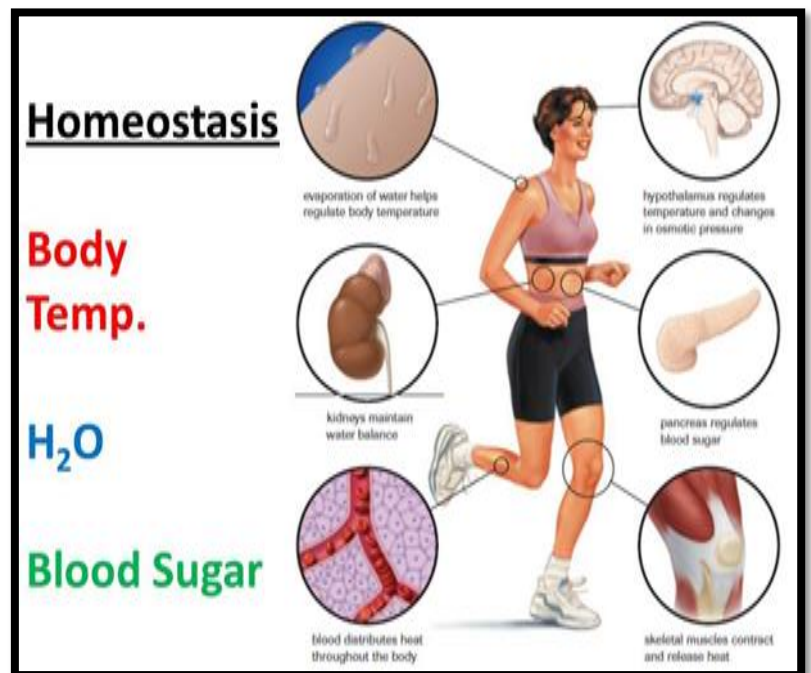
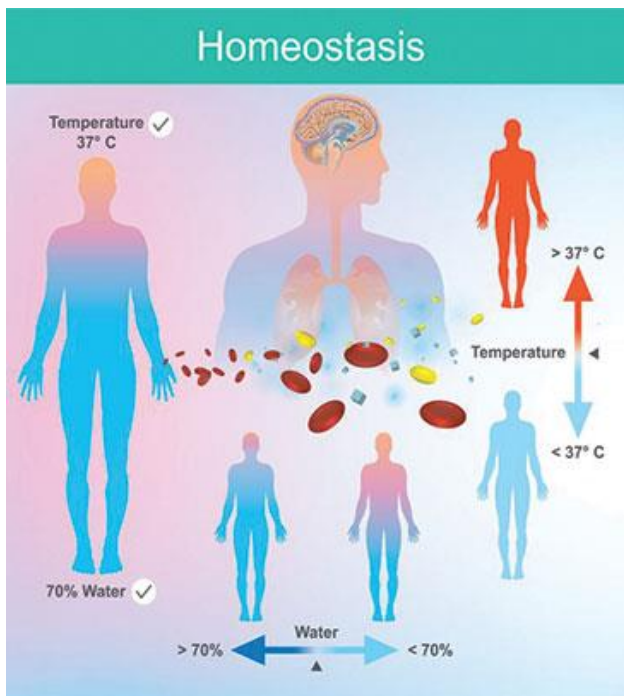




Homeostasis

The investigation that the enzyme systems and metabolic processes responsible for the maintenance of cellular function are dependent on an environment with stable electrolyte and hydrogen ion concentrations are referred to as **homeostasis**. A characteristic of a system that regulates its internal environment and tends to maintain a stable, relatively constant, condition of properties.

There are several examples of homeostasis. For example, our concentration of salts and glucose (sugar) is constant; our body temperature is usually around 37 degrees Celsius (98.6 degrees Fahrenheit); the amount of blood in our bodies is about 5 liters.





Department of Anesthesia Techniques
Title of the lecture:- Homeostasis

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Homeostatic Imbalance

Disturbance of homeostasis (body's normal equilibrium) caused by :

1. Diseases
2. Anesthesia

Which cause :

- a. Fluid- electrolytes imbalance
- b. Acid-base disturbance
- c. Metabolic disturbance

Body Fluids

Body Fluids are divided into :

1. The intracellular fluid (ICF) which exists inside the cells accounts for a 60% bwt.
2. Extracellular fluid (ECF): Cells exist in it account for 40% bwt . From which, they take up O₂ and nutrients into it, they discharge Metabolic waste products.

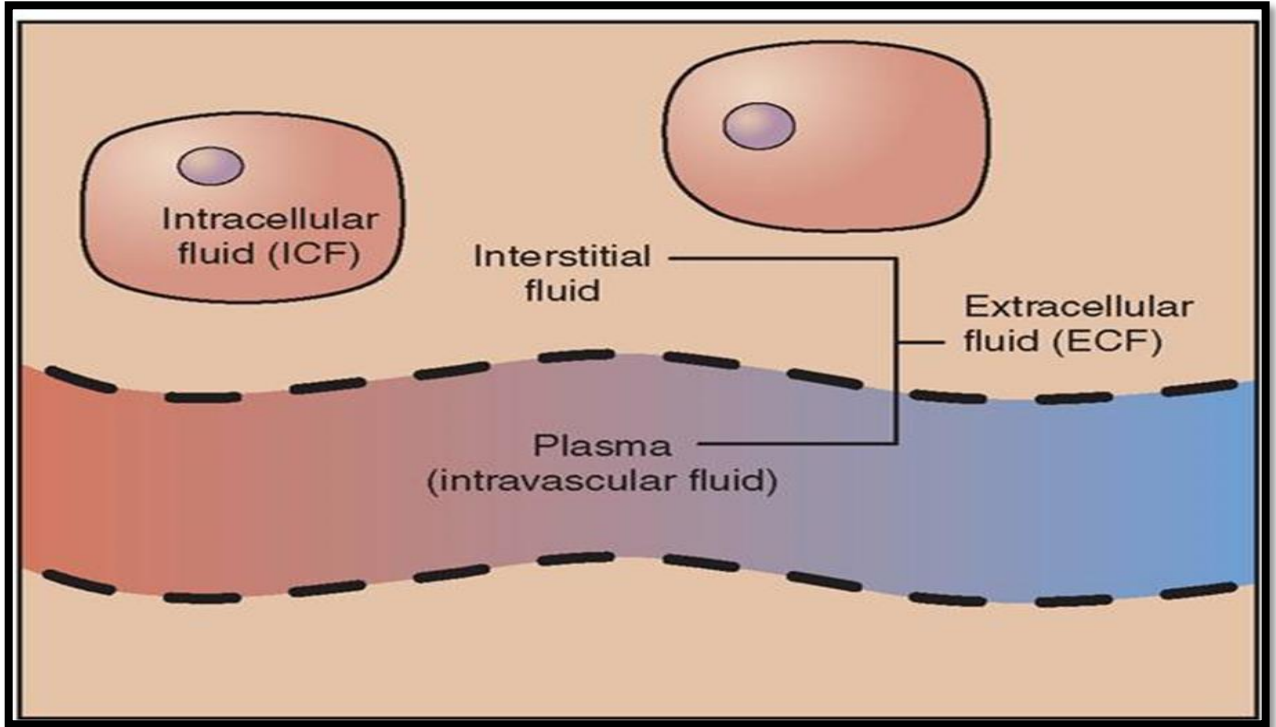
The ECF is divided into four components :

- a. The interstitial fluid : the part of ECF outside the vascular system ,bathing the cells .
- b. The circulating blood plasma. Plasma and the cellular elements of the blood which fill the vascular system .
- c. Lymph: is a collection of the extra fluid that drains from cells and tissues plus other substances.
- d. Transcellular fluid: A body fluid that is not inside cells but is separated from plasma and interstitial fluid by cellular barriers.

*Plasma and interstitial fluid are the two components that make up at least 97% of the ECF. Lymph makes up a small percentage of the interstitial fluid. The remaining small portion of the ECF includes the transcellular fluid.

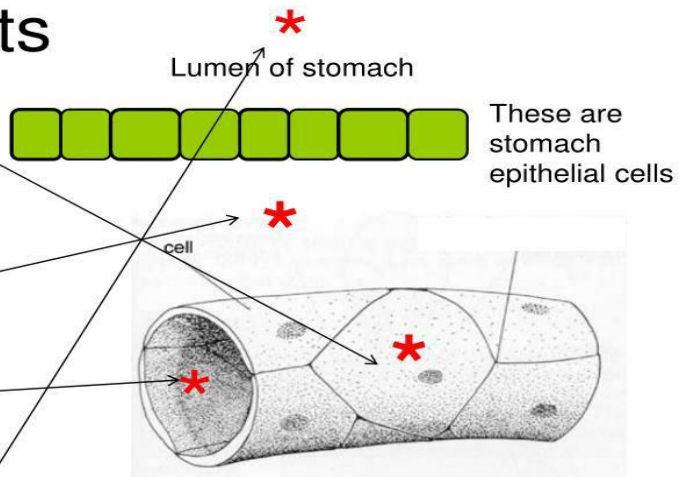
*1/3 of total body water is extracellular .

*the remaining 2/3 is intracellular fluid.



Compartments

- **Intracellular Fluid** (60% Body Wt)
- **Extracellular Fluid**
 - **Interstitial fluid** (the water immediately outside cells, between and around cells) (30%)
 - **Plasma fluid** (the water inside blood vessels, but not in blood cells) (9%)
 - **Transcellular fluid** (the water enclosed in chambers lined by epithelial membranes) (1%)

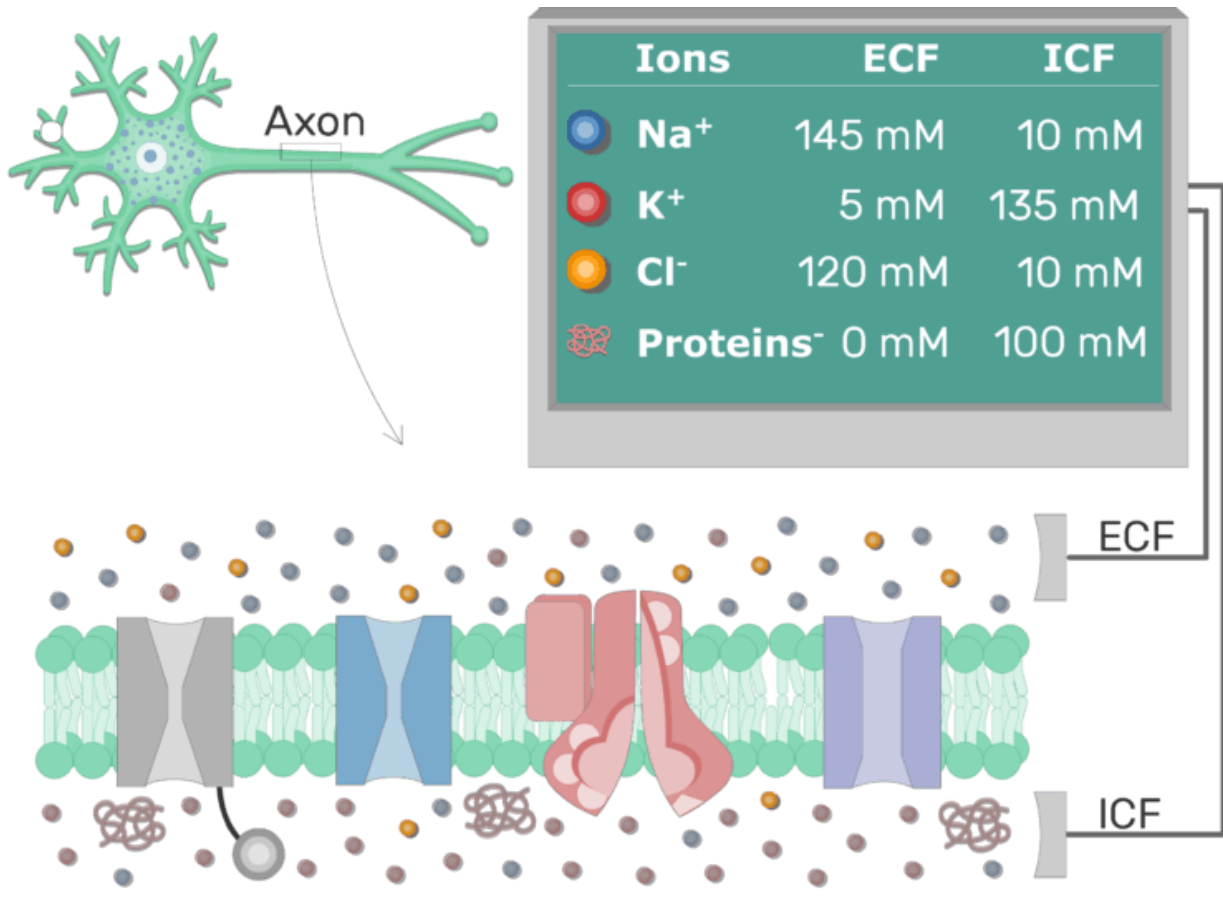




Differences Between Extracellular and Intracellular Fluids

The extracellular fluid contains large amounts of

- Sodium, chloride, and bicarbonate ions
 - Nutrients for the cells, such as glucose, fatty acids, and amino acids .
 - Oxygen & Carbon dioxide gasses
 - Cellular waste products
- The intracellular fluid contains :
- Large amounts of potassium, magnesium, and phosphate ions.





Water balance

The principal sources of body water are:

- (1) ingested water
- (2) water produced as an end-product of metabolism.

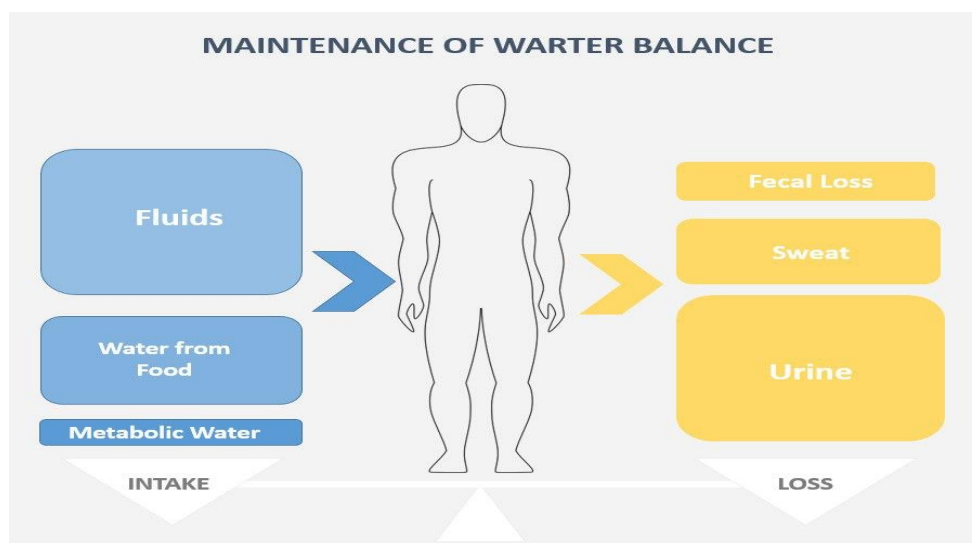
Water losses are classified as:

- 1) sensible: from the kidneys and gastrointestinal tract.
- 2) insensible losses: from the skin and lung

- Normal balance is maintained with intake and losses of 2.5—3 litres per day .
- Intake from ingested fluid (1300 ml), solid food(800) ml) and metabolic waste (400 ml).

This is balanced by insensible fluid losses of 0.5 ml kg-1 h-1 (850 ml) from skin and lungs; plus losses from urine (1500 ml) and faeces (100 ml)

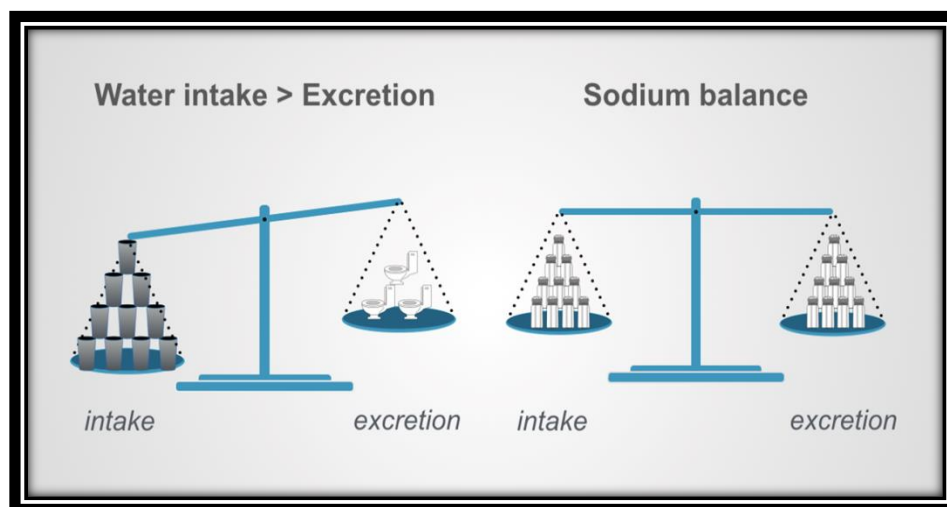
These values are in health, normo-thermia & rest.





Sodium Balance

- ✓ Sodium balance is related to ECF volume and water balance .
Daily ingestion has a range (50—300 mmol) .
- ✓ It is regulated by the kidneys depending on :
 - a. Glomerular Filtration Rate (GFR) .
 - b. Sympathetic tone and Renin-Angiotensin system (Stimulation of Aldosterone secretion)
 - c. ADH and Aldosterone Hormones (Retention of Na^+ & Excreting of K^+)



Na⁺ Imbalance

- Sodium, must be tightly regulated to avoid osmosis and cell damage.
- The renal system maintains ECF volume by regulating sodium and osmotic concentration by retaining or excreting water.
- Measurement of urine and plasma osmolalities helps in diagnosing electrolyte disturbances.
 - ❖ (Normal Plasma osmolality ranges from 280 to 295 mOmol / litre).

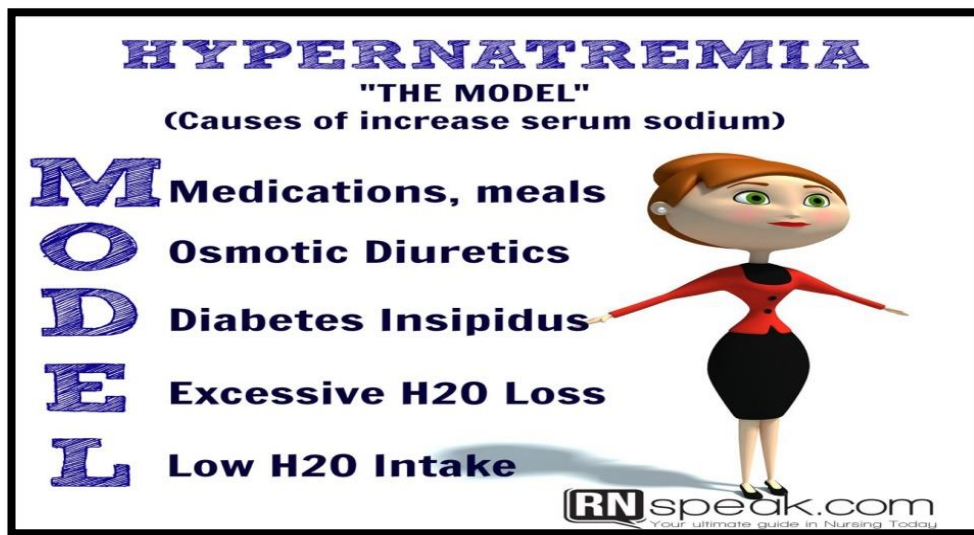


Hypernatraemia & Hyponatraemia

Hypernatraemia:

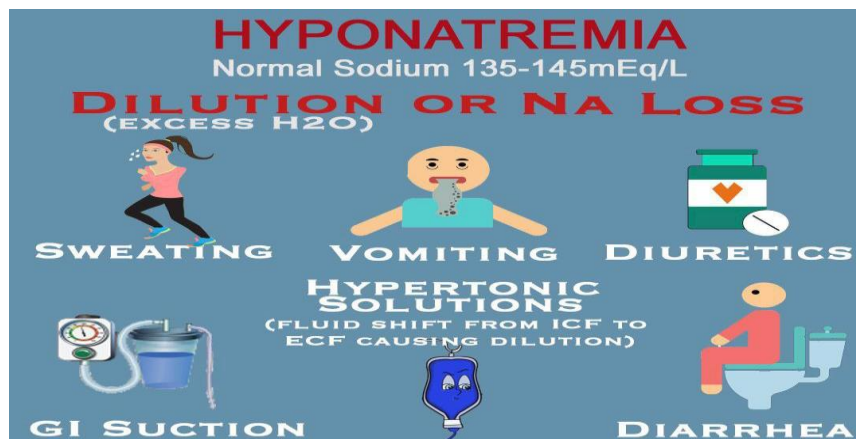
Leads to pyrexia (fever), nausea, vomiting, convulsions, coma and focal neurological signs.

Correction is advisable over 48—72 h with 5% dextrose.



Hyponatraemia:

symptoms depend on the cause, magnitude and pidity. the aim of treatment is to raise plasma Na⁺ concentration to 125 mmol per litre gradually over a period of no less than 12 h while treating the underlying cause.





Impact of Anesthesia

Understanding basic fluid and electrolyte physiology is essential to good perioperative fluid management .

Anesthesia and critical care patients are often fasted and under physiological stress. Therefore, homoeostatic regulation of fluid balance is impaired .

A disturbance in normal fluid balance induces a physiological 'stress' response via :

1. Metabolic
 2. Neuroendocrine
 3. Immune-mediated systems
- The characteristic response to anesthesia and surgery is sodium and water retention .

Excess ADH secretion in the postoperative period is largel in response to hypovolaemia.