Laboratory 2 – Molecular Activity and Membrane Transporter

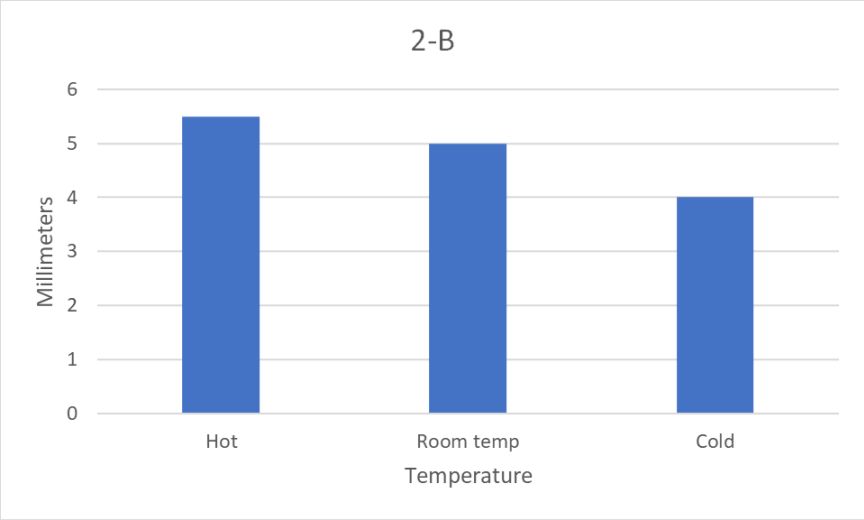
Purpose: These labs experiments were to get a better understanding of cells and what their mechanism is. We learned the different types including passive, active, osmosis, and differential permeability as well as the concept of filtration and the effects cells have from tonicity.

2-B: Measurement of diffusion through a liquid

Procedure:

- Three Petri dishes were filled with 40 mL of 25˚C water
- In each dish, one crystal of potassium permanganate was dropped
- After 5 minutes the largest diameter of the colored spot was measured
- These steps were repeated but for temperatures of 5˚C and 45˚C
- Using the results, graphs of ranges and means for each temperature were created to compare results.

Results:



Discussion:

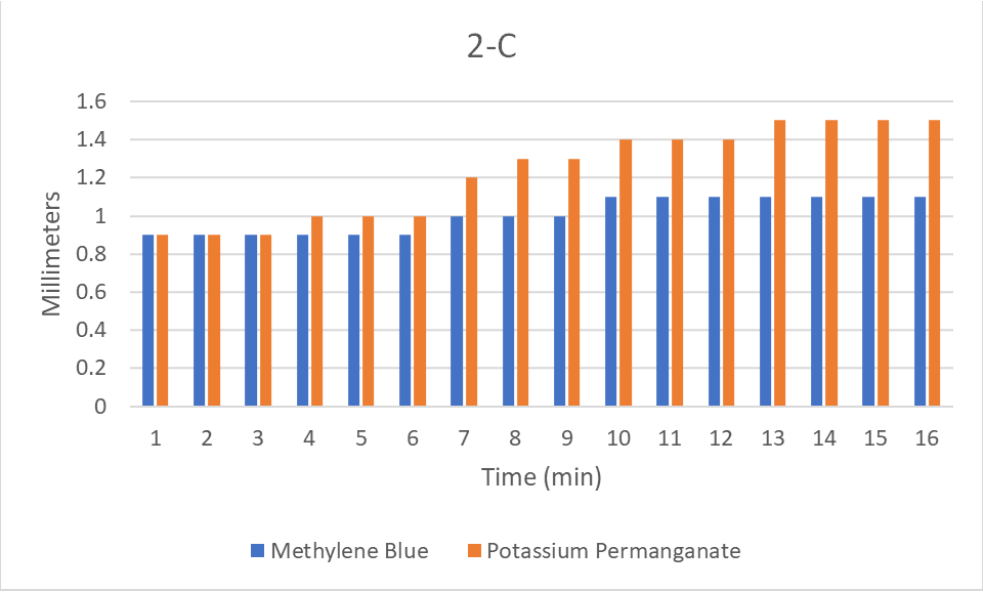
From the results, we could see that the one with the largest expansion would be the one with the hot water and the one with the smallest would be the one with the cold water. Although I was not the one that did this experiment, the results seem to be fairly accurate to what I would have thought that would happen. Normally hot objects seem to expand much faster than cold items, cold tends to make things shrink.

2-C: Measurement of diffusion through agar

Procedure:

- Taking 2 petri dishes filled with agar, 2 drops of methylene were placed in one dish and 2 drops of potassium permanganate were placed in the other dish
- The time and diameter of the spots were timed and measured immediately. After every minute for 10 minutes the diameter of the spots was measured in millimeters
- After a graph was created to compare the diffusion rates of both chemicals

Results:



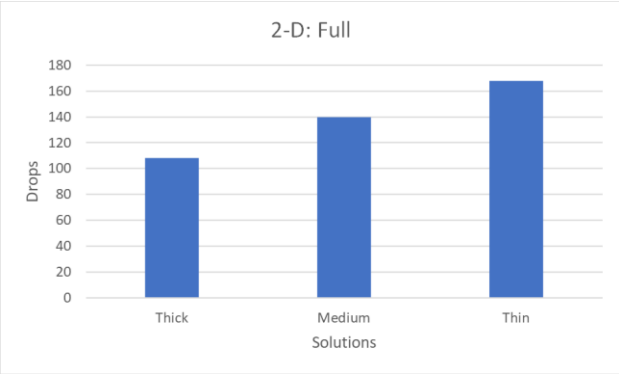
Discussion:

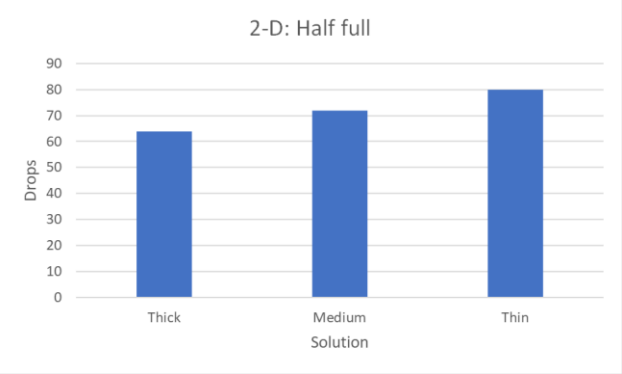
From the results we gathered in this experiment, we could see that Potassium Permanganate expanded much more and more rapidly than Methylene Blue. When my partner and I first put the drops in, both were at about the same size, and they both did not expand much for the first 3 minutes. According to the Merck Index the molecular formula for methylene blue is $C_{16}H_{18}ClN_3S$ and the molecular formula for potassium permanganate is $KMnO_4$ according to the molecular formulas less elements are involved in potassium permanganate which perhaps can be the reason of a faster diffusion rate compared to methylene blue.

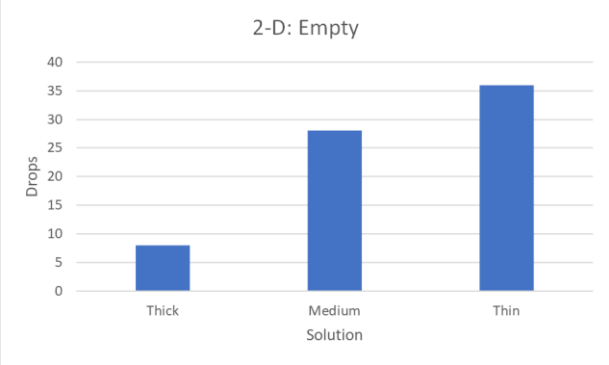
2-D: Demonstration of filtration

- Taking 3 filter papers, they were made into cones and placed into 3 separate glass funnels
- Three 100-militer solutions of charcoal and water making a thick, medium thick, and thin solution were made then weighed to retrieve the mass of the charcoal used
- 50 mL of each solution were poured into the funnel one at a time then the number of drops per minute were counted, again when the funnel was half filled, then when it was nearly empty
- The procedure was repeated with the remaining 50 mL of each solution

Results:







Discussion:

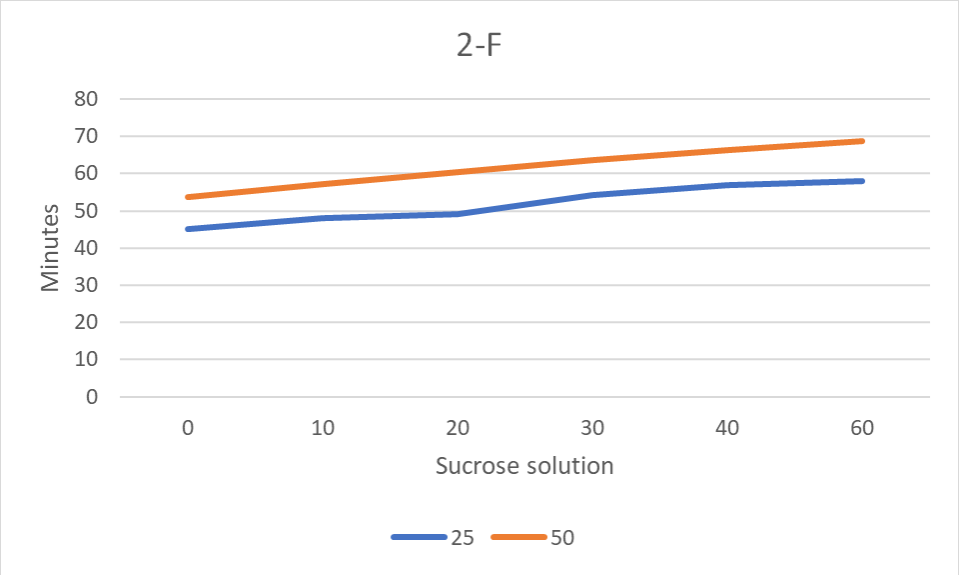
In this experiment the results were very predictable. The solution with the most charcoal had the slowest filtration drops compared to the thin solution, which had the fastest time. My partner and I made a small mistake when doing our first trial, we let one of our cups with charcoal sit for too long and did not mix it before pouring it into the filter paper. None of the charcoal passed through the filter paper we used.

2-F: Measurement of osmosis

Procedure:

- 2 dialysis bags were filled with sucrose solutions and attached securely to the bottom of 2 open, thin glass tubes. One bag being filled with 25% of the sucrose solution and the other 50%
- Both bags were inserted into separate beakers of distilled water ensuring that the dialysis bags were fully submersed but not touching the bottom of the beakers, each suspended by a ring clamp being applied to the glass tube
- The systems equilibrated for 5 minutes, then the fluid levels were marked and time was recorded
- Fluid levels were the measured every 10 minutes for 50 minutes
- The length was divided by the number of minutes to get the rate in mm/min
- The rate of osmosis for each system was determined

Results:



Discussion:

In this experiment, we could see from the results that the system with the fastest osmotic rate was the 50% sucrose solution meaning that the water molecules of this solution were able to move through the high concentration of water molecules to a lower concentration faster than the 25% sucrose solution.

2-G: Measurement of differential permeability of sugar and starch

Procedure:

- A dialysis bag was filled with 1% starch-10% glucose solution
- The bag was tied to a glass rod and suspended in a beaker of distilled water
- After 15 minutes the water was checked for starch by adding 10 drops of Lugol's solution to 5 mL of water, red color indicated no starch and a navy blue indicated starch
- Sugar was tested by adding 3 mL of benedict's solution to 5 mL of water, simmering the solution for 5 minutes, a blue color indicated no sugar and a color change indicated sugar
- The water was tested again at 30, 45, and 60 minutes
- Results were recorded

Results:

Time (min)	A	B
15	no starch	little sugar
30	no starch	moderate sugar
45	no starch	more sugar
60	no starch	lots of sugar

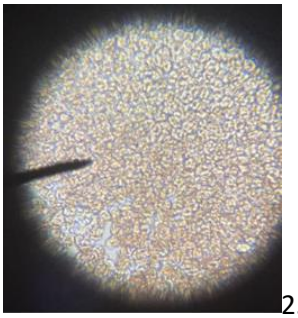
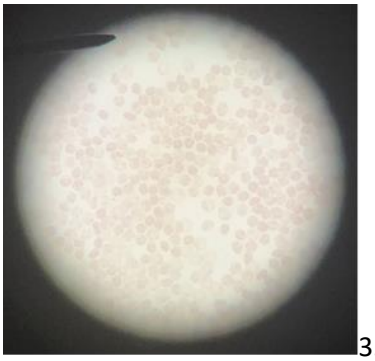
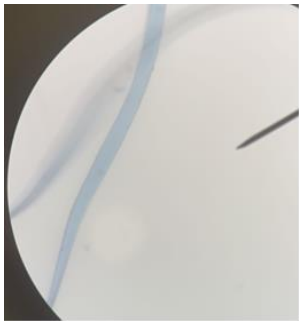
Discussion:

In this experiment, after 15 minutes there was no starch in the water and no sugar in the water. At 60 minutes there was still no starch, and the solution was a reddish-brown color however there was a red color that indicated the presence of sugar. This indicates that as time passed sugar was able to escape into the water while the starch did not.

2-H: The effects of tonicity on red blood cells (Demonstration)

Procedure:

- One milliliter of distilled water, physiological saline, and salt water were separated into 3 test tubes
- A drop of blood was added to each tube and contents were mixed thoroughly
- A wet mound slide was made of each solution
- The following were observed: hemolysis of cells in hypotonic solution, maintenance of cell size in the isotonic solution, and crenation of cells in the hypertonic solution
- A drawing of each observation was made and an explanation

1.  2.  3. 

1. Sodium 2%

2. Sodium 5%

3. DI water

Discussion:

In this experiment, observation of blood in sodium 2%, sodium 5%, and DI water under a microscope occurred. In the sodium 2% solution I observed crenation of cells in the hypertonic solution because the blood cells appeared to have shrunk meaning the solute concentration inside the cell is lower. In the sodium 5% solution I observed hemolysis of cells in the hypotonic solution because it appears that the cells have swelled up and are enlarged meaning the solute concentration inside the cell is higher. In the DI water solution, I observed maintenance of cell size in the isotonic solution because it was hard to see what was on the slide of this one but since there was no obvious change it means the solute concentration inside the cell is equivalent to the solution outside of the cell. Overall, I thought this experiment was very fascinating due to being able to see the way the cells were able to react.

Conclusion:

After many experiments I have a better understanding of how the molecular activity and membrane transports. There are many things that come into play, like temperature which makes things expand faster or slower. Density of the solution is another factor, the thicker a solution is the slower it will filter. For the most part, these experiments had a predictable outcome, but they helped show how diffusion, osmosis, passive diffusion and active diffusion work.