Introduction to blood Physiology

2-bal ygoloisyhP/2 Stage

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Blood

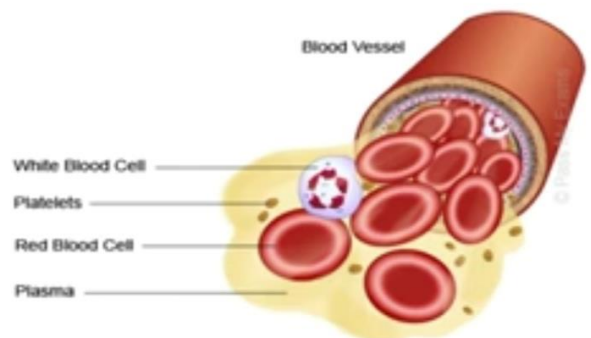
Def.,

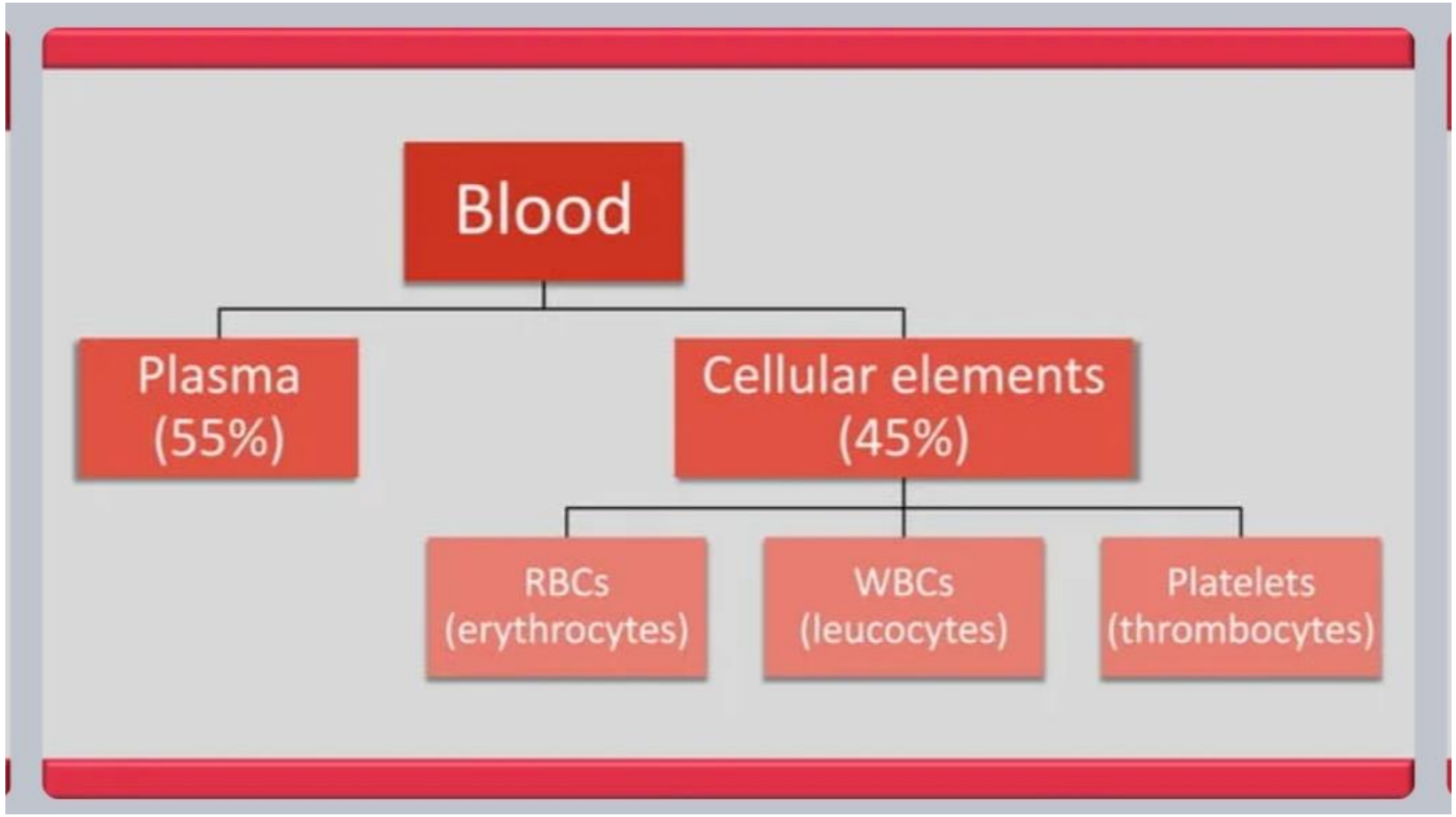
- **Blood is** a complex reddish fluid which circulates continuously inside CVS

Volume:

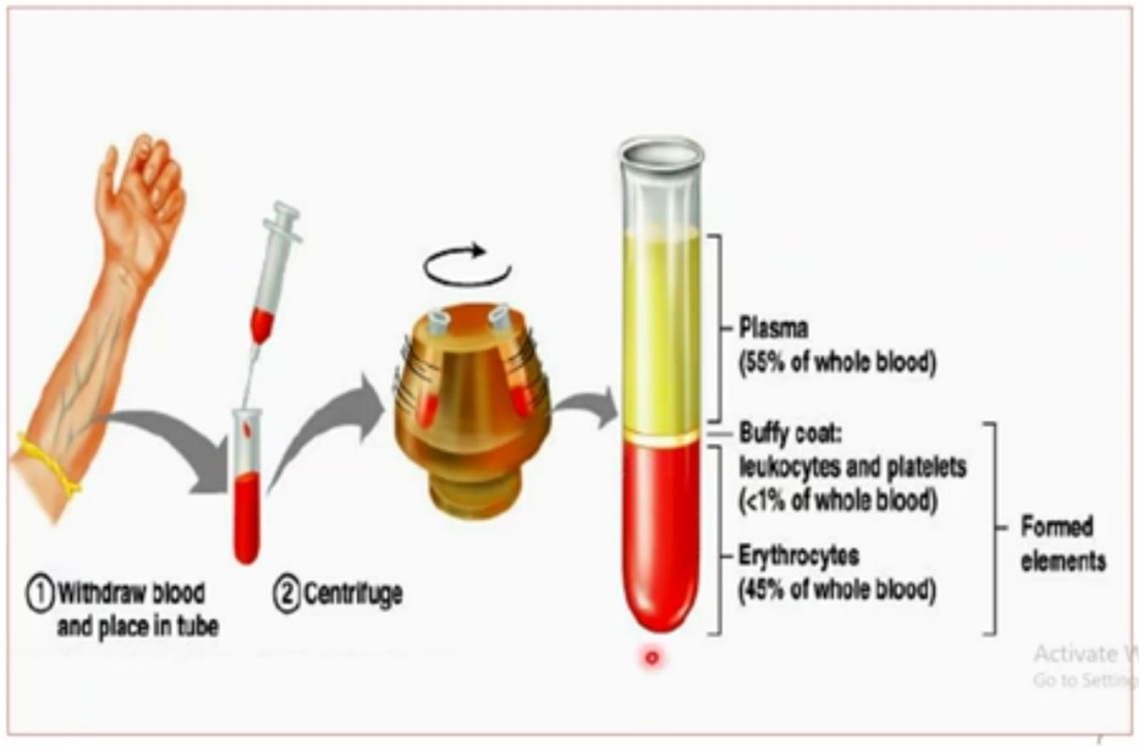
- 5.6 L in 70kg man

i.e. 8% of body weight




Blood
Plasma (55%)
Cellular elements (45%)
RBCs (erythrocytes)
WBCs (leucocytes)
Platelets (thrombocytes)

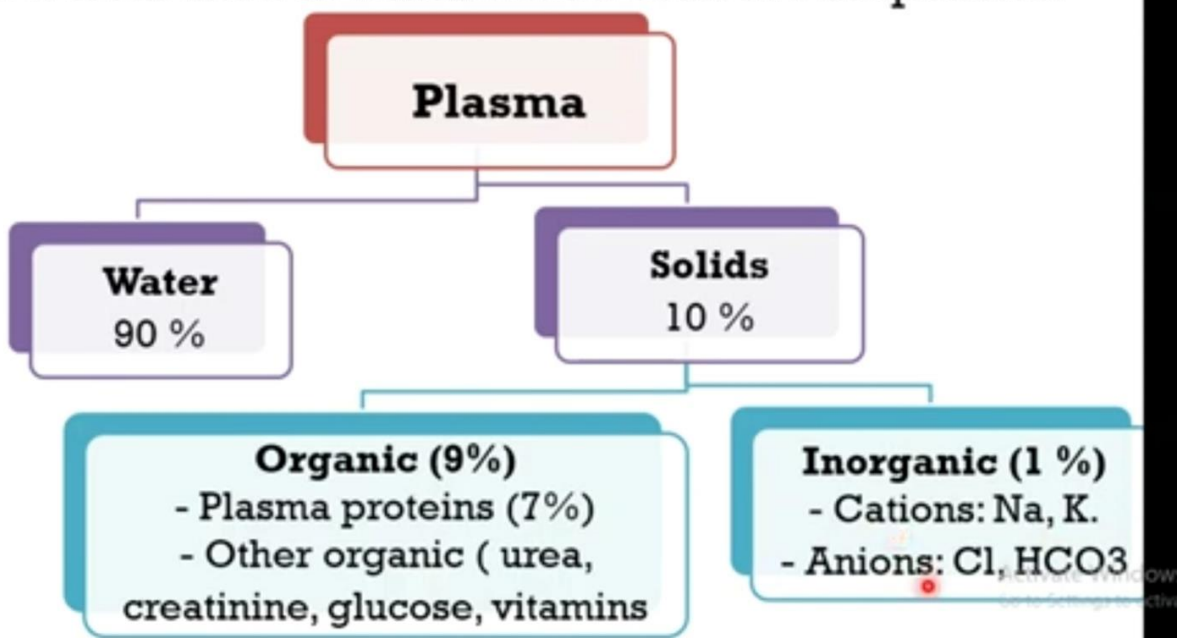
Blood Composition



Plasma

Def.,

It is a clear fluid in which blood cells are suspended



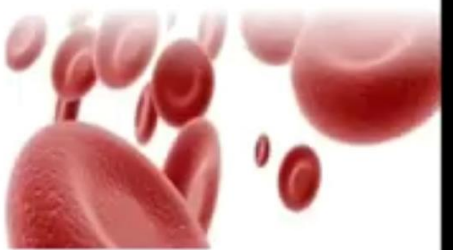
Functions of plasma

Constituent	Function
Water	Absorbs, transports and releases heat
Albumins	Osmotic balance
Globulins	Defense mechanism
Fibrinogen	Blood clotting
Electrolytic ions	pH buffering

Red Blood Corpuscles (RBCs)

Erythrocyte count:

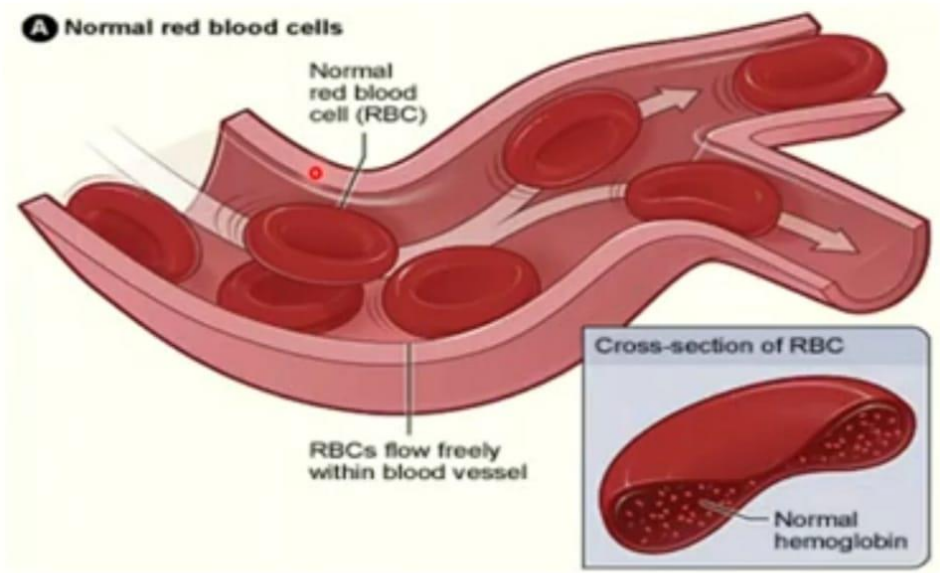
- **Males:** 5.0-5.5 million/mm^3
- **Females:** 4.5-5.0 million/mm^3
- **Newborn:** 6.0- 8.0 million/mm^3
- **Child and old age:** 3.5- 4.5 million/mm^3
- **Persons living at high altitude:** increase



Red Blood Corpuscles (RBCs)

Shape :

Circular, Non-nucleated, Biconcave discs



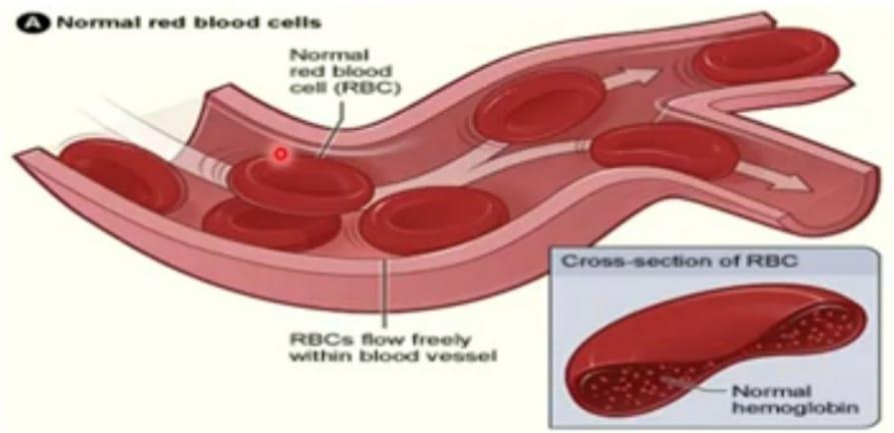
Red Blood Corpuscles (RBCs)

❑Structure of RBCs:

- ❖ RBCs are **not true cells**, because they have **no nuclei**, so called ***corpuscles***.

a) The cell membrane:

- ❖ Is plastic semipermeable membrane
- ❖ Has large surface area

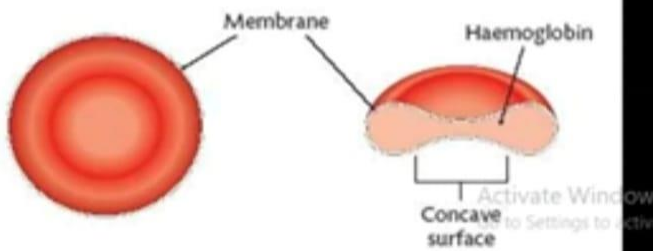


Red Blood Corpuscles (RBCs)

❑ Structure of RBCs:

b) Contents:

- ❖ **Hb** (34% of RBC) is the main constituent.
- ❖ **K^+** is the chief intracellular cation.
- ❖ **Carbonic anhydrase** enzyme helps CO_2 transport,
- ❖ **No mitochondria**, so they obtain energy from **anaerobic glycolysis**



Functions of RBCs

1) Functions of cell membrane:

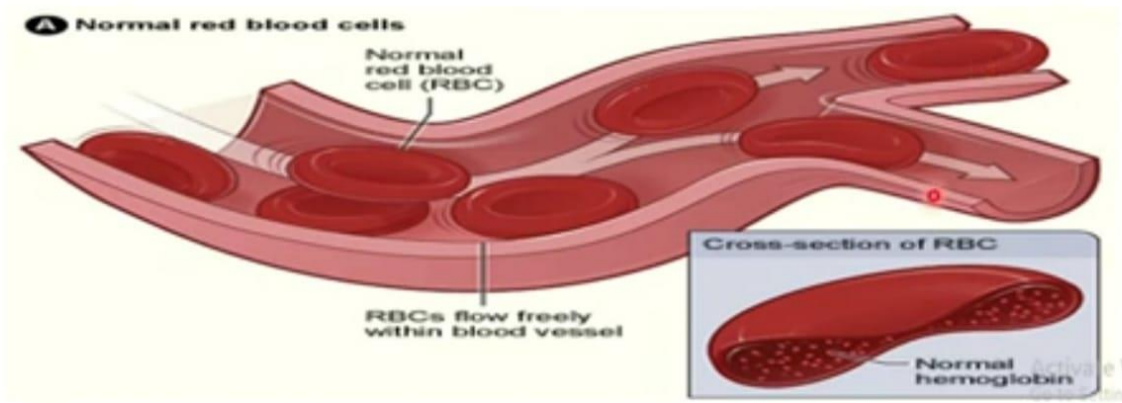
a) **It has a large surface area** than the actual cell volume;

- ❑ Gives RBCs its **biconcave shape**.
- ❑ Allows **easy diffusion of gases** through cell membrane.

Functions of RBCs

1) Functions of cell membrane:

b) Plastic → enhances cell flexibility → allow RBCs to be squeezed in small capillaries without rupture of it.



Functions of RBCs

1) Functions of cell membrane:

c) **It keeps Hb inside RBCs** → prevent its loss in urine.

- Filtration of Hb into glomeruli causes its precipitation in renal tubules and acute renal failure.

2) Functions of Hb:

a. **Transport of O_2** from lung to tissues by hemoglobin.

b. **Transport of CO_2** from tissue to lung by help of carbonic anhydrase

c. Hb is an **excellent acid - base buffer**

Functions of RBCs

3) Functions of carbonic anhydrase enzyme:

- It helps in transport of CO_2.

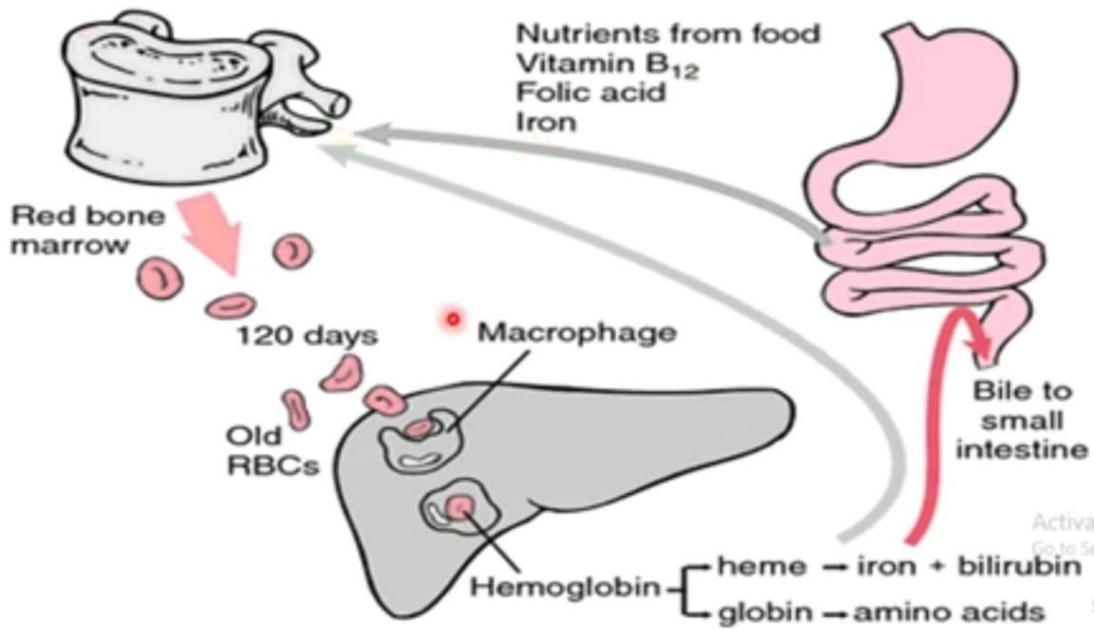
4) Blood viscosity:

- RBCs share in production of blood viscosity, which maintains arterial blood pressure.

Red Blood Corpuscles (RBCs)

Life span and fate of RBCs

- Life span of RBCs is about 120 days



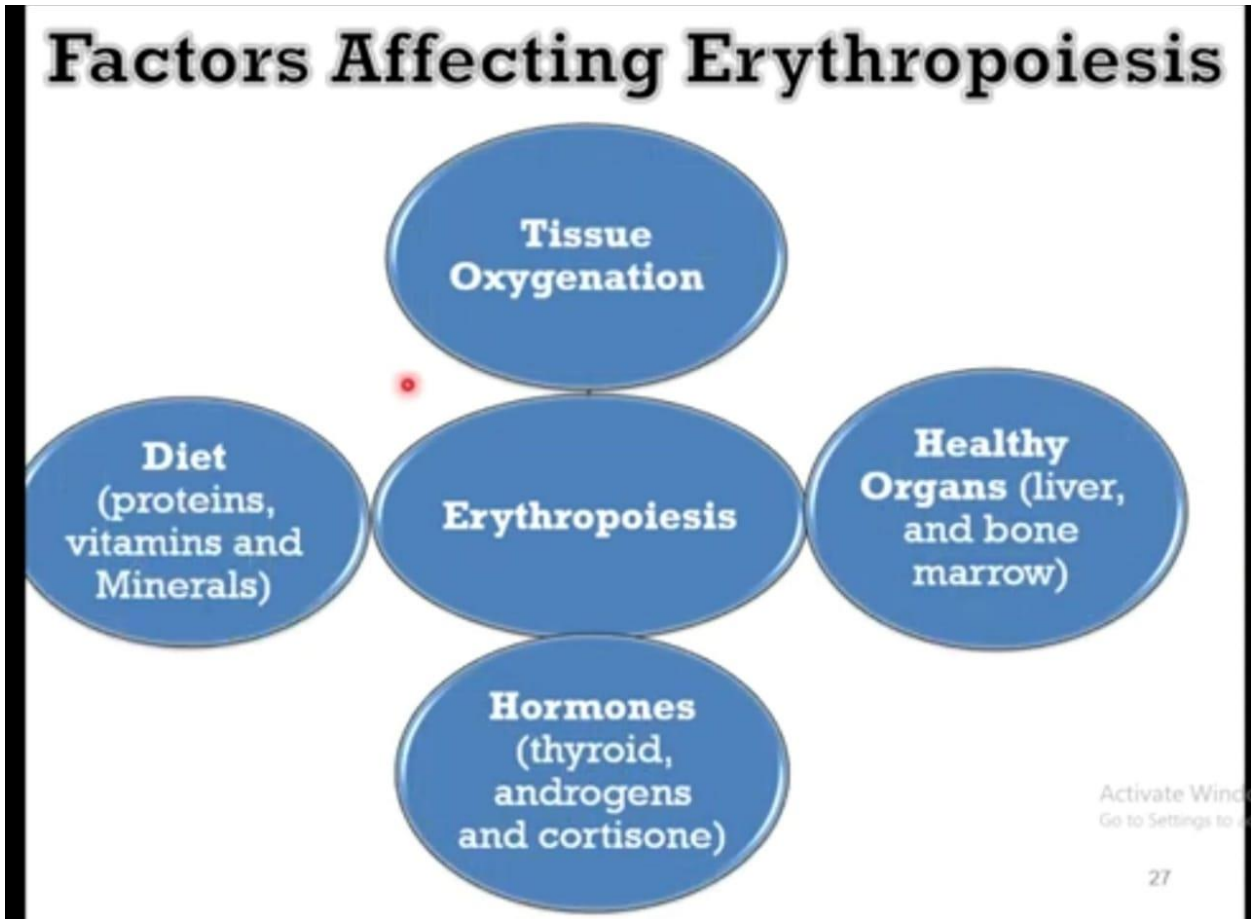
Erythropoiesis

The production of RBCs is known as erythropoiesis.

Adult	Red bone marrow of long bones (hip bone, breast bone & ribs)
Child (upto 5 year)	Bone marrow of all the bones
Foetus	Liver & spleen

- Increase in number of RBCs is known as **polycythemia**
- Decrease in number of RBCs is known as **erythropenia**

Factors Affecting Erythropoiesis



White Blood Cells (Leucocytes)

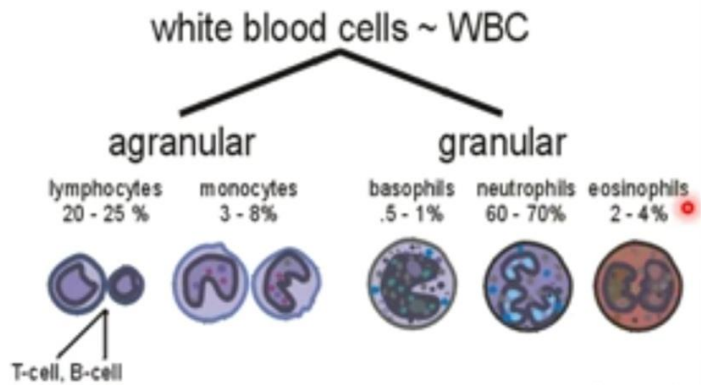
Count of WBCs:

- Ranges from **4000-11000**/mm3.

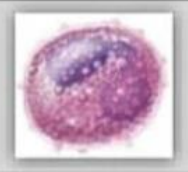
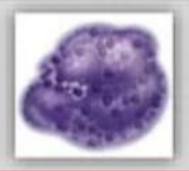
Types of WBCs:

- Classified into 2 types;

1. **Granular**: 3 types
   - ❑ Neutrophils
   - ❑ Basophils
   - ❑ Eosinophils
2. **Agranular**: 2 types
   - ❑ Monocytes
   - ❑ Lymphocytes



Granular WBCs

Type	Appearance	Features	Functions	Location produced
Neutrophils		• Nucleus with 3-4 lobes • Stain with neutral dye (hematoxylin)	Destroy bacteria by phagocytosis	Bone marrow
Acidophils (eosinophils)		• Nucleus with 2 lobes • Stain with acidic dye (eosin)	Combat the effect of histamine in allergic reactions	Bone marrow
Basophils		• Nucleus with indistinct lobes • Stain with basic dye (methylene blue)	Liberate heparin and histamine in allergic reactions to intensify inflammatory response	Bone marrow

Agranular WBCs

Type	Appearance	Features	Functions	Location produced
Lymphocyte		• Smallest of WBCs • Large round nucleus	Produce antibodies	Bone marrow, spleen, tonsils
Monocyte		• Largest of WBCs • Large kidney shaped nucleus	Ingest microorganisms	Bone marrow

Leucopoiesis

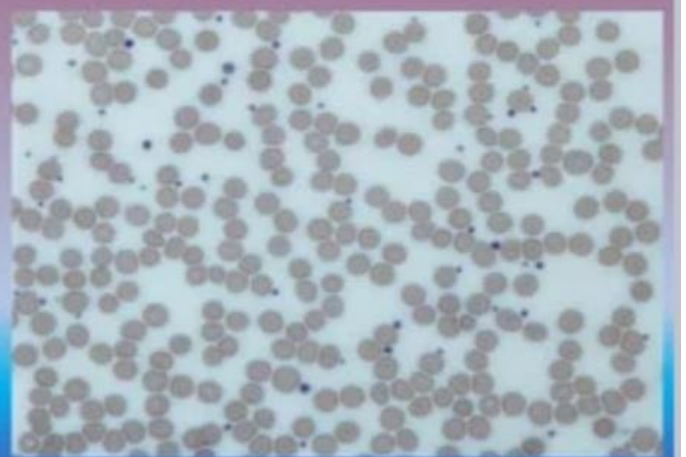
The production of WBCs is known as leucopoiesis.

Adult	Liver, spleen, tonsils, bone marrow
Foetus	Liver, spleen

- Increase in number of WBCs is known as **leucocytosis**
- Decrease in number of WBCs is known as **leucopenia**
- Pathological increase in number of WBCs is known as **leukemia (blood cancer)**

PLATELETS

- Also called thrombocytes.
- Derived from ruptured multinucleate cells (megakaryocytes)
- Smallest of formed elements.
- Are fragments of megakaryocytes.
- Lack nuclei.
- Normal platelet count = 300,000/mm3
- Survive 5-9 days



Thrombopoiesis

The production of platelets is known as thrombopoiesis.

Platelets are the fragments of large cells called megakaryocytes that remain in the bone marrow.

- Increase in number of platelets is known as **thrombocytosis**
- Decrease in number of platelets is known as **thrombocytopenia**

Blood Collectoin

Blood sampling used for the laboratory tests can be either:-

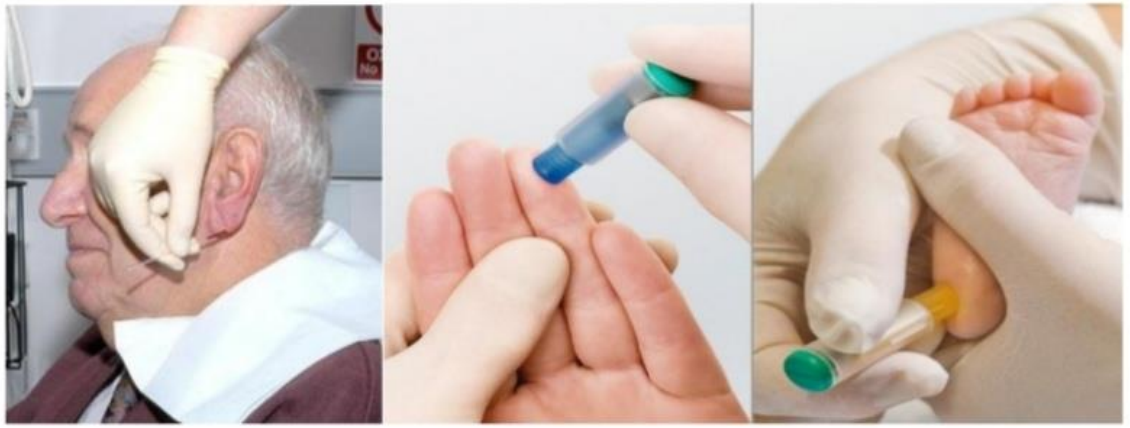
1- Capillary blood. In this method blood can be taken by pricking:-

A- The lobe of the ear

B- The side surface of the finger

C- The infants from the planter surface of the heel or The great toe.

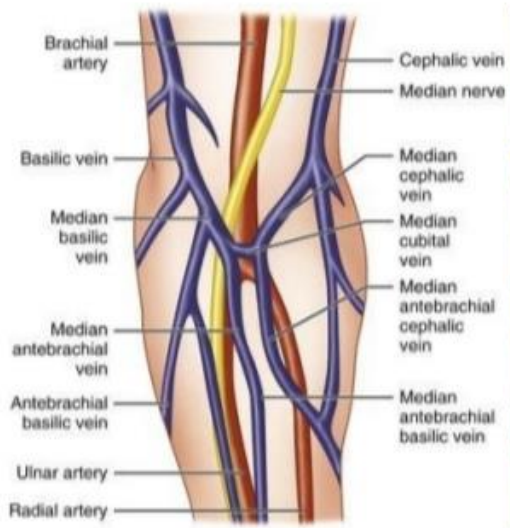
This method is carried when the test <u>needs little amount of blood</u>.



2- Venous blood.

It is preferred for most hematological examination. In this method blood can be collected from many sites especially the **antecubital veins** of the forearm

This method is carried when the test needs a lot of amount of blood.



3- Arterial blood.

This is done by a special type of syringe the artery usually chosen is the **radial artery**. The test is especially valuable for blood gas analysis.