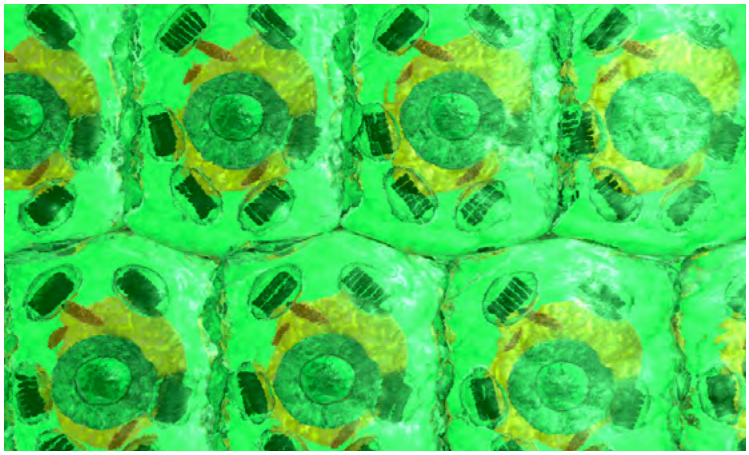
Chapter 3

The Cell



3.5 The Cell Membrane

The cell membrane, which is found in both animal and plant cells, defines a cell's boundary, separating the inside of the cell from the outside.

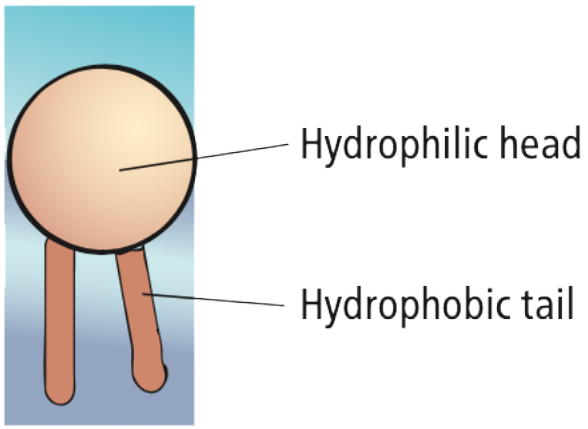
One of the cell membrane's primary functions is to serve as a gatekeeper, controlling what goes into the cell and out of the cell. To see how the cell membrane performs this function, let's look at its structure. The three primary components of the cell membrane are phospholipids, proteins, and short carbohydrates.

FIGURE 3.9
When oil and water are combined, they do not mix. Instead, there is a distinct layer of oil and a separate layer of water.

Phospholipids are molecules that are part hydrophilic and part hydrophobic. What does this mean? Have you noticed how oil and water separate after they have been combined? The oil floats on top of the water in a distinct layer, rather than mixing with it (Figure 3.9). This is because oil is *hydrophobic*, or insoluble in water. (*Hydrophobic* literally means "afraid of water.") The opposite of hydrophobic is *hydrophilic*, or soluble in water. (*Hydrophilic* literally means "loves water.")

Phospholipids have hydrophilic "heads" and hydrophobic "tails" (Figure 3.10). This determines how they orient themselves in the cell membrane. The hydrophilic heads are naturally drawn to the watery environment inside and outside the cell, whereas the hydrophobic tails naturally try to avoid this environment. The result is that the phospholipids form a double layer, or bilayer, with the hydrophobic tails pointing inward and the hydrophilic heads pointing outward (Figure 3.11). You can think of the phospholipids as making a sandwich, with the heads as two slices of bread and the tails as the peanut butter inside.

FIGURE 3.10
A phospholipid has a hydrophilic head and hydrophobic tails.



© Conceptual Biology by Jennifer Yeh

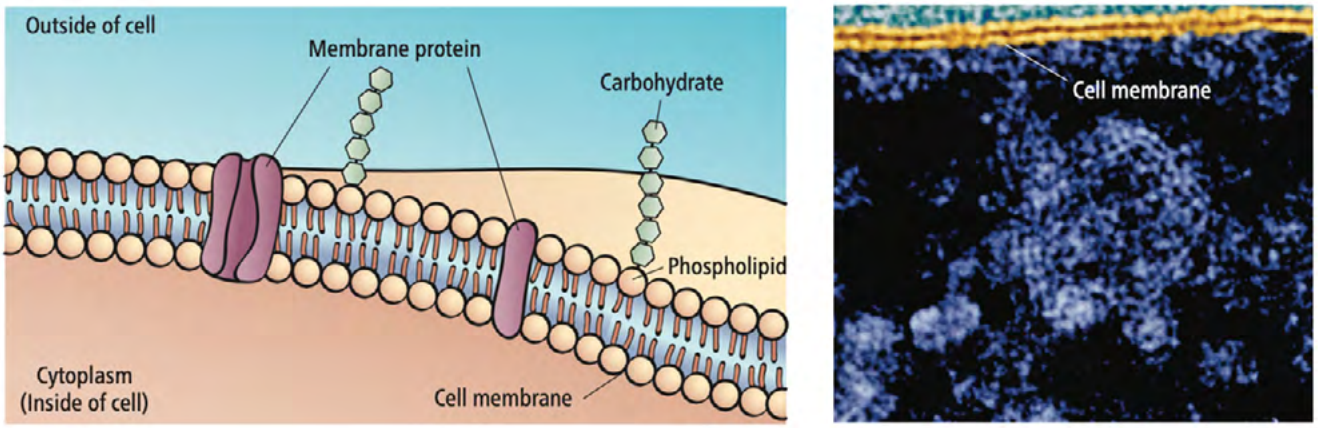


FIGURE 3.11

(a) The cell membrane includes a phospholipid bilayer, with hydrophobic tails pointed inward and hydrophilic heads pointing toward the inside and outside of the cell. Proteins are embedded in the membrane, and short carbohydrates are attached to the outside of the membrane. (b) This photograph of a cell membrane shows the double layer of phospholipids. The hydrophilic heads are shown in yellow and the hydrophobic tails are shown in red.

The cell membrane also includes a large number of *membrane proteins* embedded like straws through the phospholipid sandwich. Membrane proteins serve a variety of functions: They help cells communicate with other cells, control transport into and out of cells, and join cells to one another. Because different cells have different functions, membrane proteins also differ from one cell type to another.

Short carbohydrates are attached to the membrane proteins and phospholipids on the outside surface of the cell. These carbohydrates play an important role in cell recognition, the ability to distinguish one type of cell from another. For example, certain immune-system cells use these short carbohydrates to identify foreign cells, such as disease-causing bacteria.

Because the cell membrane includes a mosaic of phospholipids and proteins, and because the phospholipids and many membrane proteins slide freely around the cell surface, the cell membrane is often described as *fluid mosaic*. The fluidity of the cell membrane is essential to its ability to control the movement of materials into and out of the cell.

READING CHECK

What role do phospholipids play in the structure of a cell?

CHECK YOUR ANSWER

The phospholipids are molecules that are hydrophilic on one end and hydrophobic on the other. Within a solution of water, they'll naturally organize themselves into a bilayer where the hydrophilic regions face outward into the water while the hydrophobic regions are sandwiched inside. This bilayer creates the basic structure of the cell's membrane.

© Conceptual Biology by Jennifer Yeh

You can read more about the cell membrane at this website:

https://www.genome.gov/genetics-glossary/Cell-Membrane

© Conceptual Biology by Jennifer Yeh