



Osmosis: In or Out?

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Background Information

A solution consists of a solute and a solvent. Water is considered the universal solvent, particularly for living organisms because it can dissolve hydrophilic solutes such as electrolytes necessary for muscle contraction and nerve impulses. Sugars are another common solute and are used for cellular respiration. Water diffuses passively through semipermeable membranes while most solutes cannot. Osmosis is the passive movement of water across membranes towards higher solute (hypertonic) concentrations until the solutions become isotonic, meaning the solutions will have an equal solute concentration, when possible. When one solution has a significantly greater solute concentration (high concentration gradient), more water is necessary to equilibrate the two solutions. Cells can even rupture or dehydrate if they are placed in extremely hypotonic or hypertonic solutions respectively. To determine whether water will flow into or out of a cell, there are two key things to remember: which is hypertonic (higher solute concentration), the medium or the cell and to know that water will diffuse towards the hypertonic solution.

Lab Objectives: Determine whether media and cell are hypotonic, hypertonic, or isotonic based on average mass changes.

Materials

- Dozen large eggs
- Gallon of white vinegar
- Storage container with lid that will hold eggs and can be stored in a refrigerator
- Corn syrup
- Sports drink (red works well)
- Drink cups
- Balance (electronic or triple-beam)

Pre-Lab Directions for Instructor:

Place raw eggs in a storage container with vinegar in a refrigerator for at least two days before the lab activity. Results are best if the vinegar is refreshed at least once. Immediately before the lab activity, gently wipe or rub away the remaining shell from the egg using bare hands. Rinse the egg with cool water (egg can still be cooked) and blot dry to begin the lab. Be sure to explain how to use the electronic or triple-beam balance for the best results.

Exercise

I have placed raw eggs in vinegar for several nights to remove the hard shell from the egg. The egg serves as the model cell for this osmosis investigation. We will measure the change in the mass of the egg to determine the direction of water flow (into or out of the "cell").

Lab Directions

- Wipe remaining shell off of egg without busting the membrane.
- Quickly rinse egg with water and blot dry.
- First, weigh and record the INITIAL mass of each egg in Table 2.
- Place an egg into a container with a sports drink, water, or corn syrup. Because corn syrup is much more dense than the egg, the egg will tend to float and a cup with a bit of water can be used to force the egg down into the corn syrup as seen below in the picture.
- Wait for 40 minutes (or a bit less). This time will be used to cover the background information and complete Table 1.
- Remove egg from container and blot the water or sports drink off the surface. If the egg was in corn syrup, quickly rinse it with water and blot it dry.
- Next, reweigh the eggs and record their FINAL mass in Table 2.
- Now, calculate the difference (FINAL-INITIAL) mass and record in the last column of Table 2.
- Calculate the average difference for each medium and record in Table 3.
- Please answer the post-lab questions based on the results and background information.



Table 1. Osmosis scenarios

Scenario	Cell	Medium
1	95% H ₂ O 5% solute	90% H ₂ O 10% solute
2	90% H ₂ O 10% solute	95% H ₂ O 5% solute
3	95% H ₂ O 5% solute	95% H ₂ O 5% solute

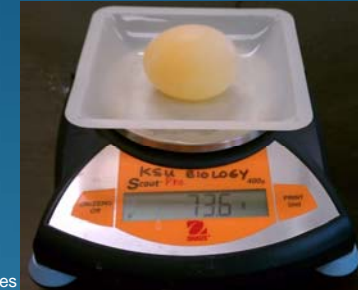


Table 1. Osmosis scenario outcomes and examples

Scenario	Cell is (Hypertonic, Isotonic, or Hypotonic)	Medium is (Hypertonic, Isotonic, or Hypotonic)	Water moves (in or out of cell)	Cell Size (no change, increases, decreases)	Example
1	Hypotonic	Hypertonic	Out of cell	Decreases	Using tap water instead of saline
2	Hypertonic	Hypotonic	In cell	Increases	Drinking sea water
3	Isotonic	Isotonic	In and out at an equal rate	No change in size	-Using saline eye drops. -Sugar solution for IV fluids.

Table 2. Initial and final egg mass class results.

Media	INITIAL Egg Mass (grams)	FINAL Egg Mass (grams)	FINAL - INITIAL Egg Mass (grams)
Sports Drink			
Sports Drink			
Water			
Water			
Corn Syrup			
Corn Syrup			

Table 3. Average difference for eggs in each medium.

Media	Average Difference= of the (FINAL-INITIAL Mass) for each medium. (g)
Sports Drink	
Water	
Corn Syrup	

Post-Lab Questions

1. Was the egg hypotonic or hypertonic to the sports drink? How do you know? Hypertonic, the egg mass increased.
2. Was the egg hypotonic or hypertonic to the water? How do you know? Hypertonic, the egg mass increased.
3. Was the egg hypotonic or hypertonic to the corn syrup? How do you know? Hypotonic, the egg mass decreased.
4. Why did the egg gain more mass with water than sports drink? The concentration gradient was greater between the egg and water than between the egg and sports drink.
5. If there was a lot of shell left on the egg how would that affect osmosis? Which would take on more water faster: an egg with a lot of shell or an egg without any shell? Why? Decrease the rate of osmosis because the shell decreases surface area for osmosis.

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