**Introduction:** Capillary action is important for moving water (and all things dissolved in it) around. It is defined as the movement of water within the spaces of a porous material due to the forces of adhesion, cohesion, and surface tension. Capillary action occurs because water is sticky – water molecules stick to each other and to other substances, such as glass, cloth, organic tissues, and soil. Dip a paper towel into a glass of water and the water will "climb" onto the paper towel. In fact, it will keep going up the towel until the pull of gravity is too much for it to overcome. Plants use capillary action to absorb water and nutrients from the ground and pull it up their stalks. They can then distribute this water throughout the plant.

**Lesson Summary:** The purpose of this lesson is for students to learn about and observe capillary action as property of water.

**Grade Level:** 9-12th grade

**Time Required:** 50 minutes, 10 minute clean up

**Materials:**

* 5 celery stalks
* Clear plastic cups
* 2 white carnations
* Food coloring
* Plastic capillary tubes
* Water source
* 5 beakers
* Paper towels
* Vegetable peeler or plastic knife
* Ruler

**Activity Introduction/Preparation:** The attached PowerPoint may be used as an introduction reference that could be a useful preparation guide for the students before this activity takes place.

**Safety:**

-There is NO eating or drinking during the lab. Even though celery is edible, it is not to be eaten.

-Do not get food coloring on skin or clothes because it may stain.

-Be extra careful when handling capillary tubes, especially if glass.

-Pre-cut celery stalks. Use caution when doing so.

-Notify a teacher immediately in the case of spills or broken glIf any spills occur or glass breaks students should let a teacher know immediately to help with clean up.

**Activity Plan:**

1. Briefly discuss properties of water and phenomenon of capillary action in tubes and in relation to plants

2. Break students into four groups. Give each group a large plastic cup, a celery stalk, some paper towels, and a lot of capillary tubes

3. Color each group’s water: blue, red, purple, and orange

4. Put the tubes into the colored water and seeing how high the water will climb up

5. Place the celery stalk into the water cup and leave it for 10 minutes

6. After 10 minutes, take out the stalks and peel the edge

7. Measure how high the water climbed inside the celery

8. Wrap the celery into the paper towels and note any changes

*Lesson Extensions:*

9. Split the stalk of a flower into 2 glasses of color. Also, put celery stalk into water and leave both over the week

10. Make observations daily

***Discussion:***

1. How high did the water climb in their tubes?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What happened to the celery stalks in the colored water?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What occurred when the celery was wrapped in paper towels? Did the towels change? Which has better capillary action, celery or towels?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Lesson Extensions:*

1. What you predict will happen to the celery and flowers over the next week? Record your hypotheses.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Discuss the hypotheses as a class in terms of capillary action as a property of water and how that applies in real life.

**Assessment:** You can discuss the concept of capillary action applicable to this experiment. Let the class know water rises because it attracts to the surface of the capillary tubes. A lot of water is in contact with the edges of the tube because it is so narrow. The plants depend on capillary action because they absorb water and nutrients from the ground and distribute it through the plant via capillary tubes. The next week discuss the daily changes in the celery and the flower. See which plant absorbed more color and in what patterns the color was absorbed. The celery has a lot of capillary tubes in the stalk, so its water uptake is greater. When celery is wrapped in paper towels, the towels absorb some of the water because it is attracted to the paper fibers. This causes some water to leave the stalks and weaken their colors. The celery’s stalks have way more capillary tubes, so the water is held in the plant fairly well.

**References:** Here are some websites that may be helpful

* <http://www.chem.ufl.edu/~saacs/outreach/capillary.pdf>

**Authors:**
Undergraduate Fellow Name: Kristen Bowen

Please email us your comments on this lesson:
E-mail to ljohnson@cvm.tamu.edu
Please include the title of the lesson, whether you are a teacher, resident scientist or college faculty and what grade you used it for.