MASSACHUSETTS FARM TO SCHOOL

HARVEST of the MONTH in the CLASSROOM

CARROTS

HISTORY

Carrots originated in Central Asia over 1,000 years ago and were derived from a wild carrot called Queen Anne's Lace. This wild carrot ancestor is also a taproot crop but has a white root. Archaeologists have found wild carrot seeds in Europe that were 5000 years old! The carrots we know today, orange and more uniform in size and shape, have been selectively bred over centuries from earlier carrots that were purple and yellow, and sometimes white. Today the largest producers of carrots are China, the United States, Poland, Japan, and France.

FUN FACTS

People in the United States eat an average of 10 pounds of carrots every year.

Carrot seeds are tiny. There are more than 23,000 seeds in one ounce.

The earliest versions of carrots were white and purple.

Cultivated carrots originated in Afghanistan.

FARMER BIO

The Athearn Family at Morning Glory Farm on the island of Martha's Vineyard farms 144 acres. They grow a wide variety of vegetables from Asparagus to Zucchini, hay and meat. Simon Athearn's favorite carrot variety is Bolero because it is thick, not overly long, can withstand cold and has the best carrot flavor of any carrot he's ever grown. All of Morning Glory Farm's products are sold through their farm store and local restaurants. *Photo Credit: Alison Shaw / Morning Glory Farm.*

HARVEST of the MONTH in the CLASSROOM

December

Grades 7-9 • 1 Period

BEND A CARROT LAB

OBJECTIVES

Students will:

- learn about osmosis
- perform a scientific experiment
- understand the scientific method

ESSENTIAL QUESTIONS

- What is osmosis?
- How does water move in and out of a cell?

MATERIALS NEEDED

Supplies Needed for each station:

- 4 carrots (or carrot pieces)
- 2 sealing plastic bags
- 1 permanent marker
- 2 spoonfuls salt in a plastic cup
- 1 plastic spoon
- At a central location (or with the teacher) sponges and towels for clean up

INTRODUCTION

In this lesson from the Oregon Museum of Science and Industry (https://omsi.edu/) students will investigate the process of osmosis by adding salt to a sealed bag of raw carrots and comparing it to a bag of unsalted raw carrots (control). Students will have the opportunity to see how the water in plants and plant roots (i.e. carrots) responds to salt concentrations. They will see osmosis at work.

Note: Because osmosis takes 15–30 minutes to occur, you may wish to start the activity with students first. Then do a demonstration while you are waiting for the osmosis to proceed, or choose to have students keep their bags of carrots in the classroom overnight. After 24 hours, even more water will move out of the carrots.

This video (https://www.youtube.com/watch?v=0WAWOgRF5N4) demonstrates the entire lab.

Ask students the following questions:

- Have you ever seen wilted plants?
- What makes plants wilt?
- What makes plants stand up straight?
  A lack of water will make a plant wilt. Giving a plant water will help it stand up straight.
- How does the water from the pot get into the plant?
  Water moves from the soil into the roots. The water can then move through the plant.
- If water moves into plants, can it move out of them?
- How does water usually leave a plant?
  Students may say that water goes back into the soil, that it disappears, or that it evaporates as from a pan left on the countertop.

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Mass. Farm to School

INTRODUCTION, cont.

As students make their observations ask them these guided questions:

- How are the carrots the same in each bag?
- How are they different?
- Is there new material appearing?
- Where is it coming from?

PROCEDURE

1. Label your bags: Label one bag "Salt" and the other bag "No Salt."
2. In the bag labeled "Salt" add 1 spoonful of salt.
3. Add two carrots to each bag. • Shake the bag to mix the carrots and the salt. • Wait about 30 minutes.
4. Observe your carrots.
   How have the carrots changed?
   How are the carrots different in each bag?
   How do the carrots feel when you bend them?

Ask students to reflect on the following:

- How do the carrots look after being in the bags?
- How are they the same? How are they different?
- What would happen if we left them in for a longer time?
  The carrots would lose more water; other students might believe they have already lost all their water.
- How is this similar to what happens in plant roots?
  When the soil is dry, water moves out of the roots into the soil. Alternatively, when the soil is salty and wet, water also moves out of the plant roots into the soil.
- Does this only happen with salt or would it happen with other chemicals as well?
  Yes, it happens with all particles. Soil has no salt, but when the soil around plant roots is dry, the water will leave the roots.

Students should understand that through osmosis, the water has moved from the carrots to the salt. Salt contains sodium ions in higher concentration than that in the carrot, so the water moves out of the carrot.

PROCEDURE

Background Information (for teachers):
This experiment investigates the movement of water into and out of cells. The movement of water in and out of cells depends on the amounts of dissolved chemicals (like sugar or salt) inside and outside of cells. Plants rely on the water in their cells to help them stand up straight—they wilt when they don't have enough water in their cells.

Movement of Water
All cells are surrounded by a barrier called a cell membrane. The cell membrane controls the movement of most chemicals into and out of the cell. One exception to this is water. Cell membranes allow water to move into and out of the cell. When water moves across a cell membrane in a particular direction, it is called osmosis. The direction water moves across the membrane depends on the concentration of particles (e.g., the amount of dissolved salt, sugars, starch, etc.) inside and outside the cell.

Isotonic: When the concentration of particles inside and outside the cells is the same, the solutions are isotonic (iso- means same and –tonic means solution). In this case, water moves equally into the cell and out of the cell.

Hypertonic: When the concentration of particles outside the cell is greater than the concentration inside, the outside is called hypertonic (hyper- means more). In this case, more water will move out of the cell. As water leaves the cell, the cell starts to shrivel and shrink.

Hypotonic: When the concentration of particles outside the cell is less than the concentration inside, the outside is called hypotonic (hypo- means less). In this case, more water will move into the cell than out. In other words, osmosis is the spontaneous, net movement of water to an area of higher concentration of particles.

EXTENSIONS & VARIATIONS

Extensions include measuring the amount of water lost from the carrots, varying the salt solutions, and investigating other liquids, vegetables or solids.

There are many possible variables to change in this experiment. Students could try this with additional materials such as different vegetables (e.g., celery, potatoes, cucumbers) or different solids (e.g., sugar, baking soda, Epsom salt, detergent, calcium chloride) or different liquids (e.g., vinegar, oil, corn syrup).

Lesson Adapted from the Oregon Museum of Science & Industry