Al-Mamoun university collage

Physiology

Medical lab Tech

Second stage

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Lecture 4

The Blood

Blood is a connective tissue, not body fluid, made of fluid (plasma) and cellular elements (RBC, WBC and platelets).

Components of Blood:

I. ***Formed* elements:**

- **a.** Red blood cells [RBC_S] = **Erythrocytes**
- **b.** White blood cells WBC_S = **Leucocytes**
- **c.** Platelets = **Thrombocytes**

II. **Plasma (55%) : i**t is composed of :

- **a.** **Water:** about 97% of plasma is water, which form the intravascular component of the extracellular fluid.
- **b.** **Plasma proteins :** dissolved proteins that serve for different functions as follows :

Albumin: the most numerous plasma proteins that serve mainly for **transport** of hormones, drugs, and biologically active substances. Plus regulatory effect on **blood volume** (osmotic pressure –oncotic pressure)

Globulin: that serves for **immune** functions

Fibrinogen: That serves for **blood clotting** and homeostasis.

Prothrombin: also serves for **blood clotting** and hemostasis

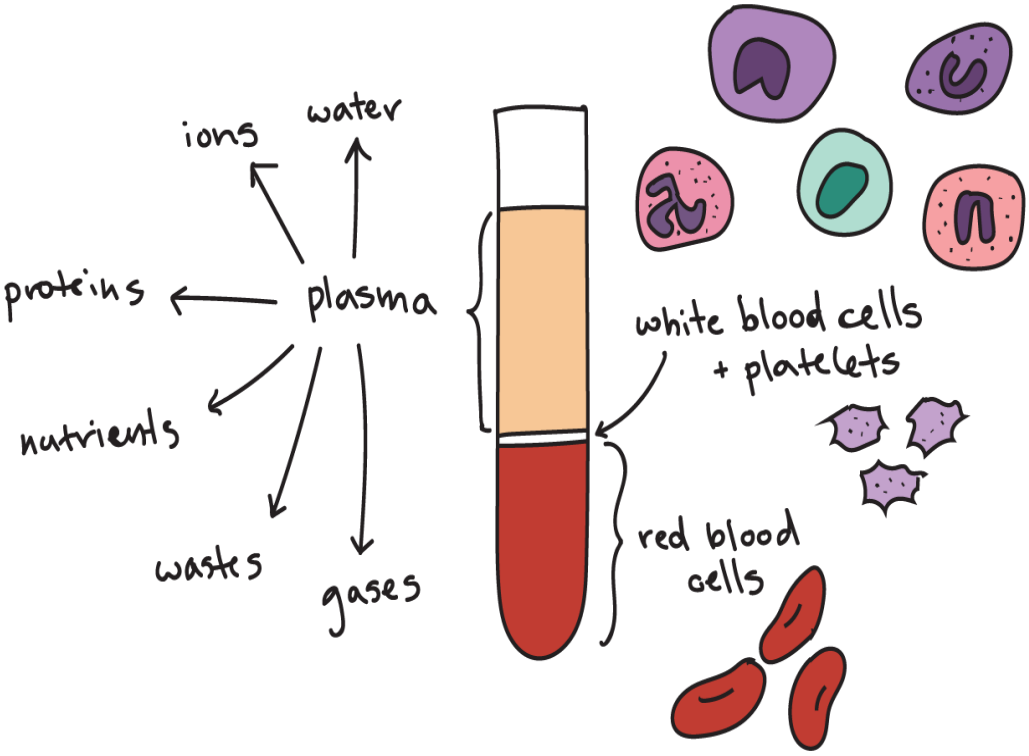
All plasma proteins are produced in liver except one type;

gamaglobulin), which is produced by the plasma cells.

c. Organic materials: such as glucose , amino acids , and fat

d. Nonorganic materials: such as ions (sodium, potassium, calcium, Chloride & bicarbonate)

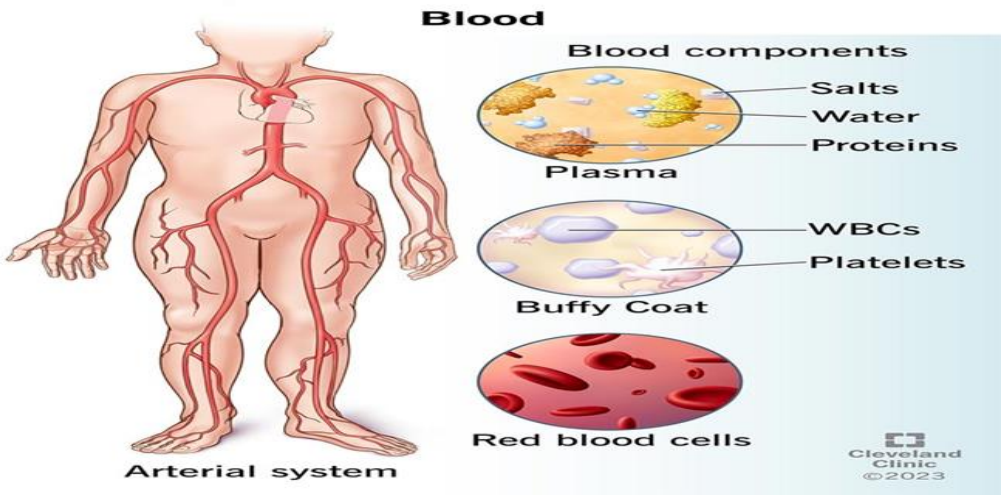
e. Others: hormones & blood gases.



Functions of Blood:

1. **Transportation:**
   - a. **Oxygen** lungs to body cells
   - b. **Carbon dioxide** body cells to lungs
   - c. **Nutrient** from GI tract to body cells
   - d. **Nitrogenous wastes** from body cells to kidneys
   - e. **Hormones** from glands to body cells

2. **Regulation (Maintenance of homeostasis)**
3. **Protection**
   - a. **Clotting** against blood loss (platelets and clotting proteins)
   - b. **Immunity** against many disease-causing agents (leukocytes, antibodies,complement proteins)



Erythrocytes red blood cells (RBCs) function (Oxygen, carbon dioxide transport).

Hemoglobin: large molecules with globin and hemes

Globin ↙ ↘ heme group

Globin: complex protein with 4 polypeptide.
Heme group: iron containing pigment part of hemoglobin to which oxygen binds each heme carries one O_2.

Iron

Iron: The total body iron (Fe^{++}) = 65% in Hb
The daily requirement of Fe in ♂= 1 mg, & in ♀= 2 mg (due to additional loss in menstrual cycle)
The old RBC (aged 4 months) will be destroyed in spleen & liver by macrophage release Fe to be utilized again, while bilirubin excreted by the biliary system.

Normal hemoglobin levels:

Female: adult 12-16 grams/100 ml blood

Male: adult 13-18 grams/100 ml blood

Infant: 14-20 grams/100 ml blood

State of hemoglobin:

1. Oxyhemoglobin : when O_2 is bound to iron
2. Deoxyhemoglobin: no O_2 bound to iron
3. Carbaminohemoglobin : when CO_2 bound to polypeptide chain

Hematopoiesis:

Hematopoiesis the maturation ,development and formation of blood Cells red bone marrow (myeloid tissue) location of hematopoiesis.

Stem cells:

A stem cell is a cell with the unique ability to develop into specialized cell types in the body. Different types of stem cell

There are three main types of stem cell:

1. embryonic stem cells
2. adult stem cells
3. induced pluripotent stem cells

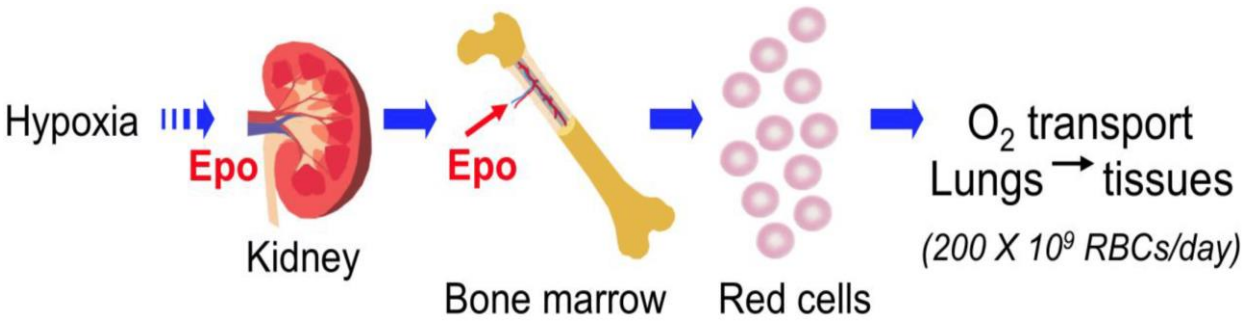
Hemocytoblast:

The miotic precursor to blood cells before differention , mature cell become committed to being certain type blood cell .

Erthrocyte lifespan 100-120 days (primarly destroyed by macrophage in spleen).

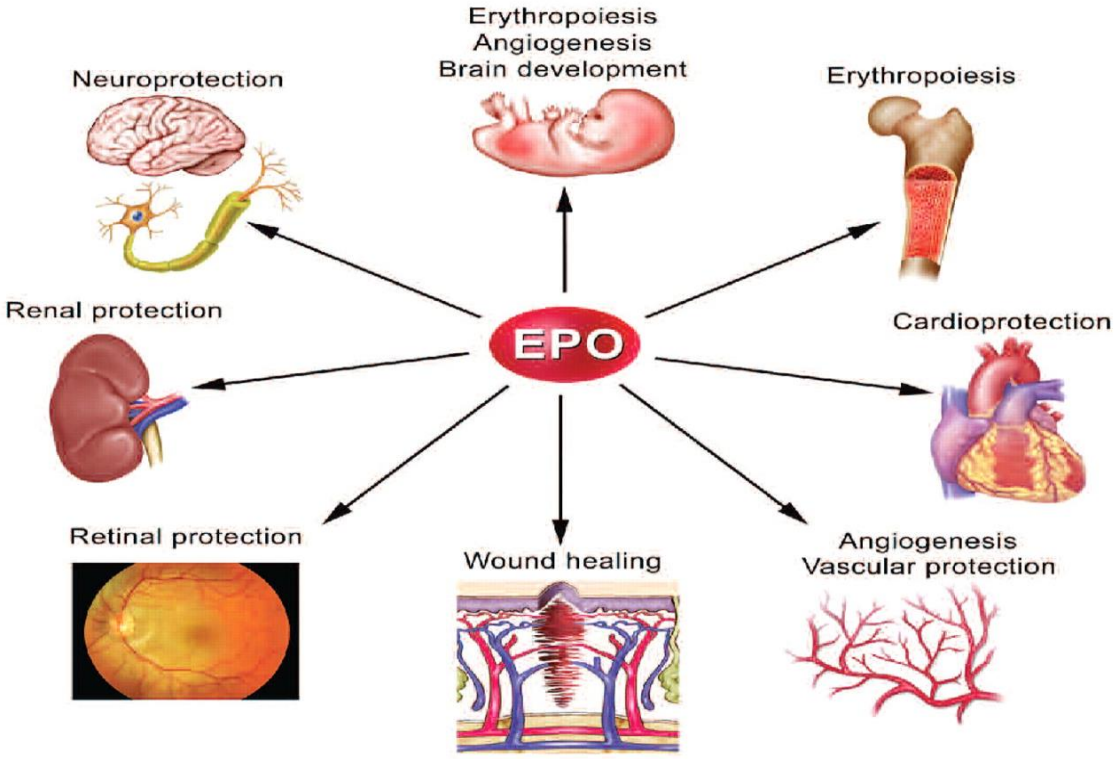
Erythropoiesis:

Is the process which produces red blood cells RBCs. It is stimulated by decrease oxygen in circulation, which detected by kidenys , which then secrete hormone **erythropoietin is the hormone that stimulates RBC production.**



Erythropoietin Action in Stress Response

B-complex vitamins – vitamins B12 and folic acid are essential for DNA synthesis in early mitotic division leading to erythrocytoes .



What is Erythropoietin therapy?

Erythropoietin therapy, also known as EPO therapy, is a type of medical treatment that uses a man-made form of erythropoietin (EPO) to increase red blood cell production and treat anemia.