Problem Set #8
Chapter 9

Problems from your book: 9.4, 9.7, 9.8, 9.9, 9.14

Chpt 9

1.) Why do micelles form?

2.) Flipases are enzymes that flip phospholipids in the membrane. Why are they required to flip-flop a phospholipid across a membrane?

3.) **Lateral Diffusion**

a) What would the Edidin experiment have shown if there was no lateral diffusion?

b) Fluorescence photobleaching recovery experiments can be used to determine the diffusion coefficient of a phospholipid. In this type of experiment, an area of the cell is bleached with light. The rate at which fluorescently labeled phospholipids enter the photobleached area can be correlated to the diffusion coefficient. What would a fluorescence photobleaching recovery experiment have shown if there is no lateral diffusion?

4.) Consider a membrane in a eukaryotic cell. The concentration of Ca^{2+} ions on the inside of the cell is 60 mM and 20 mM on the outside of the cell. The change in potential is $\Delta\psi = \psi_{in} - \psi_{out} = +30$ mV.

a.) If $\mu = \Delta\overline{G}_A = RT \ln\frac{[A_{in}]}{[A_{out}]} + Z_A\mathsf{F} \quad \Delta\psi$, what is the $\Delta\overline{G}_A$ at 37 °C for a Ca^{2+} ion crossing the membrane coming from the outside of the cell and going to the inside of the cell?

b.) Based upon your answer in part (a), is a Ca^{2+} ion going from the outside to the inside of the cell more likely to cross the membrane via facilitated diffusion or a Ca^{2+} -ATPase pump? Please explain your answer in terms of ion transport mechanisms.

5.) Consider a membrane in a mammalian cell. The concentration of K^+ ions on the inside of the cell is 100.0 mM and 10.0 mM on the outside of the cell. The change in potential is $\psi_{out} - \psi_{in} = 65.0$ mV.

a.) What is the $\Delta\overline{G}$ (in kJ/mol) at 37.0 °C for a K^+ ion crossing the membrane going from the outside to the inside of the cell?

b.) Based upon your answer in part (a), what type of membrane transport mechanism do you think K^+ would be transported from outside to the inside of the cell? Give an example of a transport protein that would be used to transport K^+ under these conditions.

6.) Describe how the Na^+,K^+-ATPase pump works.

7.) Describe how the Ca^{2+}-ATPase pump works.

8.) Describe how the H^+,K^+-ATPase pump works.

9.) Describe how the H^+,Lactose permease pump works.

10.) Describe how Bacteriorhodopsin works.

11.) Compare and contrast all pairs of pumps listed in 6-11.

12.) If all of the valines in Gramicidin A were changed to leucine, what would be the effect upon ion transport? Explain your answer.

13.) Name the three classes of membrane proteins and give an example of each.

14.) Why can't triacylglycerols be significant components of lipid bilayers?