Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Laboratory: Investigating Synthetic Membranes**

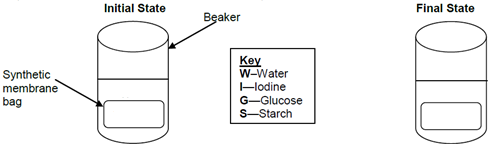
1. Pre-Lab Q’s
   1. What happens when iodine reacts with starch?
   2. Why is it useful for each cell to be surrounded by a selectively permeable membrane?
   3. Today you will investigate a synthetically selectively permeable membrane which provides a simplified model of the cell membrane. Fill in the table below with your hypothesis about which substances will diffuse across the membrane.

|  |  |  |  |
| --- | --- | --- | --- |
| **Molecule or Ion**  **(molecular formula)** | **Charge?** | **Will it diffuse across the membrane?** | **Why or Why Not?** |
| Iodine (I3-1) | Negative |  |  |
| Water (H2O) | None |  |  |
| Glucose (C6H12O6) | None |  |  |
| Starch (sugar made up of many glucose molecules) | None |  |  |

1. Materials:

|  |  |  |
| --- | --- | --- |
| * Iodine (I3-1) * Water (H2O) * Glucose (C6H12O6) | * Glucose test strips * Digital Scale * Graduated Cylinder | * Beaker * Synthetic membrane * Starch (sugar made up of many glucose molecules) * 250mL beaker |

1. Procedure:
   1. The figure below shows a sample experimental design. Fill in the figure with what substances you will put inside and outside of the bag to set up your experiment. Then, fill in what will be in the bag and the beaker at the conclusion of the experiment (final state).



* 1. Based on your experimental design and the materials listed above, how will you know what crossed the membrane?

|  |  |  |
| --- | --- | --- |
| **Substance** | **If it diffused across the membrane?** | **If it did not?** |
| Iodine |  |  |
| Water |  |  |
| Glucose |  |  |
| Starch |  |  |

* 1. Obtain your teacher’s signature on your experimental design and predictions to ensure they are valid: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. Add 200mL of distilled water to your 250mL beaker. Then add up to 4mL of whatever substance(s) are going on the outside of the beaker.
     1. Record what you added and how much:
  3. Obtain a piece of pre-soaked dialysis tubing (aka synthetic membrane) and two clips. Fold and twist the bottom of the piece of tubing 1 cm up and clip it so nothing can leak out.
  4. To open the other end, rub it between your fingers until the edges separate. Use pipettes to add up to 8mL of solution to the inside of the tube (DO NOT GO OVER 8mL! Although more will fit, we want to leave some room for movement of materials or else our experiment will not work!)
     1. Record what you added and how much:
  5. Next, clip off the top of the tube in the same way you did before 1 cm from the top. Rotate the tube around and make sure your clips are secure and no fluid leaks out.
  6. Rinse the bag thoroughly in distilled water. Dry off the bag with a paper towel and place it in your beaker.
  7. Now that your experiment is set-up, record your initial observations.

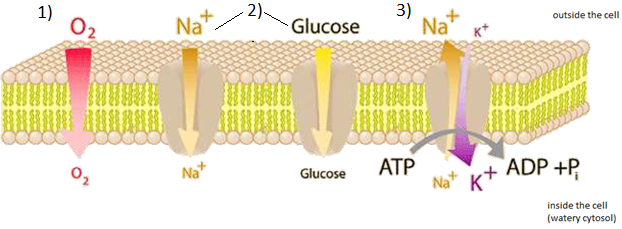
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | In the bag | | In the beaker | | Measurement to evaluate movement of water |
|  | Color | Glucose? | Color | Glucose? |
| Initial State |  |  |  |  |  |
| Final State |  |  |  |  |  |

* 1. You must wait 30 minutes to allow diffusion to occur. Work on the analysis questions while you wait, and then come back and fill in your final table results.

1. Analysis Questions
   1. Which way would you expect more water to diffuse – into the bag or out of the bag? Explain why.
   2. Complete this table.

|  |  |  |
| --- | --- | --- |
| **Molecule/Ion** | **Did this molecule or ion cross the membrane?** | **How do you know?** |
| Iodine (I3-1) |  |  |
| Water (H2O) |  |  |
| Glucose (C6H12O6) |  |  |
| Starch (sugar made up of many glucose molecules) |  |  |

* 1. Based on your results, what factors seem to play a role in which substances cross the membrane?
  2. Did any of your results differ from your predictions in the first part of this lab? If so, what were the differences?
  3. What is your explanations for the differences between your predictions and observations?



The diagram above shows what the cell membrane really looks like as opposed to a synthetic membrane. In a real cell membrane:

1. Small, uncharged molecules like O2 can diffuse across as long as it’s down its concentration gradient.
2. Na+ and glucose can also diffuse but they need help from special protein channels.
3. Finally, on the right you can see that molecules like Na+ and K+ can diffuse AGAINST their concentration gradients (go from low to high concentration) if the cell uses ATP energy.
   1. What is similar between what we observed with our synthetic membranes and what is possible in a real cell membrane (based on the diagram)?
   2. What is different about what between what we observed with our synthetic membranes and what is possible in a real cell membrane (based on the diagram)?
   3. Finally, if you were to repeat this experiment, is there anything you would do differently to improve upon it? Explain.