Body Fluids

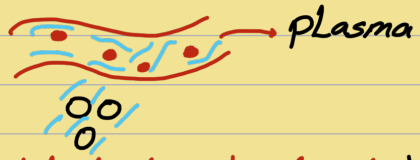
* water → males → 60% TBM
  → females → around 55% TBM
  → (females have more fat)

⟹ fluids are distributed in two major compartments :-

1-) Intracellular fluid compartment (inside cells) = 2/3

2-) Extra cellular fluid compartment (outside cells) = 1/3

- intra vascular (inside vessels) = 20%
  plasma + Lymph



- extra vascular = 80%
  interstitial (between cells)
  transcellular (synovial, pericardial, pleural, peritoneal, ocular)

* Movement of fluids :-
  they aren't static

⟹ certain factors regulated the movement of fluid :-

1-) osmotic pressure → pull
2-) hydrostatic pressure → push

* composition of fluid :-

- ICF (↑K^+, ↑PO_4^{-3}, ↑pro)
- ECF (↑Na^+, ↑Cl^-)

دفعة القدس

- IV ↑pro
- EV ↓pro

* water balance.

water input = water output

water input	water output	
2.5 Liters/day	- urine 60%	sensible
- Drinking 60%	- faces 6%	sensible
- moist food 30%	- sweat 6%	sensible
- metabolism 10%		
	- evaporation from the skin	insensible 28%
	- breathing	insensible 28%

* system that regulate fluids :-

- urinary system
- cardiovascular system (pituitary, parathyroid and adrenal glands)
- endocrine system
- respiratory system

⟹ Dehydration :- excessive loss of water from the body (water without Na^+)
(↓ECF volume, ↑osmolarity ECF, water move from inside the cells towards ECF) → Shrinkage

⟹ Over hydration :- excessive intake of water
(↑ " " , ↓ " " , water move from ECF towards cells) → Swelling (edema)

Measurments of body fluids.

→ Dilutional method.

$C_1V_1 = C_2V_2$

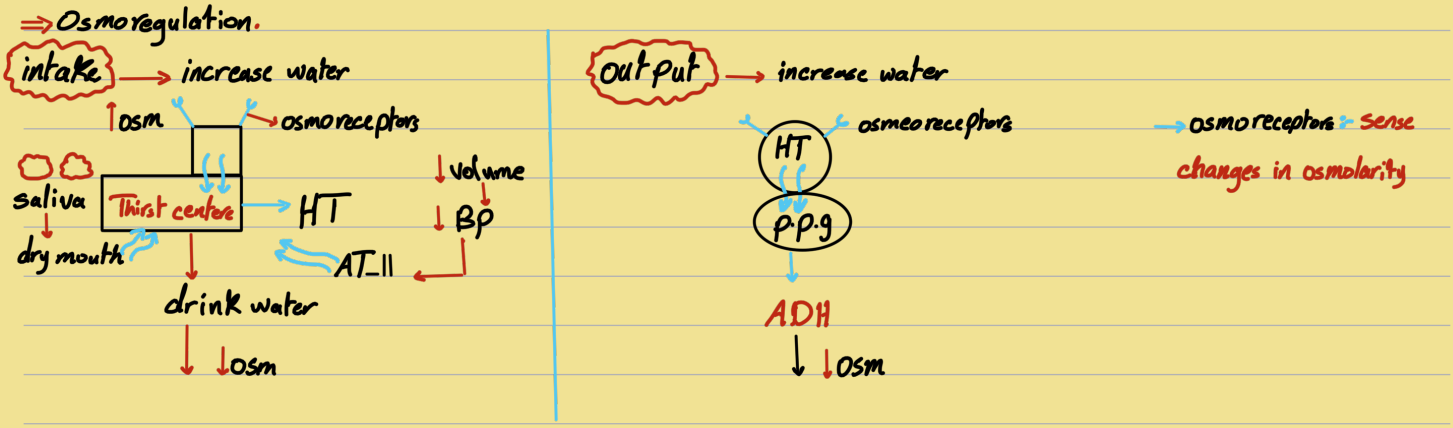
$M_1 = M_2$

→ Dyes we can use:
- non toxic
- rapidly and evenly distributed
- not metabolized and excreted
- easy to measure
- does not affect

1. TBW
   - ^3H_2O, T_2O — radioactive water
   - ^2H_2O, D_2O — heavy water
   - → both are radioactive
   - Antipyrine (it isn't radioactive)
2. ECF
   (Na^+ radioactive, iothalamate, thio sulfate, inuline)
3. ICF
   ICF = TBW − ECF
4. plasma
   (albumin, evans blue)
5. BCV → cr
6. TBV
   plasma / (1 − hematocrit)

Regulatory mechanisms of body fluids:-

⇒ Osmoregulation.



⇒ Regulation of ECF volume.

→ depends on Na excretion in urine and its controlled by RAAS and ANP

1.) RAAS

↓ ECF volume, ↓ BP

↓

Juxtaglomerular cells (in Kidney) release Renin

↓

From liver ← AT_gen

↓ Renin

AT_I

↓ ACE → enzyme produced in lungs

stimulate ← AT_II → causes vasoconstriction

adrenal supernal gland cortex ↑ BP

to secrete Aldosterone → increase reabsorption of Na^+ and secretion K^+ (يسحب Na^+ ويكب K^+)

↓ ↑volume, ↑BP

2.) ANP
- → vasodilation
- → Na excretion → ↓ BP
- → ↓ Angiotensin
- → ↓ Aldosteron

↑ ECF volume

↑ sterchon artia

Disorder.

→ **disorders of volumes**

- hypo volemia (↓ volume)
  - excessive, loss of fluid, diarrhea, vomiting
  - ↓ ADH (diabetes insipidus)
- hyper volemia (↑ volume)
  excessive intake or administration of fluid

→ **disorders of osmolality**

- hypo natremia (↓ osmolality)
  excessive loss of Na^+, administration of fluids
- hyper natremia (↑ osmolality)
  excessive intake of Na^+, " " "

Disorder of volumes and osmolality.

→ hypo natremia
- with dehydration → high loss of water, diarrhea, vomiting
- with over hydration → administration of hypotonic water, ↑ ADH

→ hyper natremia
- " " → Loss of hypotonic fluid, ↓ ADH
- " " → high release of aldosterone, ↑ osmolality and volume

⇒ Edema.

Causes :-

1-) ↑ cap HP.
↑ BP, ↑ venous pressure, vasodilation

2-) ↓ cap OP.
↓ synthesis of protein, ↑ loss of protein

3-) ↓ Lymph drainge.
cancer, surgery, infection, congenital

4-) ↑ permeability

⇒ Safety factors for preventing edema.

1-) low tissue compliance
2-) Lymph flow can increase 10-50 folds
3-) protein wash-down with lymph flow

The End