Biological membranes are heterogeneous lipid bilayers with proteins.
Different types of mb proteins require different conditions for mb release.
Integral membrane proteins directionally insert in the membrane bilayer

Outside cell

Inside cell
Glycophorin and bacteriorhodopsin are integral proteins that span (cross) the bilayer = transmembrane proteins.

transmembrane helices
Transmembrane helices are predicted by hydrophobic stretches of 20-25 aa residues.
Transmembrane helices are predicted by hydrophobic stretches of 20-25 aa residues
Transmembrane regions are usually α-helices or continuous β-sheets (β-barrels)

Bacteriorhodopsin: a light-driven proton pump

Porin: a pore-forming protein
A protein’s surface polarity corresponds to its environment

Tyr and Trp exhibit ‘snorkeling’ – pointing their polar group toward mb exterior

Also, often ‘positive inside’ – positively charged aa’s facing cytoplasmic region
In integral transport proteins, interiors are hydrophilic and exteriors are hydrophobic.
Some integral membrane proteins contain covalently-linked lipids

= Lipid-linked proteins (lipoproteins)
Some lipid-linked proteins are fatty-acylated

- Myristic acid (14:0) is attached to N-terminal α-amino group of Gly (via an amide linkage)
  - Permanent modification
  - Myristoylated proteins are found in many subcellular compartments
- Palmitic acid (16:0) is attached to a specific Cys (via a thioester linkage)
  - Reversible modification; may be removed by a palmitoyl thioesterase
  - Palmitoylated proteins are found on the cytoplasmic face of the plasma membrane
Some lipid-linked proteins are “prenylated”

- Farnesyl residue
- Geranylgeranyl residue

Isoprene units are linked to a C-terminal Cys

C-terminal C-X-X-Y motif determines which type of lipid will be attached
Some lipid-linked proteins have GPI anchors

GPI-linked proteins are found on the exterior surface of the plasma membrane

**Glycosylphosphatidylinositol anchor**
Lipid-linked proteins cluster in or outside of rafts based on their linked lipid.
Peripheral membrane proteins bind to the surface of the membrane

Common interaction: ion pairs

Phosphatidylcholine

Figure 10-14 part 1
Lehninger Principles of Biochemistry, Fifth Edition
© 2008 W.H. Freeman and Company
Solutes move across a permeable mb to equalize concentration and charge.

Before equilibrium
Net flux

Before equilibrium
No net flux

$V_m > 0$

$V_m = 0$

At equilibrium

At equilibrium
Transporters catalyze passage through the membrane

**Channels:**
- Transport near rate of free diffusion
- Less stereospecific

**Carriers:**
- Transport slower than free diffusion
- Stereospecific

**Simple diffusion** (nonpolar compounds only, down concentration gradient)

**Facilitated diffusion** (down electrochemical gradient)

**Primary active transport** (against electrochemical gradient)

**Secondary active transport** (against electrochemical gradient, driven by ion moving down its gradient)

**Ion channel** (down electrochemical gradient; may be gated by a ligand or ion)
Glucose enters the cell via passive transport (through a uniporter)
Lactose enters *E. coli* cells via secondary active transport (through a symporter)