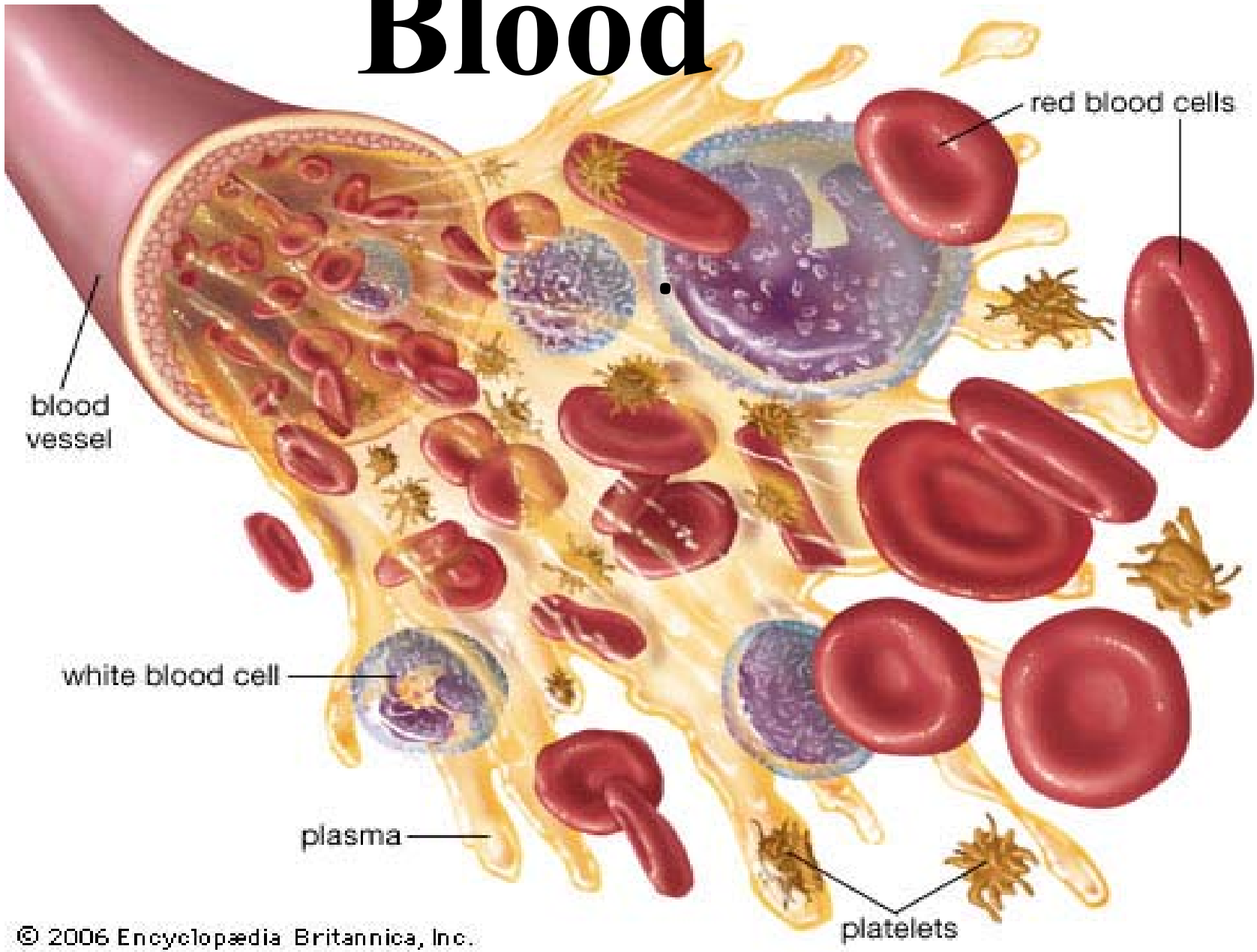
Blood


red blood cells
blood vessel
white blood cell
plasma
platelets
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Connective Tissue

C.T. proper

1. **Loose C.T.**
2. **Adipose C.T.**
3. **Reticular C.T.**
4. **Dense C.T.**
5. **Elastic C.T.**
6. **Mucoid C.T.**

modified C.T.

Fluid nature

Blood

Solid nature (supporting C.T.)

- **Cartilage**
- **Bone**

Blood

Modified type of CT

Mesodermal in origin

- Considered modified connective tissue because it contains:
  - cells
  - a liquid ground substance (**called plasma**)
  - dissolved protein fibers.
- Adult has ~ **5.5 -6 L**
  - Circulate in **CVS**
  - **Blood formation = hematopoiesis**
- Consists of liquid and cellular components by a machine called a centrifuge.

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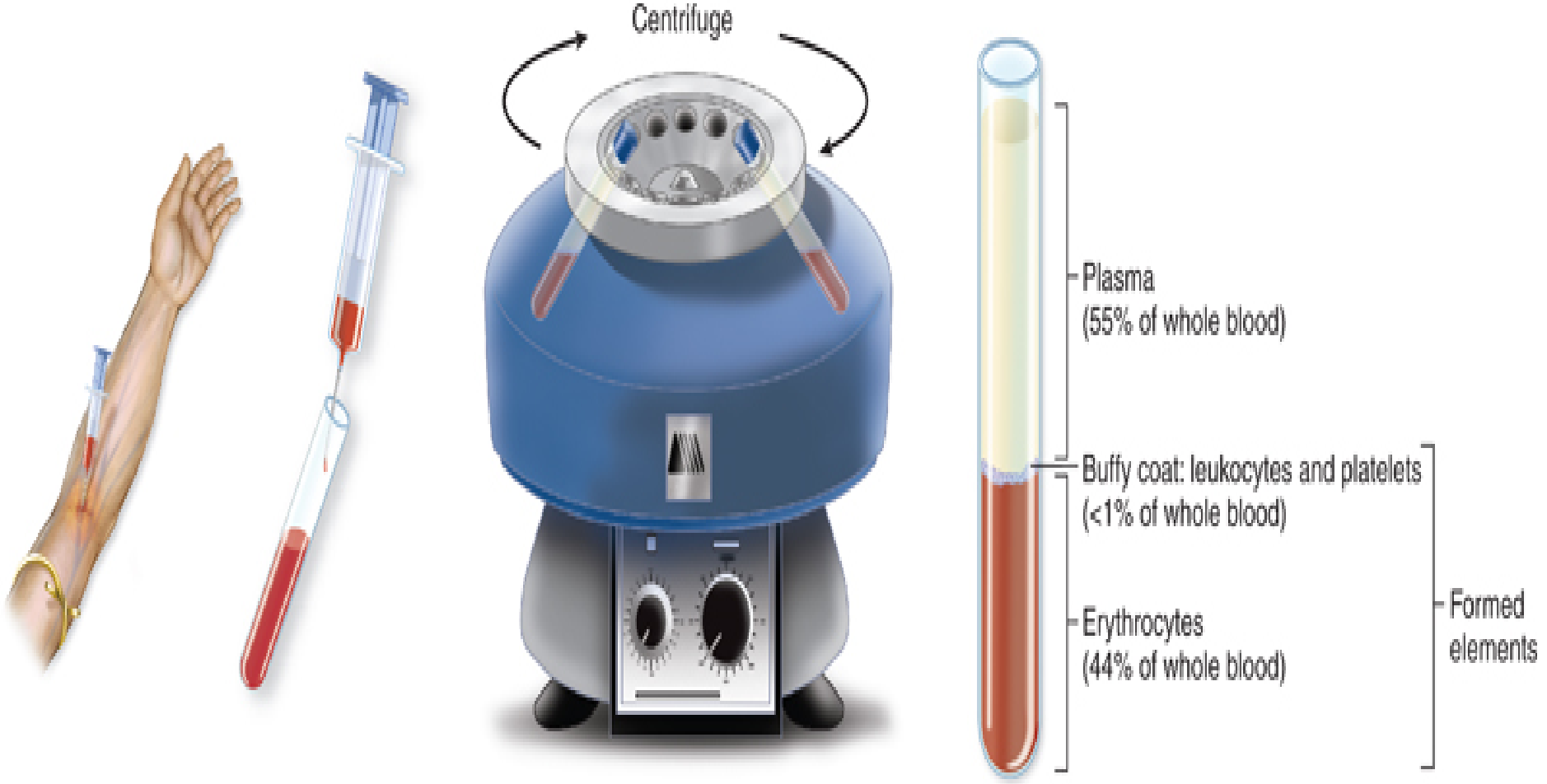


(1) Withdraw blood into a syringe and place in a glass tube.

(2) Place the tube into a centrifuge and spin for about 10 minutes.

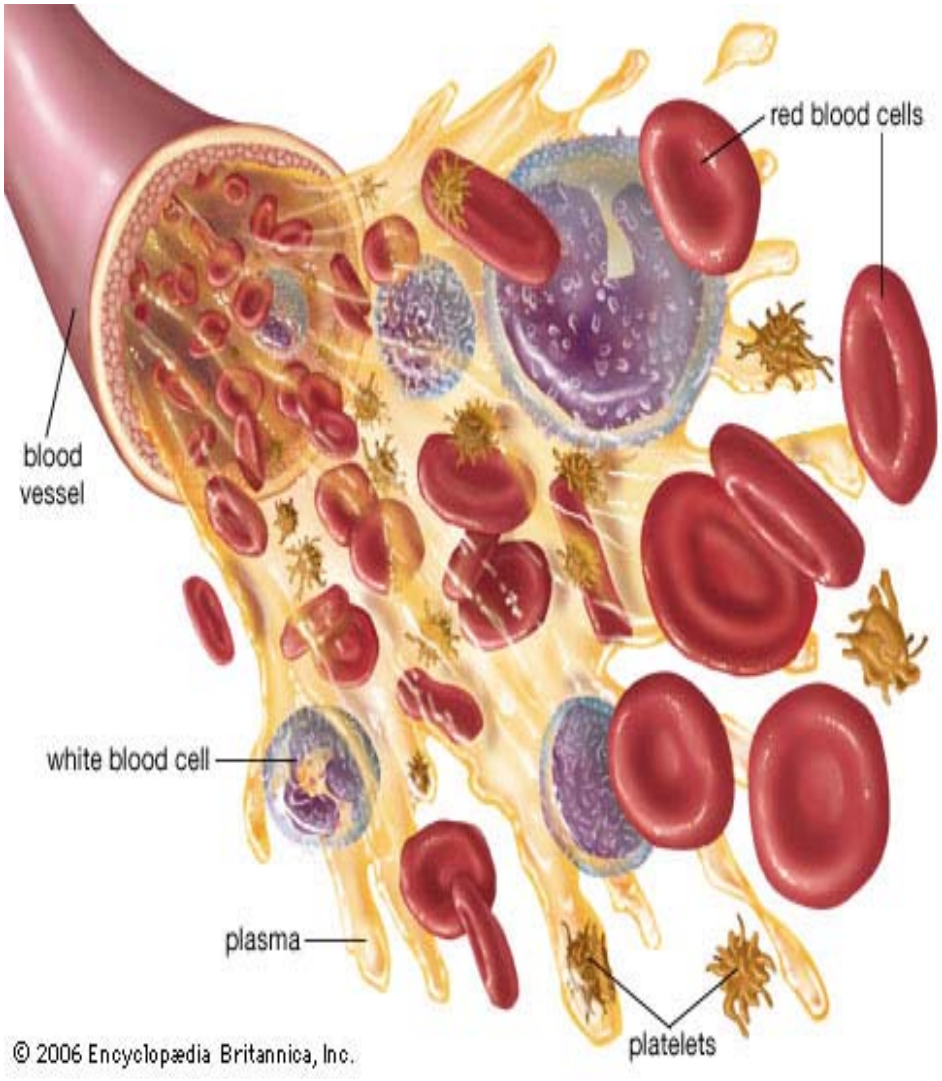
(3) Components of blood separate during centrifugation to reveal plasma, buffy coat, and erythrocytes.

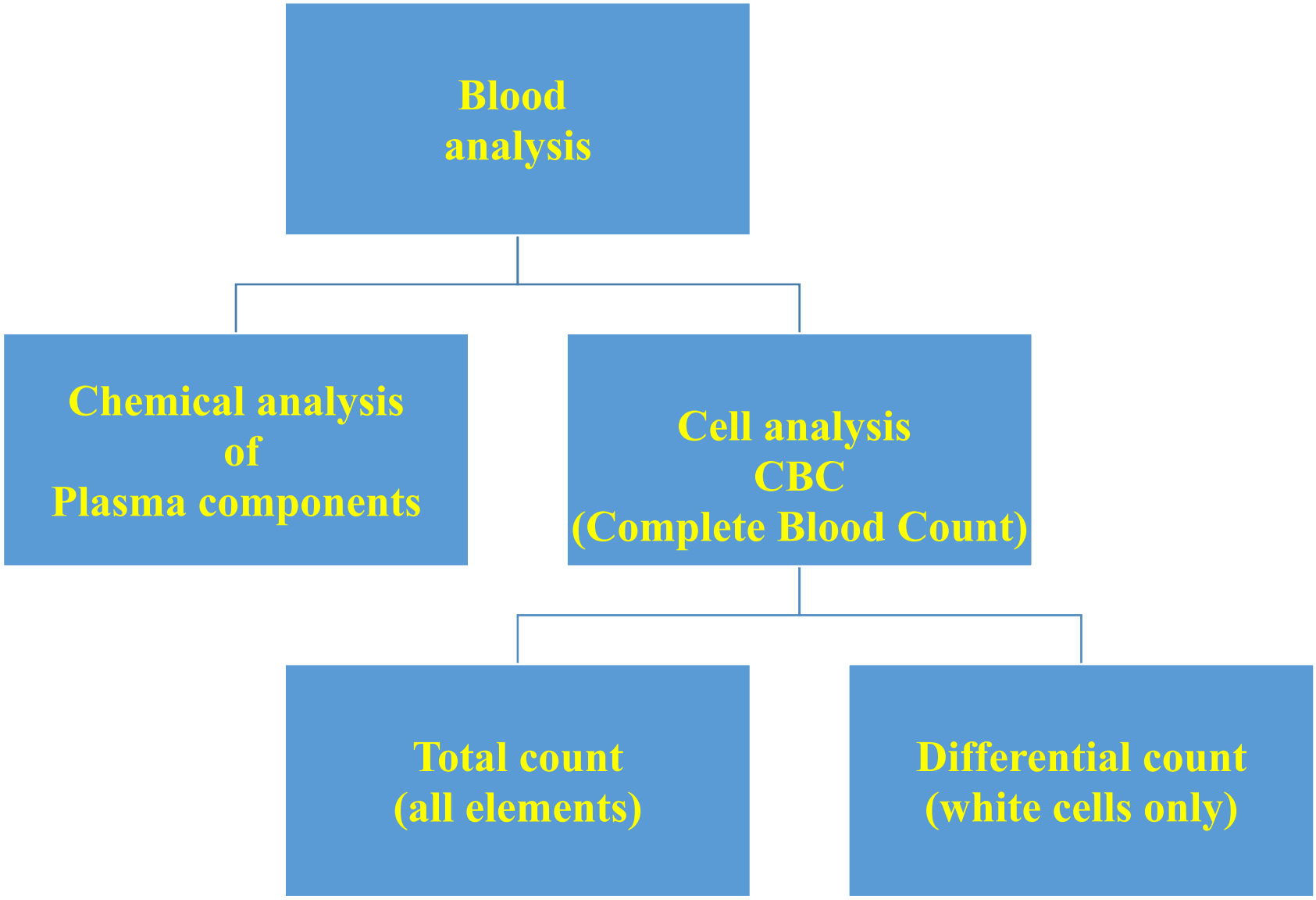
BLOOD

- **1-Formed Blood elements**
- **Cells : 45%**
- **Originate in the red bone marrow**

Plasma: 55%

3-No aberrant fibers.




Blood analysis
Chemical analysis of Plasma components
Cell analysis CBC (Complete Blood Count)
Total count (all elements)
Differential count (white cells only)

Plasma

55% of blood volume:

- **Water 92%.**
- **organic substances:7 %**

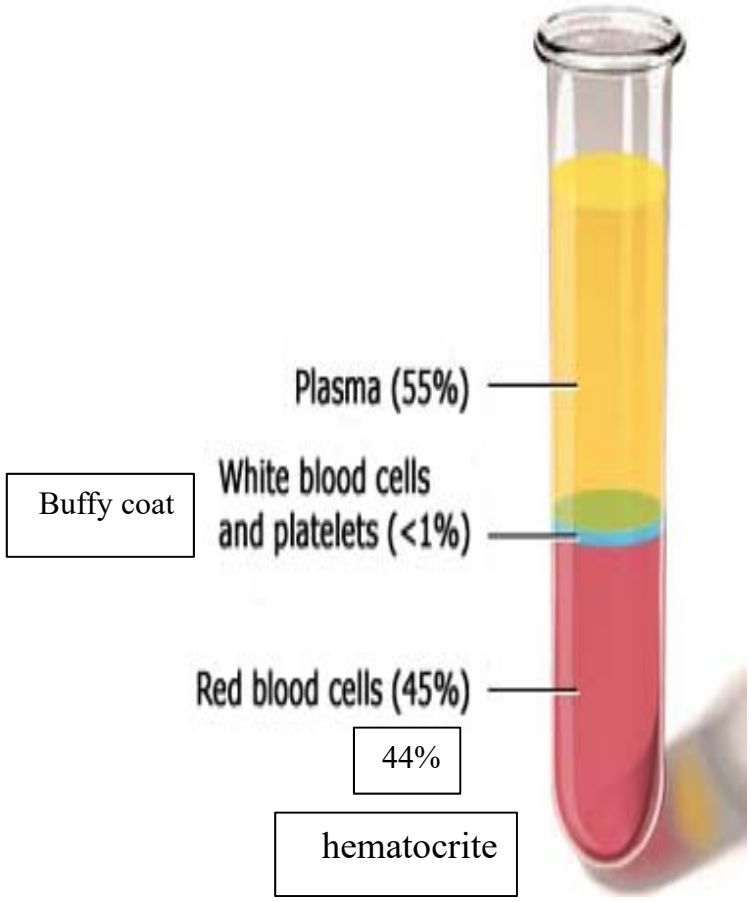
➢ plasma proteins

(albumin, globulin, prothrombin and **fibrinogen**)

➢ Hormones & enzymes.

- **inorganic salts 1%**

(NaCl, Bicarbonates, phosphates & calcium)



The Blood Film= Smear

Preparation of blood for laboratory study

- Why do we do a blood film ?

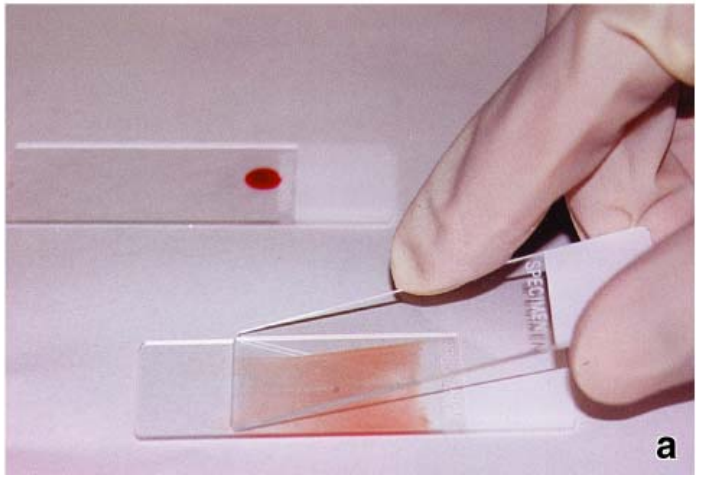
1.To study blood elements.

2.To make differential leucocytic count.

Steps :

- Put a small drop of blood
- Spread into a thin film
- Stain with Leishman or Giemsa stain

(methylene blue +eosin)



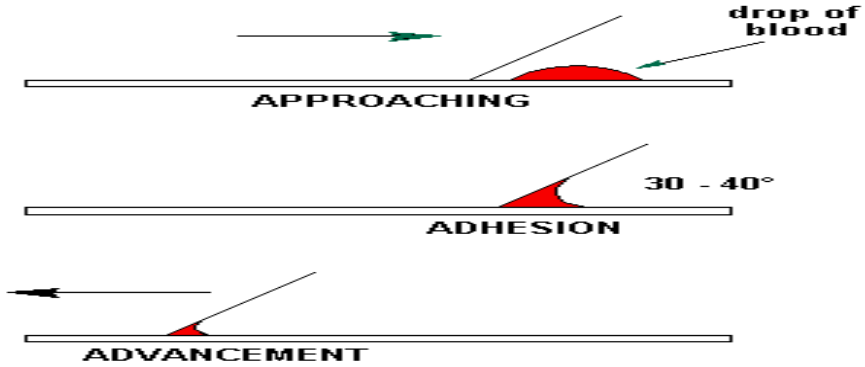


Fig. 7 - How to prepare a blood smear

Blood film

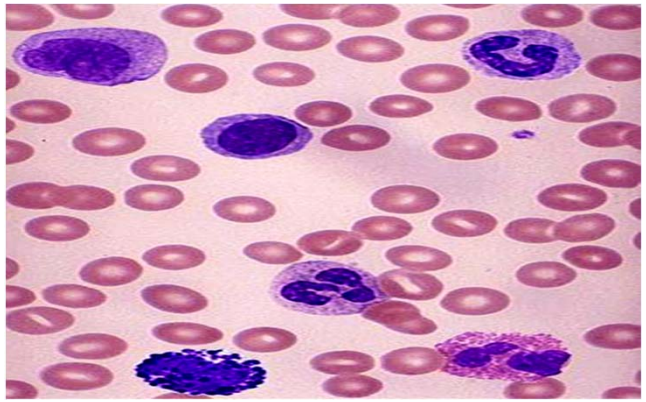
- Why do we do a blood film ?

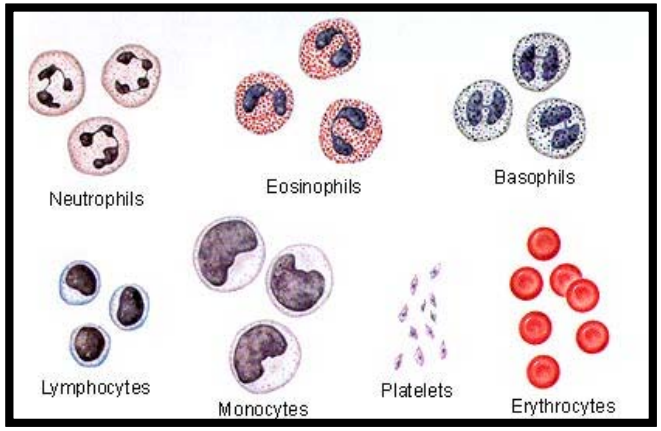
1.To study blood elements.

2.To make differential leucocytic count.

Steps :

- Put a small drop of blood
- Spread into a thin film
- Stain with Leishman or Giemsa stain (methylene blue +eosin)





Stains of blood film

Giemsa's / Leishman's

= **methylene blue + eosin**

►basophilic **(violet)**

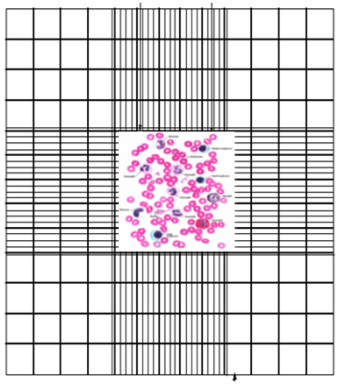
►eosinophilic **(pink)**

►azurophilic **(red purple)**

Complete blood count (CBC)

I-Total count :

It is the total number of blood elements (RBCs, WBCs,or Platelets) per cubic millimeter



Cubic millimeter=micro liter

Measured by

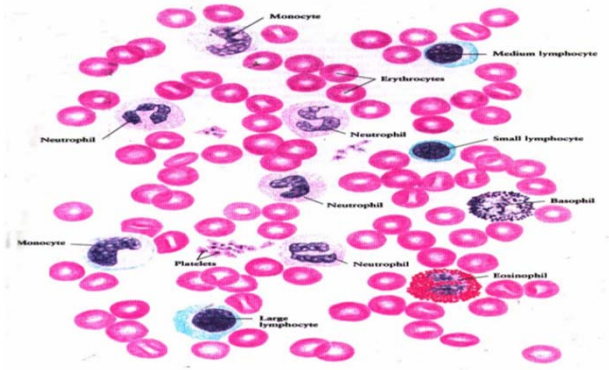
Hemocytometer

Or automatic counter

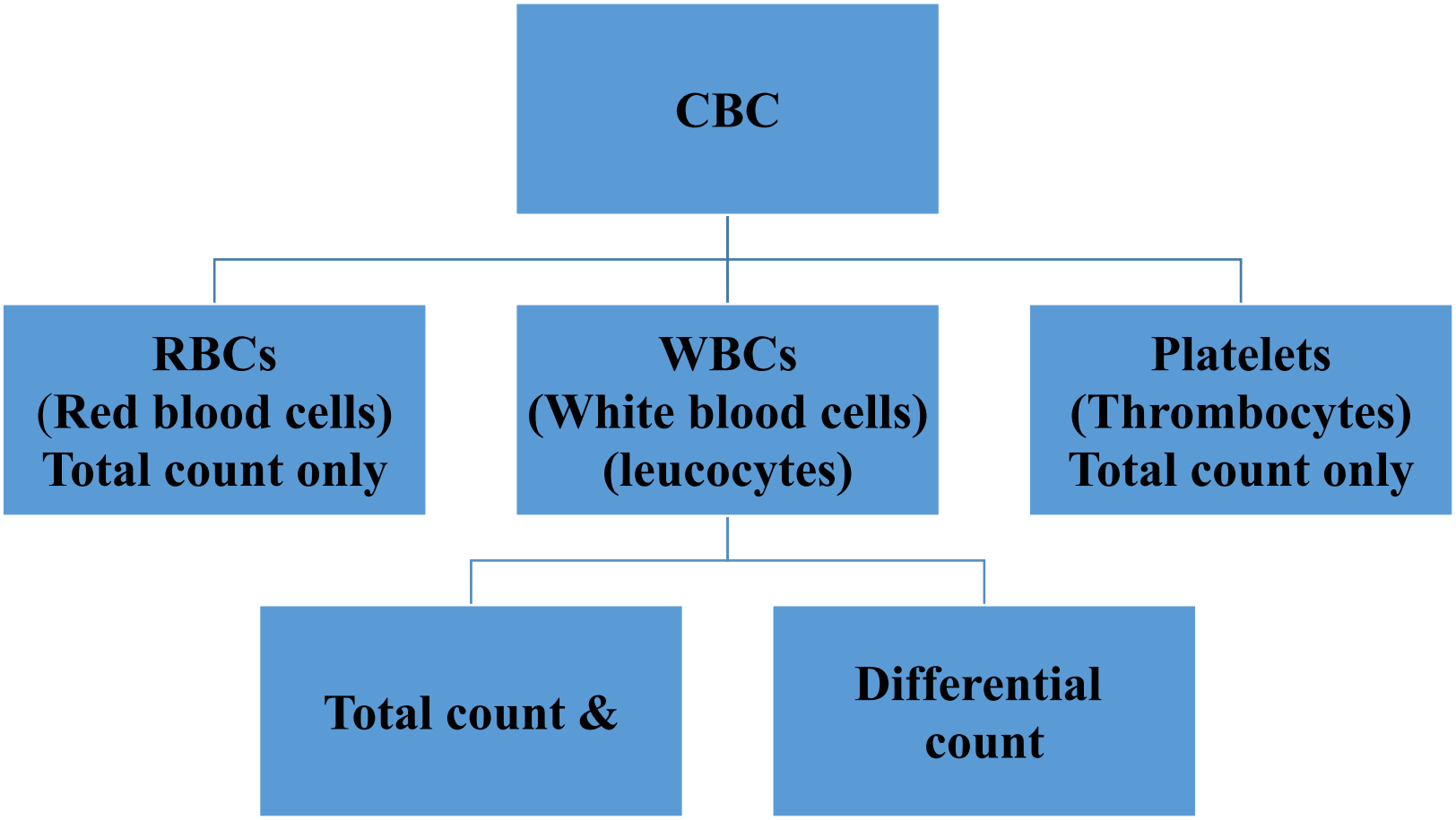
II-Differential leucocytic count

- the percentage of each type of leucocytes to the total count
- Done by blood film.

Or automatic counter



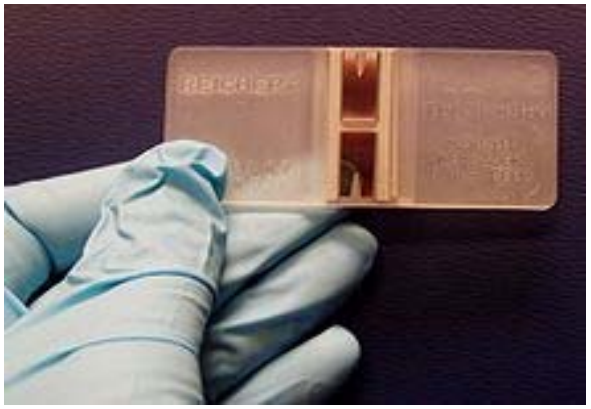
Complete blood count (CBC)



Blood cell count=**CBC**

- **Manual method= Conventional**

=hemocytometer= counting chamber.



- **Electronic method**

= **automated hematology analyzer.**

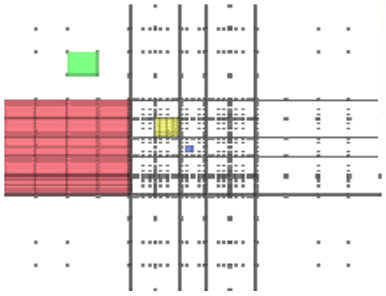
RBC count **4.5-5** million/mm^3 in female

Total leukocytic count 4,000-11,000/mm^3

Platelet count 250,000- 350,000/mm^3

- **Differential leukocytic count**

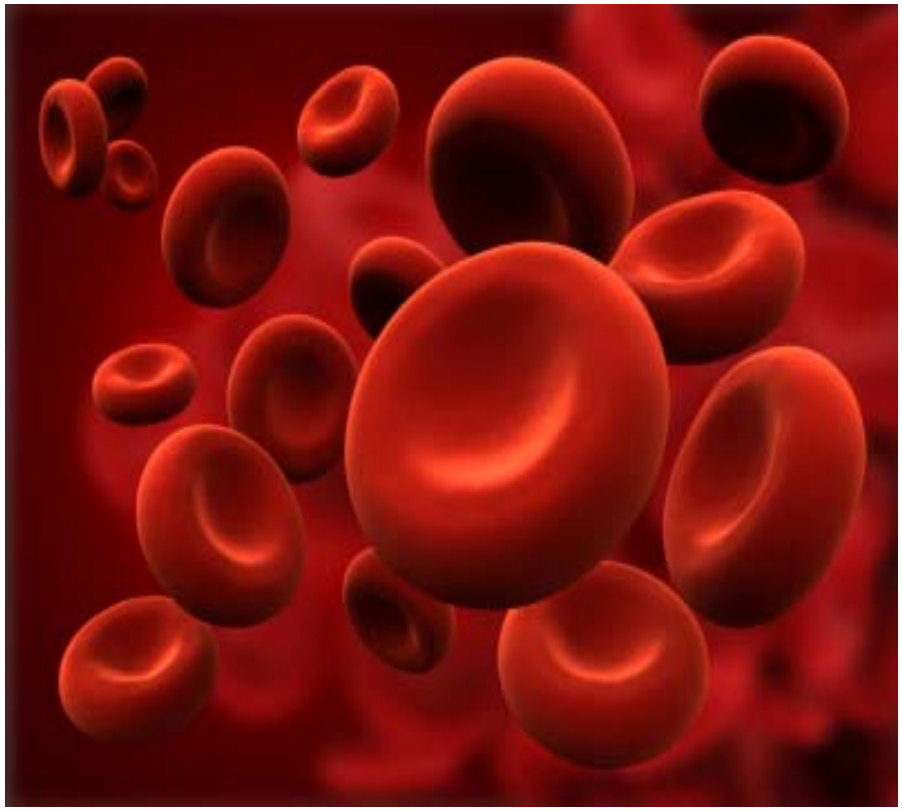
=Examination of blood film



Red Blood corpuscles =Erythro/cytes

- Blood cell

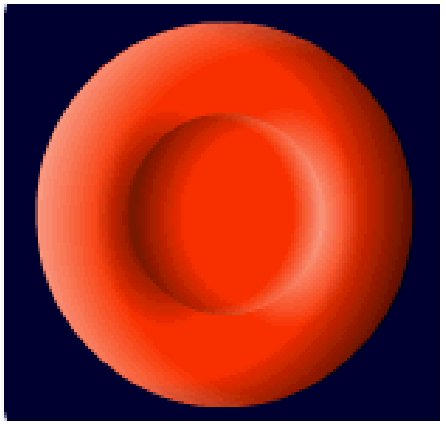
1. Total or Differential count
2. Shape & size
3. Structure (nucleus + granules)
4. Function
5. Life span
6. Abnormalities

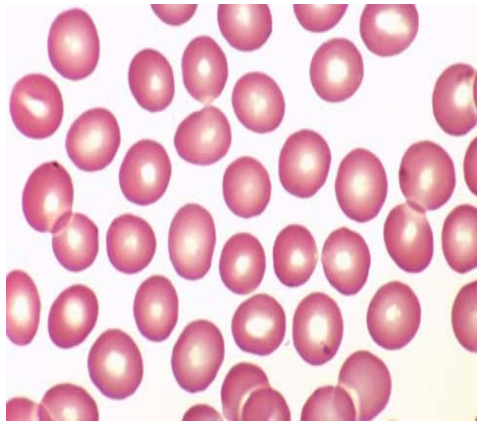


Red Blood corpuscles

Normal RBCs total count:

- In **males** 🚹 5- 5.5 millions / mm^3 blood
- in **females** 🚺 4.5-5 millions / mm^3 blood





• LM of RBCs:

❖**Shape:** - Biconcave discs.

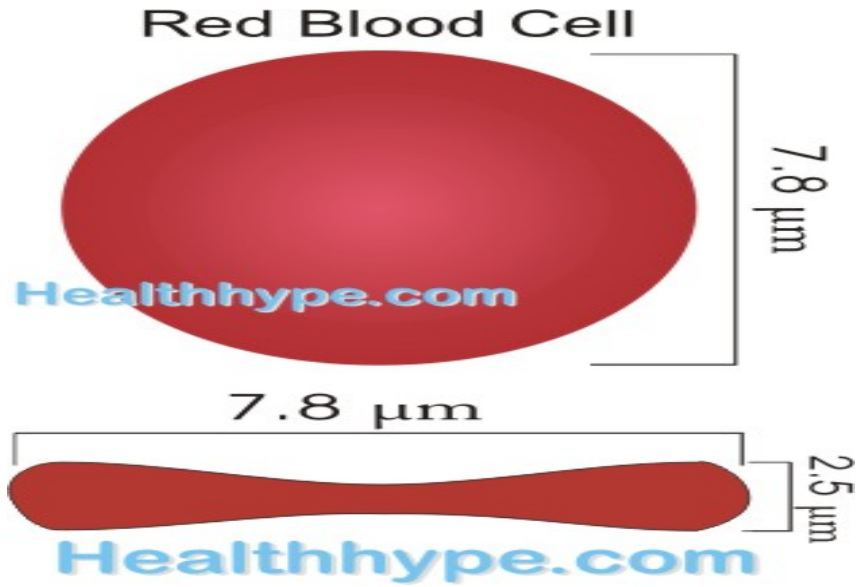
- Mature RBCs are membrane- bound corpuscle.

❖**Size:**

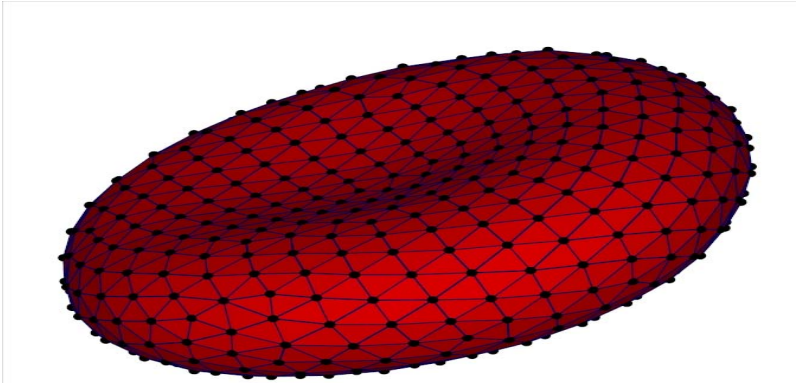
- -Diameter 7.5 µm
- -Thickness 1 µm

❖**Nucleus:** Anucleate.

❖**Cytoplasm** **33% of the corpuscular volume is Hemoglobin ➖ heme "Fe"+ Globin 'protein'**

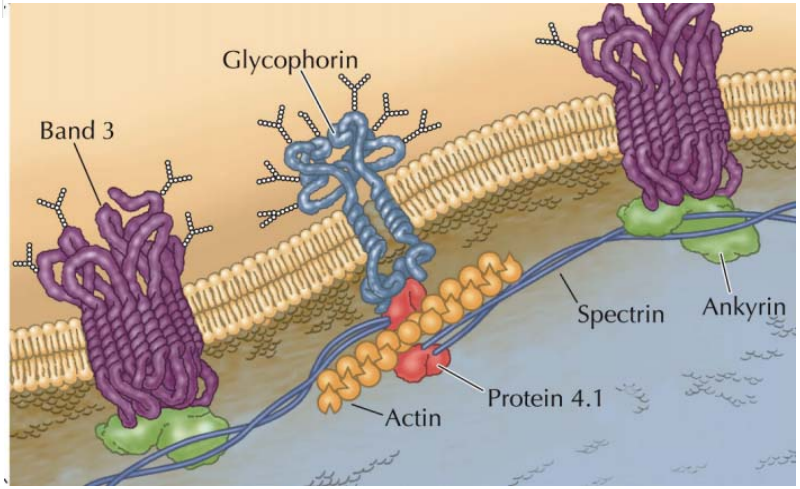


EM picture of RBCs:



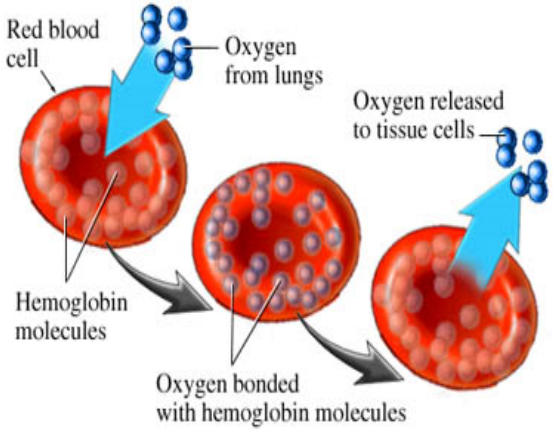
- **No** nucleus, **No** typical organelles.
- Only few mitochondria
- subplasmalemmal cytoskeleton (actin, spectrin & ankyrin) responsible for the flexibility of RBCs.
- **Glycocalyx**

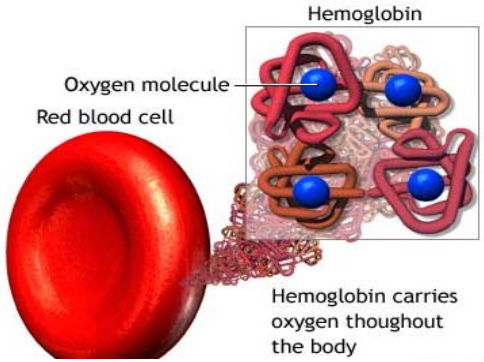
responsible for the **ABO/ Rh** blood group.

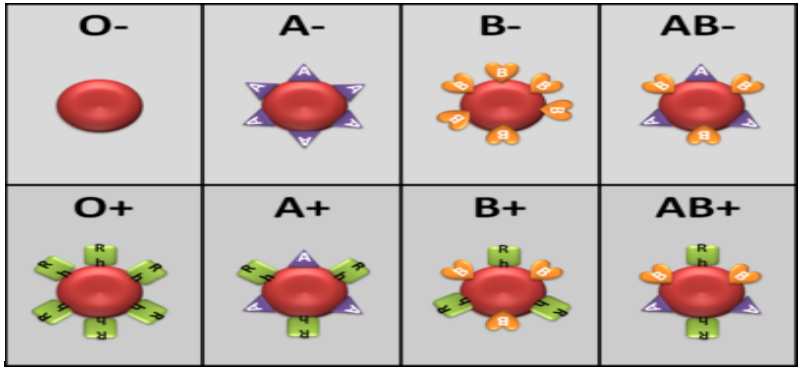


- Function of RBCs

Carry O2& CO2



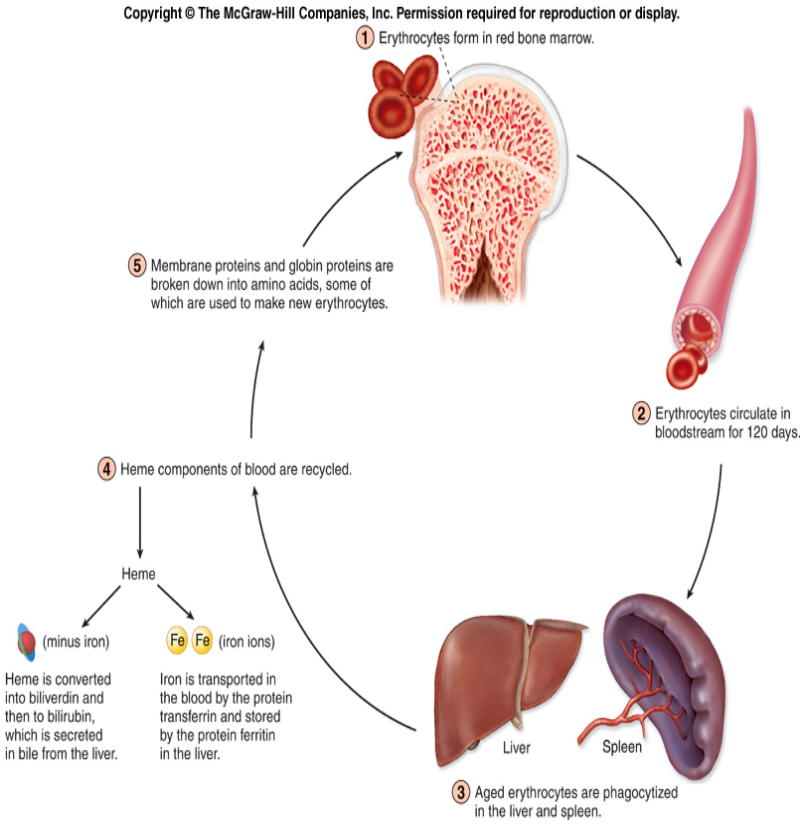




2- life span:

- **100-120 days**
- Then removed by **Macrophages** of

spleen and liver sinusoids.



• Adaptation to function

1- ▲surface area.

2- ▲amount of HB

(no nucleus/ organelles)

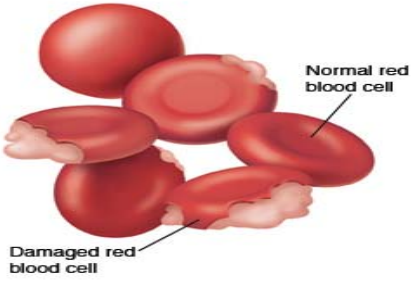
3- ▲ ▲ HB at the periphery

4- selective permeability

5- carbonic anhydrase

6- ▲ flexibility to squeeze without damage

7- **Glycocalyx**



Abnormalities of RBCs

- **Abnormalities of RBCs in number**
- Anaemia:

decrease in the total number of RBCs.

- Polycythaemia:

increase in the total number of RBCs.

Causes: **(decreased oxygen tension)**

Physiological: newborns ,high altitude

Pathological: chronic lung and heart diseases.

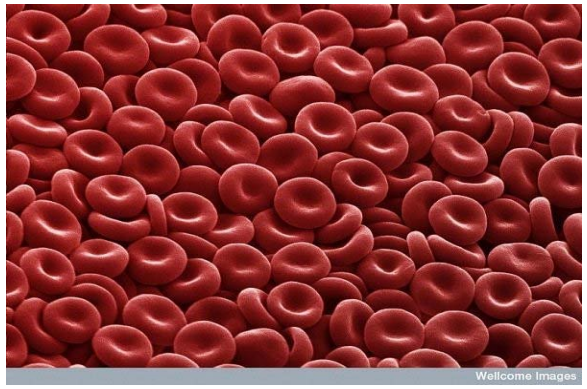
- **Abnormalities of RBCs in size**
- **Microcytosis**:

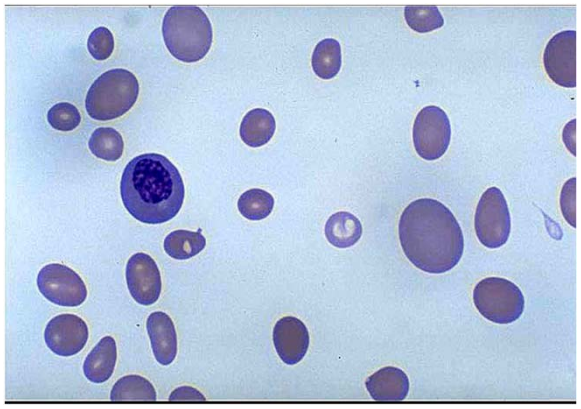
diameter of RBCs is **less than 6μm.** (Microcytic anaemia)

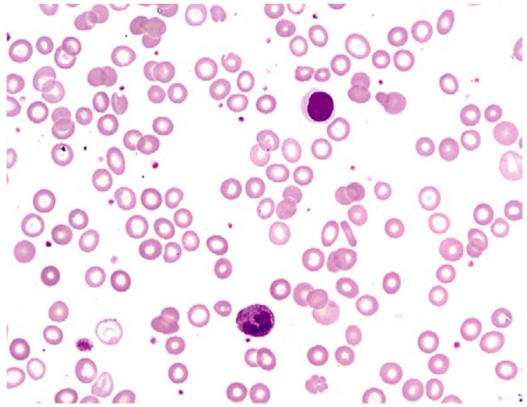
- **Macrocytosis**:

diameter of RBCs is **more than 9μm.** (Macrocytic anaemia)

- **Anisocytosis?? Variable size**



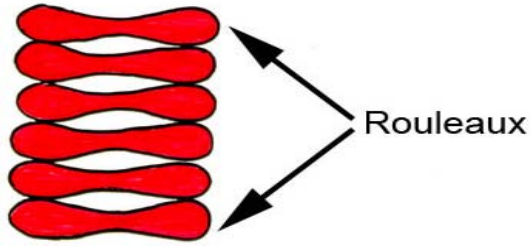




Abnormalities of RBCs in shape

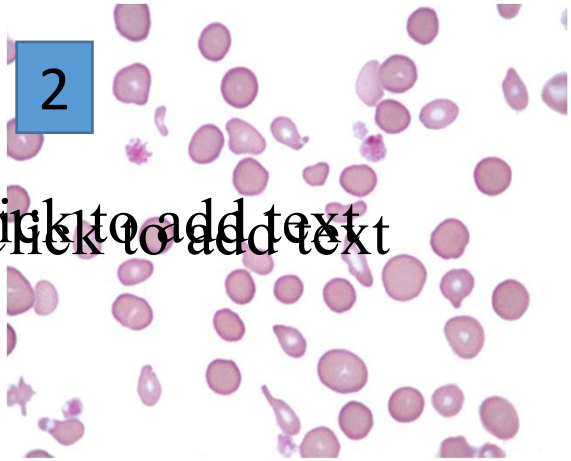
1- Rouleaux formation

In slow circulation



2- Poikilocytosis

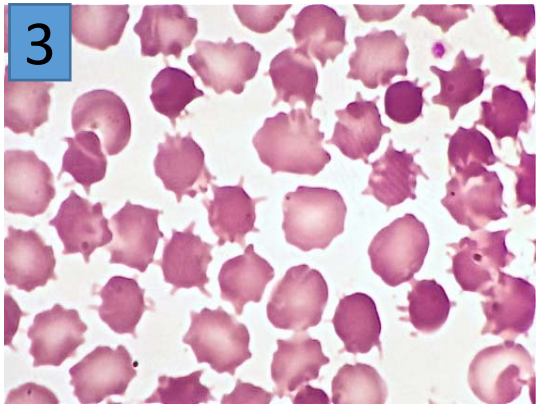
•Variable in shape



Click to add text

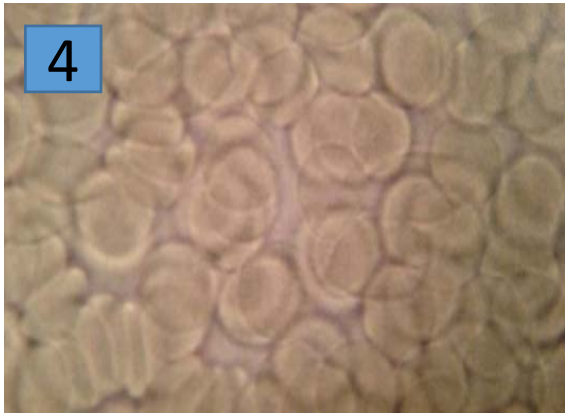
3- In hypertonic solution

►echinocytes(crenation)

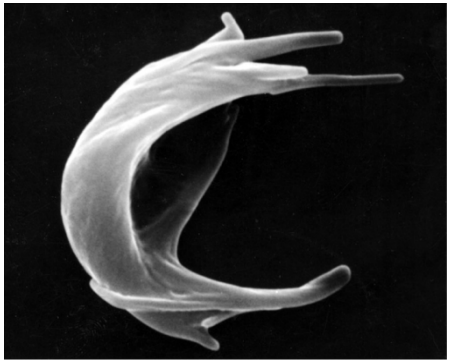


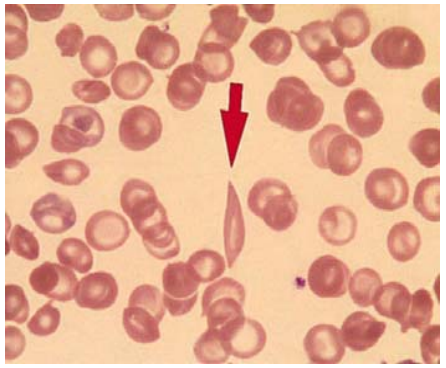
4- In hypotonic solution

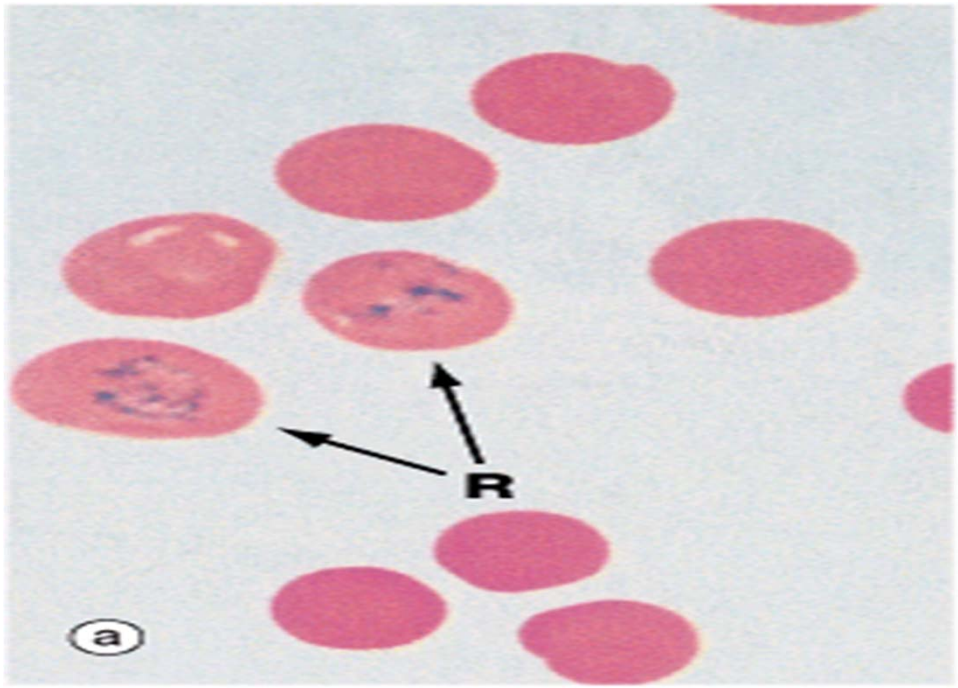
►Ghosts



- **Sickle Cell Anemia (abnormal Hemoglobin)**





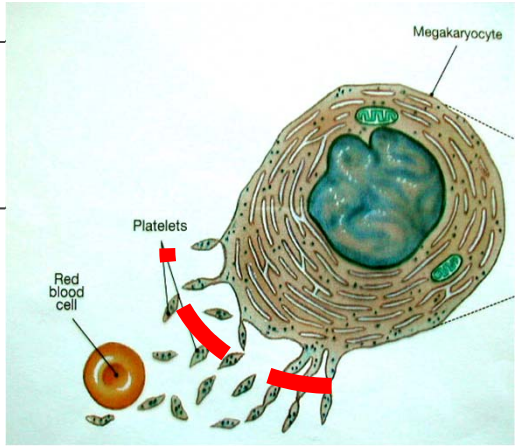


- Reticulocytes
  - immature RBCs
- Reticulocytes represent 1% of all RBCs in normal blood film.
- Nucleated
- **differ than mature RBCs**
  - slightly larger (8µm).
  - Cytoplasm contains remnants of ribosomes.
  - On staining with **cresyl blue** form a reticulate pattern.
- **Clinical significance:**

An increase in this percentage indicates an

- **accelerated rate of erythropoiesis.**
- **compensate for anemia or hemorrhage.**
-

BLOOD PLATELETS

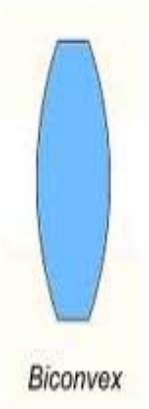


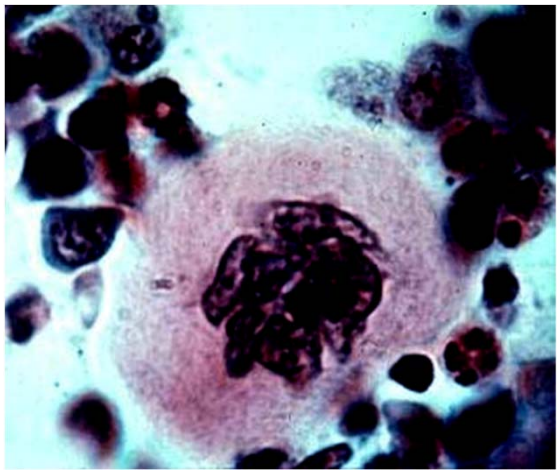
- **Origin:** from megakaryocyte in the bone marrow.

❖**Normal Platelet Count**

250,000-350,000/ mm^3

200-400,000

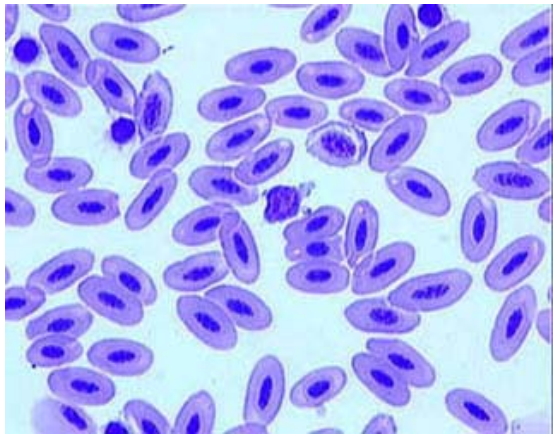




Structure (L. M) :

- Non-nucleated bodies,
- 2-4microns,central granular portion **(granulomere)** &peripheral clear zone **(hyalomere)**

- **Cell fragments of megakaryocyte.**
- **Thrombocytes.**
- **Thromboplastids**



❖***LM picture***

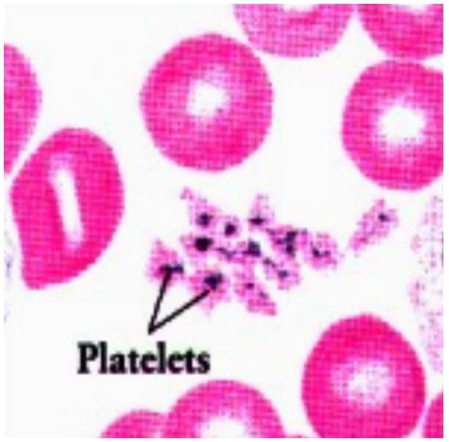
- **Shape:** Anucleate, biconvex discs.
- **Diameter** :2-3 µm.

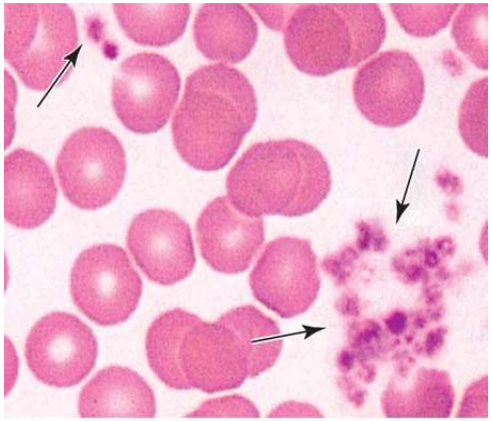
BLOOD PLATELETS

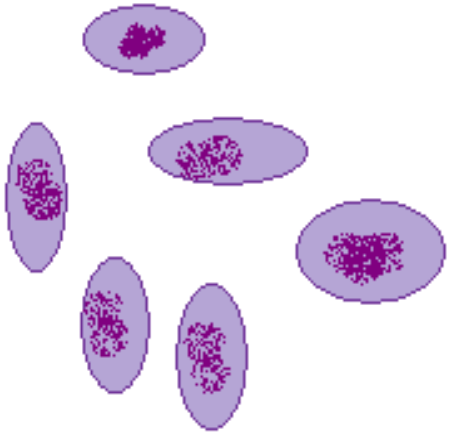
❖**LM picture**

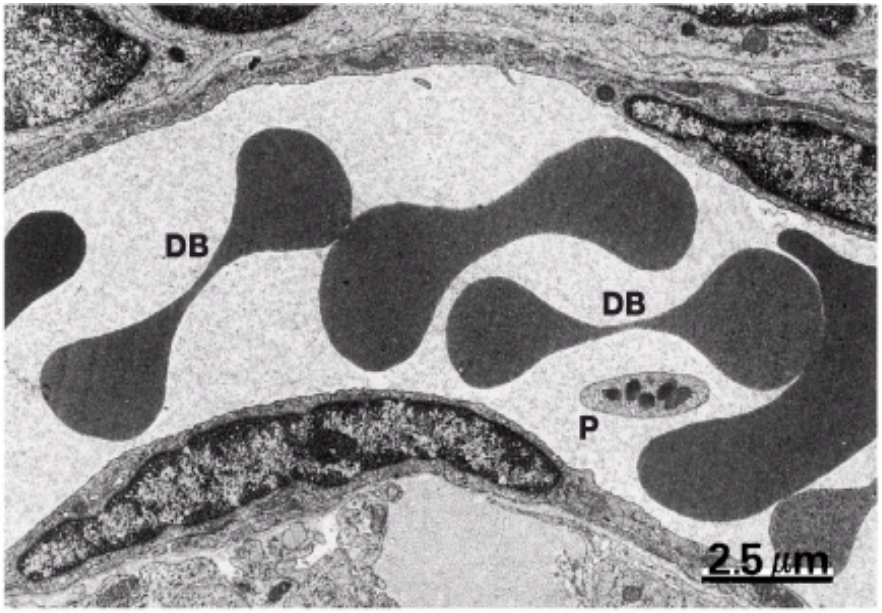
- **Granulomere**,granular central region

- **Hyalomere** at the periphery, there is a pale basophilic zone









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BLOOD PLATELETS

❖**EM:**

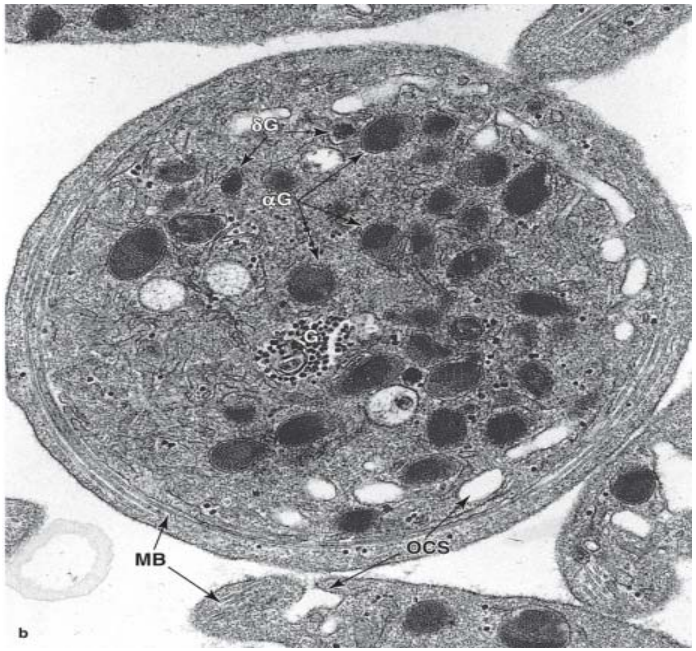
➢**Shape:**

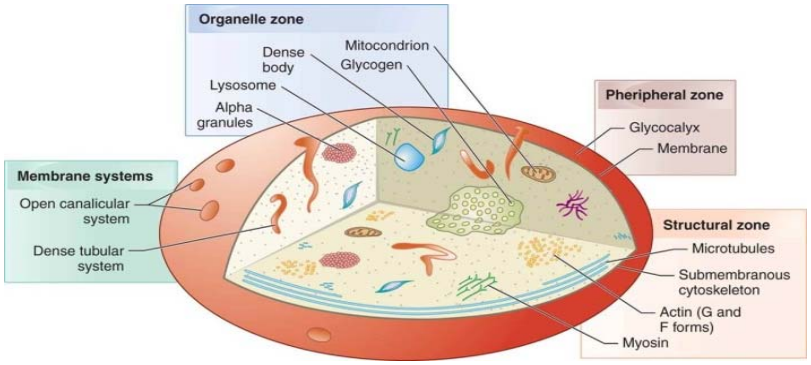
- **Irregular.**
- **Pseudopodia.**

➢**Platelet membrane:**

▲▲glycoprotein coat for:

- **Adhesion**
- **Aggregation**
- **Hyalomere &granulomere**





➢Platelet granulomere

few mitochondria & ribosomes.

➢scattered glycogen particles.

➢3 types of granules:

➢ Alpha **(α)**granules:

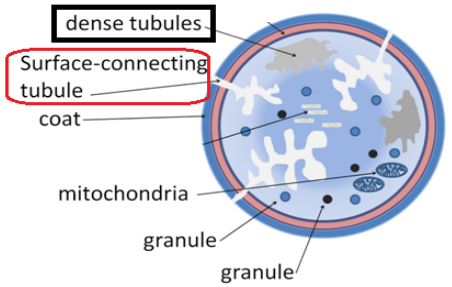
- Large.
- Abundant.
- PD-GF, coagulation factors.

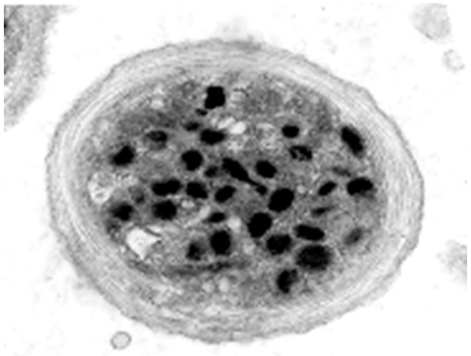
➢ Delta granules:

- Medium (size, no.)
- ATP, ADP, serotonin.

➢ Lambda**(λ)** granules:

hydrolytic enzymes.





•Platelet hyalomere

- Electron- lucent.
- Lacks organelles.
- It contains:

➢ **circumferential bundle of 10-15 microtubules ► ► discoid shape**

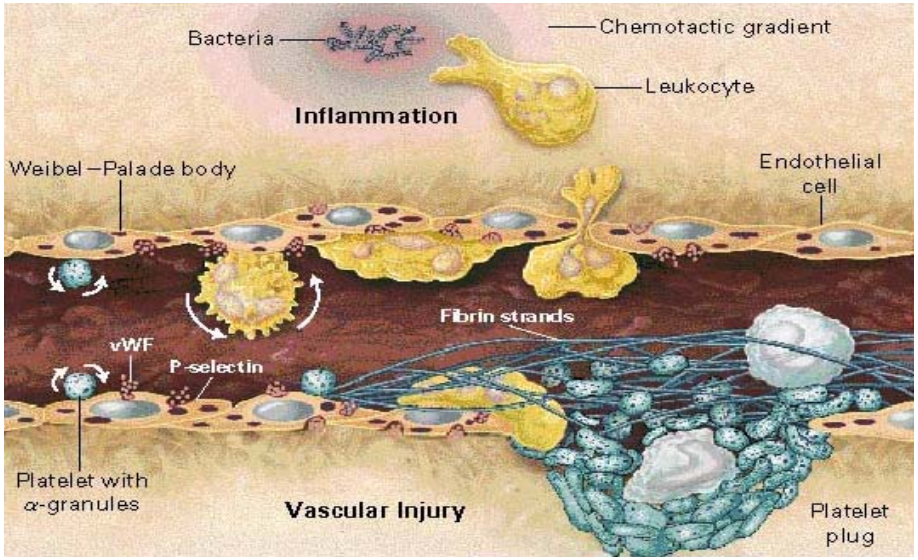
➢ **Actin & myosin ► ► motility + clot retraction**

➢ **Canalicular system + tubular system.**

PLATELET FUNCTION

At sites of injury of BVs:

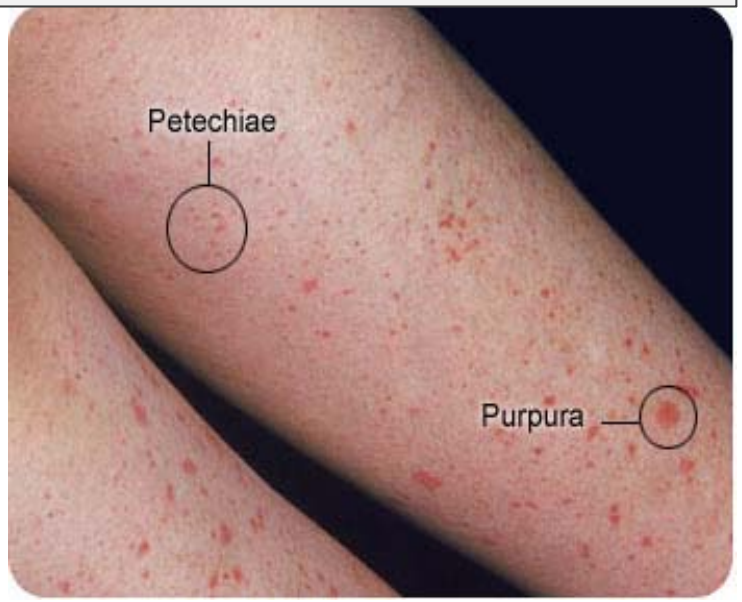
- Platelet adhesion
- Platelet aggregation
- Thrombus formation
- Clot retraction
- Clot removal
- **Functions of platelets**
- Platelet aggregation-→white thrombus
- Local blood coagulation-→ red thrombus
- Serotonin → Vaso-constristriction
- **Clot retraction** → by microfilaments
- Clot removal→ by **proteolytic enzymes**



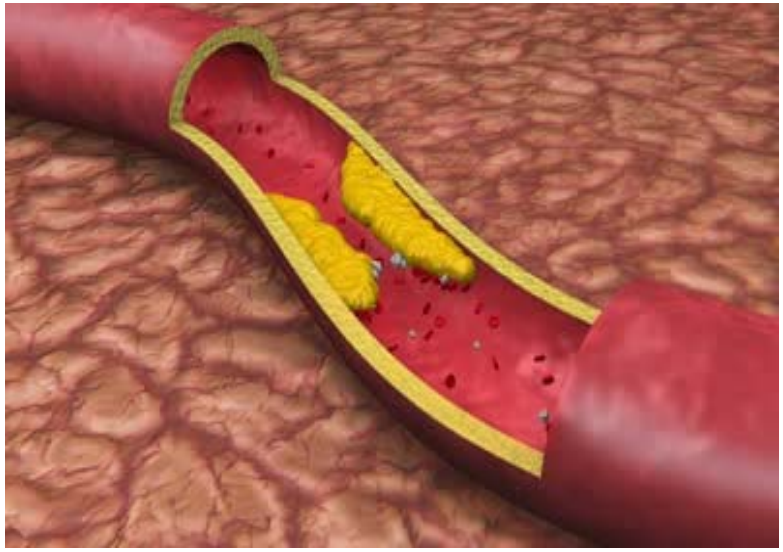
PLATELET ABNORMALITY

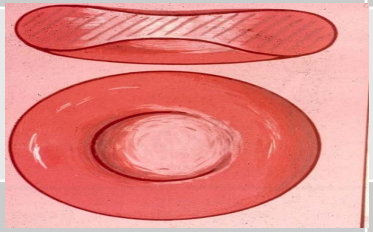
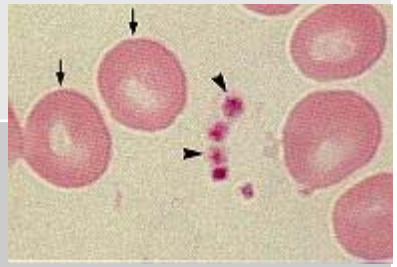
- Thrombocytopenia ▼ ▼ ▼

Thrombocytopenia (purpura)



- Thrombocythemia ▲ ▲ ▲
- Thrombasthenia



	RBCs Red blood corpuscle **Erythrocytes – Greek: "Red**	**Platelets** **Thrombocytes** **Thromboplastides**
Number	***males*** **is 5 - 5.5 millions / mm³** ***females*** **it is 4.5-5 millions / mm³ blood.**	**250,000-350,000/mm³**
Size	7.5-8.5 um **Macrocytes > 9 µm,** **Microcytes < 6 µm** **Anisocytosis = variation in si** 	3µm **2-5 µm diameter** 
Shape	biconcave disc	**Biconvex**
Structure	no nuclei& other organelles **Bag of Haemoglobin**	**Fragments of megakaryocyte Non-nucleated**
Life span	**100-120 days..**	**Life span 10 days in blood**
Function	**Carry O2 & Co2**	**- the process of thrombus formation (blood clotting) in response to any vascular endothelial injury to prevent excessive blood loss.** **- clot retraction and removal of the blood clot after healing of the vessel wall to re-establish the flow of the blood.**
Abnormality	**Polycythaemia: i.e. increase in the total number of R.B.Cs.** **Anaemia: i.e. decrease in the total number of R.B.Cs.** **Sickle Cell Anemia**	**INCREASE → Thrombosis** **Decrease → Bleeding**