



Al-Rasheed University College Pharmacy Department

2nd Stage / 1st Semester

2021-2022



# Blood's physiology

Physiology lab #1

Done by:

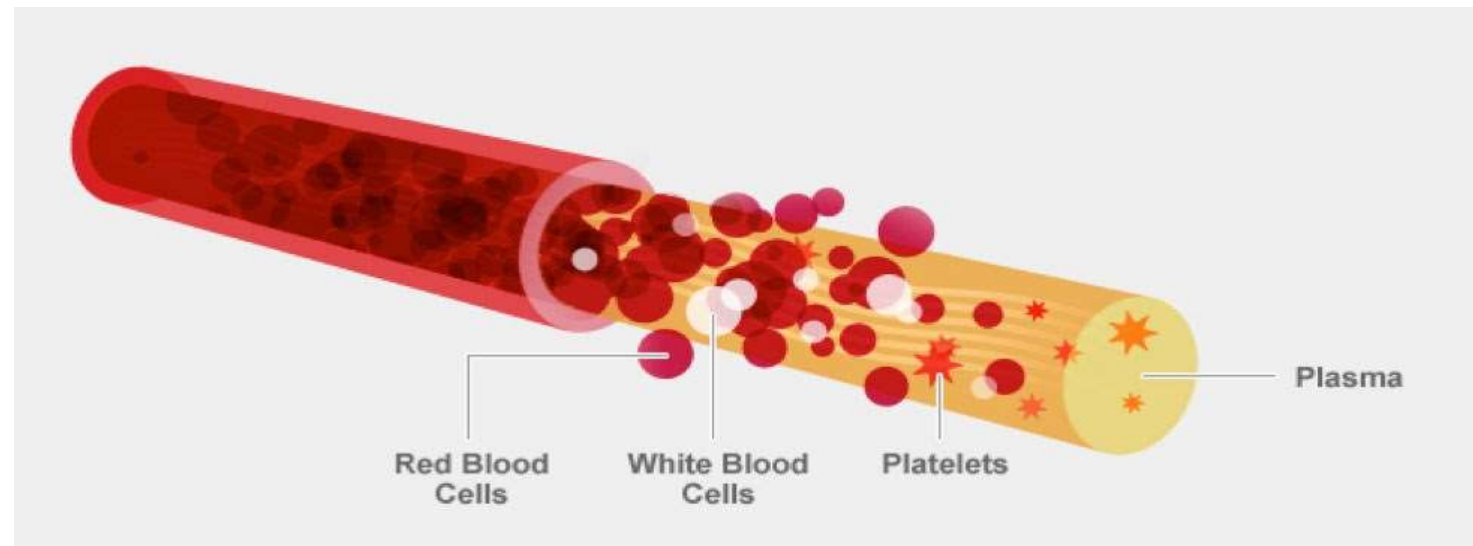
Assis. Lecturer Mohammed Akram Al-Mahdawi

# Introduction:

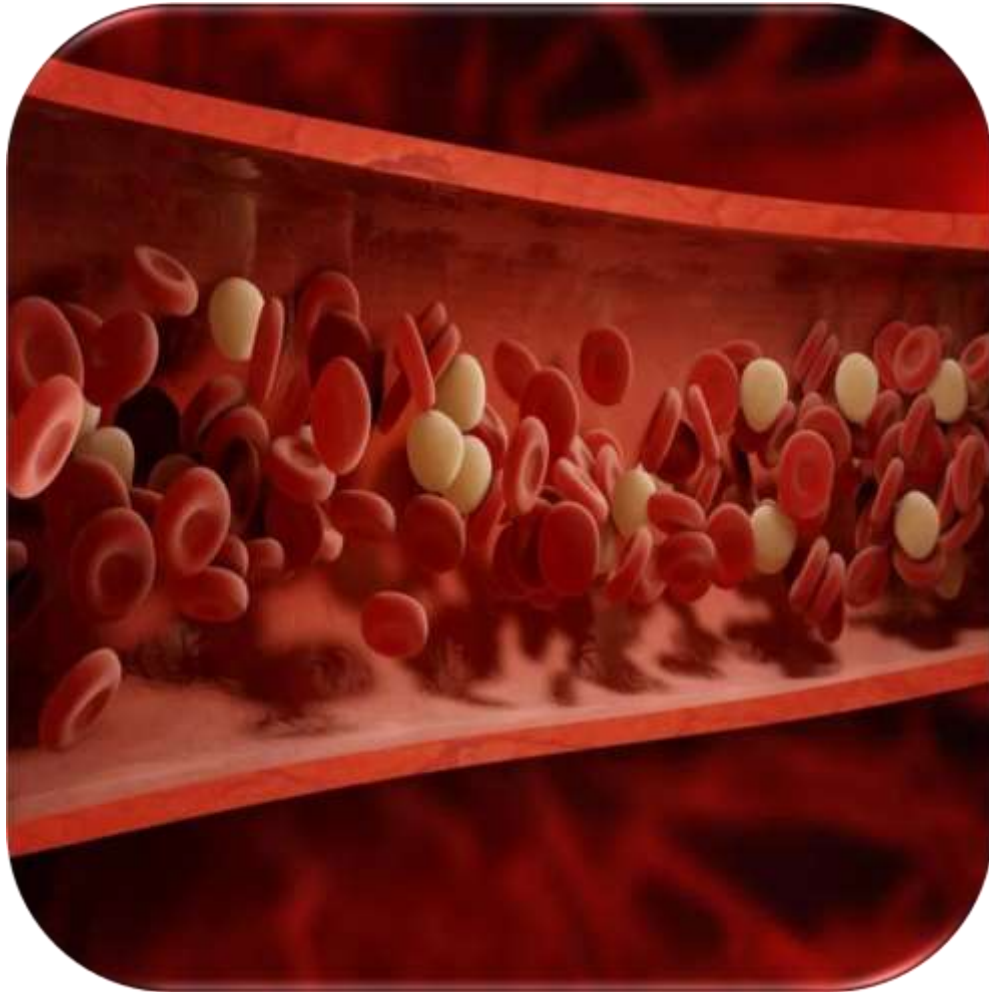
- **Blood** is the primary transport medium which is responsible for supplying nutrients, oxygen to the various body cells.
- **Blood** is classified as a **connective tissue**. Classification is based on;

Presence of cells (**RBC** and **WBC**), Cell fragment (**Platelets**) surrounded by liquid matrix (**Plasma**).

- RBC, WBC and Platelets are described as **Formed elements**.
- The total blood volume in the average adult is approximately is 4-5L in females, and 5-6L in males.



# General properties of **Blood**



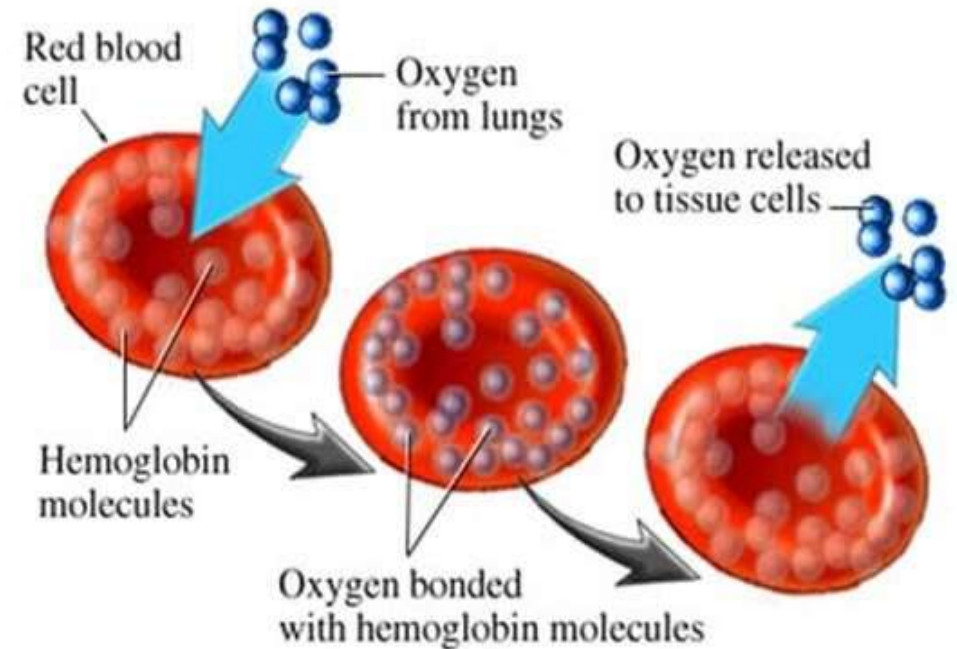
|                                      |  |
|--------------------------------------|--|
| <b>Fraction of body weight</b>       | <b>8%</b>  |
| <b>Volume /body weight</b>           | <b>80-85 ml/kg</b>   |
| <b>Mean temperature</b>              | <b>36.5 – 37.5 C</b>   |
| <b>PH</b>                            | <b>7.35-7.45</b>   |
| <b>Viscosity (relative to water)</b> | <b>Whole blood 4.5-5.5</b><br><b>Plasma 2.0</b>                                |
| <b>Osmolarity</b>                    | <b>280-296 mOsm/L</b>  |
| <b>Mean salinity (mainly NaCl)</b>   | <b>0.9%</b>  |
| <b>Hematocrit (PCV)</b>              | <b>Female 37%-48%,<br/>Male 45%-52%</b>  |
| <b>Hemoglobin (Hb)</b>               | <b>Male 13-18 g/dl<br/>Female 12-16g/dl,</b>                                   |
| <b>Mean RBC count</b>                | <b>Female 4.8 million/mm<sup>3</sup>,<br/>male 5.4 million/ mm<sup>3</sup></b> |
| <b>Platelet count</b>                | <b>130000 – 360000/mm<sup>3</sup></b>  |
| <b>Total WBC count</b>               | <b>4000 – 11000/mm<sup>3</sup></b>   |

- **RBCs** has the highest number of cells within the blood. Which, we can determine the **oxygen carrying capacity of the blood**.
- If the number of **RBC** is low >>> Individual is suffering from anemia >>> low oxygen carrying capacity. And VISE VERSA.
- **There are three common measurements used to assess blood's oxygen carrying capacity:**

Hematocrit value (HCT, PCV Value)

Hemoglobin concentration (Hb)

Total RBCs count



## QUESTION TIME?

■ The values of (RBCs count, PCV value, and Hb conc.) tend to be lower in women than in men, and the possible physiological reasons?

1-Androgens stimulates RBC production >>> Men have higher levels of androgens than females >>> Thus Men have higher levels of RBC than women.

2-Women in reproductive age have periodic menstrual losses.

3-Hematocrit is inversely proportional to the percentage of body fat. Fat percentage is higher in women than in men

# Blood's general functions

## Transportation



- 1-O<sub>2</sub>, CO<sub>2</sub>
- 2-Nutrients
- 3-Hormones
- 4-Waste products
- 5-Metabolic heat

## Regulations



- 1- water content
- 2- blood contains chemicals that regulate PH (7.35 – 7.45)
- 3- osmolarity and electrolyte balance

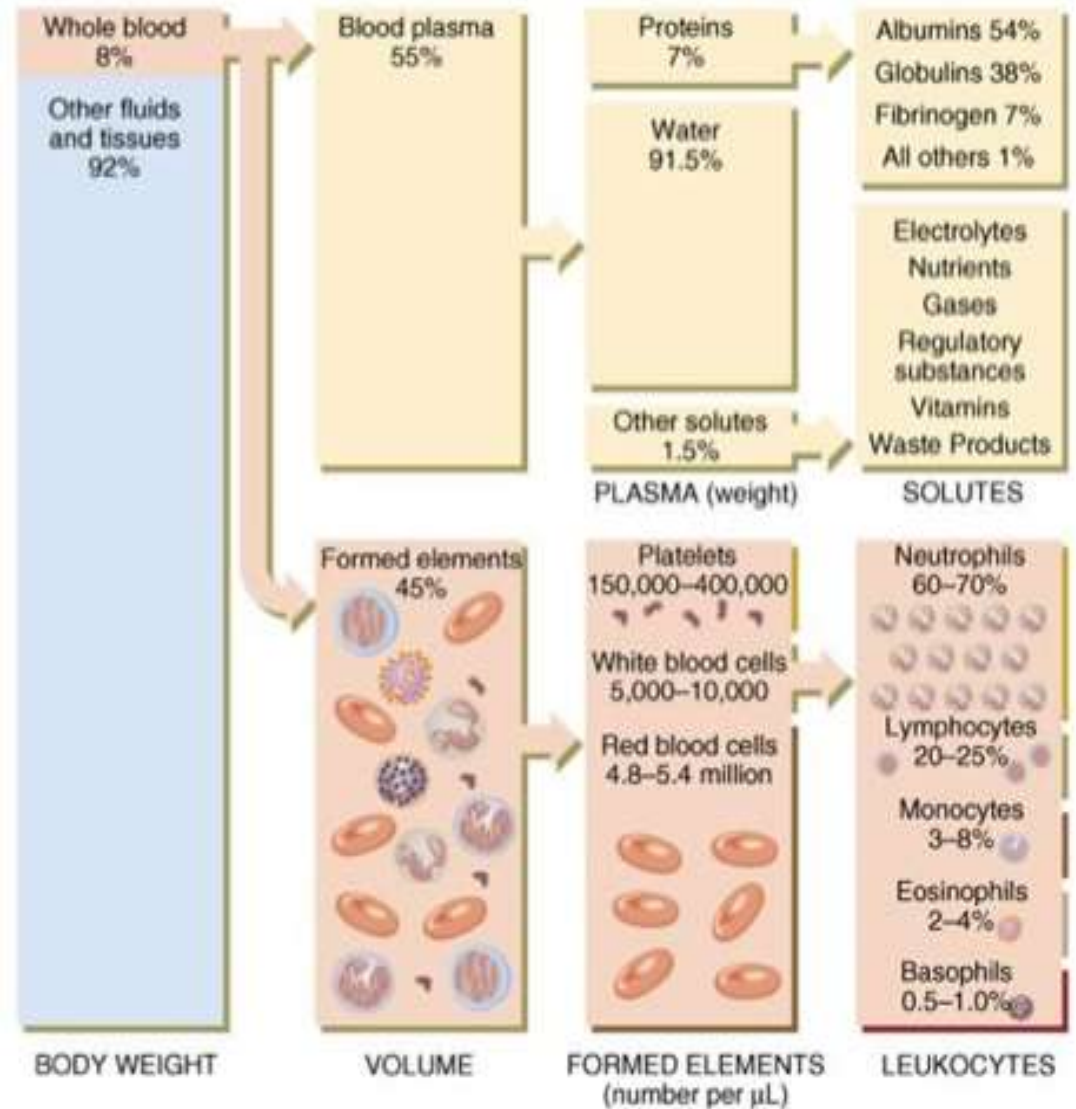
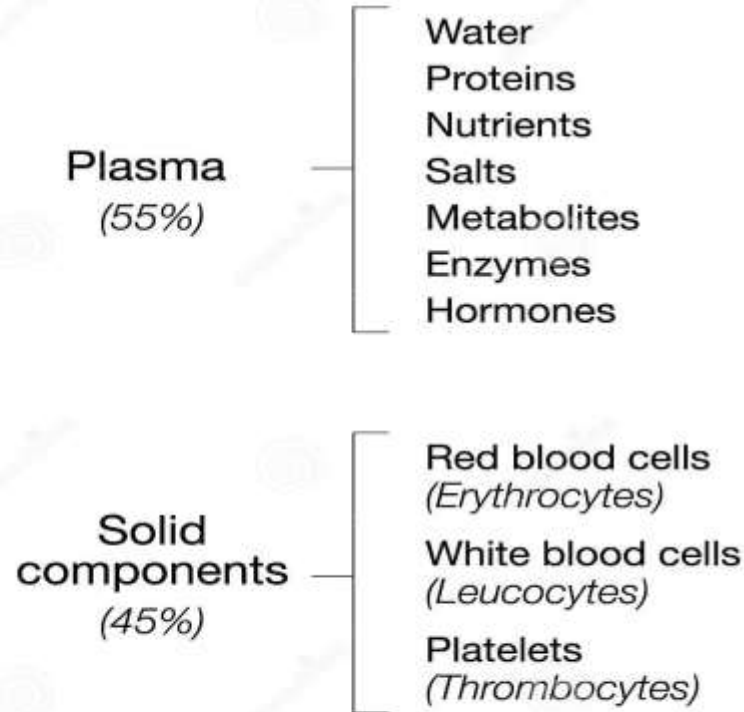
## Protection



- 1- inflammation
- 2- WBCs destroys bacteria and cancerous cells
- 3- antibodies and complement proteins
- 4- platelets/clotting to prevent blood loss

# Bloods components

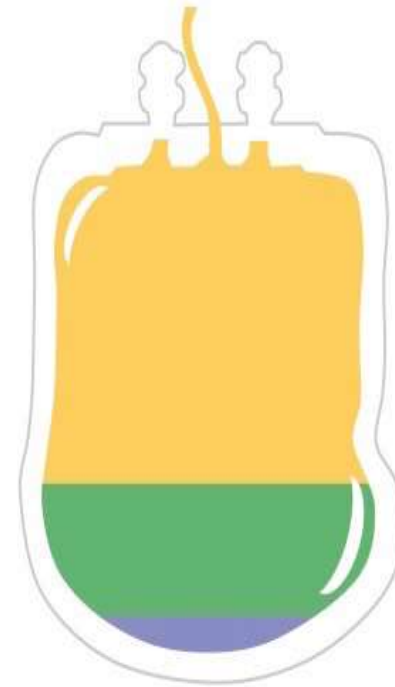
## Components of Blood





# Types of plasma proteins

- Proteins are the most abundant **plasma** solute.
- Their concentration ranges from (6-9 gm/dl).
  
- **Plasma displays different function including:**
  - Clotting
  - Defence
  - Transport
  
- **Plasma's proteins are classified into three main categories:**
  - 1-Albumin (60%)
  - 2-Globulin (36%)
    - Alpha - Globulin
    - Beta - Globulin
    - Gamma – Globulin
  - 3-Fibrinogen (4%)



## Major Types:

### ■ Albumin (60%)

Major component of osmotic pressure of plasma

### ■ Globulins (35%)

Antibodies (immunoglobulin) and transport proteins

### ■ Fibrinogens (4%)

Functions in blood clotting

### ■ Other (<1%)

Various roles ( $\alpha$ -1-antitrypsin, coagulation factors, etc.)



- **Albumin:**

- The most abundant plasma protein, which constitutes about (60%)
- Contributes in the viscosity of **blood**.
- Regulate osmotic pressure and osmolarity.
- Transport lipids, hormones, calcium and other solutes.
- Act as buffer to regulate plasma PH.

- **Globulins:**

- **Alpha-globulin function:**

- Transportation (haptoglobin and ceruloplasmin)
- Promote clotting (prothrombin)
- Regulate salt content and blood pressure (angiotensin I & II).

- **Beta-globulin function:**

- Transport iron (transferrin)
- Defense against toxins and micro-organisms

- **Gamma-globulin function:** They are classified as antibodies that provide defense against pathogens and viruses.

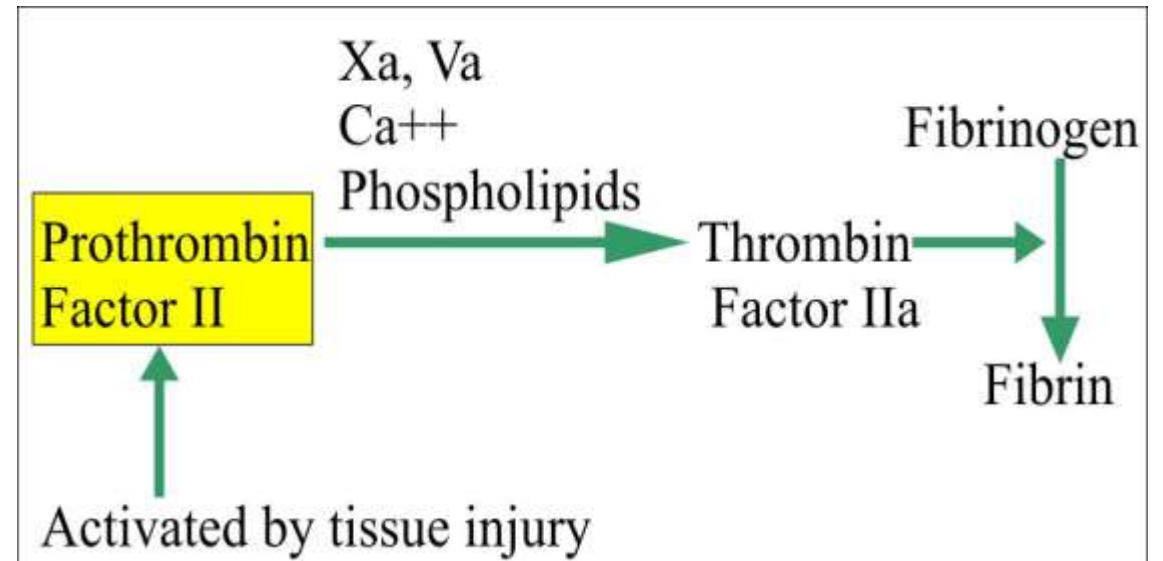
- **Fibrinogen:**

- A key factor in **blood clotting**, converted to **fibrin** (the main component of **blood clot**)
- Removing fibrinogen from **plasma**, the remaining fluid is called **serum**.

- **Important note:**

All types of **plasma proteins** are produced in the liver. However!

Gamma-globulin is produced in the lymphatic tissue, cytoplasm of immature and mature plasma cells and in spleen.



## Types of plasma soluble solutes

- **▪ Non-protein nitrogenous substances:**
  - They are usually waste end products of catabolism of different substances and toxic
  - **▪ These waste products are cleared through excretion by the kidneys**
    - The most abundant is urea, which is the end product of amino acid catabolism
    - Other waste products are ammonia, creatin, creatinine, uric acid, and bilirubin
- **▪ Nutrients:**
  - **▪ Absorbed by the digestive tract and transported to plasma**
  - **▪ They include; glucose, amino acids, fats, cholesterol, phospholipids, vitamins and minerals**
- **▪ Gases:**
  - Oxygen (O<sub>2</sub>) and Carbon dioxide (CO<sub>2</sub>)
  - Small amount of nitrogen important for diving and aviation

- **Regulatory Substances:**

- Include: enzymes and hormones.

- **Electrolytes:**

- Include: sodium, potassium, magnesium, calcium, chloride, bicarbonate, phosphate and sulfate.

- Sodium accounts for about 90% of all electrolytes

- Sodium plays a major role in regulating osmolarity and blood pressure

**You Did**

**It!!!**



**End  
of lecture**