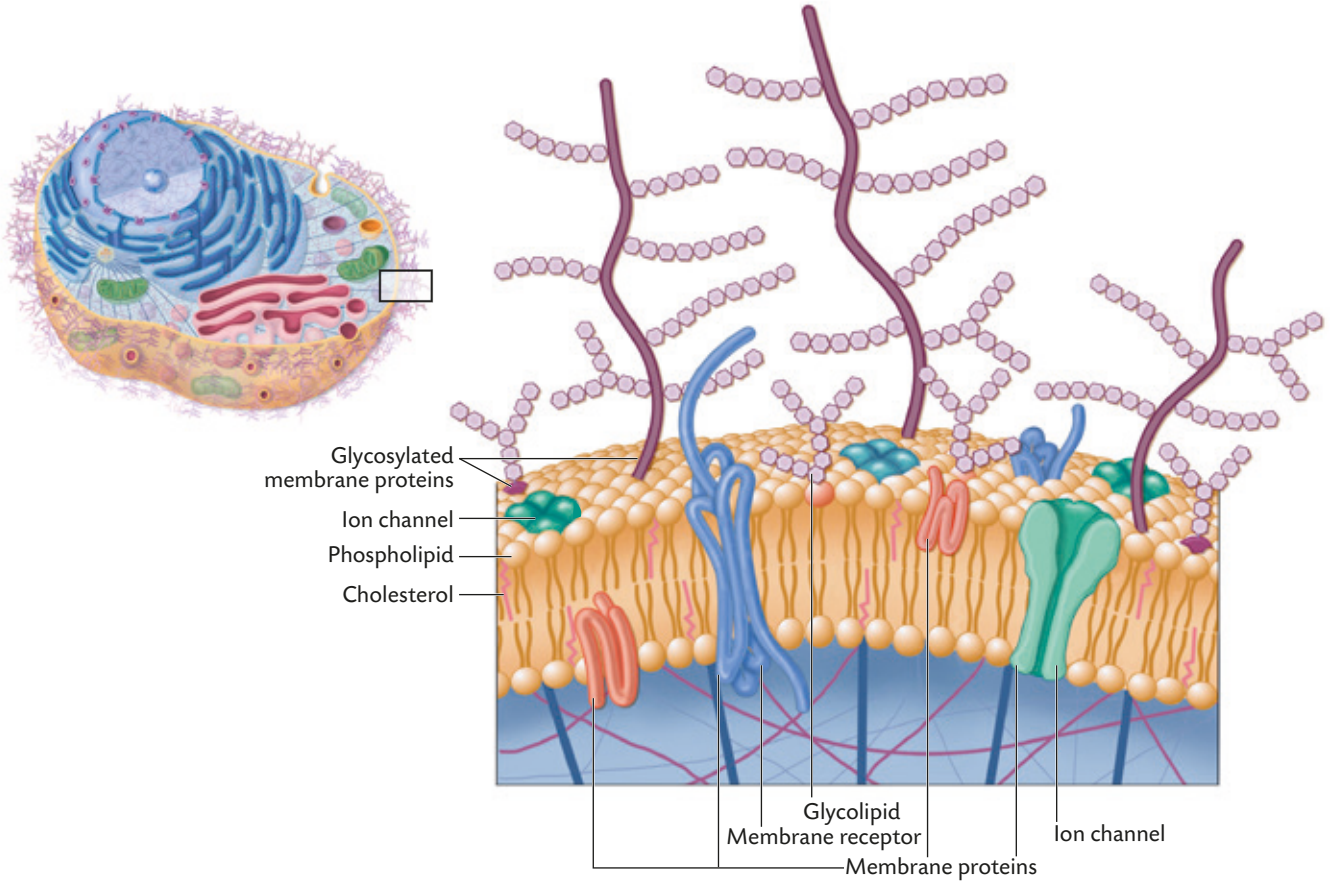


***Figure 2.2*** Structure of the cell membrane. The membrane consists of lipids and proteins. In the lipid part, phospholipids form a double layer (lipid bilayer), with cholesterol molecules in between the phospholipid molecules. The polar (hydrophilic) phosphate heads of the phospholipids face the intra- and extracellular aqueous solutions, and the nonpolar fatty acid tails form the hydrophobic middle stratum of the membrane. The membrane proteins are either transmembrane proteins that traverse the membrane one or several times, or they are confined to one side of the membrane. On the outside of the membrane, carbohydrate molecules are bound to many of the protein molecules (glycosylated proteins) and lipid molecules (glycolipids), thus enveloping the cell with a hydrophilic carbohydrate coat.

ed by anchoring to the cytoskeleton (p. 52). On the extracellular side, carbohydrate molecules are bound to many of the membrane proteins (glycosylated proteins) and lipid molecules (glycolipids). The cells are thus enveloped in a hydrophilic carbohydrate mantle, the *glycocalyx*, which provides mechanical and chemical protection.

The membrane proteins include structural proteins, transport proteins (ion channels and carrier proteins), enzymes, and receptors. The ion channels consist of transmembrane proteins that form channels spanning the membrane. Ions dissolved in water are surrounded by a jacket of water molecules (p. 16), and therefore cannot dissolve in, or diffuse through, the hydrophobic stratum of the membrane. However, open ion channels function as diffusion tunnels between the aqueous phases on either side of the cell membrane. The ion channels represent only a small proportion of the membrane surface, but millions of ions may pass through each open ion channel per second. The electrical resistance across the membrane is an expression of how easily ions can traverse the membrane, and the membrane resistance is approximately 100 000 000 times greater than for a cytosolic layer of the same thickness. Thus, despite the presence of ion channels, the membrane forms a very effective barrier against ions.

Small polar molecules that are not ionized can, to some extent, diffuse through the membrane between the phospholipid molecules. Among such molecules, water molecules (18 Da)

Membrane proteins include structural proteins, ion channels, carrier proteins, enzymes, and receptors