

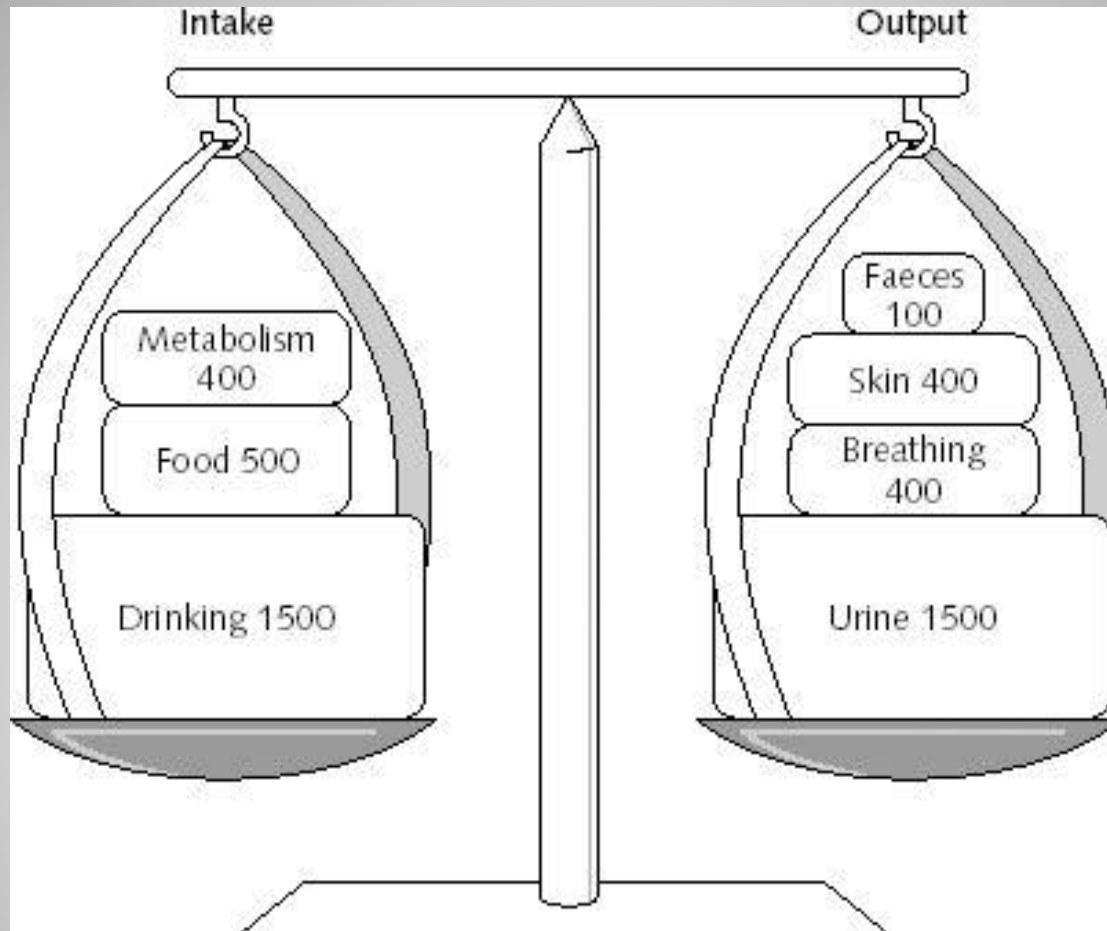
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# Ions in the body & Fluids

# Introduction

- **Electrolytes:** Are minerals in your body that have an electric charge. They are in blood, urine and body fluids. Maintaining the right balance of electrolytes helps your body's blood chemistry, muscle action and other processes.
- **Electrolytes :** An element or compound that, when melted or dissolved in water or another solvent, dissociates into ions and is able to conduct an electric current.

- ✓ Levels of electrolytes in our bodies can become too low or too high. That can happen when the amount of water in your body changes, causing dehydration or over-hydration. Causes include some medicines, vomiting, diarrhea, sweating or kidney problems.
  
- ▶ **Fluid balance**
  - The amount of water gained each day equals the amount lost.
  
- ▶ **Electrolyte balance**
  - The ion gain each day equals the ion loss.
  
- ▶ **Acid-base balance**
  - H<sup>+</sup> gain is offset by their loss.



**Balance between typical fluid intake and output in a 70 kg adult.  
(Values are ml per 24 hours.)**

- **These electrolytes are involved in metabolic activities and are essential to the normal function of all cells.**

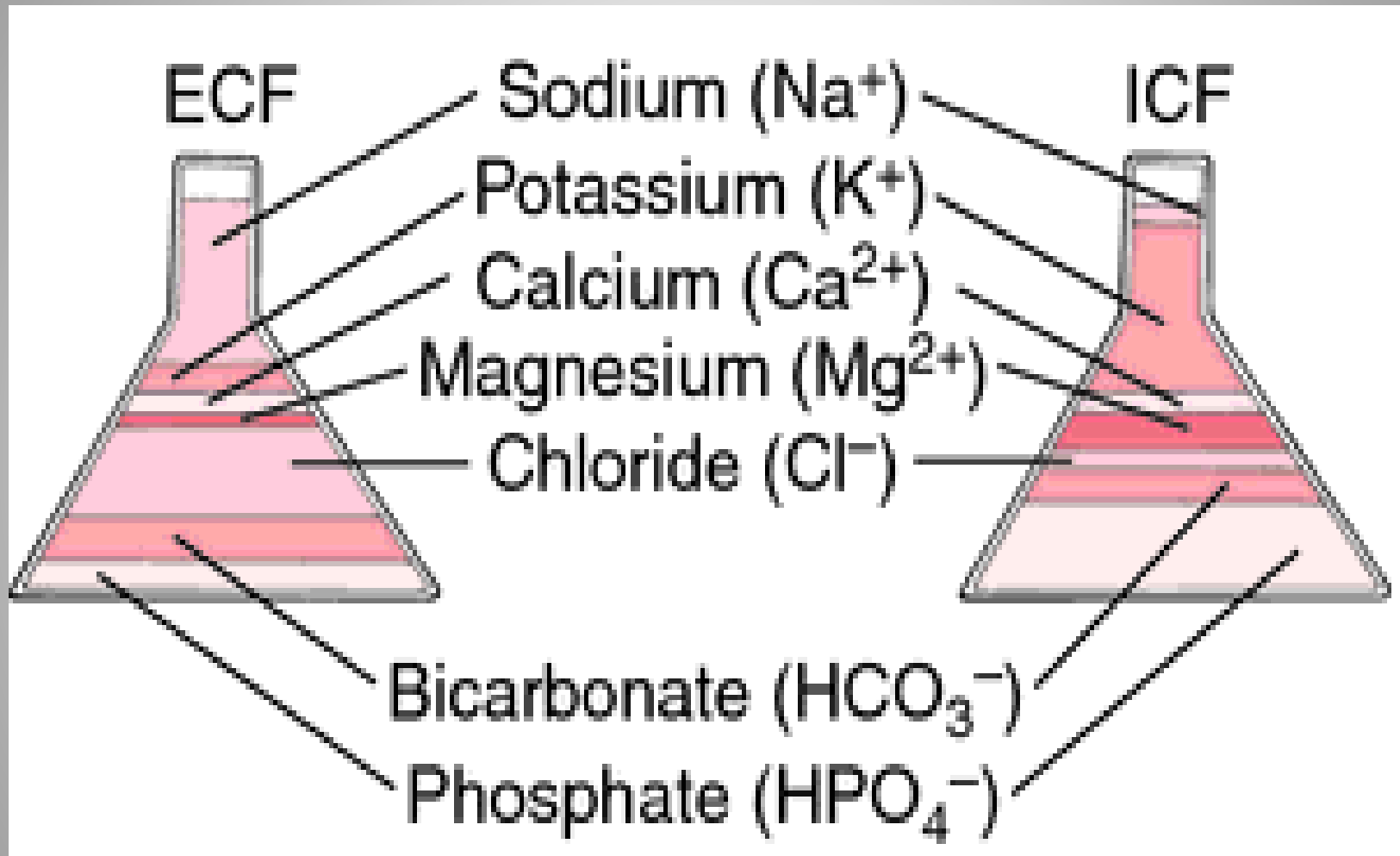
# Factors that affect body fluids are:

- **Age. (80% Baby, 60% Adult, 40% aged client)**
- **Gender.**
- **Body fat content.**

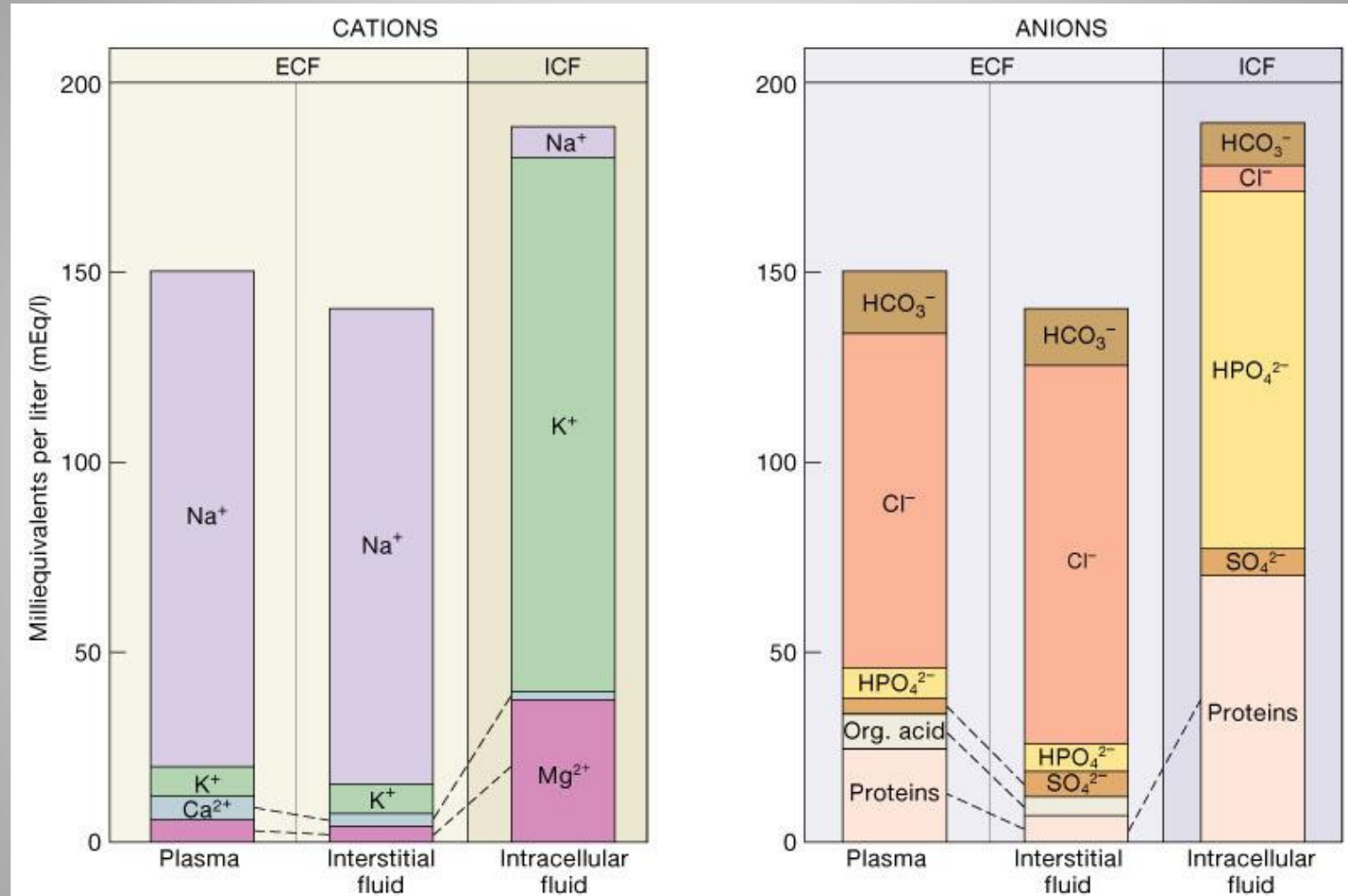
# The ECF and the ICF are two distinct fluid compartment

- ▶ **Intracellular Fluids(ICF): All fluids inside cells.**
  - The cytosol of cells Makes up about two-thirds of the total body water. ( $2/3 \approx 66\%$ )
- ▶ **Extracellular Fluids (ECF) : All fluids outside cells.**
  - ✓ Major components include the interstitial fluid. (between,  $\approx 25\%$ ).
  - ✓ Plasma (Intravascular fluids= inside). ( $\approx 5-8\%$ )
  - ✓ Minor components include all other extracellular fluids, respiratory, urinary tracts. 1-2%





# Cations and Anions in Body Fluids



**Intracellular fluid (ICF) inside cells About 2/3 of body fluid**  
**Extracellular fluid (ECF) outside cells**  
**Interstitial fluid between cell is 80% of ECF**

# COMPOSITION OF BODY FLUIDS

The fluids circulating throughout the body in extracellular and intracellular fluid spaces contain

1. Electrolytes
2. Minerals
3. Cells

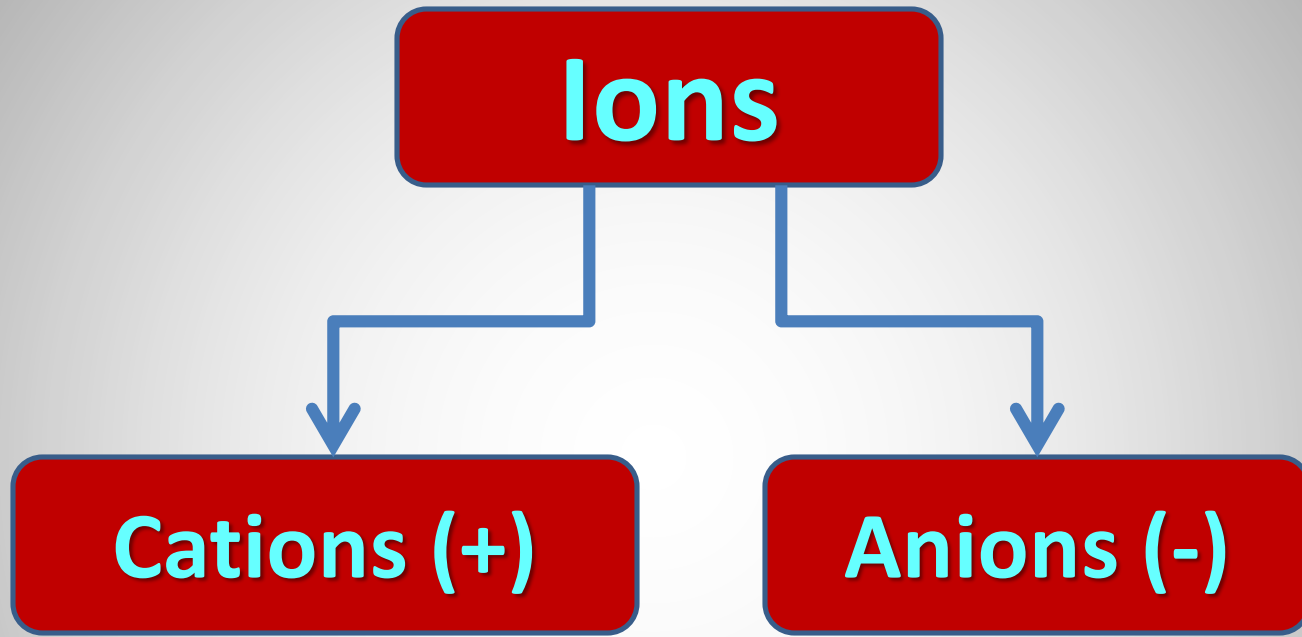
# COMPOSITION OF BODY FLUIDS

- **Water.**
- **Non electrolytes.**
  - \* Do not dissociate.
  - \* Mostly organic molecules.
  - \* Do not contribute in osmotic activity.
- **Electrolytes.**
  - \* Dissociate (ionic bonds).
  - \* Charged particles. (electricity).
  - \* Responsible for osmotic activity.

- **Water moves between ICF & ECF which end to change in solute concentration.**
- **The exchange is regulated by hydrostatic & osmotic pressure.**
- **Changes of solute concentration in any compartment affect water flow.**

- **Osmosis**: Is the net movement of water from an area of low solute concentration to an area of higher solute concentration across a semi-permeable membrane.
- **Diffusion**: Is the net movement of solute from an area of high solute concentration to an area of lower solute concentration.
- **Excretion** is any process which gets rid of unwanted metabolic products. This includes carbon dioxide, in the air we breathe out; nitrogen and salts in sweat; urine; bile pigments in fecal; hair and nails can also be considered excretion
- The main organs concerned with excretion in the body are the **kidneys**

- **Isotonic:** The solutions being compared have equal concentration of solutes.
- **Hypertonic:** The solution with the higher concentration of solutes.
- **Hypotonic:** The solution with the lower concentration of solutes.





- Most common cations and anions in the living system are:

Cations	Anions
$\text{Na}^+$	$\text{Cl}^-$
$\text{K}^+$	$\text{H}_2\text{PO}_4^-$
$\text{Mg}^{+2}$	$\text{HPO}_4_2^-$
$\text{Ca}^{+2}$	$\text{HCO}_3^-$
$\text{Fe}^{+2}$	--
$\text{Fe}^{+3}$	--

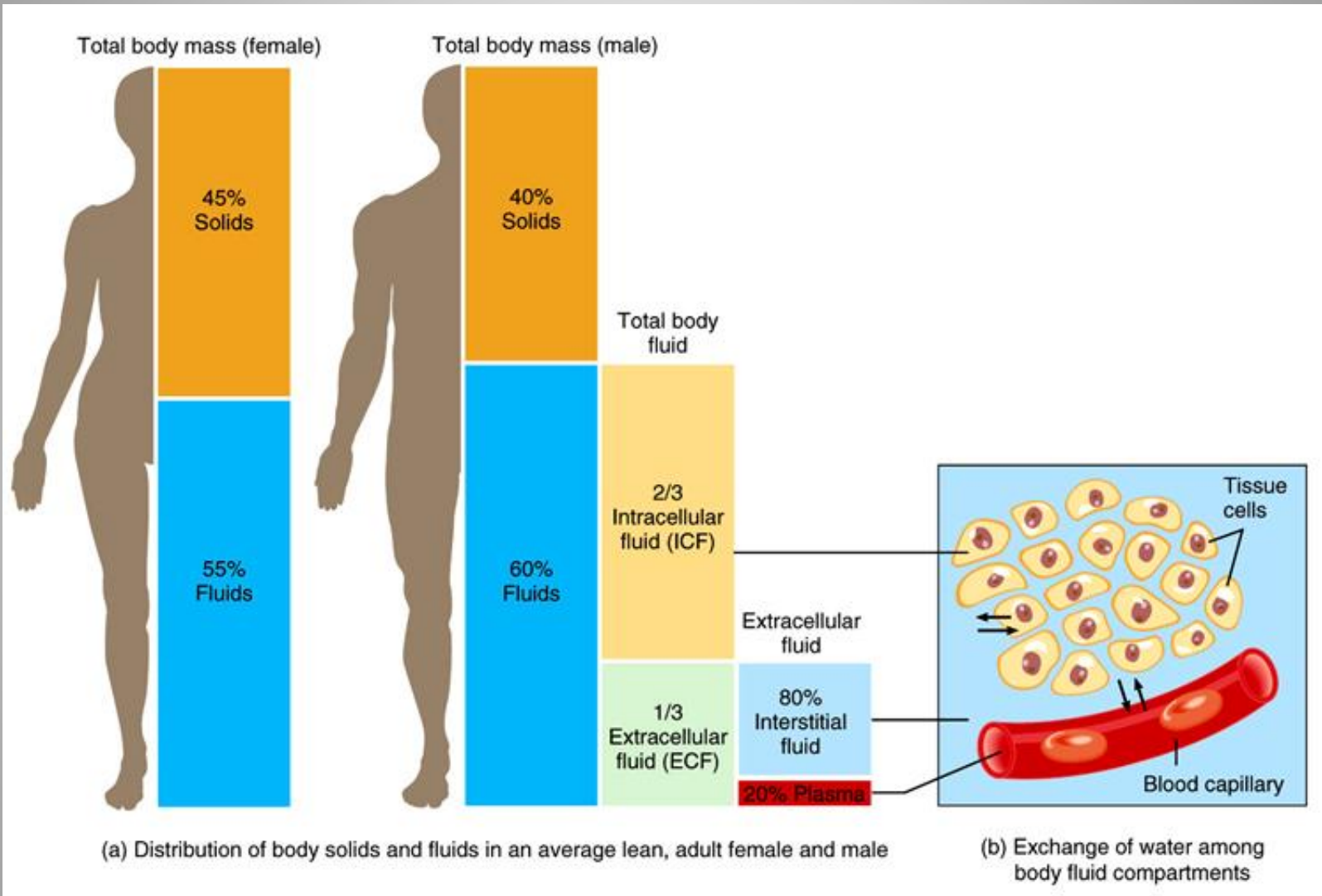
# Electrolytes in Body Fluids

- Calcium is the most abundant mineral in the body. Calcium salts are structural components of bones and teeth.  $\text{Ca}^{+2}$  which are primarily extracellular cations, function in blood clotting, neurotransmitter release, and contraction of muscle.  $\text{Ca}^{+2}$  level is controlled by parathyroid and calcitrol.
- In general, imbalances in calcium concentrations affect the bones, kidney and gastrointestinal tract. Calcium also influences the permeability of cell membranes and thereby regulates neuromuscular activity.

- **Sodium affects the osmolality of blood and therefore influences blood volume and pressure and the retention or loss of interstitial fluid.**
- **Potassium affects muscular activities, notably those of the heart, intestines and respiratory tract, and also affects neural stimulation of the skeletal muscles.**
- **Mg<sup>+2</sup> ions -intracellular cations that act as cofactors for enzymes.**

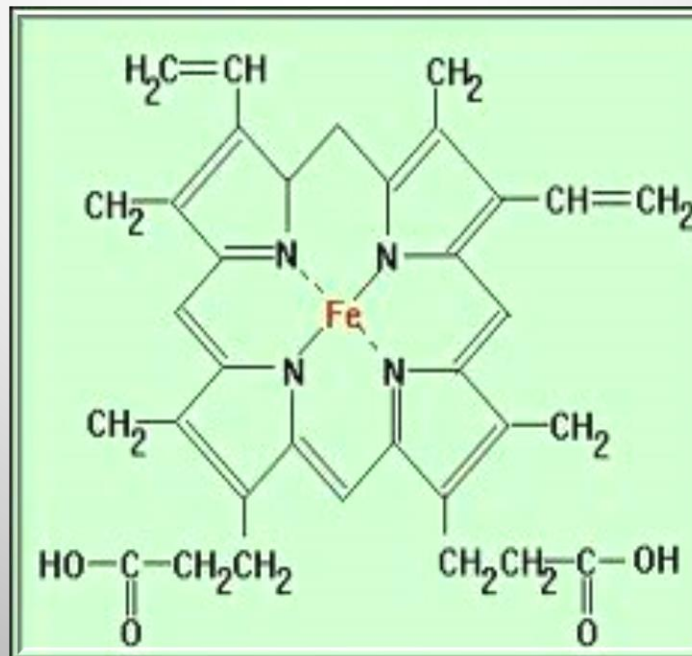
- **Phosphate ions are principally intracellular anions and their salts are structural components of bones and teeth, also required for the synthesis of nucleic acids and ATP and participate in buffer reactions. Level is controlled by PTH and calcitrol.**

# Body Fluid Compartments

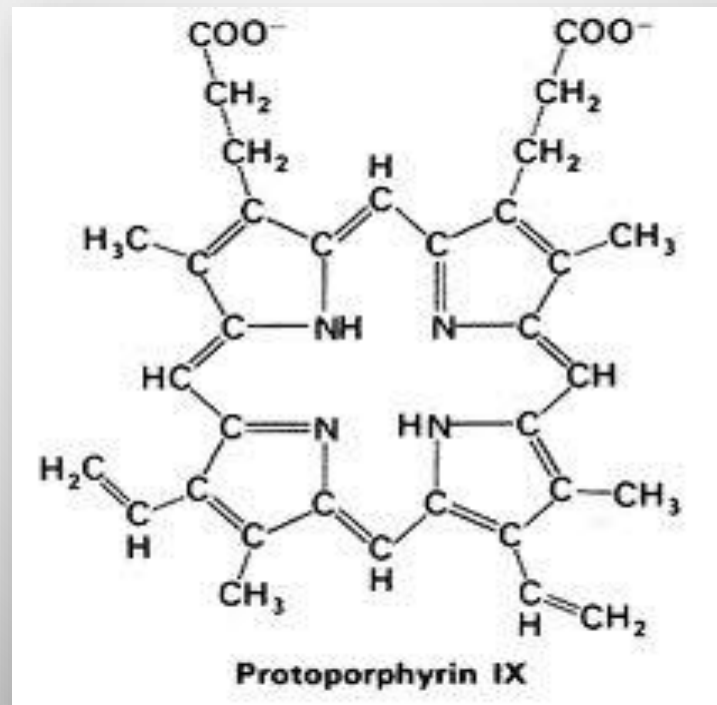


**In adults, body fluids constitute 55% of female and 60% of male total body mass**

- A traces of certain metallic cations are needed to maintain life, like presence of ferrous ion  $\text{Fe}^{+2}$  in hemoglobin which play important role in transport of oxygen and carbon dioxide:



- The metallic ions exist as a complex ion (central metal ion or more surrounded by the molecule), the molecule usually contains nitrogen, oxygen, sulfur that can form coordination bonds with the central metal ion





- **Pb<sup>+2</sup> have toxic effect to kidney and also cause nerve damage, while Hg<sup>+2</sup> cause damage to brain and nerve system, the toxicity is due to reaction with molecule sulfur with the ion which cause molecule to be disrupted**



*Thank you*