Phospholipids

Like fats, **phospholipids** (Figure 3.18) are composed of fatty acid chains attached to a glycerol molecule. Unlike a triglyceride, a phospholipid only has two fatty acid chains instead of three. The third carbon of the glycerol backbone is bound to a phosphate group (Figure 3.21). The addition of alcohol modifies the phosphate group. Because of this arrangement, a phospholipid has both hydrophobic and hydrophilic regions. The fatty acid chains are hydrophobic and exclude themselves from water, whereas the phosphate "head" is hydrophilic and interacts with water.

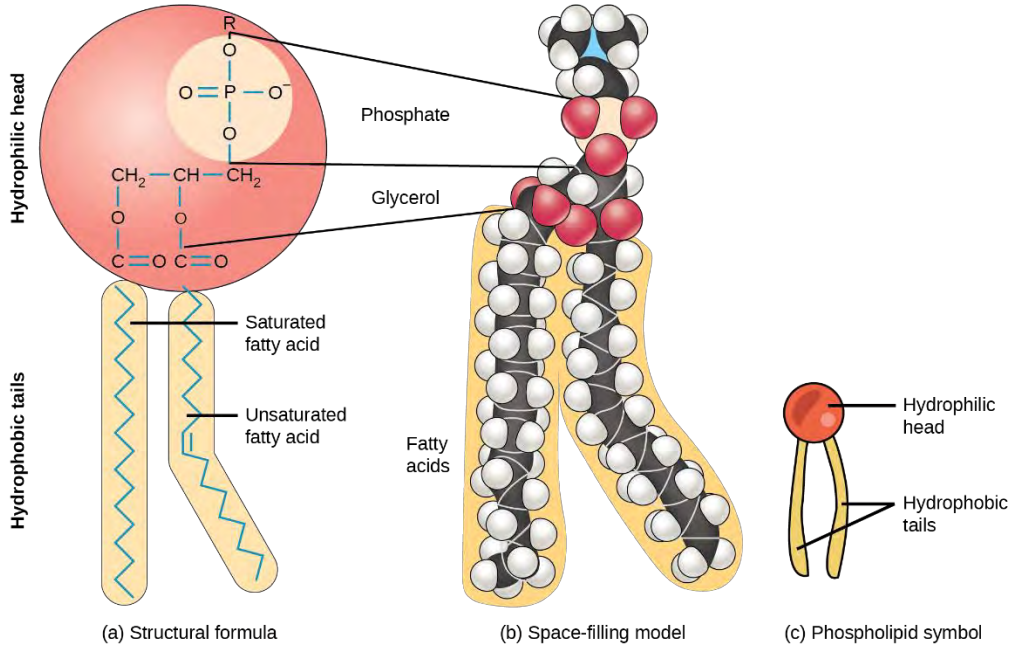


Figure 3.21 The molecular structure of a phospholipid. (Credit: Clark et al. / Biology 2E OpenStax)

Phospholipids are the major component of the plasma membrane. They come together and organize themselves in what is called a phospholipid bilayer (Figure 3.22). The phospholipid bilayer consists of two adjacent layers of phospholipids arranged tail to tail. The hydrophobic tails associate with one another, forming the interior of the cell membrane. The polar heads interact with the fluid inside and outside of the cell.

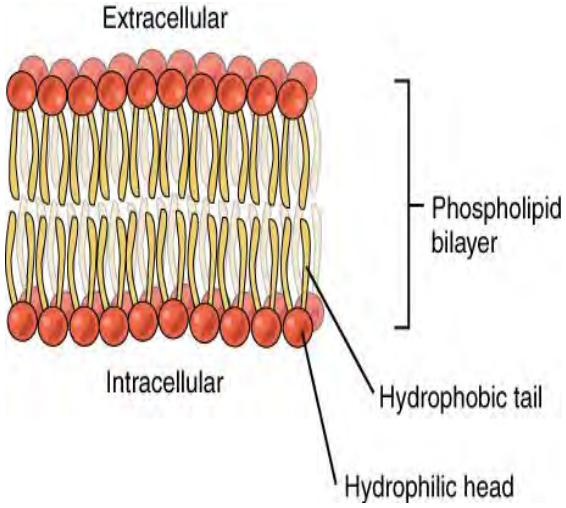


Figure 3.22 The cell membrane is composed in part of a phospholipid bilayer (credit: Betts et al./ Anatomy and Physiology OpenStax)

Steroids

Unlike the phospholipids and fats discussed earlier, **steroids** have a ring structure. Steroids do not structurally resemble other lipids; however, they are all hydrophobic. All steroids have four linked carbon rings (Figure 3.23). Some steroids, like cholesterol, have a short tail.

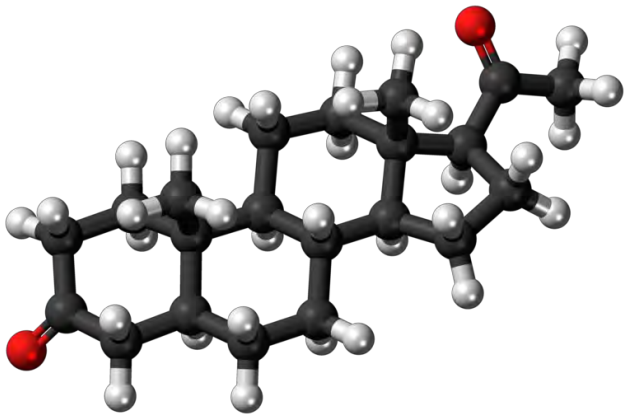
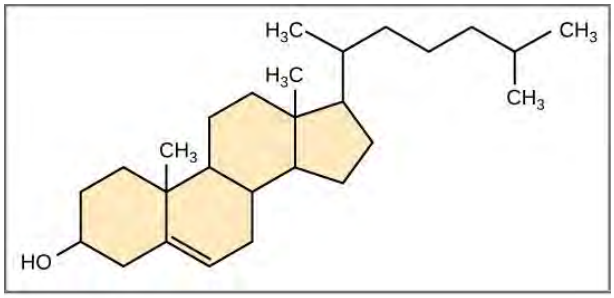


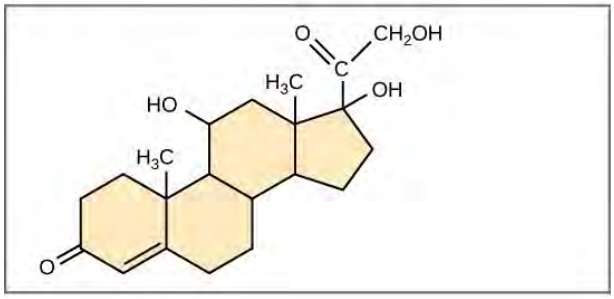
Figure 3.23 Ball-and-stick model of the 5α-Dihydroprogesterone molecule, a steroid hormone. (credit: Jynto/ Wikimedia)

Cholesterol is the most common steroid. In animals, the liver synthesizes cholesterol, which acts as the precursor for many steroid hormones, including testosterone and estradiol. Testosterone and estradiol are crucial hormones that lead to the sexual maturation and secondary sex characteristics of males and females. A **hormone** is a chemical signaling molecule, usually a protein or steroid, secreted by an endocrine gland or group of endocrine cells. It acts to control or regulate specific physiological processes. Another example of a steroid hormone is cortisol. Cortisol is released by the adrenal gland and can affect glucose regulation and inflammation (Figure 3.24).

Cholesterol is also the precursor of bile salts, which help emulsifying (breakdown) fats. Although cholesterol is often spoken of in negative terms, it is necessary for the body to function properly. It is also a key component of an animal cell's plasma membrane, which will be discussed in Chapter 4.



Cholesterol



Cortisol

Figure 3.24 Four fused hydrocarbon rings comprise steroids such as cholesterol and cortisol (credit: Clark et al. / Biology 2E OpenStax)

Waxes

Waxes are also classified as lipids. They are composed of a hydrocarbon molecule with an alcohol (–OH) group and a fatty acid chain. Examples of animal waxes include beeswax and lanolin, both of which can be used to prevent and treat dry skin. Plants also have waxes. The superficial waxy cuticle that covers leaves helps prevent plants from drying out (Figure 3.25).

Figure 3.25 Plant leaves have a superficial waxy cuticle, which often gives them their shiny appearance. (credit: Yash Deshpande / Wikimedia)

CONCEPTS IN ACTION- For an additional perspective on lipids, explore "Biomolecules: The Lipids" through this interactive animation.

Check your knowledge

Which type of lipid makes up the superficial cuticle found on plant leaves?

a. Phospholipids
b. Cholesterol
c. Steroids
d. Waxes

Answer: d