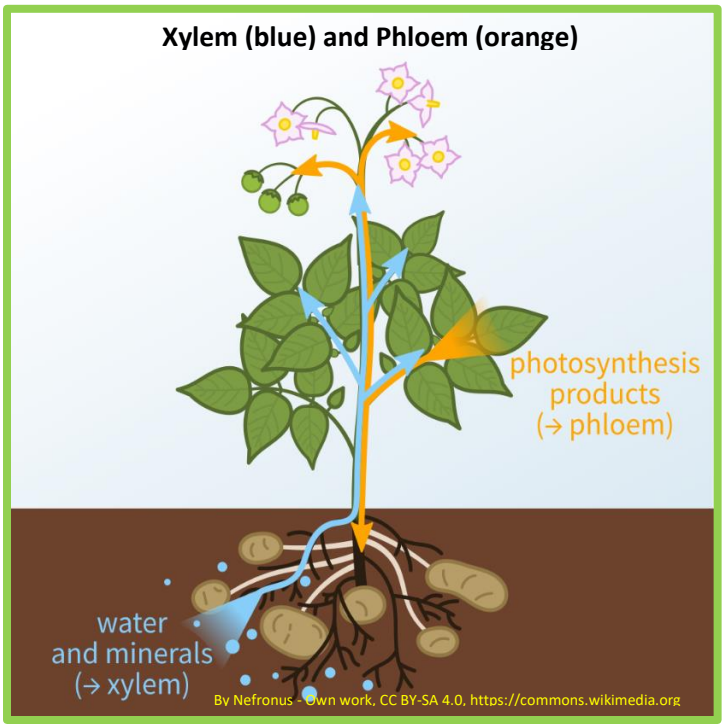
LET'S EXPERIMENT WITH PLANT PLUMBING:

Directions:

1. Review the glossary.
2. Look over the diagram of xylem and phloem.
3. Collect your materials for the experiment.
4. Make a hypothesis.
5. Conduct the experiment.
6. Review your results
7. Read the background information to see the science behind the results.

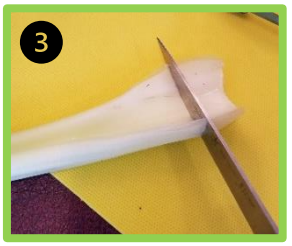


Glossary:

- System: a group of two or more structures working together to perform a job—for your quest structures would be tiny plant parts
- Xylem (*zie-lem*): a system of structures that together act like a tiny pipe or straw to move water and minerals up from the roots through stems to the buds and leaves
- Phloem (*flow-em*): a system of structures that together act like a tiny pipe to move sugars that leaves make to all other parts of the plant
- Adhesion: when water particles stick to other things like xylem and phloem pipes
- Cohesion: when water particles stick to other water particles

Materials:

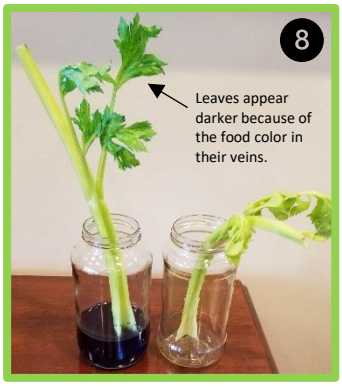
- Two drinking glasses or jars able to hold up celery
- Water
- Red or blue food color
- 2 Stalks of celery with leaves (white flower optional)
- Knife (with parent help) or scissors



Steps: match numbers in photos to direction numbers.

1. Fill one jar with 1-2 inches of water. Leave one empty.
2. Add about 8 drops of food color into the water. Stir.
3. Cut ½ inch off the non-leaf end of each piece of celery.
4. Place one cut end into the jar with colored water the other in the empty jar.
5. Put the jar in a warm place (kitchen is good) and leave it alone overnight or longer.
6. Come back and look at the celery.
7. Slice about 1/4 inch off the bottom of the one in water and look at the cut end.
8. Ask an adult to scrape a little off the celery rib to view the veins vertically. What do you notice about the veins, the leaves, and the celery without water?

Why did all of this happen?



Background:

Have you ever eaten celery and got "strings" caught in your teeth? Well, those strings are the pipe-like xylem and phloem. The strings that were stuck in your teeth, and this experiment have proven that plants have plumbing. In the celery experiment, colored water went up the pipes and turned them a color, while the celery in the other jar wilted because it had no water to move up its pipes.

Plant stems have two main jobs: 1) move fluids through paired up bundles of xylem and phloem pipes, and 2) to support the plant so it can hold up leaves up to the sunlight.

How does water move up a plant? When plants are full of water, like the celery in our experiment, some of the extra water leaves the plant through little holes in the leaves called stomata. As water particles move into the air, they pull on the water particles left in xylem in the leaf, which pull on the particles in xylem in the stem, which pull on the particles in xylem in the root. Because of cohesion, it's like a big chain of water from root to stem to leaf and into the air. The same thing happened in our celery experiment, except water particles from the glass with colored water dragged the food coloring with them. BUT the food coloring didn't evaporate into the air. It stayed in the celery leaf. Huge trees move water and minerals in the exact same way, but they move lots more water.

Xylem moves water one way - up. Phloem, however, works a little differently. A leaf sends the sugars it makes in different directions depending on the location of the leaf on a branch. Leaves higher on a branch send sugars up to the tip. Lower leaves send sugars down to the roots, and leaves in the middle will send sugars in both directions.

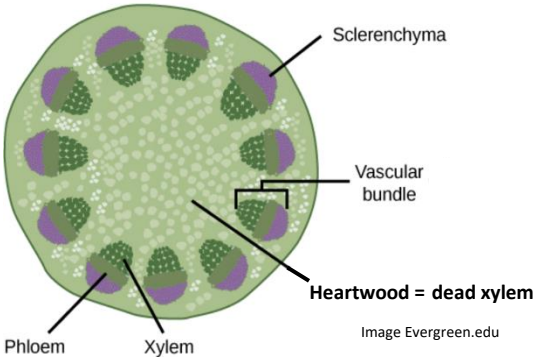


Image Evergreen.edu

So, what make a stem so strong that it can hold up the entire plant? Some stems are green, flexible, and live for only one season, like celery. Other stems are woody and live through several season, even years, but both these types of stems have the same structures. Tree trunks are just huge plant stems that support many branches, leaves, flowers, and fruit. Their trunks must be extremely strong to hold everything up. So, what makes them so strong? Does this have anything to do with their pipes moving water and sugar? Yes! Although phloem is strong, xylem is pretty strong and stiff by itself because its tubes contain fibers called lignin (lig-nin) and cellulose (cel-lu-lose), which helps plants become stiffer and stronger. And guess what? Together, lignin and cellulose forms wood. In fact, the center part of a tree is made of nonliving xylem tubes called heartwood and although not living, heartwood remains very strong.