1. Indicate whether the following statements are true or false. If a statement is false, explain why it is false.

A. Although cholesterol is a hydrophobic molecule, it has a hydrophilic head group like all other membrane lipids.

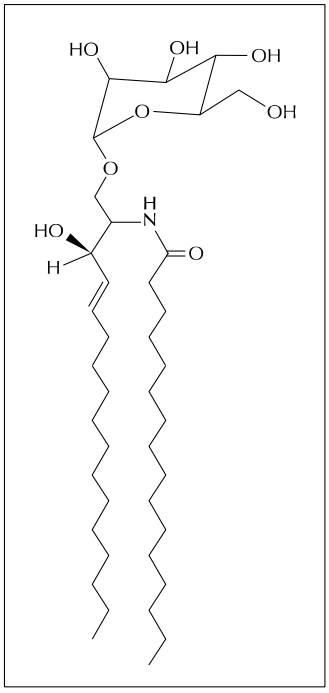
B. Phosphatidylserine is the most abundant type of phospholipid found in cell membranes.

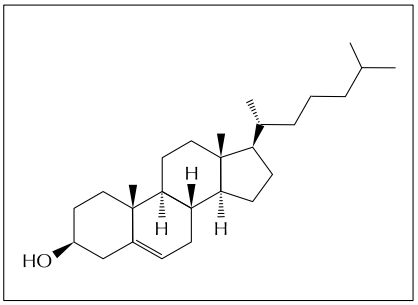
C. Glycolipids lack the glycerol component found in phospholipids.

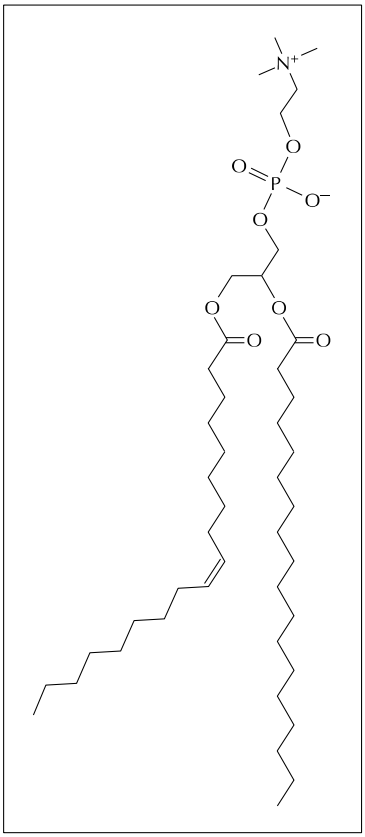
D. The highly ordered structure of the lipid bilayer makes its generation and maintenance energetically unfavorable.

2. Three different membrane components are shown in the Figure. Using the list below, identify the three components, and label the chemical groups indicated.

A. glycerol
B. sugar
C. phospholipid
D. glycolipid
E. sterol
F. unsaturated hydrocarbon
G. saturated hydrocarbon
H. sterol polar head group

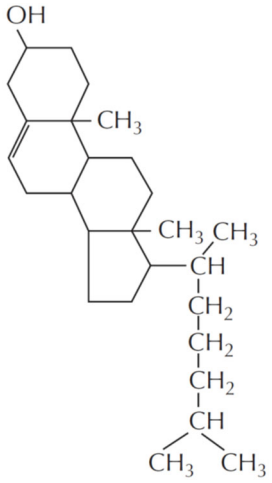






3. Although membrane proteins contribute roughly 50% of the total mass of the membrane, there are about 50 times more lipid molecules than there are protein molecules in cellular membranes. Explain this apparent discrepancy.

4. Which of the following is NOT correct regarding the molecule whose structural formula is shown below?



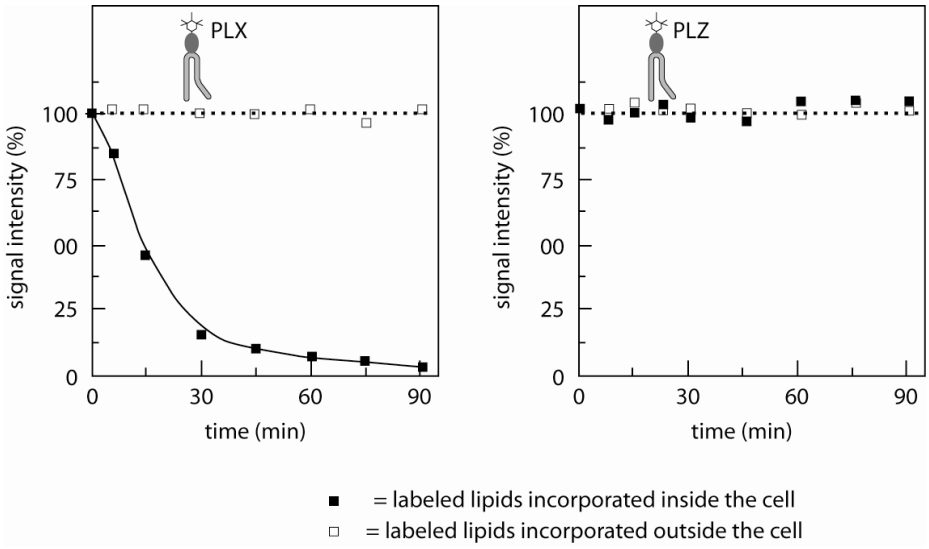
A. It is an amphiphilic molecule.
B. It is a sterol.
C. It makes the membrane less permeable to small hydrophilic molecules.
D. It is found in membranes of virtually all living cells.
E. It affects the fluidity of the lipid bilayer.

5. There are two properties of phospholipids that affect how tightly they pack together: the length of the hydrocarbon chain and the number of double bonds. The degree of packing, in turn, influences the relative mobility of these molecules in the membrane. Which of the following would yield the most highly mobile phospholipid (listed as number of carbons and number of double bonds, respectively)?

(a) 24 carbons with 1 double bond
(b) 15 carbons with 2 double bonds
(c) 20 carbons with 2 double bonds
(d) 16 carbons with no double bonds

6 For the following exercise, watch the little video on FRAP

You are interested in studying the composition of lipid bilayers and how they are maintained. You discover two uncharacterized phospholipids, which you call PLX and PLZ. You decide to characterize the behavior of PLX and PLZ by labeling the head group of each phospholipid. This label is stable when the lipid resides in the membrane's outer leaflet but unstable when the lipid resides in the membrane's inner leaflet. You incorporate labeled versions of PLX and PLZ into either the inside or the outside of the cell, and monitor the change in signal intensity of these lipids in the plasma membrane. Your data are presented in the graphs in the Figure below.

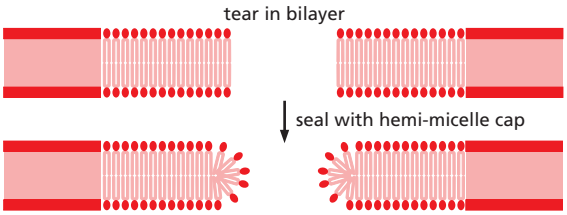


A. Where in the plasma membrane are PLX and PLZ normally located?

B. Are there flippases in the cell for either of these phospholipids? Why?

7. If a lipid raft is typically 70 nm in diameter and each lipid molecule has a diameter of 0.5 nm, about how many lipid molecules would there be in a lipid raft composed only of lipids? At a ratio of 50 lipid molecules per protein molecule, how many proteins would be in a such a raft domain? (neglect the loss of lipids to accommodate the surface of the protein)

8. When a lipid bilayer is torn, why does it not seal itself by forming a “hemi- micelle” cap at the edges, as shown in the figure below?



9: Predict the properties of a lipid bilayer in which all of the hydrocarbon chains were saturated. What would be the properties if all of the hydrocarbon chains were unsaturated?

10: Margarine is made from vegetable oil by a chemical process. Do you suppose this process converts saturated fatty acids to unsaturated ones, or vice versa? Explain your answer.

11: Many snake venoms contain enzymes that cause red blood cells to lyse. Imagine that you have purified such an enzyme. When you add the purified enzyme to red blood cells, you find that in addition to cell lysis, choline with a phosphate group attached to it is released, as well as diacylglycerol (glycerol with two fatty acid chains attached). What molecule is cleaved by the enzyme to cause cell lysis?

12: Predict which of the following organisms will have the highest percentage of unsaturated fatty acid chains in their membranes. Explain your answer.
A. Antarctic fish
B. Desert iguana
C. Human being
D. Polar bear
E. thermophilic bacterium

13: If lipid rafts form because membrane components such as sphingolipids and cholesterol molecules preferentially associate with one another, why do you think it is that they aggregate into multiple tiny rafts instead of into a single large one?

14: The lipid bilayers found in cells are luid, yet asymmetrical in the composition of the monolayers. Is this a paradox? Explain your answer.

15: Phosphatidylserine, which is normally contained to the cytoplasmic monolayer of the plasma membrane lipid bilayer, is redistributed to the outer monolayer during apoptosis. How is this redistribution accomplished?