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Lab: The Incredible Egg

Big Concepts

- ➔ Describe the structure of the cell membrane.
- ➔ Identify hypertonic, hypotonic, and isotonic solutions & describe their effect on a cell.

Purpose: To observe the process of passive transport across the semipermeable membrane of an egg.

Background Information:

A cell membrane permits some materials to pass through while keeping other materials out. Such a membrane is called “selectively permeable.” Under normal conditions, water constantly passes in and out of this membrane. This diffusion of water through a selectively permeable membrane is called osmosis. Like other substances, water diffuses from an area of higher concentration to an area of lower concentration. When the movement of water molecules in and out of a cell reaches the same rate, a state of equilibrium is reached. If the concentration of water molecules is greater outside a cell, then the solution is hypotonic to the cell. Water will move into the cell by osmosis. The pressure against the inside of the cell membrane will steadily increase. If the pressure becomes great enough, the cell membrane will burst. A solution is isotonic to the inside of the cell when there is the same concentration of water molecules on the inside and outside of the cell membrane. To maintain equilibrium, water molecules move into and out of the cell at the same rate. Suppose a living cell is placed in a solution that has a higher salt concentration than the cell has. Such a solution is hypertonic to the cell, because there are more salt ions and fewer water molecules per unit volume outside the cell than inside. Water will move from the area of higher water concentration (inside the cell) to the area of lower water concentration (outside the cell). The selectively permeable membrane does not allow salt ions to cross the cell membrane. The cell shrinks as the cell loses water.

Pre-Lab Questions:

1. Why is the cell membrane considered to be selectively permeable?

2. List at least one example molecule that CAN easily diffuse through the membrane and explain why.

3. List at least one example molecule that CANNOT easily diffuse through the cell membrane and explain why.

4. Describe the process of osmosis (what moves? In what direction? Why?)

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5. Draw three pictures to demonstrate a cell in each of the following environments:
    a. Draw a picture of a beaker and a cell inside that beaker. Show the percent concentration of water on each side AND draw an arrow to show the direction of the net movement of the water.

ISOTONIC	**HYPERTONIC**	**HYPOTONIC**

Hypothesis: *I will assist you in writing these two hypotheses.

If an egg is placed in corn syrup, then the egg mass will _____(increase/decrease) because _____.

If an egg is placed in water, then the egg mass will _____(increase/decrease) because _____.

Procedure:

Day 1: Vinegar

1. Label your cups = Cup 1 and Cup 2. Also, write your names on each cup.
2. Use a graduated cylinder to measure 200 ml of vinegar. Pour the vinegar into Cup 1. Repeat this step for Cup 2.
    a. On each of the cups, draw a line to show the level of the liquid.
3. Find the mass of each of the eggs in grams and record it in Table 1.
4. Find the circumference of each of the eggs (in cm) at its widest point with a piece of string and a ruler. Record it in Table 1.
5. Carefully place a raw egg into each cup making sure that the data your measurements correlate with the cup number.
6. Cover your cups with plastic wrap. Leave the cup undisturbed for 24 hours.

Day 2: Syrup vs. Water

1. Record at least TWO qualitative observations about each cup and egg in Table 3.
2. Carefully remove your eggs. Gently rinse the eggs with tap water. Then pat dry. Do not try to get extra shell off of your eggs!
3. Measure the new mass and circumference of each of the eggs. Record your answers in Table 1.
4. Use a graduated cylinder to measure the amount of vinegar that was left in your cup. Record this amount in Table 2.
5. After measuring and recording the amount of vinegar remaining, you may discard the used vinegar down the sink. Rinse and dry your cups.
6. Pour syrup up to the line in Cup 1 and water in Cup 2.
7. Place the eggs into their respective cups, cover them, and leave them undisturbed for 24 hours.

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Day 3: Final Observations

1. Record at least TWO qualitative observations about your cups and eggs in Table 3.
2. Carefully remove your eggs. Gently rinse the eggs with tap water. Then pat dry.
3. Measure the new mass and circumference of each of the eggs. Record your answers in Table 1.
4. Draw a line on the cup containing the **syrup** at the level of the liquid.
    a. Dump the syrup down the drain, clean the cup, then fill the cup up with water up to the syrup line. ***CLEAN THE SINK!!!
    b. Pour this water into a graduated cylinder. *We are using this method because it is very difficult to clean a graduated cylinder that has syrup in it. Record this amount in Table 2.
5. For the cup containing water, pour the water into a graduated cylinder. Record this amount in Table 2.
6. Dispose of the eggs, plastic wrap, and cups in the garbage.

Table 1: Mass and Circumference

	Mass (g)		**Circumference (cm)**	
	Cup 1 - Syrup	**Cup 2 - Water**	**Cup 1 - Syrup**	**Cup 2 -Water**
Day 1 (Start of the experiment)				
Day 2 (After the Vinegar)				
Day 3 (After either Syrup or Water)				

Table 2: Volumes of Solutions

Solution	**Initial Volume (mL)**	**Final Volume (mL)**
Vinegar - Cup 1 (Day 1 and 2)	200	
Vinegar - Cup 2 (Day 1 and 2)	200	
Syrup - Cup 1 (Day 3)	200	
Water - Cup 2 (Day 3)	200	

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Table 3: Qualitative Observations

	Describe both cups and eggs here *QUALITATIVE OBSERVATIONS ONLY!!
After Vinegar	
After Syrup	
After Water	

Conclusion Questions:

****You must answer the conclusion questions in complete sentences! Including the CER questions!****

1. What was the **independent variable** in this lab?

2. What were the **dependent variables** in this lab? **You should be able to identify 2 dependent variables.**

3. List at least two **constants** of this lab.

4. How did the results of your experiment compare to each hypothesis you wrote? Does your data support each hypothesis or not?

5. Were there any errors in your lab (problems, mistakes, or challenges)? If so, how might they have affected your results?

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6. **Write a CER** to answer the following question: Which solution - the syrup or the water - was HYPERtonic to the egg?

Claim	
Evidence	
Reasoning	

7. **Write a CER** to answer the following question: Which solution - the syrup or the water - was HYPOtonic to the egg?

Claim	
Evidence	
Reasoning	

8. Could elodea or paramecium (single celled eukaryotic organisms) from a freshwater lake be expected to survive if transplanted into the ocean? Explain.

9. Your red blood cells float around in a liquid called plasma within your blood vessels. Plasma has a concentration equal to that of your red blood cells.
    a. Why is it important for the concentration of plasma to be equal with that of your red blood cells?

    b. What would happen to a red blood cell if the concentration of the plasma was “watered down” meaning the concentration decreased (became more like pure water)?

10. Do plant cells need to be as “worried” about the water and solute concentrations of their surroundings as animal cells do? Why or why not?