

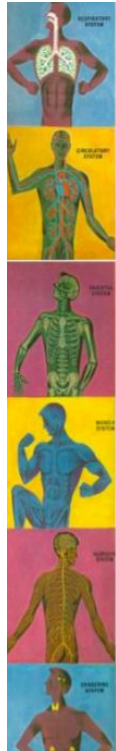
Body fluids

Resources : Dr.maha slides + Guyton and hall medical physiology

• أول قاعدة ضروري تحطونها بأذهانكم : "Inputs = outputs"

Steady state : water intake = water loss

• في حال اختلفت هذه القاعدة تنشأ حالتان :

	Water deficit	Water excess
	<ul style="list-style-type: none">• Input < output.• Leads to:<ul style="list-style-type: none">– Hypovolemia– Dehydration• Physiologic regulation:<ol style="list-style-type: none">1. Activates hypothalamic thirst centre → ↑fluid intake• The hypothalamic thirst centre is activated by:<ul style="list-style-type: none">– ↓ ECF volume (10-15%)– ↑ ECF osmolarity (1-2%)2. ↑ ADH secretion by posterior pituitary → ↑ water reabsorption by the kidney.	<ul style="list-style-type: none">• Input > output• Leads to:<ul style="list-style-type: none">– Hypervolemia.– Edema.• Physiologic regulation:<ol style="list-style-type: none">1. ↓ ADH secretion → ↓ water reabsorption → ↑ water excretion by kidney.2. Decrease thirst

• في حالة الـ **water deficit** :

Input is less than output which leads to **hypovolemia** (a decreased volume of circulating blood in the body) and **dehydration** (A condition caused by the excessive loss of water from the body, which causes a rise in blood sodium levels).

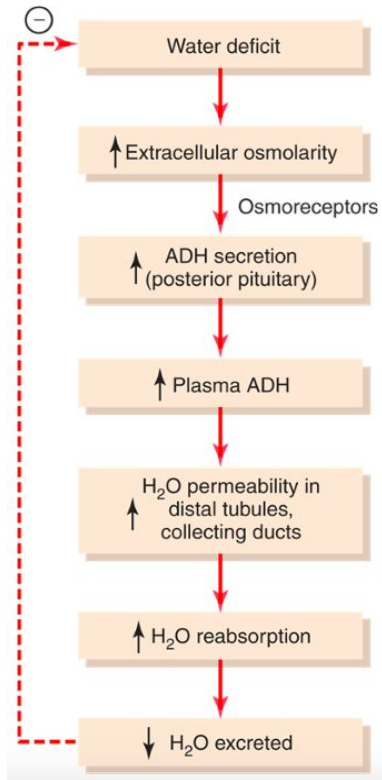
الجسم يبحاول يوازن ويعدل الخلل عن طريق :

١- بما أن الجسم صار في حالة جفاف وقل مستوى السوائل هنا بيزيد تركيز الصوديوم مما يحفز مراكز في الدماغ تؤدي إلى شعور الإنسان بالعطش بالتالي شربه للماء بالتالي تخفيف مستويات الصوديوم.

تخيلوا إن عندنا كوبين أحدهما تركيز السكر فيه قليل (مما يعني إنه محلول مخفف) والثاني تركيز السكر فيه عالي (محلول مركز والماء فيه قليل) المحلول المركز يمثل هذه الحالة لكن عوضاً عن السكر هنا عندنا صوديوم.. قل الماء بالجسم فزاد تركيز الصوديوم

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٢- إفراز هرمون مثل ADH :

An increase in extracellular fluid osmolarity (which in practical terms means an increase in plasma sodium concentration) **ADH** enters the bloodstream and is transported to the kidneys, where it increases the water permeability of the late distal tubules, cortical collecting tubules, and medullary collecting ducts."Guyton"

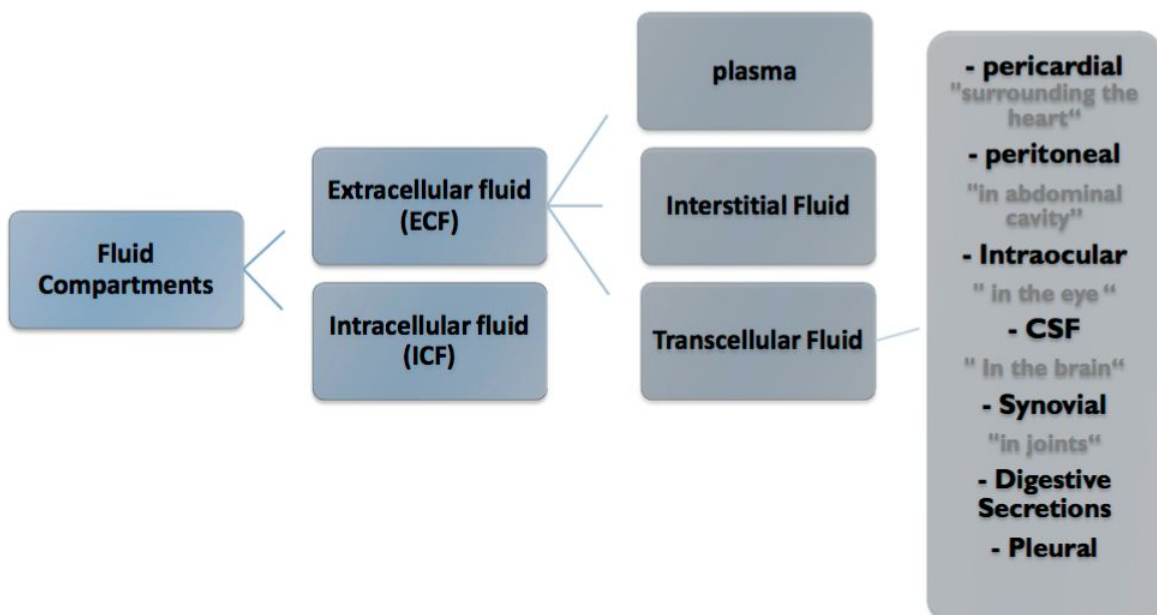
الخلاصة :

هذا الهرمون يساعد على الاحتفاظ بسوائل الجسم قدر المستطاع وتقليل خروجها عبر البول.

(الصورة من قايتون لتوضيح دور الهرمون)

- **الحالة الثانية (العكس) :** إذا زاد تركيز السوائل بيقل تركيز الصوديوم (كأنه محلول مخفف) بالتالي ينشط تأثير الهرمون < نقل إعادة امتصاص السوائل < يزيد إخراج السوائل عن طريق البول.

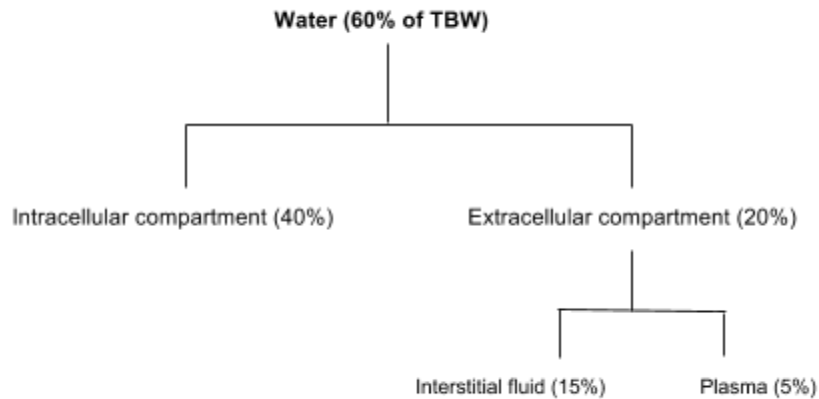
• Body fluid compartment :



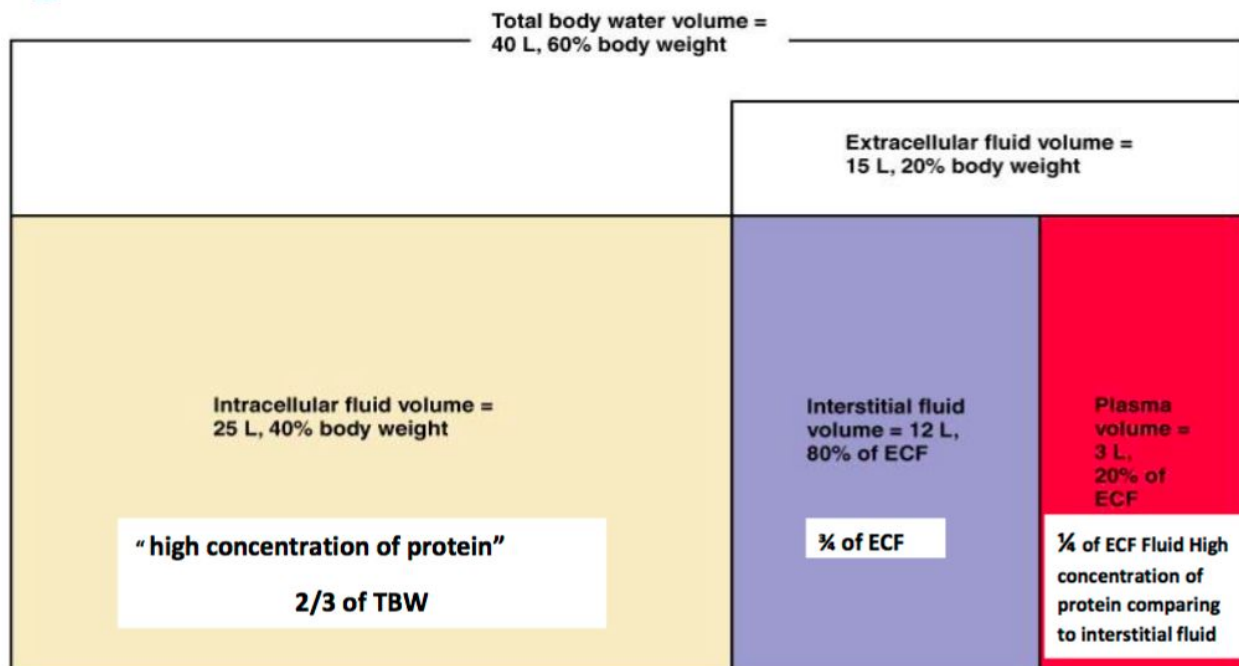
Body fluids

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Water occupies **60%** of TBW (**60%** = **40%** "Intracellular" + **20%** "Extracellular")



صورة ممكن تلخص لكم الفكرة :



Body fluids

Resources : Dr.maha slides + Guyton and hall medical physiology

هذه الصورة تلخص أكثر من سلايد بمحاضرتكم : (من قايئون)

Body Fluid Compartments

The total body **fluid** is distributed mainly between two compartments: the *extracellular fluid* and the *intracellular fluid* (Figure 25-1). The extracellular **fluid** is divided into the *interstitial fluid* and the blood *plasma*.

There is another small compartment of **fluid** that is referred to as *transcellular fluid*. This compartment includes **fluid** in the synovial, peritoneal, pericardial, and intraocular spaces, as well as the cerebrospinal **fluid**; it is usually considered to be a specialized type of extracellular **fluid**, although in some cases its composition may differ markedly from that of the plasma or interstitial **fluid**. All the transcellular **fluids** together constitute about 1 to 2 liters.

In the average 70-kilogram adult man, the total body water is about 60 percent of the body weight, or about 42 liters. This percentage can change, depending on age, gender, and degree of obesity. As a person grows older, the percentage of total body weight that is **fluid** gradually decreases. This is due in part to the fact that aging is usually associated with an increased percentage of the body weight being fat, which decreases the percentage of water in the body.

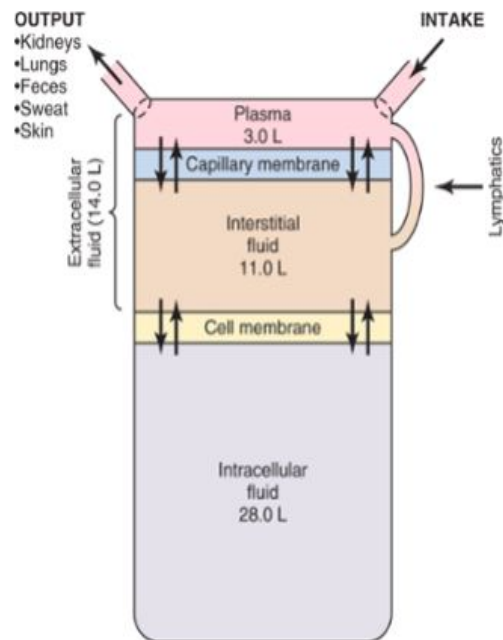


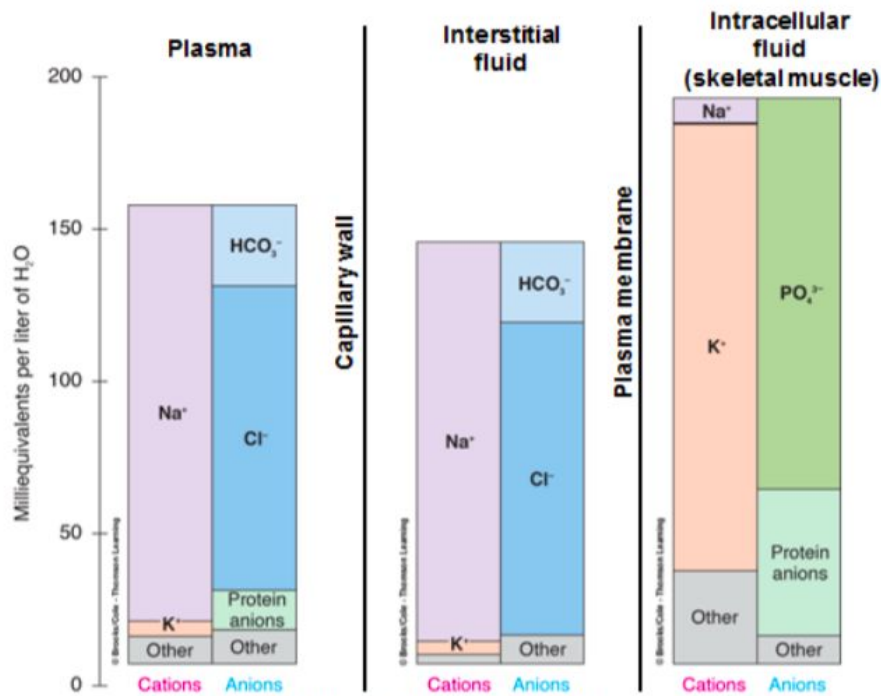
Figure 25-1 Summary of body fluid regulation, including the major body fluid compartments and the...

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Does the composition of the different differ?



[Figure 15-2; Sherwood]

الفكرة الأساسية من السلايد هي توضيح الأيونات الرئيسية في كل كومبارتمنت، وكلكم عارفين إن الأيونات (كاتيون "+") & أنيون "-" (ضروري جداً جداً تعرفون التالي : "تحفظونه زي أسماءكم، هذي أساسيات بتسألون عنها حتى في آخر بلوك"

- **Intracellular compartment :**

The **main** cation here (+) is **Potassium "K⁺"** while the **main** Anion (-) is **Phosphate "PO₄⁻"**.

- **Extracellular compartment :**

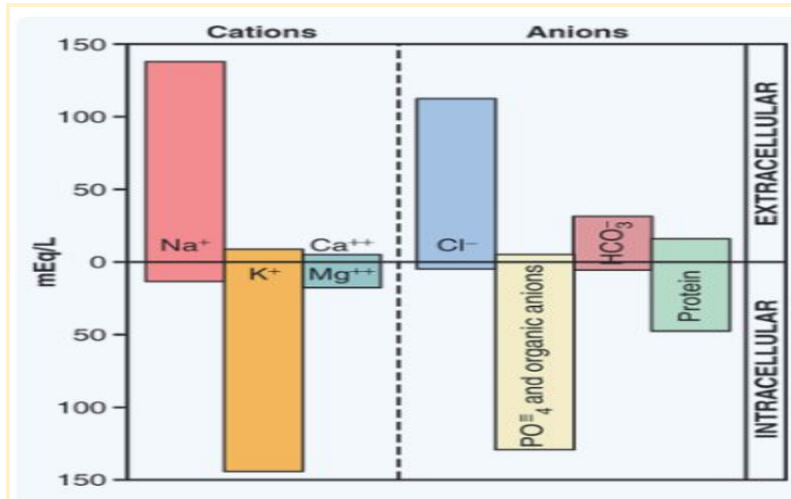
The **main** cation here (+) is **Sodium "Na⁺"** while the **main** Anion (-) is **Chloride "Cl⁻"**.

- ECFs are constantly mixing and have the same composition except for **proteins** : **Plasma** has high concentration of protein comparing to interstitial fluid.

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صورة من قايئون توضح الفروقات :



• Osmolarity :

It measures how concentrated or diluted a solution is = the number of osmoles of a solute per litre of solution.

تتذكرون مثال السكر اللي ذكرناه بالبداية والمحلول المخفف & المركز ؟ الخاصية اللي تحدد مقدار التركيز تسمى اوزمولاريته.

- **High osmolarity** = High concentration of **solute** = Low concentration of **water**.
- **Low osmolarity** = Low concentration of **solute** = High concentration of **water**.



What happens to the different compartments with the administration of IV fluids?

Adding **hypertonic** solution

- ↑ ECF osmolarity
- Water moves out of cells into ECF.
- ICF volume decreases.
- ECF volume increases.
- ↑ ICF osmolarity

Adding **isotonic** solution

- No change in ECF osmolarity.
- No osmosis occurs through cell membrane.
- ECF volume increases.


Adding **hypotonic** solution

?
Activity


Body fluids

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بالنسبة لصورة السلايد السابق، هنا عدة صور من تيمنا بتساعدكم في الفهم بإذن الله :



Volume contraction (removing)



Volume contraction
"decrease in the ECF volume"

Loss of isotonic solution <small>e.g. Diarrhea</small>	<ul style="list-style-type: none"> - Stable osmolarity. (osmolarity of fluid lost \approx osmolarity of ECF) - Decrease in ECF volume. ↓ - Decrease in arterial pressure ↓
Loss of hypotonic solution <small>dehydration or water deprivation</small>	<ul style="list-style-type: none"> - Increase Osmolarity in both ECF and ICF. ↑ - Decrease volume in both ECF and ICF. ↓
Loss of Hypertonic solution <small>e.g. Adrenal Insufficiency</small>	<ul style="list-style-type: none"> - Decrease Na⁺ in the ECF. ↓ - Decrease osmolarity in both. ↓ - Decrease in ECF volume. ↓ - Increase in ICF volume ↑

Volume Expansion
"Increase in the ECF volume"

Adding of isotonic solution <small>e.g. infusion of isotonic NaCl</small>	<ul style="list-style-type: none"> - No change in Osmolarity. - Increase in ECF volume. ↑ - Isosmotic "isotonic" expansion .
Adding of hypotonic Solution <small>e.g. syndrome of inappropriate anti diuretic hormone(SIADH).</small>	<ul style="list-style-type: none"> - Decrease in both ECF and ICF Osmolarity. ↓ - Increase in both ECF and ICF volume. ↑
Adding of Hypertonic solution <small>e.g. high NaCl intake</small>	<ul style="list-style-type: none"> - Increase in both ECF and ICF Osmolarity. ↑ - Increase in ECF volume. ↑ - Decrease in ICF volume. ↓ - Hyperosmotic volume expansion.

طريقة للربط (ماراح تنسونها إذا ربطتوها بهالشكل) :

http://ksumsc.com/download_center/Archive/1st/435/1.%20Foundation%20Block/435%20Team%20work/Physiology/Summary%20of%20Homeostasis%202.pdf

Body fluids

Resources : Dr.maha slides + Guyton and hall medical physiology

إذا عرفتموا حل اللغز ؟ (الاستفهام الموجود في السلايد)

What happens during **adding** of isotonic solution :

- No change in osmolarity.
- Increase in ECF **volume**.

(It only increases the volume of ECF but it does not change the osmolarity or the ICF volume).

★ **Helpful videos :**

[Homeostasis of Extracellular Fluid](#)

[An amazing explanation of Isotonic, Hypotonic, Hypertonic IV Solutions](#)

أتمنى إنني شملت أغلب نقاط محاضرتكم ووضحتها بشكل جيد، شرحتها بناءً على طلب أحد زميلاتكم
أي استفسار بخصوص المحتوى / أي نقطة ما فهمتها اسألوني عنها : <http://ask.fm/khwla>
بالتوفيق جميعاً ولا تنسوني من دعواتكم :