

**Al-Mamoon University College**

**Human Physiology**

Medical lab Tech

Second stage

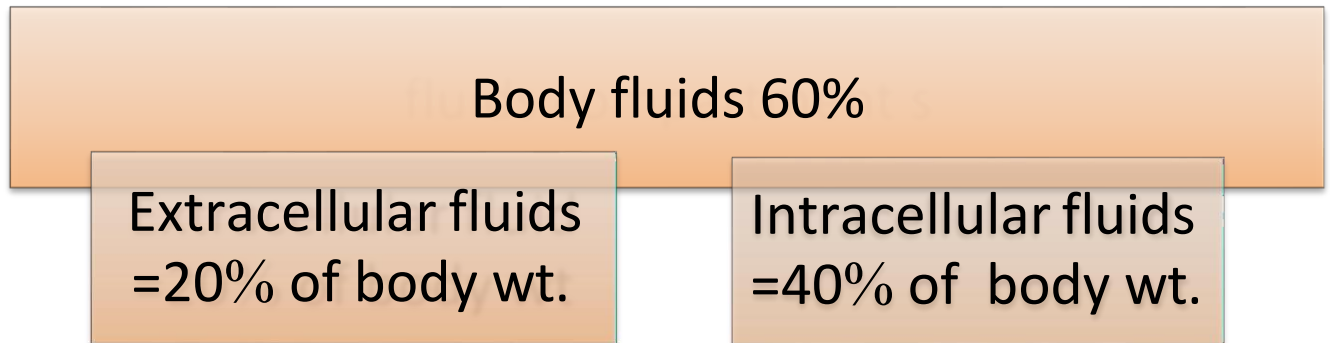
**2024/2025**

**Lecture 2**

# Body fluids

## Body fluids:

- Cells exist in an extra-cellular fluid (**ECF**), sometimes called (**external environment**), from this fluid the cells take up oxygen and nutrients and they discharge metabolic waste products.
- **Solutions** play a big role in physiology. **Solutions** are a mixture of **solvent** (usually water in biology) and **solutes** (ions, proteins, glucose and other nutrients, oxygen and CO<sub>2</sub>).
- **Fluid compartment  $\approx$  60% of body weight.**



Extracellular fluid → outside the cell

Intracellular fluid → inside the cell

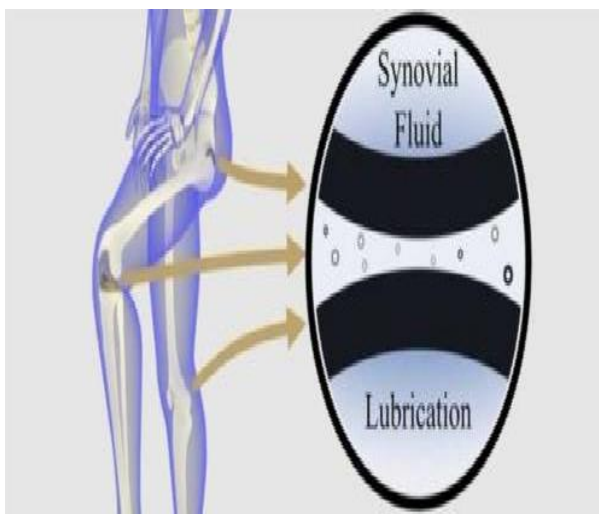
Wt. → Weight

Extracellular fluid (ECF) includes:

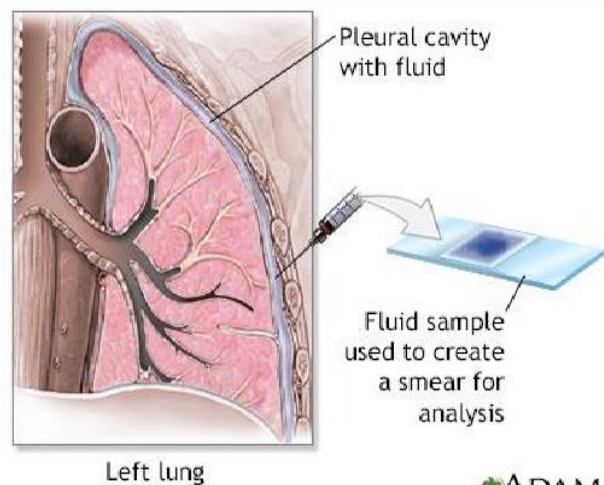
- Plasma 5% of body wt.
- Interstitial fluid (IF) 15% of body wt.
- Transcellular fluid.

**Extracellular fluid divide into three compartments:**

1. **Plasma**: fluid inside the vessel which different from blood by being without blood element (RBC, WBC, Platelets).
2. **Interstitial fluid**: It is fluid between the cells which is similar in composition to plasma but without proteins.
3. **Transcellular fluid**: It is another small compartment of extracellular fluid it includes (CSF), digestion secretion, synovial fluid, intraocular, pleural, and pericardial). Transcellular fluid constitutes about 1-2 liters.

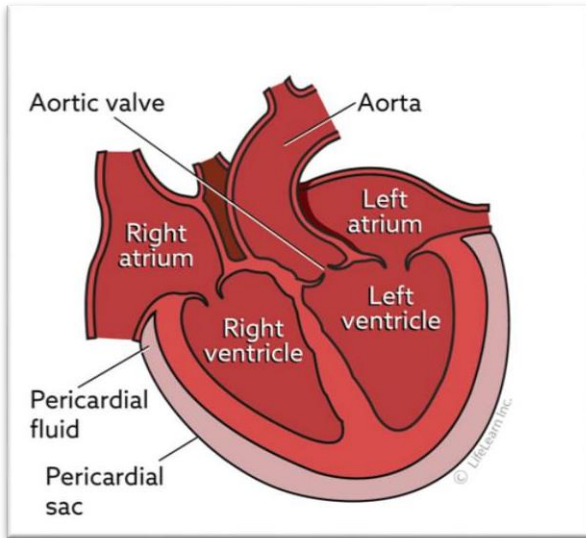


Synovial fluid

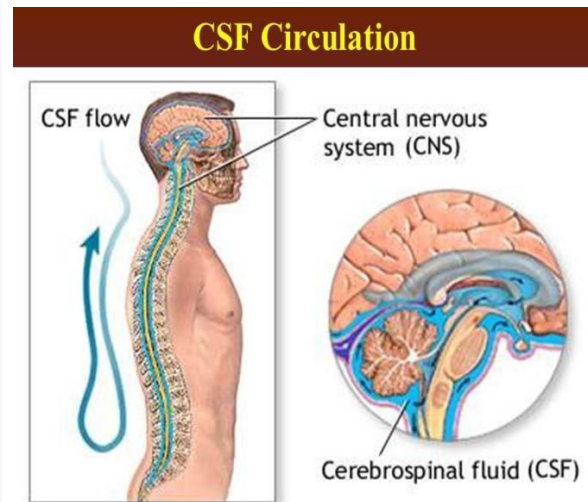


pleural fluid

ADAM.



Pericardial fluid



cerebrospinal fluid

### Some factors effect on body fluids:

- Age
- Gender
- Obesity
- Water intake and output
- Climate
- Physical activity
- Habits

### Dehydration & edema

**Dehydration** is the decrease of body water below normal range.

### Symptoms of dehydration:

- Dry skin
- Dark colored urine

- Urine less frequent
- Feel fatigued or tired
- Confusion
- Headache
- Dizziness

### **Edema :**

Edema is the medical term for swelling caused by fluids trapped in your body's tissues. Edema happens most often in your feet, ankles and legs, but can affect other parts of your body, such as your face, hands and abdomen.

### **Symptoms of edema:**

A symptom of edema is swelling in your body. Swelling occurs when a part of your body gets bigger because there is an accumulation of fluids in your tissues. Swelling can happen anywhere on your body but most often affects your feet, ankles and legs.

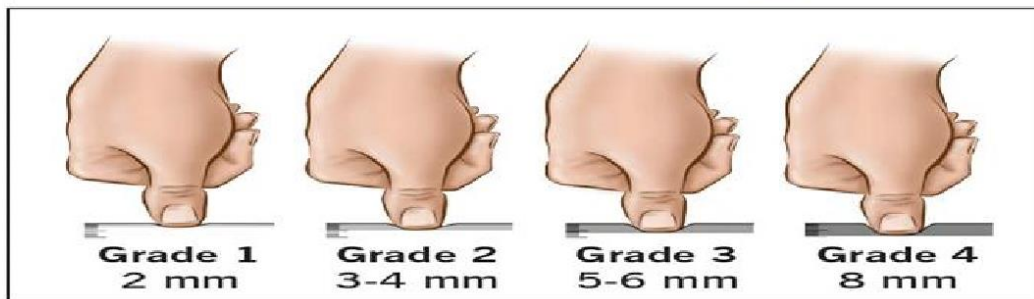
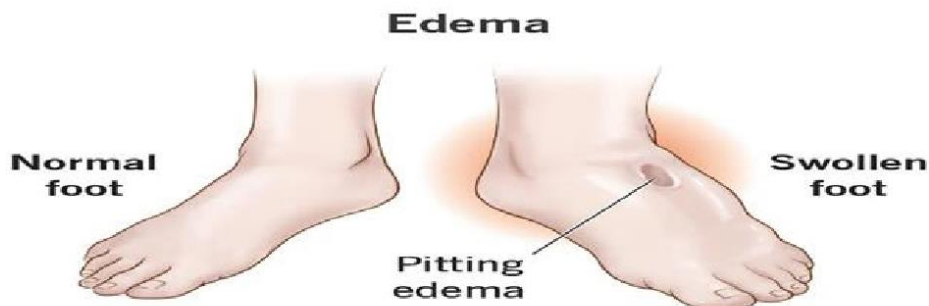
Symptoms of swelling include:

- An area of your body is larger than it was a day ago.
- The skin over the swollen area looks stretched and shiny.
- Difficulty in walking if your legs, ankles or feet swell.
- You may be coughing or have breathing troubles.
- Mild pain or a sore feeling in the affected area.

# edema

**Extracellular:** most common type due to abnormal accumulation of (fluid in interstitial space). caused by excessive capillary fluid filtration .

**Intracellular:** caused by hyponatremia, depressed metabolism, inflammation, lack of nutrition to the cells.



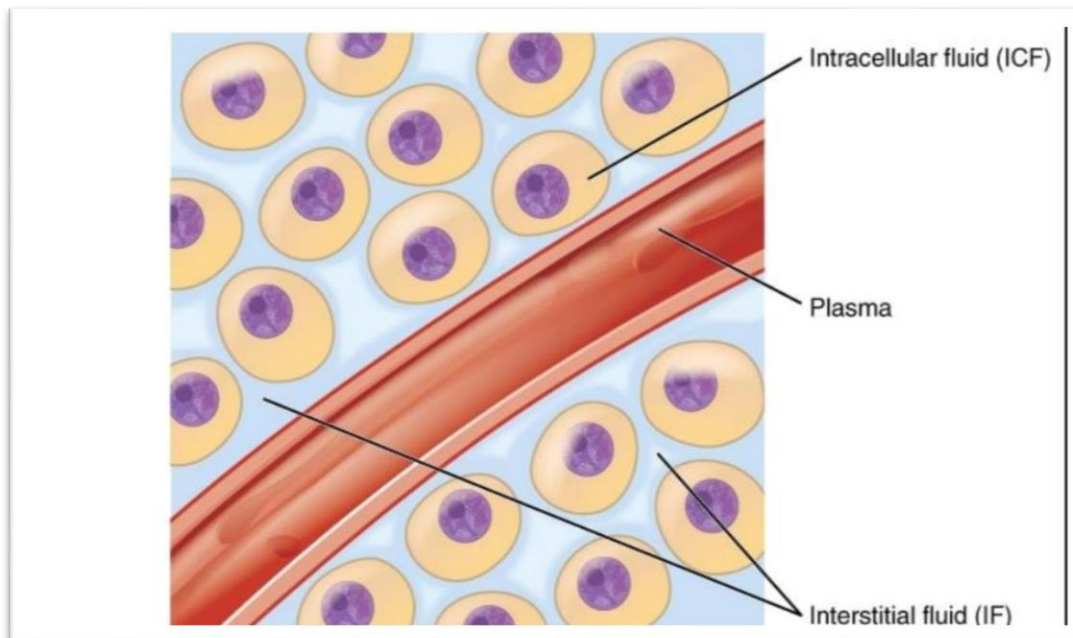
## Boundaries between body fluids compartments :

### ▪ **Capillary walls :**

Separate plasma from interstitial fluid, Permeable to electrolyte but not protein.

### ▪ **Cell membranes :**

Separate intracellular fluid from interstitial fluid , permeable to water but not to electrolyte .



## Daily intake of water ,[water is gained from 3 sources :](#)

- Drinking of water
- Ingestion of food
- Synthesis of water from body oxidation of carbohydrates

➤ All those sources add  $\cong 400$  ml/day

**Dailay loss of water: water is lost through 4 ways:**

- **Insensible water loss :**

This is through respiratory tract by evaporation and through the skin by diffusion. Loss through the skin occurs independently of sweating it is increased when the cornified layer is lost (in extensive burns).

- **Water loss in feces (stool):**

Only small amount of water is lost in feces. This can increase to several liters a day in people with severe diarrhea.

- **Sweating:**

The amount of water lost by sweating is highly variable. This amount depends on the physical activity and temperature. The volume of sweat is about 100 ml/day, but this could increase in hot weather.

- **Water loss by kideny:**

About 1300 ml from body occurs in the urine excreted by kidney. Urine volume can be as low as 0.5 L/day in dehydrated person. The kidney takes the task of adjusting the excretion rate of water and electrolytes.

**Osmosis:**

Is the diffusion of water across selectively permeable membrane from the region of higher water concentration to the region of lower water concentration. When a solute added to pure water, this will reduce the concentration of water in the mixture. Thus, the higher solute concentration, the lower water concentration.



## **Isotonic, Hypotonic and Hypertonic fluids :**

If the cell place in solution of impairment solutes having an osmolarity of 282 mOsm/L, the cell will not be **shrink** or **swell** because the fluid is equal in intracellular and extracellular fluids. This solution called **isotonic solution**.

Examples of isotonic solutions:

- 1. 0.9 % solution of sodium chloride (NaCl).**
- 2. Glucose solution.**

These solutions are important in clinical medicine **because** they can be infused into the blood without the danger of upsetting osmolality between the intracellular and extracellular fluids.



### **Hypotonic fluid .**

Solution that has low concentration of solute (less than 282 mOsm/L). Cell in this solution will swell because water continues to diffuse into cell.

### **Hypertonic fluid .**

Solution having a higher concentration of solute, water will flow up of the cell to the (ECF). Cell in this solution will shrink.

## **Electrolytes (dissolved ions):**

Electrolytes are substances that have a natural positive or negative electrical charge when dissolved in water. They help your body to regulate chemical reactions, maintain the balance between fluids inside and outside your cells. They're also a key way to diagnose a wide range of medical conditions and diseases.

### **Major positive ions (Cations)**

### **Major negative ions (Anions)**

<b>Sodium ion <math>\text{Na}^+</math></b>	<b>Chloride ion <math>\text{Cl}^-</math></b>
<b>Potassium ion <math>\text{K}^+</math></b>	<b>Bicarbonate ion <math>\text{HCO}_3^-</math></b>
<b>Calcium ion <math>\text{Ca}^{2+}</math></b>	<b>Sulfate ion <math>\text{SO}_4^{2-}</math></b>
<b>Magnesium ion <math>\text{Mg}^{2+}</math></b>	<b>Phosphate ion <math>\text{PO}_4^-</math></b>

## **Function of some electrolytes :**

### **Sodium (+)**

Sodium plays a critical role in helping your cells maintain the right balance of fluid. It's also used to help cells absorb nutrients. It's the most abundant electrolyte ion found in the body.

### **Hypernatremia (too much sodium) symptoms .**

- Cause confusion or behavior changes.
- Strong reflexes and loss of muscle control.
- Coma.

### Hyponatremia (not enough sodium):

- Confusion.
- Weakened reflexes.
- Nausea and vomiting.
- Seizures and coma.

### Magnesium (+)

Magnesium helps your cells as they turn nutrients into energy. Your brain and muscles rely heavily on magnesium to do their job.

### Hypermagnesemia (too much magnesium):

- Heart rhythm changes.
- Weakened reflexes.
- Decreased ability to breathe.

