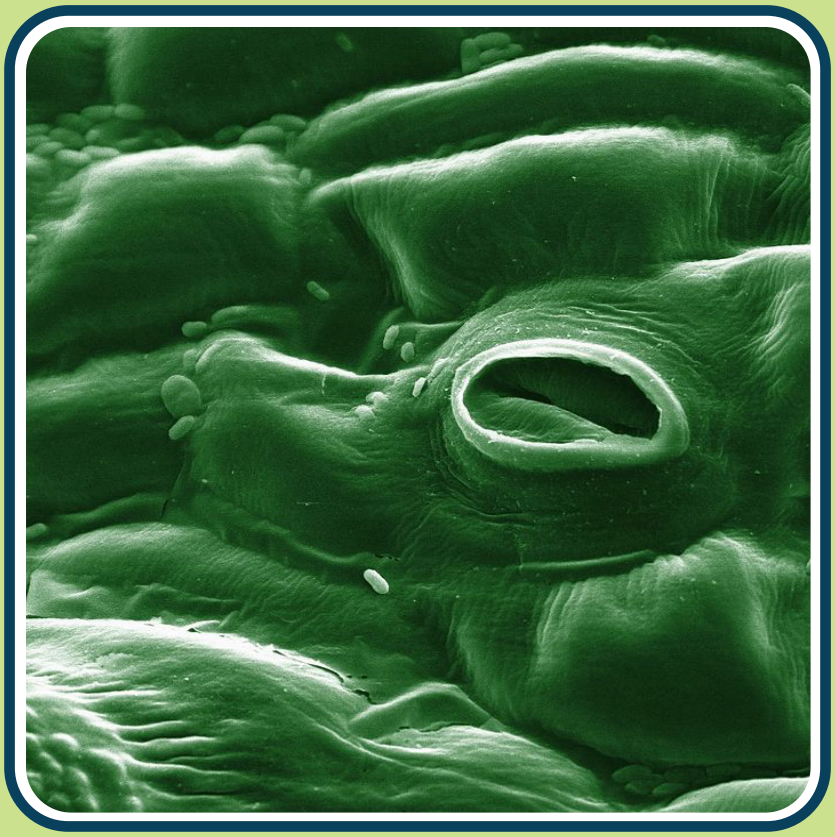
STEM Sims™

Transpiration



STEM Sims™

Transpiration

Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Transpiration is the process in plants where they lose water out of the openings in their leaves. Take the following brief quiz to see how much you already know about transpiration. See the bottom of page 4 to check your answers.

1. About how many gallons of water each hour can a large maple tree lose during a hot summer day?
   a. 6
   b. 60
   c. 600
   d. 6,000

2. Transpiration in plants can increase the humidity in the air above a town.
   a. true
   b. false

3. The wilting of leaves is a mechanism in which plants reduce their leaves' surface area to reduce transpiration water loss.
   a. true
   b. false

4. About what percentage of a plant's total energy expended goes to the transpiration process?
   a. 20%
   b. 55%
   c. 75%
   d. 98%

5. Which part of a cactus is responsible for transpiration?
   a. leaves
   b. roots
   c. stem
   d. flowers

I've Got the Sweats!

You know that people can sweat. Have you ever seen a plant sweat? In this investigation, you'll see if you can make a plant "sweat."

Materials

one medium-sized house or garden plant
two clear plastic bags (large enough to place over a small branch)
two twist-ties
one pair of scissors

Procedure

1. Make sure that you get permission before conducting this experiment.
2. Use caution with the plastic bag. Small children can suffocate if the bag is misused.
3. Place one end of the clear plastic bag around one small branch on the plant with the open end of the bag facing the stem of the plant.
4. Secure the end of the bag nearest the stem to the branch with one twist-tie in a way like the picture below. Make sure to seal the bag so no air can enter or exit the bag.
5. Use the scissors to carefully cut the end from the other clear plastic bag so the bag becomes a hollow cylinder.
6. Secure the bag to a different branch on the plant in a similar way as the other bag only this bag will have an open end at the tip of the branch.
7. Wait two to three hours and then observe and compare the two clear plastic bags.
8. Remove both bags from the plant and dispose of the bags and other materials properly.

Questions

1. Describe the difference between the two clear plastic bags at the end of the experiment.

2. Provide a reason for the difference in the two plastic bags.

3. Describe what you think would happen if you left the two plastic bag in place on the branches over a period of 3 or 4 weeks.

4. Provide a reason for why your response to the previous question would have happened.

Transpiration

Lifting Water

The world's tallest trees are redwoods that can live to be around 2,000 years old and reach heights of around 115 meters (390 feet). The leaves near the tops of these trees need water to carry out the process of photosynthesis. Unfortunately, that water is in the ground and must be moved up the tree from the roots to the treetop. Trees have a natural piping system called the xylem that provides the pathway for the water to travel throughout the tree. The xylem cells are dead; however, their cell walls remain forming the pipe structure.

If you've ever had to lift a few gallons of water you know that water is heavy and is not easy to carry, let alone lift hundreds of feet high. So, the question must be asked, what provides the pressure to move the heavy water this huge distance up the tree? The main answer comes from something called transpiration.

Leaves have pores that allow the plant to take in carbon dioxide that the plant needs for the process of photosynthesis. However, as the needed gas comes into the leaf, some water exists the leaf and evaporates. This process creates a negative water vapor pressure in the cells of the leaf that surrounds the pores. As water leaves through the pores, other water molecules are pulled up the xylem. This pulling force is because water sticks to water and extends all the way down to the root system. If this continuous water pathway is maintained, water is effectively moved from the roots to the top of the tree. As water leaves the roots to move up the tree, the roots create a negative water pressure that encourages water from the soil to move into the roots.

This process is truly amazing since a typical redwood tree can transpire around 1,900 liters (500 gallons) of water each day. Since a gallon of water weighs about 3.75 kilograms (8.3 pounds), that means that the tree must lift over 1,800 kilograms (4,000 pounds) of water each day from its roots to the treetop.

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STEMsims.com

Answers: Page 2 Answers: 1) b, 2) b, 3) a, 4) d, 5) c. **Page 3 Answers:** I've Got the Sweats! 1) The sealed ended bag should have collected water inside the bag. 2) The water was released through the process of transpiration. 3) The branch might die. 4) This is because those leaves could not extract carbon dioxide from the air.