7th Grade Science: Cells and Systems Unit Storyline & Overview

OpenSciEd 6.6 Cells and Systems

Anchoring Phenomenon

A middle-school student injured his foot and could not walk. Over the next 4 months, the foot healed and he could walk again.

Unit Level Driving Question

How do living things heal?

Unit Overview: ~ 23 Days

This unit launches with students hearing about an injury that happened to a middle school student that caused him to need stitches, pins, and a cast. They analyze doctor reports and develop an initial model for what is going on in our body when it heals. Students investigate what the different parts of our body are made of, from the macro scale to the micro scale. They figure out parts of our body are made of cells and that these cells work together for our body to function. Once students have figured out what their bodies are made of and how the parts of their body work together to be able to move, they wonder how the parts of our body heal. They start by watching a timelapse of a knee scrape and notice that over time the part that was scraped is filled in with new skin cells. Students investigate what happens when cells make more cells, what cells need to make more cells, and how cells get what they need to make more cells. Students return to the healing timeline they made at the start of the unit and apply what they have figured out about the interactions between the different systems in the body to explain the various events of healing that took place for the injury at the start of the unit. Finally, they apply their model for healing to explain growth at growth plates in children's bodies as they become adults.

How will students engage with the phenomena?

DATA SETS	VIDEOS OR IMAGES	HANDS-ON/LAB ACTIVITIES	READINGS	COMPUTER INTERACTIVES

Click here to access the JCPS 7th Grade Website

Click here to access JCPS Cells and Systems Student Notebook

Click here to access **Cells and Systems Unit Slides Guide** (Teacher resource for in-the-moment instructional guidance)

Click here to access the JCPS Unit Customization Overview

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Lesson level question	What students will do *(Standards alignment)*	What students will figure out	Storyline: This lesson	Navigation to Next Lesson
Lesson Set 1: What are the different parts of our body made of?				
1: What happened in the student's foot so they could walk again? 4 days 	**1.A** Obtain information from images and doctor's notes to identify patterns between the relationship of important events (effect) and the evidence of interacting subsystems healing (cause). **1.B** Develop an initial model of the healing process that occurs within and between multiple interacting systems and subsystems and restores the foot's function. **1.C** Ask questions that arise from observations of injuries to multiple subsystems that result in the loss of function of the foot (larger complex system).	• A student who was previously able to walk was injured in an accident and could no longer walk. • Some of the injured parts of the foot needed outside supports during the healing process. • Over time, the injured parts of the foot were able to heal; some took longer than others. • The injury caused gaps between the damaged structures in the foot.	*We share our experiences moving our bodies and times when we were unable to. We read doctor's notes and see images of an injury. We create a timeline of important events that show evidence of healing. We develop models to show how the parts of the foot work together so the patient can walk again. We brainstorm related phenomena of other times we have seen healing in humans and other living things.*	*We want to know more about how parts of the foot work in an uninjured foot before we can figure out why they are not working in an injured foot.*
2: What do our bones, skin, and muscles do for us? 2 days 	**2.A** Analyze and interpret data to highlight the interactions between subsystems (skin, muscle, bone) within the larger system (foot or wing). **2.B** Revise the experimental design and conduct an investigation to predict the change in function of the chicken wing (effect) when parts are injured (cause).	• Skin is attached to the muscle underneath it, and the muscle is attached to bones. • Bones move when the muscles attached to them move. • The muscles and bones are both parts of the wing system (or foot system) and interact for the wing (or foot) to move. • When one part of the system is broken or injured, the whole system is affected and can't function the way it used to.	*We investigate the parts that make up a chicken wing and how they work together when moving by watching a video of the dissection of its skin, muscle, and bone. We map the parts of the chicken wing to the parts of the human foot to make sense of how these parts work together in similar ways in each. Then, we revise the investigation to figure out how function can be affected because of an injury.*	*We want to look more closely at the different parts of the foot to figure out more about how they interact so we can figure what happens for them to heal.*
Lesson 1/2 Pre-Assessment Opportunity • Initial models in science notebook • Driving Question Board				

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Lesson level question	What students will do *(Standards alignment)*	What students will figure out	Storyline: This lesson	Navigation to Next Lesson
3: How can medical images and diagrams help us figure out more about the structures in the body? 1 day  	**3.A** Critically read and interpret scientific texts (images and diagrams) adapted for classroom use to describe patterns to figure out that blood and nerves are present in skin, muscle, and bone of a human body.	• There are blood vessels in the different parts of the bone, muscle, and skin. • There are nerves that run through the layers of the skin, the muscle, and the bone.	We decide we need to see the different structures inside a body. We observe different types of medical images of a body. We analyze various scientific diagrams to help us interpret the different structures within the images we observed.	*We figured out that the skin, muscles, and bone in our body are very similar to the ones we observed in the chicken wing we looked at in the previous lesson. We also noticed that when we looked closer at these parts, there were other parts, like blood vessels and nerves, and we wonder what their role is inside the body.*
JCPS MODIFICATION: Reduced lesson 4 from 3 days to 2 days. The microscope activity has been changed to only use a virtual microscope rather than a real microscope. Students still have the opportunity to practice changing the magnification power to engage with the crosscutting concept of scale. Thus, students still understand the basic principles of a microscope while also engaging in three dimensional learning as required by NGSS.				
4: Why is there blood in all these places in the body? 2 days  	**4.A** Collect data at different scales to answer scientific questions about the components found in blood. **4.B** Critically read scientific text to make sense of patterns within structures we observe in the blood related to their function in the body.	• As a whole, the blood's function is to travel around the body carrying the things the body needs. • The blood's flowy liquid nature (structure) allows it to perform its function. • Blood vessels in a body help blood get to where it needs to go throughout the body. • Blood is composed of a mixture of components that we cannot see without a microscope. • Blood is made of red blood cells, white blood cells, platelets, and blood plasma. • The structure of blood cells relates to their function: their round shape helps them travel easily through the tubular blood vessels. • Platelets' structure relates to their function: their branching arms and stickiness help them plug damaged parts	We view an image of blood vessels to determine that blood circulates everywhere in the body, and we notice that blood in a test tube settles into layers. We use virtual microscopes to investigate human and mammal blood observing that blood is composed of several different smaller structures. We read an article to make sense of the patterns we saw, considering how the structures of the blood and its components support their functions in the body.	*We figured out that blood and blood vessels run throughout the body to bring the body things it needs, and blood has microscopic structures that support its functions. Like blood vessels, we also saw nerves in skin, muscle, and bone, and we wonder why there are nerves all over the body, too.*

		of the blood vessels to stop leaks.		
Lesson level question	**What students will do** ***(Standards alignment)***	**What students will figure out**	**Storyline: This lesson**	**Navigation to Next Lesson**
5: What do nerves do, and why are they in different parts of the body? 2 days  	**5.A** Gather and synthesize information from scientific text and other sources to describe the basic structure of nerves and nerve cells and explain how its structure supports both the function of those cells within the nervous system and the interactions that occur between nerves and other parts of the body (e.g., skin, bone, muscle).	• Nerve cells have a very unique structure--they have long, thin "branches" or "tentacles" extending from a central portion. • Nerve cells branch out and connect to other nerve cells, forming a network of nerves that carry signals between all parts of the body and the brain. • The structure of nerve cells is perfectly suited for their function--they branch out and connect with all parts of the body so that they can carry signals back and forth between the body and the brain.	*Nerves, like blood vessels, are found throughout the body. We investigate nerves under a microscope and we notice that nerves have a unique and intricate structure. We read about nerves and learn that the nerve cell's structure suits its function. We engage in a few quick experiences that help us understand the role that nerves play in our bodies. Then we revisit the foot injury and think about how we can leverage what we now know about the function of nerves to better understand how the foot works and the healing process.*	*We figured out that the structure of nerve cells is perfectly suited for the function that they carry out, but there is more that we need to figure out about the role of nerves in healing.*
6: What will we see if we look at skin, bone, and muscle with the microscope, too? 1 day 	**6.A** Analyze and interpret observational data of microscopic structures of skin, bone, and muscle, relating those structures to the functions of those parts of the body.	• Bone, muscle, and skin are made up of repeating patterns of microscopic structures called cells, and groups of these cells form tissues. • Cells that make up different tissues are structured differently, depending on their function in the body. • Structure is the characteristic of something (the shape or way it's made or arranged) that supports its function.	*We investigate magnified images of bone, skin, and muscle and then use our observational data to come to consensus around how cells' unique structures support their functions in the body*	*Now that we have figured out what the different parts of the foot system are made of when they're functioning correctly, we will go back to our timeline and capture what we have figured out. What else do we need to know about the foot to explain how it heals?*
7: Are all things made of cells? 1 day 	**7.A** Plan an investigation and construct an argument using evidence from the microscopic scale that all things are not made of cells. **7.B** Develop a model at a zoomed-in scale to describe what changes happen	• Microscopic samples from living things that we analyze are made of cells. • Microscopic samples from things that were never living are not made of cells.	*This lesson marks the end of the first lesson set. Students take an individual assessment where they plan an investigation to collect data to determine if other things are made of cells. They analyze microscopic images of living and non-living things as data to look for evidence of cells. They use*	*We figured out that not all things are made of cells but the parts of the things we looked at that were once living are made of cells. Now we wonder, What happens to these cells when an injury occurs?*

	to the structure and function of skin cells at the time of injury.		*these data to argue from evidence that parts of living (or formerly living) things are made of cells--not things that were never living are not made of cells.*	
Lesson 7 Mid-Point Assessment Opportunity • *Are Other Things Made of Cells?*				
Lesson level question	**What students will do** ***(Standards alignment)***	**What students will figure out**	**Storyline: This lesson**	**Navigation to Next Lesson**
<u>Lesson Set 2:</u> How do the parts of our body heal?				
8: What happened as the skin on top of the foot healed? 1 day	**8.A** Develop a model to predict how the interacting systems and subsystems of groups of skin cells work together to form or repair new tissues and organs.	• New skin (which is made of cells) forms as the site of the injury gets smaller and smaller.	*We revisit the healing timeline and Driving Question Board to connect what questions we have answered, like what the foot is made of and how these parts work together to help us function. We revise our definition of healing to include that healing must involve filling in the gaps in the injury with cells, but we do not know how. We observe a time-lapse video of a skin wound healing to gather more information about what must be happening in the healing process. We revise our model to specifically focus on and predict what happens with cells for skin to heal.*	*We figure out that as a skin wound heals, the opening in the skin gets smaller and smaller, and there is new skin where there was not skin before. We wonder how the cells that make up the skin fill the gap.*

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9: What is happening at the site of an injury to fill the gap? 1 day 	**9.A** Analyze and interpret data from a video and microscopic images at varying spatial and time scales to conclude that new cells come from old cells following a predictable pattern of repeated steps.	• New cells come from old cells, which grow and split through a repeated and nonrandom process. • When cells grow and split, they make new cells of the same type (e.g., skin cells make new skin cells and bone cells make new bone cells). • A gap in the skin, muscle, or bone is filled by new cells as a result of cells growing and splitting.	*We analyze a video and microscopic images of cells splitting and growing in different organisms. By observing this process at different spatial (zoomed-in/out video and images) and time scales (full/half-speed video), we make sense of how our body fills a gap at the site of an injury, such as broken skin or bone.*	*Because our body fills a cut in the skin or a break in the bone by making new cells, we want to know what the cells require to do this. We know that our body requires food and energy to grow, so we wonder if cells need something similar to split and grow.*
Lesson level question	**What students will do** ***(Standards alignment)***	**What students will figure out**	**Storyline: This lesson**	**Navigation to Next Lesson**
10: What do cells need to grow and make more of themselves? 2 days 	**10.A** Analyze and interpret data for patterns to identify the relationship between the amount of food (cause) and the amount of bacteria made (effect) to provide evidence that cells need food to grow and make more of themselves. **10.B** Construct a written argument using cause-and-effect relationships to conclude that the cells that make up multicellular organisms need food to make more cells, as do the cells of unicellular organisms.	• Cells need food to make more cells. • More cells grow when they have more food around them. • There are single-celled (unicellular) and many-celled (multicellular) living things. • Cells are living things. • All living things are made of cells.	*We recall what we (humans) need to grow and wonder if cells also need the same things to grow, since they are living, too. Since we can't easily study cells from our bodies, we investigate single-celled organisms. We look at data from a scientist, who grew bacteria on agar plates with different nutrient levels. We analyze the data and notice that the quantities of bacteria made increased with increasing nutrient levels. We read about other unicellular organisms and figure out that they are living things that need food to make more of themselves.*	*We figured out that living things can be made of one or many cells and those cells need food to grow, like humans. We wonder how those cells get what they need in order to make new cells.*

Lesson 10 Formative Assessment Opportunity

- Exit Ticket: Written Argument
- Self-Assessment and Peer Feedback Opportunity
- *What do bacteria need to make more of themselves?* Explanation

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11: How do cells get what they need to grow? 1 day 	**11.A** Construct an explanation to show that the structure of cell membranes and cell walls (tiny openings) let certain things in and out of cells (function).	• Plant cells have a cell wall and a cell membrane. • The cell wall is a structure that is unique to plants and helps the cell maintain its shape. • The cell membrane and cell wall act as a barrier and allow things the cell needs (food, nutrients, etc.) into and out of the cell.	*We observe onion cells using microscopes. We add salt water, then plain water, to the onion skin and observe changes in the cells. We use our observations to explain how plant cells let water out of and into the cell.*	*We think we have enough information to explain healing--let's do that, and revisit our DQB to see what we're still wondering about.*
Lesson 11 Formative Assessment Opportunity • *Data from Investigating Red Onion Cells Explanation*				
Lesson level question	**What students will do** ***(Standards alignment)***	**What students will figure out**	**Storyline: This lesson**	**Navigation to Next Lesson**
12: How do the structures and systems in the body work together to heal the injury? 2 days 	**12.A** Apply scientific ideas and evidence to construct an explanation for how systems of the body interact to support the healing process in the foot at different scales.	• The body reacts to an injury by swelling, which increases blood flow and brings extra fluid to injured tissue to help it heal. • The healing process for the foot is similar to how other body parts and other living things heal as well.	*We revisit the timeline of healing from Lesson 1 and develop explanations for how healing happens based on each event we had listed. We come to consensus about how the healing in the foot happened, developing a list of key science ideas. We use what we have figured out about healing so far to see if we can explain how the systems in our body interact to support the healing process.*	We know that the systems and structures in the body work together to heal injuries, but how is this similar or different from growing?
Lesson 12 Summative Assessment Opportunity • *How do the systems in the body interact during the healing process?* Explanation				
JCPS MODIFICATION: Skip Lesson 13. Since the anchoring phenomena and the PEs will have been fully addressed and assessed prior to this lesson, you can skip this lesson for the sake of time.				
14: How can shifting our perceptions of ability and disability allow us to be	**14.A** Analyze and interpret data to find similarities and differences in people's	• A person could be healed, but that part of the body may have a different function than before.	*We revise our definition of healing to include thinking about the impacts on the way our body functions. Then we*	*End of unit*

more thoughtful about how we make our environments more accessible? 3 days  	perceived abilities to function and meet their goals when having disabilities. **14.B** Define a design problem (inaccessibility of our school environment for people with disabilities) that can be solved through the development of small changes to the current system (school environment) to improve its accessibility for many people, including those with disabilities.	• Some disabilities are temporary and some are permanent. • Some disabilities are visible and some are invisible. • Many disabled people count disability as an important part of their identity. It is something to celebrate and take pride in. • It's important for environments to be designed to be more accessible for all people.	*consider how we are still able to achieve our goals even when the way our body functions changes. We read and hear about five stories from people with disabilities, the challenges they face, as well as their perception of their disability. We brainstorm ways to adapt and redesign our environment in order to make it more accessible to people with disabilities.*	

Additional Assessment Opportunities: ***Review the 'Assessment System Overview' section of the teacher guide to help identify assessment opportunities in each lesson.***

- Lesson Performance Expectation Assessment Guidance
  - Use this document to see which parts of each lesson or student activity sheets can be used as embedded formative assessments
- Progress Tracker
  - A thinking tool designed to help students keep track of important discoveries that they make while investigating. Shows growth over time.
- Student Self Assessment Discussion Rubric
  - Can be used anytime after a discussion to help students reflect on their participation in the class that day.
- Formative Assessments aligned to Cells and Systems PEs

The storyline builds towards the following standards

- MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers and types of cells.
- MS-LS1-2: Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- MS-LS1-3: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.