~~HW10: Chapter 11 Problems 4, 6, 24, 25~~

(4) a) Lipids have polar head groups and hydrophobic fatty acid tails. The polar head groups will interact with solvent molecules in the aqueous phase and the tails will associate with each other.

b) The fact that bilayers can form vesicles and spherical containers means that cells and organelles can form

(6) I would expect a lower rate of diffusion because the membrane would be less fluid at a lower temperature

(24) a) As mentioned in class, it takes ≈ 27 amino acids to form a transmembrane helix

Bilayer = 40 Å thick α-helix = 5.4 Å / turn with 3.6 residues/turn

$$\frac{40\text{ Å thick}}{5.4\text{ Å/turn of } \alpha\text{ helix}} = 7.4 \text{ turns of an } \alpha\text{-helix}$$

$$7.4 \text{ turns} \times \frac{3.6 \text{ residues}}{\text{turn of } \alpha\text{-helix}} = 27 \text{ amino acids}$$

For 7 TM helices, you'd need 27 × 7 = 189 amino acids

A protein with a M$_r$ of 64,000 has roughly

$$64{,}000 \text{ Da} \times \frac{1 \text{ average amino acid}}{110 \text{ Da}} = 581 \text{ amino acids}$$

Based upon this, yes, a protein of M_r = 64,000 could have 7 TM helices.

b) I would make a hydropathy plot

c) This portion of the protein is <u>not</u> a transmembrane helix. It is too small and too polar based upon its amino acid sequence (sequence = RSPDFRKAFKRLLCF)

d) It has 25 amino acids and a lot of hydrophobic residues, so yes this protein segment could span the bilayer (almost)

(25) a) Model A: yes. The railroad track
Model B: No. The model doesn't predict a regular pattern
Model C: yes.

b) Model A: yes
Model B: no
Model C: maybe

c) Model A: maybe
B: yes
C: yes

d) Model A: Maybe
Model B: No
Model C: yes

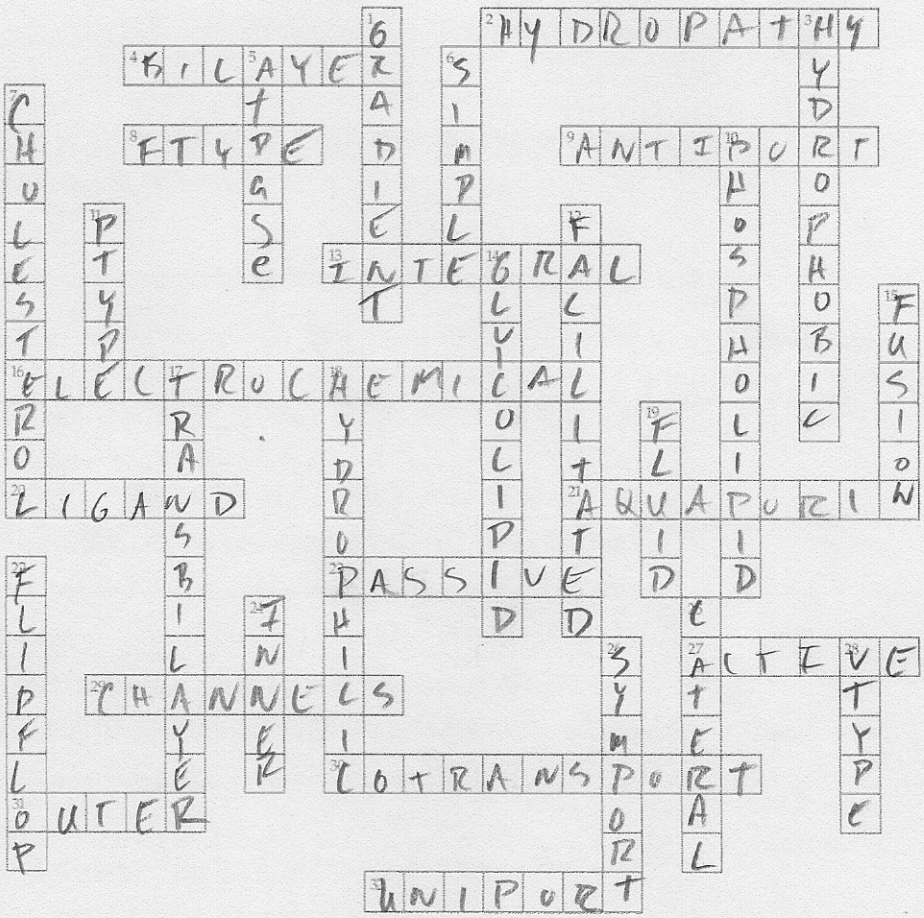
e) Model A: maybe
Model B: yes
Model C: yes

f) A: Maybe
B: yes
C: yes

g) A: No
B: no
C: yes

SELF-TEST

Do You Know the Terms?



ACROSS

2. A plot of _____ index vs. amino acid residue number in a protein predicts potential membrane-spanning α-helical regions of integral membrane proteins; such a plot is *not* useful for predicting β-barrel transmembrane segments
4. The structural organization of lipids in biological membranes.
8. One category of _____-_____ ATPases that are responsible for the production of ATP in mitochondria and chloroplasts; they are also known as ATP synthases.
9. _____ refers to the simultaneous transport of two solutes across a membrane in opposite directions.
13. _____ proteins are very firmly associated with the membrane via hydrophobic interactions with the fatty acid chains of membrane lipids.
16. The _____ potential takes into account the effects of the chemical concentration gradient and the electrical gradient.
20. An example of a(n) _____-gated ion channel is the acetylcholine receptor.
21. The _____ family of integral proteins provides channels for rapid movement of water across plasma membranes.
23. Facilitated diffusion is also called _____ transport.
27. The transport of solutes against a concentration or electrochemical gradient that requires the input of energy is known as _____ transport.
29. Ion-selective _____ provide a route for the rapid movement of ions across membranes.
30. Simultaneous transport of two solutes across a membrane, in either the same or opposite directions.
31. A membrane protein in an intact erythrocyte that reacts with trypsin must have at least one domain exposed on the _____ face of the lipid bilayer.
32. _____; transport of a single solute across a membrane.

DOWN

1. An ion _____ is a source of potential energy that drives secondary transport processes in cells.
3. _____ interactions among lipid molecules in water drive the formation of micelles, bilayers, and liposomes.
5. The Na^+K^+ _____ is an example of a cotransporter that is critical to the function of all cells.
6. Type of diffusion that occurs down a concentration gradient.
7. Membrane component that can modulate membrane fluidity
10. The major class of membrane lipids, in terms of weight percent.
11. _____ - _____ ATPases are reversibly phosphorylated by ATP as part of the transport process.
12. _____ diffusion is mediated by an integral membrane protein that lowers the activation energy for transport; this process exhibits saturation kinetics.
14. Class of lipids containing covalently attached carbohydrates.
15. SNAREs are proteins required for membrane _____ in the process of exocytosis.
17. "Flip-flop" of lipids in membrane bilayers is also known as _____ diffusion; facilitated by flippases.
18. Describes the polar head groups of membrane lipids and peripheral membrane proteins.