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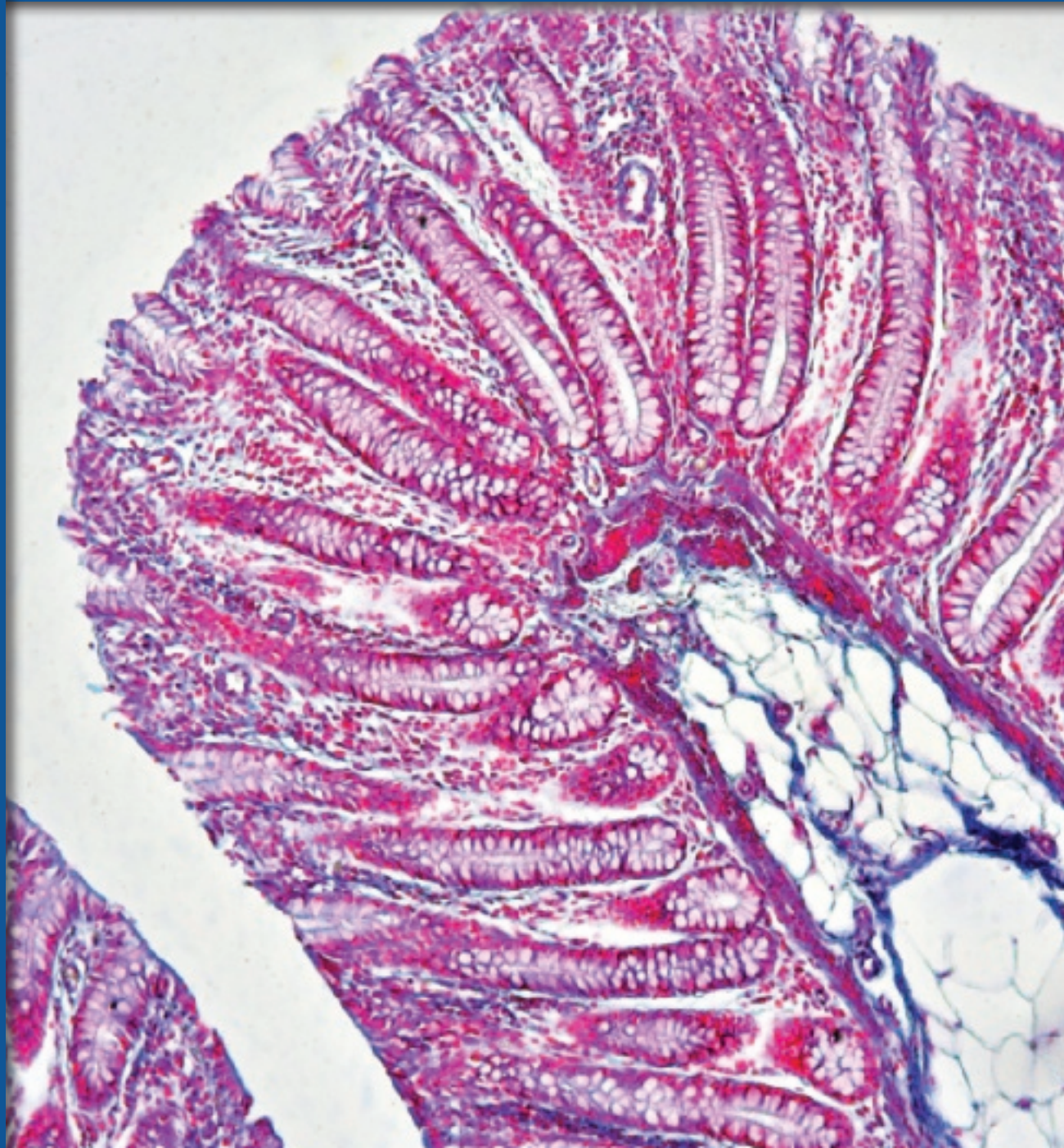
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Unit 6

Cells and Systems:

How do living things heal?

Student Procedure Guide



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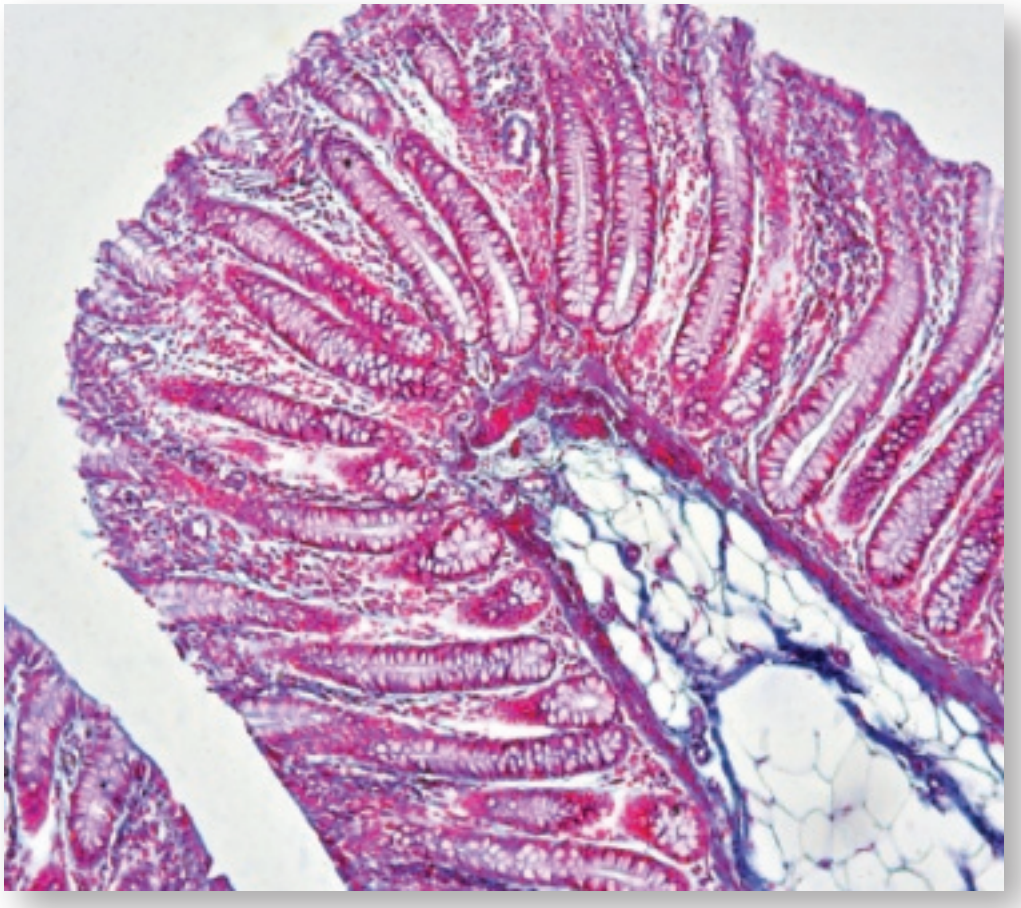
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Cells and Systems:

How do living things heal?

Student Procedure Guide

Core Knowledge Science

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ISBN: 978-1-68380-709-4

Cells and Systems

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Lesson 1: What happened in the student's foot so they could walk again?

What do you like to do?

In your notebook



1. Answer the following questions:

- What is your favorite activity that involves moving your body?
- What parts of your body do you use when doing this activity?

Has there ever been a time when you were unable to do your favorite activity?

With your class



2. Discuss the following questions:

- Why was your body not physically able to do this activity?
- How long was it before you could do this activity again?
- What were some things you had to do so your body could heal and you could do the activity again?

Explore an interesting phenomenon.

Today, this middle school student can walk, run, and jump! However, 4 months ago, he had an injury that prevented him from being able to do these things. He dropped a heavy weight on his foot during PE class. After this happened, he was not able to stand, walk, or run and had lots of pain.

With your class



3. Discuss this question with your class: Why do you think he was not able to do these activities with his body (standing, walking, running) after the injury?

Obtain more information about the injury.

On the day the injury happened, the student was taken to the hospital so a doctor could take a closer look at his foot. The doctor determined that he would need surgery.

In your notebook



4. Follow your teacher's instructions for the *Emergency Room Report*:

- Read the report.
- Underline or circle things that you notice or wonder about the report, and be prepared to share these with the class.

Obtain information about what was done to the foot.

After surgery, doctors put a cast on his foot.

On your own



5. Follow your teacher's instructions for reading and annotating the *Post-Operation Report*, and be prepared to share your noticing and wonderings with the class.

Obtain information about the recovery.

One week later, he had to go back to the doctor to have an x-ray of his foot to see how it was healing. The doctor put a new cast on it. In addition to the x-ray, the doctor used a tool to test the tips of his toes and the top of his foot to determine what, if any, feelings he could detect.

On your own



6. Follow your teacher's instructions for reading and annotating the *Recovery Reports* with things you notice and wonder.

Define "healing."

With your class



7. Complete the following with your class:

- On your sticky note, in big dark letters, write your ideas about what you think healing is in the human body.
- Place your sticky note on the What Do We Mean by Healing? poster at the front of the room.
- After you post your sticky note, read through other people's definitions. We will then co-construct a definition as a class.

Record evidence for healing.

With a partner



8. Use the *Evidence for Healing* and complete the following with your partner:

- Look back at your noticings about the doctor's report you were assigned.
- Highlight clues that healing was happening.
  - Some clues will be the doctor's observations about what was happening inside the patient's body.
  - Other clues will be the actions the doctor took in the patient's care.
- On your handout, record important clues that you think indicate that healing was occurring in the foot.

Create a timeline of the injured foot's healing process.

Scientists Circle



9. Gather in a Scientists Circle and follow your teacher's instructions to complete the following:

- Each pair will share out about the important events that they think are clues of healing from the Recovery Report they were assigned.
- After sharing, each pair will explain why they think that event is a clue that healing was happening.

Navigation

With your class



10. Discuss this question with your class: What were the parts of the foot impacted by the injury that needed to heal?

Developing Initial Models

On your own



11. Develop an initial model to explain, "What happened 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.

Record questions that come to mind as you construct your model.

- 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.
- 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 it healed, as represented by the arrow.

Choose a target norm to focus on.

- We're about to listen to each other's ideas about what was happening over time when the foot was healing from this injury.
- We are going to look at our Classroom Norms.

With a partner



12. Discuss this question with your partner: Which norms do you think might help us pay more attention to each other?

13. Choose 1 norm that you personally will work on for the rest of the class.

Compare initial models of healing.

In your notebook



14. Draw a 2-column chart in your science notebook under the title "Comparing Our Models."

15. Explain your model to an elbow partner:

- Each student talks for 1 minute.
- Then record similarities and differences you notice about the ideas represented.

Initial Consensus Model Discussion

Scientists Circle



16. Develop a class record of what we agree on and where we have competing ideas across the initial models. Discuss the following questions:

- What was common in how other people represented the different parts of the foot and their interactions during healing?
- How would we represent each of these parts and interactions in our model?
- What differences or areas of disagreement were there between your model and your partner's?
- What other new ideas do we want to consider?

Home Learning About Related Phenomena

Home Learning



17. Talk with someone in your family older than yourself. Tell them you are learning about healing.

- Ask them, "Have you ever seen examples of body parts or other things that can heal from injury?"
- Be thinking about what questions you have about these phenomena!

Navigation

With your class



18. Discuss the following questions with your class:

- As you were considering other examples of healing or other related phenomena:
  - Did you have any questions about whether or not something counted as "healed"?
  - Did you have any questions about people whose bodies might work or function differently after their injury?
  - Did you have any questions about how healing might be similar or different for individuals?

Explore differences in how people experience the world.

In your notebook



19. Create a 2-column chart in your notebook:

- On the left side, write the heading "Task."
- On the right side, write the heading "How it is completed."

Brainstorm ways people communicate.

In your notebook



20. Complete the following:

- In the left column, under "Task," write "Communicate."
- In the right column, under "How it is completed", brainstorm differences in how people communicate.
- Be prepared to share your ideas with the class.

Ways People Communicate

With your class



21. Examine some different ways people communicate, including some types of adaptive equipment for communicating.

Brainstorm ways people perceive/sense the environment.

In your notebook



22. Complete the following:

- Draw a line under what you wrote for ways people communicate.
- Write "Perceive/Sense" in the left column, under the line you just drew.
- In the right column, under "How it is completed", brainstorm differences in how people see, hear, and understand their surroundings.
- Be prepared to share your ideas with the class.

Ways People Perceive/Sense

With your class



23. Examine some different ways people might perceive the environment around them, including some adaptive equipment for this purpose.

Brainstorm ways people eat.

In your notebook



24. Complete the following:

- Draw a line under what you wrote for ways people perceive/sense.
- Write "Eat" in the left column, under the line you just drew.
- In the right column, under "How it is completed", brainstorm differences in how people eat.
- Be prepared to share your ideas with the class.

Ways People Eat

With your class



25. Examine images of adaptive equipment for eating.

Brainstorm ways people move.

In your notebook



26. Complete the following:

- Draw a line under what you wrote for ways people eat.
- Write "Move" in the left column, under the line you just drew.
- In the right column, under "How it is completed", brainstorm differences in how people move around.
- Be prepared to share your ideas with the class.

Ways People Move

With your class



27. Examine images of adaptive equipment for moving.

Expand our definition of healing.

In your notebook



28. Complete an individual Quick Write using the following prompts:

- I used to think healing was _____.
- Now I think healing is _____.

With your class



29. Be prepared to share your ideas with a partner and then with the class.

Revisit our home learning about related phenomena.

On your own



30. Look back at what you wrote on your home learning handout.

- Is there anything you would want to change or share differently?
- How might we add to our related phenomena based on our revised definition of healing?

Share related phenomena.

With your class



31. Discuss this question with your class: Have you ever seen other examples of things that can heal from injury?

32. Be thinking about what questions you have about these phenomena.

Connect related phenomena to our consensus model.

Turn and talk



33. Discuss these questions with a partner: Do you think any of the processes involved in the foot's healing could explain how other things heal? Which ones? Why or why not?

What questions do you now have?

With your class



34. Look back at

- our Noticings and Wonderings–Post Operation poster from the hospital reports and images,
- our How Does the Foot Heal over Time? poster,
- your initial model, and
- our list of Related Phenomena.

35. Take a minute to review those materials to find questions that you have about the phenomena we have explored so far (including our related phenomena).

36. Add questions to sticky notes:

- Write up to 3 questions about healing, and at least 1 question about other related phenomena.
- Write 1 question per sticky note.
- Write in marker—big and bold.
- Put your initials on the back in pencil.

Build our Driving Question Board.

Scientists Circle



37. Bring your sticky notes with questions on them and your science notebook to our Scientists Circle and follow these procedures:

1. The first student reads their question aloud to the class, then posts it on the DQB.
2. Students should raise their hand if one of their questions related to the question that was just read aloud.
3. The first student selects the next student whose hand is raised.
4. The second student reads their question, says why or how it relates, and posts it near the question it most relates to on the DQB.
5. The student selects the next student, who may have a related question or a new question.
6. We will continue until everyone has at least 1 question on the DQB.

Ideas for Future Investigations and Data We need

In your notebook



38. Consider what kind of investigations we could do and/or what additional sources of data we might need to figure out the answers to our questions.

39. Add your ideas to a new notebook page titled "Ideas for Future Investigations and Data We Need."

40. Be prepared to share these ideas with a partner and then with the class.

Sharing Ideas for Future Investigations and Data We Need.

With your class



41. As a class, let's make a public record of ideas for future investigations we could pursue.

Navigation

Turn and talk



42. Discuss this question with a neighbor, and be prepared to share your ideas with the class: If we could look more closely at bone, muscle, and skin, how might this help us with some of our questions?

Lesson 2: What do our bones, skin, and muscles do for us?

How do parts of our body work together?

With your class



1. How can investigating how different parts of our own bodies work help us figure out what healing is and how it happens?
2. Using your own foot, calf, or forearm:
   - What does it look and feel like when you're not moving it?
   - What does it look and feel like when you move it?

Look at muscles and bones.

With a partner



3. If we can figure out what is happening with our bones and muscles when we move our foot, how might that help us figure out why the student with the injured foot couldn't walk on it?

An Idea for Looking at Muscles and Bones

With your class



4. What if we use a chicken wing to figure out how these parts work together?
5. How might this help us figure out how our foot works?
6. How could looking more closely at parts of the wing and how they interact help us figure out more about our foot?

Compare a human arm to a chicken wing.

With your class



7. How does the chicken wing resemble a human arm?
8. What parts look similar?

Prepare a data table.

In your notebook



9. Make a chart on a blank page in your science notebook.
   - Title the left column "Part of the chicken wing".
   - Title the right column "Observations".

Investigate the chicken wing.

In your notebook



10. Watch the Intact Chicken Wing Investigation video.

- Be prepared to record observations when the video is paused.

Chicken Wing at Different Stages of Dissection

In your notebook



11. Observe the 3 images on the slide. Record the following in your Chicken Wing Dissection table:

- Any additional observations
- Any new questions you have

Map the chicken wing to the human foot.

In your notebook



12. Work with your class and a partner to fill in your copy of *Mapping the Chicken Wing to the Human Foot*.

How could we revise the investigation?

With your class



13. If we want to figure out more about how the injury affected different parts of the student's foot and prevented him from being able to walk, how could we revise this dissection?

How would function change in an injured chicken wing?

In your notebook



14. On the next page in your science notebook, use what you recorded in your *Mapping the Chicken Wing to the Human Foot* handout to:

- Explain how the function of the wing would be affected if 1 of the parts of the wing were injured.
- Use words or pictures or both to capture your predictions.

Share your predictions.

Turn and talk



15. Share your predictions with a partner about how the function of the chicken wing would be affected if 1 of the parts of the wing were injured.

16. Be sure to share any drawings you used to capture your ideas.

- Be prepared to share your predictions with the whole class!

Prepare a data table.

In your notebook



17. Make a chart on a blank page in your science notebook.

- Title the left column "Part of the chicken wing".
- Title the right column "Observations".

Investigate the injured chicken wing.

In your notebook



18. Watch the Injured Chicken Wing Investigation video.

- Be prepared to record observations when the video is paused.

Reflections on the Chicken Wing as a Model

Turn and talk



19. Compare the injured chicken wing to the injured foot.

- Was there anything from our timeline or from the doctor's notes that we didn't see in the injured chicken wing? Look back in your notebook at the doctor's notes if needed.
- Be prepared to share your ideas with the whole class!

Building Understandings About Systems

With your class



20. In many of our units this year, we have done a lot of systems thinking. For example, in the *Cup Design Unit*, what was the system or systems we were investigating?

21. What about the Storms Unit? What system or systems did we investigate then?

Discuss the body as a system.

With a partner



22. Is the body a system?

23. If we think about the body as a system, what would be some of the parts or components of this system?

- Be prepared to share your ideas with the whole class!

Progress Tracker: What have we figured out?

In your notebook



24. Create a 3-column chart lengthwise on a new page under the heading "Progress Tracker". Leave some space after the heading.

25. Keep track of the important discoveries we make during this unit.

26. Write the question we are working on in the left column:

- *What do our skin, muscles, and bones do for us*?

27. Write what we have figured out so far in the middle column. In the right column, think about the big picture of how healing happens as we figure new things out. You can write in pictures or words or both. Take as much space as you need to record your thoughts.

Lesson 3: How can medical images and diagrams help us figure out more about the structures in our body?

Taking Stock of Our Chicken Wing

Last lesson, we used a chicken wing to investigate some different parts of the body and how they interact.

With your class



1. What did we figure out about how skin, muscles, and bones interact for the body to move?
2. Why were we observing a chicken wing instead of a human foot?
3. What are some ways that medical professionals can observe the inside of the body?

Machines That Take Images of the Body

Discuss with your class.

With your class



4. Have you ever had an x-ray or MRI?

Annotate images.

Refer to our *A Medical Professional's View Inside the Body* to help annotate each image.

On your own



5. What parts of the body are visible (or not) in each image? On your handout:
   - Observe each pair of x-rays and MRIs.
   - Draw arrows to label the parts you can identify.
   - Circle parts of the images you have questions about.

Explore different ways to see inside the body.

Turn and talk



6. How did the x-ray and MRI help us see what the inside of each part of the body looked like?
7. What was similar or different?
   - Be prepared to share with the whole class!

Connect to related phenomena.

With your class



8. What did you and your partner notice about MRIs and x-rays?

9. What structures of a body could you identify?

10. Did the x-rays and MRIs show us what we wanted to know about the muscles, skin, and bones?

How can cross sections help us make sense of the body?

With your class



11. In the Everest Unit, why did we look at images that cut across the Earth's crust and deep into the Earth itself?

12. How can cross sections help us make sense of the body?

Observe different MRI images of the knee.

Refer to our *Interpreting MRI*, focusing only on the MRIs on the left side.

On your own



13. What do you notice and wonder about these MRIs?

14. What similar parts of the body can you recognize in each image?

Compare the knee MRIs and diagrams.

On your own



15. Using *Interpreting MRI*:

- Compare horizontal and vertical MRIs and scientific diagrams.
- Label anything in the MRI that you can identify using the scientific diagram.
- Label parts that you can't identify with a "?"

Discuss observations with a partner.

With a partner



16. Analyze *Close-up Diagrams of Skin, Muscle, and Bone*.

- What new information do we get from looking at these close-up diagrams?
- What patterns do we notice from looking at the close-ups of the skin, muscles, and bone?

Compare and label structures in MRIs and diagrams.

On your own



17. Using *Close-up Diagrams of Skin, Muscle, and Bone*, annotate *Reference: Interpreting MRI*.

- Compare *Close-Up Diagrams of Skin, Muscle, and Bone* and the *Interpreting MRI* handout.
- Add additional labels to the *Interpreting MRI* handout to acknowledge new structures you have identified.
- Mark new structures with a star.

Discuss connections between close-up diagrams.

With your class



18. What did you notice about skin, bone, and muscle from the close-up diagrams?

Make sense of blood vessels and nerves.

With your class



19. Why do you think blood vessels and nerves are found in each of these structures, like skin, muscles, and bone?

20. What do you think blood vessels and nerves do?

Lesson 4: Why is there blood in all of these places in the body?

Look back to last time.

With your class



1. We have evidence from last time that blood vessels can be found in the hand, knee, and foot.
   - Where else do you think we would find blood in the body?

Where is blood in our bodies?

With your class



2. Observe photos from a museum exhibit. This person donated their body to science. The blood vessels alone were preserved.
   - What do you notice and wonder?

Blood After Standing Still

With a partner



3. Observe the image of blood samples in test tubes. Discuss with a partner:
   - What do you notice?
   - What does it mean?

Vinegar and Oil Salad Dressing (Optional)

With your class



4. Some people enjoy salad dressing that's made of vinegar and oil mixed with spices. This kind of dressing must be shaken well before pouring it onto a salad. Observe the image of dressing that has been sitting on the counter for a few hours.
   - How does this example of a mixture help you understand what's going on with blood that's been sitting out for a while?

What should we investigate next?

With your class



5. How could we figure out what's in blood?

Plan to investigate microscopes.

With a partner



6. What do we need to figure out about microscopes so that we can use them to understand what's in blood?

- Be prepared to share your responses with the class.

What's the total Magnification?

With your class



7. To find the total magnification, multiply the eyepiece (10×) and the objective lens magnifications. For example, when using the 4× objective lens, the total magnification is 40× (4 × 10). That's 40 times closer than you could see with your eyes alone.

- Objective lenses are 4× (red/low), 10× (yellow/medium), 40× (blue/high).
- Eyepiece lens is 10×.

Prepare a data table.

In your notebook



8. Create a table like this on a whole page so you have room to draw your observations.

Observations of mm graph paper with a microscope

Total Magnification	Drawing	Measurement in mm
40x (red/low)		
100x (yellow/medium)		
400x (blue/high)		

Figure out how microscopes work.

With your group



9. Work with your partner or group to find answers to these questions:

1. How do you use the different parts of the microscope?

a. Where do you put the graph paper to be able to see it with the microscope?

b. Where and how do you look through the microscope?

c. How do you focus the microscope to see clearly?

d. Does the light help you see the paper differently?

2. How does the microscope work to help us see so closely?

a. Where are the lenses?

b. How do the lenses change what you can see?

c. How do the lenses move while someone is focusing?

3. How close-up can we see things with the microscope?

a. How much of the graph paper can you see with each objective?

b. Record your observations in your notebook.

Building Understandings Discussion About Scale

Scientists Circle



10. Discuss with your class:

- What did you notice about what you could (or couldn't) see with and without the microscope?
- How did changing the objectives change what you could see? Why?

Look ahead to next time.

Scientists Circle



11. How could using the microscope help us figure out more about what is in the blood?

Prepare to investigate blood with a microscope.

With your class



12. Discuss with your class:

- Why did we want to look at blood with a microscope?
- What blood will we use?
- How will we record our observations?

Images from a Digital Camera on the Microscope

With your class



13. To take microscopic images, we replaced the eyepiece with a digital camera connected to a computer. The computer enlarges the images to make them easier to see. The camera magnifies images 30×. If you're looking at an image at low magnification using the 4× objective lens, the total magnification is 4 × 30, or 120 times closer than you could see with your eyes alone.

- The digital camera eyepiece for our images is about 30x.

Prepare to record our human data.

In your notebook



14. Create a table for recording our microscope observations of human blood on one page of your notebook.

Blood sample from: _____	
Total Magnification	**Observations**
40x (red/low)	
100x (yellow/medium)	
400x (blue/high)	

Prepare to record our animal data.

In your notebook



15. Create a table for animal blood. Adjust the magnification because we will be using images.

- If the microscope camera magnifies the image by 30×, what is the total magnification for each animal sample if they were taken with the same objectives as our microscopes (4×, 10×, 40×)?

Blood sample from: _____	
Total Magnification	**Observations**
None (just looking at the slide with eyes)	
_____x (red/low)	
_____x (yellow/medium)	
_____x (blue/high)	

Investigate blood with a microscope.

With your group



16. Work with your partner or group to investigate blood using the following procedures:

a. Slides are fragile so handle them gently.

b. Hold slides by the edges.

c. Put the slide under the clips to hold it still.

d. Start at the lowest objective (4×, red/low).

e. Focus slowly! If you only see a blur of one color across your view, that's not what you're looking for.

f. Adjust the amount of light coming in through the slide to help you see better.

g. Draw what you see in the whole field of view in the corresponding part of your data table.

h. Be sure everyone in your group has a chance to see (and adjust the focus, if needed).

i. Switch to the next highest objective (10×, yellow/medium) and repeat the process from step 5 (and then again for the highest objective (40×, blue/high)).

Reflect on your observations.

In your notebook



17. What structures were evident that were not visible without the use of a microscope?

- Compare what you could (or couldn't) see with the microscope to what you could (or couldn't) see without it.

Share your observational data with a partner.

With a partner



18. Compare your observations of human blood.

1. What did you see that was the same and different?
2. What patterns do you notice?

19. Compare your observations of animal blood.

1. What did you see that was the same and/or different between the samples you each saw?
2. How does the animal blood compare to the human blood?
3. What patterns do you notice?

20. Compare your observations at different scales.

1. How did changing objectives (magnifications) change what you could see?
2. How did what you observe at the microscopic scale differ from what you observed without the microscope?

Share your observational data.

With your class



21. Discuss the following with your class:

- What patterns did you and your partner find in your observational data?

- What can we conclude about blood based on these patterns in your observations?
- How similar or different was the blood on the slide just looking at it with your eyes compared to when you saw it at the microscopic scale?

Look back to last time.

With your class



22. What were some of the patterns we noticed about blood last time, when we looked at blood at a different scale than our eyes can see alone?

Read to find out.

On your own



23. Individually read *What Is Blood?* and do the following.

- While you read, keep our questions in mind:
  - What are all the 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.
- Jot down any questions that come up during your reading.
- Respond to *Reading: What Is Blood?*.

Building Understandings Discussion About Blood

Scientists Circle



24. Discuss with the class:

- What did you figure out from the reading about the components of blood?
- What did you find out about what these different components do?

25. Annotate one of the drawings you made of your observations of blood in your science notebooks, now that you know what these structures are called and what they do.

Analyze blood at a different scale.

With your class



26. With your class, analyze and discuss the museum exhibit.

- Is blood everywhere in our bodies?
- What role do blood vessels play?

Progress Tracker Update

In your notebook



27. Turn your notebook to landscape and add another row to record what you figured out about why blood is all over the body.

Question	What we figured out in words/ pictures	This makes me think or wonder about healing...
Why is there blood in all these places in the body?		

Revisit our Driving Question Board.

With your class



28. Revisit our Driving Question Board with your class.

- What questions can we answer about blood?
- What new questions do we have now that we can add to our Driving Question Board?

Navigation

With a partner



29. Discuss nerves with a partner.

- What similarities do you notice about where blood and blood vessels are found in the body and where nerves are found in the body?
- Why do you think both blood and nerves are found all over the body?

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

Navigation

With a partner



1. In Lesson 3, we looked at a cross section of the foot.
   - What did we notice?
   - Based on what we saw, what did we decide we needed to figure out?

With your class



2. In Lesson 3, we looked at images from inside the body.
   - What structures did we find in all the close-up images of the skin, muscle, and bone?
   - How does the location of blood and blood vessels around the body compare to the location of nerves?
   - Where on our *How Does the Foot Heal Over Time?* poster or Driving Question Board did we include ideas of questions related to nerves?

With a partner



3. To help us decide on our next steps:
   - What did we do to help us figure out the function of blood in the body?
   - What did we figure out?
   - Similar to how we investigate the blood, what could we do to help us figure out the structure and function of nerves in the body?

Share prior knowledge.

With your group



4. Take a few moments to think about the following question:
   - What are some things you think you know about nerves?
5. Share your ideas with the whole group.

Make a prediction.

In your notebook



6. When we look at images of nerves . . .
   - What do you think we will see?
   - How will it compare to what we saw in the blood sample?
7. Write your prediction in your notebook, and explain your thinking.
   - Be prepared to share your thinking with the class.

Investigate images of nerves from a microscope.

On your handout



8. Write the investigation question at the top of your handout:

- "How can images taken using a microscope help us figure out more about nerves?"

9. Examine the images of nerves at low, medium, and high magnification.

10. Circle, label, or highlight things you notice and wonder about.

Share initial observations.

With your group



11. Think about what you observed using the images of nerves from under the microscope.

- What did you notice about how the nerves were structured?
- In what ways did changing the scale (zooming in) affect what you observed?
- How does the structure of nerves compare to blood?

Navigation

With your group



12. What have we figured out today?

13. What do we need to figure out next?

Navigation

With a partner



14. What did we observe about the structure of nerves?

15. In general, what do we know about the relationship between structure and function?

Obtain information from scientific text.

On your own



16. To get the information you need from the reading. . .

- Read for the gist: skim the title, headings, and captions on images.
- Mark up the text.
- Examine any images, graphs, or tables.
- Identify the ideas from the text that support what you've figured out so far.

Navigation

Scientists Circle



17. Remember our science classroom norms.

- What did you find out from the reading that helped you make sense of what you observed when looking at nerve images?
- Does the structure of a nerve cell help us better understand and describe its function? Explain your thinking.

How do nerves function?

With a partner



18. Do Activity #1—Sensing Touch with a partner.

- Work with a partner.
- Partner A closes eyes.
- Partner B lightly touches the back of partner A's hand with the tips of two paper clips approximately 1 cm apart.
- If partner A senses both paper clips, move the paper clips slightly closer together and touch partner A's hand again.
- Continue until partner A cannot distinguish between the two paper clips.
- Switch partners.
- Try other parts of your body.

How do nerves function?

With your class



19. Do Activity #2—Nerve Speed with your class.

- Students stand in line and join hands.
- First student holds a timer; last student holds a whistle.
- First student starts the timer and squeezes the next person's hand.
- When you feel your hand squeezed, you squeeze the next hand, and so on. . .
- When the last student feels their hand squeezed, they blow the whistle and the first student stops the timer.
- Try removing students from the line to see what happens.
- Try separating two people in the line so their hands no longer join.

Update Progress Tracker.

In your notebook



20. Turn your notebook to landscape orientation and draw a 3-column Progress Tracker.

- Write the lesson question in the left column: "What do nerves do and why are they in different parts of the body?"
- Use words and pictures to document what you have figured out and how it helps us understand healing.

Navigation

With your group



21. What have we figured out about nerve cells? What do they do, and why are they in different parts of the body?

22. What do we need to figure out next?

Lesson 6: What will we see if we look at skin, bone, and muscle with the microscope, too?

Looking Back to Last Time

With your class



1. Discuss with your class: What did analyzing blood and nerves at the microscopic level help us figure out about these two parts of the body?

Make predictions.

With a partner



2. Discuss the following questions with your partner:

- What do you think we will see when we look at muscle, skin, and bone with the microscope?
- Will it look like blood? Will it look like nerves? Will it look like something different?

Investigation Questions

With your class



3. Work with your class to decide: What will looking at bone, skin, and muscle under the microscope help us figure out about these body parts?

Recall cross sections.

With your class



4. The slides we'll be looking at today are very thin slices of skin, bone, and muscle. They're similar to other cross sections we've seen, except much smaller.

Investigate skin, bone, and muscle with a microscope.

With your group



5. With your group, follow these procedures to investigate the samples on your slides.

- Slides are fragile, so handle them gently and hold them by the edges.
- Put the slide under the clips to hold it still.
- Start with the lowest/shortest objective (4x, red, 40x total magnification).
- Focus slowly! If you only see a blur of one color across your view, that's not what you're looking for.
- Adjust the amount of light coming in to help you see better.

- Observe what you can at this objective.
- Change objectives to the next highest. Refocus, adjust the light, and observe.
- Change to the highest objective. Refocus, adjust the light, and observe.
- Choose the objective where you think you had the best view for seeing how the part is structured.
- Looking at the sample with the best objective, record your observations in the data table.

6. 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.

Share your observational data.

With a partner



7. Use your data to support your ideas as you discuss these questions:

- What similarities did you see between the same body parts and among different ones?
- What differences did you see?
- How do you think the structures you saw are related to the functions of those body parts? What makes you think that?

Consensus Discussion About Structure and Function

Scientists Circle



8. Discuss with your class:

- We wanted to look at skin, bone, and muscle with microscopes to see what they were made of. What did you find out?
- We wondered if the structures that make up the skin, bone, and muscle are related to their function. Do we have evidence to support that claim?

9. As a class, develop a definition of a *cell*.

On your own



10. Open to the next blank page in your notebook, title it "Using different scales," and answer this question:

- How has looking at these different body parts using different scales helped you figure out more about the structure and function of these parts?

Progress Tracker Update

In your notebook



11. Turn your notebook to landscape and add another row to record what you figured out about cells' structure and function.

Lesson 7: Are all things made of cells?

Navigation

With your class



1. What did we figure out about bone, skin, and muscle?
2. Why were we trying to figure out more about the bone, skin, muscles, nerves, and blood?

What other things are made of cells?

On your own



3. Receive a copy of *Part 1: Are Other Things Made of Cells?* from your teacher.
4. Read the question to yourself:
   - How would we figure out whether other things are also made of cells?
5. Complete the *Part 1: Are Other Things Made of Cells?*.
6. Receive a copy of *Part 2: Are Other Things Made of Cells?* from your teacher and use data from the microscopic images as evidence to construct an argument about whether all things are made of cells.

Building Understandings Discussion

With your class



7. Discuss with the class:
   - What are some patterns you noticed when you analyzed the different images?

What does the injured part look like close up?

In your notebook



8. Think about the question: What does it look like close up when a part of our body is injured?
   - Choose one of the parts of the body that was injured in the foot from Lesson 1—the skin, bone, or muscle.
   - Develop a model of what this part would look like close up, right when the injury occurred.

Home Learning

Home Learning



9. You will receive a copy of the DQB questions that your teacher typed up and a copy of *DQB Questions or Parts of Questions* We *Have Answered*.
10. Use the copy of the DQB questions to complete *DQB Questions or Parts of Questions We Have Answered* by choosing 2-4 questions and answering them with evidence.
11. Be prepared to share with the class which questions we can answer now with evidence.

Lesson 8: What happened as the skin on top of the foot healed?

What questions have we answered?

Scientists Circle



1. Discuss with your class: What questions from our DQB have we answered?
2. Move these to the new poster on the side of the DQB titled "Questions We Have Answered".

Observe a time-lapse video of skin healing.

Writing in Science



3. Watch the video of skin healing after a bike crash.
   - Record your ideas on *Time-Lapse Video of Skin Healing Observations*.
   - Identify 2-3 noticings for each time point and use your handout to record the noticings in detail.
   - Complete the second row in your handout.
   - If time permits, share your ideas with your small group.
   - Be prepared to share your ideas with the class.

Share noticings and wonderings from the skin healing process.

With your class



4. Discuss with your class:
   - What did you notice first as the skin healed?
   - What happened next in the process as the skin healed?
   - What happened toward the end of the skin healing?
   - What do you think was happening that we could not see with just our eyes at these time periods?

Record observations of time-lapse of skin healing.

In your notebook



5. Tape *Time-Lapse Video of Skin Healing Observations* into your notebook on the next blank left-hand page.
6. Title the page "Time-Lapse of Skin Healing."
7. Title the opposite right-hand page "Initial Skin Healing Model".

On your own



8. Develop a model on this right-hand page of what you think is happening as the skin heals at a microscopic level.

- Using what we have figured out about different parts of the body at different scales, the different systems in the body, and the structure and function of these parts, develop a model to predict how cells help make new skin form on the foot.
- Use words, pictures, symbols, or zoom-ins.
- Be sure to include how the cells fill the gap caused by the injury.

Be prepared to share your model in a small group and then with the class.

Compare our predictive models.

With your group



9. Small Group Talking Stick Round 1:

- Take your model with you and meet with the small group you are assigned to.
- When given the start signal, pass around a pencil as a talking stick. Taking turns, have each person use their model to explain how skin cells form new skin on the foot (1 minute per person).
- As each person shares, think about how their model compares with other models you've seen (including your own).

10. Small Group Talking Stick Round 2:

- Pass the talking stick around again to have each person share at least 1 similarity, difference, or question they noted about the models that were shared (1 minute per person).

How do we think cells help the new skin form in the gap?

With your class



11. Discuss:

- What do we know about what is happening as the skin heals?
- What don't we know about what is happening as new skin develops in the gap?
- What are our different ideas on how this healing works?
- How could we figure which of these ideas are correct?

Revise our current definition of healing.

In your notebook



With your class



12. Individual Quick Write:

- I used to think healing was _____.
- Now I think healing is _____.

13. Prepare to discuss.

- Be prepared to share your ideas with the class, and include why you think what you think!

14. Share your or your partner's ideas about how to revise our definition of *healing* with the class.

Develop new questions for the DQB.

On your own



15. Write 1 or 2 questions on sticky notes in large, bold writing so everyone can see. Write only 1 question per sticky note.

16. Share these with the class and then post them on the DQB.

Lesson 9: What is happening at the site of an injury to fill the gap?

How do we think cells help new skin form in the gap?

With your class



1. What might we see happening when we zoom in for a closer look?
2. How are the cells able to close the gap?

Discuss evidence needed from cell video and images.

On your own



3. In the *Observations to Evaluate Claims* handout:
   - Record the claims your class made about cells filling the gap from an injury.
   - Discuss what evidence you need to collect.
   - Record it in the evidence column.
   - Add a line through the whole chart under what you wrote for each entry.

Observe cell video.

With a partner



4. With your partner, watch the video multiple times, pausing and replaying in slow motion when necessary.
   - Record your observations from the video in Part 2 on the handout.
   - Discuss and consider how this video connects to the skin healing video we watched in Lesson 8.

Evaluate each claim with a partner.

With a partner



5. After watching the video and recording your observations:
   - Highlight any of the claims in Part 1 that have evidence from the video to support them. In the right column, circle any evidence you were expecting to see that you observed in the video.
   - If you saw any new evidence in the video that supports a claim, add it in a new color to the right column in Part 1.

Consensus Discussion Evaluating Claims

Scientists Circle



6. Share with your class the observations from the microscope images and how these observations helped you evaluate each claim.

7. Co-construct a model with the class, starting with a single cell, to explain what we observed happen in the video and microscope images.

Progress Tracker Update

In your notebook



8. Turn to your Progress Tracker and add another row to record what you figured out about what happens at the site of an injury to fill a gap.

Make predictions.

Turn and talk



9. With a partner, discuss the following questions:

- How do cells grow and split to make new cells?
- What new questions do we have about these processes?

Lesson 10: What do cells need to grow and make more of themselves?

Navigation

With a partner



1. We've seen that cells can make more of the same type, but. . .
   a. What do they need to be able to make more cells?
   b. Where do they get the stuff they need to make new cells?
   c. Be prepared to share your ideas with the class.

Your Ideas About Bacteria

In your notebook



2. In your notebook, write down ideas you may have about bacteria.
   a. Where have you heard about bacteria before?
   b. How do you think bacteria might relate to our healing story?
   c. Do you have any new questions?
   d. Be prepared to share your ideas with the class.

Share initial ideas about bacteria.

With your class



3. Discuss: What do we think we know about bacteria?

Compare bacteria cells to human cells.

With a partner



4. Share with your neighbor:
   a. What do you notice about bacteria cells compared to human cells?
   b. What is similar and/or different?

Propose investigation ideas.

With a partner



5. The scientist wiped this agar plate with a swab from their cheek.
   a. How could we get evidence to convince us that bacterial cells need food and nutrients to grow and make more cells?
   b. Be prepared to share your ideas with the class.

E. coli Bacteria

With a partner



6. Scientists use *E. coli* because. . .

- they are easy to grow in the lab
- there are non-disease-causing versions (strains)
- they share some similar features with other cells

What is agar?

With your class



7. Agar is a dry powder made from red algae.

- It dissolves in boiling water.
- When an agar solution cools, it forms a semisolid jelly.
- Scientists create agar plates by pouring hot agar solution into a petri dish and letting it cool.

How will bacteria respond to different nutrient levels?

With your class



8. Watch the Bacteria Streak video.

- Investigation procedure, step 1: Prepare solutions of agar with different levels of nutrients.
- Investigation procedure, step 2: Streak *E. coli* bacteria onto agar plates.
- Investigation procedure, step 3: Place agar plates in incubator undisturbed.
  - Temperature: 37°C / 98.6°F
  - Left in incubator for 2 days without being disturbed

Predict outcomes.

In your notebook



9. In your science notebook, write your ideas:

a. When the bacteria are on the agar plate with no nutrients, what do you predict we will observe on the plate?

b. When the bacteria are on the agar plate with more nutrients, what do you predict we will observe on the plate?

Analyze data with the I^2 strategy.

With your group



10. We'll use the Identify and Interpret (I^2) strategy to analyze the cell growth data.

a. First, make observations:

i. Point to something you notice in the images.

ii. Talk with your group using "What I See" (WIS) comments.

b. Second, interpret what these observations mean:

i. Think about what each observation means.

ii. Talk with your group about "What It Means" (WIM) for each of your observations.

c. Be prepared to share your ideas with the class.

Images of E. coli on Agar with Different Nutrient Levels

With your group



11. Use the Identify and Interpret (I^2) strategy to analyze the cell growth data on *Reference: Secondary Data for E. coli Grown on Agar with Different Nutrient Levels*.

Consider other single-celled organisms.

With your class



12. With your class, discuss the following question:

a. What are some questions we can try to answer by reading about these other single-celled things?

Obtain information from scientific texts.

On your own



13. To get the information you need from the reading, use *Lesson 10: Obtaining Information from Scientific Text*.

b. Read for the gist—skim the title, headings, and captions on images.

c. Mark up the text.

d. Examine any images, graphs, or tables.

e. Identify the ideas from the text that support what you've figured out so far.

Read about single-celled organisms.

On your own



14. As you're reading, think about the following questions:

a. What do you notice about this organism that's similar or different to the other organisms and cells we've seen?

b. How does this organism's structure and function relate to where it lives? Why do you think it lives where it does?

c. Do they relate to our healing story? If so, how?

d. Finish reading your article for home learning.

e. Be prepared to share your responses with the class.

Discuss different single-celled organisms.

With your group



15. Share what you read about a single-celled organism, and listen to what others learned about different single-celled organisms.

a. What do you notice about this organism that's similar to or different from the other organisms and cells we've seen?

b. How does this organism's structure and function relate to where it lives? Why do you think it lives where it does?

c. Do they relate to our healing story? If so, how?

d. As a group, find similarities and differences among these organisms.

Building Understandings Discussion

Scientists Circle



16. Discuss with your class:

a. Would each of the single-celled organisms we read about make more of themselves following the same pattern we saw with *E. coli* bacteria? Explain your thinking.

b. What did you figure out that your single-celled organisms had in common?

c. Do we have enough evidence that bacteria and other single-celled creatures are living things? What makes you think so?

d. How do bacteria and other single-celled organisms compare to human cells? What is similar and different about them?

Living vs. Nonliving: Cells

With your class



17. Thinking back to Lesson 7. . .

a. What did we figure out about living versus nonliving things regarding cells?

b. Do you think that all living things are made of cells? What evidence could you use to support your answer?

c. Be prepared to share your responses with the class.

The Lifespan of Cells

With a partner



18. Analyze and read *Reference: Lifespan of Cells*. Annotate or highlight anything that helps us answer, "How long do cells live?"

Progress Tracker Update

In your notebook



19. Turn to your Progress Tracker and add another row to record what you figured out about single-celled organisms.

Assessment: What do bacteria need to make more of themselves?

On your own



20. In your notebook add additional readings/information from Lessons 9 and 10.

a. Be prepared to individually complete an assessment using those resources.

b. Remember, you can share your thinking using words, pictures, or a combination.

c. Individually complete *What do bacteria need to make more of themselves?*.

Lesson 11: How do cells get what they need to grow?

Navigation

Turn and talk



1. What do cells need to grow and make more cells?

Share initial ideas.

In your notebook



2. How do you think cells get what they need to grow and make new cells?
   - Be prepared to share with the class.

Prepare to investigate onion skin cells.

With your group



3. To prepare to investigate your onion skin slide, read through the steps found in *Procedure to Investigate Structures in Red Onion Cells* and discuss the following questions:
   - What questions do you have?
   - What are we trying to figure out from this investigation?

Record your data.

With your group



4. As you work, document your observations and your thinking on *Data from Investigating Red Onion Cells*. Make sure to calculate the total magnification at which you are observing!

Conduct the investigation.

With your group



5. Conduct the investigation following the steps in *Data from Investigating Red Onion Cells*.
6. Use a new dry piece of paper towel each time you soak up liquid from the onion slide.
7. Make sure to record your data on your handout for the appropriate steps and answer the corresponding questions.

Building Understandings Discussion

Scientists Circle



8. What did you notice about the structure of the red onion cells?

Compare animal and plant cell images.

With a partner



9. With your partner, analyze and compare the images on *Reference: Animal and Plant Cell Images*. Discuss the following questions and be prepared to share your observations with the class.

- Which are animal cells and which are plant cells? How do you know?
- Do you see evidence of two boundaries in any other cells besides the red onion cells?

Building Understandings Discussion

Scientists Circle



10. Discuss the following questions with your class.

- What did you notice about the structure of the onion cells before you added anything, and when you added. . .
  - Salt water?
  - Plain water the second time?
- What do you think happened to cause what you observed?
- What are the functions of the structures we saw in these cells?

Update Progress Tracker.

In your notebook



11. What have we figured out?

- In your notebook, add another row to your Progress Tracker.
- Write the lesson question in the left column: "How do cells get what they need to grow?"
- Use words and pictures to document what you have figured out and what you now wonder about healing.

Lesson 12: How do the structures and systems in the body work together to heal the injury?

What can we explain about how the foot healed?

With your class



1. What are some of the big ideas we've figured out about cells that can help us explain healing?
2. Do you think we can explain how healing happened around each of the events on our timeline?

Read a report from a doctor visit.

On your own



3. Read the report from the doctor visit about the injured finger.
   - What did you find out about swelling?
   - Be ready to share an idea about swelling with the class.

Building Understandings Discussion

With your class



4. Discuss with your class: What have we figured out about swelling?

Explaining How Healing Happened in the Foot

With a partner



5. First, you will work with your partner to explain two events in the healing timeline using evidence. Second, you will explain your events to someone from the other group. Third, you and that new partner will work together to explain the last event on the chart.

With a partner



6. With your new partner:
   - Share your explanations and evidence. Think: What do our explanations have in common?
   - Listen to your partner's explanations and jot some notes about how to explain healing around those events.
   - Work together to explain the final event in our timeline: How did the body heal so the student could walk again without crutches?

What happens inside the body as it heals?

Scientists Circle



7. Work together as a class to explain how the injured foot healed. What happens inside the body as it heals?

Explain how the different systems in the body interact during the healing process.

On your own



8. Use the key science ideas we just listed to construct an explanation that answers the question, "How do the different systems in the body interact when healing happens?"

The Healing Process of Two Other Organisms

With a partner



9. Analyze the images and read about two other organisms, a lizard and a sea star, to look for similarities and differences in how their body heals from an injury.

10. Use what you have figured out about healing to answer the questions on the handout.

Exit Ticket

On your own



11. Think about what you saw with the lizard and the sea star. On a piece of paper or notecard, answer the following question: ***How do you think the process of healing and the process of growing are similar or different?***

Lesson 13: How is the process of growing similar to healing?

Navigation

With your class



1. Until now we have been working to explain healing. Today is our chance to test how generalizable our model ideas are in explaining something other than healing.

Compare human bones.

With your class



2. Discuss:

a. In our unit, we have been figuring out some things about bones. Think about bones in a young child compared to an adult. How do the bones of an adult compare to the bones of a child?

b. Many of you were saying that children are growing and so their bones must be growing too. If you think about how how this happens, what are some initial ideas you have about how bones might grow?

Make predictions about growth plates.

In your notebook



3. Write two predictions in your notebook to answer these questions.

a. What happens in those spaces at the growth plates?

b. Where else in the body besides the hand or knee, do you think we would find these spaces/growth plates?

Examine growth plates all over the body.

With your class



4. Write two predictions in your notebook to answer these questions.

a. What do you notice about where the growth plates are found?

b. Think back to the x-rays we saw. What do you think we would see on an x-ray where we see purple lines in the diagrams?

c. What do you think happens at these growth plates between the time someone is a baby until they are an adult?

d. What do we think needs to happen for the bone to grow?

Individually complete an assessment.

On your own



5. Use your key science ideas, science notebooks, posters we have created together, and evidence from the growth plate images to support your thinking.

Evaluate our DQB questions.

Scientists Circle



6. Gather in a standing Scientist Circle at the DQB.
7. Share what categories of questions we still need to make progress on.

Celebrate our progress on the DQB.

With your class



8. Which questions have we made the most progress on?
9. What have we figured out?
10. What new questions do we have?

Revisit the DQB.

Scientists Circle



11. Join your class in a standing Scientist Circle around the DQB. Share what categories of questions we still need to make progress on.

Navigation and Self-Assessment

Home Learning



12. Reflect on your use of peer feedback as home learning.

Quick Write: Reflect on our experiences.

On your own



13. Answer the following questions in your science notebook.
    1. What was most challenging in this unit? Year?
    2. What was most rewarding in this unit? Year?
    3. Think about how you engage in sensemaking discussions with classmates. How would you want to engage in those experiences the next time around?
        a. What would you do the same?
        b. What would you do differently?
14. Be ready to share these ideas when you return to class.

Lesson 14: How can shifting our perceptions of ability and disability allow us to be more thoughtful about how we make our environments more accessible?

Take stock of our home learning.

On your own



1. Reflect on the supports used in the healing process. Take out your home learning and answer the following: How do members of your community support healing?
2. Be prepared to share your stories with a partner.

Share community stories of healing methods.

Turn and talk



3. Share a story from your community about healing methods used to support healing. Discuss with your partner how each support might help the healing process, and why people use these supports.
4. Record any questions you have in your science notebook.
5. Be prepared to share your thinking with the whole class.

Return to doctor's response.

With your class



6. What is recorded on the recovery report from Lesson 1 that is a clue that the doctor felt the student was healed and had full function?

Was the student able to play basketball again?

On your own



7. Listen to the audio and annotate the transcript to figure out if the student was able to return to the same physical activities he did before his injury.
   - Underline the parts of the transcript that you find interesting.
   - Circle the parts you have questions about.
   - Highlight parts that talk about the things he could do before and after the injury.
   - Be ready to share these ideas with the class.

Compare body function from other healing stories.

In your notebook



8. Draw a 2-column chart in your science notebook labeling the left side "Jeremy's Story" and the right side "Matt's Story."

9. As you watch the videos, consider the following questions:

- How is each person's story similar and different from the case we have been looking at since Lesson 1?
- What is Jeremy's view about the function of his body before and after his injury?
- What does Matt share about playing basketball?

Compare stories of healing.

Turn and talk



10. Turn and talk with a partner about these questions. Be ready to share your thinking with the class.

- How is each person's story similar and different from the case we have been looking at since Lesson 1?
- What is Jeremy's view about the function of his body before and after his injury?
- What does Matt share about playing basketball?

Identify shifts in perspectives about disability.

With your class



11. Discuss the following questions with your class.

- What did Jeremy share about how he feels about his disability?
- What did Matt share about how he feels about his disability?

Home Learning



12. As you work on your home learning, consider the following question: What are different people's perspectives about disability and how can these change?

Share ideas from home learning.

With your class



13. Reflect on the disability icons shown on your home learning and on the slide.

- What similarities and differences did you notice?
- What do these icons suggest about people with disabilities?
- Why do you think this icon was updated in 2010?

Rosie King's Story

With a partner



14. As you listen to Rosie's story, think about the following questions. Be prepared to share your thinking with the whole class.

- What is her invisible disability?
- What are some things she shares about her disability?

Reflect on disability.

On your own



15. Individually, in your notebook, reflect and write down how your thinking has changed around disability. Use these sentence stems to help you.

- What I used to think about disability:
- What I now think about disability:

Home Learning: Sinéad Burke's Story

Home Learning



16. As you watch Sinéad's story, think about the following questions. Be prepared to share with the whole class next time.

- What does Sinéad share about her disability?
- What parts of her environment does Sinéad say is challenging for her to navigate and why?
- What is Sinéad's design challenge?

Share findings from home learning.

With your class



17. As a class, discuss these questions.

- What does Sinéad share about her disability?
- What parts of her environment does Sinéad say is challenging for her to navigate and why?

Sinéad Speaks About Design

Turn and talk



18. Turn and talk about these ideas, and be prepared to share your thinking with the whole class. What does it mean when Sinéad says that design. . .

- "Is a way in which we can feel included in the world?"
- "Is a way in which we uphold a person's dignity and their human rights?"
- "Can inflict vulnerability on a group whose needs aren't considered?"

Sinéad's Design Challenge

With your group



19. Sinéad asks us to think about:

- Who are we not designing for?
- How can we amplify their voices and experiences?

20. Design brainstorm: If Sinéad were to visit our classroom. . .

- What areas of our school would need to be redesigned so she can easily access our classroom?
- How would you redesign these areas?
- How would your redesign improve accessibility for Sinéad?
- Be ready to share your thinking with the whole class.

Think about other needs.

With your group



21. Thinking of the student from Lesson 1, and the basketball players Jeremy and Matt, if they were to visit our classroom:

- What areas of our school would need to be redesigned?
- Would your adaptations also work for Sinéad?
- Be prepared to share your thinking with the whole class.

Design for invisible disabilities.

With your group



22. If Rosie visited our classroom:

- What types of adaptations might make the environment more accessible for Rosie?
- What areas of our school would need to be redesigned?
- Be prepared to share your thinking with the whole class.

Reflect on the unit.

With your class



23. Reflect on the following with your class:

- What are some needs we all have?
- Why is it important to be aware of and listen to other people's perspectives?

Procedures for Investigating Blood with a Microscope

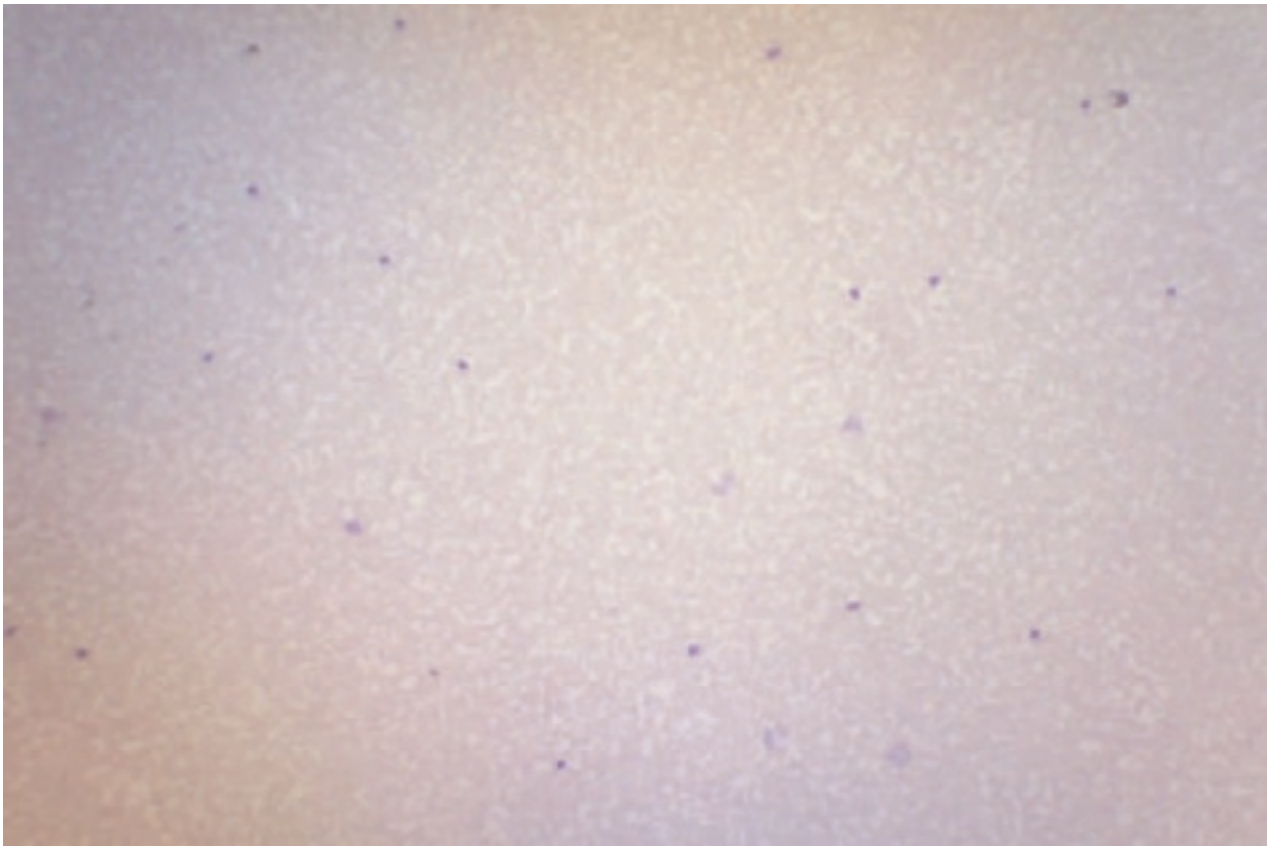
1. Slides are fragile so handle them gently.
2. Hold slides by the edges.
3. Put the slide under the clips to hold it still.
4. Start at the lowest objective (4x, red/low).
5. Focus slowly! If you only see a blur of one color across your view, that's not what you're looking for.
6. Adjust the amount of light coming in through the slide to help you see better.
7. Draw what you see in the whole field of view in the corresponding part of your data table.
8. Be sure everyone in your group has a chance to see (and adjust the focus, if needed).
9. Switch to the next highest objective (10x, yellow/medium) and repeat the process from step 5 (and then again for the highest objective (40x, blue/high)).

Microscopic Images of Animal Blood

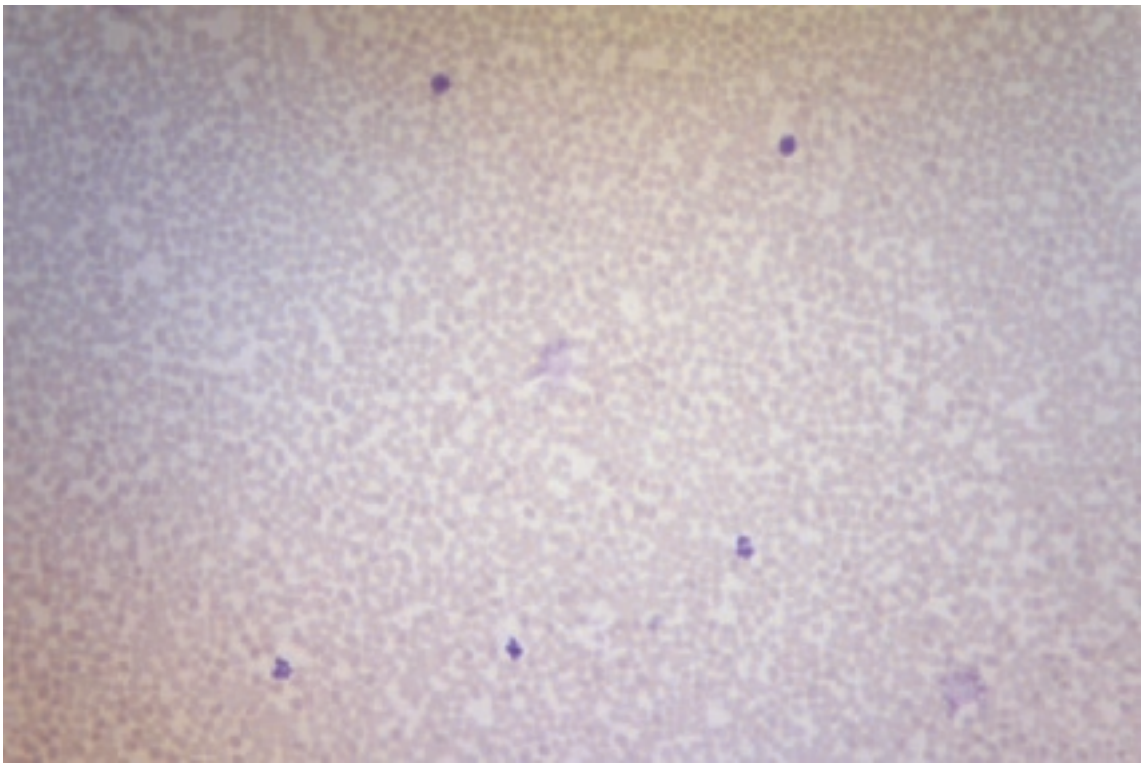
Cat blood on a slide, viewed without a microscope



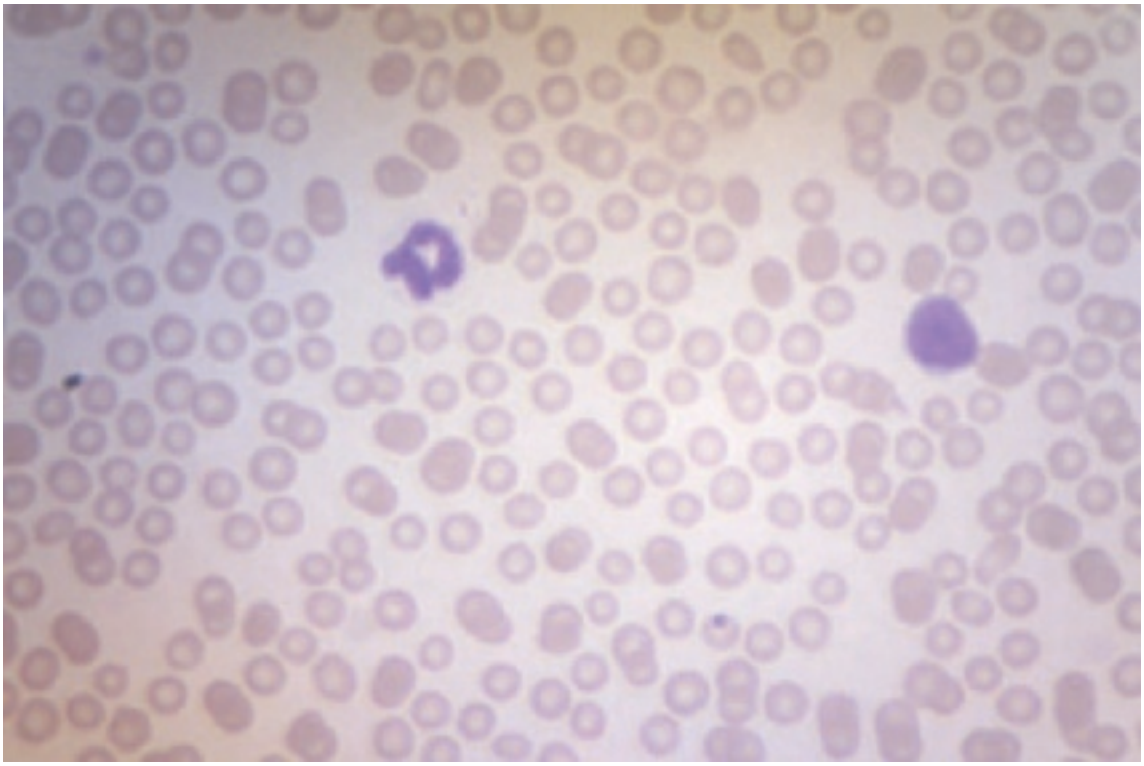
Cat blood viewed through a microscope at low magnification



Cat blood viewed through a microscope at medium magnification

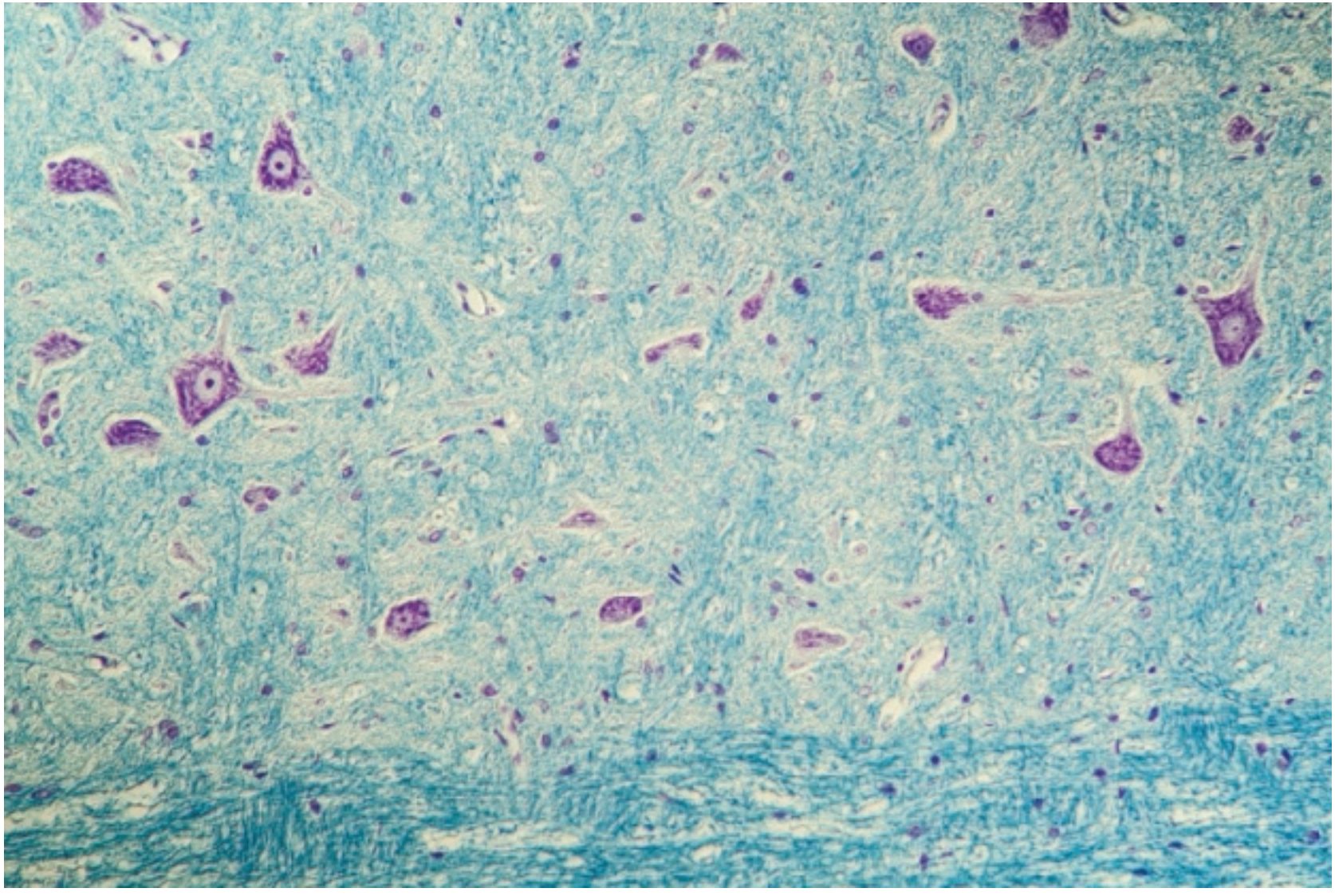


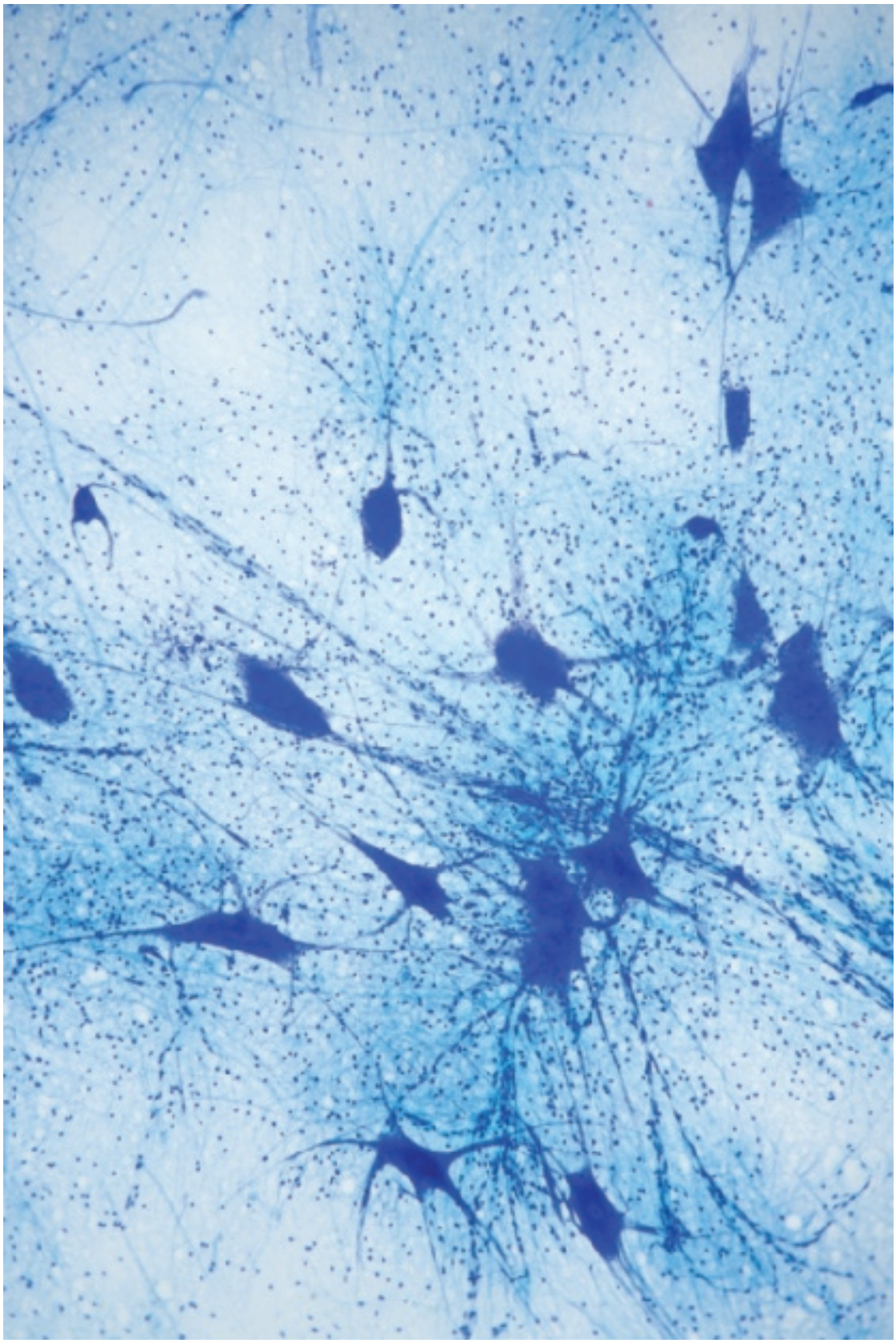
Cat blood viewed through a microscope at high magnification



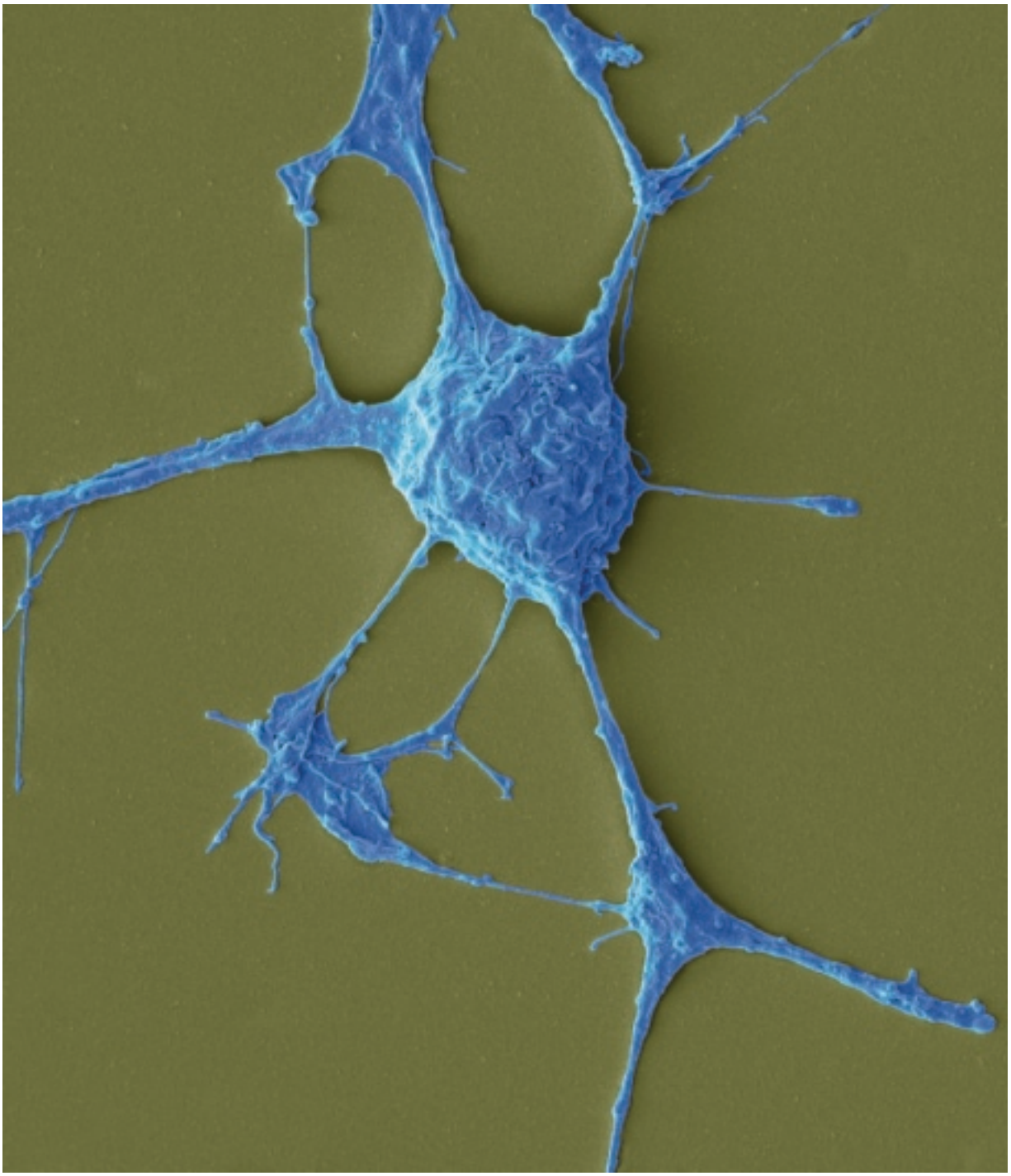
Microscopic Images of Nerves

Human nerve smear at low magnification

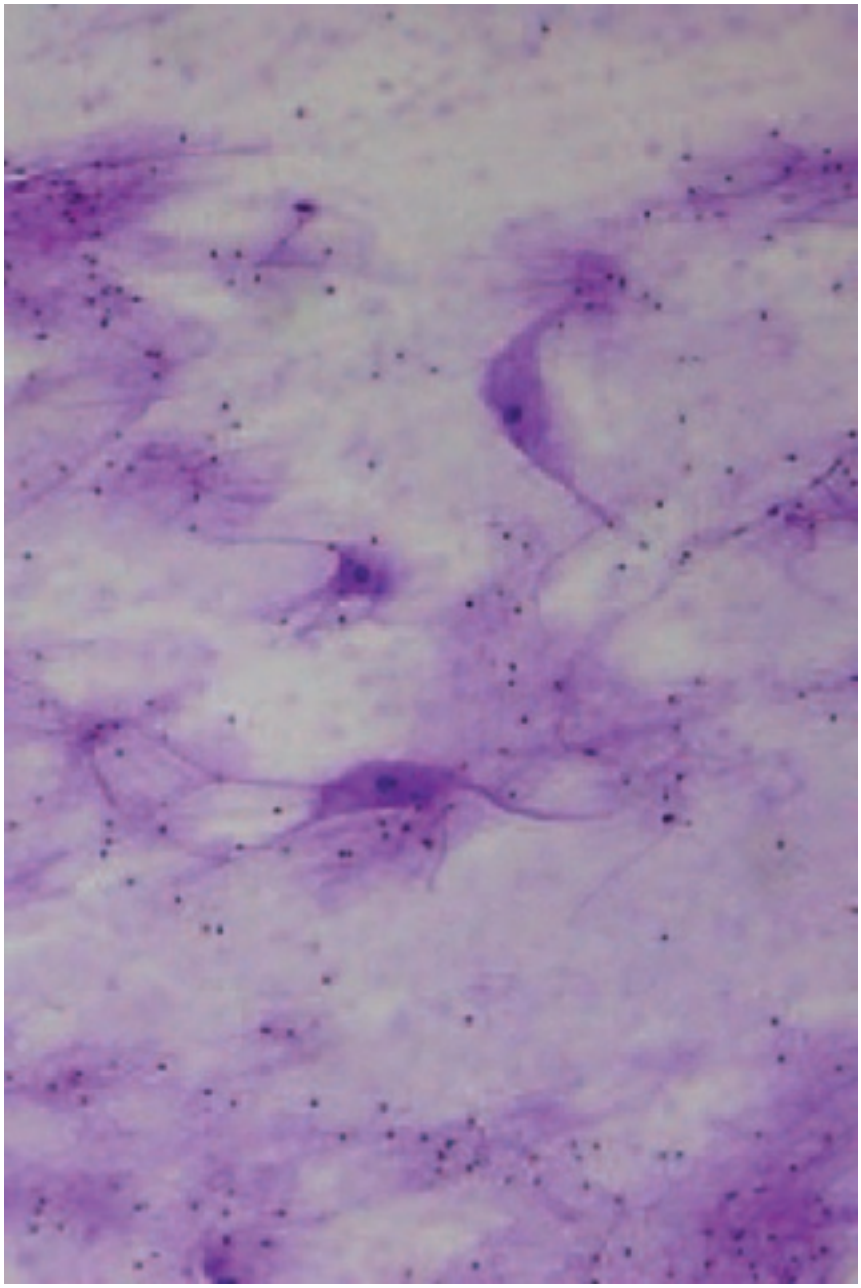




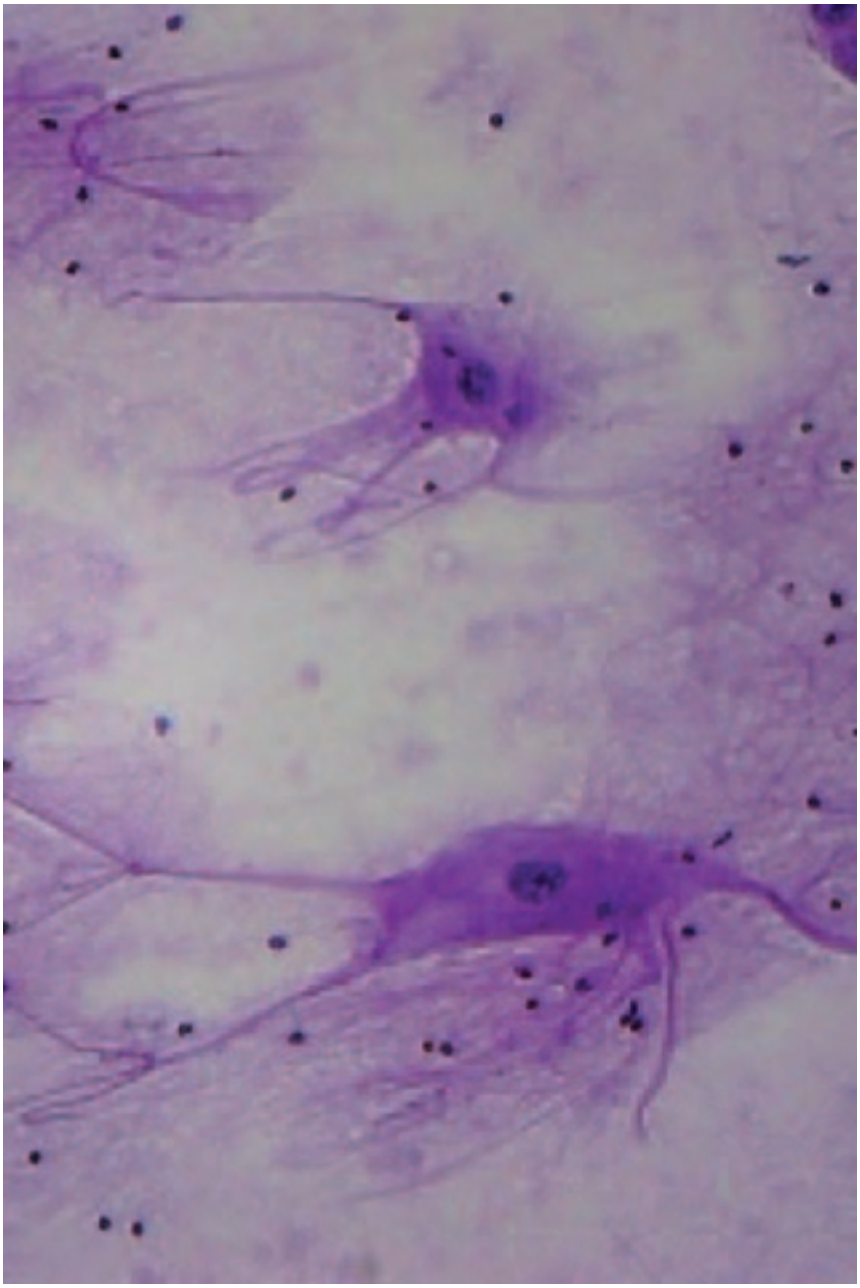
Human nerve smear at medium magnification



Human nerve smear at high magnification

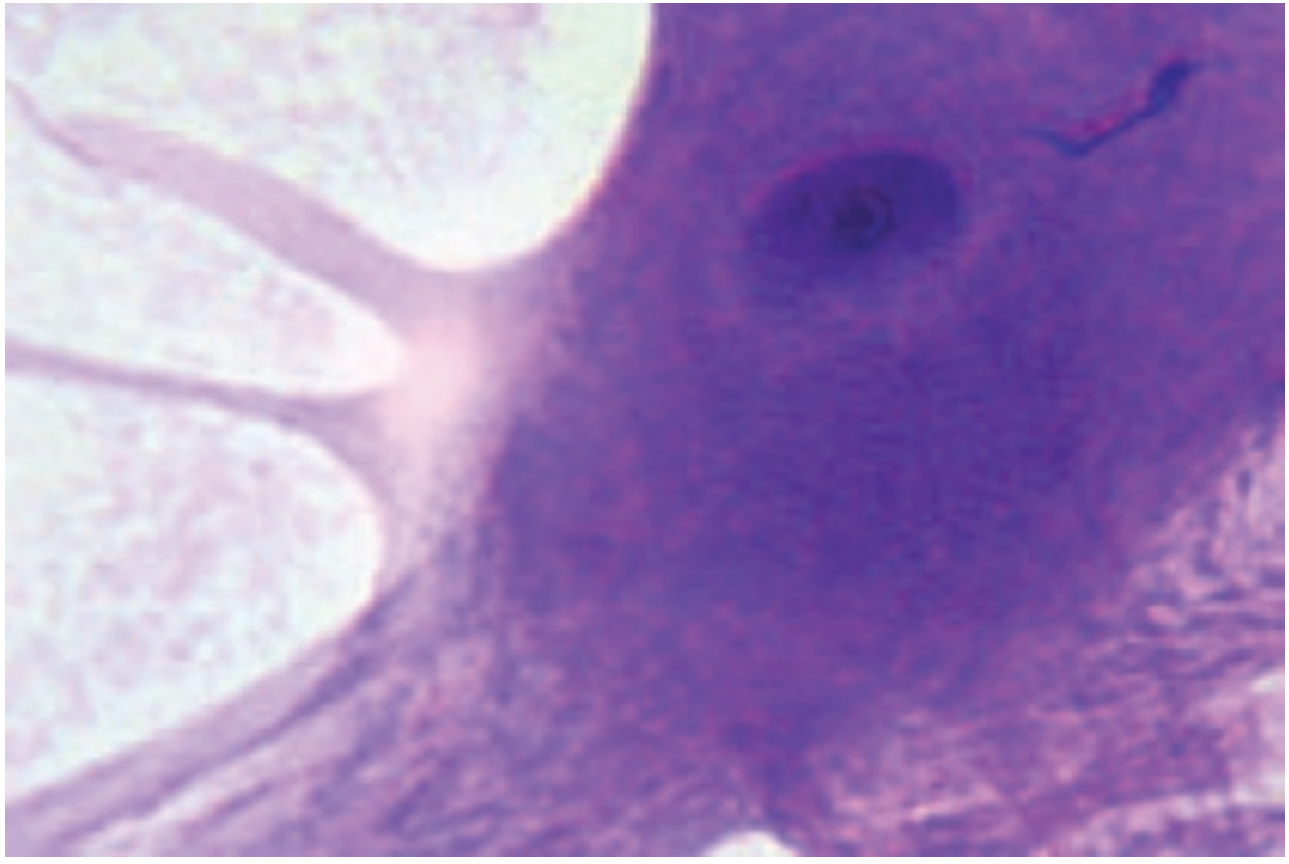


Ox nerve smear at low magnification



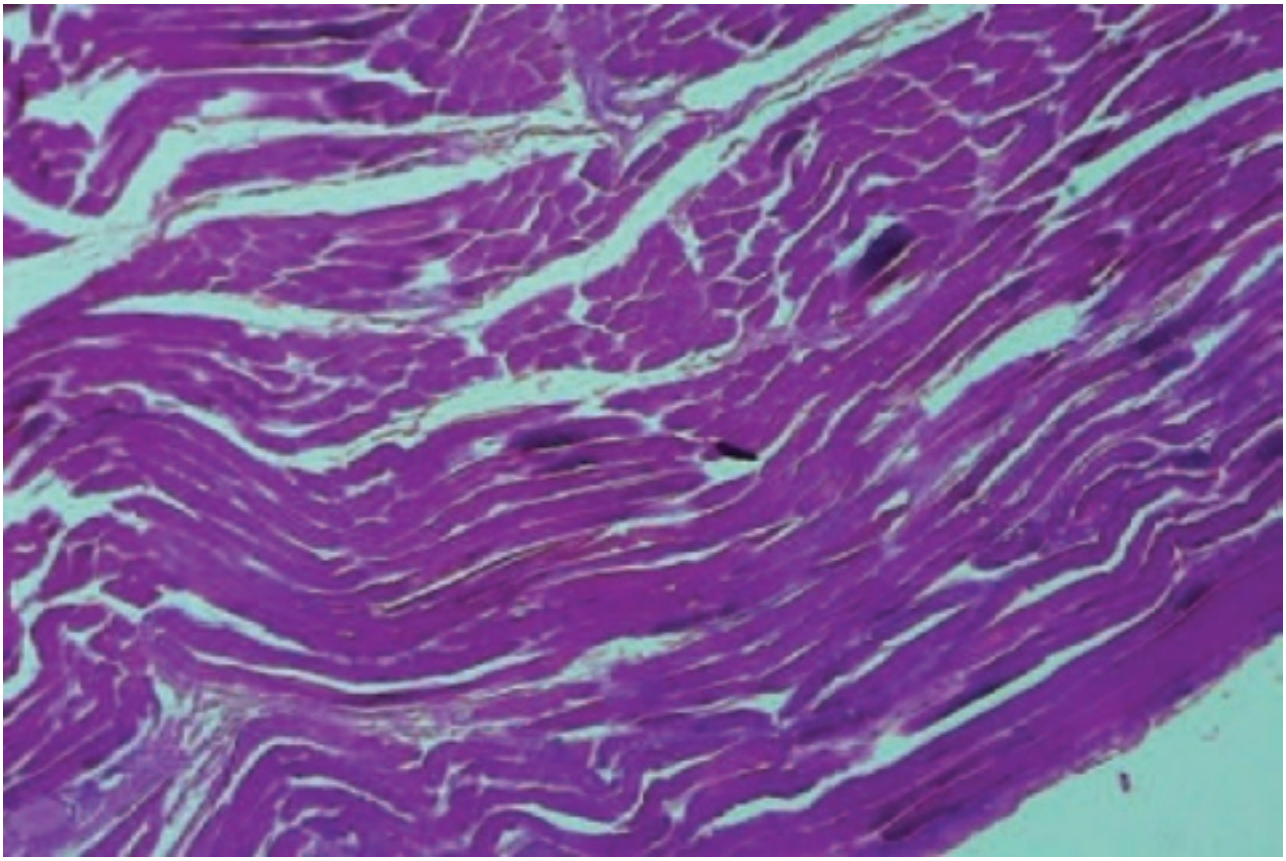
Ox nerve smear at medium magnification

Ox nerve smear at high magnification

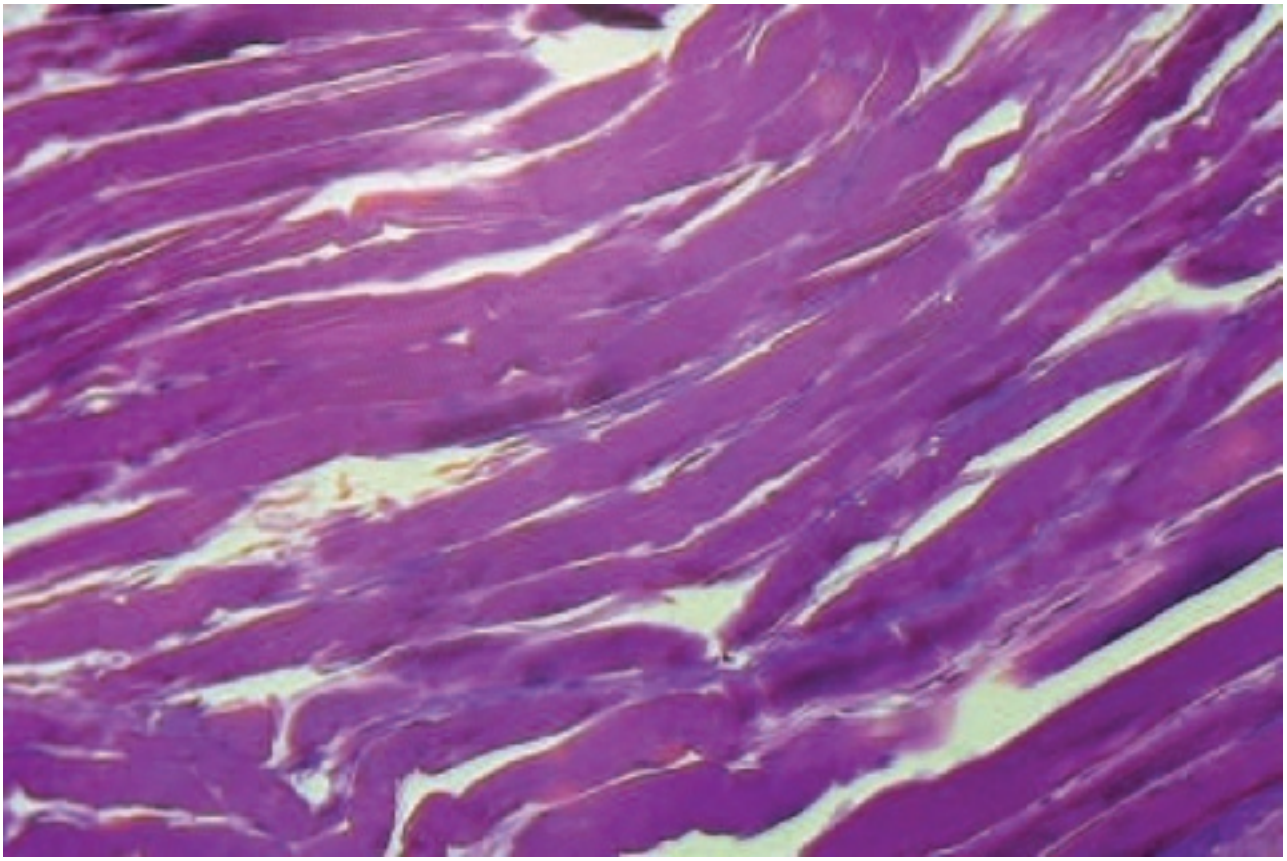


Microscopic Images of Muscle, Bone, and Skin

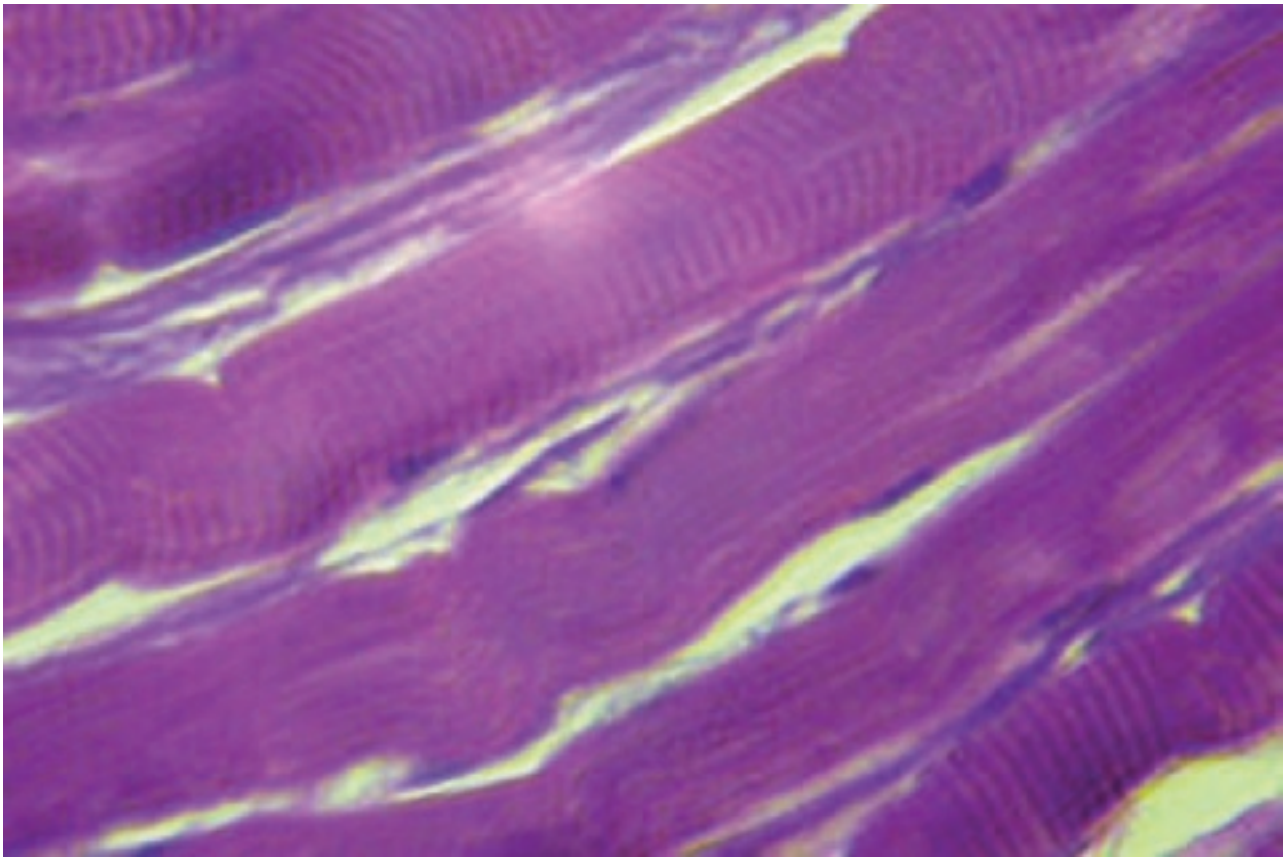
Human muscle at low magnification



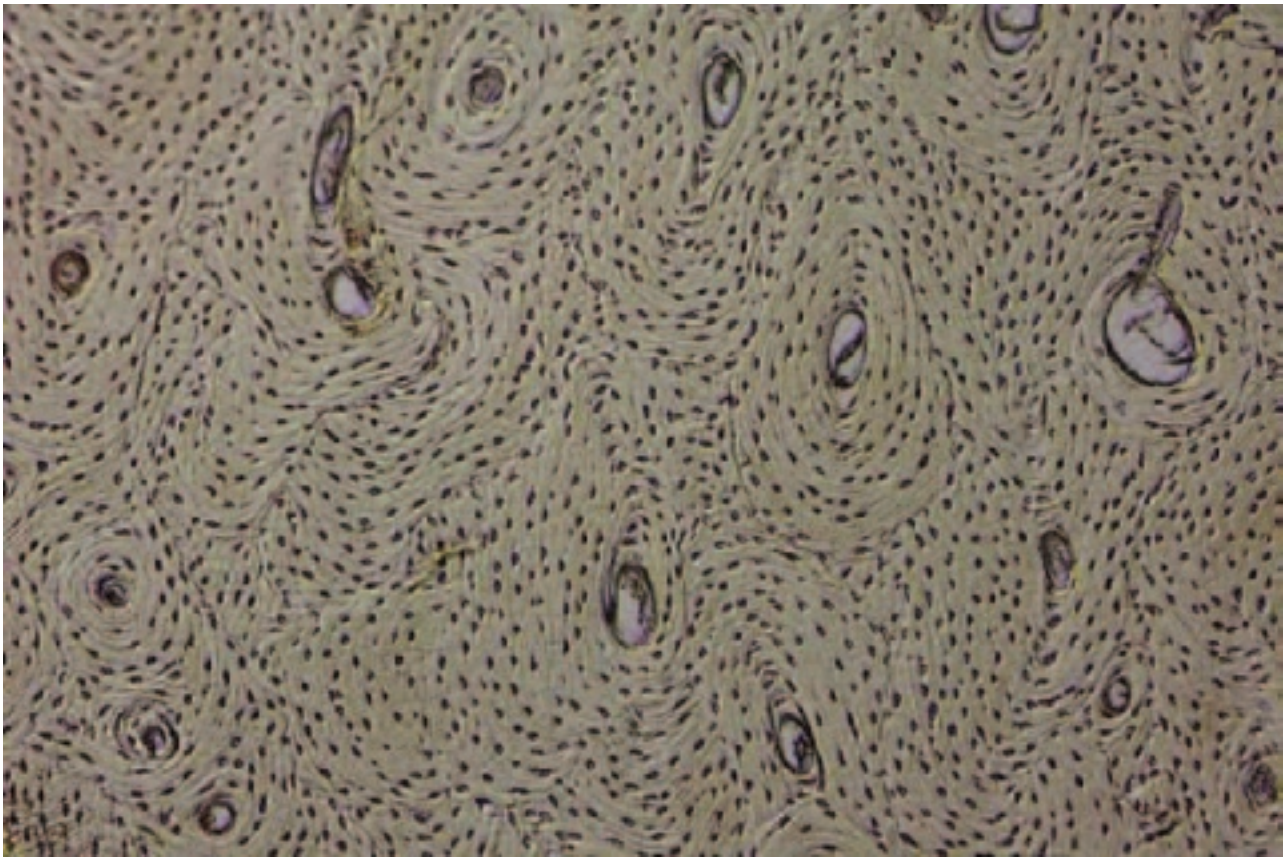
Human muscle at medium magnification



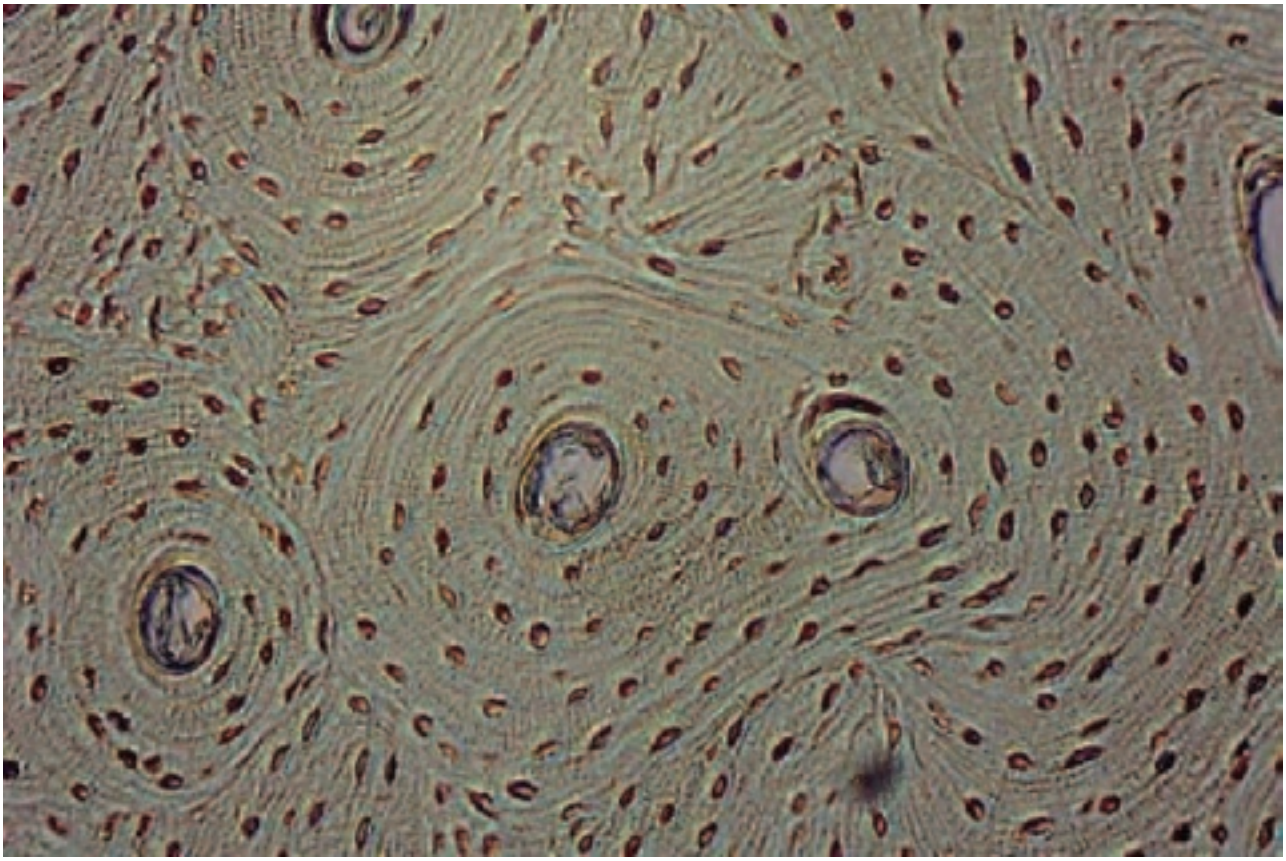
Human muscle at high magnification



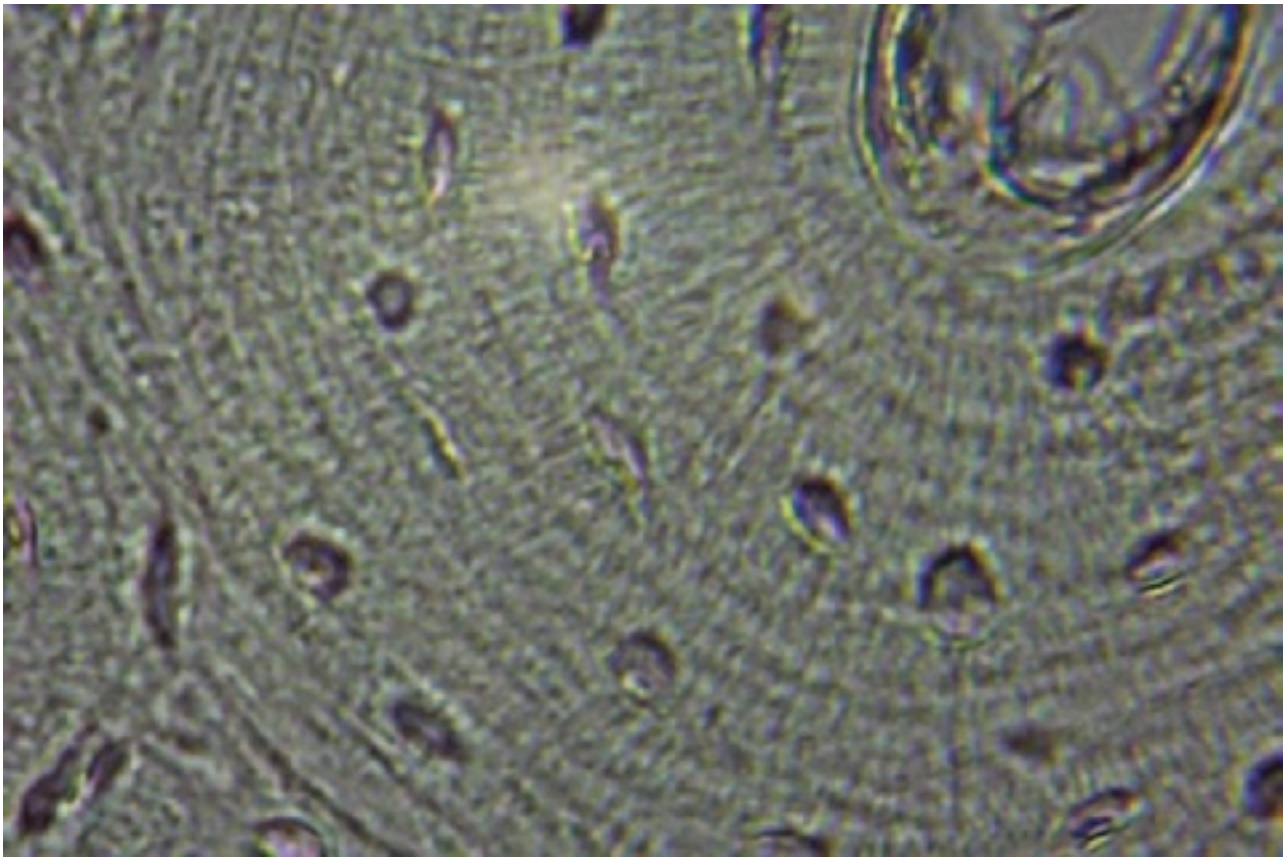
Human bone at low magnification



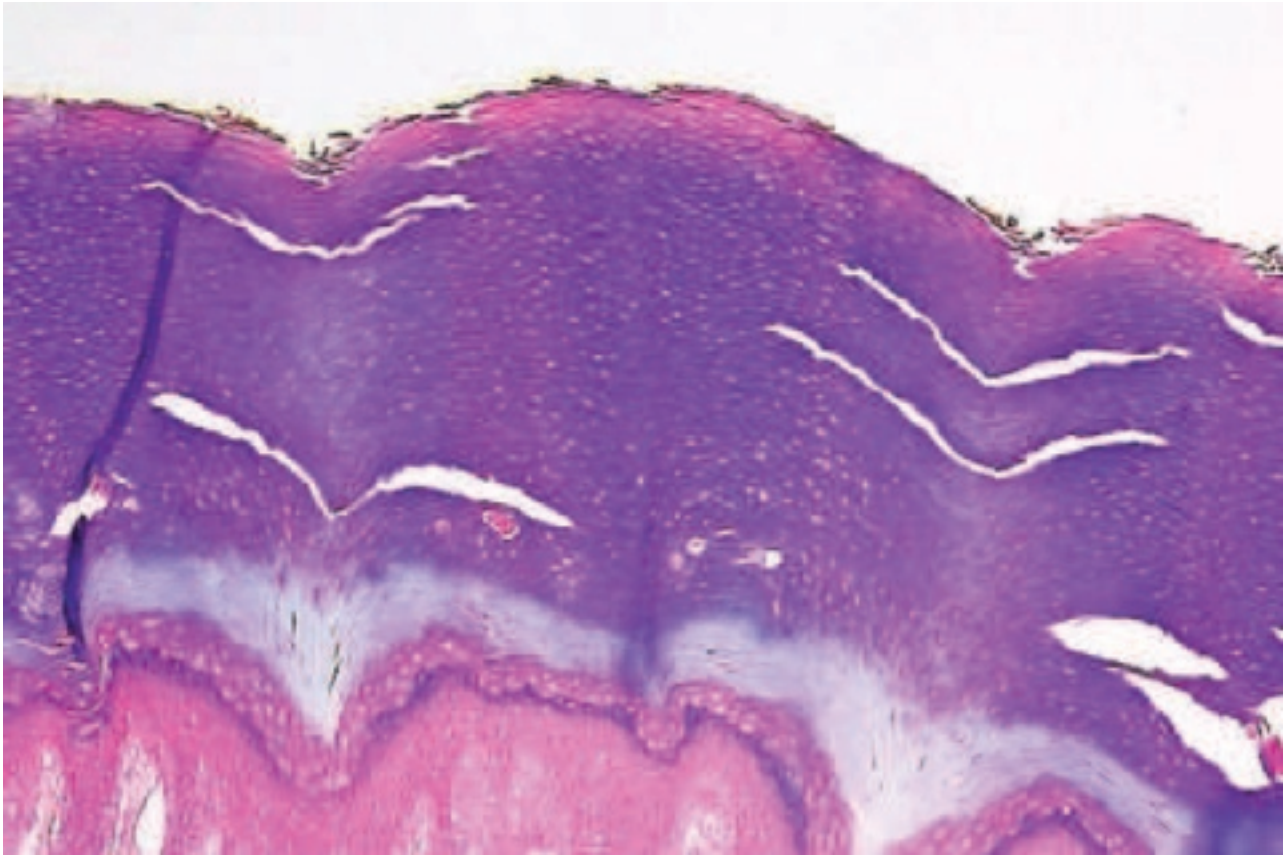
Human bone at medium magnification



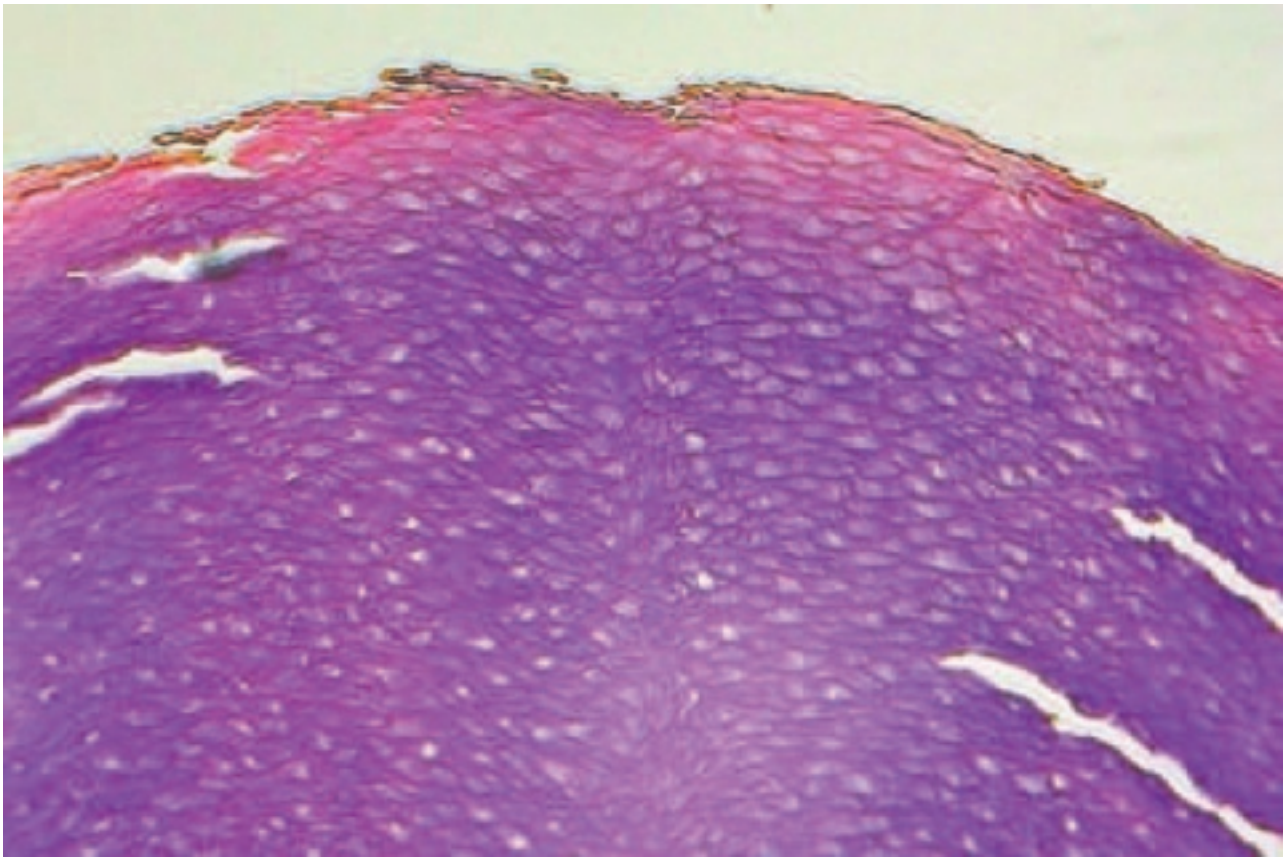
Human bone at high magnification



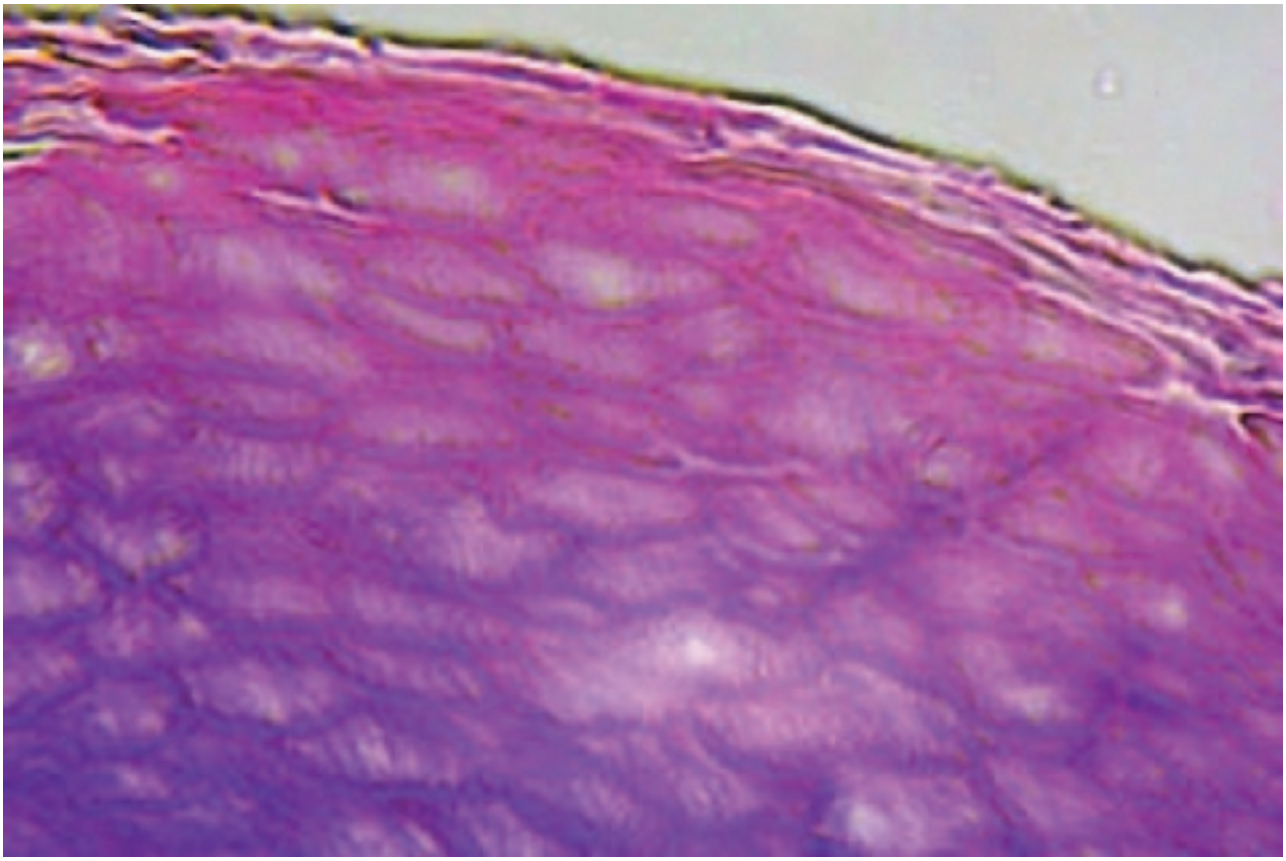
Human skin at low magnification



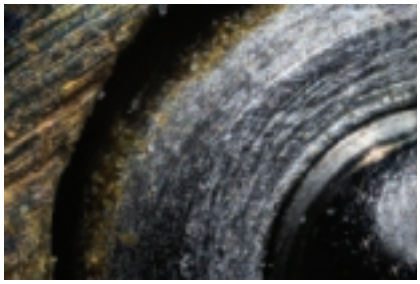
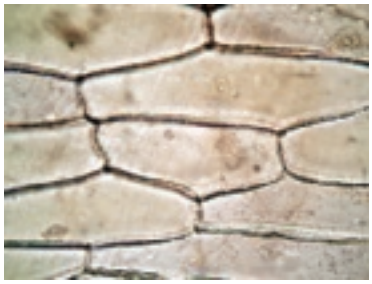
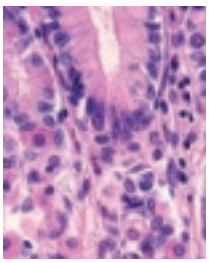
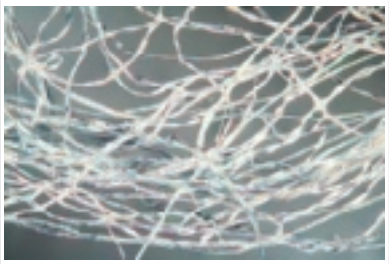
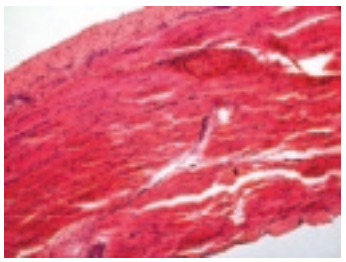
Human skin at medium magnification



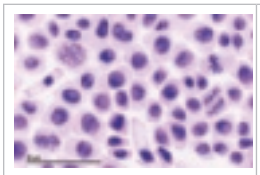
Human skin at high magnification

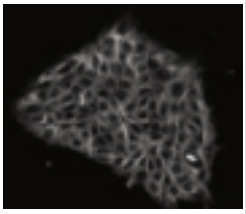


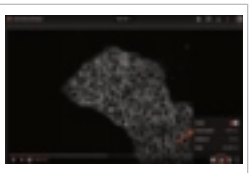
Microscopic Images of Various Objects

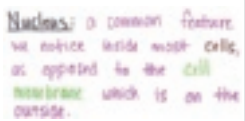
A Piece of Metal	Onion Skin	Grains of Sand
		
Animal Stomach	**Fabric Fibers**	**Muscle**
		

One Cell Making Two Similar Cells

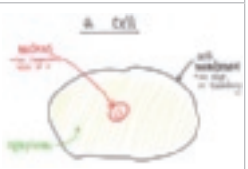


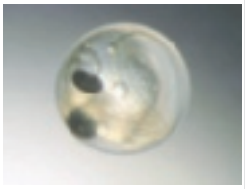


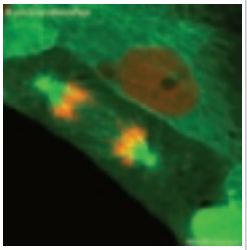
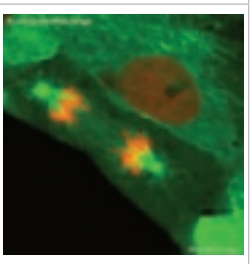
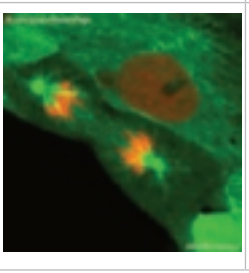
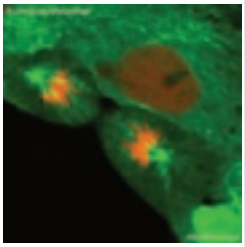
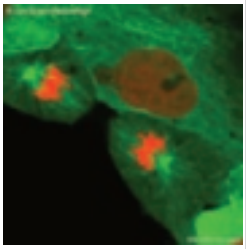
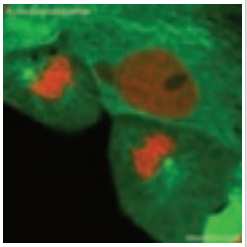
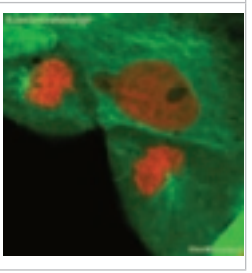




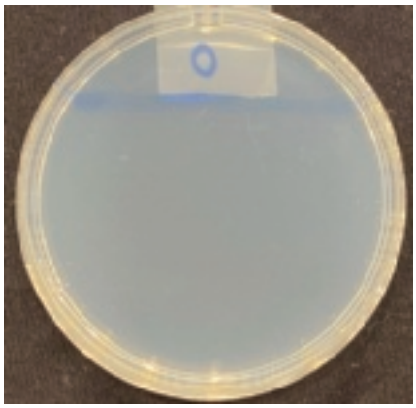



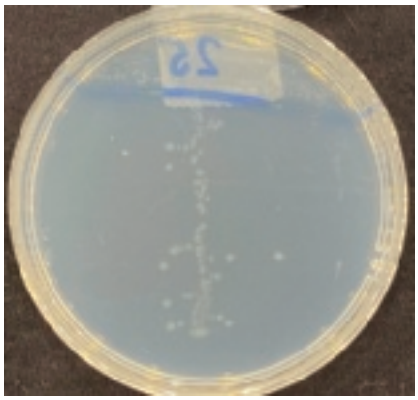








Secondary Data for E. coli Grown on Agar with Different Nutrient Levels

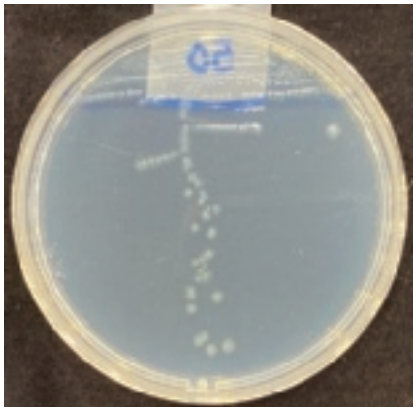
The images below show the growth of *E. coli* on agar plates containing 0, 25, 50, 75, and 100% nutrients after 2 days at 37°C/98.6°F.



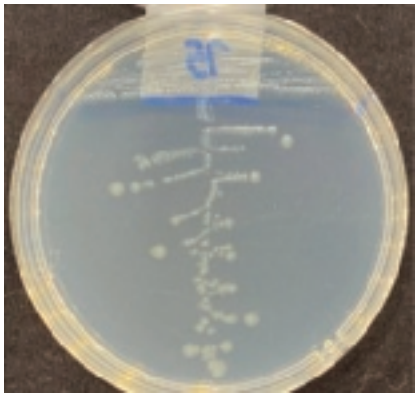
0% nutrients



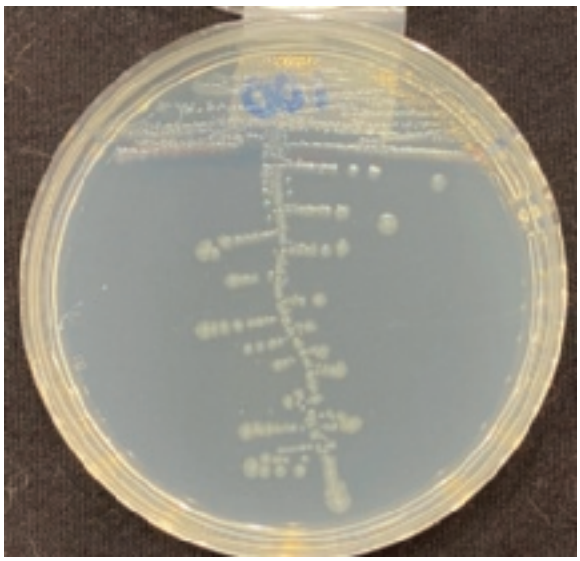
25% nutrients



50% nutrients



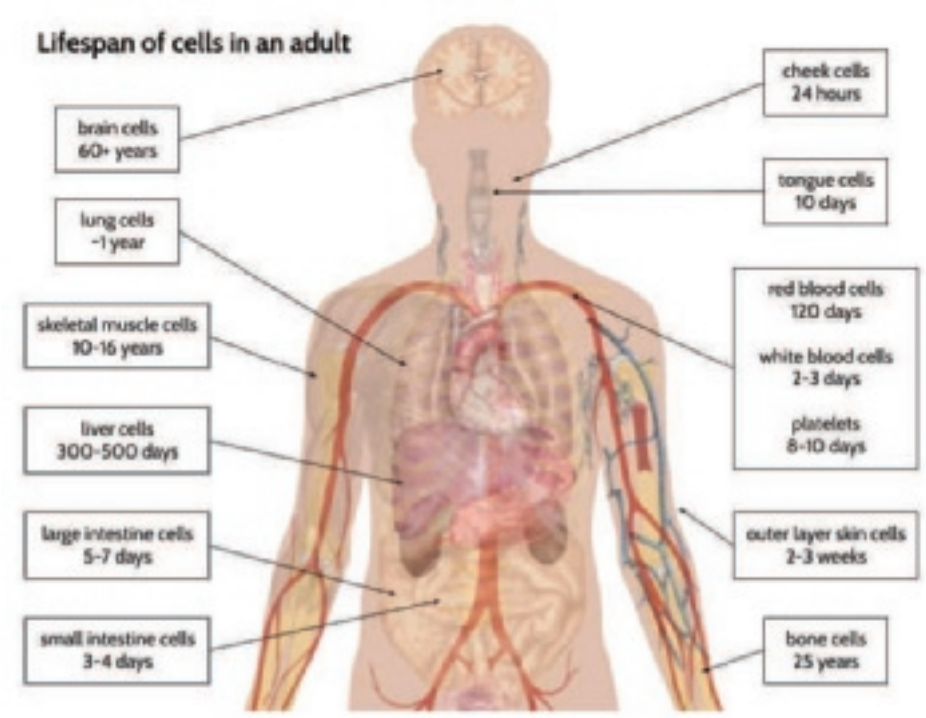
75% nutrients



100% nutrients

Lifespan of Cells

Analyze the image below to figure out more about whether other cells in our body die and how long they live.



Self-Assessment and Peer Feedback

Does the argument include the important elements?

Important elements of scientific argument	Self-assessment	Peer feedback: Use a colored pencil
1. Does the argument state a claim about the following question? What do you think our (human) cells need in order to reproduce and make more of themselves? **Remember...** • You may use words, pictures, or a combination of both to help make your argument.	Underline places where you state a claim. Make notes of where you can improve your claim. Think about the way you use words or pictures to communicate your claim.	Are the underlined parts where they state a claim? If so, add a check mark. Are there additional places where they state a claim but it isn't underlined? If so, underline them. Could their claim be improved by using different words or pictures? If so, what would you add?
Does the argument include evidence from classroom investigations or readings to support the science ideas?	Circle evidence that you used. Make notes about where you could add more evidence to support your claim.	Are the circled ideas examples of evidence? If so, add a check mark. Is there additional evidence that is not circled? If so, circle it. Could the argument use more evidence to support it? If so, add suggestions of what evidence could be used and where to use it.
Does the argument include cause-and-effect language?	Highlight places in your argument where you use cause-and-effect language. Make notes about where you could add more cause-and-effect language in your argument.	Are the highlighted areas examples of cause-and-effect language? Is there additional cause-and-effect language that is not highlighted? If so, highlight it. Could the cause-and-effect language be made more clear? If so, add suggestions of how to make the cause-and-effect language more clear.

Based on self-assessment and peer feedback, consider how to revise the argument: What should be added? What should change?

- Does the argument include a claim about what human cells need in order to reproduce and make more of themselves?
- What evidence from investigation or readings does the argument use? Is there additional evidence to include?
- Does the argument include cause-and-effect language? Can the idea of cause and effect be made more clear in the argument?

Record notes about what to revise directly on *What do bacteria need to make more of themselves?*.

Peer Feedback Guidelines

Giving Feedback to Peers

This tool was inspired by the Sticky Note Feedback resource originally developed by Ambitious Science Teaching at https://ambitiousscienceteaching.org/sticky-note-student-feedback/.

Feedback needs to be specific and actionable.

That means it needs to be related to science ideas and have your own suggestions for improvement.

Examples of productive feedback:

- "Your argument said that our cells need food to grow. I think you should add evidence from the bacteria growth investigation to show how you know this."
- "Your argument said that based on the investigation, all living cells need nutrients to reproduce. I think you should add specific details from the investigation to show which data supports your claim."
- "Your argument said that human cells don't need to eat in order to reproduce because our cells are not the same as bacteria. I disagree with your claim and suggest reviewing the readings, which give examples of other living cells that also need food to reproduce."

Examples of unproductive feedback that do not help other students improve:

- "I like your argument."
- "I agree with everything you said."

How to Give Feedback

Your feedback should give ideas for specific changes or additions the person or group can make. Use the sentence starters below if you need help writing feedback:

- I like how you _____. It would be more complete if you added _____.
- I see you're thinking about _____. Do you think you should add _____?
- The argument said that _____. I disagree because _____. I think you should change _____.
- I agree that _____. I think you should add more evidence from _____.
- I agree/ disagree with your argument that _____. However, I do not think the _____ (evidence) you used matches your claim.

Receiving Feedback from Peers

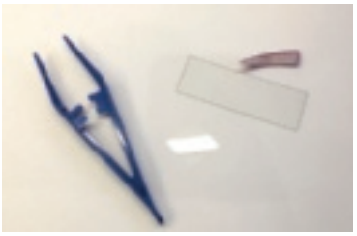
The purpose of feedback is to get ideas from your peers about things you might improve or change to make your work more clear, more accurate, or better supported by evidence you have collected. It can also help you communicate your ideas more effectively with others. When you receive feedback, you should take these steps:

- Read the feedback carefully. Ask someone else to help you understand it, if necessary.
- Decide if you agree or disagree with the feedback, and reflect on why you agree or disagree.
- Revise your work to address the feedback.

Alternate—Preparing Red Onion Skin Slides

Procedure for preparing your onion skin slide

1. Get a slide, a coverslip, a piece of red onion, and tweezers (or a toothpick) from your teacher.



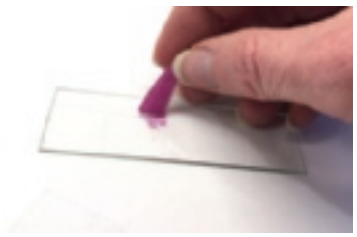
2. Gently bend the piece of onion against the curve until it snaps.



3. Carefully peel off a thin layer of the onion's outer purple skin. The onion skin will look like pink cellophane. You can use your fingers, tweezers, or a toothpick to help peel the skin off. Try not to wrinkle or fold the skin, stretching it as flat as possible.



4. Lay the onion skin across the slide as you are pulling it away from the onion flesh. Use your tweezers, toothpick, and/or fingers to spread the skin as smoothly as possible on the slide so it's not folded or wrinkled. You will likely have some wrinkles, but you want at at least some area that is smooth. (That's where you will want to focus with the microscope.)



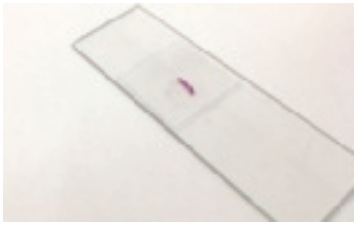
5. Add one drop of water on top of the onion skin.



6. Rest one edge of the coverslip on the slide next to the onion skin. From there, let the coverslip fall gently over the water and the onion skin.



7. Check to make sure there are no air bubbles under the coverslip. You want a tight seal with as few air bubbles as possible. If you see bubbles, try one more time: carefully slide or lift off the coverslip, smooth the onion skin again, add a drop of water, and gently drop the coverslip again. If you still see some bubbles this time, that's OK.

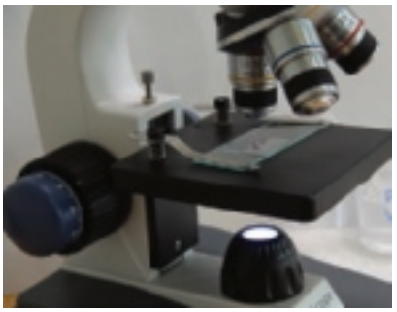


8. Follow the rest of the procedures on Procedure to Investigate Structures in Red Onion Cells and answer the prompts on Data from Investigating Red Onion Cells.



Procedure to Investigate Structures in Red Onion Cells

Procedure for investigating the onion skin in plain water



1. Place the red onion slide under the microscope and observe it under the medium objective (10x, yellow). If the water under the coverslip has evaporated, place a few drops of plain water at the edge of the coverslip. Use the coarse focus to find the structures and the fine focus to make them clearer. Begin with a low light and adjust as needed. Try to find a smooth pigmented area of the onion skin so you're looking at just a single layer rather than a wrinkle or fold.
2. Record your observations in the first row of the data table on *Data from Investigating Red Onion Cells*. Begin to answer Question 1 on *Data from Investigating Red Onion Cells* while you wait for your group to finish recording their observations. After everyone has had a chance to see the red onion in **plain water** and record their observations, set that slide aside.

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		

Procedure for investigating the onion skin in salt water

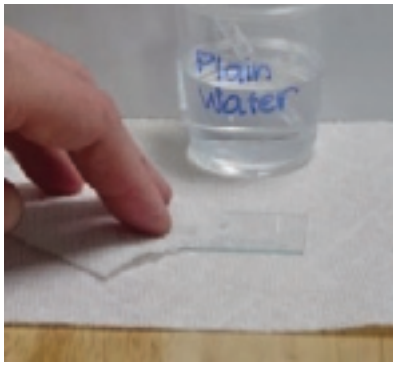
3. Place the red onion slide on a paper towel. Use a toothpick to slide one corner of the coverslip off the slide.



4. Carefully use a toothpick to lift the coverslip off the slide and set it on the paper towel. If the piece of onion sticks to the coverslip, use the toothpick to carefully slide it onto the microscope slide.

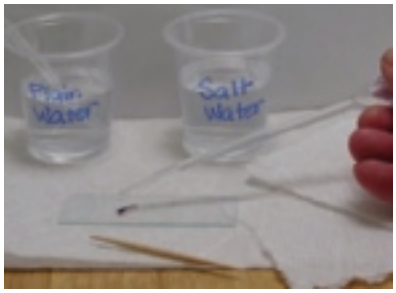


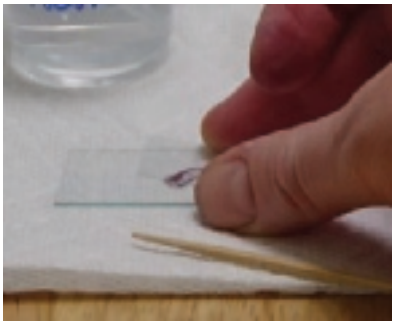
5. Carefully blot the coverslip on the paper towel. Use another small piece of paper towel to carefully blot the **plain water** off the onion skin slide. Be careful not to wrinkle the onion skin!



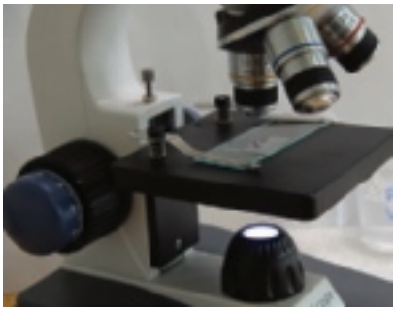
6. Add 2-3 drops of **salt water** to the onion skin on the slide and let it sit for 1 minute. After 1 minute, rest one edge of the coverslip on the slide next to the onion. Let the coverslip fall gently over the **salt water** and the onion skin.

- If you see large air bubbles under the coverslip, gently tap the coverslip with the toothpick. It's OK if you have some small air bubbles.





7. Place the **salt water** red onion slide under the microscope and observe it under the medium objective (10x, yellow). Use the coarse focus to find the structures and the fine focus to make them clearer. Begin with a low light and adjust as needed. Try to find a smooth pigmented area of the onion skin so you're looking at just a single layer rather than a wrinkle or fold.



8. Record your observations in the second row of the data table on *Data from Investigating Red Onion Cells.* Finish Question 1 and respond to Question 2 on *Data from Investigating Red Onion Cells* while you wait for your group to finish recording their observations. Make sure everyone has had a chance to see the red onion in **salt water** and record their observations on *Data from Investigating Red Onion Cells.*

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		

Procedure for reinvestigating the onion skin in plain water

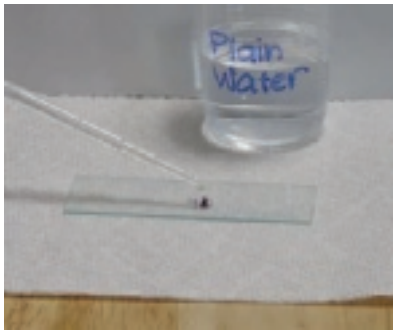
9. Remove the slide from the microscope stage and place it back on the piece of paper towel. Use a toothpick to slide one corner of the coverslip off the slide. Carefully lift the coverslip off the slide and set it on the paper towel. If the piece of onion sticks to the coverslip, use the toothpick to carefully slide it onto the microscope slide.



10. Use a small piece of paper towel to carefully blot the **salt water** off the onion skin slide. Be careful not to wrinkle the onion skin!



11. Add 2-3 drops of **plain water** to the onion skin on the slide and let it sit for 1 minute.



12. While you wait, rinse off each side of the coverslip with a few drops of **plain water** and carefully blot it dry on the paper towel.

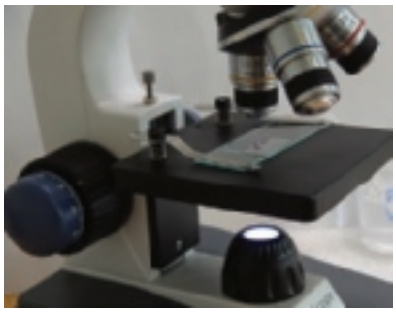


13. After 1 minute, rest one edge of the coverslip on the slide next to the onion. Let the coverslip fall gently over the **plain water** and the onion skin.

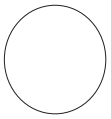
- If you see large air bubbles under the coverslip, gently tap the coverslip with the toothpick. It's OK if you have some small air bubbles.



14. Place the **plain water** red onion slide under the microscope and observe it under the medium objective (10x, yellow/medium, 100x total magnification). Use the coarse focus to find the structures and the fine focus to make them clearer. Begin with a low light and adjust as needed. Try to find a smooth pigmented area of the onion skin so you're looking at just a single layer rather than a wrinkle or fold.



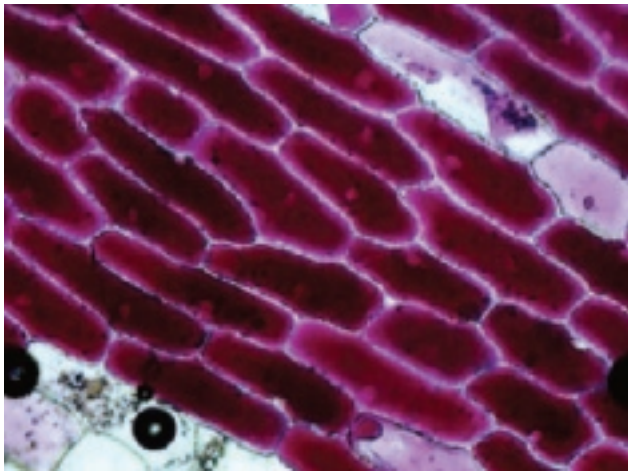
15. Record your observations in the last row of the data table on *Data from Investigating Red Onion Cells.* After everyone has had a chance to see the red onion in **plain water** again and record their observations, set that slide back on the piece of paper towel.

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

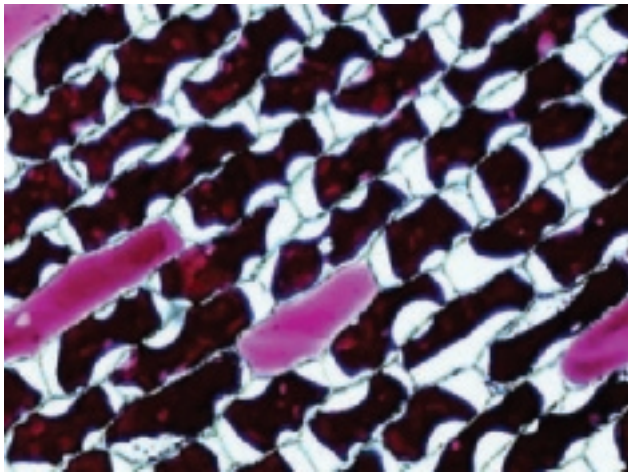
16. Follow your teacher's instructions for cleanup.

Reference: Red Onion Investigation Images

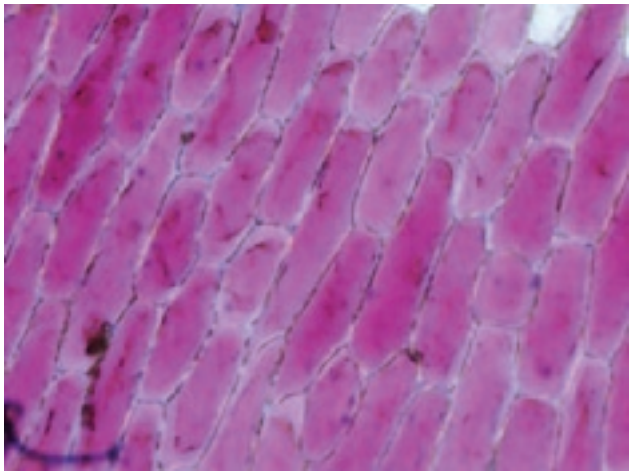
Red onion in plain water at medium magnification



Red onion in salt water at medium magnification

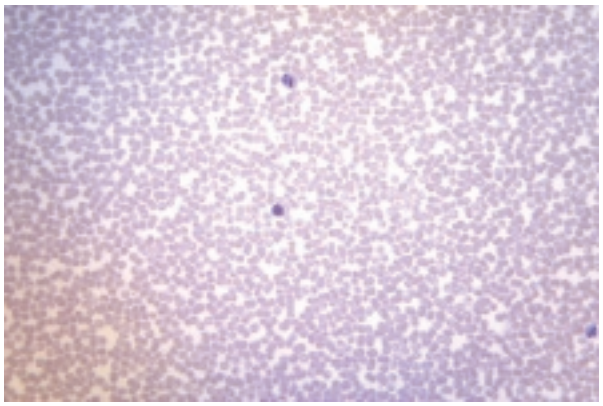
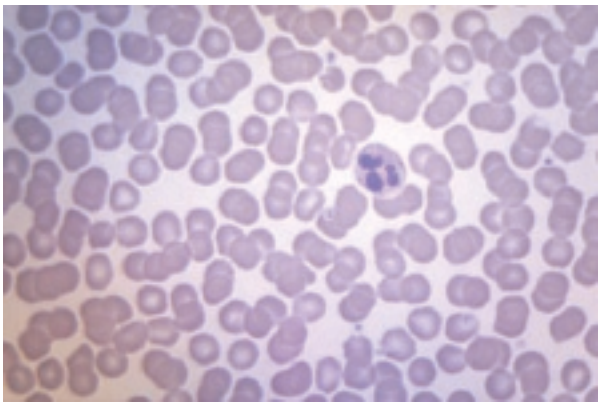


Red onion returned to plain water at medium magnification

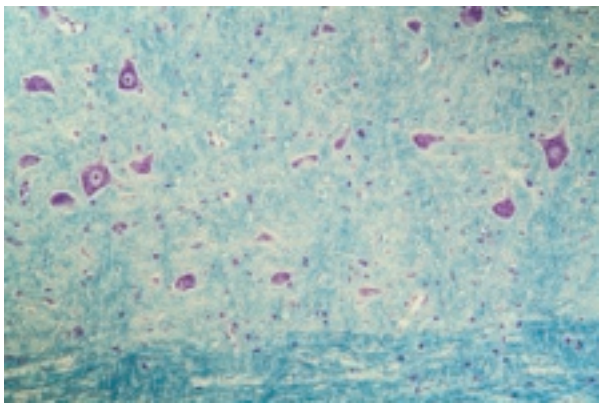
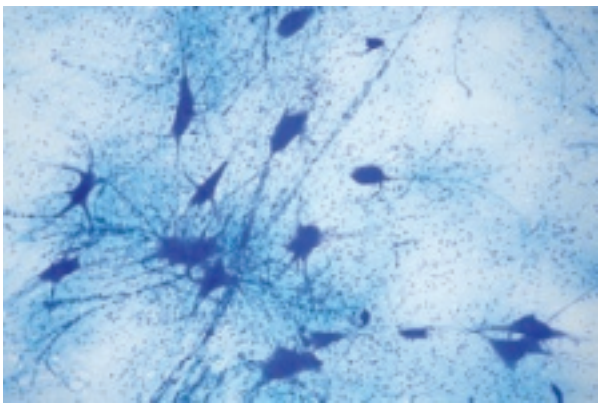


Reference: Animal and Plant Cell Images

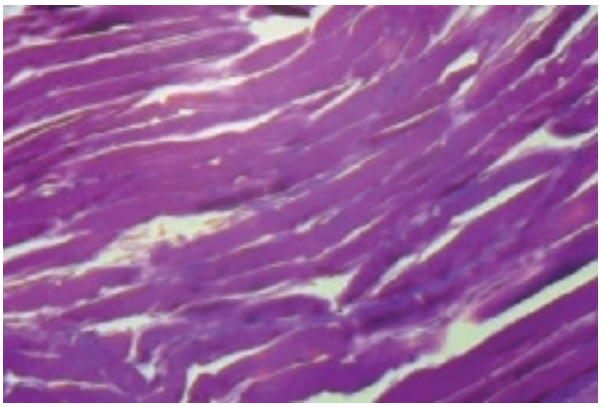
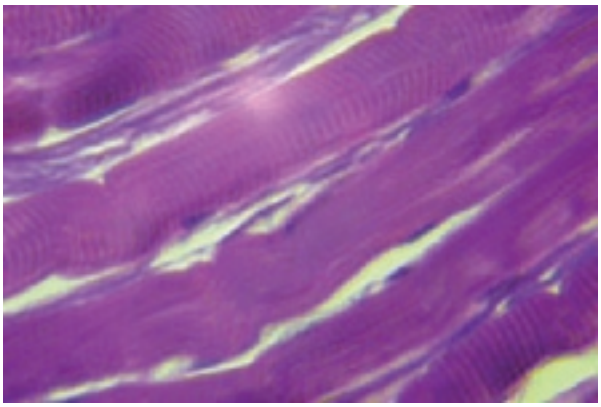
Blood Cells

Medium magnification	High magnification
	

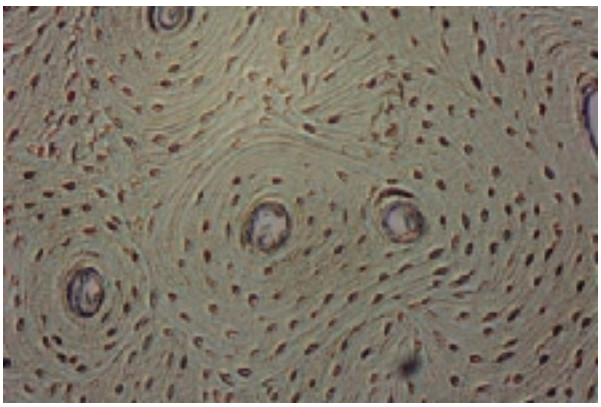
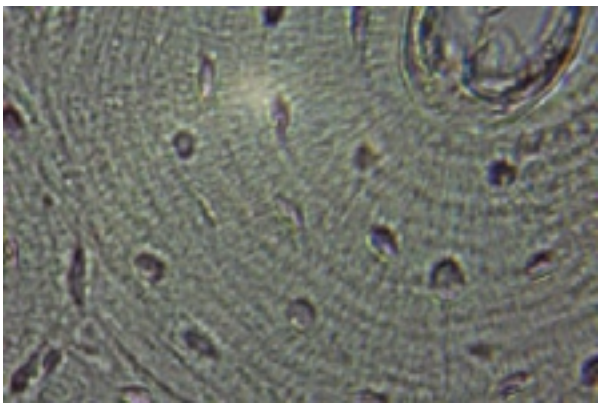
Nerve Cells

Low magnification	Medium magnification
	

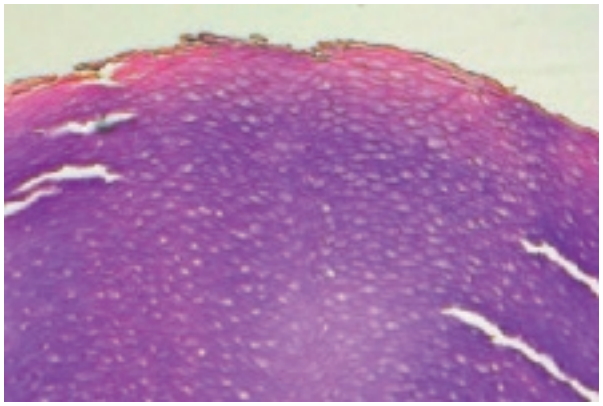
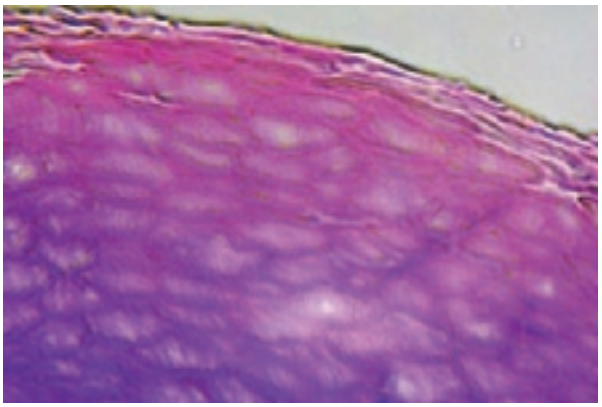
Muscle Cells

Medium magnification	High magnification
	

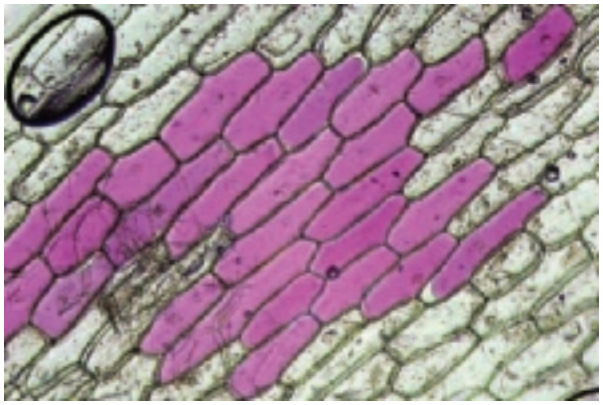
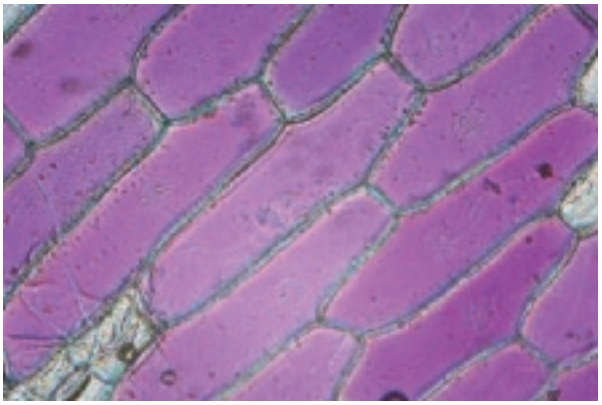
Bone Cells

Medium magnification	High magnification
	

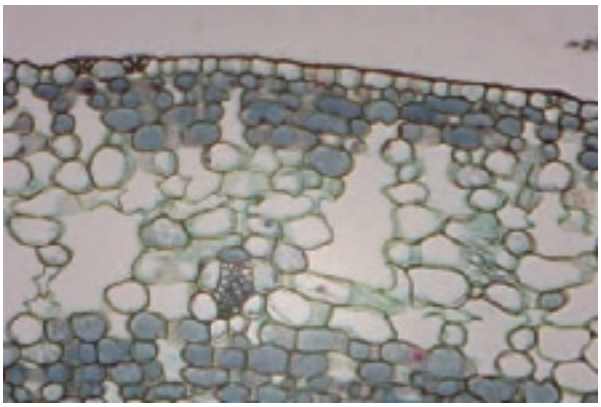
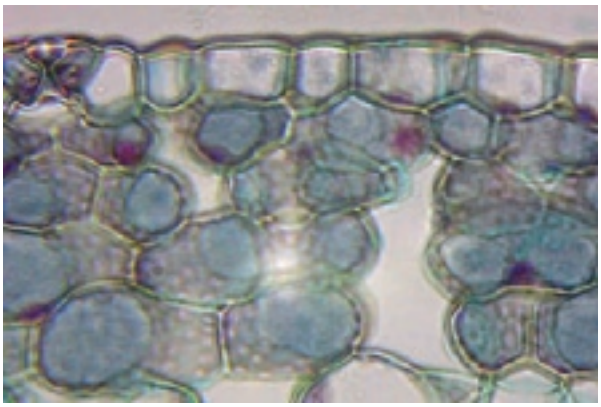
Skin Cells

Medium magnification	High magnification
	

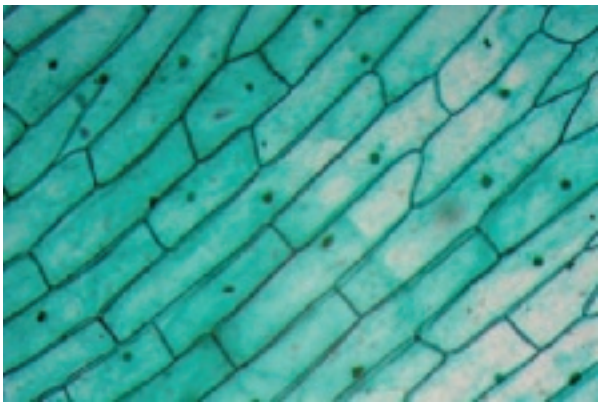
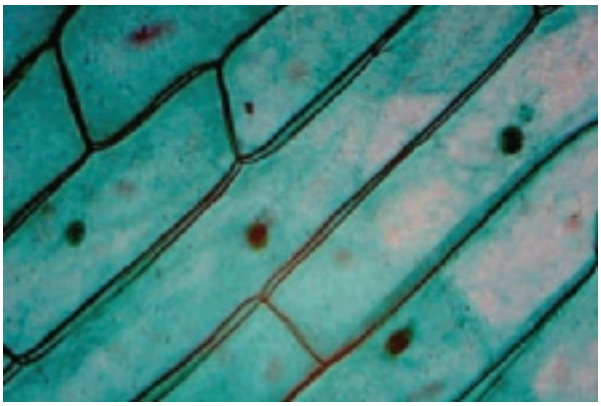
Red Onion Plant Cells

Low magnification	Medium magnification
	

Pitcher Plant Leaf Cells

Medium magnification	High magnification
	

Allium Plant Cells

Low magnification	Medium magnification
	

Images of Swelling Due to Injury

Compare these images of the injured foot to look for swelling.

Pre-Surgery



Post-Surgery



Today

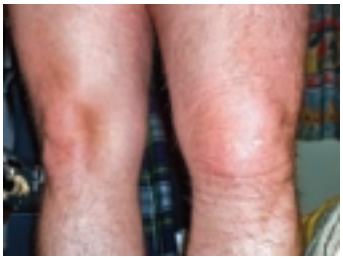


Consider these other examples of swelling due to injuries in these body parts.

Swollen Ankle



Swollen Knee



Swollen Ankle and Top of Foot



Doctor Report re: Swollen Finger

Name: [redacted] Date: 11/16/19 Time: 4:30 PM

Type of injury: Patient reports "jamming" right index finger while playing volleyball; patient reports pain when trying to bend the finger
Examination Notes: Finger is swollen and showing redness and bruising. Patient is significantly worried about recovery — wants to play volleyball again. Reassured the patient that swelling is the body's automatic reaction to an injury in a tissue — there is increased blood flow to the area and extra fluid buildup. Swelling will lessen as the tissues in the finger heal.
Testing: X-rays show no broken bones
Treatment goals: Relieve swelling and pain, regain function of the finger and resume typical activities without pain
Care plan: Wrap finger with tape to help reduce swelling Immobilize injured finger with splint Keep elevated to reduce swelling Ice area for 20 minutes to help reduce swelling
Follow-up appointment: 11/30/19



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Special thanks to the following people for their significant contributions to this unit:
- Alexander Novak, Los Angeles, CA

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ISBN: 978-1-68380-709-4

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