There are mainly two types of transport :

 # Type one: Passive diffusion

1- which does not require additional energy and occurs down the concentration gradient (high – low concentration) " Down Hill"

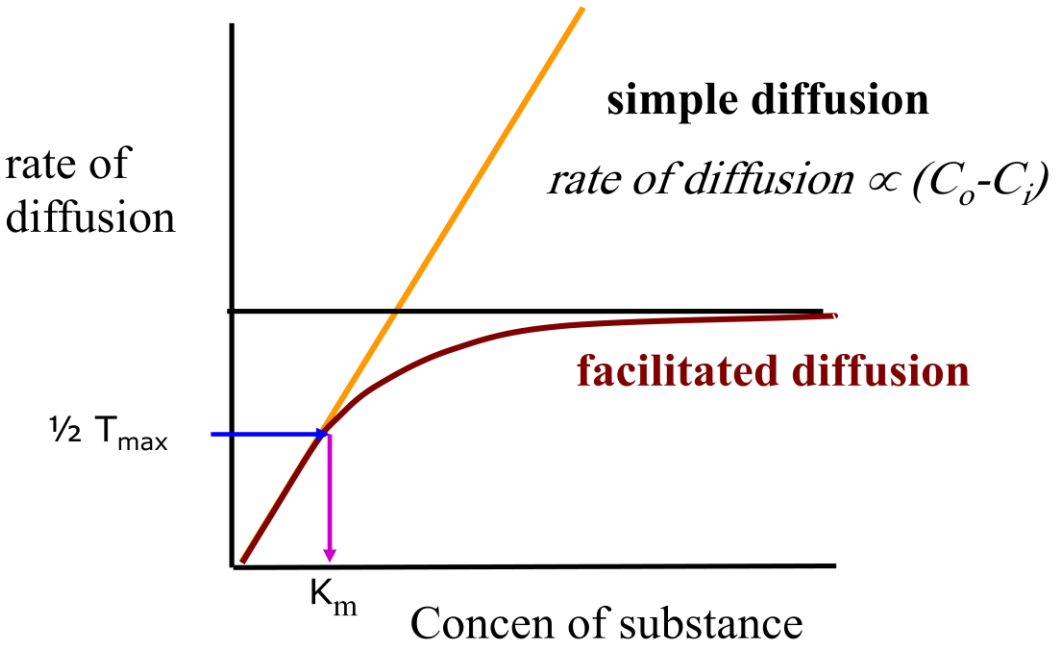
(^_^) **<u>Notice</u>** that kinetic energy of molecules is the main force that drives passive diffusion.

 # Type two:

Active transport which requires energy and occurs against the concentration gradients " UP HILL "

Types of passive diffusion

Simple diffusion	Facilitated diffusion	Osmosis " specific for water"
(a) lipid-soluble molecules move readily across the membrane. " non-polar molecules" like CO2,O2,N2. - NOTE : water CAN pass through the lipid bilayer BUT ONLY few portions with a very slow rate,don't apply that on all molecules like glucose as it does not pass at all NOTE: simple diffusion occurs via the membrane directly or via some CHANNELS like channels of water molecules.	**"carrier mediated diffusion"** **# A Carrier is needed which still opens and closes based on the concentration gradient (high to low)** **# The carriers are saturated " If they have no more capacity to hold the substances"** **# This diffusion may occur through gated channels, and if they are closed there is no passage."if the channel is opened then the movement is by diffusion "** **<u>There are also some other specific types of passive diffusion like filtration and bulk flow</u>**	**Osmosis** occurs from pure water toward a water/salt solution. Water moves down its concn gradient. # Osmotic pressure: The amount of pressure required to counter osmosis **# Osmolarity VS Osmolality** **Omolarity is** the osmolar concn – expressed as osmoles/ liter of solution **while Osmolality is osmoles/kg** **Note:** it's more practical to major osmolarity, and the quantitative difference between **osmolality and osmolarity is only 1% in the biological systems so they roughly mean the same when they are mentioned**



Rate of diffusion is limited by

- T_{max} Transport maximum (V_{max} -velocity maximum) of the carrier protein
- the density of carrier proteins in the membrane (i.e., number per unit area)

The capacity is determined by T_{max} and the affinity is determined by K_m

Some notes about Osmosis and osmotic pressure:

The membrane which allows the passage of water molecules in osmosis does not allow the passage of other molecules "semi-permeable".

Water molecules keep passing through the membrane until the column of water reaches a certain height then the pressure stops the passage of more molecules and this is what we call it osmotic pressure

We can prevent water movement during osmosis by applying a piston, if we press the piston on a side till it equals the osmotic pressure.

IMPORTANT : Water molecules pass from the lower osmolarity (higher concn of water molecules) to the higher osmolarity (low cocn of water molecules)

The Osmotic pressure can be calculated by Vant's Hoff equation

$\Pi = б\ R\ T\ n\ C$

Sigma is the reflection coefficient : measures the resistance of the membrane to the movement of a substance ,it varies from (0-1)

When it equal 1>> the membrane is impermeable and if it equals zero the membrane is freely permeable

Oncotic or colloid is the pressure that is resulted from proteins only which withdraw the fluids to its side and that helps in the re-absorption of the cell

Tonicity and its effect on RBCS

The normal solution in our plasma is iso-osmotic solution

When the solution is :

Isotonic: the osmolarity is the same in and out the cell

Hypertonic : the osmolarity is higher out and less inside ,we mean the concentration of salts is high outside so water concentration is low that's why the water moves from the cell to the outside

Hypotonic: the osmolarity is higher inside (high salt inside compared to outside)

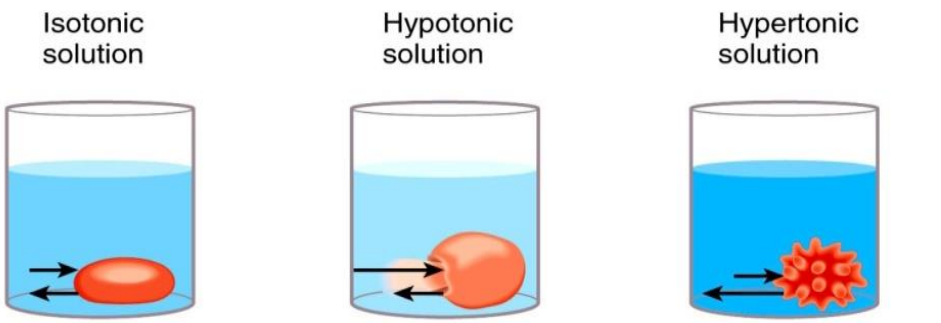
A clinical case about iso-osmotic solutions: if we give a patient normal saline (NaCl), which has a molecular weight of 150 the osmolarity of the saline is 300 which is isotonic solution and good for the patient's cells , BUT NOTICE HAT hypotonic solutions are very dangerous for our bodies.

Example

The same osmolarity 300mosml/l in and out

250 mosml/L out and 300 mM inside

250 mosml/L inside and 300 mosml/L outside



(a) Illustrations showing direction of water movement

Normal RBC shape

RBC undergoes hemolysis

RBC undergoes crenation

(b) Scanning electron micrographs (all 15,000x)

Figure 03.09 Tortora - PAP 12/e