5.2B: Selective Permeability

The hydrophobic and hydrophilic regions of plasma membranes aid the diffusion of some molecules and hinder the diffusion of others.

Learning Objectives

• Describe how membrane permeability, concentration gradient, and molecular properties affect biological diffusion rates.

Key Points

• The interior and exterior surfaces of the plasma membrane are not identical, which adds to the selective permeability of the membrane.
• Fat soluble substances are able to pass easily to the hydrophobic interior of the plasma membrane and diffuse into the cell.
• Polar molecules and charged molecules do not diffuse easily through the lipid core of the plasma membrane and must be transported across by proteins, sugars, or amino acids.

Key Terms

• polar: a separation of electric charge leading to a molecule or its chemical groups having an electric dipole
• amphiphilic: Having one surface consisting of hydrophilic amino acids and the opposite surface consisting of hydrophobic (or lipophilic) ones.
Selective Permeability

Plasma membranes are asymmetric: the interior of the membrane is not identical to the exterior of the membrane. In fact, there is a considerable difference between the array of phospholipids and proteins between the two leaflets that form a membrane. On the interior of the membrane, some proteins serve to anchor the membrane to fibers of the cytoskeleton. There are peripheral proteins on the exterior of the membrane that bind elements of the extracellular matrix. Carbohydrates, attached to lipids or proteins, are also found on the exterior surface of the plasma membrane. These carbohydrate complexes help the cell bind substances that the cell needs in the extracellular fluid. This adds considerably to the selective nature of plasma membranes.

![Image of plasma membrane](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/5%3A_Str...)

Figure 1: **Asymmetry in Plasma Membranes**: The exterior surface of the plasma membrane is not identical to the interior surface of the same membrane.

Recall that plasma membranes are amphiphilic; that is, they have hydrophilic and hydrophobic regions. This characteristic helps the movement of some materials through the membrane and hinders the movement of others. Lipid-soluble material with a low molecular weight can easily slip through the hydrophobic lipid core of the membrane. Substances such as the fat-soluble vitamins A, D, E, and K readily pass through the plasma membranes in the digestive tract and other tissues. Fat-soluble drugs and hormones also gain easy entry into cells and are readily transported into the body’s tissues and organs. Molecules of oxygen and carbon dioxide have no charge and so pass through membranes by simple diffusion.

Polar substances present problems for the membrane. While some polar molecules connect easily with the outside of a cell, they cannot readily pass through the lipid core of the plasma membrane. Additionally, while small ions could easily slip through the spaces in the mosaic of the membrane, their charge prevents them from doing so. Ions such as sodium, potassium, calcium, and chloride must have special means of penetrating plasma membranes. Simple sugars and amino acids also need help with transport across plasma membranes, achieved by various transmembrane proteins (channels).

Media, iframe, embed and object tags are not supported inside of a PDF.

Diffusion across a semipermeable membrane: This interactive shows that smaller molecules have an easier time making it across a semipermeable membrane. Adjust the pore size so the larger molecules can make it through!