Teacher Guide

Wood & Cell Structure Activity

Introduction:
Many wooden artifacts are recovered from underwater conditions, like shipwrecks. When an object is waterlogged (fully saturated with water), oxygen is excluded, thus preventing or slowing many typical reactions that lead to complete decay. Over time, water enters the wood cells and eventually degrades the cellulose and lignin, thus undermining the structural integrity of the cellular structure. If excavators or conservators allow the waterlogged artifact to dry out, the weakened cells can collapse and cause the artifact to shrink, crack, and warp. To prevent this collapse, conservators replace the water with another material, such as polyethylene glycol, which will support the weakened cell walls. In this lab, students replicate the effects of waterlogging on wood cells and study the process through microscopy.

Objectives:

- To understand the effects of waterlogging at the cellular level and its impact on artifacts

Georgia Performance Standards:

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.

d. Explain the impact of water on life processes (i.e., osmosis, diffusion).

SBO1.Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions.

a. Describe the major structures and evolutionary changes of major organs, tissues, cells, and organelle types in nonvascular/seedless & vascular/seed plants.

Supplies:

Bass wood strips or pieces
Ruler
Distilled water
Beaker (100 mL)
Beaker (25 mL) or weights
Single-edge razor or X-acto knife
Microscope slides (4)
Coverslips
Tweezers
Compound microscope
Food dye

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Safety: Razor blades should be handled carefully.

Teacher Pre-Lab:

- Long, thin strips of balsa wood can be purchased at craft supply stores for less than $1 and broken into smaller sections by scoring and snapping. The sections should be small enough to submerge in a beaker. Alternatively, some craft stores sell packs of balsa wood pieces.
- Place the pieces of wood in shallow container. Prepare enough pieces of wood for each student or group to have at least one.
- Add enough water to submerge the wood. Add a few drops of brightly colored dye to the water.
- Beakers, glass slides, or small weights can be placed on top of the wood pieces to keep them submerged (they may float).
- Allow the wood to sit in the dye bath for at least 2 months or longer. Cover the container to limit evaporation. As needed, replace water lost through evaporation so that the wood remains submerged. Longer soaking is preferable and will achieve greater cell wall penetration and more visible cellular damage.

Procedure:

1. Place a small piece of dry balsa wood into a beaker and cover with water. Allow it to soak while continuing with steps below.
2. Remove one piece of wood from the stock dye bath. Pat it dry with a paper towel.
3. Using a fresh single-edge razor blade or X-acto knife, cut a thin slice from the transverse plane of the dyed wood. Take extra care to cut perpendicular to the grain direction so that the cells are clearly visible. Make sure your fingers are away from the cutting edge. The slice should be almost paper thin to allow the microscope light to pass through. Cutting thin slices requires practice and a very sharp blade.
4. To prepare a wet-mount slide, place a drop of distilled water in the middle of a glass slide. Using tweezers, place the wood slice in the drop of water. Coverslip and label the slide.
5. Remove the piece of wood from the beaker you filled with water. Pat it dry.
6. Using a razor blade, cut a thin slice from the transverse plane of the wet wood.
7. To prepare a wet-mount slide, place a drop of distilled water in the middle of a glass slide. Using tweezers, place the wood slice in the drop of water. Coverslip and label the slide.
8. Examine the two slides under the microscope at 10x power and at 40x. Draw the cells on the worksheet. Observe differences between the wet wood and the dyed (waterlogged) wood.
9. Allow the dyed (waterlogged) wood sample to dry out. The sample may dry overnight at room conditions, but could require several days. To encourage drying, carefully remove the cover slip. Sample slides may be placed on a warming plate or in a warm oven for

several hours or overnight. Replace cover slip and handle carefully to prevent dry samples from blowing off slides.

10. Examine the *dried* (dyed, waterlogged) wood under the microscope at 10x and 40x. Draw the cells on the worksheet. Observe the differences between the dried-out waterlogged wood and the dry wood.

Clean up: Return all supplies. Water and dye baths can be poured down the sink.

Selected Resources:

- Riss, Dan (1993). First Aid for Wet-site Objects. *Conserve O Gram, (6/1)*. Retrieved July 28, 2021 from: http://www.nps.gov/museum/publications/conserveogram/06-01.pdf

- Levitan, Alan (1993). Emergency Treatment for Water-Soaked Furniture and Wooden Objects. *Conserve O Gram, (7/7).* Retrieved July 28, 2021 from: http://www.nps.gov/museum/publications/conserveogram/07-07.pdf