IMHOTEP'S LEGACY ACADEMY

8.8b Osmosis Project

Grade 8 Activity Plan

Reviews and Updates

8.8b Osmosis Project

Objectives:

1. To demonstrate osmosis and the permeability of the cell membrane.
2. Use plant cells to demonstrate how the loss of water through osmosis causes the plasmolysis of the cell membrane.

Keywords/concepts: cells, plasmolysis, osmosis, diffusion, permeable and non-permeable membranes, turgor

Curriculum outcomes: 304-4, 304-5.

Take-home item: Bouncy egg

Note: Prior to this activity eggs need to be soaked in vinegar for at least 24hrs

Segment	Detail
African Proverb and Cultural relevance (5 min.)	"Knowledge is better than riches." **Cameroon**
Pre-test (10 min.)	Discuss what happens to a plant when you fail to give it water. Ask why it went limpy? Ask/discuss what would happen if you put a limpy piece of celery/wilty vegetable into water for a few hours.
Background (15 min.)	Discuss osmosis and give simple definitions.
Activity 1 and 2 (20 min.)	Using potatoes and eggs to illustrate the concept of osmosis, describing the conditions necessary for the process to occur.
Activity 3 (20 min.)	Introduce plasmolysis and illustrate it at a microscopic level using an onion.
Follow-up (5 min.)	Have students report their observations and determine whether they are consistent with what was taught.

Suggested interpretation of proverb: Riches come and go, but knowledge is forever.

BACKGROUND INFORMATION
Some definitions of osmosis

Osmosis is a process in which water moves through a membrane. The natural movement of water is from the side of the membrane with a high concentration of water to the side with a low concentration of water. The direction of water movement through the membrane depends on the concentration of water inside the membrane and the concentration of water outside the membrane.

Osmosis is the diffusion of water through a semi-permeable membrane.[1] More specifically, it is the movement of water across a semi-permeable membrane from an area of high water potential (low solute concentration) to an area of low water potential (high solute concentration). It is a physical process in which a solvent moves, without input of energy, across a semi-permeable membrane (permeable to the solvent, but not the solute) separating two solutions of different concentrations

Plasmolysis *From Wikipedia*

Plasmolysis is an effect of exosmosis in plants. A plant cell in a more dilute salt solution will absorb water by endosmosis, so that the increased volume of water in the cell will increase pressure, making the protoplasm push against the cell wall, a condition known as turgor.

Turgor makes plant cells push against each other in the same way and is the main method of support in non-woody plant tissue. Plant cell walls resist further water entry after a certain point, known as full turgor, which stops plant cells from bursting as animal cells do in the same conditions. If a plant cell is placed in a more concentrated salt (hypertonic) solution, it loses water and hence turgor pressure, making it flaccid. Plants with cells in this condition wilt. Further water loss causes plasmolysis: pressure decreases to the point where the plasma membrane of the cell peels away from the cell wall, leaving gaps between the cell wall and the membrane. There is no mechanism in plants to prevent excess water loss in the same way as excess water gain, but plasmolysis can be reversed if the cell is placed in a weaker solution.

Plasmolysis only occurs in extreme conditions and rarely happens in nature. It is induced in the lab by immersing cells in strong saline or sugar solutions to cause exosmosis, often using Elodea plants or onion epidermal cells because the process is clearly visible.

Activity 1: Osmosis- Soaking Spuds Demo

Source: http://www.biology4kids.com/files/cell_main.html

Purpose: To demonstrate osmosis and the permeability of the cell membrane.

Suggested format: assemble students for the demo, and proceed to subsequent activities while osmosis takes place.

Items	**Quantity (for mentor)**
Potato	1
5" Bowl	2
Table Salt	30g
Distilled water	1l

Procedure:

1. Slice potato into several pieces; place some pieces of the potato in one bowl and the rest in the other.
2. Fill both bowls with water. Add two tablespoons of salt to one and label it "salt water."
3. Let the potatoes soak for 15 minutes and compare.

Questions

1. Is there a difference in the firmness of the potatoes? Why?
2. Is there a change in the amount of water in the potatoes?
3. Where did the water go? Why?
4. What is osmosis?

Through osmosis, water moves from areas of low salt concentration to areas of high salt concentrations. Adding salt to the water creates a higher salt concentration in the dish than in the potato. Consequently, water in a potato that is soaking in salt water migrates out, leaving behind a limp spud.

Activity 2a: Making naked eggs

Source: http://www.exploratorium.edu/cooking/eggs/activity-naked.html

Purpose: To demonstrate osmosis and the permeability of the cell membrane

*Suggested format: mentor should perform experiment **before session** and encourage students to make their own "naked eggs" at home.*

Item	**Quantity (for mentor)**
Eggs	10
Vinegar	2litres
500ml Mason jars	10
Large table spoon	1
Food colouring	3
Spoon	1

Procedure:

1. Place eggs inside the container (one container per egg)
2. Add enough vinegar to cover the eggs. Notice that bubbles form on the eggs. Cover container, put in refrigerator, and let eggs sit in vinegar for 24 hours.
3. Scoop your eggs out of the vinegar. Be careful - since the eggshell has been dissolving, the egg membrane may be the only thing holding the egg together. The membrane is not as durable as the shell.
4. Carefully dump out the vinegar. Put the eggs back in the container and cover them with fresh vinegar. Leave the eggs in the refrigerator for another 24 hours.
5. Scoop the eggs out again and rinse them carefully.
6. When you're done, you'll have an egg without a shell. It looks like an egg, but it's translucent—and the membrane flexes when you squeeze it. Very cool!

The Science: When you submerge an egg in vinegar, the shell dissolves. Vinegar contains acetic acid, which breaks apart the solid calcium carbonate crystals that make up the eggshell into their calcium and carbonate parts. The calcium ions float free (calcium ions are atoms that are missing electrons), while the carbonate goes to make carbon dioxide—the bubbles that you see.

Activity 2b: Experimenting with Naked Eggs

Source: http://www.exploratorium.edu/cooking/eggs/activity-nakedexperiment.html

Item	**Quantity (10 students)**
"Shell-less" Eggs	From previous activity
Water	2litres
500ml Mason jars	3
Large table spoon	1
Corn syrup	500ml
Spoon	1

Procedure:

1. Put one of your shell-less eggs into a small container and add enough corn syrup to cover the egg. Put another egg in a small container and add enough water to cover the egg. Put both eggs in your refrigerator for 24 hours.
2. After 24 hours, take a look at your eggs. What's happened?

The Science: The egg that was in the water is plump and firm. The egg that was in the corn syrup is shriveled and flabby. After you dissolve the eggshell, the egg is surrounded by a membrane. (Actually, it is two membranes, but they are held tightly together.) This membrane is selectively permeable—which means it lets some molecules move through and blocks other molecules. Water moves through the membrane easily. Bigger molecules—like the sugar molecules in the corn syrup—don't pass through the membrane.

When you put a naked egg in corn syrup, you are creating a situation where the egg membrane separates two solutions with different concentrations of water. The egg white is about 90% water; corn syrup is about 25% water. In this situation, random movements of water molecules cause them to move from the side of the membrane where they are more abundant to the side where they are less abundant. So water migrates from inside the egg to outside the egg, leaving the egg limp and flabby.

Activity 3: Plasmolysis

Learning objectives: To demonstrate how the loss of water through osmosis causes the plasmolysis of the cell membrane

Suggested format: during this activity, goggles must be worn. Mentor should conduct the experiment encouraging students to make observations

Item	**Quantity (for mentor and 10 students)**
Safety goggles	11
Red onion	1
Microscope slides & cover slips	10
Tweezers	2
Compound Microscope	2
Iodine	100ml
Small knife	1
Water	As needed
Salt	20g

Procedure:

1. With goggles on, carefully cut the onion into wedge shaped pieces using a knife.
2. Use an eye dropper to place a drop of water in the centre of a microscope slide.
3. Use the tweezers to peel a thin layer of skin tissue from the thick part of the onion wedge and place it in the centre of the microscope slide.
4. Add a drop of water and a drop of stain (iodine) over the onion tissue on the slide.
5. Carefully lower a cover glass slip at an angle on the stained tissue to allow air bubbles to escape.
6. Examine the prepared slide under the compound microscope at 100X magnification. This is your control experiment.
7. Record what the cells look like.
8. Prepare a 5% salt solution by adding 5 grams of salt (measure with balance) per 100 ml of distilled water in a beaker. Stir until dissolved. Also prepare a 10% solution by adding 10 grams of salt per 100 ml of distilled water in another beaker.
9. Use a dropper to add a few drops of the 5% solution to one side of the cover slip of your prepared slide. The 5% solution should mix with the fluid already on your onion tissue slide.
10. Carefully slide the triangle shaped end of a paper towel under the opposite end of the cover slip. This will cause the liquid to mix more with the fluid on the slide.
11. Use additional drops of 5% solution as needed to complete the introduction of the new solution.
12. Repeat steps 7 and 8.
13. Use a dropper to add a few drops of the 10% solution to one side of the cover slip of your slide with the 5% solution. The 10% solution should mix with the fluid already on your onion tissue slide.

14. Carefully slide the triangle shaped end of a paper towel under the opposite end of the cover slip. Use additional drops of 10% solution as needed to complete the introduction of the new solution.
15. Repeat steps 7 and 8.

Results

Record your data and compare your results.

1. What happened to the cytoplasm when the 5% solution was added?
2. What happened when the 10% solution was added?
3. Can the cell wall be seen more easily when the salt solutions were added?
4. Were there any changes to the cell wall?
5. Did other structures in the cell change?