Name: _____ Date: _____

Student Exploration: Cell Types

Vocabulary: ATP, bacteria, carbon dioxide (CO_2), cell, cellular respiration, compound light microscope, eukaryote, multicellular, muscle cell, neuron, organelle, photosynthesis, prokaryote, protist, red blood cell, root hair cell, tissue, unicellular, white blood cell

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. How do you know if something is alive? Describe some of the characteristics of living things.

   _____

   _____

2. Humans, plants and mushrooms are all alive. What do these organisms have in common?

   _____

   _____

Gizmo Warm-up

In the *Cell Types* Gizmo™, you will use a light microscope to compare and contrast different samples. On the LANDSCAPE tab, click on the ***Elodea* leaf**. (Turn on **Show all samples** if you can't find it.) Switch to the MICROSCOPE tab to observe the sample as it would appear under the microscope. By default, this microscope is using 40x magnification.

1. Drag the **Coarse focus** slider until the sample is focused as well as possible. Then, improve the focus with the **Fine focus** slider. What do you see? _____

   _____

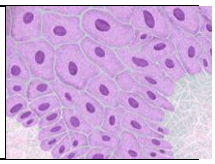
   _____

2. Select the 400x magnification. If necessary, adjust the fine focus. Now, what do you see?

   _____

   _____

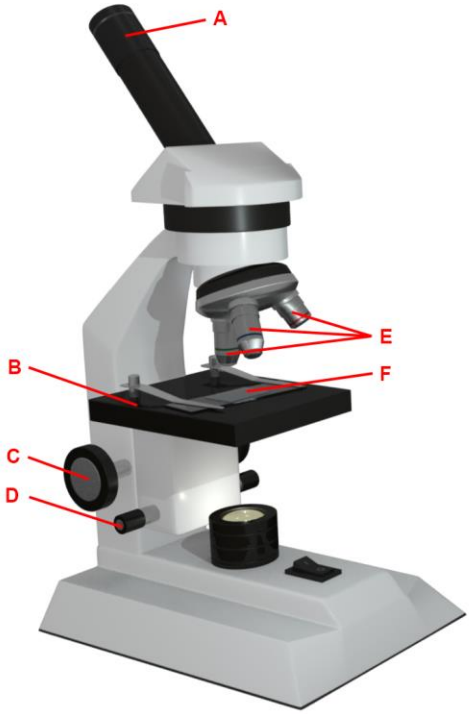
   The individual chambers you see are **cells,** the smallest functional unit of an organism.

Activity A: **Observing cells**	Get the Gizmo ready: • On the LANDSCAPE tab, click on the woman's right arm to choose the **Human skin** sample. • Select the MICROSCOPE tab.	

Introduction: Complex organisms are made up of smaller units, called cells. Most cells are too small to be seen by the naked eye. Microscopes are used to magnify small objects, so here you will use a **compound light microscope** to observe the cells of different organisms.

Question: What are similarities and differences between cells from different organisms?

1. Match: Read about each microscope part. Match the description to the part on the diagram.



_____ **Stage**: Platform where a slide is placed.

_____ **Eye piece**: Lens at the top of the microscope that the user looks though. This lens most commonly magnifies a sample by 10x.

_____ **Coarse focus knob**: Large knob that moves the stage up and down to focus the sample.

_____ **Fine focus knob**: Small knob that moves the stage over a short distance to refine the focus.

_____ **Objective lens**: A second lens that further magnifies the sample. Microscopes usually have several objective lenses with different magnifications. The total magnification is the product of the eyepiece magnification and the objective lens magnification.

_____ **Slide**: A rectangular piece of glass upon which a sample is mounted for viewing under a microscope.

2. Manipulate: With 40x selected, use the **Coarse** and **Fine focus** sliders to focus on the sample. Then, choose 400x and focus on the sample using the **Fine focus** slider.

   A. Which focus knob is easier to use at 40x? _____ 400x? _____

   B. Turn on **Show labels**. What structures can you see in human skin cells?

   _____

   C. Turn off **Show labels** and turn on **Show scale bars**. The scale bar has a width of 20 micrometers, or 20 µm. (There are 1,000 micrometers in a millimeter.)

   Using the scale bar, about how wide is a human skin cell? _____

(Activity A continued on next page)

Activity A (continued from previous page)

3. Observe: An **organelle** is a cell structure that performs a specific function. Observe the samples below under the highest magnification. Click the **Show labels** checkbox to label the organelles. List the organelles and approximate size of the cells in each sample.

Sample	Organelles	Estimated size (μm)
Mouse skin		
Fly muscle		
Maple leaf		
Elodea		
Fungus		

What do all of these samples have in common? _____

_____

In **eukaryotic** cells, genetic material is contained inside a distinct, membrane-bound nucleus. Plant and animal cells are classified as eukaryotes.

4. Observe: Click on the cow and observe ***E. coli*** under the highest magnification. Notice the microscope magnification is larger for this organism, and notice the scale bar is smaller.

   A. What is the approximate size of *E. coli*? _____

   B. What organelles are present in *E. coli*? _____

   _____

   C. What organelle is missing from *E. coli*? _____

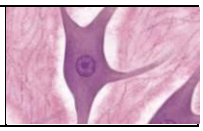
   E. coli is an example of a **bacteria**. Bacteria are classified as **prokaryotic** cells because their DNA is not contained in a membrane-bound nucleus.

5. Compare: Look at the **Sand/silt** sample under the microscope.

   A. Turn on **Show labels**. Does sand/silt have any internal structures?_____

   B. Do you think sand or silt is alive? Explain. _____

   _____

Activity B: **Specialized cells**	Get the Gizmo ready: • On the LANDSCAPE tab, click on the woman's head to choose the human neuron sample.	

Question: How do a cell's specialized structures relate to its function?

1. Collect data: Use the microscope to observe the samples listed in the table below. For each sample, estimate the cell size and check off the organelles that are present. If there is no column for an organelle, list it in the **Special structure(s)** column.

Sample	Estimated size (µm)	Nucleus	Cell membrane	Cytoplasm	Special structure(s)
Human neuron					
Human skin					
Human muscle					
Human blood					

2. Observe: Select the human skin sample. On the MICROSCOPE tab, choose the 400x magnification, focus on the sample, and turn on **Show labels**. Click on the **Nucleus** label. If necessary, adjust the **Stage** sliders to see the full description.

   A. What is the function of the nucleus? _____

   _____

   B. What is the function of the cytoplasm? _____

   _____

   C. What is the function of the cell membrane? _____

   _____

3. Observe: Select the human **neuron** sample. Focus the cells at 400x. Turn on **Show labels**.

   A. Click on the axon label to read the description. What is its function? _____

   _____

   B. What is the function of a dendrite? _____

   Neurons transmit messages in the form of electrical and chemical signals, through axons and dendrites, from one part of the body to another.

(Activity B continued on next page)

Activity B (continued from previous page)

4. Compare: Select to the human **muscle** sample. Observe the sample at 400x.

   A. What do muscle cells have that other cell types do not? _____

   B. What is a striation and how does it help muscle cells function? _____

   _____

5. Compare: Select the human blood sample. Observe at 400x. Look under **Show information** on the right-hand side of the Gizmo.

   A. What is the function of **red blood cells**? _____

   _____

   B. What is the function of **white blood cells**? _____

   _____

   C. What organelle is missing from the red blood cells? _____

6. Compare: Compare the human and animal samples (human and mouse skin; human and worm neurons; human and fly muscle; human and frog blood).

   A. In general, are there any major differences that you can see? Explain. _____

   _____

   _____

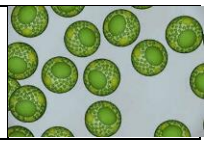
   _____

   B. What organelle do frog RBCs have that human RBCs do not? _____

   Most mammalian red blood cells have no nucleus. This allows the red blood cell to use all of its volume to transport oxygen.

7. Extend your thinking: Many types of cells, such as the ones in this activity, live together in groups, called **tissues**. A tissue is a group of similar cells that together carry out a specific function. Describe how the skin cells, neurons, muscle cells, and blood cells you have observed relate to the functions of skin, nerve, muscle, and blood tissue.

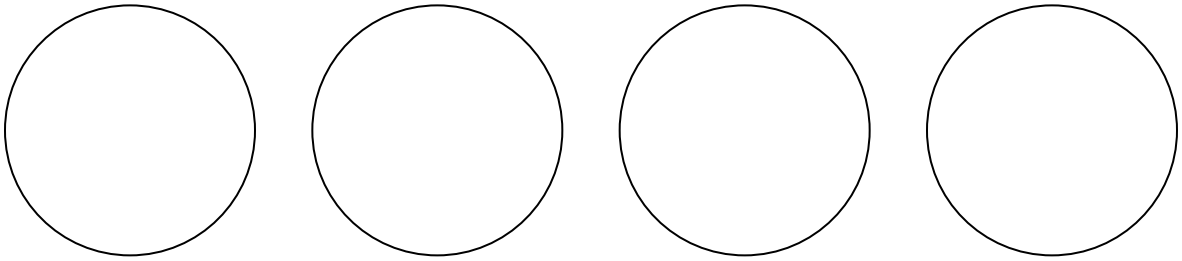
   You can write your answer on another sheet of paper.

Activity C: **Plants and unicellular life**	Get the Gizmo ready: • On the LANDSCAPE tab, select the **Microalgae** sample.	

Introduction: Most of the animals and plants we are familiar with are **multicellular**, they are made up of many cells. However, many living things only consist of a single cell. These microscopic organisms are **unicellular**.

Question: How are unicellular organisms similar to multicellular organisms?

1. Observe: Compare the microalgae, the *Elodea* leaf cells, the maple leaf cells, and the root hair cells at 400x. Sketch each below:



Microalgae | *Elodea* | Maple leaf | Root hair

   A. What structures do all of these cells have in common? _____

   _____

   B. What structures are missing from the root hair cells? _____

   C. What is the purpose of this structure, and why do you think it is missing from the root hair cells? _____

   _____

   Photosynthesis is the ability of some organisms to generate food from sunlight. Cells that are not exposed to sunlight will not take part in photosynthesis.

   D. How are the algae cells different from the other cells? _____

   _____

   Microalgae are examples of unicellular organisms. Each cell is a single organism.

2. Explore: Which other samples in the Gizmo do you think represent unicellular organisms?

   _____

(Activity C continued on next page)

Activity C (continued from previous page)

3. Observe: Switch to the **Protist** sample. Protists are unicellular organisms common in ponds On the MICROSCOPE tab, select the 100x radio button and focus the image.

   A. Watch the motion of the protists at 100X and 400X. What structures allow each protist to move?

   Amoeba: _____ *Euglena*: _____ *Paramecium*: _____

   B. In the table below, draw the structures that allow the protists to move on their images on the left and describe the structures in the spaces on the right:

	Amoeba	
	*Euglena*	
	*Paramecium*	

   C. Which protist is photosynthetic? How do you know?_____

   _____

4. Compare: On the LANDSCAPE tab, click on the cow to switch to the ***E. coli*** sample. On the MICROSCOPE tab, select **2500x**, focus the image and turn on **Show labels**.

   A. Find two structures that help *E. coli* move and describe them below:

   Name: _____ Description: _____

   Name: _____ Description: _____

   B. Do protists (amoeba, *Euglena*, *Paramecium*) use similar structures to move? _____

   Explain. _____

   _____

Activity D: **Are cells alive?**	Get the Gizmo ready: • On the LANDSCAPE tab, select the worm to choose the **Worm neuron** sample. • Select the TEST FOR LIFE tab.	

Introduction: All organisms need energy from food to function. During **cellular respiration**, cells use glucose from food to produce **ATP**, a molecule that stores energy for the cell, and **carbon dioxide** (CO_2). You can test for the products of respiration to see if your sample is alive.

Question: How can you test if cells are alive?

1. Observe: The first row of the dish contains an ATP reagent that will glow if ATP is in the liquid. The second row of the dish contains phenol red, a reagent that turns orange when the liquid is acidic. Each row of the dish contains an example of a positive test (positive control), an example of a negative test (negative control), and the sample.

   A. Click **Play** ( ). What happens? _____

   B. Does the worm neuron sample produce ATP? How do you know? _____

   _____

   C. What happens to the phenol red? _____

   D. When CO_2 combines with water it forms carbonic acid. How does this explain the phenol red result? _____

   _____

   E. Based on the test results, are the worm neurons alive? _____

2. On the LANDSCAPE tab, select the **Maple leaf** sample. Return to the TEST FOR LIFE tab.

   A. Click **Play**. Does the maple leaf sample produce ATP? _____

   B. What happens to the phenol red? _____

   In the light, plant leaves undergo photosynthesis, using CO_2, water, and light energy to produce food. In the dark, plants cannot perform photosynthesis.

   C. Click **Reset** ( ), then click on the **light switch** to turn off the lights. Click **Play** to run the experiment in the dark. What happens? _____

   D. Based on the test results, are maple leaves alive? _____

(Activity D continued on next page)

Activity D (continued from previous page)

3. Collect data: Using the table below, select the sample on the LANDSCAPE tab. Perform the experiment in the light on the TEST FOR LIFE tab. Turn off the light by clicking on the light switch and perform the experiment again in the dark. Record the results below.

Sample	Light - ATP	Light Respiration	Dark - ATP	Dark - Respiration
E. coli				
Fungus				
Human skin				
Maple leaf				
Root hair				
Protists				
Sand/silt				

4. Analyze: Which of the samples in the above table are alive? _____

   _____

   How do you know? _____

   _____

5. Discuss: Based on the results of the experiment, which samples from the table above are likely to undergo photosynthesis? _____

   How do you know? _____

   _____

6. Analyze: Small particles of silt are about the same size and shape as a cell.

   A. Is silt alive? _____

   B. How do you know? _____

      _____

      _____