

PHYSIOLOGY Team 433

Lecture 7: Blood Compositions

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Color Index

Blue = Main Topic
Violet = sup topic
Red = important
Orange = Explanation

White & Black = Addition

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Objectives

At the end of this lecture student should be able to :

- Recognize functions of blood
- Describe Cellular and non-cellular components of blood
- Define Erythropoiesis; Leukopoiesis, and Thrombopoiesis.

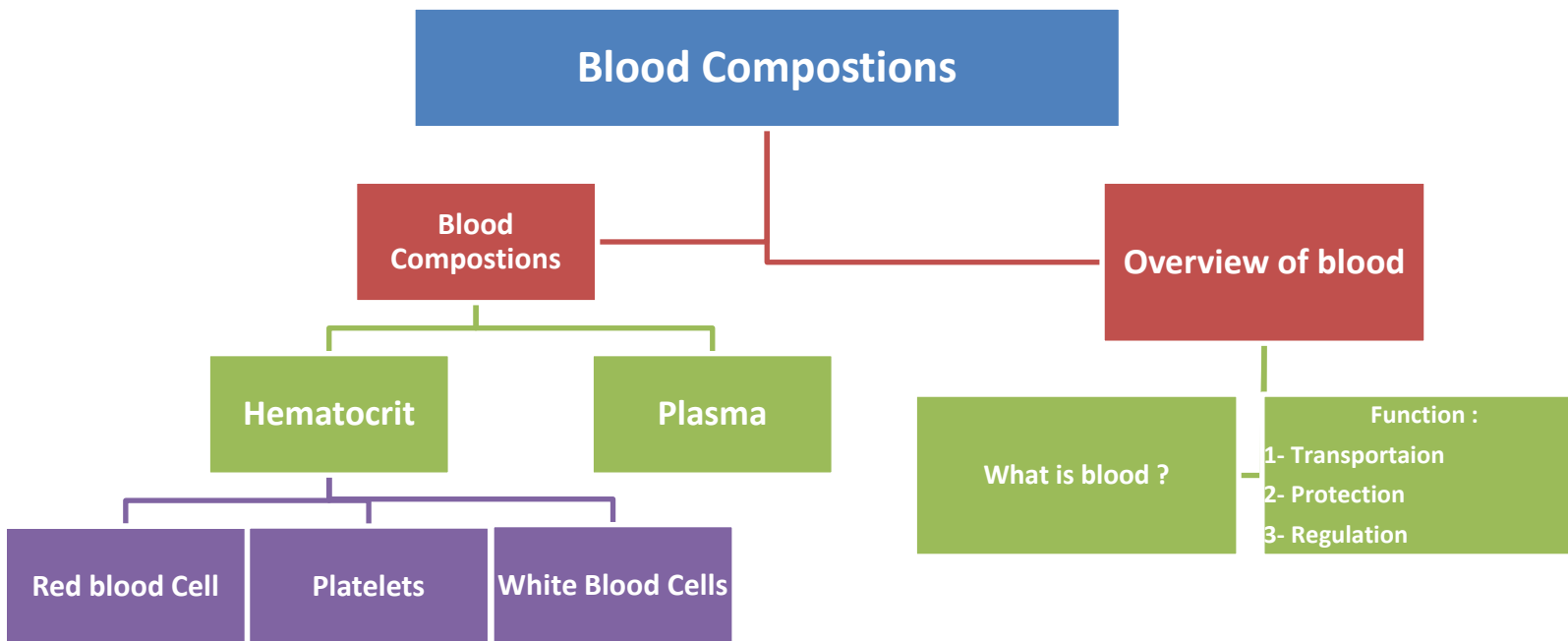
RBCs formation

WBCs formation

Platelets formation

- Describe features of RBCs, WBCs, and Platelets.

Mind Map



What is Blood?

- Blood is a fluid connective tissue found within the cardiovascular system.
- Accounts for about **8%** of TBW.
- Its volume is **5-6 L in males** and **4-5 L in females**
- Much more dense than pure water. ← أكثر كثافة من الماء النقي
- It is slightly alkaline, with a pH of **7.35- 7.45**.
- Its color varies from bright to dark red.
- It has a salty metallic taste.

General Functions of the Blood

1- Transportation: النقل

- Gases like: O₂ and CO₂.
- Nutrient and Metabolic wastes like: Glucose and Amino acids.
- Hormones and Enzymes
- Antibodies
- Electrolytes and Ions

2- Homostasis : التوازن

- Temperature regulation.
- pH regulation: By buffering systems found in the blood that **maintain the pH between 7.35 to 7.45**.
- Electrolytes regulation (Na, K, Cl,.....).
- Blood pressure regulation: By increasing or decreasing blood flow to the kidneys.

3- Protection: الحماية

ميكانيكية التجلط →

- Defense mechanism: By **WBCs** .
- Clotting mechanism: Blood contains materials that **stop bleeding** when vessels are damaged (Homeostasis).

4- Blood clotting prevent blood loss.

تجلط الدم

Blood Compositions
 8% of Total body weight
 (5-6 L in males and 4-5 L in females)

Same ionic composition as interstitial fluid

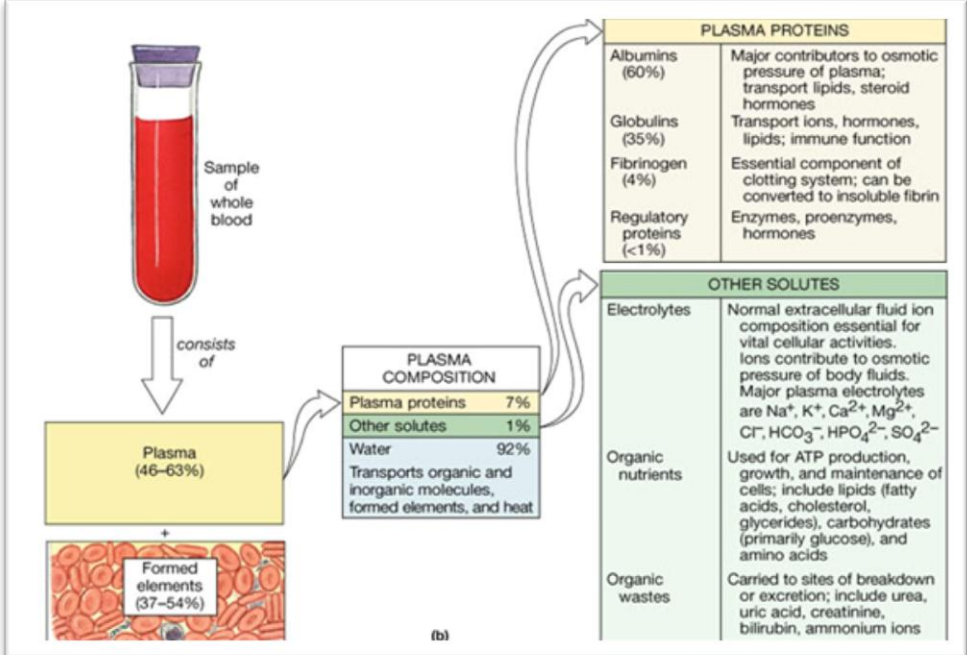
Cellular Component
 (Packed Cell Volume **PCV**)
 Also called **Hematocrit**
45%

Plasma: ECF
 Most of it is Water (92% - 98%)
 7% Plasma proteins e.g. (albumin, globulin, Fibrinogen) - 1% ions
55%

Red Blood Cells ,RBCs
(Erythrocytes)

White Blood Cells ,WBCs
(Leukocytes)

Platelets
(Thrombocytes)



The diagram illustrates the composition of plasma. It starts with a test tube of whole blood, which is centrifuged to separate into plasma (top, 46-63%) and formed elements (bottom, 37-54%). The plasma is further detailed as follows:

PLASMA COMPOSITION	
Plasma proteins	7%
Other solutes	1%
Water	92%

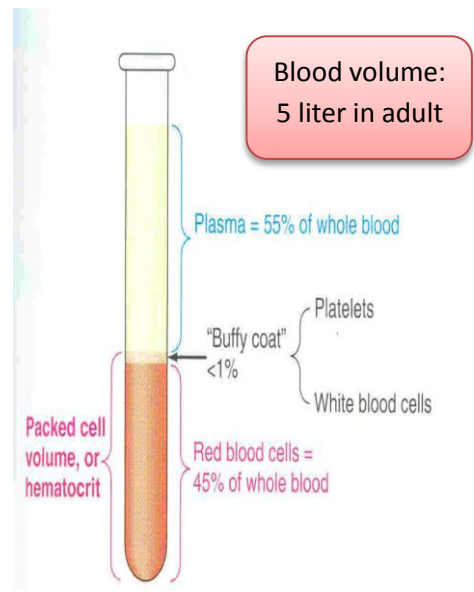
The plasma proteins are further categorized into:

PLASMA PROTEINS	
Albumins (60%)	Major contributors to osmotic pressure of plasma; transport lipids, steroid hormones
Globulins (35%)	Transport ions, hormones, lipids; immune function
Fibrinogen (4%)	Essential component of clotting system; can be converted to insoluble fibrin
Regulatory proteins (<1%)	Enzymes, proenzymes, hormones

The other solutes are categorized into:

OTHER SOLUTES	
Electrolytes	Normal extracellular fluid ion composition essential for vital cellular activities. Ions contribute to osmotic pressure of body fluids. Major plasma electrolytes are Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺ , Cl ⁻ , HCO ₃ ⁻ , HPO ₄ ²⁻ , SO ₄ ²⁻
Organic nutrients	Used for ATP production, growth, and maintenance of cells; include lipids (fatty acids, cholesterol, glycerides), carbohydrates (primarily glucose), and amino acids
Organic wastes	Carried to sites of breakdown or excretion; include urea, uric acid, creatinine, bilirubin, ammonium ions

Water transports organic and inorganic molecules, formed elements, and heat.





	<u>RBCs</u>	<u>WBCs</u>	<u>Platelets</u>
Organelles	Lack nuclei and mitochondria	Have nucleus and mitochondria	Lack nuclei
Shape	Flattened biconcave disc	granular and non-granular (amoeboid*)	Irregularly shaped (amoeboid*)
Size	Diameter: 7-8um	Differ in sizes according to types	Diameter : 2-3um
Movement	Flexible	Diapedesis can "slip between " capillary wall	_____
Life span	120 days	Differ in life span according to types	5-10 days
Numbers	4.7-5.2 million/mm ³	4000-11000/mm ³	250000-500000/mm ³

*** Amoeboid has irregular shape and usually move freely in blood**

Plasma Proteins

Albumins (60%)	are the most abundant type of plasma proteins, maintain the plasma volume by osmotic pressure. (Low concentration of Albumin will cause edema).
Globulins (35%)	Alpha and beta Globulins transport lipids and certain minerals through the bloodstream. Gamma Globulins are antibodies.
Fibrinogen (4%)	for blood clotting(Plasma without clotting factor called Serum)



BLOOD COMPOSITIONS

Red blood cells contain hemoglobin,

- Hb = 34 g/dl of cells

- Hb = 14-16 g/dl in the blood

G/dl: gram per deciliter.

Summary:

1. Blood functions are: transport, homeostasis, protection and blood clotting.
2. Blood composed of cellular components and plasma.
3. Cellular components composed of RBCs, WBC, Platelets.
4. RBCs and Platelets have no nucleus.



Multiple Choice Questions

Q1: Blood consist of hematocrit that suspended and carried in a fluid called plasma ?

- A- True
- B- False

Q2: Which of these are antibodies in plasma ?

- A- Albumin
- B- Globulins Beta
- C- Globulins Alpha
- D- Globulins Gamma

Q3: the most abundant plasma proteins are?

- A- Albumin
- B- Globulins
- C- Fibrinogen
- D- Guanine

Q4: Thrombocyte are?

- A- RBCs
- B- WBCs
- C- Platelets
- D- Plasma

Q5: Normal blood pH is?

- A- 7.20
- B- 7.40
- C- 7.30
- D- 7.50

Q6: Which of the following is true about WBCs ?

- A- Have nuclei and lack of mitochondria
- B- Have biconcave shape
- C- Can move between the walls of capillaries
- D- Have two types and regular shape