

**Study Questions for lectures 4 and 5.**

1. Draw a 16 carbon unsaturated fatty acid and a phospholipid. What are the chemical properties of these molecules that make them amphipathic. Label these parts. Explain why the chemical properties of phospholipids are important in the context of cell biology. What is the force that drives the formation of biological membranes?
2. A lipid bilayer in its gel state is (below/at /above) its transition T.
3. What is meant by membrane fluidity? Why is it important? What are three determinants of a membrane's fluid properties (in an animal cell)? Discuss the role of cholesterol in animal cell membrane properties.
4. What are the components of a plasma membrane? Compare the lateral mobility of lipids and proteins in a biological membrane. Although we haven't discussed it in lecture, speculate on the types of proteins likely to be found in the following membranes: plasma membrane, nuclear, chloroplastic, and mitochondrial.
5. Name three molecules that pass through the lipid bilayer by simple diffusion. What characteristic(s) would preclude a molecule from being able to diffuse through a plasma membrane (name at least two)?
6. On a recent fishing trip to the Caribbean you came across a fish not known to you or any of your colleagues that had washed up on shore. Thrilled by the opportunity to have discovered a new species of fish you decided to look a little further into its membrane makeup. Your results are as follows:
  - Average length of fatty acid tail: 12
  - High saturated fatty acid content
  - Presence of cholesterol: yesExplain whether these results support the idea that this fish is native to the Caribbean.
7. What drives the hydrophobic effect (e.g. Why do lipid micelles form spontaneously in water)?
8. Distinguish between primary, secondary, tertiary, and quaternary protein structure, including the pertinent bonds. Describe what a protein domain is, including its possible role in protein evolution.
9. Are the following hydrophilic, hydrophobic, or amphipathic? Monosaccharides, amino acids, fatty acids, phospholipids.
10. (Catabolic / anabolic reactions) have a negative  $\Delta G$ . These reactions are generally (favorable/unfavorable) and (require /do not require) an additional coupled reaction. (Hydrolysis / condensation) has a  $+\Delta G$  which is (favorable /unfavorable). This reaction generally (requires/ does not require) an additional coupled reaction.

12. Can a protein that is formed by a single peptide chain have a quaternary structure?
13. Using your book for the structure of the “R” groups, draw an oligopeptide comprised of Gly, Cys, Trp, and Pro. Label the C-terminus, N-terminus, peptide bonds, and R groups. Would this short peptide sequence be found exposed to water? Why or why not?
14. Explain what effect enzymes have on the following:  
Activation energy, reaction rate, and  $\Delta G$ .
16. Draw the open and closed form of glucose. What type of molecule is it? What is it used for? Draw two oligopolysaccharides made from glucose, draw one with alpha 1-4 linkages and one with beta 1-4 linkages. What are these polymers called and what is their function?
17. Explain 3 (of the many hundreds) protein functions.
18. Christian Anfinsen studied protein folding in ribonuclease. He denatured or “unfolded” the protein using high concentrations of urea. How is it that urea is able to unfold proteins?
19. What common feature of alpha helices and beta sheets makes them universal building blocks for proteins?
20. Using active transport as an example, explain how an unfavorable chemical reaction can be made to occur by coupling it to a favorable chemical reaction. What is the most common favorable reaction coupled to unfavorable reactions?
21. Why do most transport proteins have several transmembrane domains and how do they contribute to protein function?
22. Simple diffusion and facilitated diffusion both move molecules from areas of \_\_\_\_\_ concentration to \_\_\_\_\_. Facilitated diffusion uses membrane \_\_\_\_\_ to move molecules across the membrane.