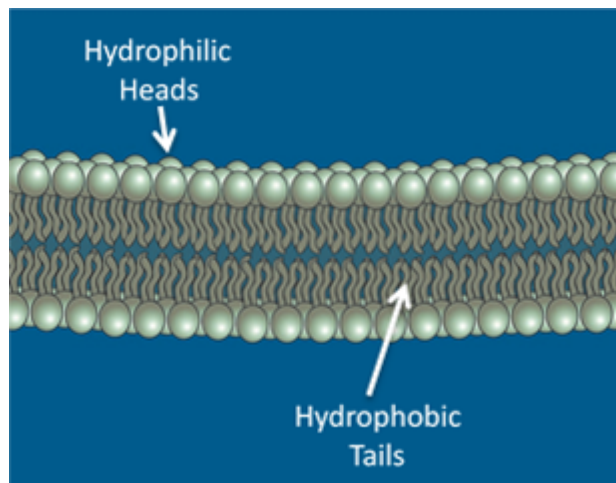


5.1.2

Membrane Phospholipids

A key component of the membrane is a double layer of phospholipids, the **phospholipid bilayer**. This bilayer forms the scaffolding into which the other components of the membrane are housed. This bilayer has a central hydrophobic region and two outer hydrophilic sections (**amphipathic**), one facing the aqueous interior of the cell and one facing the aqueous extracellular space (see figure below). Recall phospholipids are composed of a hydrophilic head containing a phosphate group and two hydrophobic tails composed of long chain fatty acids.



Phospholipid Bilayer. Image created by BYU-IU student, Hannah Crowder 2013

In water, phospholipids can form a bilayer. The hydrophobic fatty acid tails turn away from the water, and the hydrophilic phosphate heads turn towards the water.

The hydrophobic core of the membrane creates a barrier, preventing hydrophilic substances, such as ions and large polar molecules, from moving across the membrane. Hydrophobic (lipid soluble or lipophilic) materials, on the other hand, typically move readily across the membrane. Because some things easily pass through the membrane and others do not, we describe the membrane as being **selectively permeable**. Lipids within the membrane can rotate (spin) and move across each other within a leaflet, but typically cannot flip-flop unless an enzyme is present called flipase (finally a name that makes sense!). Each separate bilayer can be described as a leaflet with the terms inner and outer. The outer and inner leaflets differ in the type of phospholipids and components that they contain. Additional leaflet names are as follows:

Extracellular leaflet = Outer leaflet of plasma membrane

Cytosolic Leaflet= Inner leaflet of plasma membrane and Outer leaflet of organelles

Luminal Leaflet = Inner leaflet of organelles

In addition to the phospholipids, another important lipid found in membranes is **cholesterol**. Cholesterol is a hydrophobic molecule and resides among the fatty acid tails of the phospholipid bilayer. As mentioned above, the membrane exhibits fluidity, allowing movement of components within the membrane. Cholesterol plays an important role in regulating the fluidity of the membrane across a range of temperatures the body is exposed to. At high temperatures, cholesterol enhances the interactions between phospholipid fatty acids and prevents destabilization and melting of the membrane. At low temperatures, cholesterol prevents phospholipid tail groups from interacting too strongly with each other, a condition which would otherwise stiffen the membrane and decrease fluidity. Thus, without cholesterol the membrane might be compromised leading to impaired cellular function. Together, phospholipids and cholesterol comprise nearly 50% of the membrane.



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