Maple Tree Cell

Background: Maple trees have many different specialized cells that help the tree grow, function, and produce the sap we turn into syrup.

Photosynthetic Cells: All green plants, from algae to maple trees have photosynthetic cells. In maple trees, these cells are found in the leaves. Each one of these cells contains small bodies called cholorplast, which allow the cells to photosynthesize. Photosynthesis is the process of converting sunlight into the simple sugar grlucose. These chloroplasts contain stroma and grana. Grana are membranes that contain the important molecules chlorophyll a and chlorophyll b that are able to absorb sunlight. The stroma contains enzymes that are capable of creating glucose through the Calvin Cycle.

Ray Cells: These cells appear as lines radiating from the center of the tree towards the bark. These cells are a type of parenchyma, or living cell, within the tree. They have two very important jobs, transporting and storing sugars and moving metabolic waste and phenolic compounds towards the dead heartwood within a tree.

Transport Cells: There are two main types of transport cells, tracheids and vessels. Both transport water and nutrients up and down the tree in the form of sap. In hardwoods, like maple, vessels are responsible for most of the transport even though tracheids are also present. Vessels are like long straws made up of many cells, which are called vessel elements. At maturity, vessel elements are dead, meaning they have no cell contents, which allows sap to travel freely through them. Vessel elements are connected vertically by perforated plates, and horizontally by pores between the cells, allowing for sap flow both up and down the tree, but also around the outside of the tree. These cells grow differently in different types of hardwoods. If the tree is a diffuse porous hardwood, like maple, small vessels grow throughout the growing season. If the tree is a ring porous hardwood, like black ash, large vessels grow early in the growing season and not throughout the rest of the year.

Fiber Cells: At maturity, these cells are dead. Even though, fiber cells make up a large part of the tree, and provide the structural support that makes trees and wood so strong. An interesting feature of these dead fiber cells is their ability not to burst in freezing weather. When water freezes it expands, which is why if you freeze a water bottle it will break. Fiber cells contain a special protein that stops the formation of the large expanding ice crystal that would break the cell, allowing fiber cells to remain strong and intact.

References and Resources:

Rechlin, M. *Maple Syrup: An Introduction to the Science of a Forest Treasure*. McDonald & Woodward Publishing Company. January 15, 2016.

"Educator Resources for Build-A-Cell: Plant" BrainPop Educators. Retrieved 30 January, 2019. https://educators.brainpop.com/bp-game/build-a-cell-plant/

Activity:

Cell Debate:

Goal: Allow students to explore the function and structure of different cell types within a maple tree.

Equipment:

- Drawing implements (markers, colored pencils, crayons, etc.)
- Paper
- Modeling material (if you would like)

Procedure:

1. Divide the class into groups, one for each cell type or as many as you would like to cover.
2. Give each group a synopsis of their cell type, or allow them to do some research on their cells.
3. Have each group draw or construct a model of their cell type.
4. Moderate a debate.
    a. Give each group five minutes to present their cell and why it is important.
    b. Allow two minutes for questions.
    c. (Optional) Allow for a three-minute rebuttal from each group.
    d. Have the class vote on which cell type is most important.

Link to Standards: