



Summary

Biological membranes define cellular boundaries, divide cells into discrete compartments, organize complex reaction sequences, and act in signal reception and energy transformations. They are composed of lipids and proteins in varying combinations particular to each species, cell type, and organelle. They consist of a continuous double layer of lipid molecules in which various membrane proteins are embedded. This lipid bilayer is fluid, with individual lipid molecules able to diffuse rapidly within their own monolayer. The fluid mosaic model describes features common to all biological membranes. The lipid bilayer is the basic structural unit. Fatty acyl chains of phospholipids and the steroid nucleus of sterols are oriented toward the interior of the bilayer; their hydrophobic interactions stabilize the bilayer but give it flexibility. Peripheral proteins are loosely associated with the membrane through electrostatic interactions and hydrogen bonds or by covalently attached lipid anchors. Integral proteins associate firmly with membranes by hydrophobic interactions between the lipid bilayer and their nonpolar amino acid side chains, which are oriented toward the outside of the protein molecule.

The lipids and proteins of membranes are inserted into the bilayer with specific sidedness; thus membranes are structurally and functionally asymmetric. Many membrane proteins contain covalently attached oligosaccharides. Plasma membrane glycoproteins are always oriented with the carbohydrate-bearing domain on the extracellular surface.

Among their roles, membranes are essential to: maintaining the integrity of the cell and the various membrane-bound organelles within the cell, regulating the transport of materials into and out of the cell, responding to external and internal stimuli, and cell-to-cell recognition.