Cells

Overview

Students will prepare slides of cork, onion, and human cheek cells and observe them under the microscope. They will compare and contrast the similarities and differences between plant and animal cells.

North Carolina Essential Science Standards:

7.L.1.2 Compare the structures and functions of plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, chloroplasts, mitochondria, and vacuoles).

Background

Cork, from the bark of the cork oak tree, *Quercus suber*, is made up of dead cells. The rigid cell wall that surrounded each cell is all that remains. Cork was the material observed by Robert Hooke in 1663, and the structure led him to coin the term *cell* because what he saw looked like many small compartments. These cells will be looked at as a dry-mount preparation without a cover slip.

Onion cells are relatively large, easy to prepare, and easy to see under the light microscopes available in many school science labs. An onion bulb is actually the stem of the onion plant surrounded by specialized storage leaves. The cells to be observed will come from peeling the epidermis (skin) from a piece of one of these leaves. Diluted Lugol's solution (iodine and potassium iodide) can be used to stain the onion cells and makes their cell walls and nuclei easily visible. The cells will look like layers of rounded or pointy bricks. The onion cell contents are surrounded by a flexible plasma membrane, which is in turn surrounded by a rigid cell wall. The membrane and the cell wall may not be visible as separate entities in this exercise.

Cheek cells are easily collected by scraping the skin on the inside of the mouth gently with a toothpick. When viewed through a microscope, these cells will not be orderly like the onion cells, but will be scattered over the surface, sometimes singly, sometimes in clumps. Since animal cells have a flexible plasma membrane but do not have a cell wall, the cheek cells will have many different shapes and may even fold over on themselves.

Materials

*Materials marked with an asterisk must be supplied by the teacher or the students.

Materials for the whole class

- 1 stock bottle Lugol's dilute solution (500 ml) to be diluted and distributed to small dropper bottles
- 1 empty half-gallon jug for diluted Lugol's solution
- 1 graduated measuring cup (30 ml / 1 oz)
- 2 pipettes
- Labels for Lugol's solution
- 1 cup of isopropyl alcohol for dipping cheek cell slides after use

Materials for small groups (2-3 students)

- 1 thin slice of cork
- *1 piece of fresh onion (approximately 1 square centimeter)

- 1 plastic cup (for distributing onion piece and later for a small amount of water)
- 3 flat microscope slides
- 2 cover slips
- 1 pipette
- 2 toothpicks
- 1 dropper bottle of dilute Lugol's solution (shared by 2 groups)
- 1 copy of BLM 2 *Preparing and Observing Onion Cells*
- 1 copy of BLM 3 *Preparing and Observing Cheek Cells*
- *1 sharp knife for cutting onion and slicing thin cork sections
- *1 light microscope with built in or external light source
- *Paper towels

Materials for individual students

- *Science notebook

Preparation

- You will need very little dilute Lugol's solution for this exercise, but it is easiest to prepare it now because you will use it again in the **Size Matters** exercise elsewhere in this teachers guide. Prepare diluted Lugol's solution by filling the half gallon jug to its shoulder with tap water. Using the 30 ml (1 oz) graduated measuring cup, add approximately 60 ml of Lugol's dilute stock solution and stir. The iodine may turn the jug and the measuring cup brown, but save them to make more solution if necessary. With a clean pipette, distribute this diluted Lugol's solution to the small, labeled dropper bottles provided.

  Lugol's solution will degrade over time. To delay this degradation, store the solution containers in a dark place.

- Using a sharp knife (or a scalpel or a razor blade), slice small pieces of cork as thinly as possible—one piece for each pair of students. Place these in stations around the room to be picked up by students.
- Slice open an onion to expose the inner layers. Cut pieces of onion that are approximately 1 centimeter on a side and place them in stations around the room to be picked up by students. It is best to prepare the onion pieces immediately before class so that they do not dry out.
- Set up microscopes and distribute all materials except the cork and onion pieces.
- Remind students about proper microscopy techniques:
  - Starting on lowest magnification (shortest objective lens)
  - Changing objective lenses
  - Adjusting the coarse and fine focus knobs
  - Adjusting the light diaphragm
  - Preparing wet mount slides (see student handout)

Procedure

The following procedures assume that students are already familiar with microscopy techniques as outlined on page 3 of this guide. The directions are written for the typical classroom compound microscopes with low-, medium-, and high-powered objective lenses.

- Have students start by looking at a piece of cork.
  - Distribute the pieces of cork.

    - Have students put the cork on a microscope slide and then mount it on the microscope. There is no need for a cover slip. (Because it is difficult to get cork slices of even thickness, cover slips may not lie flat or may break easily.)
    - Students may now practice looking at the cork through low and then medium magnification. High magnification may not work, if the slices are too thick. The longer objective lens may touch the specimen or push it to the side.
    - Have students use a full notebook page to make a quick sketch of what they see. They should also record the date and magnification they used. To calculate the magnification, multiply the power of the eyepiece by the power of the objective lens.
- If students are working in pairs, one may prepare the onion slide and the other may prepare the cheek cells slide.
- Demonstrate to students how to peel off the epidermis layer from the concave side of their piece of onion and lay it on a microscope slide. Show them how to use a toothpick to spread the layer flat so that at least some part of it is just one cell thick. If the slice is too sticky, moisten it with a tiny bit of water.
- Demonstrate how to scrape cells from the inside of the cheek. This should be done gently. The cells can then be smeared onto a microscope slide.
- Distribute the onion pieces and the handouts.
- One student will follow the directions on the student worksheet, BLM 2 *Preparing and Observing Onion Cells*, but all students should make the observations and do their own notebook work.
- One student will follow the directions on the student worksheet, BLM 3 *Preparing and Observing Cheek Cells*, but all students should make the observations and do their own notebook work.
- After they have made their observations, students should discard the cover slips, rinse the slides, and lay them out to dry on a paper towel. The cheek cell slides should be dipped in a cup of alcohol before being laid out to dry.

Reflection/Discussion

- In what ways are onion cells and cheek cells different from each other?
- In what ways are they the same?
- Why do the cork cells look so different from the other two?
- What did you see inside the cells?

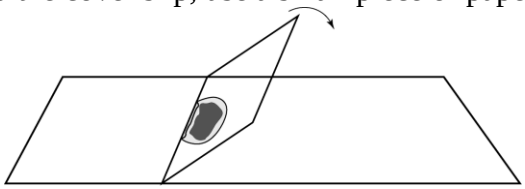
Assessment

Students should write two paragraphs comparing and contrasting onion and cheek cells.

BLM 2: Preparing and Observing Onion Cells

Part I

- An onion scale has a single layer of cells called the epidermis on both sides of the scale. To remove the epidermis, bend a piece of onion just until it snaps. The two halves will be attached by the epidermis. Carefully peel off the epidermis from the rest of the onion. This layer should be thin and almost transparent, like a piece of plastic wrap.
- Place the layer on a microscope slide, trying to make it flat so that at least some part of it is a single layer. Gently using a toothpick may be helpful, and if the tissue is too sticky, add a drop of water.
- Cover the specimen with a cover slip, starting at an angle as shown in the figure. This should get rid of most of the air bubbles.
- If water seeps out around the cover slip, use a small piece of paper towel to soak it up.



Part II

All members of the group should make these observations.

- Using the lowest magnification (shortest) objective lens, look at the slide to get oriented and to get the specimen centered in the field of view.
- Switch to medium magnification. Center the field so that a single layer of cells is visible. In your science notebook, write a sentence or two describing what you see.
- Switch to high magnification. Using a whole notebook page, make a sketch of what you see. Make your sketch large and include as much detail as you can. Mark the sketch with the date and the magnification you are using. To calculate the magnification, multiply the power of the eyepiece by the power of the objective lens.

Part III

- Remove the slide from the microscope.
- Gently lift up the cover slip. If the specimen sticks to the cover slip, gently move it back to the slide surface using a toothpick. Add a small drop or two of Lugol's solution—just enough to cover the specimen with a thin layer of liquid. *Lugol's solution may stain skin or clothes, so be careful.* Lower the cover slip back into place.
- If lifting the cover slip is too difficult, add Lugol's to one corner of the cover slip, and draw it into the specimen by placing a piece of paper towel on the opposite side of the cover slip.
- Use a piece of paper towel to soak up any extra liquid.

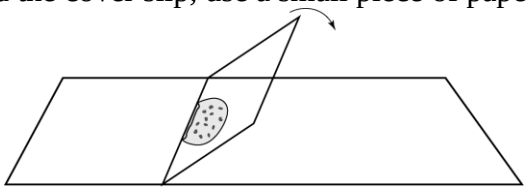
All members of the group should record these observations in their notebooks.

- Repeat the steps listed in Part II. Start with the lowest magnification to get oriented.
- Switch to medium magnification and write a sentence or two about what you see.
- Switch to high magnification and sketch what you see in your notebook.
- Record the date and the magnification used.

BLM 3: Preparing and Observing Cheek Cells

Part I

- **Gently** scrape the inside of your cheek with a clean toothpick. The cells will come off easily.
- Add a small drop of water to a microscope slide, and then spread the cells on the toothpick in the drop.
- Cover the specimen with a cover slip, starting at an angle as shown in the figure. This should get rid of most of the air bubbles.
- If water seeps out around the cover slip, use a small piece of paper towel to soak it up.



Part II

All members of the group should make these observations.

- Using the lowest magnification (shortest) objective lens, look at the slide to get oriented and to get some cells centered in the field of view.
- Switch to medium magnification. Center the field so that a number of cells are visible. In your science notebook, write a sentence or two describing what you see.
- Switch to high magnification. Using a whole notebook page, make a sketch of what you see. Make your sketch large and include as much detail as you can. Mark the sketch with the date and the magnification you are using. To calculate the magnification, multiply the power of the eyepiece by the power of the objective lens.

All members of the group should record these observations in their notebooks.

- Switch to medium magnification and write a sentence or two about what you see.
- Switch to high magnification and sketch what you see in your notebook.
- Record the date and the magnification.