PST-cell: Basic Cell Poster Kit

Having the entire Basic Cell Poster Kit enables broader lessons and discussion about cells in general by comparing the different cell types. This page has the lesson plans that can be done with all of the micrographs. Lessons that are specific to each poster are on the next pages. The final page contains the broader discussion questions related to all of the posters.

Lessons for the basic cell kit as a whole

1. In combination with the Dynamic Cell Models from Cell Zone®, Inc., any student or group of students can choose one cell from any poster to model. Once they have assembled their cell model, they can then describe/defend their model to their classmates or to you.
2. Lessons when pairing the use of this poster with microscopy:
   - Have your students make wet mounts and set them up on microscopes with the microscope pointer indicating a specific item within the microscope field. Then ask your students to find that same item on a poster and identify it with their classmates.
   - Indicate an item on the poster by pointing or drawing on the frame with a dry erase marker and have your students find a similar item in their microscope field; each student can do this or groups of students can do this and you can check.
3. Hand your students a dry erase marker and have them identify every part of a cheek cell that they can see clearly in the photomicrograph by writing on the poster frame. Either leave it open ended (thus giving them an option to identify things that they cannot see like the ER or ribosomes) or give them a specific list.
4. Have your students come up with a list of the items they could find in these cells. Then bring out the posters and dry erase markers and have them find everything on their list on the posters.
5. Have your students describe the features that make each cell type recognizable. Then have them identify those features on the poster with a dry erase marker.
6. Have your students compare this image to the standardized drawing or model of a typical animal or plant cell. Ask them if they look the same. Have them identify all the things that they can see in both and figure out why they cannot see so many of the items indicated in the drawing or model; the reason is that those other items are too small for light microscopy to resolve.

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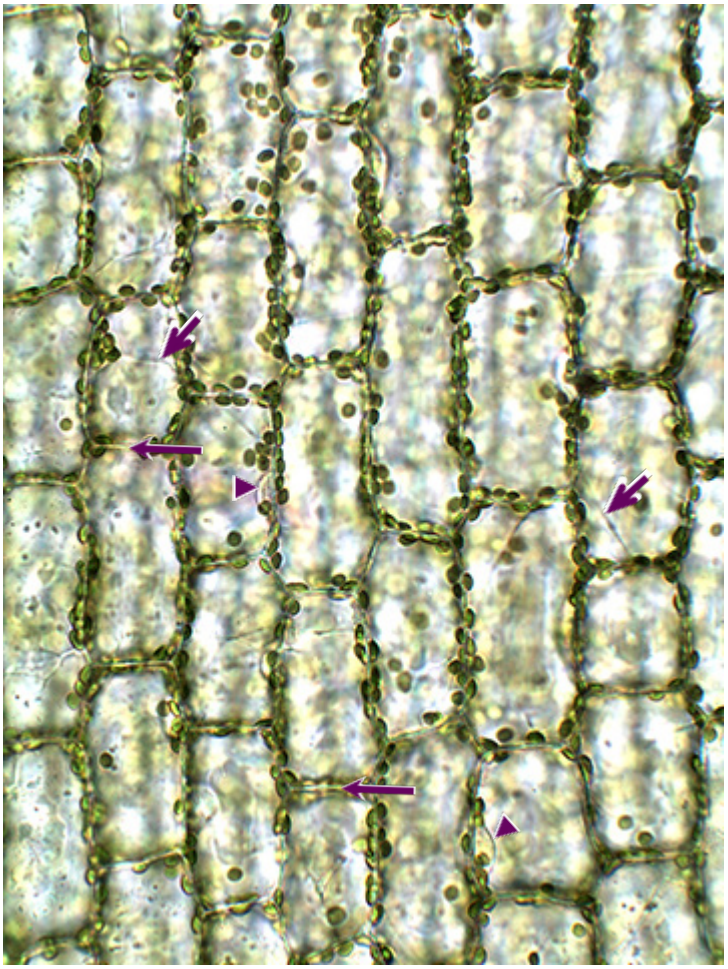
PST-cell-1: *Elodea* Cell
Visual Microscopy Kit



This is an unstained whole mount of an *Elodea* leaf, coverslipped in pond water at 400X. *Elodea* is an aquatic plant. Two of each of the following arrows are overlaid on this image:

→ Indicates visible cell walls

▸ Indicates visible, although unstained, nuclei

→ Indicates cytoplasmic strands

Each of the green dots is a chloroplast. These are abundant in these cells.

The central vacuoles are not visible in this photo. They are detectable when viewing cytoplasmic streaming, because they are the clear areas the chloroplasts do not enter. When streaming, some chloroplasts do cross through more clear areas, but they do so along cytoplasmic strands. Such movement would be over or under the vacuole.

Specific lesson for the *Elodea* poster

When pairing the use of this poster with microscopy: If your students are able to see cytoplasmic streaming, ask them if the chloroplasts seem free to move anywhere or if they are restricted in their movement in any way. They will usually figure out that there is something blocking the center of the cell, and will eventually realize it is the central vacuole. For a better chance of seeing cytoplasmic streaming, take the healthiest leaves from the tips of the shoots (the smallest, newest leaves) and warm them under the light of the microscope.

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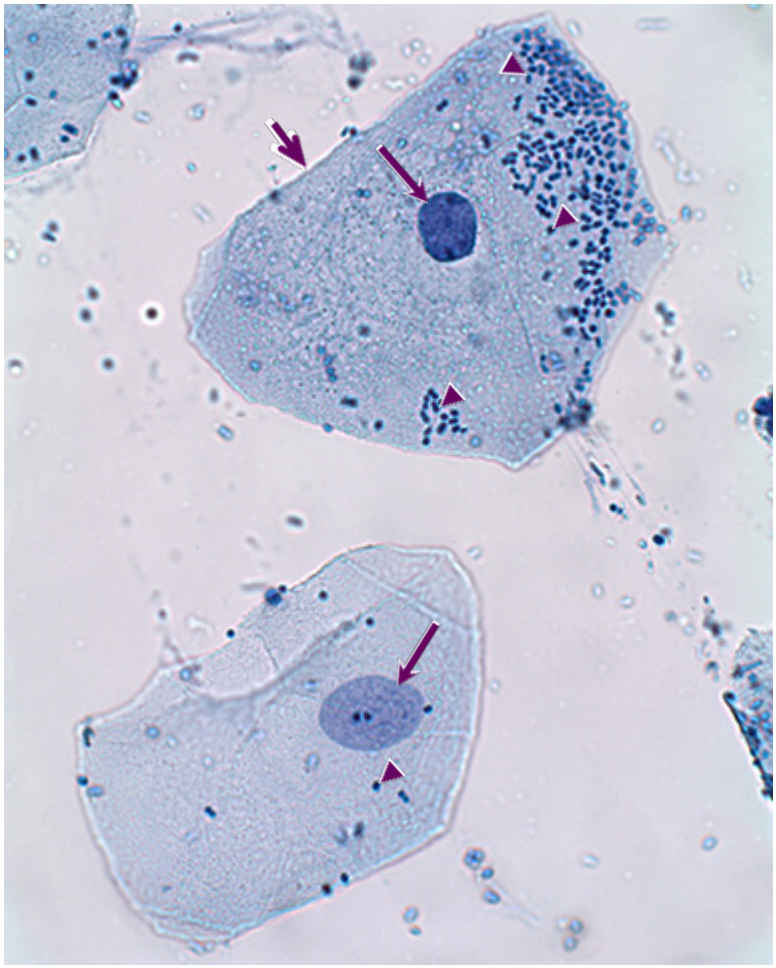
PST-cell-2: Cheek cell
Visual Microscopy Kit



This poster shows two human cheek cells that were smeared from the inside of the cheek onto a slide and stained with methylene blue. This photomicrograph was taken at 1000X magnification to ensure visibility of bacteria. Specific items are indicated by each of the following arrows on this image:

→ Indicates the nucleus of each cell

▸ Indicates visible bacteria on or under the cells

➔ Indicates the cell membrane

The methylene blue stains the nuclei and bacteria more darkly than the cytoplasm of the cell. The nuclei are inside the cells, while the bacteria lay on top of or under the cells. Since bacteria are found inside our mouths, it is typical to find them in these wet mount preparations. Note that it is difficult to spread cheek cells on a slide without folding them a little bit, so there are some ruffles on the cells as an artifact from smearing them.

Specific lessons for the cheek cell poster

1. When pairing the use of this poster with microscopy: If you do not use oil immersion objectives with your class, ask your students why they cannot see the bacteria in the microscope as clearly as on the poster. The reason is because they are just too small to see without further magnification.
2. Ask your students if the bacteria in the poster are inside the cheek cells (no, they are not because they are separate cells).

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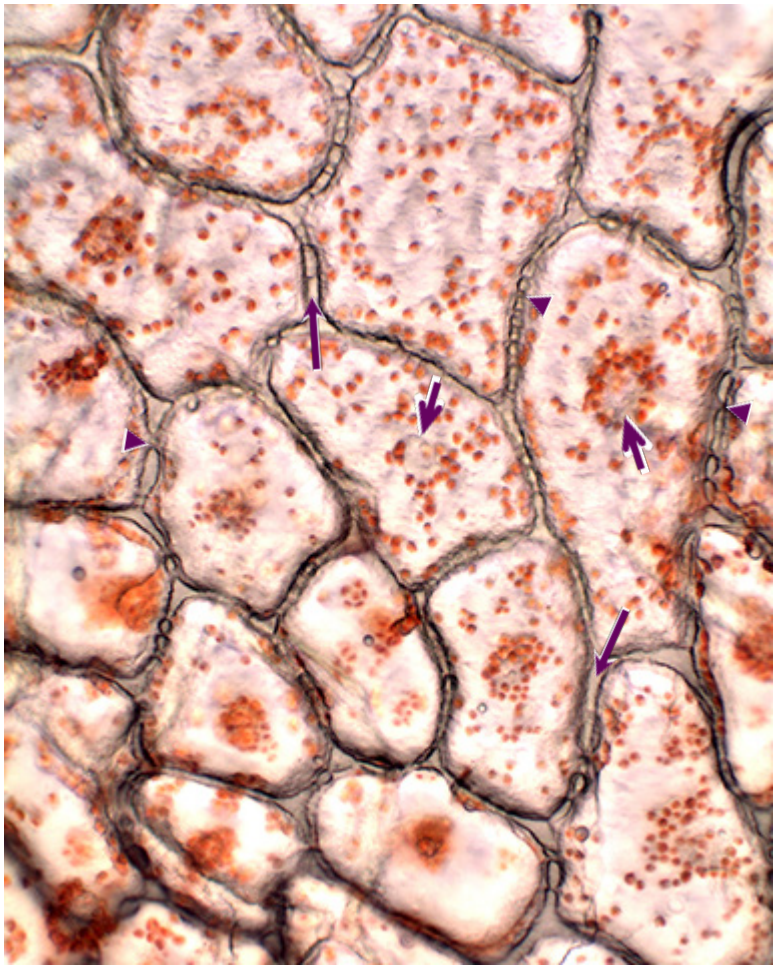
PST-cell-3: Red Pepper cell
Visual Microscopy Kit



This poster is a wet mount of red pepper peel at 400X. Many red pepper cells are unstained and coverslipped in water. Specific items are indicated by each of the following arrows on this image:

→ Indicates the thick cell walls around each cell

▸ Indicates plasmodesmata (connections between cells)

➔ Indicates nuclei

The red pepper appears red because these cells contain red-colored plastids called chromoplasts. Red pepper cells contain chromoplasts instead of chloroplasts; these organelles function to provide the red pigment and are visible as small red dots inside every cell. Sometimes the chromoplasts cluster around nuclei and enable the unstained nuclei to be more visible. The peel of a red pepper is crunchy, due to the presence of thick cell walls around each cell. Plant cells have cell junctions called plasmodesmata—they are visible here as they navigate across the thick cell walls.

Specific lessons for the red pepper poster

1. When pairing the use of this poster with microscopy: Sometimes students will get more of the red pepper meat on their slides than the red pepper peel. If they do, have them evaluate which has thicker cell walls and explain why that is (the peel has the crunch when eaten, not the inner meat).
2. Ask your students if these plant cells carry out photosynthesis (they do not). See if they can figure out that chloroplasts are needed for photosynthesis and that these cells lack chloroplasts. Finally, ask them why chromoplasts are needed in these cells (to give them pigment and make them attractive to animals to spread their seeds).

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PST-cell-4: Banana cell
Visual Microscopy Kit

This poster is a wet mount of banana cells (from the part we eat) that have been coverslipped in iodine. It shows three complete banana cells from an unripe banana at 400X. Specific items are indicated by each of the following arrows on this image:

→ Indicates the cell walls around each cell

▸ Indicates cell membranes

➔ Indicates amyloplasts

Iodine turns dark (purplish black) in the presence of starch. An unripe banana contains a lot of starch within amyloplasts. Amyloplasts make and store starch, and are found in these cells instead of chloroplasts. When unstained, amyloplasts are clear.

The cell walls are very thin around banana cells. Occasionally, a small separation can be seen between the cell wall and cell membrane and this helps distinguish the two structures.

Specific lessons for the banana cell poster

1. When pairing the use of this poster with microscopy: Have students view very ripe banana cells coverslipped with iodine. Can they still see a lot of amyloplasts? They should no longer see many since the starch was broken down to sugar during ripening. *(see American Biology Teacher 77(8):620)*
2. Ask your students if these plant cells carry out photosynthesis. See if they can figure out that chloroplasts are needed for photosynthesis and that these cells lack chloroplasts. Finally, ask them why amyloplasts are needed in these cells (to store starch until ripening so that these cells can become sweet and attractive to animals to spread their seeds).

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PST-cell-4: Red onion cell
Visual Microscopy Kit

This poster is from a wet mount of red onion peel coverslipped in iodine for contrast enhancement. Just the purple onion layer was peeled and placed on the slide. It shows most of two red onion cells at 400X. Specific items are indicated by each of the following arrows on this image:

→ Indicates the nucleus

▸ Indicates a nucleolus

→ Indicates the cell walls between cells

This image shows what onion cells look like when taken from the purplish layer of the red onion. These large cells look almost like bricks, and nuclei are typically clearly visible. There is no starch in these cells… the yellow tint of iodine merely enhances contrast of the nucleus. The purplish pigment is water soluble, so it is found throughout the cytosol. No plastids are visible in these cells.

Specific lesson for the red onion poster

Ask your students if these plant cells carry out photosynthesis. See if they can figure out that chloroplasts are needed for photosynthesis and that these cells lack chloroplasts. Finally, ask them why onion cells don't contain chloroplasts (onions grow underground where there's no sunlight).

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For all Cell Zone®, Inc. posters

General Instructions:

- Move from room to room or maintain in one location
- Hang on any permanent or removable hook by the grommet
- Use a dry erase marker on the frame; erase the same day to ensure clarity
- Store multiple posters by stacking so that the grommet cannot scratch the front of a neighboring poster

Advantages with using posters:

- Hanging real cell micrographs makes your classroom or lab space look like a place where real science is done
- The posters can be hung as art or for learning
- The posters can be paired with microscopy or used separately
- You will always have a good example of what you want your students to see

PST-cell: Basic Cell Poster Kit

Having the entire Basic Cell Poster Kit enables discussion about cells in general by comparing the different cell types. This page has the broader discussion questions.

Questions for discussion:

1. Which of these plant cells has the thickest cell walls? Which has the thinnest cell walls? Can you explain the difference between the cell walls in the way the cells and tissues feel?

   The red pepper cells have the thickest cell walls. These cells are found in the protective coating around the red pepper fruit. Banana cells have the thinnest cell walls; they are also not all stuck together into a connected tissue like red pepper, Elodea, or red onion cells. The red pepper is crunchy while the banana is soft, reflecting the thickness of the cell walls.

2. There are three different plastids. Which plastid is found in which of the cell types shown in these posters? Note that some cell types do not have plastids.

   Chloroplasts are in Elodea, chromoplasts are in red pepper, and amyloplasts are in banana cells. No plastids are visible in red onion, and plastids are not found in cheek cells because plastids are only in plant cells and those are animal cells. Also, no plastids are within bacteria because prokaryotic cells lack internal membrane-bounded organelles. Note that all plastids within one organism have the same genetics... they differentiate into whichever type of plastid is needed within that cell.

3. Are nuclei visible in all the cells of these posters? Are all these cells eukaryotic? Do all these (eukaryotic) cells contain nuclei? Why don't we see them?

   Nuclei are present in all the eukaryotic cells. However, they are not visible in all the cells because they are not stained in all the cells. The cheek cells are stained for them, so that's where they are clearest. The red onion cells are coverslipped in iodine which adds some contrast to the nuclei, and there are no other organelles blocking their viewing. In banana cells, the dark amyloplasts hide the nuclei (but if you look at overly ripe cells coverslipped with iodine you may see them). There are only a few Elodea nuclei visible, because they are unstained and only show if they bulge out the cytosol.

4. Are cell walls part of all the cells of these posters? How about cell membranes?

   Animal cells do not have cell walls, so cheek cells lack them. But all the plant cells have cell walls, as do the bacterial cells. ALL cells have cell membranes. In some posters it is possible to see the distinction between the cell walls and the cell membranes.

5. If you are working with the Dynamic Cell Models from Cell Zone®, Inc., which cells were the easiest to model? Why? Could you tell the different models apart? Could you view another model and tell which cell type it represented?

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