

What You Must Know:

- Why membranes are selectively permeable.
- The role of phospholipids, proteins, and carbohydrates in membranes.
- How water will move if a cell is placed in an isotonic, hypertonic, or hypotonic solution and be able to predict the effect of different environments on the organism.
- How electrochemical gradients and proton gradients are formed and function in cells.



Early membrane model

- (1935) Davson/Danielli –
 Sandwich model
- phospholipid bilayer between 2 protein layers
- <u>Problems</u>: varying chemical composition of membrane, hydrophobic protein parts



Copyright © Pearson Education, Inc., publishing a

The freeze-fracture method: revealed the structure of membrane's interior







Phospholipids

• <u>Amphipathic</u> = • hydrophilic head, • hydrophobic tail

Bilayer

 Hydrophobic barrier: keeps hydrophilic molecules out



Membrane fluidity

- Low temps: phospholipids w/ unsaturated tails (kinks prevent close packing)
- **Cholesterol** resists changes by:
 - limit fluidity at high temps
 - hinder close packing at low temps

(a) Unsaturated versus saturated hydrocarbon tails.



Unsaturated tails prevent packing.





Saturated tails pack together.

(b) Cholesterol reduces membrane fluidity at moderate temperatures, but at low temperatures hinders solidification.

 Adaptations: bacteria in hot springs (unusual lipids); winter wheat (
 unsaturated phospholipids)

Membrane Proteins

Integral Proteins

- Embedded in membrane
- Determined by freeze fracture
- Transmembrane with hydrophilic heads/tails and hydrophobic middles

Peripheral Proteins

- Extracellular or cytoplasmic sides of membrane
- NOT embedded
- Held in place by the cytoskeleton or ECM
- Provides stronger framework



Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

Integral & Peripheral proteins

Transmembrane protein structure



Some functions of membrane proteins



(a) Transport



(b) Enzymatic activity









(f) Attachment to the cytoskeleton and extracellular matrix (ECM)

Carbohydrates

- <u>Function</u>: cell-cell recognition; developing organisms
- Glycolipids, glycoproteins
- Eg. blood transfusions are type-specific



Synthesis and sidedness of membranes



© 2016 Pearson Education, Inc.

Selective Permeability

- Small nonpolar molecules cross easily: hydrocarbons, hydrophobic molecules, CO₂, O₂, N₂
- Polar uncharged molecules, including H2O pass in small amounts
- Hydrophobic core *prevents* passage of <u>ions</u>, <u>large polar molecules</u> – movement through embedded channel and transport proteins