

# CELERY LAB - Structure and Function of a Plant

**READ ALL INSTRUCTIONS BEFORE BEGINNING! YOU MAY WORK WITH A PARTNER ON THIS ACTIVITY, BUT YOU MUST COMPLETE YOUR OWN LAB SHEET!**

Look at the back of this paper and complete step one and read step two before reading and beginning the first portion of the lab below:

Plants are incredible organisms! They can make all their own food from the simple inputs of:

**Sunlight                  air (carbon dioxide)                  water                  minerals**

This is accomplished through the magic of photosynthesis, summarized by the equations below.

**Carbon dioxide + water + light energy → glucose + oxygen**



This means that plants are able to harness the energy of the sun to turn CO<sub>2</sub> from the air into the carbon-based molecules of life — **carbohydrates, proteins, lipids, and nucleic acids**.

Plants capture the sun's light within their green leaves. Inside a leaf's cells are green organelles — **chloroplasts** — which do all this hard work of producing the food that feeds the plant... and, in fact, the whole rest of the world, too!

To do this job best, leaves have evolved a specific structure — 3 types of tissue arranged in layers:

**Epidermis                  mesophyll                  vascular tissue**

The epidermis is the outer layer of cells that acts like a protective "skin" for the leaf. **Covering the epidermis is a waxy coating, called the cuticle, which stops evaporation of water** from the leaves thereby helping plants conserve water.

In the lower epidermis are openings called **stomates (stomata)** surrounded by two cells called **guard cells**.

The **stomates (stomata)** act like the lungs of the plant in that they allow gas exchange — letting CO<sub>2</sub> into the inner plant tissues for photosynthesis and then allowing O<sub>2</sub> out as a waste product of photosynthesis.

The mesophyll is the main inner leaf tissue making up the blade of the leaf. **Most of the photosynthesis of the plant takes place in the mesophyll**. The mesophyll in the upper part of the leaf is made up of tightly packed cells, **full of chloroplasts**.

The **vascular tissue** functions like the circulatory system of the plant. The xylem carries water from the roots to the leaves and to the other upper parts of the plant.

The phloem carries the sugars produced during photosynthesis in the chloroplasts of the leaves to any place else in the plant that needs the food.

**Xylem and phloem are found in vascular bundles in the veins of the leaf.**

## Plant Transport – Option 2

**READ ALL INSTRUCTIONS BEFORE BEGINNING! YOU MAY WORK WITH A PARTNER ON THIS ACTIVITY, BUT YOU MUST COMPLETE YOUR OWN LAB SHEET!**

1. Using your notes and information on the previous page Label (or draw a line) the leaf parts in Figure 1. Two were done for you.

- a. Upper and lower epidermis
- b. Guard cells
- c. Vascular bundle (xylem and phloem)
- d. Palisade mesophyll
- e. Spongy mesophyll
- f. Cuticle
- g. Stomata

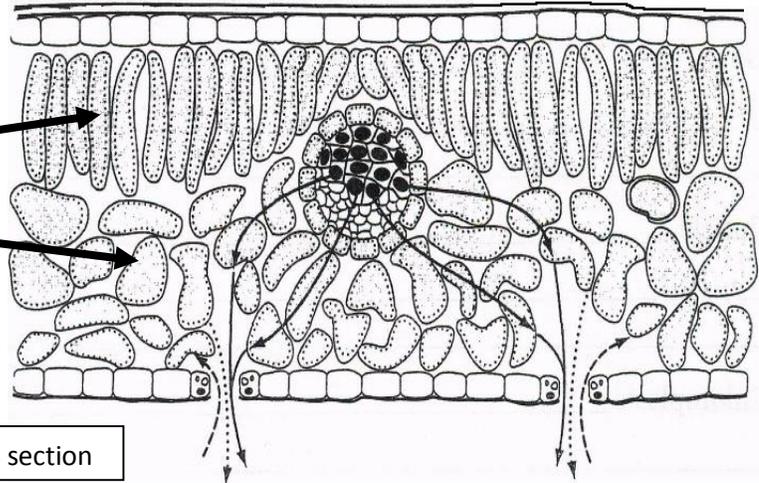


Figure 1. Leaf Cross section

2. The arrows in the diagram represent water, carbon dioxide, and oxygen. What structure do these pass into and out of? \_\_\_\_\_

### Practical: Water Movement through Xylem vessels in Celery

#### LAB INTRODUCTION:

The vascular tissue system in plants is the transport system made up of two primary specialized tissues: **xylem**, which carries water from the roots upwards to the leaves of the plant as it is needed for photosynthesis, and **phloem**, which carries glucose/ manufactured food from the leaves to the rest of the plant.

**Xylem and phloem arrange themselves in vascular bundles.** Cutting a cross-section through stem usually shows the xylem on the inner side of the vascular bundle in a stem, while the phloem is found on the outer side of the vascular bundle. In between these two tissues lies **vascular cambium**, which differentiates into either xylem or phloem tissue as the plant grows.

The arrangement of the vascular bundles changes from the root to the stem to the leaves.

## Water Movement through Xylem vessels in Celery

### INSTRUCTIONS:

- Conduct an experiment in which you observe the location of the xylem tissue within the stalk of celery, thus showing the movement of water through xylem.

### MATERIALS:

Celery stick – 3 inch piece

2 x plastic cups

Razor blade – SHARP! Handle with care -

Food Dye

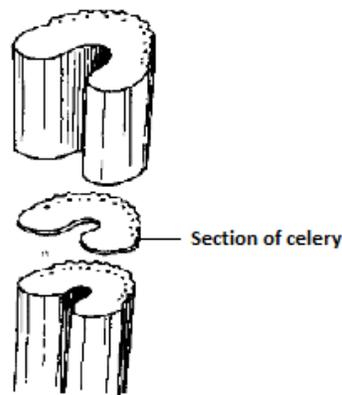
Hand lens/Microscope

mishandling blade will result in disciplinary action

**Purpose:** To locate the position of xylem in the stalk of celery.

### METHOD:

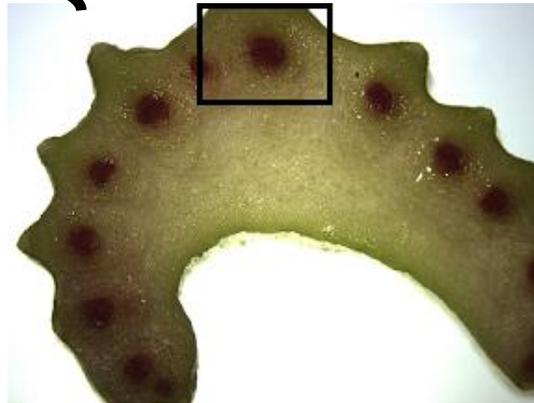
- CAREFULLY** cut a 3 inch fresh stalk of celery underneath water (use container provided) and place quickly into a cup half filled with colored water (use no more than 4 drops of food dye).  
**MAKE SURE CELERY DOES NOT CAUSE CUP TO FALL OVER AND SPILL!**
- At intervals of about 10 minutes, without removing the shoot from the dye, study the stem and leaves to see if there is any evidence of movement of the dye. Note which leaves, if any – you may not have leaves, have the dye in their veins.
- Leave the celery for 25 - 30 minutes and then do a final observation on the coloring of the stems and leaves.
- Fill a beaker or small cup with cold water for rinsing the dye off the stem.
- Remove the shoot from the dye and carefully wash the dye from the stem, in the cup of water. With a razor blade or scalpel carefully cut across the stem a few millimetres from the bottom (*fig. 1*), avoiding the region which has become deeply stained with the dye. Then cut a thin cross section to view under microscope.
- Examine the cut surface of the stem with a hand lens/microscope and make a simple outline diagram to show the distribution of dye in the stem.
- If the shoot is not needed for further experiments, the stem can be cut across at higher levels to see how far the dye has travelled.



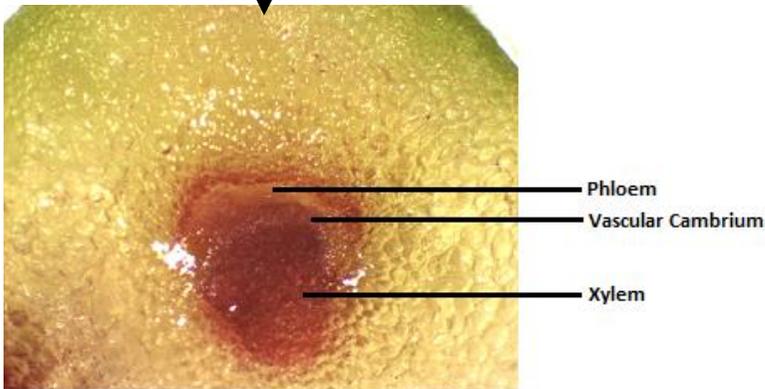
**Fig.1** Cut a cross section through the celery to examine the vascular bundles

**CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP!**

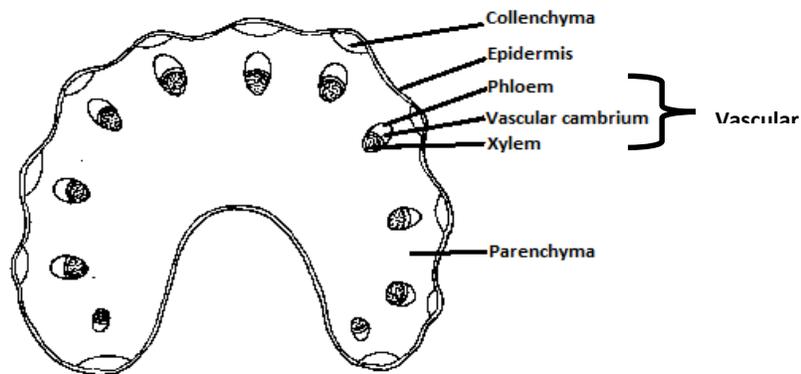
Here is an example of what you would see with a magnifying glass or with a microscope.



*Fig.2 Cross section view of celery under microscope (8X)*



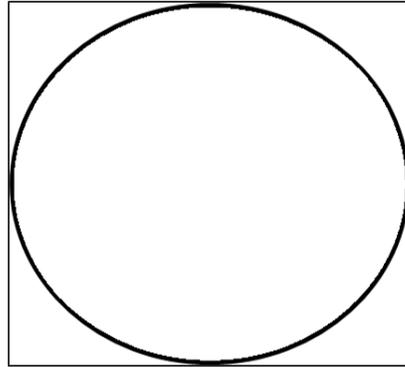
*Fig.3 Magnification of the vascular bundle clearly shows 3 distinct layers, the darkest dyed tissue being xylem (36X)*



*Fig.4 Drawing of the tissues of the vascular bundle*

DATA

From your observation make a detailed drawing of the entire cross-section to scale as you see it under the microscope using low power. Label the xylem and phloem.



Magnification: \_\_\_\_X

**CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP! CLEAN UP!**

**CONCLUSION:**

Xylem vessels run along the (outer/inner ) \_\_\_\_\_ circumference of the celery stem, while the phloem vessels run along the (outer/inner ) \_\_\_\_\_ circumference.

**QUESTIONS:**

1. Name the tissue that was stained by the dye.

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2. What can you conclude regarding the function of xylem tissue?

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3. Explain two ways in which xylem is modified to carry out its function:

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