Lipids are oils - found naturally in plants (olive oil) and animal fat

They are water-insoluble (non-polar), and fat-soluble

They are soluble in alcohols

Lipids contain - C,N,O,P

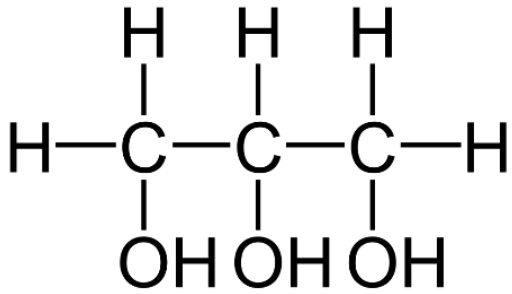
Lipids are needed in our diet because

- They form part of the cell membrane
- Stored as an energy source in the body
- Provides insulation
- Waterproof surface on skin (sebum)
- Prevents friction between internal organs
- Used to make steroid hormones

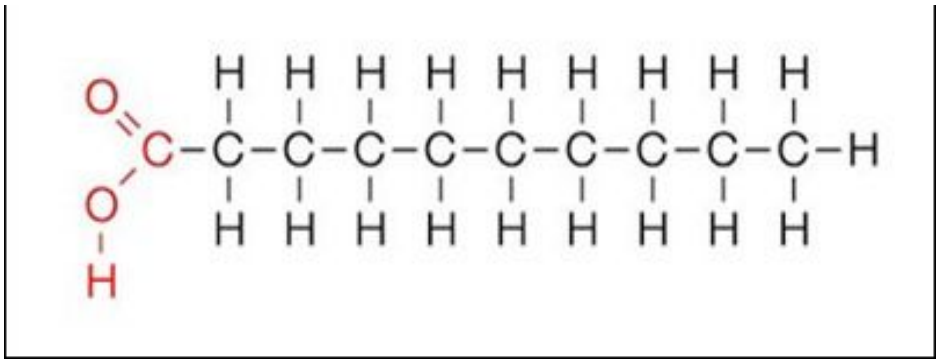
The simplest lipid is called a trigylceride

1 glycerol + 3 fatty acids

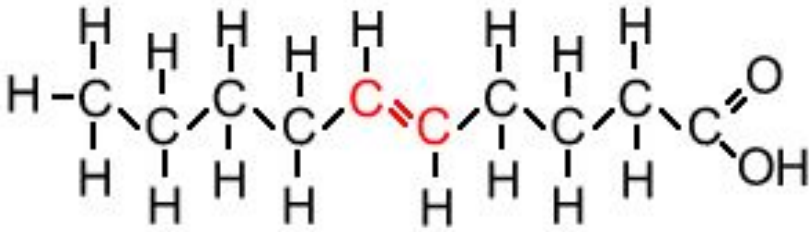
Glycerol



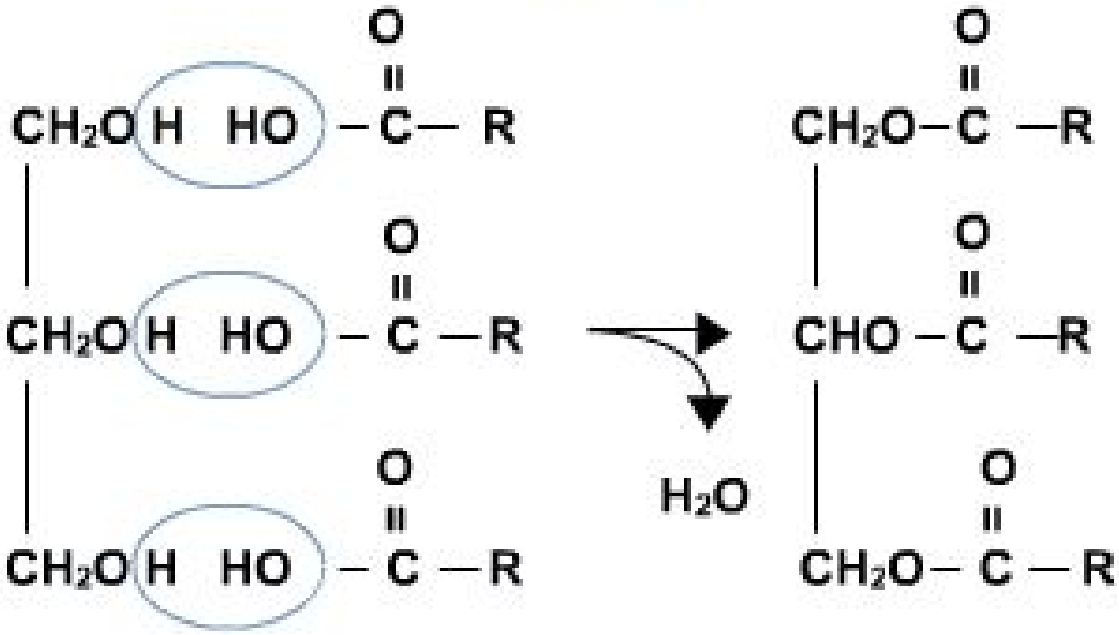
Fatty Acid - saturated - no double bonds



Fatty acid - unsaturated - one or more double bonds



A trigylceride is formed by joined one glycerol to 3 fatty acids



R= hydrocarbon chain from fatty acid

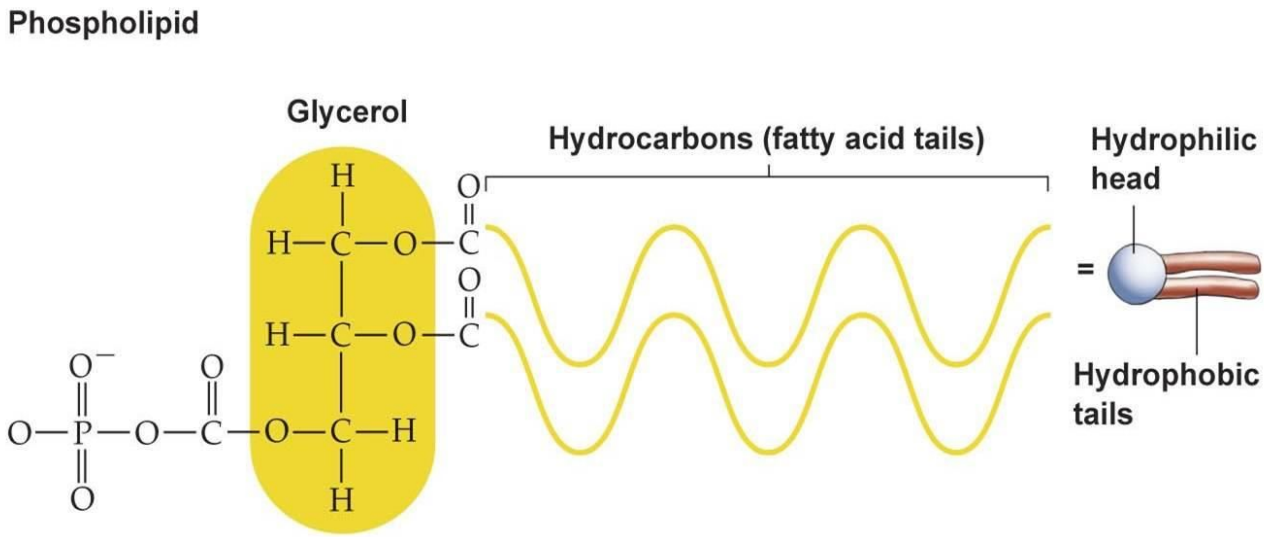
What kind of reaction is this?

How many water molecules are released?

Bond = Ester

Phospholipid

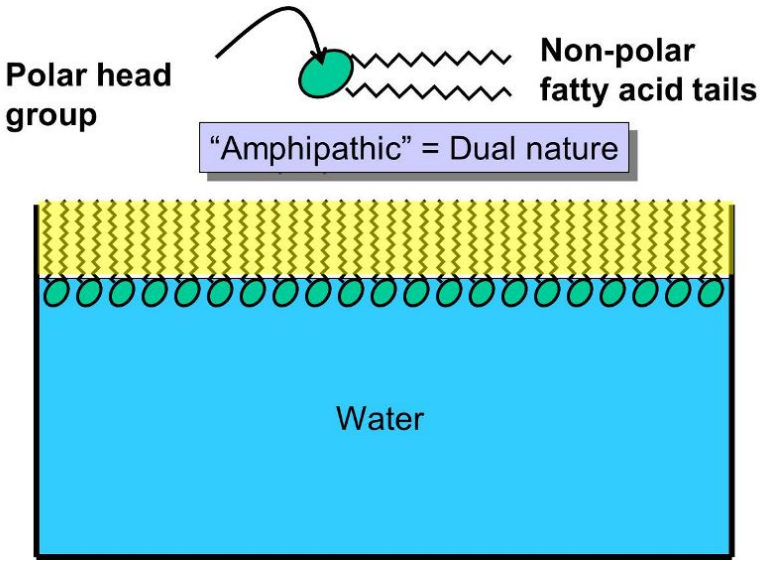
1 glycerol + 2 FA + 1 phosphate group



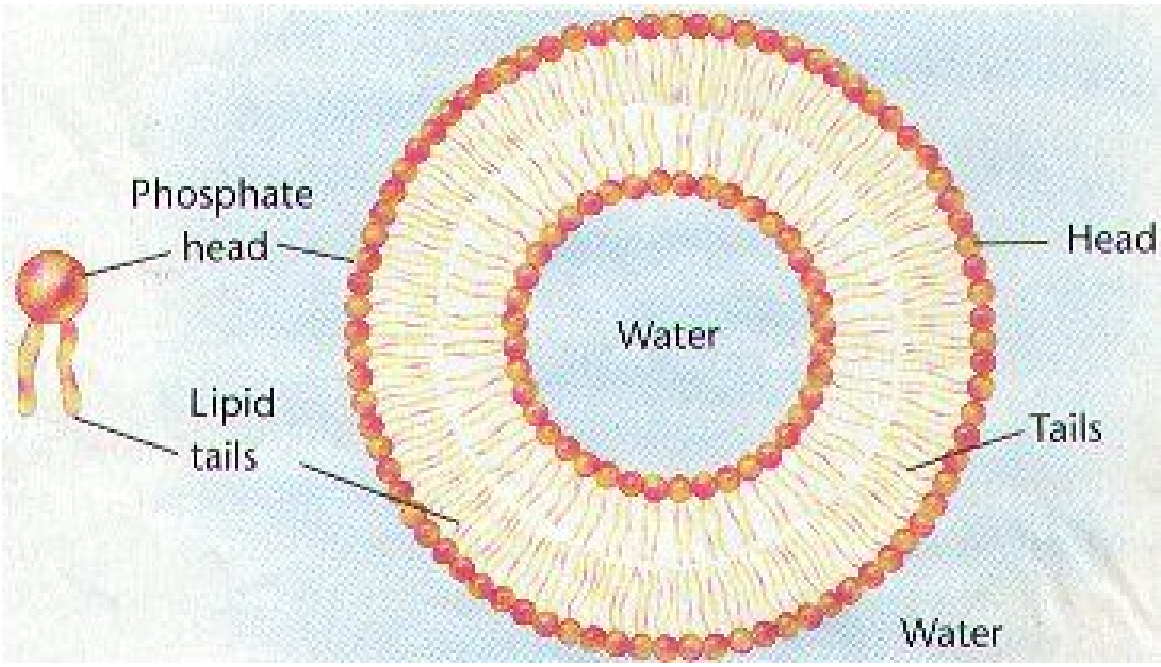
Hydrophilic head = water soluble (not attracted to fats)

Hydrophobic tail = water insoluble, mixes readily with fat

In water:

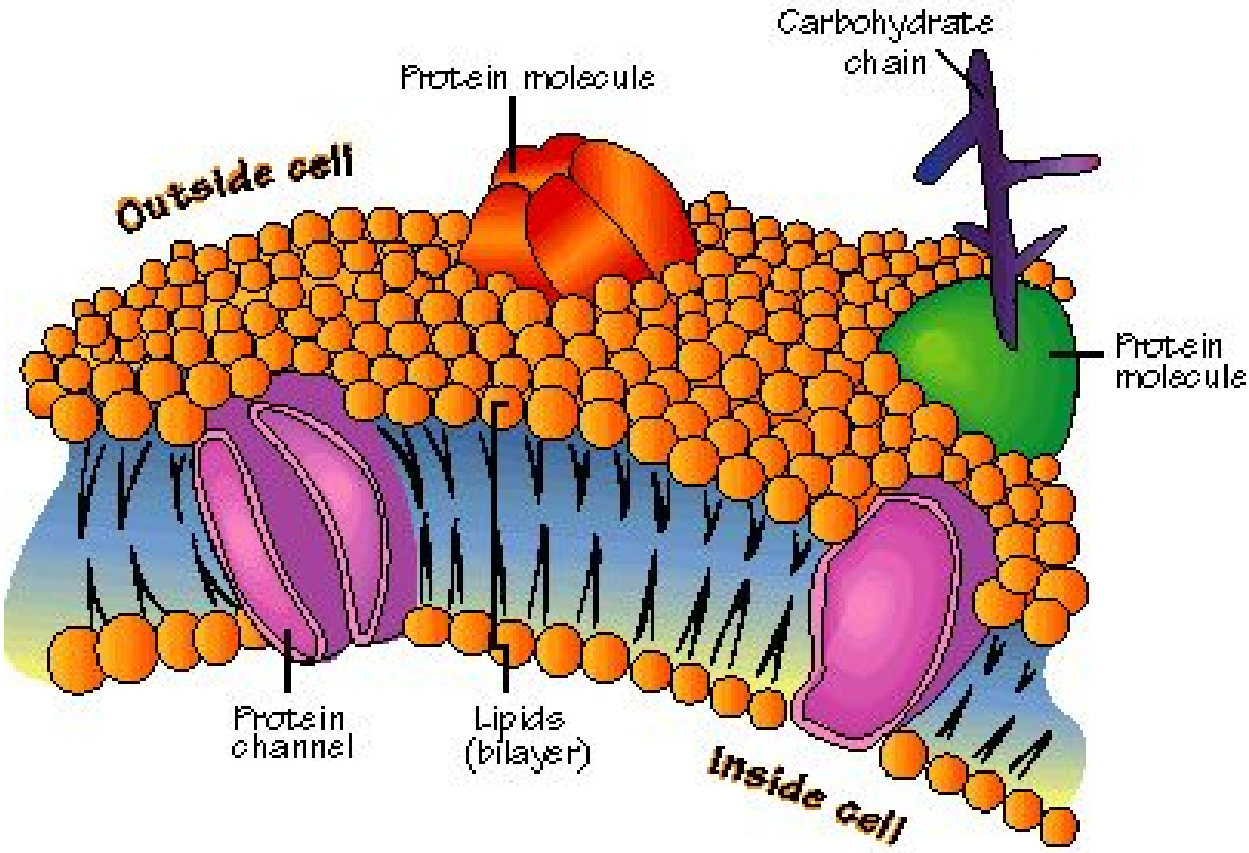


In the cell membrane - Bilayer



Only the heads face the water. The tails face away from water.

The cell membrane



Phospholipid bilayer containing

- Transport proteins (channel and carrier proteins)
- Cell surface receptors (glycoproteins and glycolipids)
- Cholesterol

Phospholipid bilayer

- The hydrophilic heads faces water
- The hydrophobic tails are buried inside the cell membrane

Allows free movement of:

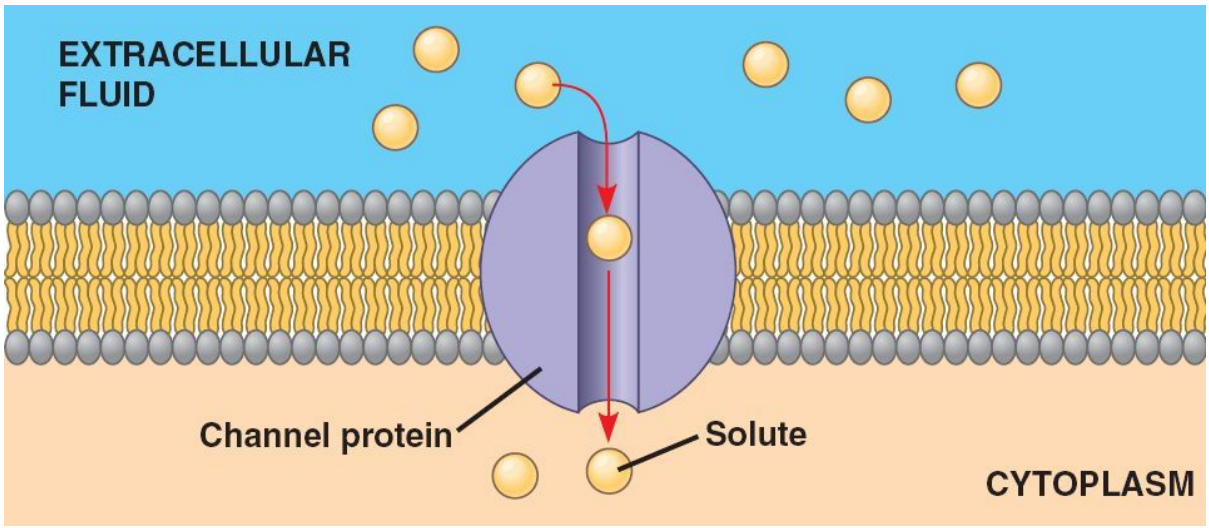
- Lipid-soluble substances, like steroid hormones
- Small, polar molecules, like CO_2 and O_2
- Small amounts of water

Makes the membrane

- Flexibile and self-sealing

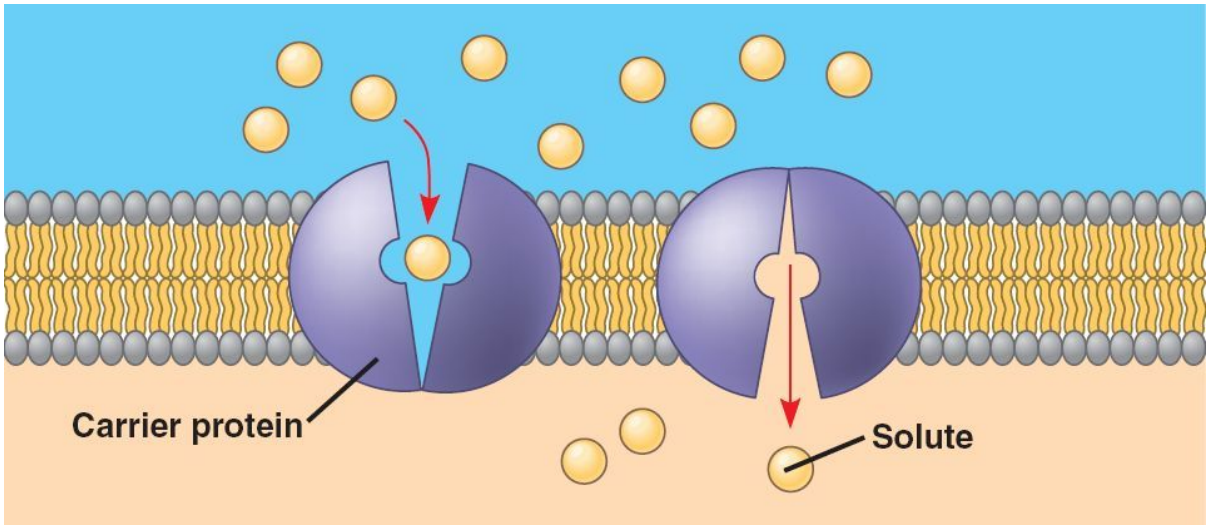
Transport proteins in the membrane

(1) Channel proteins



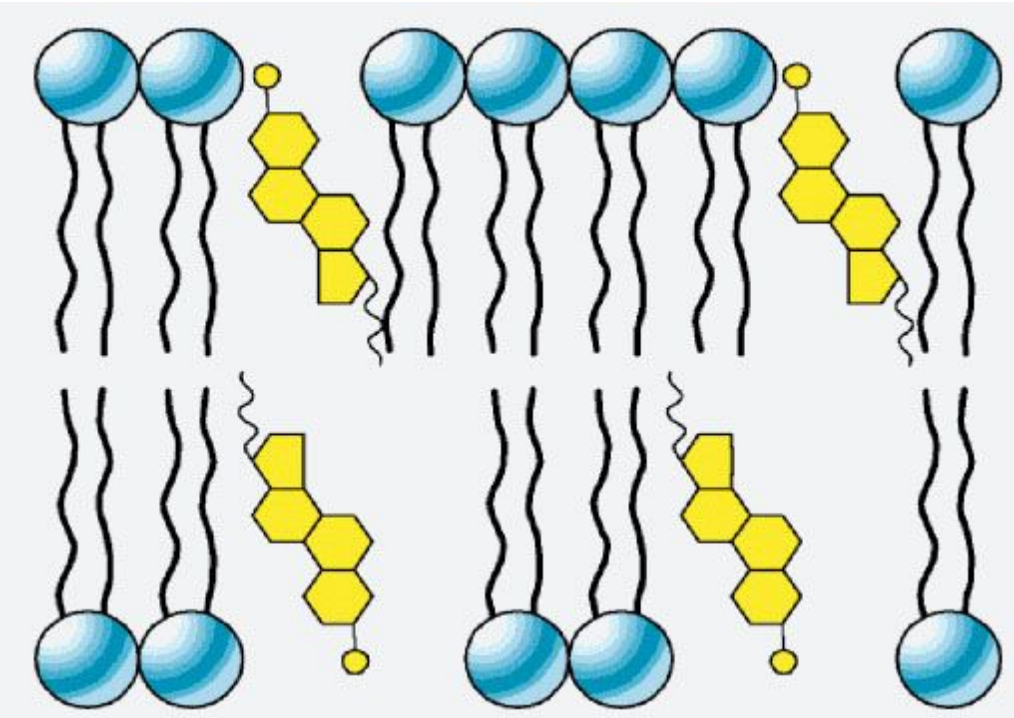
- Form pores across the membrane
- Allow diffusion of ions - Na^+,K^+, Cl^-
- Each channel protein is complementary to one ion

(2) Carrier proteins



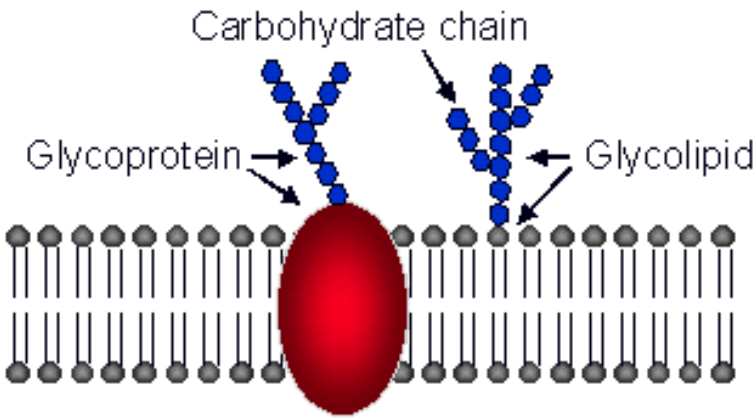
- Have a binding site for molecules that they transport
- Flip-Flop mechanism
- For larger, polar (water-soluble), molecules like glucose and amino acids

Cholesterol



- Is a rigid molecules
- Stabilises the cell membrane
- Adds strength (prevents it from being too flexible)
- Highly hydrophobic, prevent loss of water and ions from the cell
- At low temp, it prevents the fatty acid chains from crystallising
- At high temp, it prevents the membrane from becoming too fluid

Glycoproteins



- Carbohydrate attached to protein
- Act as cell-surface receptors for hormones
- Helps cells to recognise each other
- Helps cells to attach to each other and form tissue

Glycolipids

- Carbohydrate bonded to a lipid
- Cell-to-cell recognition

Fluid-mosaic model

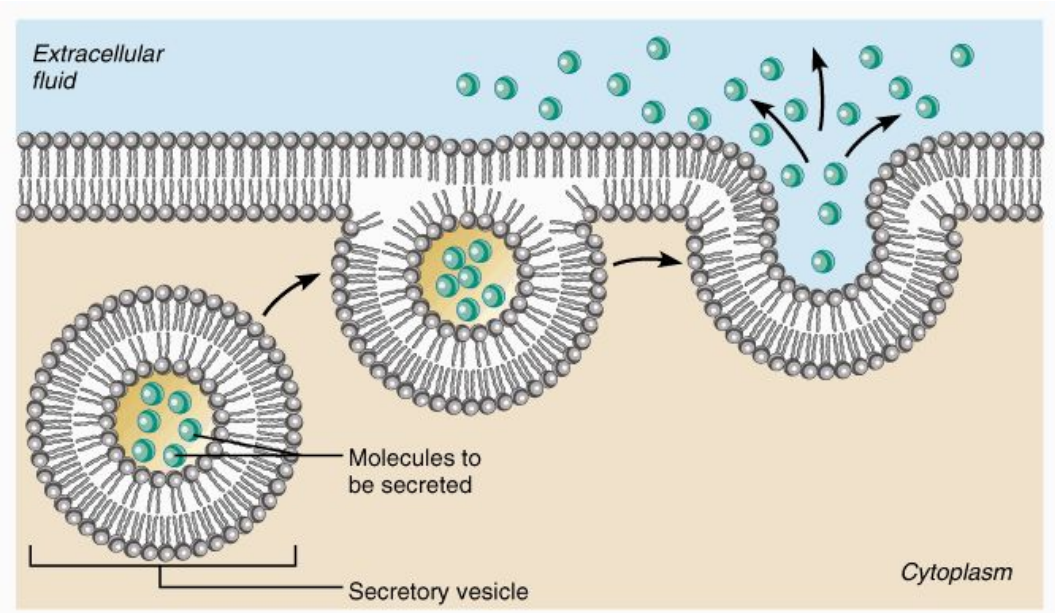
Fluid - individual phospholipid groups can move in lateral (side-to-side direction) = flexible

Mosaic = proteins embedded in the bilayer, which vary is size, shape and pattern

(page 86)

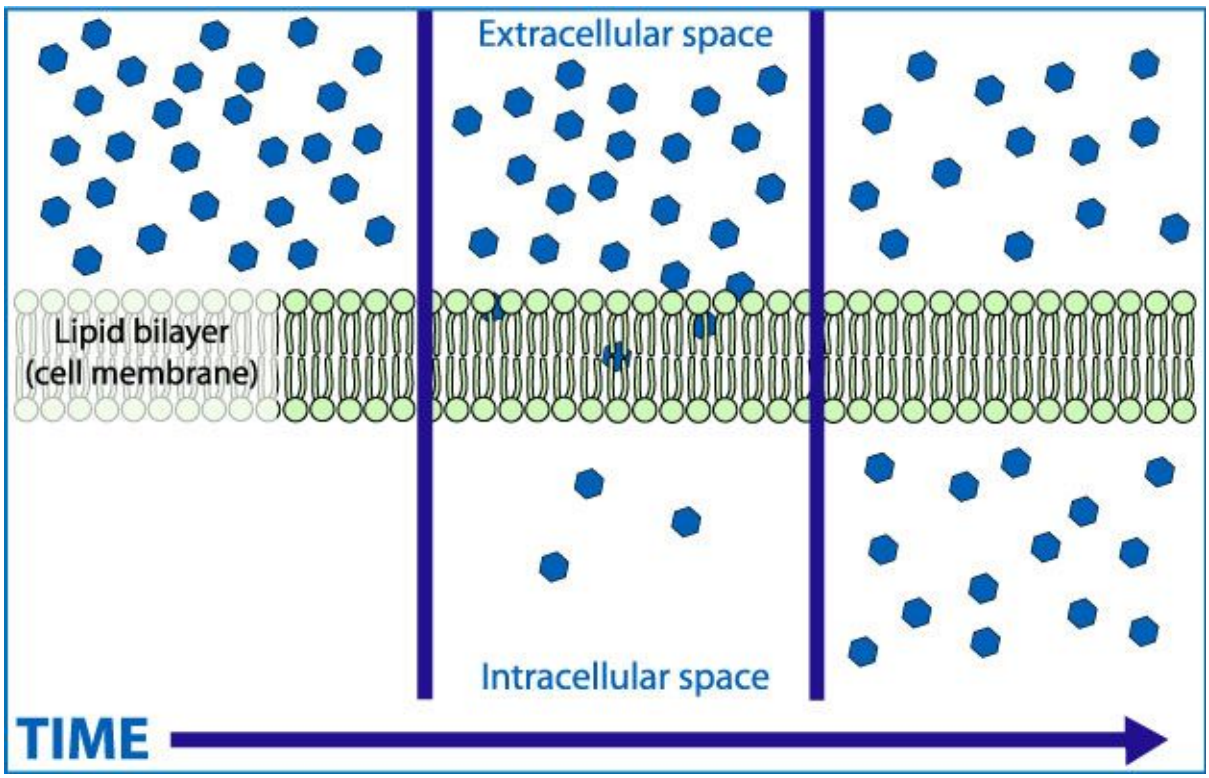
How molecules move across the cell membrane

- Lipid-soluble substances can diffuse freely
- Gases (small, polar) can diffuse freely
- Small amounts of water (small, polar) can diffuse freely
- Ions (small, charged, polar) move using channel proteins
- Glucose and amino acids (large, polar) , move across using carrier proteins
- Large quantities of proteins can be moved by exocytosis (antibodies) or endocytosis



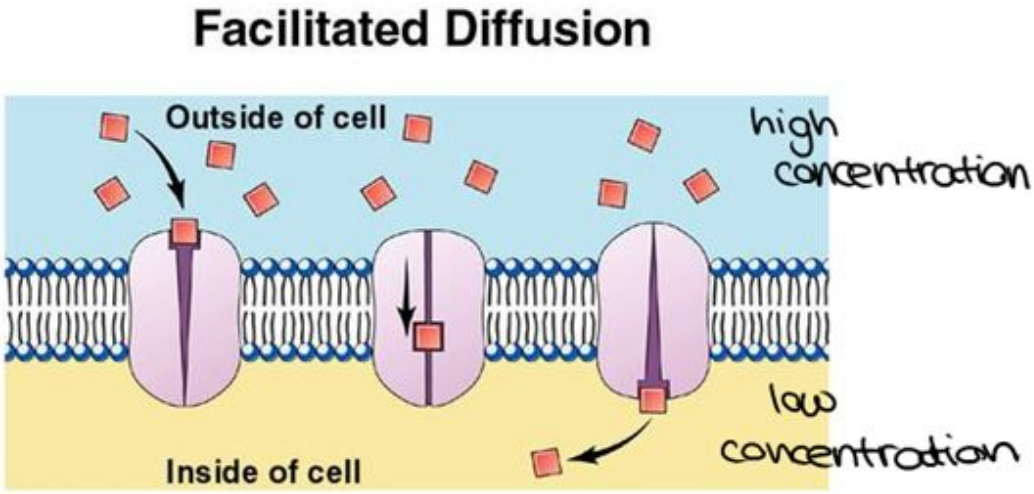
Methods of transport across the membrane

(1) Diffusion (page 87)



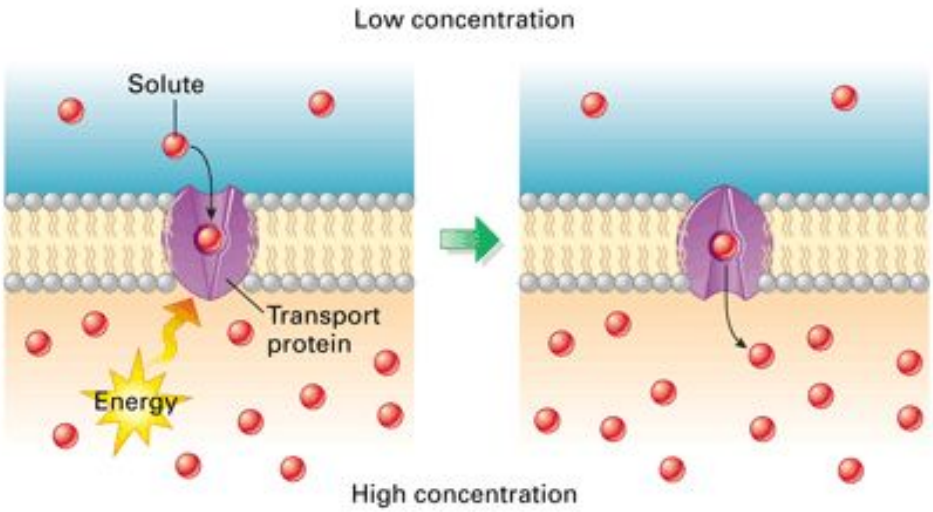
- For lipid soluble substance and gases
- From high conc to low conc (along the conc gradient)
- Stops when both sides equal
- Does not require energy
- Does not use carrier or channel proteins

(2) Facilitated diffusion (page 87)



- For ions or glucose/amino acids
- From high conce to low conc
- Stops when both sides equal
- Does not require ATP/energy (passive)
- Uses carrier or channel proteins

(3) Active transport (page 93)



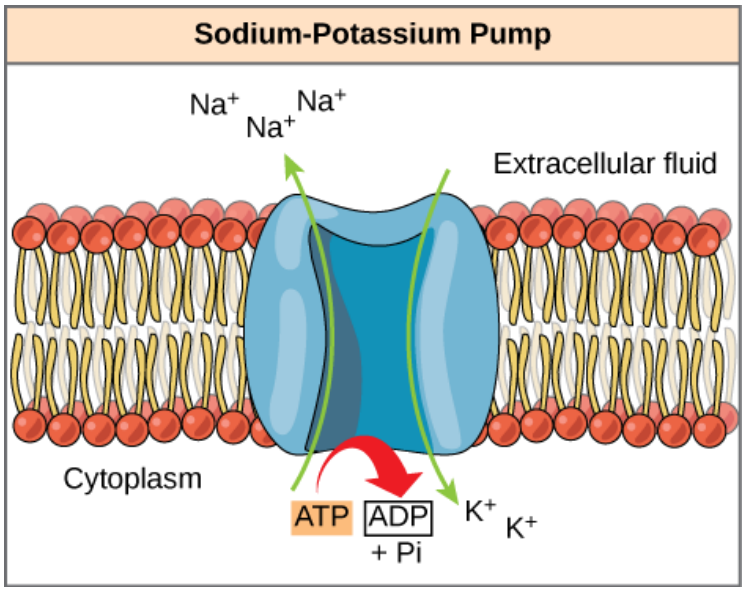
- For ions or glucose/amino acids
- From low conc to high conc
- Against the conc gradient
- Uses ATP
- Uses carrier or channel proteins

ATP is used to temporarily change the shape of the carrier/channel protein, so that molecules on the inside (high conc) are not transported out

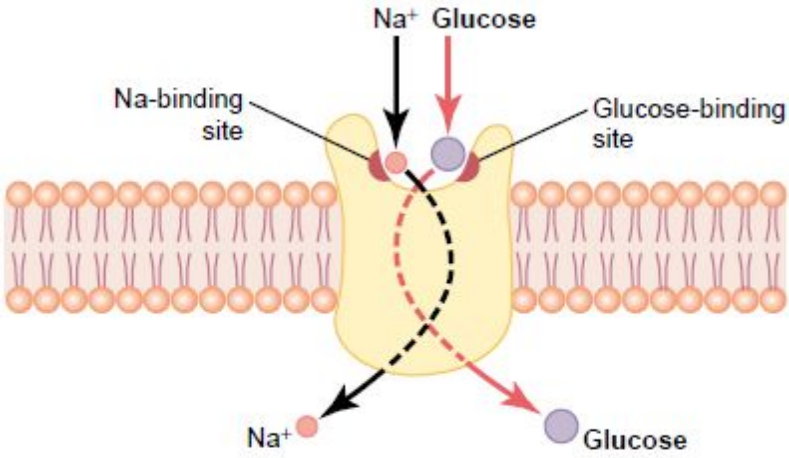
(4) Co-transport (page 94)

- Two molecules transported together
- Can be active or passive

Sodium-Potassium pump (Active)

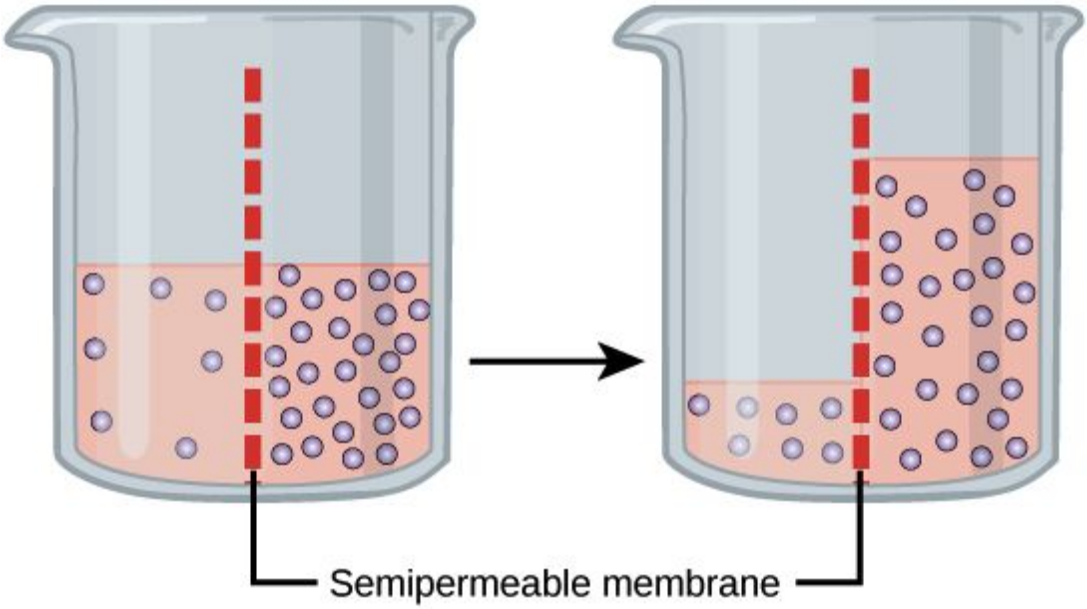


Sodium-glucose co-transport (passive, facilitated)



(4) Osmosis (page 89)

Movement of water across a semi-permeable membrane (cell membrane)



- Only refers to movement of water
- From an area where water conc is high to an area where water conc is low
- Does not require energy
- Does not use carrier or channel proteins

Water potential

Water potential - concentration of 'free' water molecules in a solution

When polar substances are dissolved in water, some of the water molecules bind to them - this reduces the concentration of 'free' water available

The more the concentration of solute (what is dissolved), the lower the concentration of 'free' water

Distilled water (no solutes) is 100% 'free' water

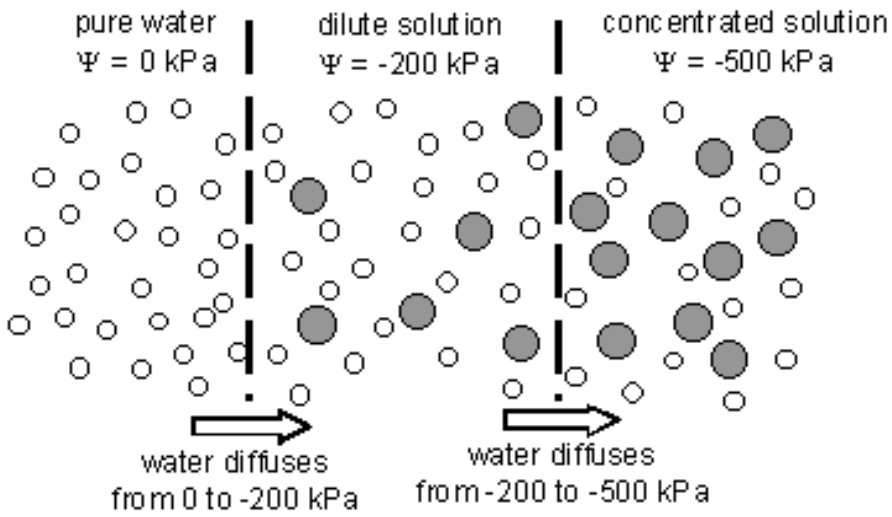
- Water potential of zero

If 1% salt dissolved in water, then water potential becomes negative

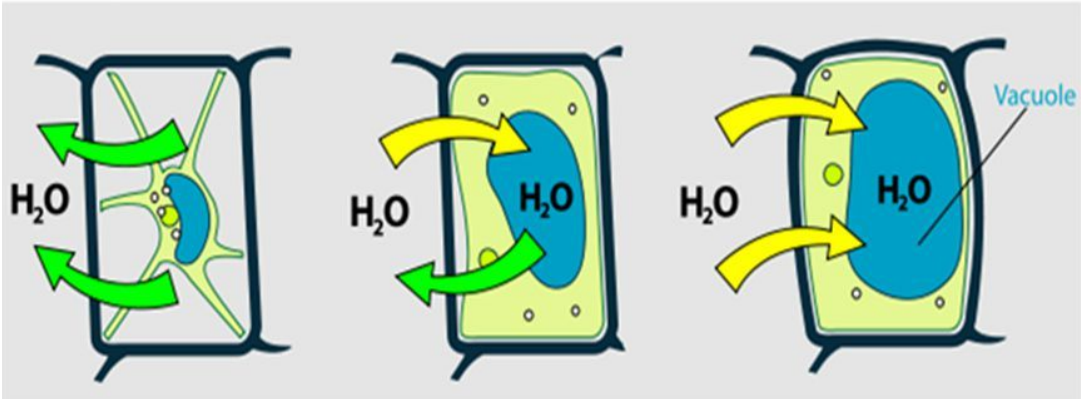
As more and more salt dissolved, water potential becomes even more negative

Water always moves from an area of high water potential to low water potential

When the conc of water on both sides is equal, a dynamic equilibrium is established and there is no net movement of water (page 90).



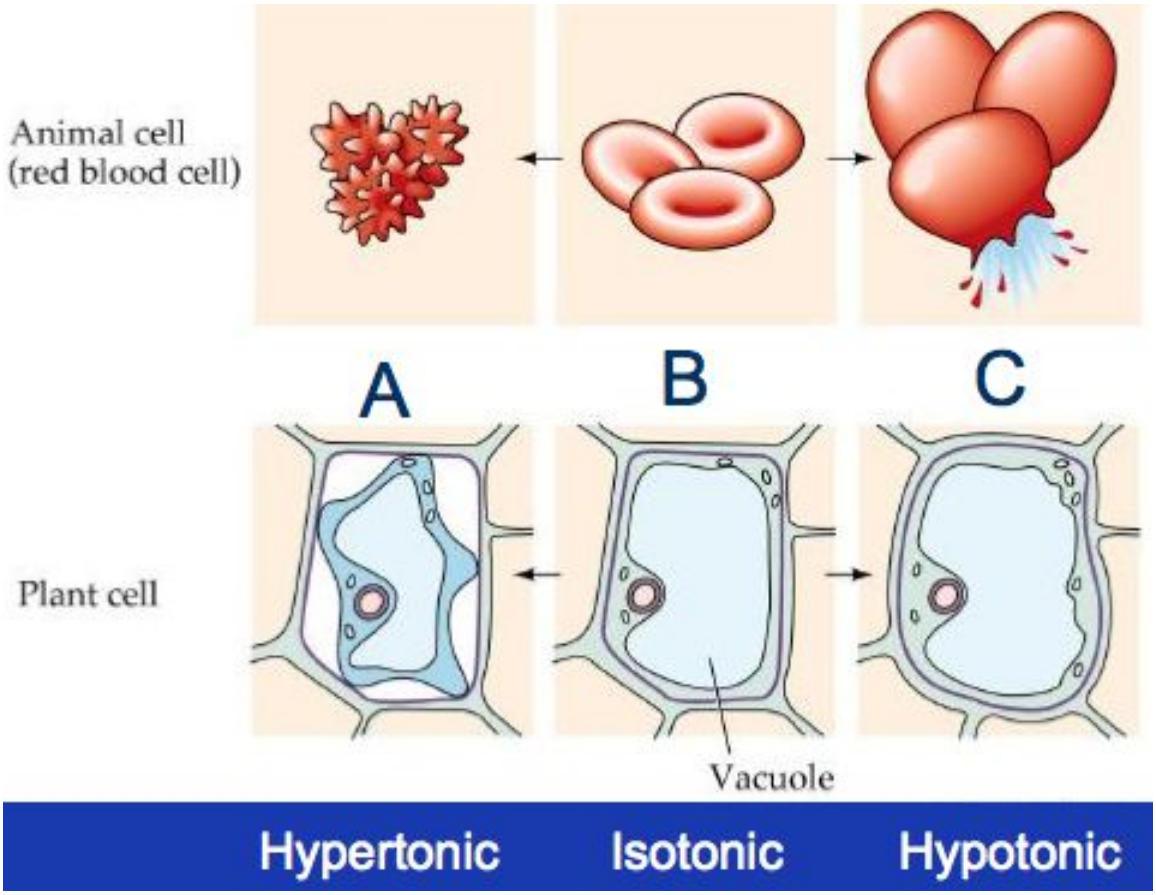
Water potential and cells (page 91 & 92)



Hypertonic = water potential is more negative outside the cell

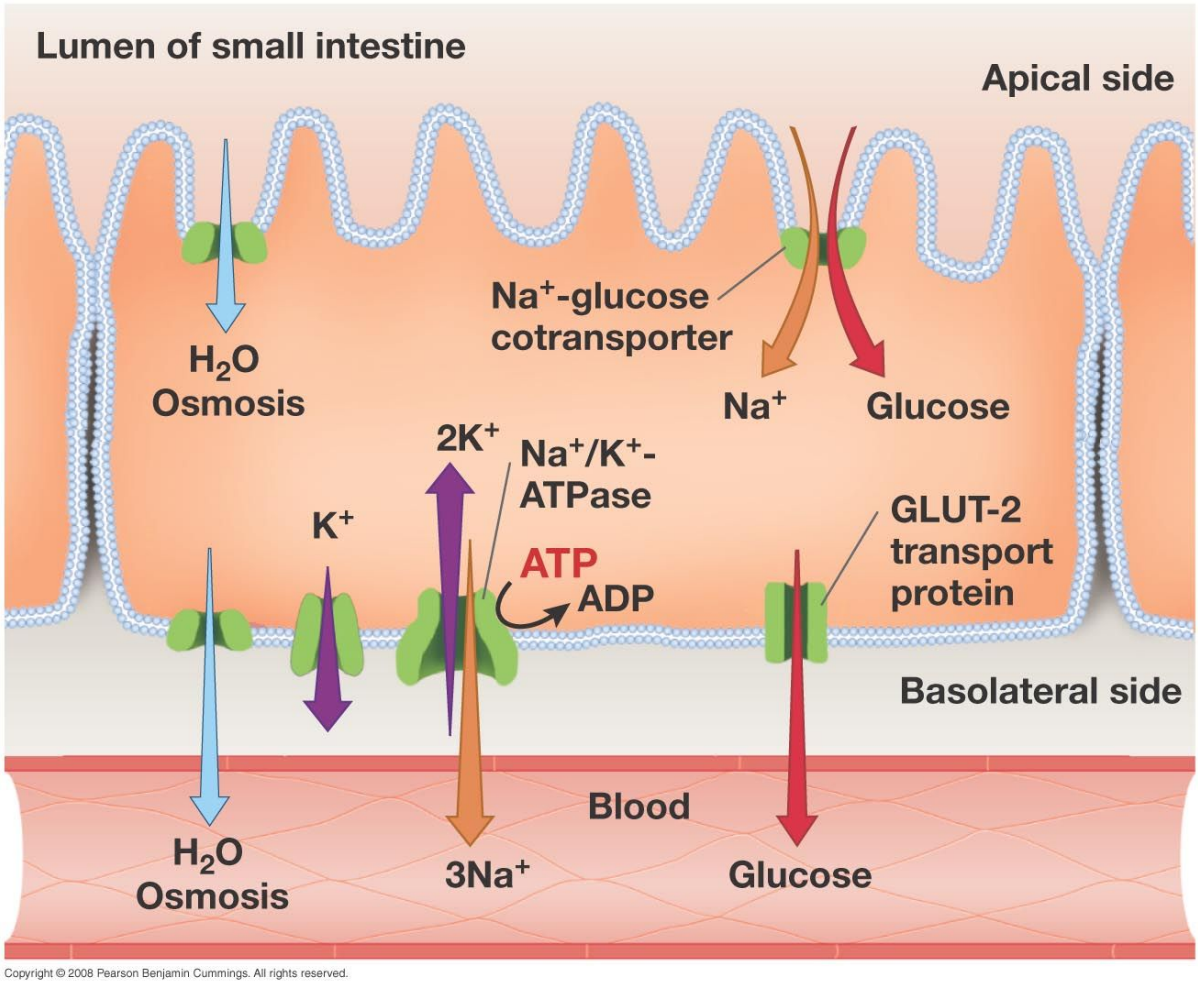
Hypotonic = water potential is more negative inside the cell

Isotonic = same water potential inside and out



Animal cells can burst in hypotonic solutions, plants cells can resist due to cell wall

Absorption of glucose in the small intestine (page 96)



-Na^+/K^+ pump transports Na^+ from epithelial cells to blood

- this creates a shortage of Na^+ inside the epithelial cells

- Na^+drawn in from lumen using a Na^+-glucose co-transport protein

- Water potential in epithelial cells decreases

- Water is drawn in by osmosis

- Glucose enters the blood via facilitated diffusion