LAB: EFFECT OF TONICITY OF A SOLUTION ON OSMOSIS OF RED BLOOD CELLS

Introduction:

You have a membrane, permeable only to water, dividing a container into two separate chambers. What will happen if you have a heavy salt solution on one side of a membrane and distilled water on the other side?

The water will move through the membrane from the area of highest concentration of water to the area of lowest concentration of water. That means, the water will begin to move through the membrane over to the chamber containing salt.

Your cells, including red blood cells (erythrocytes), act in this way. Normally, salts are not allowed to diffuse through the plasma membrane. A cell maintains its salt concentration in its cytoplasm at about 0.9% salt. The interstitial fluid (fluid found around the outside of the cell) is a salt water concentration of 0.9% as well.

If your body’s cells are put into a solution with solutes less than 0.9%, hemolysis will occur. Remember, lyse means to break, so these red blood cells will swell with water and break. Hemolysis can also occur when the cells are placed in a solution that has a solvent such as ether, that destroys the cell membrane. Blood becomes a transparent cherry red color instead of a dull opaque color during hemolysis. This is caused by the hemoglobin of the red blood cells becoming uniformly dissolved in the surrounding liquid. Therefore, the change in color of the blood is considered an indication of hemolysis.

Pre-lab: Answer the following questions to prepare for the lab.

1. Describe how water moves during osmosis.

2. What type of tonicity do cells normally have when they are found in interstitial fluid?

3. What is the scientific name for red blood cells?

4. What is hemolysis?
5. In what ways will you know if the red blood cells lyse in this lab?
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__________________________________________________________________
__________________________________________________________________

6. What will happen to the appearance of red blood cells if they are in a
   a. Hypertonic solution?
      ________________________________________________________________
      ________________________________________________________________
      ________________________________________________________________
   b. Hypotonic solution?
      ________________________________________________________________
      ________________________________________________________________
      ________________________________________________________________
   c. Isotonic solution?
      ________________________________________________________________
      ________________________________________________________________
      ________________________________________________________________

Hypothesis:

Make a hypothesis on how the cells will change when they are placed in each of the
solutions. *Use if-then statements (If I place the cell in a ______ solution, then the cell
will ________).

0.9% NaCl:
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Distilled water:
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3% NaCl:
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
Materials: test tubes, slides, cover slips, 0.9% NaCl, distilled water, 3% NaCl, pipettes, sterilized blood

Procedure:

1. View a slide with one or two drops of blood on it in the microscope. This is your control. Pay attention to the size and shape of the red blood cells.
2. Add 3-5 drops of blood to a test tube containing 2 mL of 0.9% (0.15M) NaCl solution.
3. Add 3-5 drops of blood to a second test tube containing 2 mL of distilled water.
4. Add 3-5 drops of blood to a third test tube containing 2 mL of 3% NaCl solution.
5. Hold each test tube over the white paper and rate the transparency of the solution. Record your data.
6. Mount one or two drops of the solution from each of the three test tubes on a clean glass slide. Cover with a cover slip and observe under the microscope under high power (100X).
7. In the appropriate spaces provided, draw the shape of 3-4 cells from each test tube.

Data:

<table>
<thead>
<tr>
<th>Transparency of Test Tube</th>
<th>Rate 0-5 (0 being opaque and 5 being very clear)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td>0.9% NaCl</td>
</tr>
</tbody>
</table>

Drawings of the red blood cells

Control

0.9% NaCl
Conclusion:

1. What happened to the erythrocytes placed in 0.9% NaCl?

__________________________________________________________________

2. Describe the appearance of the erythrocytes placed in the distilled water. Use the scientific name for the change in shape in your description.

__________________________________________________________________

3. Describe the appearance of the erythrocytes placed in the 3% NaCl. Use the scientific name for the change in shape in your description.

__________________________________________________________________

__________________________________________________________________

4. What tonicity was each of the solutions? (hypotonic, isotonic or hypertonic?)
   a. 0.9% NaCl ____________________________
   b. Distilled __________________________
   c. 3% NaCl ____________________________

5. Explain why you would expect crenation to occur if blood cells were placed into a 10% glucose solution.

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__________________________________________________________________

__________________________________________________________________

6. You are a doctor and a patient comes in with a swollen ankle. You suggest to soak the ankle in a water bath. How would you prepare the water bath solution so that it would draw the fluid out of the patient’s cells and reduce swelling?

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