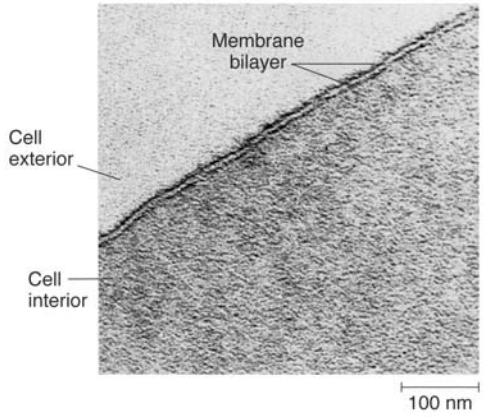
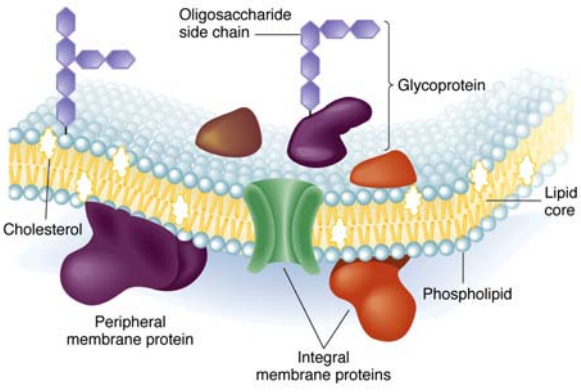
Chapter 4: Membranes

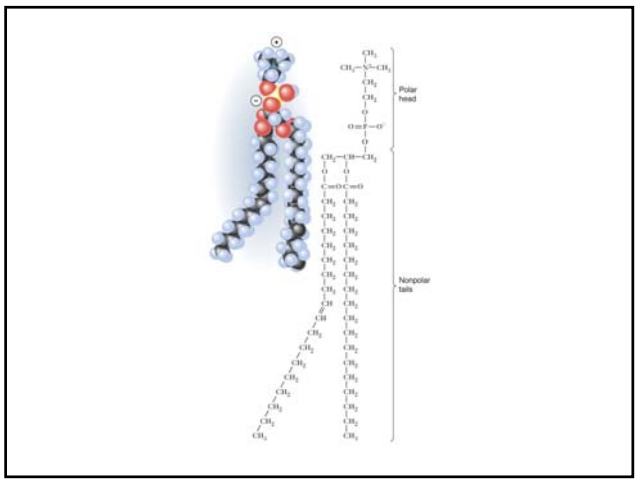
- Interesting facts: a Chimp brain- membrane of all cells. 100,000 m2, 3- soccer fields
- Membrane-plasma membrane enclose cytoplasm. Very thin- good, ex: gasoline on surface of water, but carries out essential regulation of the cell.

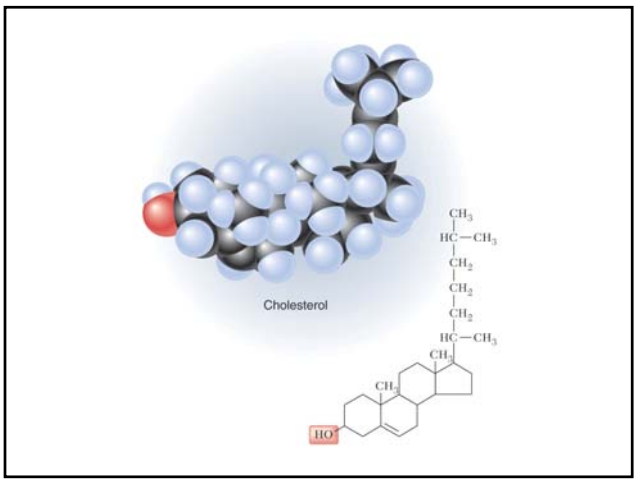


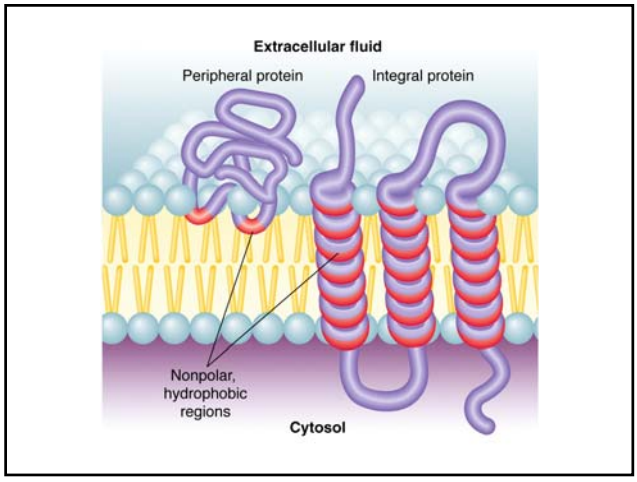
Membrane composition

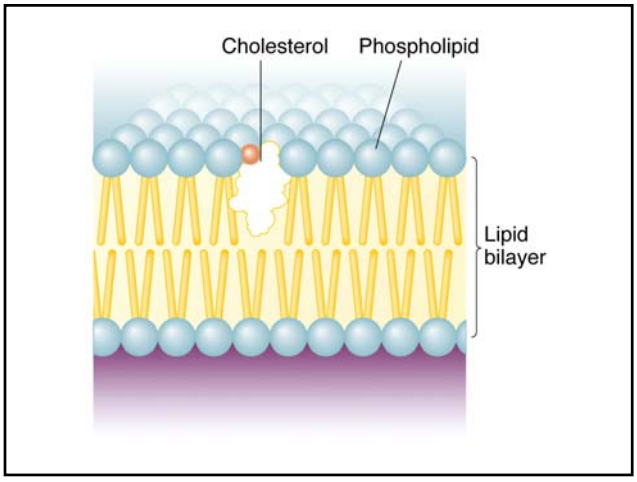
-lipid bilayer: impermeable to passage of most water-soluble molecules




Polar head
Nonpolar tails


Cholesterol
HO


Extracellular fluid
Peripheral protein
Integral protein
Nonpolar, hydrophobic regions
Cytosol


Cholesterol
Phospholipid
Lipid bilayer

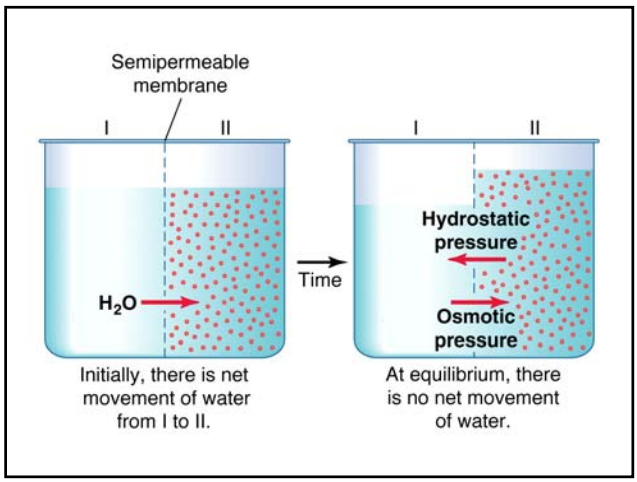
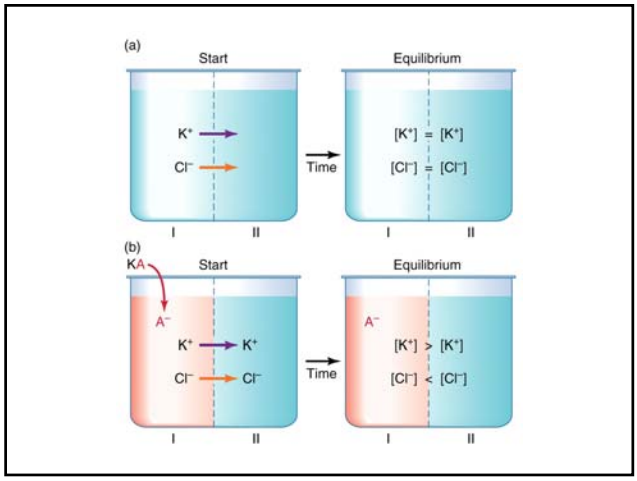


Table 4-1 Osmotic pressure of sucrose solutions of various concentrations*

Sucrose (%)	Osmotic pressure (atm)	Ratio of osmotic pressure to percentage of sucrose
1	0.70	0.70
2	1.34	0.67
4	2.74	0.68
6	4.10	0.68

* Results were obtained by Pfeffer (1877) in experimental measurements.



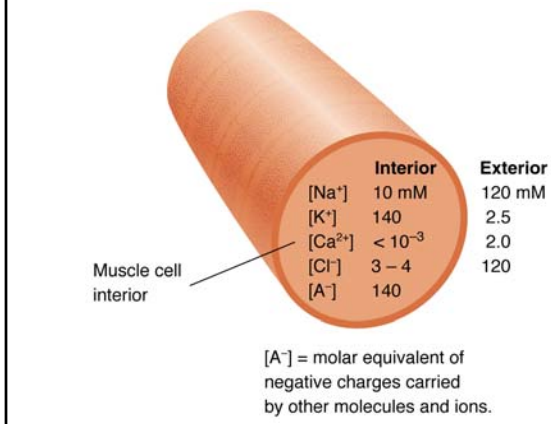
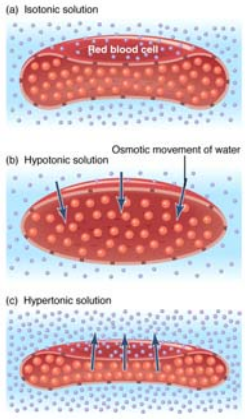
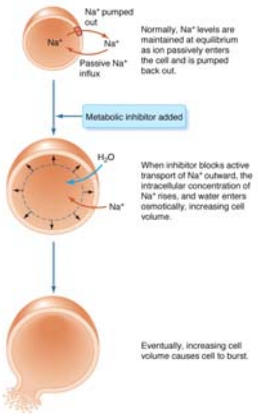
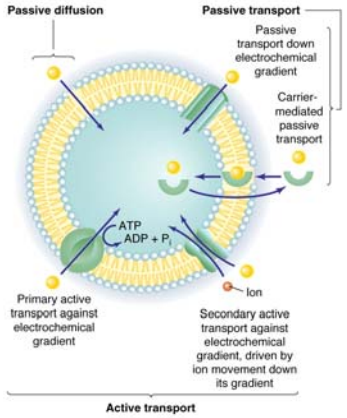


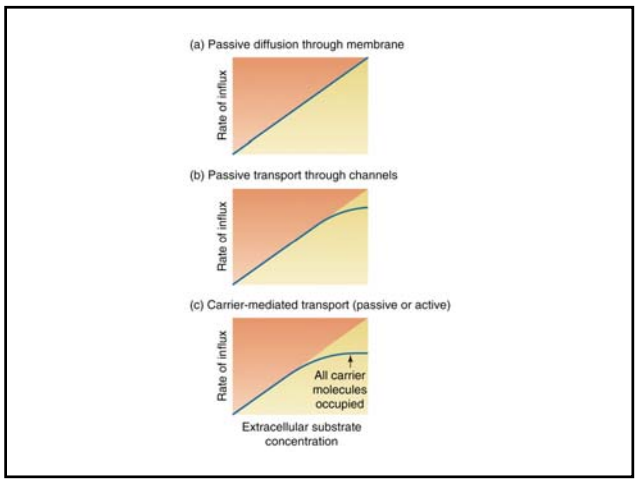
Table 4–2 Internal and external concentrations of some electrolytes in specific nerve and muscle tissues

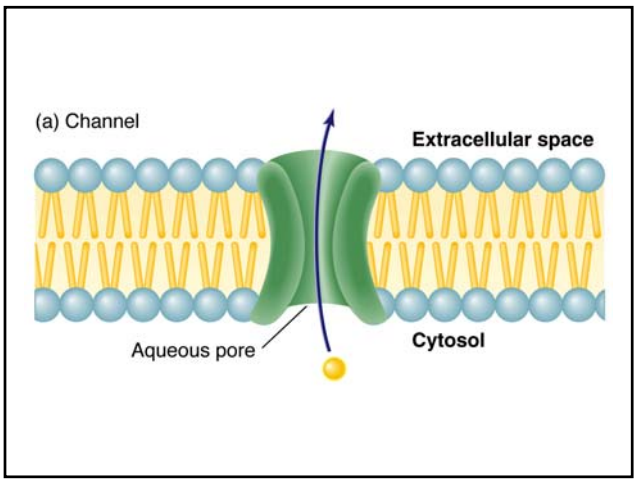
Tissue	Internal concentrations (mM)			External concentrations (mM)			Ratios, inside/outside		
	Na^+	K^+	Cl^-	Na^+	K^+	Cl^-	Na^+	K^+	Cl^-
Squid nerve	49	410	40–100	440	22	560	1/9	19/1	1/14–1/6
Crab leg nerve	52	410	26	510	12	540	1/10	34/1	1/21
Frog sartorius muscle	10	140	4	120	2.5	120	1/12	56/1	1/30

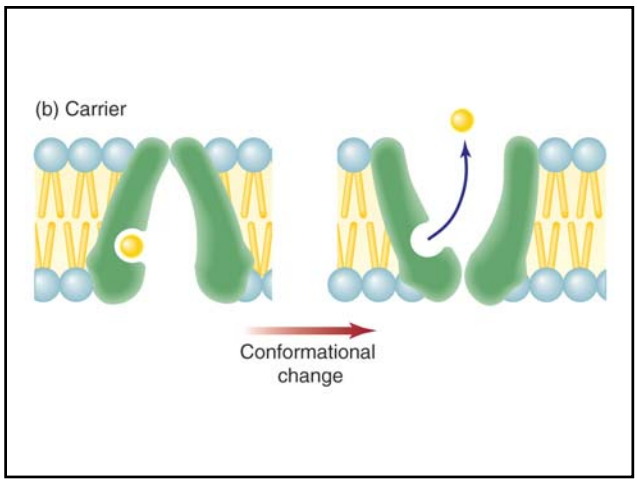


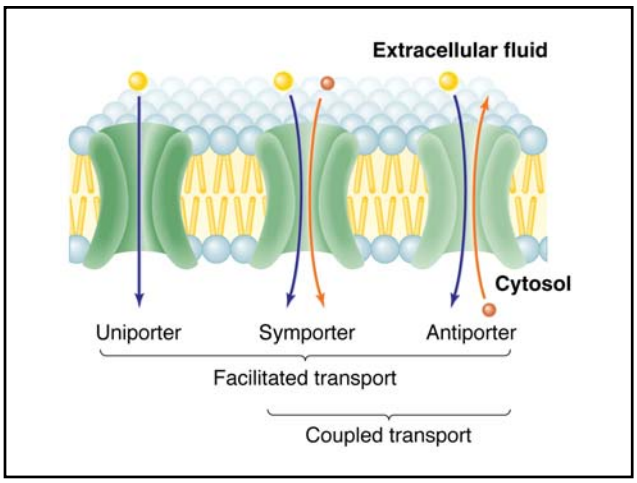


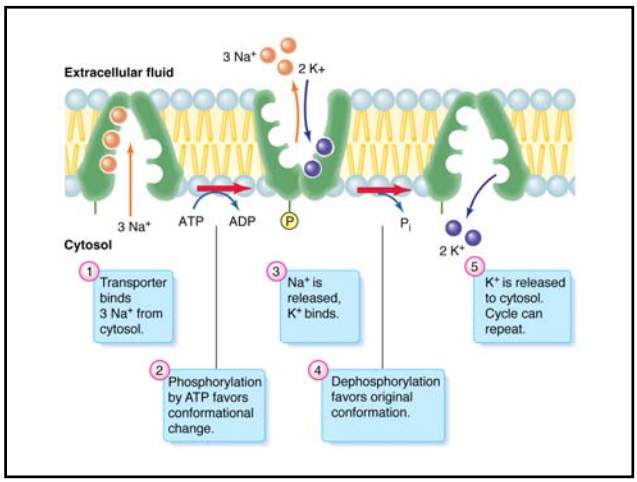


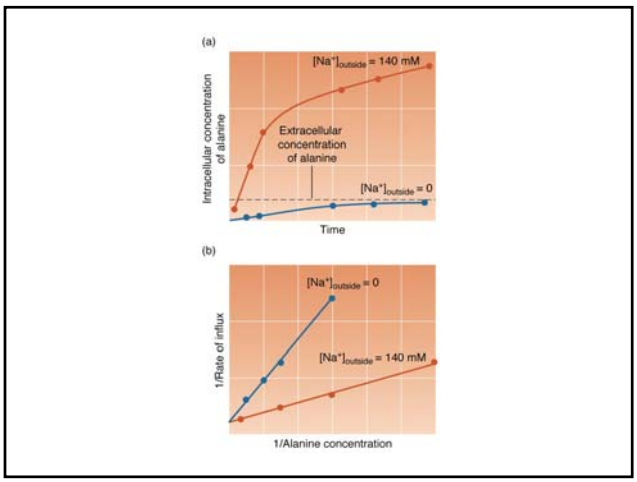

(a) Passive diffusion through membrane
Rate of influx
(b) Passive transport through channels
Rate of influx
(c) Carrier-mediated transport (passive or active)
Rate of influx
All carrier molecules occupied
Extracellular substrate concentration

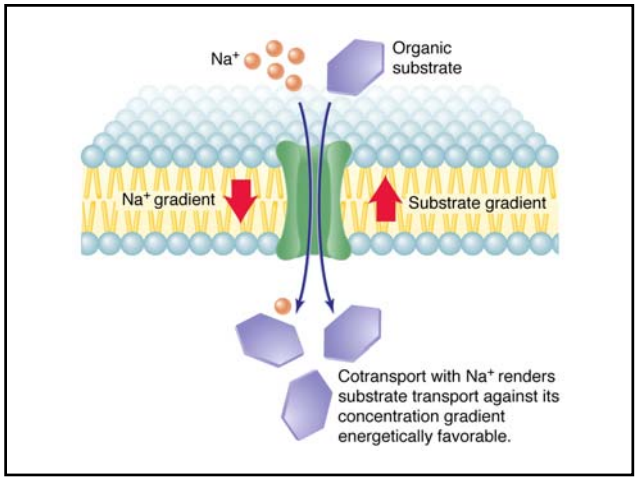

(a) Channel
Extracellular space
Aqueous pore
Cytosol


(b) Carrier
Conformational change


Extracellular fluid
Cytosol
Uniporter
Symporter
Antiporter
Facilitated transport
Coupled transport







http://en.wikipedia.org/wiki/Oral_rehydration_therapy

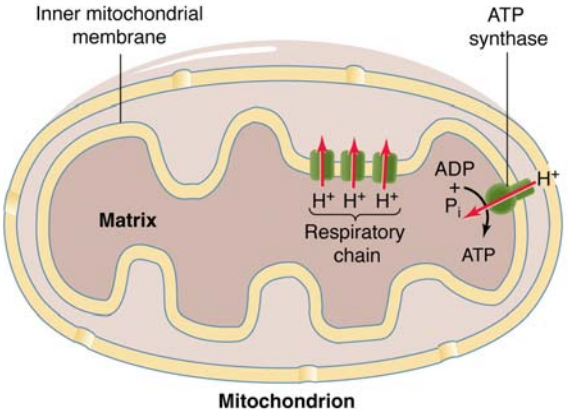
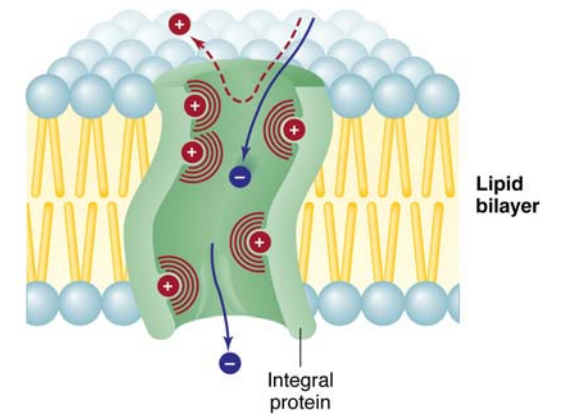
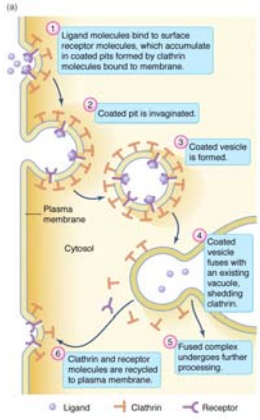
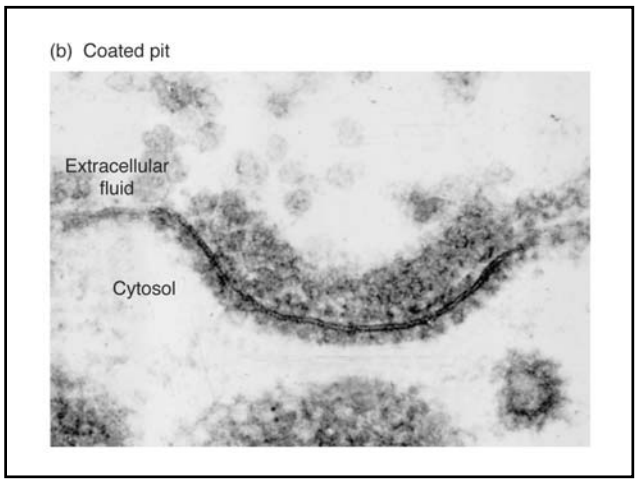


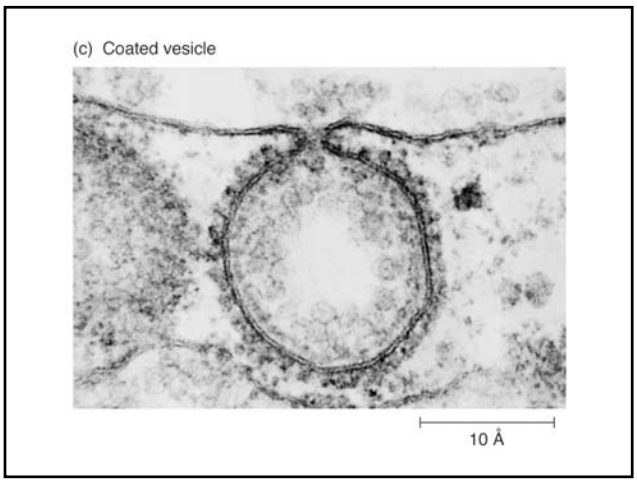
Table 4-3 Ionic radii and hydration energies of the alkali metal cations

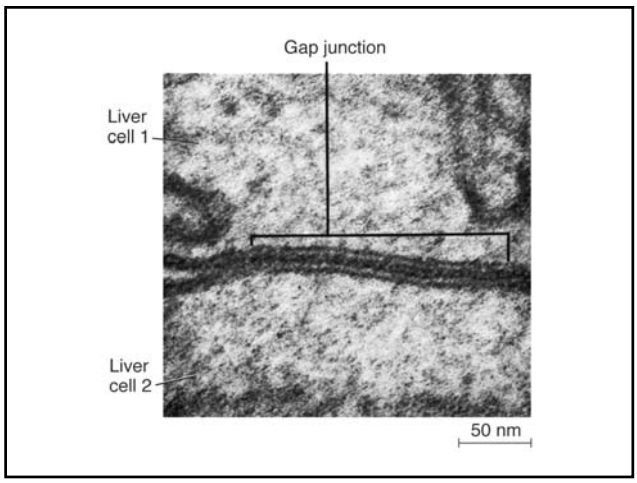
Cation	Ionic radius (Å)	Free energy of hydration (kcal · mol^{-1})
Li^+	0.60	2122
Na^+	0.95	298
K^+	1.33	280
Rb^+	1.48	275
Cs^+	1.69	267

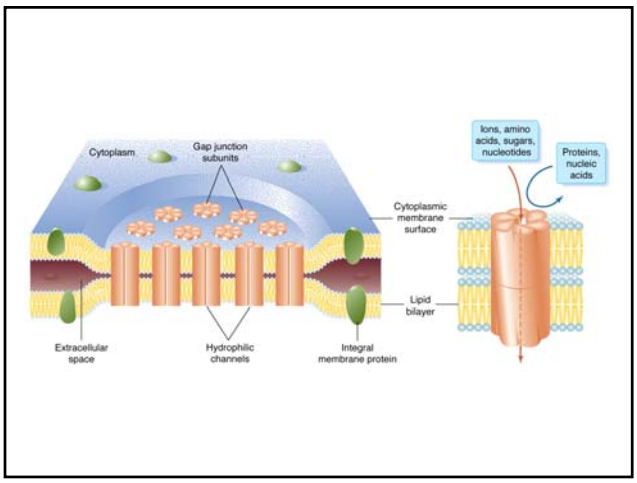


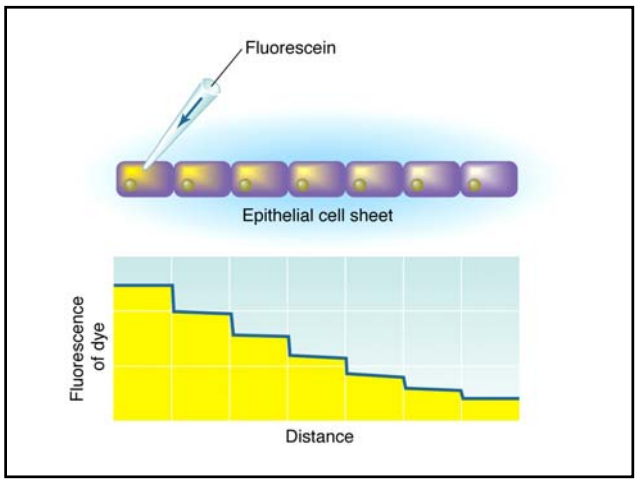


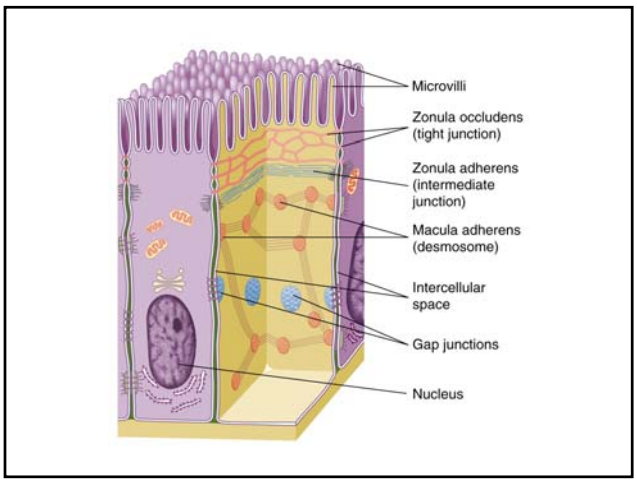

(b) Coated pit
Extracellular fluid
Cytosol

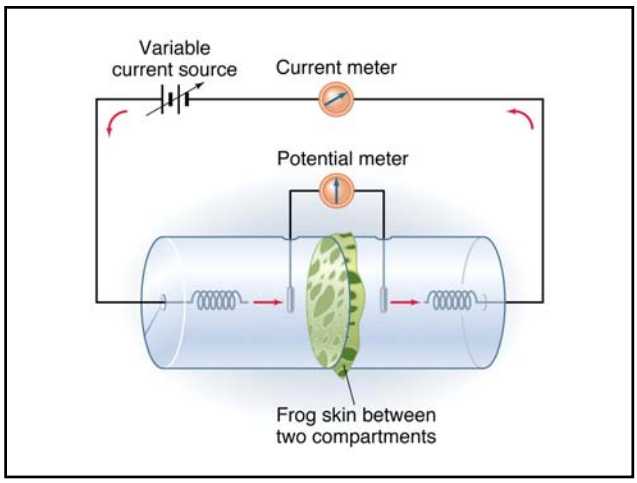

(c) Coated vesicle
10 Å

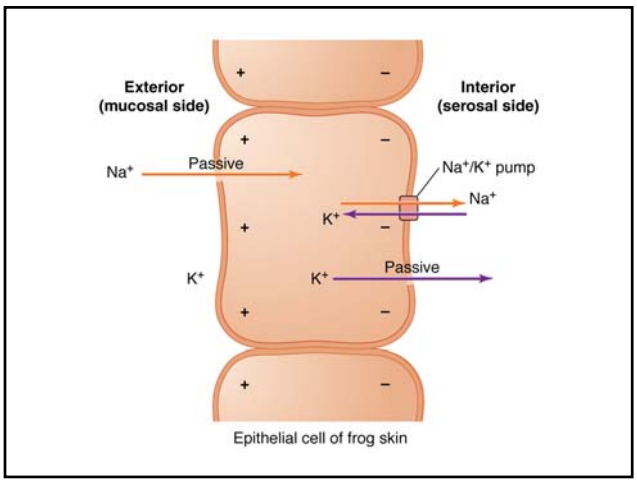

Gap junction
Liver cell 1
Liver cell 2
50 nm

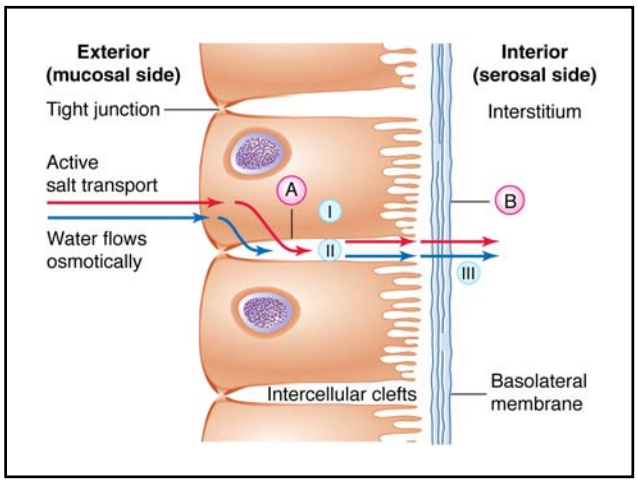

Cytoplasm
Gap junction subunits
Ions, amino acids, sugars, nucleotides
Proteins, nucleic acids
Cytoplasmic membrane surface
Lipid bilayer
Extracellular space
Hydrophilic channels
Integral membrane protein


Fluorescein
Epithelial cell sheet
Fluorescence of dye
Distance

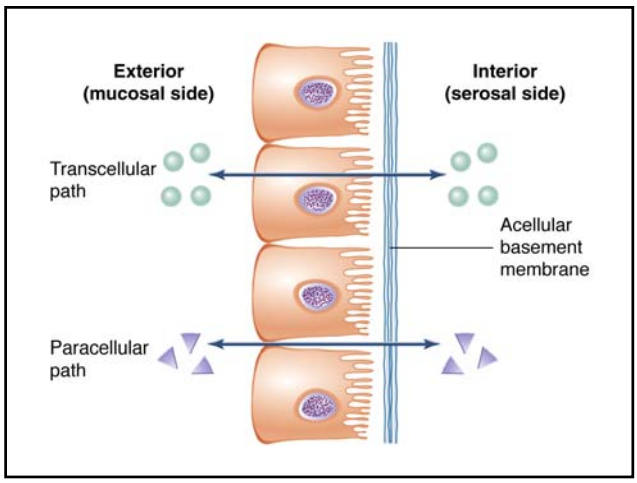

Microvilli
Zonula occludens (tight junction)
Zonula adherens (intermediate junction)
Macula adherens (desmosome)
Intercellular space
Gap junctions
Nucleus

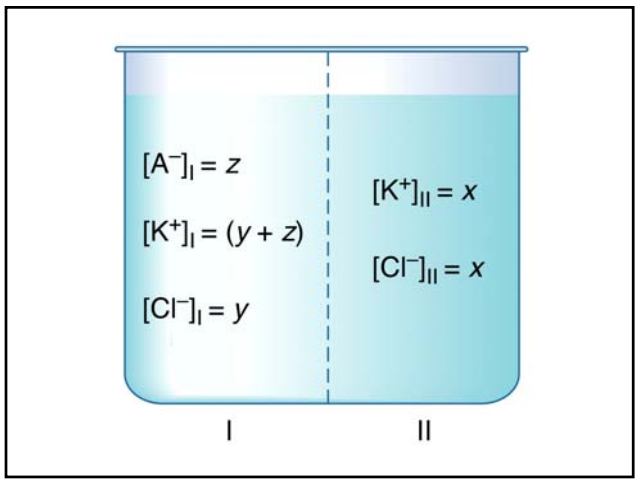

Variable current source
Current meter
Potential meter
Frog skin between two compartments


Exterior (mucosal side)
Interior (serosal side)
Na+
Passive
Na+/K+ pump
Na+
K+
K+
K+
Passive
Epithelial cell of frog skin

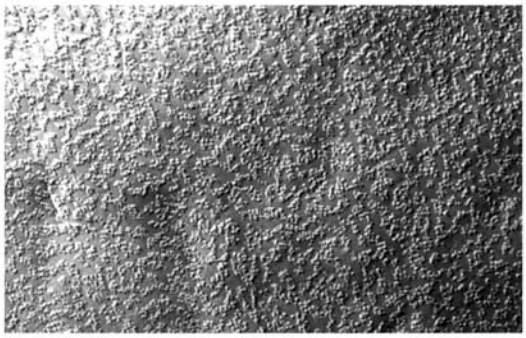


Homework problems

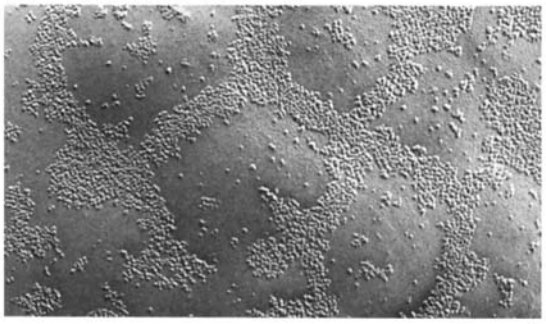




Control



45% of particles digested



70% of particles digested