanilla latte, but I'm trying to wean myself off the syrup.

(04:14) But the coffee shop, it's not designed well, at least not for me. Queuing, I'm standing beside the pastry cabinet and the barista calls for the next order. "Next, please!" they shout. They can't see me. The person next to me in the queue points to my existence and everyone is embarrassed. I order as quick as I can and I move along to collect my coffee. Now, think just for a second. Where do they put it? Up high and without a lid. Reaching up to collect a coffee that I have paid for is an incredibly dangerous experience.

(04:54) But design also impinges on the clothes that I want to wear. I want garments that reflect my personality. It's difficult to find in the childrenswear department. And often womenswear requires far too many alterations. I want shoes that reflect my maturity, professionalism and sophistication. Instead, I'm offered sneakers with Velcro straps and light-up shoes. Now, I'm not totally opposed to light-up shoes. (Laughter)

(05:24) But design also impacts on such simple things, like sitting on a chair. I cannot go from a standing to a seated position with grace. Due to the standards of design heights of chairs, I have to crawl on my hands and knees just to get on top of it, whilst also being conscious that it might tip over at any stage.

(05:47) But whilst design impacts on me, whether it's a chair, a bathroom, a coffee shop, or clothes, I rely on and benefit from the kindness of strangers. But not everybody is so nice. I'm reminded that I'm a little person when a stranger points, stares, laughs, calls me a name, or takes a photograph of me. This happens almost every day. With the rise of social media, it has given me an opportunity and a platform to have a voice as a blogger and as an activist, but it has also made me nervous that I might become a meme or a viral sensation, all without my consent.

(06:38) So let's take a moment right now to make something very clear. The word "midget" is a slur. It evolved from PT Barnum's era of circuses and freak shows. Society has evolved. So should our vocabulary. Language is a powerful tool. It does not just name our society. It shapes it.

(07:04) I am incredibly proud to be a little person, to have inherited the condition of achondroplasia. But I am most proud to be Sinéad. Achondroplasia is the most common form of dwarfism. Achondroplasia translates as "without cartilage formation." I have short limbs and achondroplastic facial features, my forehead and my nose. My arms do not straighten fully, but I can lick my elbow. I'm not showing you that one.

(07:37) Achondroplasia occurs in approximately one in every 20,000 births. 80 percent of little people are born to two average-height parents. That means that anybody in this room could have a child with achondroplasia.

(07:51) Yet, I inherited my condition from my dad. I'd like to show you a photo of my family. My mother is average height, my father is a little person and I am the eldest of five children. I have three sisters and one brother. They are all average height. I am incredibly fortunate to have been born into a family that cultivated my curiosity and my tenacity, that protected me from the unkindness and ignorance of strangers and that armed me with the resilience, creativity, and confidence that I needed to survive and manipulate the physical environment and society. If I was to pinpoint any reason why I am successful, it is because I was and I am a loved child. Now, a loved child with a lot of sass and sarcasm, but a loved child nonetheless.

(08:50) In giving you an insight into who I am today I wanted to offer you a new perspective. I wanted to challenge the idea that design is but a tool to create function and beauty. Design greatly impacts upon people's lives, all lives. Design is a way in which we can feel included in the world, but it is also a way in which we can uphold a person's dignity and their human rights. Design can also inflict vulnerability on a group whose needs aren't considered.

(09:26) So today, I want your perceptions challenged. Who are we not designing for? How can we amplify their voices and their experiences? What is the next step? Design is an enormous privilege, but it is a bigger responsibility. I want you to open your eyes.

(09:48) Thank you so much. (Applause)

Science Literacy Exercise Page 1

Use with Reading Collection 1

Roadmap for Reading

This week's reading collection focuses on skeletons. The selections include an article about a robotic skeleton and health problems of humans related to the tissues and organs that move the skeleton.

Collection 1: "Body Parts (and Breaking Them)" consists of five selections.

1. Robots: Helpers or Competitors?
2. Skeleton Diversity
3. Living with Ehlers-Danlos
4. No Pain, No Gain
5. Mending Broken Bones

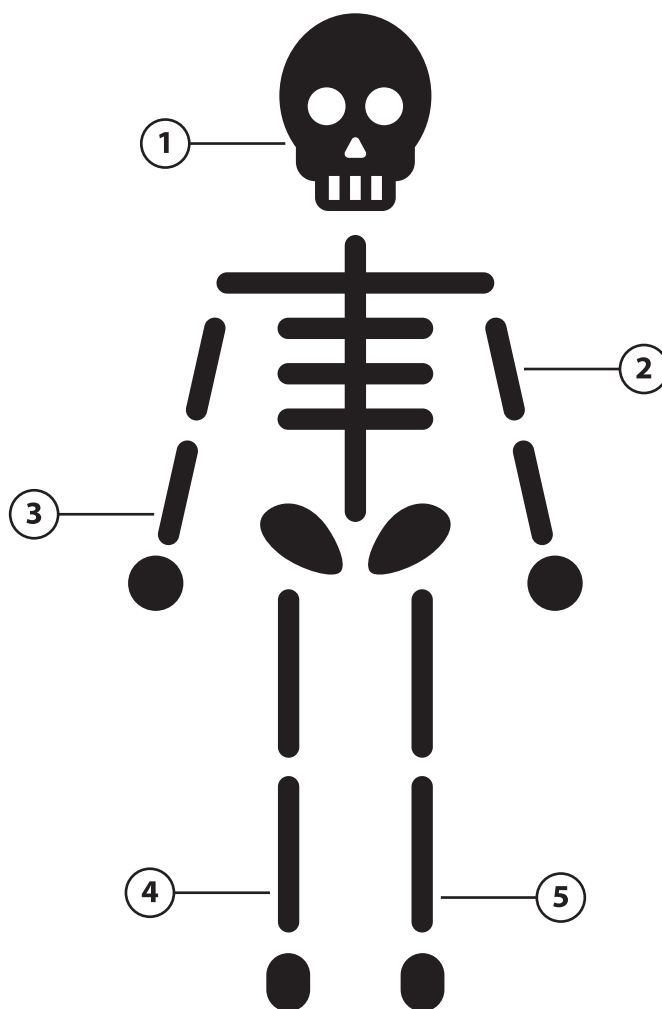
As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how images support the narrative text and how narrative text clarifies the images.
- Look for cause-and-effect relationships that can help you predict certain health outcomes.

Written Response

Your writing exercise is to respond to the reading with a graphic organizer that shares one fact from each selection that you found interesting. Each fact should refer to a cause-and-effect relationship.

- Draw your graphic organizer on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Copy the skeleton organizer template shown at the right onto your paper, leaving enough space to write a sentence next to each number.
- Write a complete sentence, in your own words, describing a fact you found most interesting from the first reading next to the number 1. Do the same for each of the remaining four readings.
- Make sure all the facts are related to skeletons, bones, and other tissues and organs that function to move the skeleton.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Five Fascinating Facts

Exercise Page 1, continued

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The facts seem haphazardly chosen, not related to skeletons, and there are several errors in the statements.	The facts are adequately chosen, mostly related to skeletons, interesting, and generally accurately stated; cause-and-effect relationships are not present in all facts.	The facts are well chosen, describe cause-and-effect relationships related to skeletons, are interesting, and are accurately stated.	
Relationships of concepts	Two or more readings are not represented. Linking lines and numbers show relationships to the reading selections clearly and correctly.	One reading is not represented. Linking lines and numbers show relationships to the reading selections clearly and correctly.	All five readings are represented. Linking lines and numbers show relationships to the reading selections clearly and correctly.	
Design	Major improvements are needed in the design of the heading, text, drawing numbers, and arrangement to fill the page.	All but one of the following are well executed: headings, text, drawing the skeleton, and filling the whole page.	The heading and text are easy to read; the skeleton drawing is attractive; the organizer fills the whole page effectively.	
Grammar and mechanics	Four or more errors in punctuation, capitalization, and spelling are present.	One or two facts are not expressed as complete sentences. One to three errors in punctuation, capitalization, and spelling are present.	Complete sentences are used, and there are no errors in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 2

Use with Reading Collection 2

Roadmap for Reading

This week's reading collection focuses on situations that take place inside the human body and are not obvious on the outside. The selections include a first-person account of being in an avalanche and an advertisement with some bad science.

Collection 2: "Inside the Body" consists of four selections.

1. Imaging Injuries
2. Threatened—and Saved—by the Cold
3. Blood Doping
4. Copper as Pain Reliever

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how images and graphics support the narrative text and how narrative text clarifies the images and graphics.
- Consider how knowledge you gained from class investigations and discussions relates to each reading.

Written Response

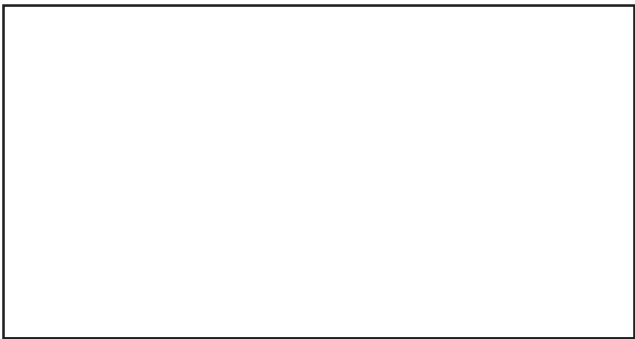
Your writing exercise is to create a meme that has two parts: "What People Think Happens" and "What Really Happens."

- Compose your meme on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Draw two boxes, and write titles for them, as shown in the template on the other side of this page.
- In the top box, draw and write about what people may think or what you thought about one of the topics in this collection.
- In the bottom box, draw and write what you learned by reading to better understand the topic.
- Keep your text brief and entertaining—no more than a line or two.
- Try to use science terms from this collection.
- Make sure your meme meets your school rules and is not offensive.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

What People Think Happens



What Really Happens



Evaluation Guidelines

Element	1	2	3	Feedback
Content	There is not a clear comparison in the meme. The science is inaccurate or unclear. The images and text seem unconnected.	The meme adequately compares what people think about the human body to the actual science. There is a minor inaccuracy in the science, but the overall message comes across.	The meme successfully compares what people think about the human body to the actual science. The “What Really Happens” box contains clearly summarized, accurate science. The two boxes work together effectively.	
Design	The template was not used as a model. The text is difficult to read.	The images and text mostly fill their rectangles. The text is readable related to the image.	The images and text fill their rectangles. The text is bold, easy to read, and well positioned related to the image.	
Grammar and mechanics	Two or more errors are present that were not intentional for comedy’s sake or space reasons.	At least one error is present that is not intentional for comedy’s sake or space reasons.	Any grammar errors present are intentional for comedy’s sake or space reasons.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 3

Use with Reading Collection 3

Roadmap for Reading

This week's reading collection focuses on cells and health. The selections include a journal entry from a fictitious Peace Corps volunteer and a list of recommended products from a mock wellness magazine.

Collection 3: "Cells, Health, and Healing" consists of five selections.

1. Cell Types
2. The Rise and Fall of Cells
3. Extreme Cells
4. Healing Tissues and Replacing Cells
5. Wellness and Health

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how scientific terms are presented, and look for textual clues to their meanings.
- Consider how each part of the reading relates to knowledge you gained from your class investigations and discussions.

Written Response

Your writing exercise is to choose one of the selections in this collection and answer three questions about it.

- Copy the graphic organizer shown at the right on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Write the title of the selection you are responding to along the left side of the organizer.
- Then, answer each of the following questions:
 - *What was one thing you read about in this selection that you already knew?*
 - *What was one thing you read that was new to you?*
 - *What was one part that was difficult to understand?*
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Title:	What did I already know?
	What was new to me?
	What was difficult to understand?

Evaluation Guidelines

Element	1	2	3	Feedback
Making meaning of reading	Questions are not all answered, were not clearly about the reading selection identified, or the answers lacked sufficient detail.	Adequate analysis shows some understanding of what the reader knows but does not show understanding that it is acceptable to not understand parts of what they read.	Thorough and personal analysis of the reading shows understanding of what the reader knows and does not know and acknowledges that it is acceptable to not understand parts of what they read.	
Style of writing	Answers to questions are too sketchy or brief to be clear.	Answers to questions are not all complete sentences or lack clear transitions.	Answers to questions are complete sentences with clear transitions as needed.	
Grammar and mechanics	Six or more errors are present in punctuation, capitalization, and spelling.	Three to five errors are present in punctuation, capitalization, and spelling.	Fewer than three errors are present in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

Science Literacy Exercise Page 4

Use with Reading Collection 4

Roadmap for Reading

This week's reading collection focuses on healing, repair, and people living with physical disabilities. The selections include an explanation of how one salamander species regrows lost limbs. Will scientists one day be able to apply their understanding to humans?

Collection 4: "Growth, Development, and Difference" consists of four selections.

1. Will Humans Be Able to Regrow Limbs?
2. Spare Parts
3. Bum Ligament: Reconstruction or PRP?
4. Living and Thriving with Physical Disadvantages

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how two parts of a selection contrast and complement one another.
- Consider how each part of the reading relates to the story of Maddy introduced in the Preface.

Written Response

Your writing exercise is to complete a thoughtful paragraph that refers to systems within living things and systems for supporting living things.

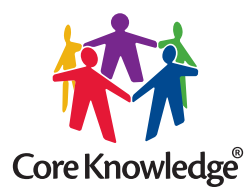
- Compose your paragraph on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Choose one of the following topic sentences as a claim.
 - *Someday, Maddy may decide that it is time to get a new left hand.*
 - *Someday, Maddy could benefit most from a human hand transplant.*
 - *Tools, devices, and systems will help Maddy do the things she wants to do.*
- Build on the topic sentence with a well-constructed paragraph. Use evidence based on details from one or more readings to support the claim with reasoning.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Exercise Page 4, continued

Evaluation Guidelines

Element	1	2	3	Feedback
Content	Inadequate support is provided for the claim in the topic sentence.	Writing exhibits adequate completion of a structured paragraph but weak support for the claim in the topic sentence.	Writing exhibits thorough support of the claim in the topic sentence, citing specific, relevant details from the reading selections.	
Supporting sentences (details)	Incomplete sentences or details irrelevant to the paragraph topic are included.	Complete sentences are included, but they are too few, lack support from the reading, or have unclear relationships with the claim.	Writing includes at least six complete sentences, encompassing three major points that support the claim.	
Organization and transitions	Writing includes statements with little clear relationship to the topic sentence or each other.	Key supporting details are present, but transitions are absent or choppy.	Ideas are presented in an order that helps the topic make increasingly more sense.	
Grammar and mechanics	Six or more errors are present in punctuation, capitalization, and spelling.	Three to five errors are present in punctuation, capitalization, and spelling.	Fewer than three errors are present in punctuation, capitalization, and spelling.	

Additional Feedback Notes:



CKSci™
Core Knowledge **SCIENCE™**

Editorial Director
Daniel H. Franck

Source Material Attribution

The development of this material was supported by the Bill & Melinda Gates Foundation, Carnegie Corporation of New York, Charles and Lynn Schusterman Family Foundation, and William and Flora Hewlett Foundation.

The OpenSciEd name and logo are not subject to the Creative Commons license and may not be used without the prior and express written consent of OpenSciEd.

This curriculum includes images that are public domain, openly licensed, or used by explicit agreement with their owners. See the attribution information with each image for ownership details and any restrictions on its use. Unless otherwise noted in the image attribution information, all images are licensed for distribution under the terms of the Creative Commons Attribution License (CC BY 4.0) by OpenSciEd or by their respective owners, or they are in the public domain.

Unit Development Team

Dawn Novak, Unit Lead, BSCS Science Learning

Jamie Deutch Noll, Field Test Unit Lead, Northwestern University

Sue Gaspar, Writer, University Of Illinois Extension

Gail Housman, Writer, Northwestern University

Ari Jamshidi, Writer, University of California, Berkeley

Meghan McCleary, Writer, University Of Illinois Extension

Tracey Ramirez, Writer, The Charles A. Dana Center, The University of Texas at Austin

Wayne Wright, Writer, BSCS Science Learning

Gretchen Brinza, Pilot Teacher, Sauganash Elementary School

Keetra Tipton, Pilot Teacher, Aptakisic Junior High School

Abe Lo, Reviewer, PD design, BSCS Science Learning

Tara McGill, Conceptual design, Northwestern University

Katie Van Horne, Assessment Specialist, Concolor Research

Barbara Hug, Unit Advisory Chair, University of Illinois Urbana-Champaign

Stina Krist, Unit Advisory Chair, University of Illinois Urbana-Champaign

Molly Reisz, Advisory Team, Dennison Middle School

Production Team

BSCS Science Learning

Maria Gonzales, Copyeditor, Independent Contractor

Kate Herman, Copyeditor, Independent Contractor

Rachel Poland, Copyeditor, Independent Contractor

Renee DeVaul, Project Coordinator

Valerie Maltese, Marketing Specialist & Project Coordinator

Chris Moraine, Multimedia Graphic Designer

Kate Chambers, Multimedia Graphic Designer

OpenSciEd

James Ryan, Executive Director

Sarah Delaney, Director of Science

Matt Krehbeil, Director of Outreach

Developers Consortium Leadership

Daniel C. Edelson, Director

Audrey Mohan, Associate Director

Professional Learning Center at Boston College

Katherine McNeill, Director

Renee Affolter, Assoc. Director

Instructional Materials Center at BSCS Science Learning

Daniel C. Edelson, Director

Audrey Mohan, Associate Director

Field Test Implementation and Evaluation Center at Charles A.

Dana Center, The University of Texas at Austin

Carolyn Landel, Director

Sara Spiegel, Assoc. Director, Implementation

Carol Pazera, Assoc. Director, Evaluation

Field Test Evaluation Center at Digital Promise

Andrew Krumm, Director

William Penuel, University of Colorado, Boulder, Co-Director

Instructional Materials Center at Northwestern University

Brian Reiser, Director

Michael Novak, Associate Director

State Steering Committee

California

Kathy DiRanna

Phil Lafontaine

Jill Grace

Iowa

Tami Plein

Louisiana

Jill Cowart

Lydia Hill

Breigh Rhodes

Massachusetts

Erin Hashimoto-Martell

Nicole Scola

Hillary Metcalf

Michigan

Mary Starr

New Jersey

Michael Heinz

New Mexico

Yanira Vazquez

Shafiq Chaudhary

Oklahoma

Tiffany Neill

Susan Wray

Rhode Island

Kate Schulz

Erin Escher

Washington

Ellen Ebert

Field Test Teachers

California

Dawn Arbogast

Michelle Baptista

Laura Barker

Monica Cordisco

Sarah Couris

Bruce Jennings

Anyia Pierre

Gilly Ryan

Robert Seagraves

Destiny Westbrook

Iowa	Massachusetts	New Mexico	Washington
Heather Clark	Hadley Donaldson	Brittany Bird	William Baur
Angie Goemaat	Bruce Kamerer	Cindy Colomb	Shawna Brown
Melissa Johnson	Gar-Hay Kit	Maya Mirabal	Marcia Garrett
Jolonda Mihalovich	Regan McKinnon	Oklahoma	Tammy Mendoza
Molly Reisz	Sarah Morris	Lori Baggett	Theresa Williams
Shelly Streigle	Daniel Rogier	Brandy Criminger	
Jen Wilson	Michigan	Susan McClarty	
Louisiana	Mike Blanks	Loraine Weekley	
Mandi Adams	Denise Church	Rhode Island	
Arkishia Chocklin	Craig Goff	Linda Grandchamp	
Martina Ebey	Rebecca Hicks	Michael Romano	
Donna Harrell	Shelly Jacobs	Stephen Scappaticci	
Nicole Lynch	Lisa Kaluzny		
Allison Rhodes	Jordan Mazur		
Angela Rychart	New Jersey		
Carrie Trotti	Courtney Baker		
Katie Wilcox	Lauren Pasanek		

Special thanks to the following people for their significant contributions to this unit:

Alexander Novak, Los Angeles, CA

Illustrations and Photo Credits

agefotostock / Alamy Stock Photo: Cover, i
 Andreas Fülscher Schliemann / Alamy Stock Photo: 20a
 ArteSub / Alamy Stock Photo: 66c
 BSIP SA / Alamy Stock Photo: 20d
 buccaneer / Alamy Stock Photo: 51b
 Eyal Bartov / Alamy Stock Photo: 65c
 Imaginechina Limited / Alamy Stock Photo: 31b, 35b
 incamerastock / Alamy Stock Photo: 19a
 John Warburton-Lee Photography / Alamy Stock Photo: 55a
 Ladanifer / Alamy Stock Photo: 51a
 LJSphotography / Alamy Stock Photo: 57d
 Lori Martin / Alamy Stock Photo: 65b
 Media for Medical SARL / Alamy Stock Photo: 20b, 23c
 NASA: 53c
 Nixx Photography, rights reserved: 29a
 NOAA: 53b
 Norbert Dr. Lange / Alamy Stock Photo: 31a
 OpenStax College CC BY 3.0: 29b
 Papilio / Alamy Stock Photo: 65a
 Reinhard Dirscherl / Alamy Stock Photo: 66b
 Samunella / Alamy Stock Photo: 19b, 23a
 Science Photo Library / Alamy Stock Photo: 31c, 57b
 Seaphotoart / Alamy Stock Photo: 52
 southeast asia / Alamy Stock Photo: 66a
 Tetra Images, LLC / Alamy Stock Photo: 54
 The Picture Pantry / Alamy Stock Photo: 55b
 Valentyn Volkov / Alamy Stock Photo: 57c
 William Mullins / Alamy Stock Photo: 53a
 Zoonar GmbH / Alamy Stock Photo: 20c

Core Knowledge Foundation

Science Literacy Development Partner

Six Red Marbles
 Carri Walters
 Executive Editor
 Kimberly Merlino
 Writer

CKSci™
Core Knowledge SCIENCE™

A comprehensive program in science, integrating topics from Earth and Space, Life, and Physical Sciences with concepts specified in the **Core Knowledge Sequence** (content and skill guidelines for Grades K–8).

Core Knowledge SCIENCE™
units at this level include:

Light and Matter
Thermal Energy
Weather, Climate, and Water Cycling
Plate Tectonics and Rock Cycling
Natural Hazards
Cells and Systems

www.coreknowledge.org

Core Knowledge Curriculum Series™