

## Chapter 7 – Membrane Structure and Function - 2016

1. The first cells to live on earth were prokaryotic and were not internally compartmentalized. The fact that compartmentalized eukaryotic cell based life has largely replaced prokaryotic forms of life is a testament to the superior nature of this form of cell structure.

Describe the adaptive value of this compartmentalization.

2. Is the table a hydrophobic or hydrophilic surface?

What evidence supports your contention?

Do hydrophobic surfaces attract or repel one another?

Identify two common hydrophobic substances

So what kind of intermolecular forces exist between hydrophobic molecules? (pg41)

(I will help explain in class if confusing)

3. What types of bonds exist between the hydrogen atoms and the oxygen atom in water?

So is water polar or non-polar?

What kind of intermolecular force exists between water molecules?

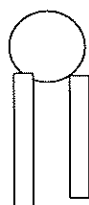
Identify the intermolecular force that exists between oppositely charged portions of two polar molecules?

4. What properties do all amphipathic molecules possess?

On pages 125 thru part of 127 is an account of the history of scientific progress as it relates to the development of the current theoretical models of cell membrane structure and function. The names of the researchers from Overton to Singer and Nicholson are not important but it is important you read this section so you can see how scientific ideas change over time. It is a clear and interesting account of the scientific process.

### Membrane Phospholipids

5. In the space provided below draw a single phospholipids molecule. Label its polar/hydrphylic portion and its non-polar/hydrophobic portion. See pg 70 for very clear description.



6. Now scale down the size of your phospholipids and draw a section of cell membrane in the space provided below. Use brackets to identify the hydrophobic and hydrophilic portions of the membrane.

7. What laboratory evidence suggests this hypothetical arrangement of phospholipids may in fact be correct? (see Figure 7.4)

8. What is the fancy word that describes this arrangement of molecules?

9. What is the primary function of this bilayer of molecules?

10. The current model suggested by Singer and Nicholson is called the Fluid Mosaic Model.

What is fluid about the membrane?

What can be found in this school that is a mosaic?

What about the membrane is mosaic?

11. What physical factor can reduce the fluidity of a membrane?

12. Would a white tailed deer or a cod living at the bottom of 300 feet of water in the North Atlantic be more subject to having the fluidity of their membrane reduced by factor #13? Explain

13. How do plants adjust the composition of their cell membranes as fall/winter approaches?  
Draw a few of these phospholipids in a bilayer in the space below.

### Membrane Steroids

14. Cholesterol, which is also a ...lipid...protein...nucleic acid...carbohydrate (circle one) may be found in the bilayer. Use red pen to add some cholesterol molecules to your bilayer above. They are kind of kinky little molecules so just draw them like this.....



**15.** Describe the function of cholesterol within the membrane if temperatures are low?

If temperatures are moderate?

What forces binds the cholesterol to phospholipids tails?

Why is it considered a “fluidity buffer”?

### **Membrane Proteins**

**16.** R.B.C.s have more than 50 different kinds of proteins embedded within their phospholipids cell membrane. Why on earth would there be so many of them?

Where are the proteins found within the membrane synthesized?

Where is the information for the synthesis of proteins found?

Would you expect your liver cells to have the same 50 proteins as your red blood cells?

Do your liver and red blood cells have the same or different genetic content?

Then how is it possible for liver cells and red blood cells to have different proteins within the membrane?

**17.** Do proteins drift about within the bilayer?

What experimental evidence exists to support that hypothesis?

**18.** If a part of a protein were found within the bilayer (where the tails are) what would be the nature of the amino acids that comprise that specific portion of the protein?

Look at pg 79....see how the various amino acids are grouped.

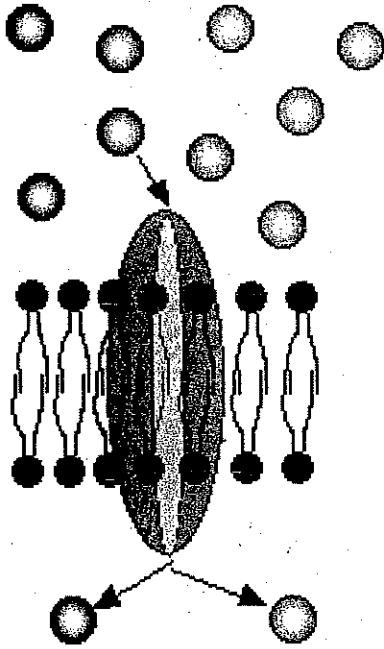
Would you expect to find the hydrophilic amino acids pictured to be found in that part of a protein attached to the surface of the bilayer?...yes...no...explain

Would you expect to find the hydrophobic amino acids pictured to be found in that part of a protein attached to the tail region of the bilayer?...yes...no...explain

**19.** So just how do proteins end up in the membrane in the first place? Is there a little man that shoves them in the proper place? Explain

It is very important for you to have a clear understanding of the functions of the various proteins that can be found within a cell membrane. With many students, putting a picture in their head first leads to descriptive words flowing out of their hands and mouths. Look at each picture below and then write a description of the function of that particular protein in the space to the right. As you describe the function indicate the evidence in the picture that supports your conclusion.

Outer Surface



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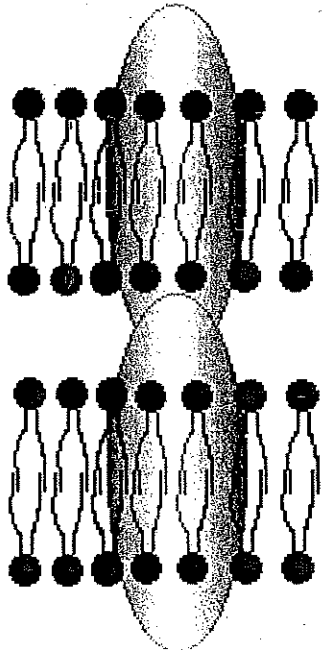
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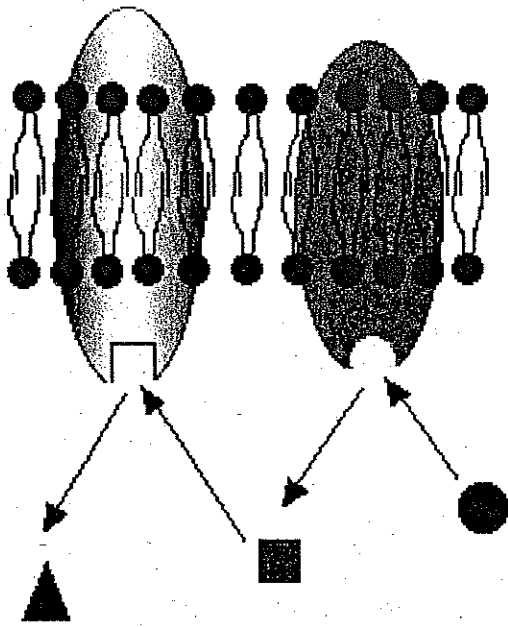
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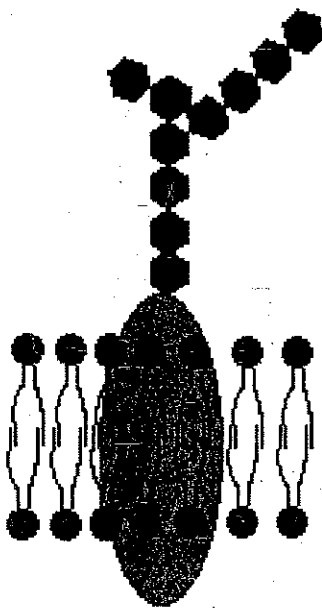
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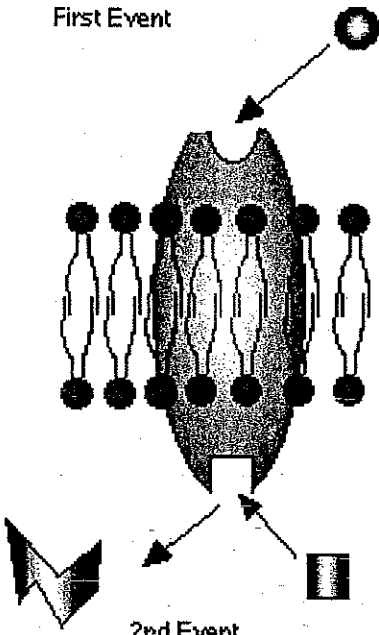


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First Event



2nd Event

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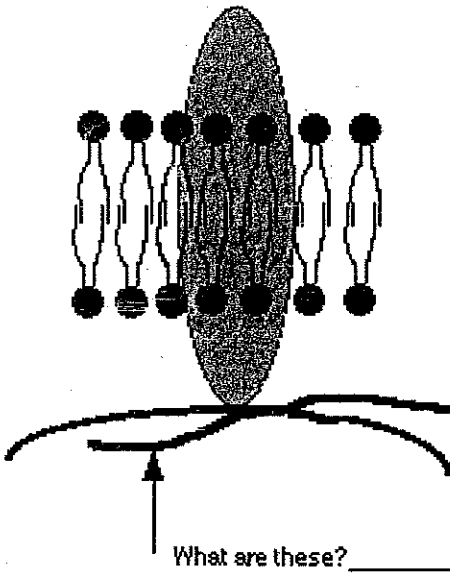
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What are these? \_\_\_\_\_

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### Membrane Carbohydrates

20. Are carbohydrates usually found on the inside or outside of the cell membrane?

Is a polysaccharide made of a few or many sugar units? Duh..because poly means?

Is an oligosaccharide made of a few or many sugar units? Duh, because oligo means?

Are the carbohydrates attached to the cell membrane poly or oligo saccharides?

What are they called if they are attached to lipids? To proteins?

Describe one general function of these hybrid molecules.

### Transport Across Membranes ....you want important! THIS IS IT! Important!!!!

21. Describe what happens as oxygen moves by passive transport across a bilayer.

22. Describe what happens as glycine (an amino acid) enters a cell by facilitated transport.

23. Describe what happens as sodium ions leave a cell by active transport.

24. Hypotonic solutions are solutions (from which) (to which) a cell (gains) (loses) water.

Hypertonic solutions are solutions (from which) (to which) a cell (gains) (loses) water.

Cells neither gain or lose water to \_\_\_\_\_ solutions.

Plant cells placed in hypertonic solutions (gain) (lose) water and become \_\_\_\_\_

Animal cells placed in hypertonic solutions (gain) (lose) water and become \_\_\_\_\_

Plant cells placed in hypotonic solutions (gain) (lose) water and become \_\_\_\_\_

Animal cells placed in hypotonic solutions (gain) (lose) water and become \_\_\_\_\_

Note: All authors have a section on specific pumps in their membrane chapters. The placement of this conceptual information leads to ineffective learning. For example, the place to relate to proton pumps is not now, out of context, but with photosynthesis where a proton pump functions to set the stage for the synthesis of ATP. This is the reason there are no questions in the worksheet that relate to specific pumps. At this point, if you have a clear understanding of the nature and differences between passive, facilitated and active transport, you are in business.

**(Review Fig. 7.19)**

**Large Scale/Bulk flow or movement of molecules and particles across membranes:**

25. What takes place during endocytosis?

26. What three forms of endocytosis are there? How are they different?

What are ligands? (protein – lipid – carbohydrate – nucleic acid) (circle one)

Are they on the inside or outside of the membrane?

Why do some FHE students and staff unknowingly suffer from hypercholesterolemia?

Is this condition genetic? Explain

27. What takes place during exocytosis?