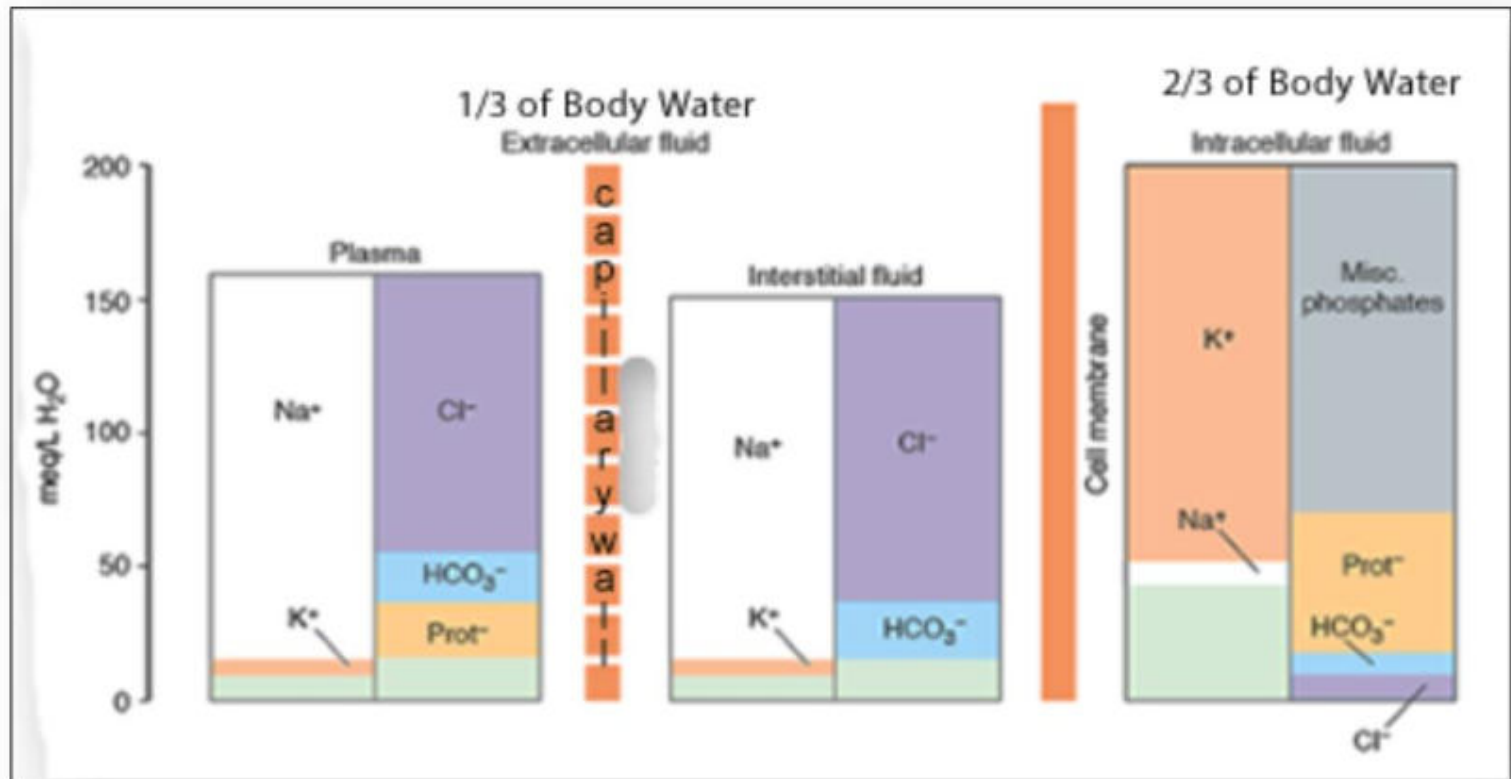


Body fluid compartments



Learning Objectives

To learn:

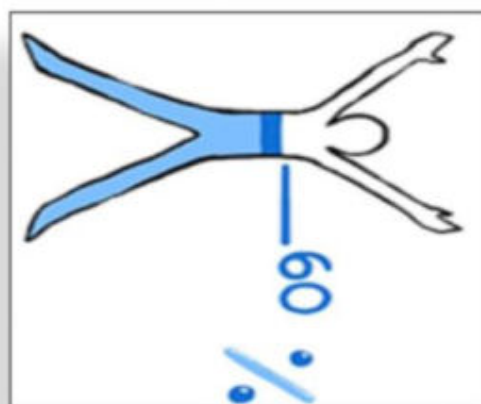
- Composition of body fluid compartments.
- Differences of various body fluid compartments.
- Molarity, Equivalence, Osmolarity-Osmolality, Osmotic pressure and Tonicity of substances
- Effect of dehydration and overhydration on body fluids

Why is this knowledge important?

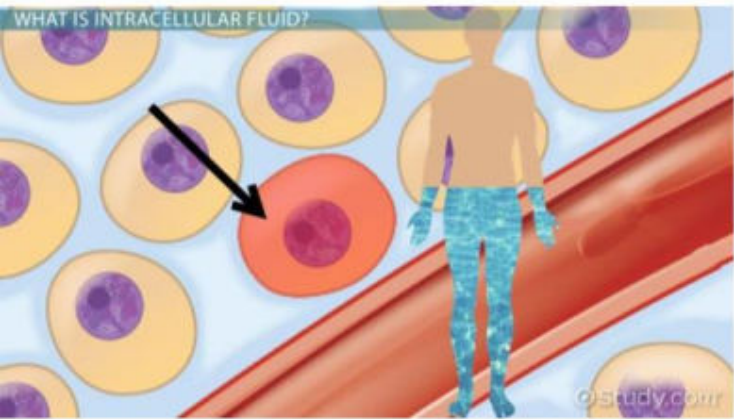
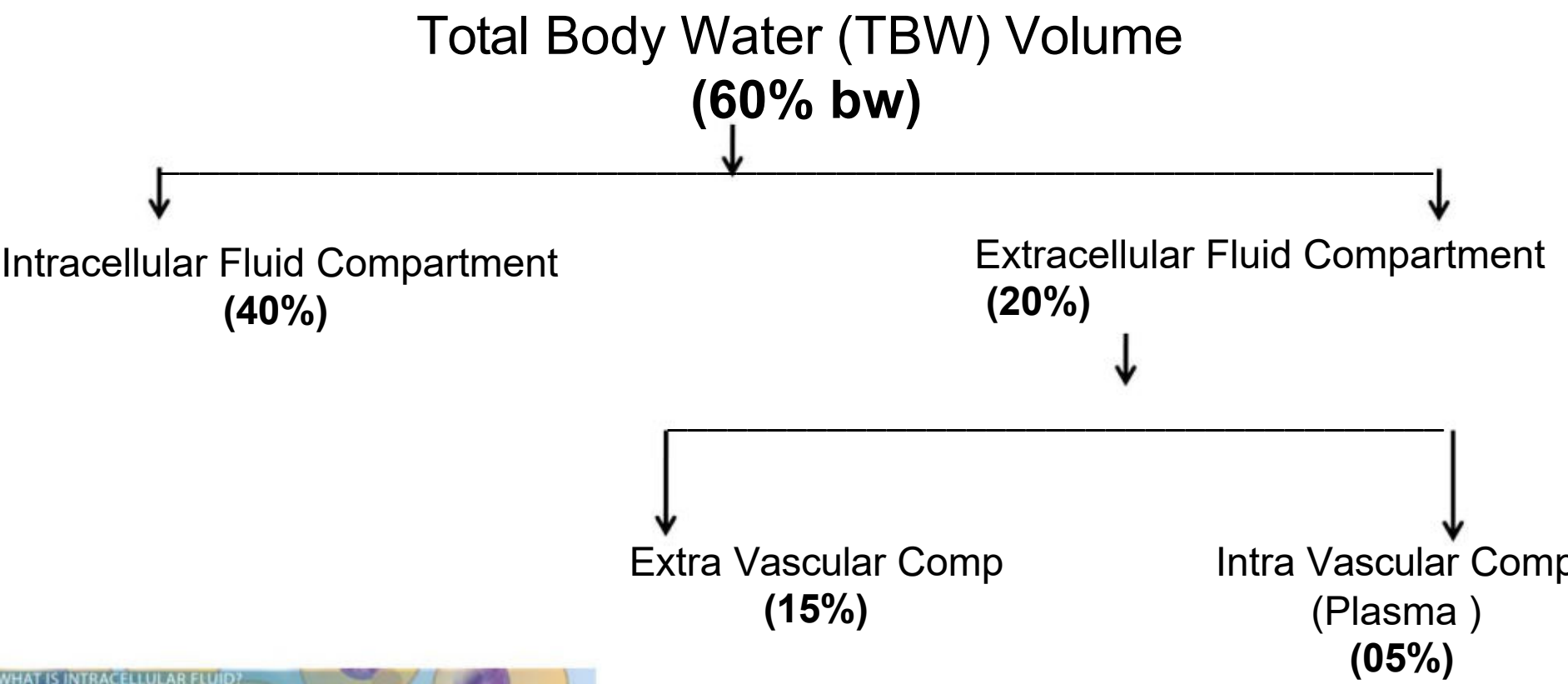
- To understand various changes in body fluid compartments, we should understand normal configuration of body fluids.

Total Body Water (TBW)

Water is 60% by body weight
(42 L in an adult of 70 kg - a major part of body).



Water content varies in different body organs & tissues,



Electrolytes distribution in body fluid compartments

Intracellular fluid comp.mEq/L

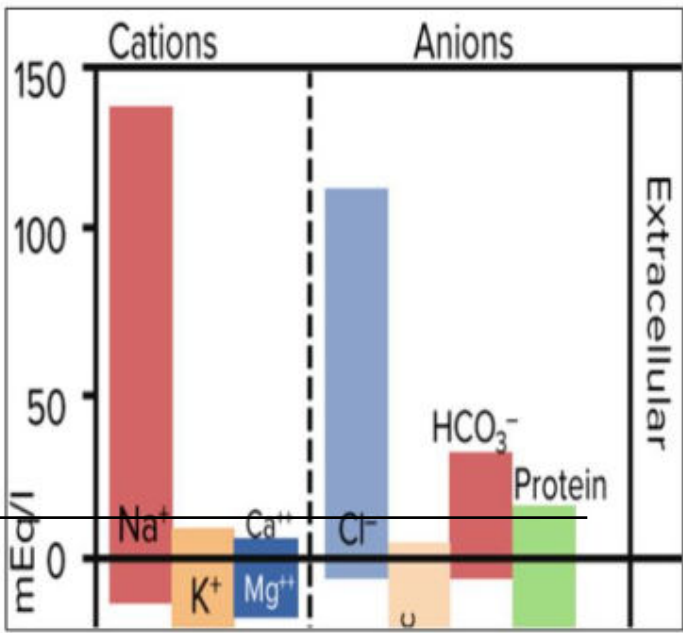
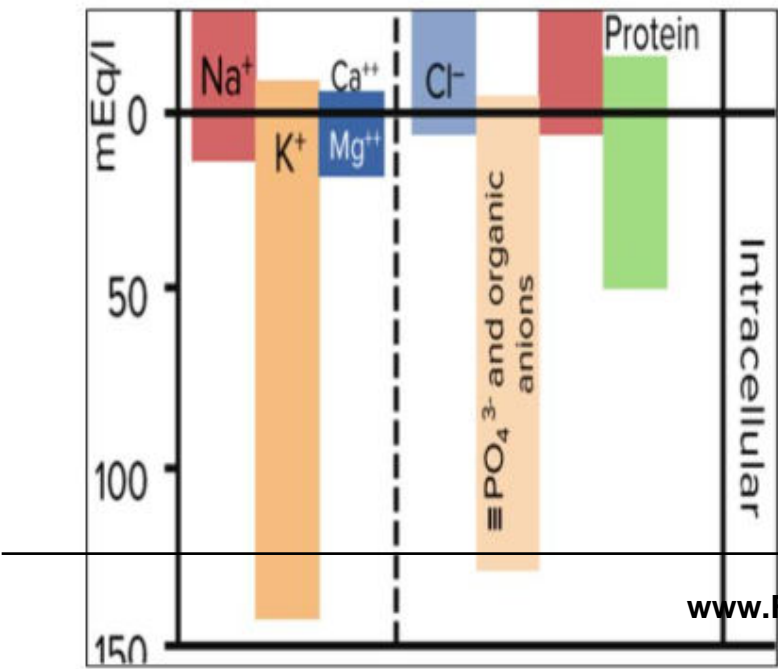
Major Cation
K⁺

Major Anions
HPO₄²⁻
Proteins -

Extracellular fluid comp.mEq/L

Major Cation
Na⁺

Major Anions
Cl⁻
HCO₃⁻



A set ‘Terminology’ is required to understand change of volume &/or ionic conc of various body fluid compartments.

Molarity
Definition
Example

Equivalence

$$\text{mEq/L} = \text{mmol/L} \times \text{valence}$$

Osmolarity

Osmolarity is total no. of osmotically active solute particles (the particles which attract water to it) per 1 L of solvent - **Osm/L**.

Example-

Osmolarity and Osmolaity?

Osmolarity is total no. of osmotically active solute particles per 1 L of solvent - Osm/L

Osmolality is total no. of osmotically active solute particles per 1 Kg of solvent - Osm/Kg

Osmosis

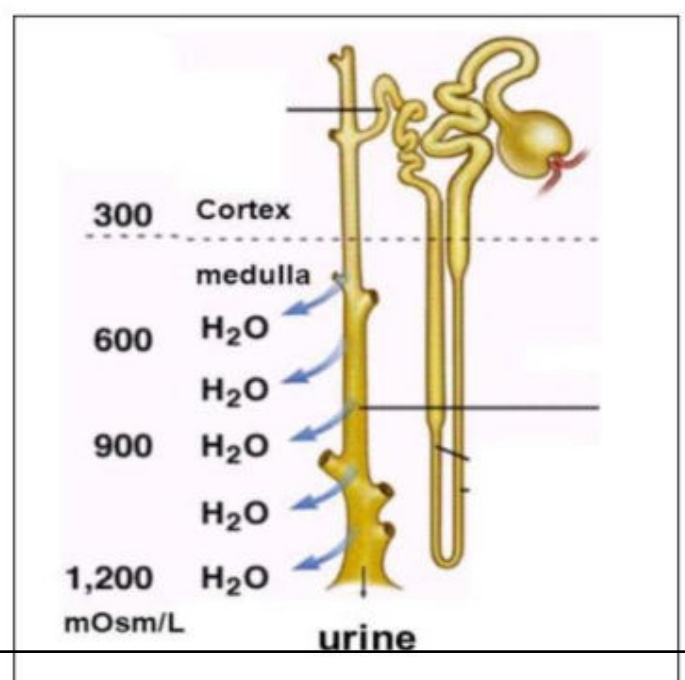
Tendency of water to move passively, across a semi-permeable membrane, separating two fluids of **different osmolarity** is referred to as 'Osmosis'.

Osmotic Pressure

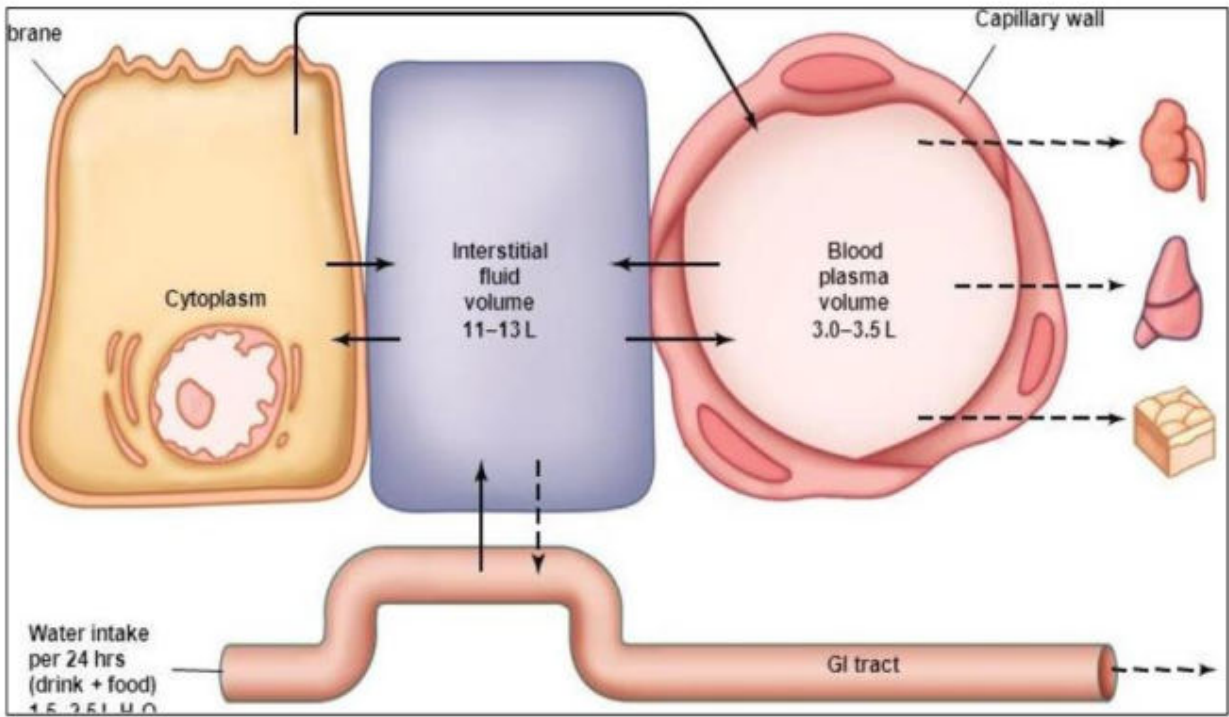
Osmotic pressure is the pressure, applied **to stop the flow of solvent molecules** from low osmolarity to a compartment of high osmolarity, separated through a semi-permeable membrane.

Normal osmolality of the ECF and ICF

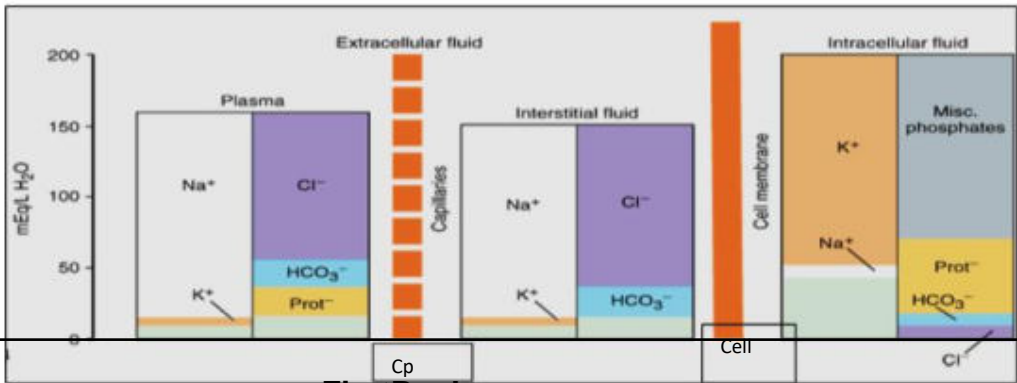
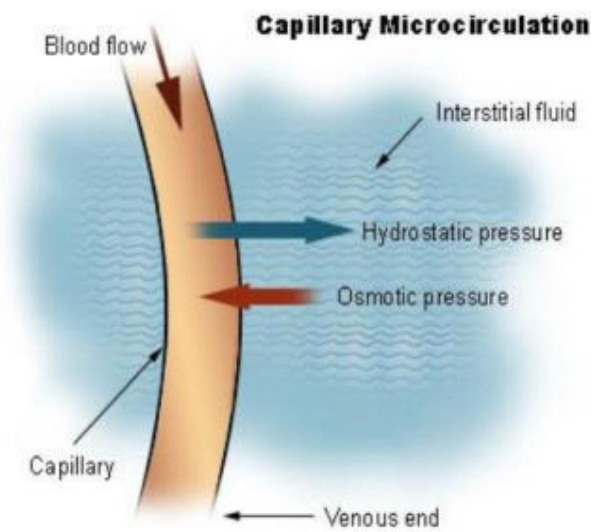
Averages 280-300 mOsm/L



Osmolality of ICF

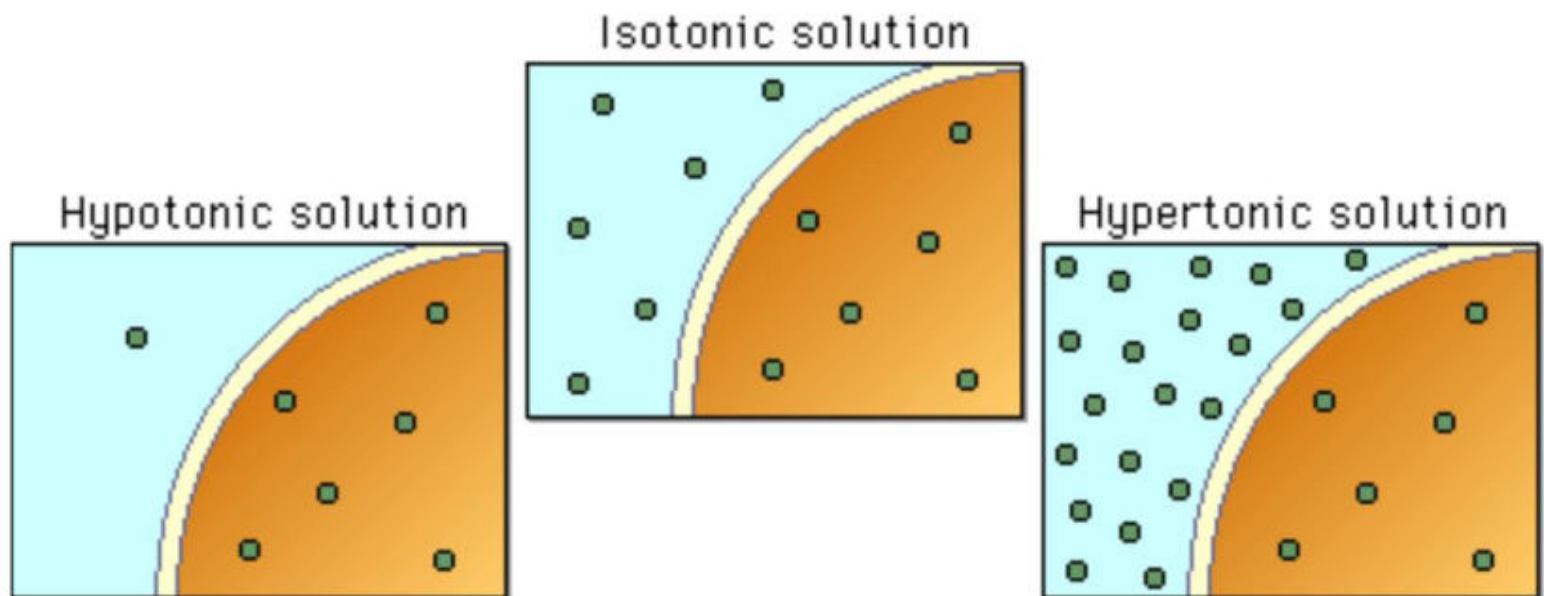


Pressures causing water moves freely between various body fluid compartments



Tonicity

Tonicity of a solution defines **cell volume change** that occurs, if the cell is placed in that solution.



Significant points of the Lecture

Importance of the knowledge about Body Fluid Compartment –

Water distribution in different compartment-

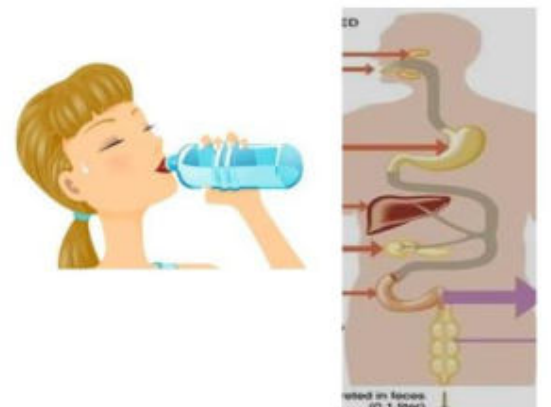
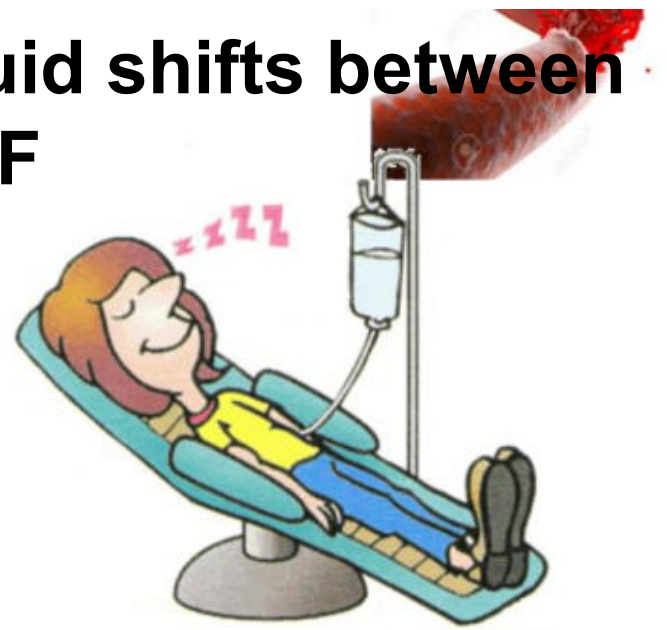
Ionic difference of different body fluid compartments-Major cation and anions-

Difference of Molarity, Equivalence, Osmolarity and Osmolality, Tonicity-

Next Lecture

Basic principles for analysis of fluid shifts between ICF & ECF

- All exchanges of water and solutes with the external environment occur through the **extracellular fluid (ECF)**
e.g. intake or loss via the
- Gastrointestinal tract
- Intravenous route.



Basic principles for analysis of fluid shifts between ICF & ECF

- Hyposmotic dehydration/overhydration will result in cell volume \uparrow and net Osmolarity \downarrow
- Hyperosmotic dehydration/overhydration will result in cell volume \downarrow and net Osmolarity \uparrow

Clinical implications












Water loss from body (ECF) -
Dehydration (volume contraction)



Excess water gain to the body (ECF) -
Overhydration (volume expansion)



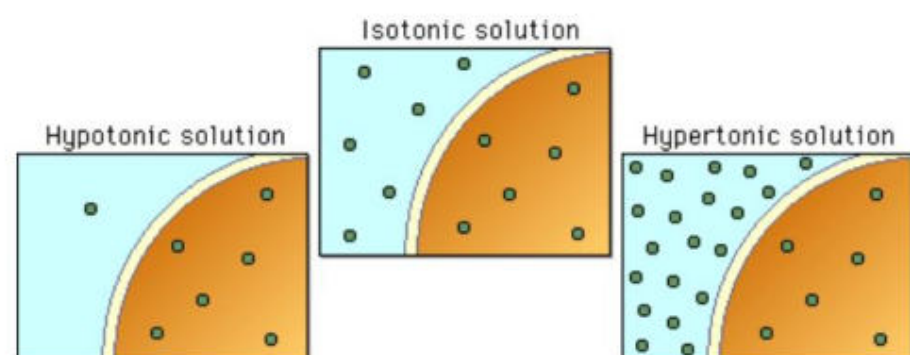
Signs and symptoms of 'dehydration' ↓ and 'overhydration' ↓

Weight gain 	Weight loss 
Swollen ankles and puffy eyes  	Dry mouth  
High blood pressure 	Low blood pressure 
Breathlessness  	Dizziness 

Dehydration (volume contraction)

Three types:

- Isosmotic dehydration
- Hyperosmotic dehydration,
- Hyposmotic dehydration



Overhydration (volume expansion)

Three types:

- Isosmotic overhydration
- Hyperosmotic overhydration
- Hyposmotic overhydration

Summary of Disturbances in Fluid Shifts in Health and Disease

Type	Example	ECF volume	ICF volume	osmolarity
Isosmotic volume contraction	-diarrhea -burn	↓	No Change	No Change
Isosmotic volume expansion	-Isotonic NaCl infusion	↑	No Change	No Change
Hyposmotic volume contraction	-aldosterone insufficiency	↓	↑	↓
Hyposmotic volume expansion	-High water intake -SIADH	↑	↑	↓
Hyperosmotic volume contraction	-sweating -fever -diabetes insipidus	↓	↓	↑
Hyperosmotic volume expansion	-High NaCl intake	↑	↓	↑

Thank you