

Blood Physiology

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Blood Physiology

-Blood is a viscous fluid that is pumped by the heart through a closed system of blood vessels. It is composed of cells (**red blood cells, white blood cells and platelets “ thrombocytes ” preventing blood loss**) which are suspended in a fluid portion, the plasma.

Characteristics of Blood :-

- 1- bright red (oxygenated).**
- 2- dark red / purplish (unoxygenated).**
- 3- much more dense than pure water.**
- 4- pH range from 7.35 to 7.45 (slightly alkaline).**
- 5- slightly warmer than body temperature 100.4 F.**
- 6- typical volume in adult male 5-6 liters.**
- 7- typical volume in adult female 4-5 liters.**
- 8- typically 8% of body weight.**

Function of the blood

- 1- Transport of O₂, nutrients and hormones to the tissue and carries CO₂ to the lungs and other products of metabolism to the kidneys to be excreted.**
- 2- It participates in the regulation pH, osmosis and electrolyte concentration .**
- 3- Maintenance of body temperature.**
- 4- Blood also serves essential “ body protective function “.**
- 5- Clot forming.**

Plasma

Plasma is a part of the extracellular fluid of the body. Pale yellow up of 91% water and 9% other.

The normal plasma volume is about 4-5% of the body weight.

Plasma consist of an aqueous solution of proteins, electrolyte and small organic molecules.

Plasma Proteins

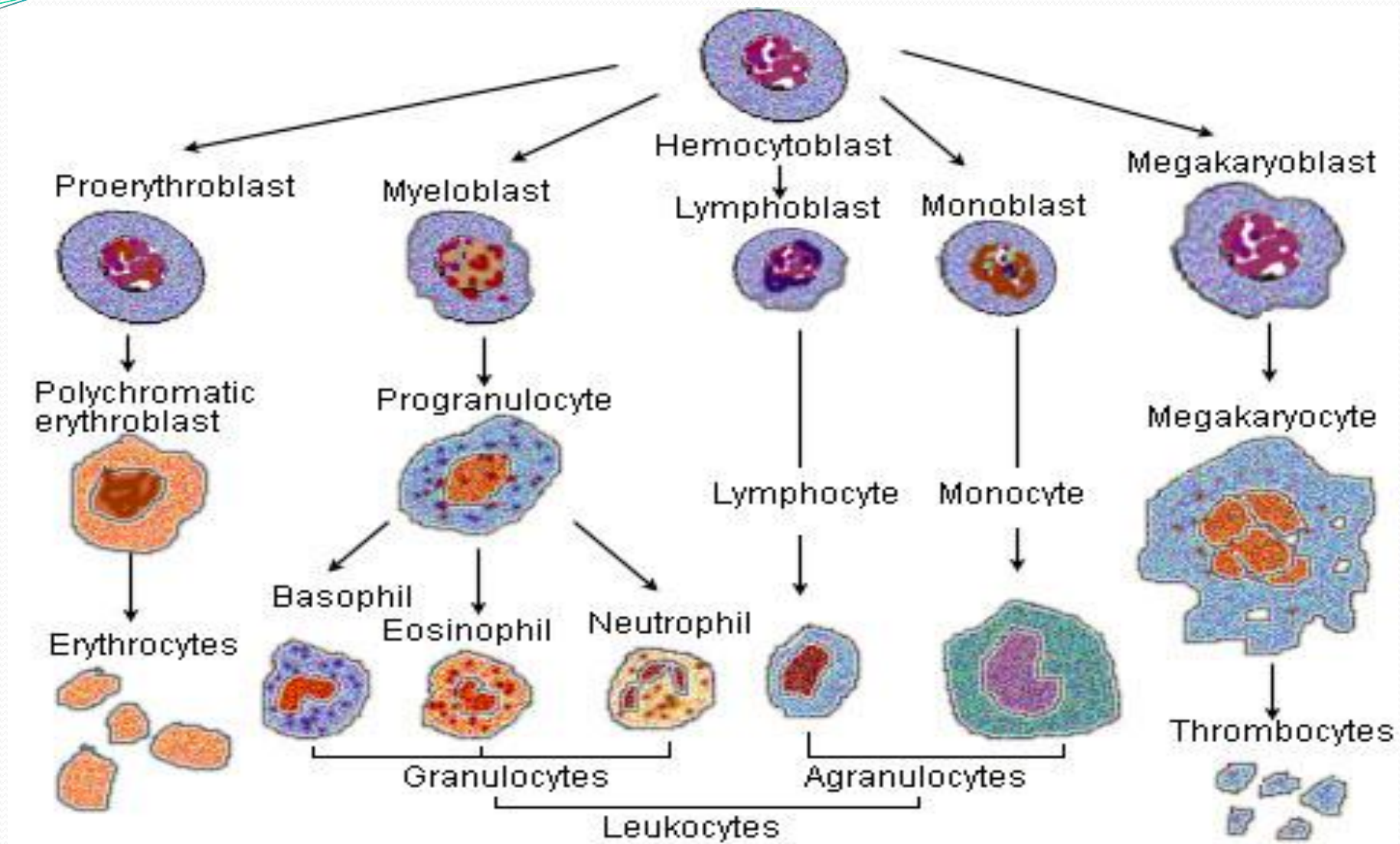
Its concentration is about 7 mg/dl. The major types of protein and their average normal concentration present in the plasma are :

- 1- Albumin, 4.5 g/dl, 58% of plasma proteins.**
- 2- Globulines, 2.5 g/dl, 38% of plasma proteins.**
- 3- Fibrinogen, 0.3 g/dl, 4% of plasma proteins.**

Hemopoiesis or Hematopoiesis

Hemopoiesis or Hematopoiesis :- Process of blood cell production.

- Proerythroblasts :- Develop into red blood cell.**
- Myeloblasts :- Develop into basophils, neutrophils and eosinophils.**
- Lymphoblast :- Develop into lymphocytes.**
- Monoblast :- Develop into monocytes.**
- Megakaryoblast :- Develop into platelets.**



Red blood cells (erythrocytes)

* Structure :

Biconcave, non – nucleated.

* Component :

a- Hemoglobin.

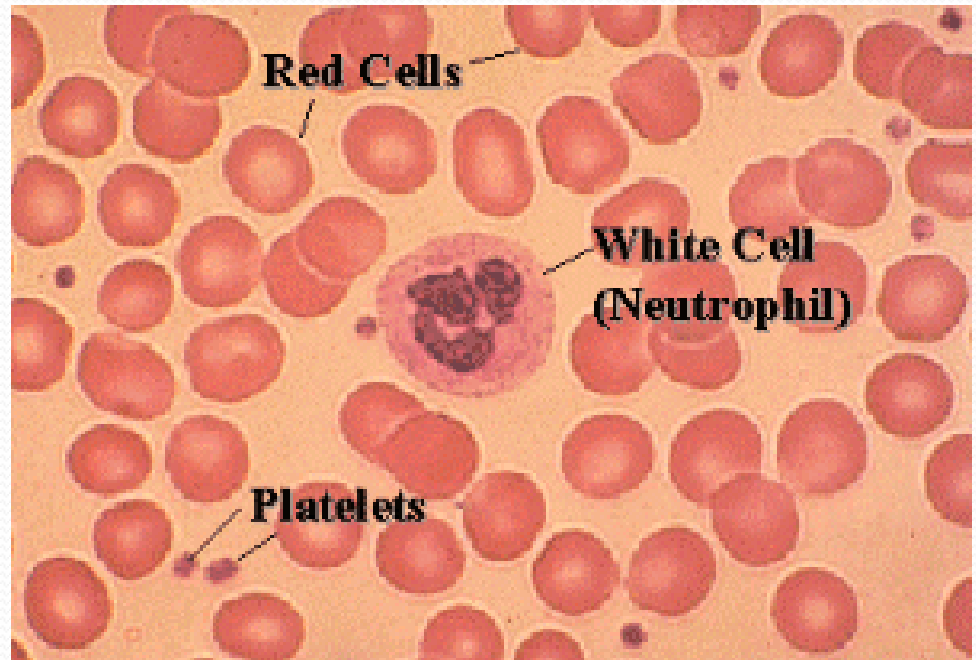
b- Lipids.

c- ATP.

d- Carbonic anhydrase.

* Function :

Transport oxygen from lung to tissue and carbon dioxide from tissue to lung.



Hemoglobin (Hb)

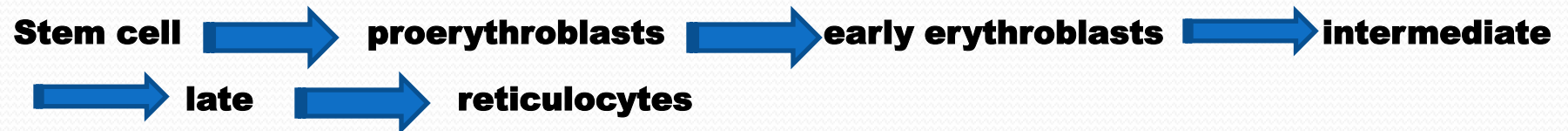
Consist of :-

1- 4 globin molecule : Transport carbon dioxide and nitric acid.

2- 4 heme molecule : Transport oxygen.

Iron is required for oxygen transport.

* Erythropoiesis :-



* Erythropoietin :-

Hormone to stimulate RBC production.

White blood cells (Leukocytes)

WBCs are divided into :-

1- Granulocytes :- 10-15 micrometers in diameter are three types according to the nature of their specific staining granules :

- Neutrophils (granules stain with acid and basic dyes).**
- Eosinophils (granules stain with acid dyes).**
- Basophils (granules stain with basic dyes).**

*** Their nuclei are lobulated, they are called polymorphonuclear leukocytes.**

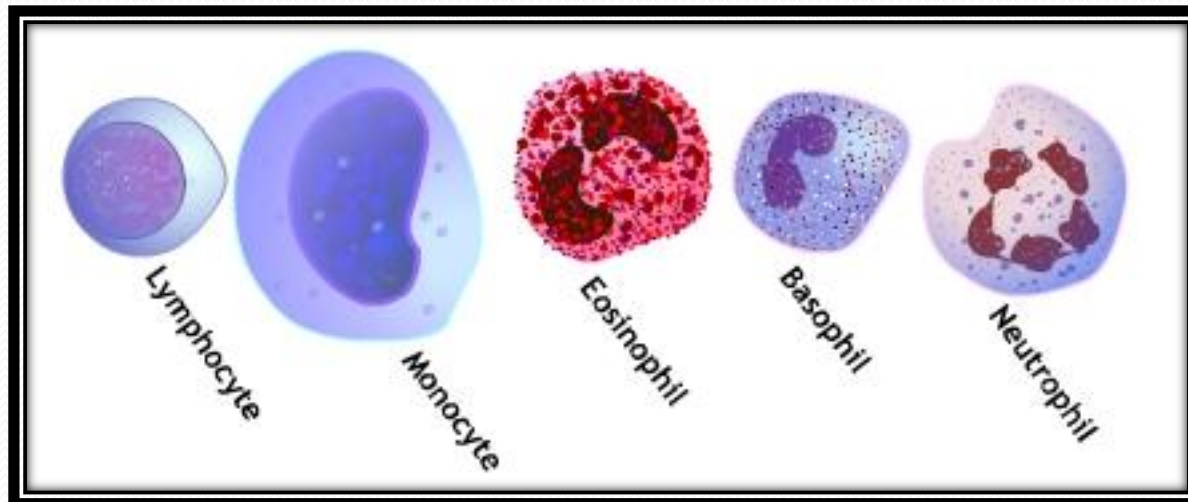
2- Non granulocytes, which are :

- Lymphocytes : the lymphocytes is small, about 6-16 micrometer in diameter. The lymphocyte has a large nucleus and scanty cytoplasm and there are three main types : (T-lymphocytes, B-lymphocytes & natural killer (NK) lymphocytes.**
- Monocytes :- The monocytes is the largest WBC, it has abundant cytoplasm , and kidney – shaped or round nucleus, about 15-20 micrometer in diameter.**

White blood cells (Leukocytes)

- **Neutrophils (50 – 70 %).**
- **Lymphocytes (20 – 40 %).**
- **Monocytes (2 – 8 %).**
- **Eosinophils (1 -4 %).**
- **Basophils (0.4 %).**

*** Leukocytes : protect body against microorganisms and remove dead cells and debris.**



Blood types (Blood groups)

- **Determined by antigen on surface (RBCs). Antibody (agglutinins) can bind to RBC antigens resulting clumping or hemolysis (rupture) of RBCs.**
- **Groups (ABO) and (Rh).**

ABO Blood Groups

Blood Group	RBC Antigen	Plasma Antibody	Blood that can be received
AB	A and B	None	A, B, AB and O
B	B	Anti - A	B and O
A	A	Anti - B	A and O
O	None	Anti A and Anti B	O

Rh Blood Group

- First studied in (rhesus monkeys).

Types :-

A- Rh positive :- Have antigens present on surface RBCs .

B- Rh negative :- Do not have these antigens present.

***Hemolytic Disease of the Newborn (HDN) :-**

Mother produces anti – Rh antibodies that crosses placenta and cause agglutination and hemolysis of fetal RBCs.

Blood Disease

1- Jaundice :- It is the yellowish discoloration of skin and mucous membranes resulting from an increased bilirubin concentration in the body fluid. It is detectable when plasma bilirubin level rises above (2 mg/dl).

2- Anemia :- Anemia means deficiency of hemoglobin in the blood. Which can be caused by either too few red blood cells or too little hemoglobin in the cells. Some types of anemia and their physiologic causes are following :-

A- Blood Loss Anemia. B- Aplastic Anemia, C- Megaloblastic Anemia, D- Hemolytic Anemia.

3- Polycythemia :- It is an increase concentration of erythrocytes in the circulation blood that is above normal for sex and age.

Blood Disease

4- Leukemias :- The term “Leukemia”, literally “White blood”, refers to a group of cancerous conditions involving overproduction of abnormal (white blood cell) from bone marrow.

5- Leukocytosis :- When total (WBC) count is higher than 11000 cell/mm³ of blood, which could be due to pathological causes (bacterial infection) or physiological causes (exercise & pregnancy).

6- Leukopenia :- When total (WBC) count is lower than 4000 cell/ mm³ of blood, which occurs for example viral infection & typhoid fever.



The End