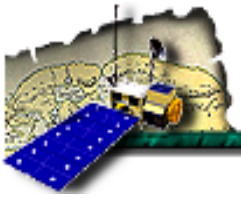

Visit to an Ocean Planet

Carrots, Celery, Dehydration & Osmosis

Overview

Students will investigate *dehydration* by soaking carrots and celery in salt and fresh water and observing the effects of *osmosis* on living organisms. Animals and plants that live in the ocean usually have a high salt level within them in order to avoid dehydration.

Concepts

- Water molecules move across a membrane to higher levels of salt concentration through a process called osmosis.
- Animals and plants that live in the ocean usually have a high salt content. On the other hand, animals and plants that are not adapted to salt water may have a low salt content, and thus become dehydrated when placed in salt water.

Materials

For each group:

- Salt water
- Fresh water
- Carrots
- Celery
- Containers (bowls, glasses, cups)

Preparation

Salt water can be created by simply putting a large quantity of salt into some water and stirring. Warm water will cause the salt to dissolve easier. If you wish to simulate the salt content of the ocean (optional), put 35 milligrams of salt into 965 milliliters of water.

This exercise can be done as a class activity/demonstration, or students can be split into small groups. Each group will need a full set of materials. There should be at least one period where the vegetables are left in water for an extended period to get the desired effect. You may therefore wish to extend this activity throughout the day, or for more dramatic and distinctive results, conduct it over two to three days. Alternatively, you can reduce the time needed for this activity if you begin with both crisp and limp vegetables. Then, both segments of the experiment--crisp and limp (step 8)--can be done simultaneously. However, by using this method you may lose some of the effect of the demonstration.

Because tasting the vegetables is part of this activity, they should be washed before starting. You might want to cover the vegetables or put them in a refrigerator if you elect to soak them overnight.

You can use glasses, bowls, or cups as containers. Celery slices and cut, peeled carrots will work best. Make certain that the pieces are small enough to completely fit inside your containers. Plastic is safer then glass, particularly for younger students, and should not affect the results of the experiment.

If students are doing the activity in groups, you may want them to record and discuss their results later with the class.

PROCEDURE

Engagement

Why can't many land and freshwater plants live in the ocean? Also, why can't many saltwater plants live in fresh water? There are freshwater fish and saltwater fish, and few of them can live in both environments; why is this so? In this activity, you will explore one of the main reasons for these differences.

Activity

1. Test the crispness of your vegetables by trying to bend and then break them. Have at least one member of the group taste each vegetable, paying attention to both its texture and its taste. If your teacher has you start with limp vegetables (optional), taste those as well.
2. Fill one bowl with fresh water and another with salt water.
3. Place several crisp, fresh carrot and celery pieces into each one.
4. Wait at least a half hour (waiting overnight will have a more dramatic effect), then take the vegetables out of the salt water.
5. Again test the flexibility of a carrot and a piece of celery that came out of the salt water. How do they compare with the results from before they were soaked?
6. Rinse these vegetables very briefly in fresh water (to remove the salt water on the outside so it does not affect the taste test). Have the same person who tasted the vegetables before the experiment taste them again. Do they differ in either taste or texture from before?
7. Repeat steps 4, 5, and 6 for the vegetables that were in the fresh water. Note that you do not need to rinse these off.
8. (Optional) Place the vegetables that had been in salt water into a new bowl of fresh water. Let them sit for at least half an hour, and then repeat steps 4, 5, and 6.

Explanation

Every living organism's salt content is controlled by osmotic factors. Through osmosis, water moves across an organism's surface or membrane toward the saltier environment. Vegetables such as carrots and celery are crisp largely because of water (fresh water) trapped within them. So, if a carrot is placed in very salty water, it will be less salty than the water around it. This causes the water in the carrot to move out of the carrot and into the salt water. The result is that the carrot becomes limp and tastes saltier than before. If placed in fresh water, the carrot is saltier than the surrounding water, so the water moves into the carrot. This causes the carrot to stiffen if it was previously limp, or preserve its crispness if it was crisp before. This is why cut carrots and celery are often stored in fresh water.

The action of salt water is an important factor for life in the oceans. To avoid salt water's dehydrating effects, most animals and plants in the ocean must maintain high levels of salt themselves. However, if you put an animal or a plant that is designed to live in fresh water or on land into salt water, it may become dehydrated and die. This is why most fresh and salt water fish and plants cannot be interchanged between salt and fresh water. They are adapted to the *salinity* of the water in which they live. The dehydration that can occur is an example of osmosis or *diffusion*. With osmosis, as we found with the carrots and celery, substances go from higher to lower salt concentrations across a membrane. Hence the water tends to leave the inside of the organism unless it has a higher salt level than its environment.

Extension

Get fresh and saltwater plants from a pet supply store. Repeat the same activity: put a freshwater plant in fresh water as the control and in the salt water as the experiment. Similarly, put the saltwater plant in fresh water (experiment) and in salt water (control). Explain the use of controls and observe differences in the plants as the experiment runs.

Purchase dried seaweed from a health food store and have the students confirm that it is quite salty in taste. What does this tell them about the environment in which seaweed grows?

What would happen to a person if he or she floated in the ocean for a long time? Have students who've spent time in the ocean, freshwater lakes, and/or swimming pools noticed a difference in how their skin reacted to each water type? Why or why not? (Because we have a high salt content in our own blood--not much less than the ocean itself-- and thanks to our protective skin, we would not be strongly affected by the dehydrating effects demonstrated in this activity. However, we would dehydrate as we normally do through perspiration and respiration.)

Vocabulary

dehydration *diffusion* *osmosis*
salinity

Source

Adapted from Orange County Marine Institute / San Juan Institute Activity Series.