Name ____ Date ________________ Period #________

Prokaryotic and Eukaryotic Cells

READ THIS FIRST! Background Information:

Understanding the nature of cell structure and function is important to an understanding of organisms. All organisms are composed of cells, whether they exist as single cells, colonies of cells, or in multicellular form. Cells are usually very small, and for this reason, a thorough understanding of subcellular structure and function has been possible only through advances in electron microscopy and molecular biology.

There are two general types of cells: prokaryotic and eukaryotic. These two words have their root in the Greek word karyon (nut), which refers to a cell's nucleus. The prefix pro- means "before" or "prior to." Thus, prokaryotic means "before having a nucleus." Prokaryotic cells do not have a membrane-bound nucleus and their genetic material (DNA) is only loosely confined to a nuclear area within the cell.

Bacteria, including the cyanobacteria (formerly known as blue-green algae), are prokaryotes. All other organisms are eukaryotes. The prefix eu- means "true." The cells of eukaryotes have true, membrane-bound nuclei containing their genetic material.

Prokaryotic and eukaryotic cells also differ in several other ways. Eukaryotic cells are generally larger and contain additional specialized compartments (membrane-bounded organelles) in which cell functions such as energy production may occur Prokaryotic cells lack membrane-bound organelles; their cell functions are carried out in the cytoplasm.

Part A: Prokaryotic Cells

Most prokaryotic cells are extremely small (approximately 1 to 2 µm (micrometers) in diameter). Most prokaryotic cells are heterotrophic, which means they depend on other organisms for food. Some prokaryotic cells are autotrophic, which means they make their own food. Bacteria have three basic shapes: round (coccus), rod-shaped (bacillus), or spiral-shaped (spirillum). To view bacteria with the compound microscope, you must use a high power objective. Even then, not much more than their basic shapes will be visible.

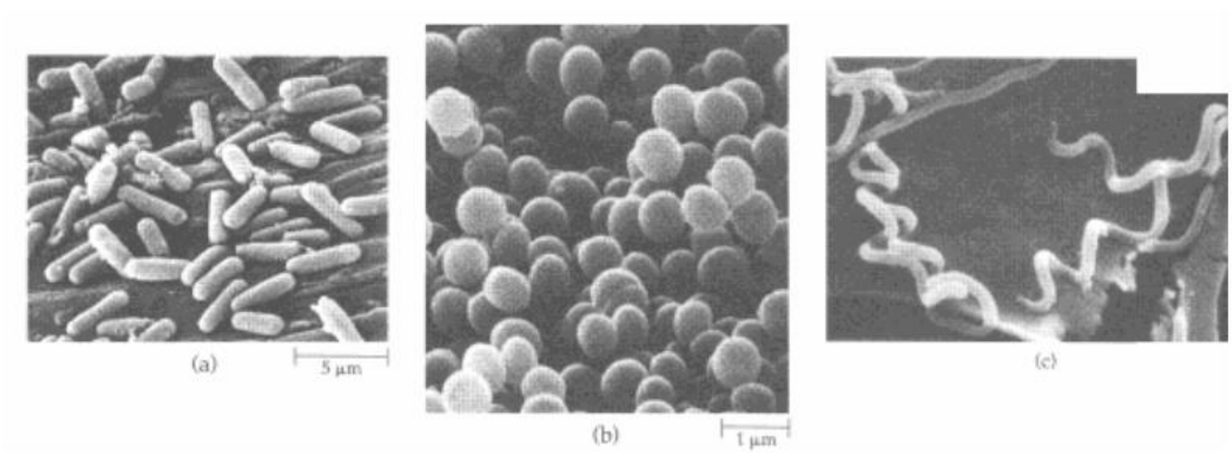


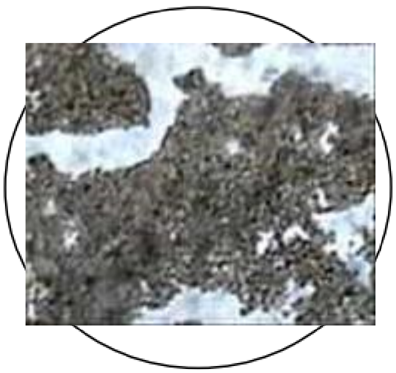
Figure 2-1: The cells of many familiar genera of bacteria include the (a) rod-shaped bacillus, (b) spherical coccus, and (c) helical spirillum.

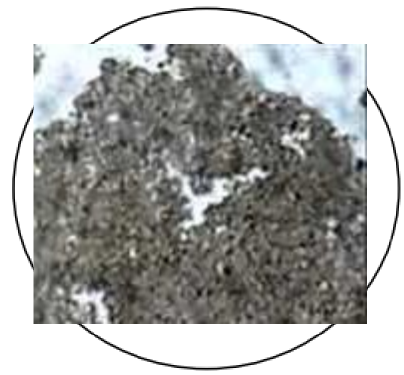
You can use the compound microscope to study bacteria, but only their external features will be distinguishable. It is possible to identify the three types of bacteria (coccus, spirillum, and bacillus) by observing their shape (Figure 2-1 above). You will also note that bacteria are often found in clusters or in chains.

Name ____ Date _______________ Period #________

PROCEDURES: Part A: Prokaryotic Cells Part 1: Observing Bacteria

1. Make a wet mount from the dilute yogurt. Smear yogurt on the slide and add a drop of Methylene Blue and a cover slip.
2. Draw simple sketches of three different prokaryotes *focusing on shape of the cells*. Sketch the prokaryotic cells in the spaces below. For each, note whether the bacteria are *spherical (coccus), rod-shaped, (bacilus), or spiral-shaped (spirillum)*. **Don't forget to write in the total magnification**.





Specimen	Yogurt Stained w/Methylene Blue	Yogurt Stained w/Methylene Blue	Yogurt Stained w/ Methylene Blue
Magnification	100x	100x	100x
Shape	___________	___________	___________

PROCEDURES: Part A: Prokaryotic Cells Part 2: Examining Cyanobacteria

1. Make a wet mount of the cyanobacteria species. We will be using blue-green algae from pond water for this part. Use one drop of pond slime water and a slide cover.
2. Observe the slide under medium power to focus and then switch to high power without moving the slide. Use the fine focus knob to bring the slime into focus.
3. Draw a representative cell in the space below and label the parts which you can identify (but don't expect to be able to identify too much!). Don't forget to include the name of the organism and the total magnification.

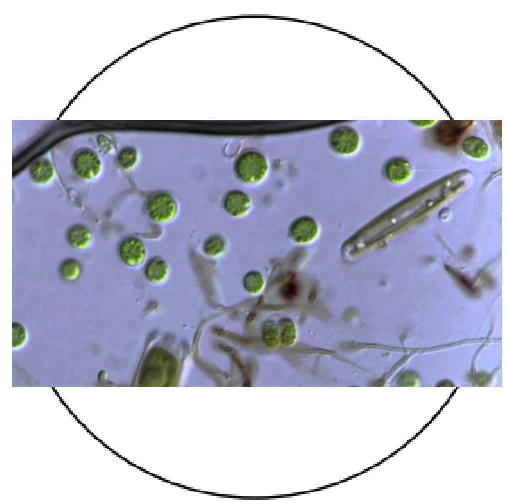
Specimen: Cyannobacteria in Pond Water

Magnification: 100x

Shape and Description: ___________________

____

____



Name ____ Date ______________ Period #________

Part B: Eukaryotic Cells

All eukaryotic organisms are composed of cells, whether they exist as single cells, colonies of cells, or in multicellular form. Your body is composed of billions of cells, most of which are very small, with specialized structures that allow for a diversity of functions.

All eukaryotic cells have their genetic material enclosed by a nucleus. In addition, a variety of subcellular membrane-bound organelles are present. These include plastids, mitochondria, lysosomes, microbodies, and Golgi complexes. Internal membrane systems divide the cell into specialized compartments. Non-membrane-bound organelles, such as ribosomes and centrioles, and a cytoskeleton including microtubules, intermediate filaments, and microfilaments are also present in eukaryotic cells.

Part B: Eukaryotic Cells Parts 1 – 6: Examining Plant Cells

During this laboratory you will investigate the structures of plant, animal, and protistan cells. The cells of plants are eukaryotic, containing both a membrane-bounded nucleus and membrane-bounded organelles. A cell wall composed of cellulose surrounds the plant cell. A large central vacuole surrounded by a membrane (the tonoplast) is used for storing water, pigments, and wastes. Within the cytoplasm are membrane-bound organelles unique to plants called plastids. In this lab, you will look at various types of plastids responsible for photosynthesis (chloroplasts), for storing starch (amyloplasts and leucoplasts) or for storing accessory pigments (chromoplasts). Chromoplasts contain several types of pigment including carotenoids, which give plants an orange or yellow color.

PROCEDURES: Part B: Eukaryotic Cells Part 1: Examining Elodea Plant Cells

1. Prepare a wet-mount slide of an Elodea leaf. Place a tiny piece of Elodea leaf on a clean slide and add a drop of water. Cover the sample with a slide cover.
2. Focus the specimen under low and medium power to first. Then switch to high power and use the fine focus knob. Observe the thick cell wall, thinner cell membrane, cytoplasm, nucleus, and chloroplasts. A large central vacuole may be apparent. These structures characterize a generalized plant cell.
3. Sketch a representative Elodea cell as observed under high power, and label its parts.
4. Do the chloroplasts appear to move? If so, describe their movement.

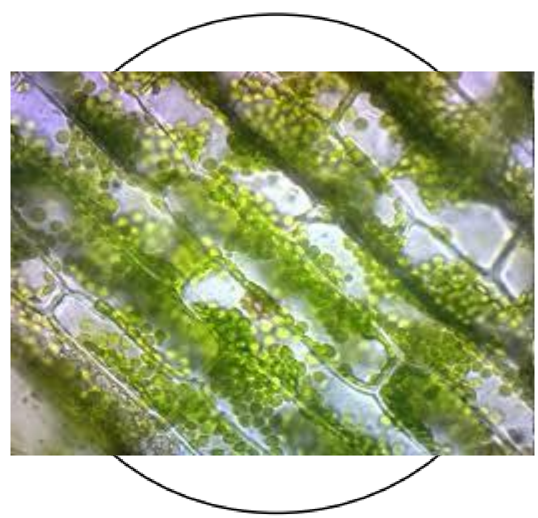
____

____

Specimen: Elodea Leaf

Magnification: 400x

Shape and Description: Rows of rectangular cells with small, circular, green chloroplasts inside. The cell wall gave the cells their rectangular shape.



Name ____ Date _________________ Period #________

PROCEDURES: Part B: Eukaryotic Cells Part 2: Examining Onion Epidermis Cells

1. Onions (Allium) have layers of modified leaves (scales) that can easily be separated from one another. Peel off a very tiny portion of one layer and examine the concave (the part that curves inward) side of the piece you have obtained. The surface is covered by a thin layer of cells, the epidermis.
2. Prepare a wet-mount slide of onion epidermal tissue. Remove a small piece of the epidermis (approximately the size of your pinky nail) by breaking the scale gently, leaving the epidermis intact. Peel the epidermis from one of the halves of the scale and smudge it onto the slide. Add one drop of iodine to the slide to stain it and add a slide cover.
3. Observe the onion cells using low power (10X objective) and then high power (40X objective).
4. Sketch a representative of the stained onion cell as observed under high power, and label its parts.

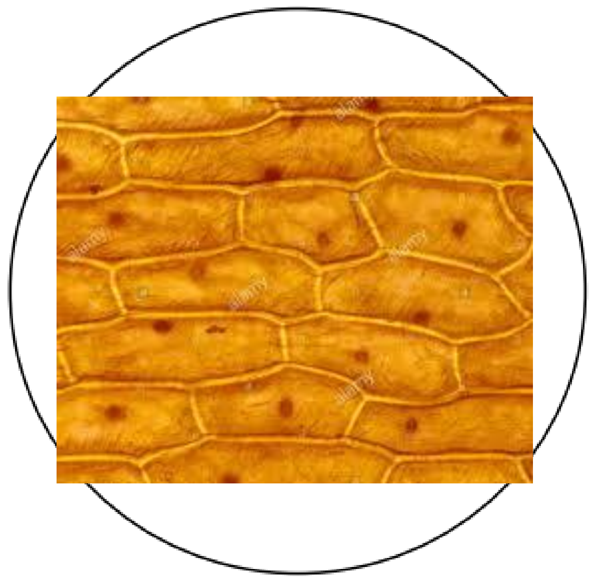
Specimen: Onion Epidermis Stained with Iodine

Magnification: 400x

Shape and Description: ____________________

____

____



Part B: Eukaryotic Cells Part 3: Compare and Contrast Elodea and Onion Plant Cells

Compare the onion cell with the Elodea cell. Since they are both plant cells, they should be similar. You will note that onion cells lack one structure (organelle) that is very conspicuous in Elodea cells. *What organelle is missing in the onion cells?*

List the similarities and differences between Elodea cells and onion cells.

Similarities	Differences

Name ____ Date ________________ Period #________

PROCEDURES: Part B: Eukaryotic Cells Part 4: Potato Plant Cells

1. Use a razor blade to slice a piece of potato tissue, as thin as possible, from the potato. Be careful not to cut your fingers.
2. Prepare a wet mount slide of the potato tissue sample. Smudge the razor-thin sample of potato onto the slide. Add a drop of iodine and observe the cells as the iodine solution makes contact with them. Cover the stained potato sample with a slide cover.
3. Study the slide at low power (10X objective) and then at high power (40X objective).
4. Sketch the stained cells in the space below. Be sure to label the cell wall and leucoplasts (amyloplasts) in your sketch (see the background information if you don't remember what this means).

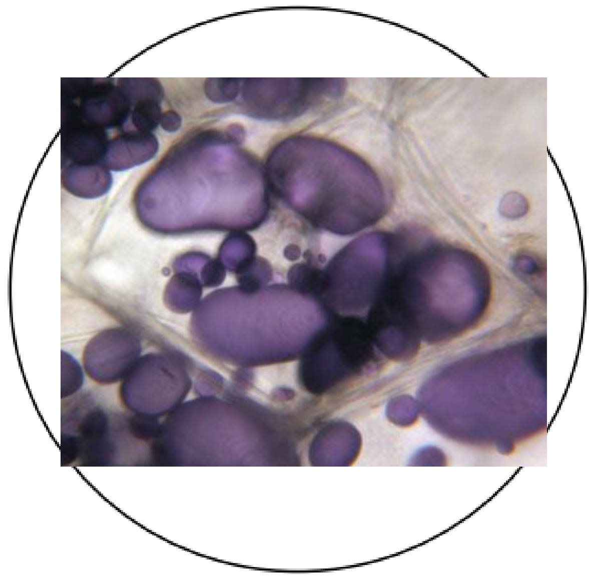
Specimen: Potato Cells Stained with Iodine

Magnification: 400x

Shape and Description: ____________________

____

____



Part B: Eukaryotic Cells Part 5: Onion and Potato Plant Cell Analysis Questions

1. How does the reaction of iodine with the potato cells compare with what you observed in your onion epidermis preparation?
2. What does this tell you about the differences between the storage products in onions and potatoes?
3. Do you see any chloroplasts? Why or why not?
4. You will probably see some small oval-shaped blue-black structures. These leucoplasts store starch. Why did they change color? (Hint: Think back to our chemistry unit!)

Name ____ Date _________________ Period #________

PROCEDURES: Part B: Eukaryotic Cells Part 6: Red Pepper Plant Cells

1. Scrape a tiny sample of tissue (about the size of your pinky nail) from a red pepper.
2. Prepare a wet mount slide of your red pepper sample. Smudge the sample onto the slide and add <u>one drop of water</u> and a <u>slide cover</u>.
3. Observe the sample using the light microscope and draw a sketch of your sample. Can you see the chromoplasts? Label the structures in your sketch!

Specimen: Red Pepper Plant Cells

Magnification: 400x

Shape and Description: ____________________

____

____

Part B: Eukaryotic Cells Part 7: Examining Animal Cells

Animal cells can be studied using the light microscope, but most of the cellular organelles within the cytoplasm are not visible without the use of special staining techniques. The nucleus and nucleolus, where ribosomes are manufactured, are usually apparent in most cells.

To study the structure of animal cells you will use prepared slides of animal tissues. These are collections of cells that have a similar function. The cells are usually organized into sheets.

PROCEDURES: Part B: Eukaryotic Cells Part 7: Examining Animal Cells

1. Use a prepared slide for this part of the investigation from our case of prepared slides. Find a slide that contains one of the following from an animal: brain, liver, blood, or muscle.
2. Observe the prepared slide under the microscope and sketch your sample. Label the nucleus, cell membrane, cytoplasm.

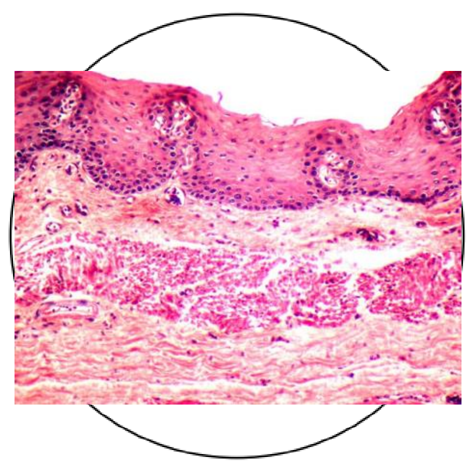
Specimen: Epithelial Tissue

Magnification: 100x

Shape and Description: ____________________

____

____



Name ____ Date ______________ Period #_______

List the similarities and differences between the plant cells and the animal cells you have observed.

Similarities	Differences

Part C: Checking for Understanding - Prokaryotic and Eukaryotic Cells

In the space below, write about what determines whether a cell is prokaryotic or a cell is eukaryotic. Refer to your data in the previous pages and include labeled diagrams.

____

____

____

____

____

Labeled Diagram of a Prokaryotic Cell	**Labeled Diagram of a Eukaryotic Cell**

YOU'RE FINISHED! NOW TURN THIS PACKET IN FOR A MAJOR GRADE!