Capillary Action Lesson

Water travels through plants by a process called **capillary action**. Capillary action is defined as "the movement of water within the spaces of a porous material due to the forces of adhesion, cohesion, and surface tension" according to the U.S. Geological Survey. The force of cohesion keeps molecules of the same substance together, therefore water molecules stick to other water molecules (like a raindrop). The force of adhesion occurs when one thing attaches to another, therefore through adhesion water molecules are attracted to and stick to a solid substance (such as a paper towel, the soil, or organic tissues). Surface tension is a layer of water molecules that are more strongly attracted to each other, thus holding the surface intact.

Let's look at our paper towel example. The water molecules in the dish are held together by cohesion. When the paper towel dips into the dish of water, the stronger force of adhesion pulls the water molecules up into the fibers of the paper towel. As the first water molecule is pulled up by adhesion, the force of cohesion keeps the water molecules held together, so as one water molecule climbs up it brings another with it, almost like forming a water chain. The water will climb until the surface tension and gravity get too strong to overcome. This is capillary action!

Now let's apply this to plants. A plant's roots spread through the soil where water is attracted and gathers. As the water in the soil touches the plant's roots, the force of adhesion pulls the water molecules into the organic tissue of the plant. Every plant is filled with tiny tubes, called capillaries or xylem, through which the water and nutrients travel from the roots up to the very top of the plant. As the plant transpires, more water is pulled through the xylem by the force of adhesion and additional water is pulled up with it by cohesion. As long as there is water in the soil, the plant's roots will be able to send water to where it is needed in the plant through capillary action.

Our new self-watering planter also works by capillary action. In the planter, the wick acts similarly to the roots. The wick connects the water source to the soil, and the force of adhesion pulls the water (many water molecules thanks to cohesion) from the reservoir up into the soil. As the plant's roots pull the water out of the soil, the wick carries more water to replenish the water within the soil. This wicking system to water plants keeps the soil evenly moist so that the plant always has the water that it needs. It also prevents the soil from becoming flooded because once the soil is saturated the surface tension and gravity will overcome the force of adhesion and the water will not travel by capillary action until water is taken out of the soil by the plant again.

This self-watering planter is a great way to learn about the process of capillary action which is the same process that plants use to pull water out of the soil.

For more information or lessons about capillary action visit these sites:

U.S. Geological Survey:
https://www.usgs.gov/special-topic/water-science-school/science/capillary-action-and-water?qt-science_center_objects=0#qt-science_center_objects

Science World: https://www.scienceworld.ca/resource/capillary-action/