جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم
قسم الادلة الجنائية

المحاضرة التاسعة

The Blood

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1. Introduction to Blood

Blood is a **specialized connective tissue** that circulates inside the blood vessels. It is essential for:

- Delivering oxygen and nutrients to all body cells
- Removing waste products like carbon dioxide and urea
- Transporting hormones from glands to target organs
- Helping maintain body temperature and pH balance

Interesting fact: The average adult has **about 5 liters of blood**, which makes up approximately **7–8% of body weight**.

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2. Functions of Blood

Blood has **three main functions**:

2.1 Transportation

- **Oxygen** from lungs → tissues
- **Carbon dioxide** from tissues → lungs
- **Nutrients** from digestive tract → cells
- **Hormones** from endocrine glands → target organs
- **Waste products** to kidneys/liver for excretion

2.2 Regulation

Blood helps **keep the body stable** by:

- Regulating **body temperature** (by distributing heat)
- Maintaining **pH balance** (around 7.35–7.45)
- Balancing **water and electrolytes**

2.3 Protection

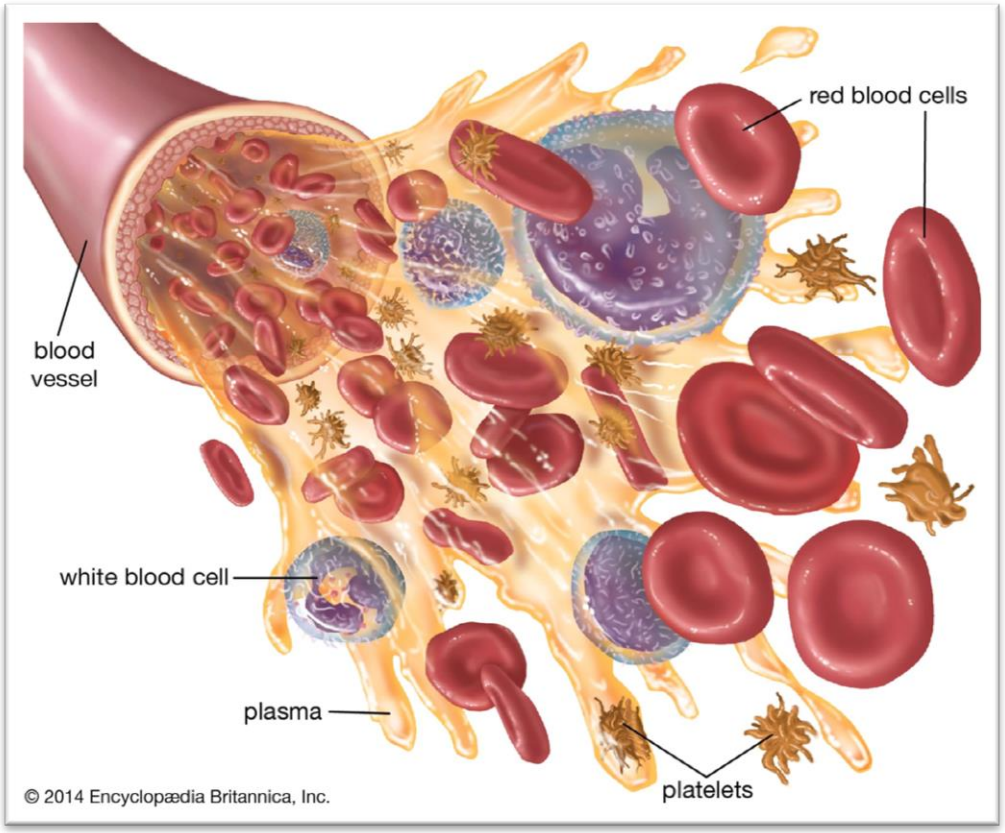
- **Immune defense:** White blood cells fight infections
- **Clotting:** Platelets prevent excessive blood loss
- **Antibodies:** Plasma proteins help neutralize toxins

3. Composition of Blood

Blood is composed of **plasma** and **formed elements**:

Component	Percentage	Function
Plasma	55%	Transport medium for cells & molecules
Red Blood Cells	40–45%	Carry oxygen & CO_2
White Blood Cells	1%	Defend against infections
Platelets	<1%	Clotting and tissue repair

Image: Blood Composition



4. Plasma

4.1 Definition

Plasma is the **liquid part of blood**, a yellowish fluid that carries blood cells and many dissolved substances.

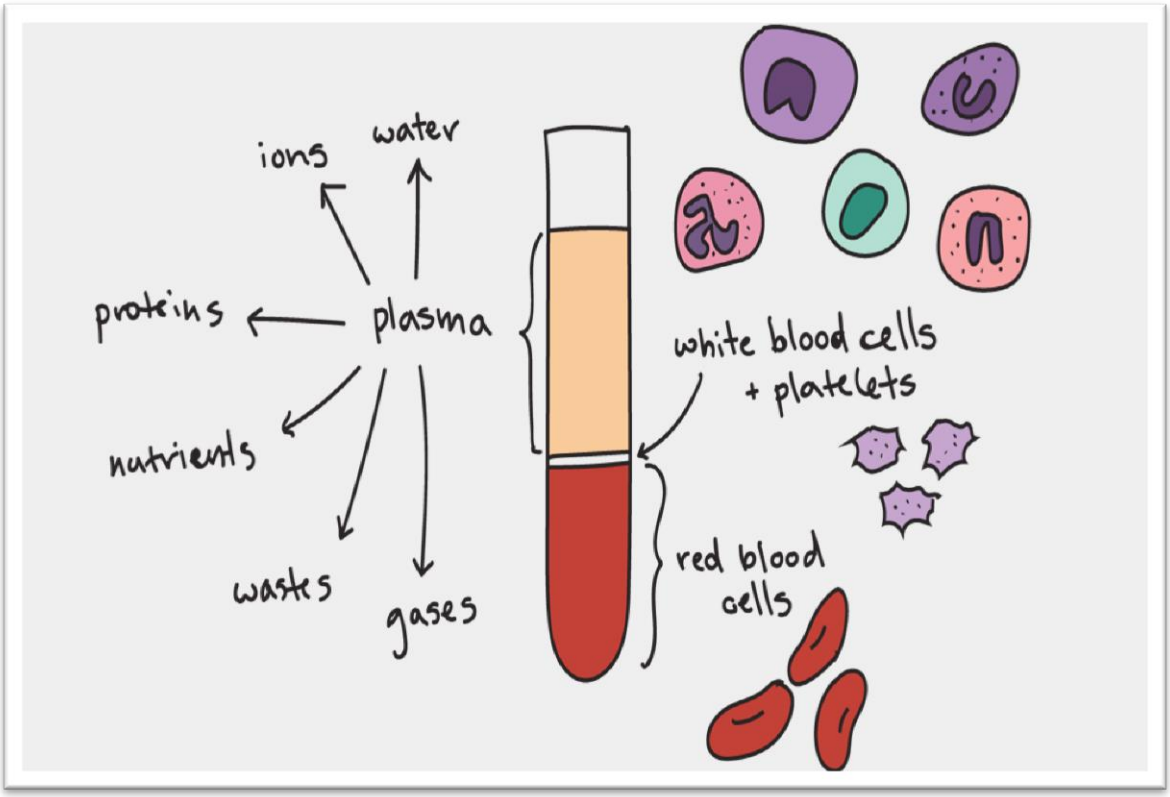
4.2 Composition

- **Water:** 90%
- **Proteins:** Albumin, globulins, fibrinogen
- **Electrolytes:** Sodium, potassium, calcium
- **Nutrients:** Glucose, amino acids, lipids
- **Waste:** Urea, creatinine
- **Hormones:** Insulin, thyroid hormones

4.3 Functions of Plasma

- Transport of nutrients and waste
- Transport of hormones and proteins
- Maintaining **blood pressure** and **volume**
- **Clotting** via fibrinogen
- **Immune defense** via globulins

Image: Plasma Composition



5. Red Blood Cells (Erythrocytes)

5.1 Definition

Red blood cells (RBCs) are the **most abundant cells** in blood, responsible for **oxygen transport**.

5.2 Structure

- **Biconcave disc shape** → increases surface area for oxygen exchange
- **No nucleus** → more space for hemoglobin
- **Flexible** → can pass through tiny capillaries

5.3 Hemoglobin

- A protein that binds oxygen in the lungs and releases it in tissues
- Contains **iron**, giving RBCs their red color

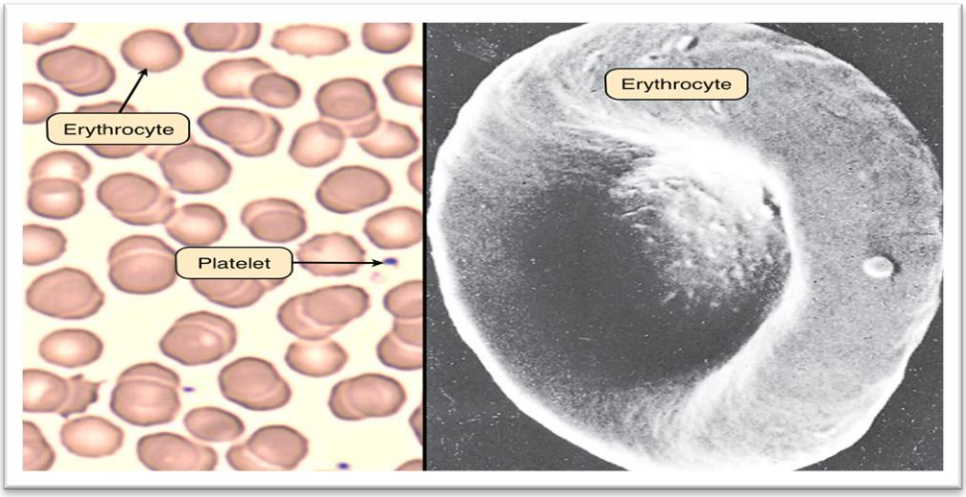
5.4 Life Span

- About **120 days**
- Old RBCs destroyed in **spleen** and **liver**

5.5 Normal RBC Count

Sex	Count (cells/µL)
Male	5 million
Female	4.5 million

Image: Red Blood Cells



6. White Blood Cells (Leukocytes)

White blood cells defend the body against **infections and toxins**.

6.1 Types

Granulocytes

- **Neutrophils:** Most abundant, fight bacteria
- **Eosinophils:** Fight parasites, involved in allergies
- **Basophils:** Release histamine during inflammation

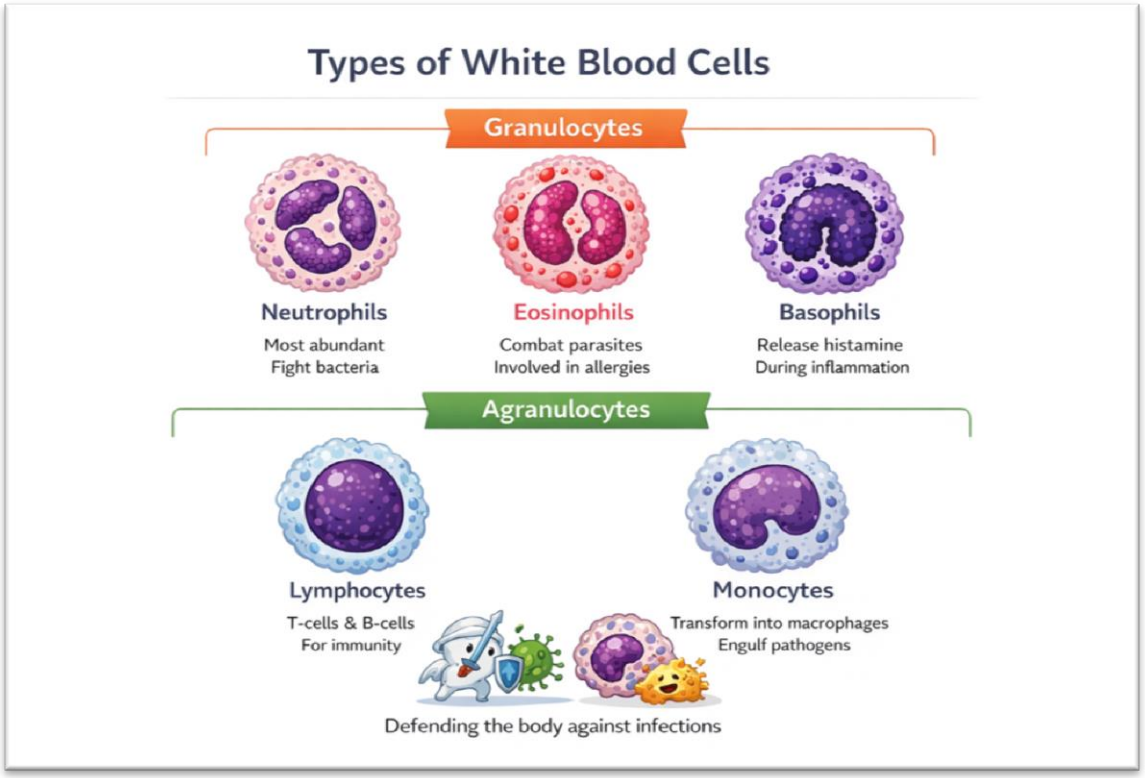
Agranulocytes

- **Lymphocytes:** T-cells and B-cells for immunity
- **Monocytes:** Transform into macrophages and eat pathogens

6.2 Normal Count

- About **4,000–11,000 cells/µL**

Image: White Blood Cells Types



7. Platelets (Thrombocytes)

- Small cell fragments produced in **bone marrow**
- Responsible for **blood clotting**

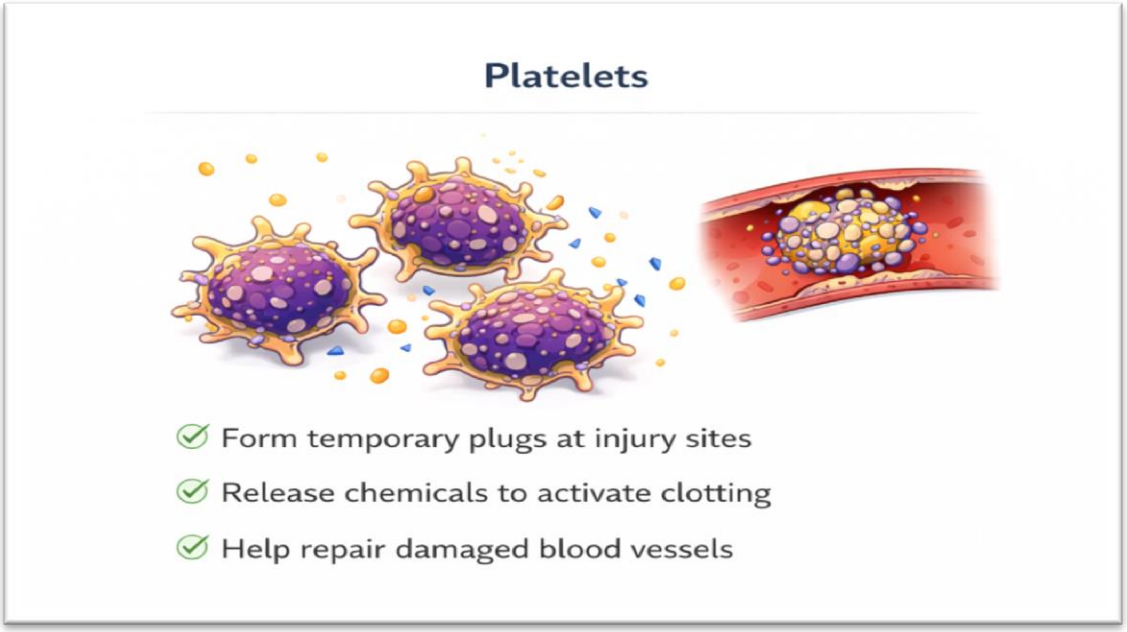
Function

1. Form **temporary plug** at injury site
2. Release chemicals to activate clotting
3. Repair damaged blood vessels

Normal Count

- **150,000–400,000 platelets/µL**

Image: Platelets

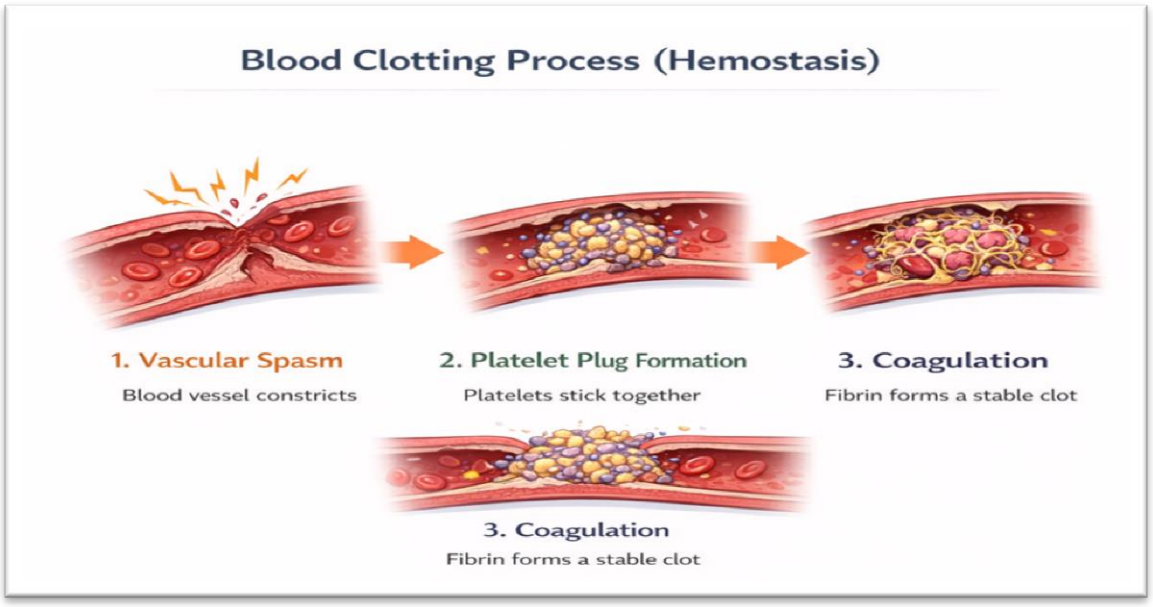


8. Blood Clotting (Hemostasis)

Blood clotting prevents excessive bleeding:

1. **Vascular spasm:** Blood vessels constrict
2. **Platelet plug formation:** Platelets aggregate
3. **Coagulation:** Fibrinogen → Fibrin forms clot

Image: Blood Clotting Process



9. Blood Groups

9.1 ABO System

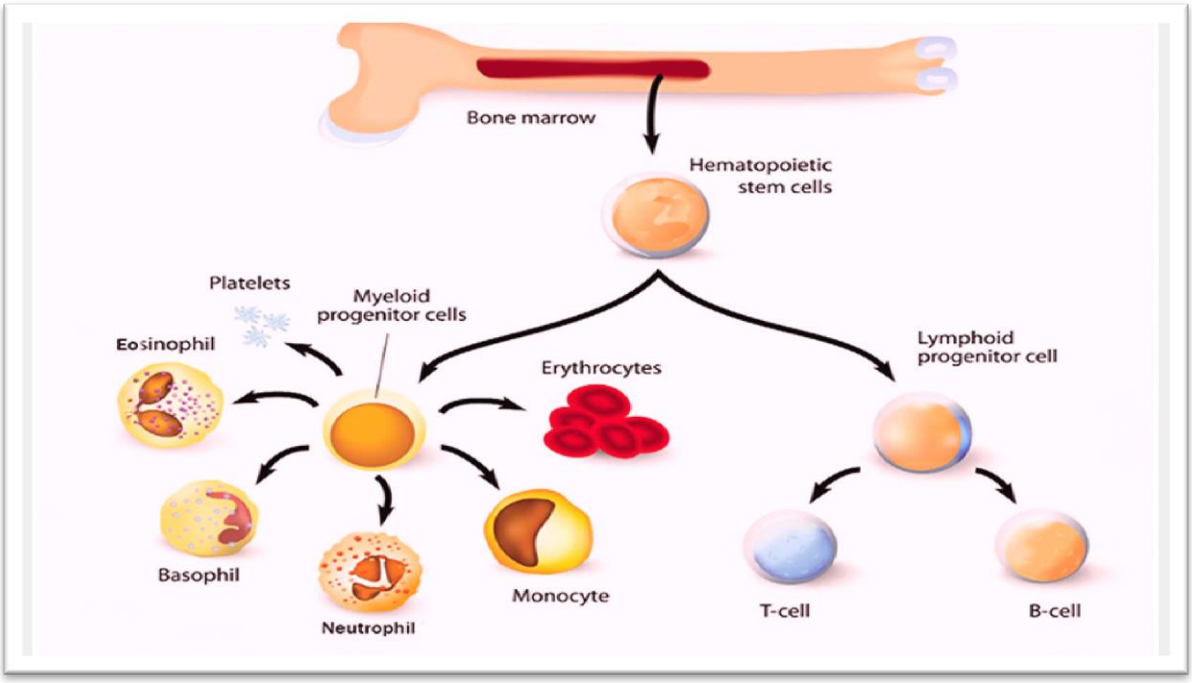
Blood Type	Antigen	Antibody
A	A	Anti-B
B	B	Anti-A
AB	A+B	None
O	None	Anti-A + Anti-B

9.2 Rh System

- **Rh+** → has D antigen
- **Rh-** → lacks D antigen

Blood type is important for **transfusions** and **pregnancy**.

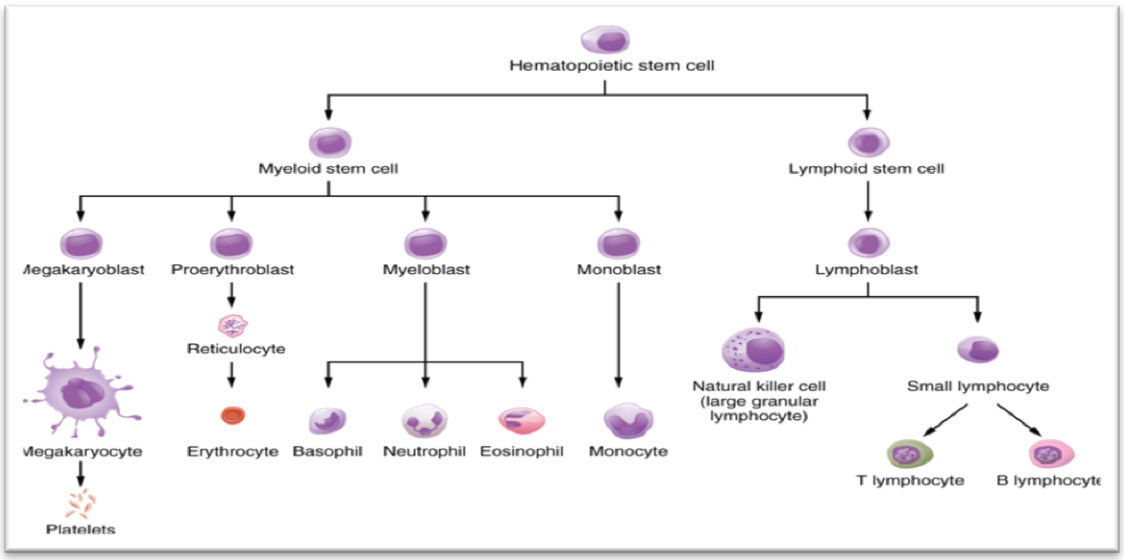
Image: Blood Types



10. Blood Formation (Hematopoiesis)

- Occurs mainly in **red bone marrow**
- Bones involved: sternum, ribs, pelvis, vertebrae
- All blood cells originate from **hematopoietic stem cells**

Image: Hematopoiesis



11. Blood Disorders

11.1 Anemia

- Low hemoglobin or RBCs
- Causes: iron deficiency, vitamin B12 deficiency
- Symptoms: fatigue, weakness, pale skin

11.2 Leukemia

- Cancer of white blood cells
- Causes uncontrolled WBC growth

11.3 Hemophilia

- Genetic disorder affecting clotting
- Bleeding occurs easily

12. Summary

Blood is a **vital connective tissue** that:

- Transports oxygen, nutrients, and waste
- Protects against infections
- Regulates temperature and pH
- Clots to prevent bleeding

It is composed of **plasma, RBCs, WBCs, and platelets**, each with a specific function.

Understanding blood is fundamental for biology, medicine, and healthcare sciences.