



Grade Level:
10th Grade

Subject:
Biology

Exhibit:
#9 Desalination
(Salt and Onion Cells)

**Approximate
Time Frame:**
2 hours (more than one
class period)

Materials:

- computer and internet
- projector
- microscope
- diluted iodine
- onion
- pair of tweezers
- tap water
- paper and pencil
- potato slices

Lesson Plan - "Hold the Onions"

Science TEKS:

1. A Demonstrate safe practices during field and laboratory investigations.
1. B Make wise choices in the use and conservation of resources and the disposal or recycling of materials.
2. A Plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology.
2. B Collect data and make measurements with precision.
2. C Organize, analyze, evaluate, make inferences, and predict trends from data; and
2. D Communicate valid conclusions.
3. A Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.
3. C Evaluate the impact of research on scientific thought, society, and the environment.
3. D Describe the connection between biology and future careers.
3. E Evaluate models according to their adequacy in representing biological objects or events.
4. B Investigate and identify cellular processes including homeostasis, permeability, energy production, transportation of molecules, disposal of wastes, function of cellular parts, and synthesis of new molecules.
11. A Identify and describe the relationships between internal feedback mechanisms in the maintenance of homeostasis.
12. C Compare variations, tolerances, and adaptations of plants and animals in different biomes.
12. D Identify and illustrate that long-term survival of species is dependent on a resource base that may be limited.



Related TEKS: Environmental Science

Vocabulary of Instruction:

- | | |
|----------------------|-------------|
| brackish water | concentrate |
| nano-parts | osmosis |
| electro conductivity | |

Advanced Preparation: Organize students' into groups and perform a desalination project, model, or experiment. Discuss how the bi-product is managed.

Instructional Procedure (5 E)

Engage: The students will understand the reverse osmosis filtration system and compare it with other desalination processes. Discuss the pros and cons of each desalination process. Students may refer to the "Water from Water" PowerPoint at tech2o.org and/or use other internet resources.

Explore: Make sure first that no one in the class is allergic to onions. This lab can be set up as a demonstration using an in focus attached to a flex camera attached to the eye piece of a microscope and shown to the classroom or as a lab done by individuals.

Take the onion and cut into quarters or eighths. On the inside of the flake layers is a thin layer of onion skin that can be peeled off with a pair of tweezers. Break a small piece of this onion skin off and place it on a microscope slide. Make two slide mounts. Put a few drops of diluted iodine solution on the skin and cover with a cover slip. Under high power (400X) you can get a good view of a few onion cells. Have the students make a drawing of what they see and label the parts including the cell wall, nucleus, and cell membrane (the cell membrane will be flush against the cell wall and will seem like part of the cell wall).

The next step is to take a saturated solution of salt water and use an eye dropper to put a few drops of salt water along the edge of the cover slip. The salt water will ooze under the cover slip and begin to soak the onion skin. Take the other slide mount and place a few drops of good clean El Paso tap water along the edge of the cover slip to soak the onion skin in fresh water. This will be your control group. Have the students predict the outcome of the soaking.

You must now let the slide sit for about half an hour to let the solution take noticeable effect. During this time have the students turn off the light on their microscope.

After waiting about half an hour, go back to the set up and view the cells again. The cells along the outer edge of the onion skin should show the most dramatic effects. Have the students draw and label another picture of what they see and compare it to the original picture before the salt water was added. What they should notice is that the cell membrane has pulled away from the cell wall and began to shrivel up. Because the cell wall is rigid it should stay in original shape. Compare the salted cells to the ones in fresh water.

The salt water has created a hypertonic situation that forces water from the cell by osmotic pressure. It is the function of the desalination plant to overcome this osmotic pressure and force water against that gradient to create fresh water.



Why
is it
important
to
desalinate
water?

This lab can be done using cheek cells scraped with a toothpick and dyed with a blue stain and then salted after initial observation. If you do not have microscopes you can demonstrate this concept by just taking potato slices and soaking some in fresh water and some in salt water and comparing the differences. The ones soaked in fresh water should get crispy while the ones soaked in salty water should get limp and eventually shrivel up. How do you like your French fries?

Explain: As El Paso uses more and more water from the aquifer below the city they are using up more of the freshest water and have to tap into the supply of brackish water. Even though the supply of brackish water is vast, it is harmful to drink. Water, water everywhere, but not a drop to drink; is an old saying that originated from mariners at drift in the ocean. When a sailor is dying of thirst, the last thing he should do is drink salty water. This will draw even more water from the cells and lead to hallucinations and death. To observe the affect of salty water on cells you can use onion skins and soak them in salty water while observing them under a microscope. This will give you an idea of the importance of a desalination plant for the city.

Elaborate/Extend:

Questions:

What is brackish water?

What makes water brackish water?

Why is brackish water harmful?

What is osmosis?

What causes the natural force of osmosis?

What is osmotic pressure?

What is osmotic pressure and how do you measure it?

How is osmotic pressure used in nature?

How much pressure must reverse osmosis exceed in order to work?

Describe the sizes of particles filtered out from pre treatment to reverse osmosis.

Why did the water leave the onion cells in the presence of salt water?

Why did the onion cells in the fresh water show no effect?

Why is it important to desalinate drinking water?

Evaluate: Closure of class will consist of student groups developing and presenting a statement about what they learned today and how it may change their ideas about water availability in El Paso. How much will you be willing to pay for fresh water?