Cell Structure & Function

Objectives

1. Explain the difference between prokaryotic and eukaryotic cells and be able to distinguish each type under the microscope.
2. Compare and contrast animal and plant cells and be able to distinguish each type under the microscope.
3. Identify the following structures on the slides and explain the functions of each: plasma membrane, cytoplasm, nucleus, nucleolus, cell wall, and plastids (including chloroplasts and amyloplasts).
4. Examine the diversity in cell size and shape.
5. Properly prepare and view wet mount slides under the microscope.

Introduction

In today’s lab you will be examining a variety of different cell types using the compound microscope. All cells have certain common features, including a fluid-filled cytoplasm surrounded by a plasma membrane, DNA (genetic material) and ribosomes (for protein synthesis). Some cells, including the prokaryotes, fungi, plants, and certain protists, also have a cell wall that lies outside the plasma membrane and functions in protection and structural support.

Biologists recognize two major categories of cell types – the prokaryotes and the eukaryotes. Prokaryotes lack a membrane-bound nucleus, have few or no organelles and are smaller than eukaryotes. Prokaryotes include organisms in the Domains Bacteria and Archaea. Organisms in Domain Eukarya (protists, plants, fungi and animals) have eukaryotic cells. These cells have a membrane-bound nucleus that houses their DNA and contain extensive internal organelles (“little organs”) that perform specific functions. As you complete this lab, note the size and structural differences between the prokaryotic and eukaryotic cells you observe.

A tremendous amount of diversity exists within each category of cells. Differences occur in size, shape, and presence and number of various organelles and other structures. Each cell’s structure correlates with its specific function. You will be examining several different plant and animal cell types to explore eukaryotic cell diversity. Plant cells have a cell wall composed of cellulose and a large central vacuole that stores water, pigments and wastes. Various plastids are also present, which produce or store various products. Chloroplasts perform photosynthesis, using light energy to produce carbohydrates. Other plastids include the amyloplasts, which store starch. Animal cells lack cell walls, plastids, and a central vacuole, but share many other common organelles with plants, including mitochondria, the endoplasmic reticulum, Golgi apparatus and cytoskeleton. Most of these shared structures will not be visible in the slides we examine today.
**Plant Cells – Epidermal Leaf Peel**

Prepare a leaf peel of *Tradescantia* or another available plant using the following method:

1. Obtain a clean slide and a cover slip.
2. Break off a portion of a plant leaf and make a small nick on bottom surface of the leaf with a razor blade. Use forceps to gently pull up a portion of the epidermis. (It should be very thin and mostly transparent).
3. Place the peeled leaf on the slide and add one drop of water to the surface.
4. Holding the cover slip at an angle on the edge of the drop of water, slowly lower the cover slip down on top of the water. There should be minimal air bubbles if done correctly.
5. Gently wipe the bottom of the slide before loading it on the microscope if any water has escaped the cover slip.

Examine the leaf peel at scanning, low and high power. Note the shape of the cells, the **cell wall** and the **chloroplasts**. What is the function of these structures?

You will also see paired, distinctly shaped cells known as **guard cells** scattered on the surface of the leaf. Guard cells surround and control the opening of pores called **stomata** (singular: stoma) on the leaf surface that allow gas exchange. Are the stomata on your specimen open or closed? Can you see chloroplasts in the guard cells?

Using what you learned in the microscope handout, estimate the size of the plant cells and record your estimate here _______________________.

Draw a few of the *Tradescantia* cells in the space below, labeling the cell wall, cytoplasm, and chloroplasts.

**Plant Cells – Potato**

Potatoes are modified underground stems used for carbohydrate storage. Starch is stored in organelles called **amyloplasts**, which will be visible under the microscope after staining the potato with iodine.

Prepare a stained wet mount of a potato using the following method:

1. Obtain a clean slide and a cover slip.
2. Using a scalpel cut a very thin slice of a potato and place on the slide.
3. Add a drop of iodine solution and apply the cover slip as described above.

Examine the potato tissue at scanning, low and high power. Iodine stains the starch a purple or blue-black color. Note the cell shape and the presence of amyloplasts. Estimate the size of the potato cells. ________________.

Are chloroplasts present? Why?

Draw a few potato cells in the space below, labeling the cell wall, cytoplasm, and amyloplasts.

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**Animal Cells – Human Cheek Cells**

The tissue that lines your cheeks contains multiple layers of flattened cells that are constantly sloughing off as you eat and drink. The layered nature of these cells serves to protect the underlying tissue against this abrasion. New cells are constantly being produced in the lower layers to replace those that are lost.

Prepare a cheek smear slide of your own cells using the following method:

1. Obtain a clean slide and a cover slip.
2. Gently rub the inside of your cheek with a toothpick and smear the collected fluid onto the slide. **Discard the used toothpick in the bleach solution at the instructor bench!**
3. Add a drop of dilute methylene blue stain to the slide and cover with the cover slip.

View the slide at scanning, low and high power. Note the cell shape, plasma membrane, cytoplasm, and **nucleus**. Estimate the size of your cheek cells. ________________.

Draw a few cheek cells in the space below, labeling the nucleus, plasma membrane and cytoplasm.

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**When you are finished with the cheek slide, place the slide and cover slip in the container of bleach at the instructor bench.**
Animal Cells – Neurons

Examine the prepared slide of neural tissue and note the large neurons. Neurons are the primary cells of the nervous system. They communicate with each other via electrical and chemical signals that are sent and received via cellular processes that project outward from the main cell body.

Note the large cell bodies and the long, slender cellular processes of the neurons. Near the center of each cell body is a spherical nucleus. Within the nucleus is a darkly stained nucleolus. What is the function of this structure?

Estimate the width of the neuron cell body ________________________.

Surrounding the neurons are smaller, darkly stained support cells called glial cells. Compare the size and shape of the neurons and the glial cells.

Draw your observations in the space below, labeling the neuron cell body, nucleus and cellular processes.

Prokaryotes

Examine the prepared slide of bacteria. You will need to view the cells on high power. Bacterial cells typically come in one of three shapes: spheres (coccus), rods (bacillus), or spirals (spirillum). You will see all three shapes on your slide.

Note the size of the bacterial cells. How does it compare to the eukaryotic cells you examined earlier?

Do these cells have nuclei?

Draw your observations in the space below.