

# CHAPTER 11

## MEMBRANE STRUCTURE

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### The Lipid Bilayer

- 11-1 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.  
**FALSE** cholesterol is amphipathic, it fits in between the phospholipids and blocks diffusion through the membrane by increasing hydrophobic interactions.
  - 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.
- 11-2 Which of the following membrane lipids does not contain a fatty acid tail?
- (a) Phosphatidylcholine
  - (b) A glycolipid
  - (c) Phosphatidylserine
  - (d) **Cholesterol**
- 11-3 Formation of a lipid bilayer might seem to be energetically unfavorable. However, this arrangement is actually favored because it allows a higher level of entropy than any other alternative. What makes bilayer formation energetically favorable?
- (a) Polar head groups form a hydrogen bonding network at the interface with water.
  - (b) **Water molecules form cage-like structures around hydrophobic molecules.**
  - (c) Hydrogen bonds form between neighboring polar head groups in the bilayer.
  - (d) Fatty acid tails are highly saturated and flexible.
- 11-4 Which of the following statements is *true*?
- (a) Phospholipids will spontaneously form liposomes in nonpolar solvents.
  - (b) In eucaryotes, all membrane-enclosed organelles are surrounded by one lipid bilayer.
  - (c) **Membrane lipids diffuse within the plane of the membrane.**
  - (d) Membrane lipids frequently flip-flop between one monolayer and the other.
- 11-5 A bacterium is suddenly expelled from a warm human intestine into the cold world outside. Which of the following adjustments might the bacterium make to maintain the same level of membrane fluidity?

- (a) Produce lipids with hydrocarbon tails that are longer and have fewer double bonds.
- (b) **Produce lipids with hydrocarbon tails that are shorter and have more double bonds.**
- (c) Decrease the amount of cholesterol in the membrane.
- (d) Decrease the amount of glycolipids in the membrane.

**11-6** Three different membrane components are shown in Figure Q11-6. 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

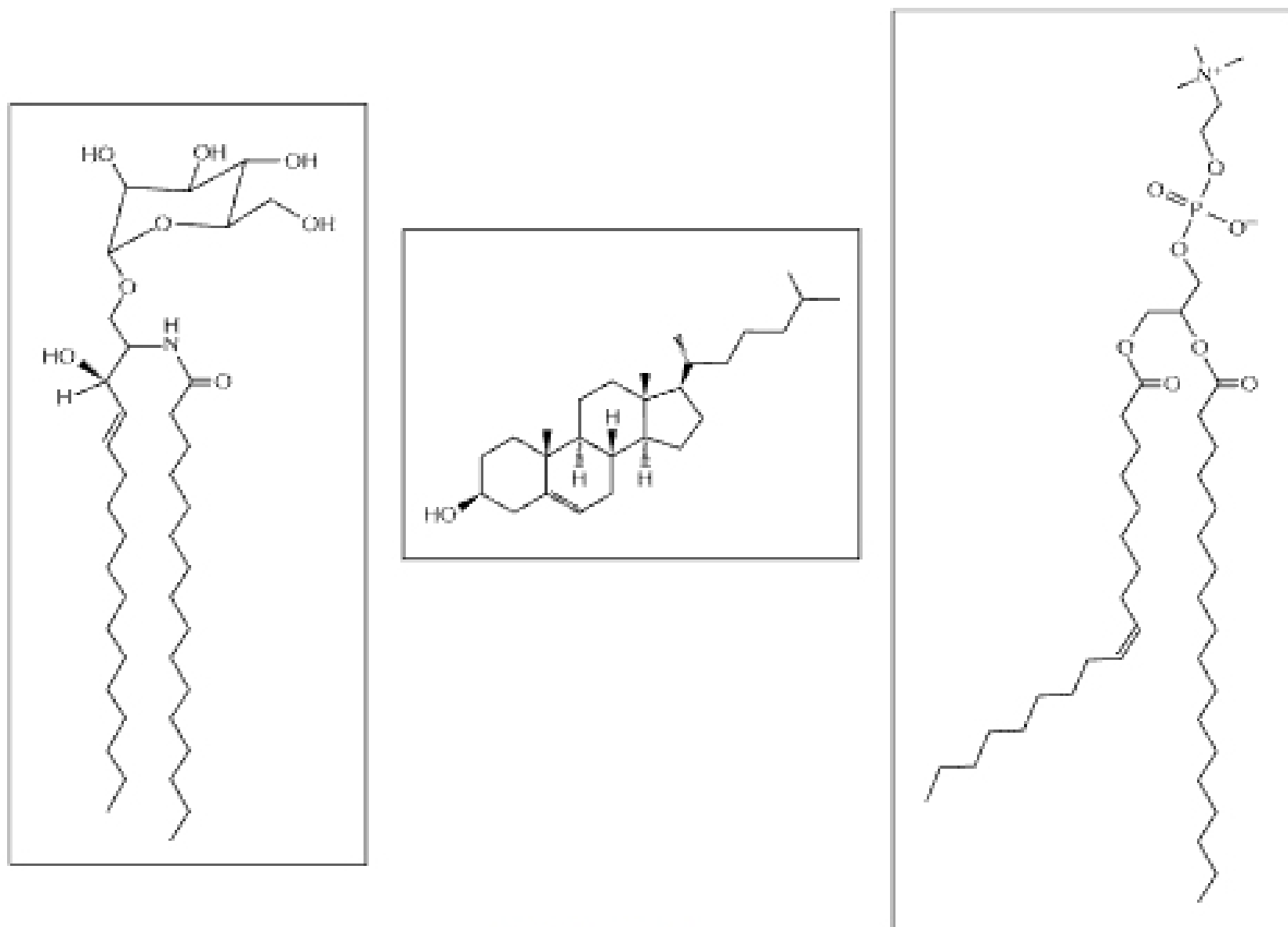


Figure Q11-6

**11-7** For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each word or phrase should be used only once.

The specialized functions of different membranes are largely determined by the \_\_\_\_\_ they contain. Membrane lipids are \_\_\_\_\_ molecules, composed of a hydrophilic portion and a hydrophobic portion. All cell membranes have the same \_\_\_\_\_ structure, with the \_\_\_\_\_ of the phospholipids facing into the interior of the membrane and the \_\_\_\_\_ on the outside. The most common lipids in most cell membranes are the \_\_\_\_\_. The head group of a glycolipid is composed of \_\_\_\_\_.

amphipathic	hydrophobic	phosphatidylserine
cholesterol	lipid bilayer	phospholipids
fatty acid tails	lipid monolayer	proteins
glycolipids	lipids	sterols
hydrophilic head groups	phosphatidylcholine	sugars

- 11-8 Three phospholipids X, Y, and Z are distributed in the plasma membrane as indicated in Figure Q11-8. For which of these phospholipids does a flippase probably exist?

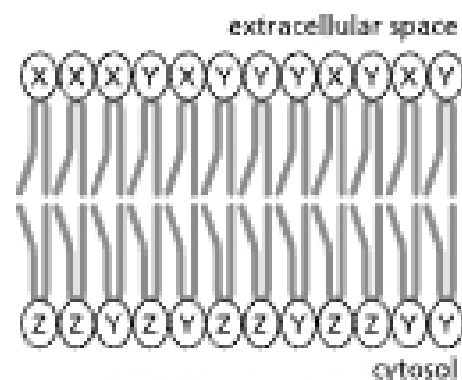


Figure Q11-8

- (a) X only  
 (b) Z only  
 (c) **X and Y**  
 (d) Y and Z
- 11-9 Where does most new membrane synthesis take place in a eucaryotic cell?  
 (a) in the Golgi apparatus  
 (b) **in the endoplasmic reticulum**  
 (c) in the plasma membrane  
 (d) in the mitochondria  
 (e) on ribosomes
- 11-10 Water molecules readily form hydrogen bonds with other polar molecules, and when they encounter nonpolar molecules they must form hydrogen-bonding networks with neighboring water molecules. Which of the following molecules will cause a “cage” of water to form?  
 (a) **2-methylpropane**