CELLS: A RADICAL IDEA

Introduction:

We often hear of controversies in Biology, scientists argue about the beginnings of the Universe, whether birds are the living descendants of dinosaurs, which ancient fossil is considered to be the first human being. For years there have been hot debates over the Principles of Evolution, but we never hear of any disagreement about the **Cell Theory**.

The Cell Theory states:

1. All organisms are composed of cells.

2. All cells come from preexisting cells.

3. The smallest unit of life is the cell.

4. All life processes arise from cellular activities.

Educated people of the early 1800's had the belief that some invisible force was responsible for life in all of its growing and changing forms. Yet, in 1839, when Schleiden and Schwannn presented the idea that cells were the creative force responsible for living organisms, their ideas were accepted almost without question. Even though it was a radical change from the beliefs of the time, the logic and proofs presented made perfect sense. Many puzzling questions were now answered.

The implications of this new principle were profound. It meant that:

1. All life forms are related to each other at the cell level.

2. All functions of organisms (including humans) are based on individual cell activities.

3. All cellular activities are based on chemical processes.

This week you will look at cells and discover some of the amazing facts about cellular life that make you and all other life on this planet possible.

Exercise #1 — Human Cheek Cells

Introduction:

There are two types of cells: **prokaryotic** and **eukaryotic**. All of the cells that you look at in the lab today are of the type called eukaryotic (true nucleus). The eukaryotic type of cell is the basic component of all multicellular life forms. There are some eukaryotic cells, such as the Paramecium, that are single-celled organisms.

However, the largest number of single-celled organisms exists as the bacteria and their relatives and they are of the cell type called prokaryotic (before nucleus). You will have the opportunity to investigate them later in the semester.

Now you will begin your journey into the world of cells by looking at human cheek cells.

Materials Needed:

Compound microscope
Microscope slide & coverslip
Toothpick
Dropper bottle of methylene blue stain

Procedure:

1. Put a small drop of water on a microscope slide.

2. **Gently** scrape the inside of your cheek with the blunt end of the toothpick. You will collect hundreds of cheek cells on the toothpick.

3. Swirl the end of the toothpick in the drop of water mixing the cells with the water. **Discard the toothpick in the trash.**

4. Cover the drop with a coverslip & add a small drop of methylene blue stain to the coverslip edge. The stain will flow under the coverslip & stain the check cells.

5. Focus the cells at high power with your compound microscope. You will be able to see the **nucleus** and an outline of the **cell membrane**. The nucleus controls the cell functions and the cell membrane determines what molecules go into and out of the cell.

6. The advantage of stains is that we can see structures better. The disadvantage is that stains kill the cells. **Never use a stain if you want to see living cells.**

Name____________________________

Human Cheek Cells Report Sheet

1. Draw a simple sketch of your cheek cells at high power. Label the cell membrane and the nucleus.

2. How do you know that your cheek cells are eukaryotic cells?

Exercise #2 — White Onion Cells

In this activity, you will be examining a plant cell. As you work through the steps, notice a difference between plant and animal cells (human cheek cells).

Materials Needed:

Microscope slide & cover slip. (Use the ones from the previous exercise.)
White onion leaf
Dropper bottle of iodine (IKI) stain

Procedure:

1. With two hands, grasp each end of the onion leaf and "snap" and peel off a one-cell thick layer of tissue. It will look like a piece of plastic wrap. You need a one-cell layer thick sample.

2. Place the onion peel into a drop of iodine stain on a slide, trying not to fold it over on itself.

3. Finish the wet mount and look at the cells under the compound microscope at low power and then at high power.

   You should be able to see the **nucleus** and the **cell wall**. The nucleus controls cell functions and the cell wall is a little box made of cellulose (fiber or wood) produced by the cell for support.

Name____________________________

White Onion Cells Report Sheet

1. Draw a simple sketch of the white onion cells at high power. Label the cell wall and the nucleus.

2. What difference(s) did you observe between the onion (plant) cell and the cheek (animal) cells?

3. What thing(s) did you observe that was the same for plant and animal cells?

Exercise #3 — Elodea Leaves

Elodea (also called Anacharis) is found in fresh water ponds and is commercially grown and sold as an aquarium plant. You will be looking at its cells now. Pay attention to the differences between the elodea cells and the onion cells that you observed in the previous exercise.

Materials Needed:

Microscope slide & cover slip
Elodea leaf

Procedure:

1. Pluck an elodea leaf from near the tip of a healthy plant. Keep track of which side is the **upper** side of the leaf.

   Make a wet mount with the upper side of the leaf facing up and find the elodea cells under low power (100X). Look near the tip of the leaf. These are often very active cells. Then switch to high power magnification.

2. You will notice that the cells are alive and active if you can see the **chloroplasts** moving around the cell. Chloroplasts are the organelles that perform **photosynthesis** (food production) in plants.

3. There is a large sac of fluid inside the elodea cells called the **central vacuole**. Imagine a swimming pool that has a huge clear sac of water floating in it. You cannot actually see the sac of water but the movements of everyone in the pool will be influenced as they bump into that large clear sac.

   Now, watch the movement of chloroplasts. See if you can observe the indirect evidence that the central vacuole is in the cell and is influencing the movement of those chloroplasts.

4. During the Microscope Lab you used a focusing technique to determine which color of thread was on top of the other. An elodea leaf is two cells thick. You should be able to decide whether the top layer is made of bigger or smaller size cells than the bottom layer.

Name____________________________

Elodea Leaf Report Sheet

1. Draw a sketch of the elodea leaf cell and label the chloroplasts and cell wall.

2. What color are the chloroplasts?

3. When you see the green color of plants, what cell structures are you actually seeing?

4. What does the movement of chloroplasts tell you about the cell?

5. If you cannot actually see the central vacuole inside the elodea cell, then how do you know that it is there?

6. What is the most obvious difference you observed between the elodea cell and the onion cell?

7. What does that observation tell you about the activity of food production in the onion cell?

8. Where is food produced in the onion plant?

DO NOT WASH OFF YOUR SLIDE! Save this elodea slide for the next exercise. You will want to look at the cells one more time.

Name____________________________

Exercise #4 — Comparison of Leaf Color Report Sheet

Various **pigments** inside the cells determine the color of plant parts. In some cases the color is inside cell organelles called **plastids**. Chloroplasts are one kind of plastid. There are other plastids that contain different colored pigments. In other cases the pigment is distributed throughout the water of the central vacuole.

Your task, in this activity, is to determine and compare where the color is located in elodea leaves, red onion skin and yellow flower petals.

In order to determine whether a pigment is in the central vacuole or inside the plastids, you must look at one cell layer and note the distribution of color within the individual cells.

Materials Needed:

Small piece of the outside red skin of the onion
Yellow flower petal
Elodea leaf slide from previous exercise
Two more slides & coverslips

Procedure:

Make a wet mount of a one-cell thick layer of the red onion skin.

Determine whether the red color is inside the plastids or distributed throughout the water of the central vacuole.

Make a wet mount of the yellow flower petal and look at the one-cell thick area on the ragged edge.

Discussion:

1. Is the yellow color inside the plastids or distributed throughout the water of the central vacuole?

2. Look again at your slide of the elodea leaf. Where is the green color in the elodea cells (central vacuole or plastid)?

3. Where is the red color in the red onion skin cells (central vacuole or plastid)?

4. Where is the yellow color in the yellow flower petal cells (central vacuole or plastid)?

Exercise #5 — Zebrina Leaf Epidermis with Stomata

All macroscopic animals have some method of breathing. Do plants have any such equivalent process?

Scattered throughout the **underside** skin of the zebrina leaf are small openings or pores called **stomata**. Stoma is the Greek word for "mouth". These openings look like green lips.

The stomata regulate the flow of air or gases into and out of the leaf. Your job is to find these stomata.

Materials Needed:

Zebrina leaf
Slide & coverslip

Procedure:

Make a leaf peel with the leaf upside down so that you can get a one-cell thick peel of the underside of the zebrina leaf. The thin layer will be on the edge of the tear.

Make a wet mount and look for the stomata.

Look closely at the structure of the stomata, notice whether you can identify the organelles inside of the two cells that make up the stomata, the guard cells. These two stomata cells are called guard cells because they "guard" the opening (stoma).

Look at the skin cells around the stomata (not the guard cells). Notice what cell organelles they **do not** have.

Name___________________________

Zebrina Leaf Epidermis Report Sheet

Discussion:

1. Draw a simple sketch of a zebrina leaf stoma, the two guard cells and a few of the surrounding cells.

2. What is the function of the zebrina leaf stomata?

3. What organelles do the guard cells contain that are absent in the skin cells of the leaf?

4. Why would the guard cells have chloroplasts when the other skin cells of the leaf do not have chloroplasts?

Rinse off your slide and place in dirty slide container. Throw the coverslip away in a glass disposal container. Carefully return your compound microscope to the cabinet.