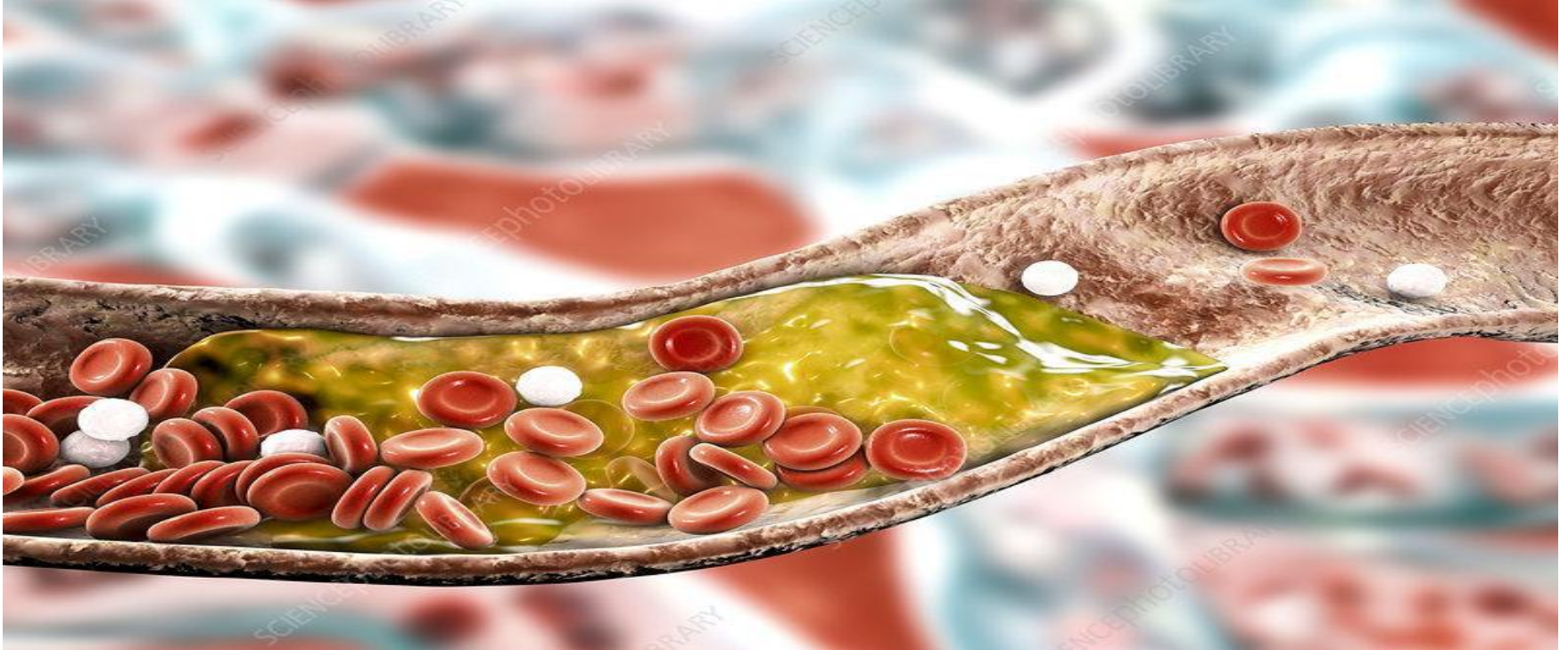


BLOOD-1



By

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LEARNING OUTCOMES

- ✓ Recognize the components of blood.
- ✓ Describe the structure of red blood cells or erythrocytes by LM &EM.
- ✓ Know some abnormalities of red blood cells.
- ✓ Describe the structure of reticulocytes and platelets by LM &EM.

➤ **Blood** is a special type of connective tissue.

➤ Mesenchymal in origin

➤ Blood composed of **formed blood elements** (represent the cells) suspended in fluid extracellular material called **plasma** (represent the matrix).

➤ **Blood cells** derived from stem cells in bone marrow.

➤ **Plasma protein** formed in liver.

➤ It is about 5 L of blood in an average adult.

Components of Blood

Blood cells
45%

- 1- Red blood cells (corpuscles) or erythrocytes (about 44%).**
- 2- White blood cells (1%) or leukocytes.**
- 3- Platelets (less than 1%).**

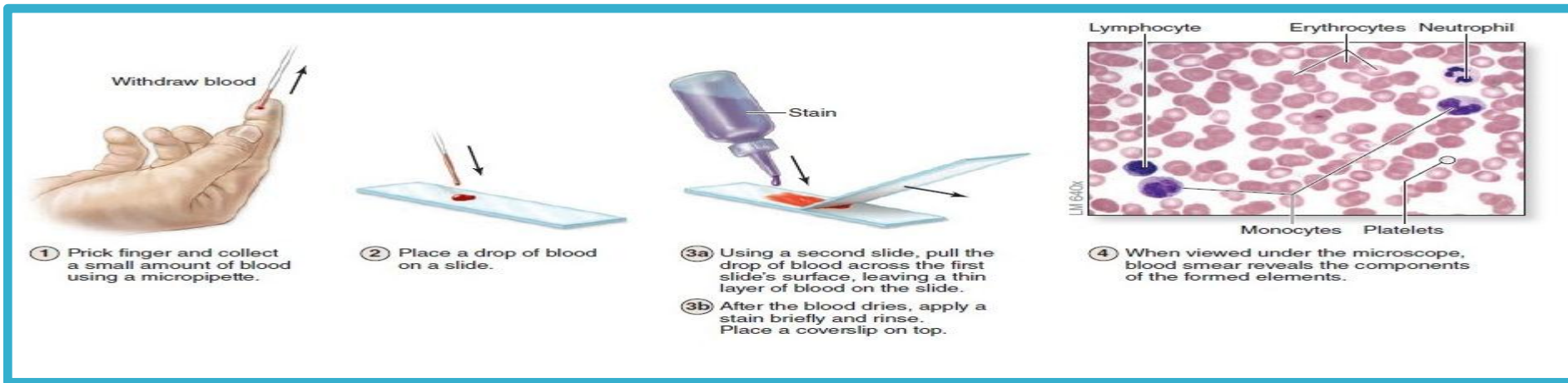
Blood plasma
55%

It is a *yellow* fluid in which the blood cells are suspended. It composed of:

- 1- Water 90 %.**
- 2- Plasma proteins 7% (albumin, globulin, fibrinogen and prothrombin) .**
- 3- inorganic salts and organic substances (amino acids, glucose, hormones, and enzymes**

How we can study blood elements

By preparing Blood film or peripheral blood smear to demonstrate the blood cells. Blood film It is a thin layer of blood on a glass microscopic slide to be stained to allow the various blood cells to be examined microscopically.



Blood Stain: Giemsa stain or Leishman stain used to differentiate blood cells by properties of their **nuclei and cytoplasmic granules**. It composed of mixture of:

- ✓ Eosin (acidic stain) → stain basic cellular components (**pink**).
- ✓ Methylene blue (basic stain) → stain acidic cellular components (**violet**).

When methylene blue is oxidized, it is converted to azures.

Cell components as lysosomes are stain **reddish blue** by binding to azures.

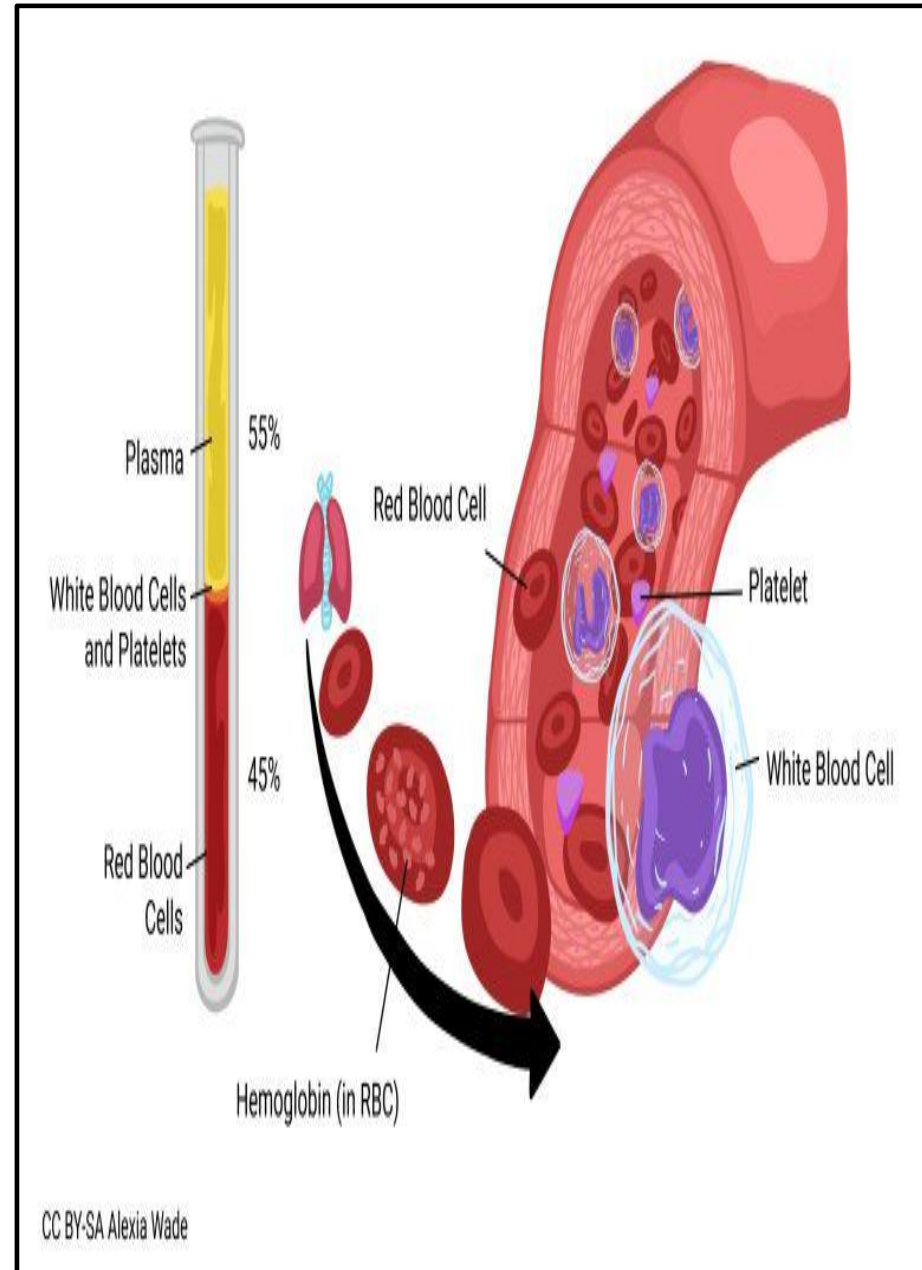
Blood cells

1-True: have nucleus.

- **White blood cells** or leukocytes (1%).

2-Not True:

- Red blood corpuscles or erythrocytes (44%).
- Platelets or thrombocytes (less than 1%).



Erythrocytes

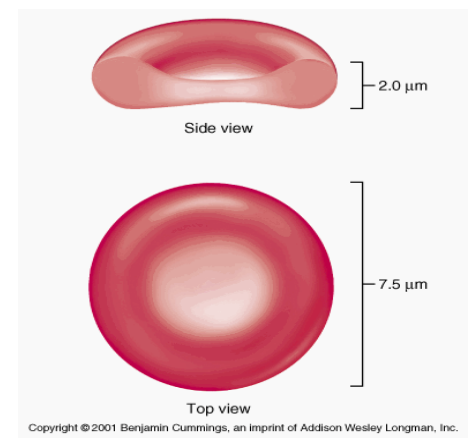
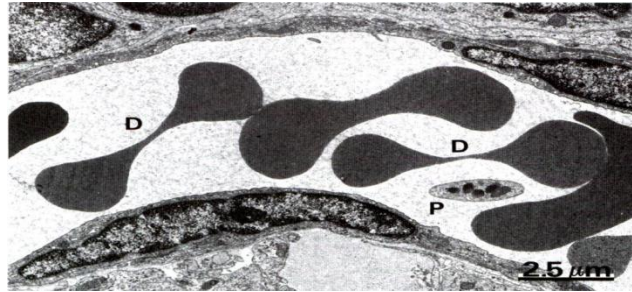
Red blood cells (RBCs)

- **Erythrocytes** (red blood cells or RBCs) are lacking nuclei and completely filled with the O₂ carrying protein **hemoglobin**.
- RBCs are the only blood cells whose function does not require them to leave the vasculature.

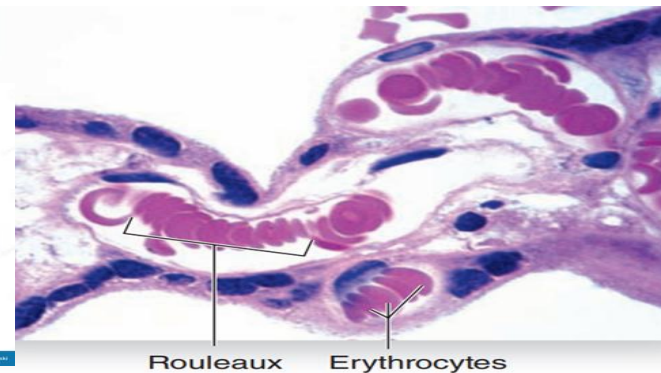
□ Number of RBCs

- Males: 5-5.5 million / cubic millimeter of blood
- Females: 4.5-5 millions / cubic millimeter of blood

□ Shape : Rounded biconcave discs



- They are soft and quite flexible and can change their shape *to bend* and adapt to the irregular turns and pass through small capillaries.
- They adhere together in stagnant blood due to their surface tension forming an arrangement resembling **stacked coins** called **rouleaux appearance**



□ Size of RBCs:

The normal diameter of RBCs varies between 6 - 9 microns (7.5 μm average).

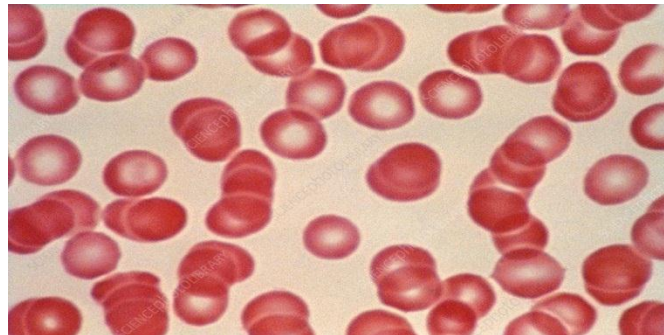
□ Life Span:

- RBCs survive in peripheral blood for about **120 days**.
- Old and deformed RCBs are removed by **macrophages** in the spleen and bone marrow.

□ Colour: depends on their *hemoglobin (Hb) content*.

Unstained erythrocytes have greenish yellow colour

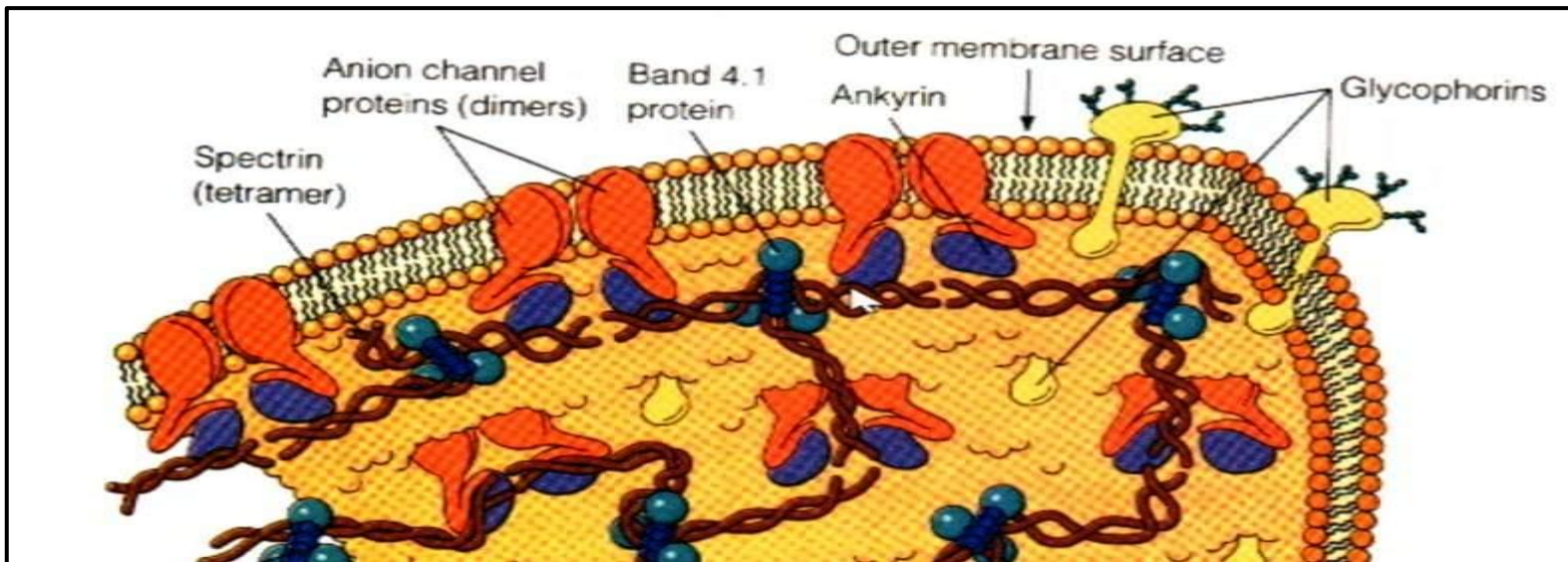
in stained blood films: deep pink in colour (**eosinophilic**).



□ Structure:

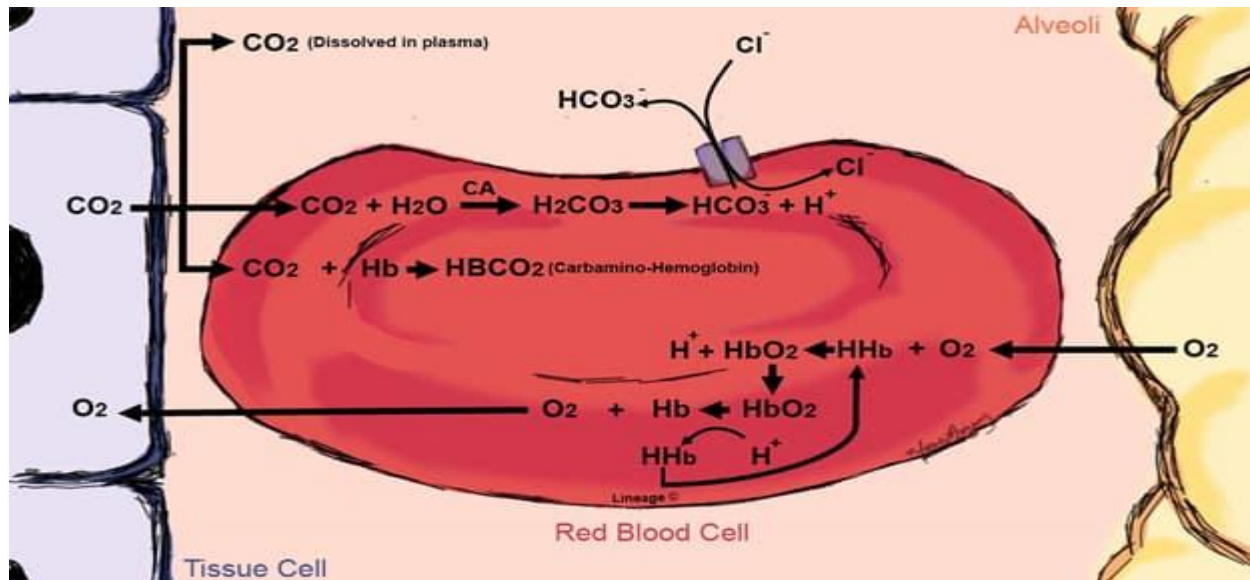
- They are **not true cells**, as they have **no nuclei, or organelles**.
- During **differentiation and maturation**, erythrocytes synthesize large amount of Hb, before they are released into the systemic circulation, the nucleus is extruded from the cytoplasm and the mature RBCs assumes a biconcave shape.
- The cytoplasm contains mainly **hemoglobin** (a cell inclusion) enclosed by cell membrane.
- Hemoglobin = the iron ("heme"), oxygen transport protein, ("globin").
- Biconcave shape provides more surface area for carrying respiratory gases.

- **The plasmalemma of the erythrocyte** consists of about 40% lipid, 10% carbohydrate, and 50% protein. The major components of the erythrocyte plasmalemma proteins are **Integral membrane proteins**, including **glycophorin A,B,C** and **band 3 protein**.
- **Glycophorin A** has antigenic sites that form the basis for the ABO blood system.
- **Several peripheral proteins** are associated with the inner surface of the membrane, including **spectrin** form a lattice bound to underlying actin filaments, and **ankyrin**, which anchors the lattice to the glycophorins and band 3 proteins.
- The erythrocyte cell membrane *and* the submembranous meshwork **maintain the cell shape, and provides the cell elasticity required for passage through capillaries.**



□ Functions of RBC:

- Mature RBCs are highly specialized to transport O₂ & Co₂.
- Transport of oxygen from lung to tissues and carbon dioxide from tissues to lung.
- Hb bind with O₂ and is carried to tissues in the form of **oxyhemoglobin**.
- Co₂ from the cells and tissues is carried to the blood with Hb in the form of **carbaminohemoglobin**. These reactions are reversible.



Abnormalities:

❖ In number of RBCs:

- **Anemia** is the condition of having a concentration of erythrocytes below the normal range.
- **Erythrocytosis, or polycythemia** An increased concentration of erythrocytes in blood, may be a physiologic adaptation found, for example, in individuals who live at high altitudes, where O₂ tension is low.

❖ In shape and size of RBCs: .

- ▶ **Macrocytic anemia**, diameter of RBCs increases.
- ▶ **Microcytic anemia**, their diameter decreases.
- ▶ **Anisocytosis**, abnormal sizes of RBCs may appear in the circulation.

❖ In HB content of RBCs:

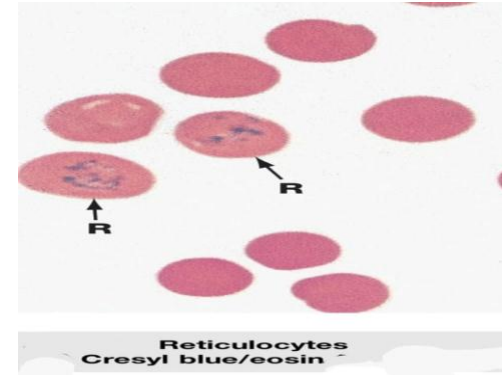
In **hyperchromic anemia**, the RBCs are darkly stained and contain more Hb % than normal.

- In **hypochromic anemia**, RBCs are faintly (lightly) stained and contain less Hb % than normal.

Reticulocytes

- They are **immature** (younger) erythrocytes.
- **Percentage:** constitute about **1%** of the total number of circulating RBCs.
- **Diameter:** is 8 μm . slightly larger than mature erythrocyte.
- **Structure:**

- ✓ having **no nuclei**
- ✓ **Cytoplasm** : Contains:
 - some **free ribosomes**
 - few mitochondria
 - Golgi elements
 - haemoglobin.

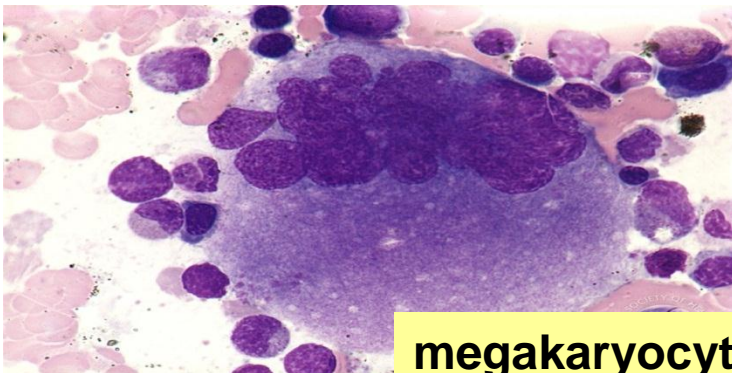


- **Stain:**
 - is slightly **basophilic** due to the ribosomes .
 - by **supravital stains** (**brilliant cresyl blue**) which stain **ribosomal RNA** that appear as blue stained network (reticulum) or few blue dots within the cell.
- **Abnormalities:** **reticulocytosis**

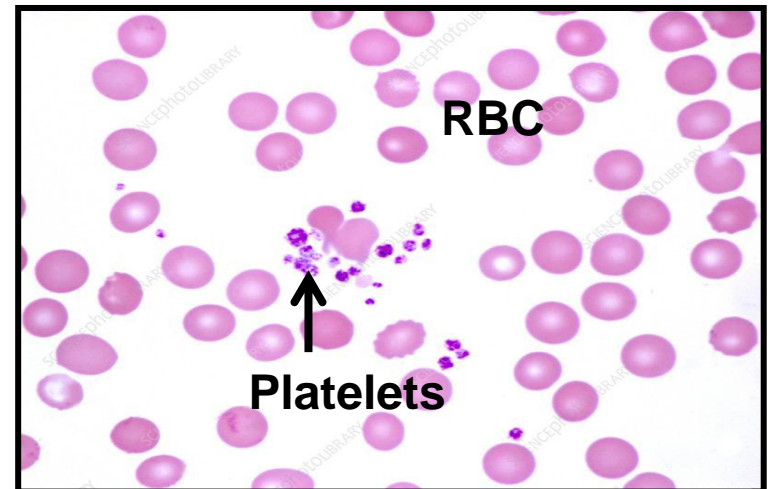
Increase the number of reticulocytes indicates a demand for increased O₂-carrying capacity as in *haemorrhage* and in *high altitude*.

Platelets (Thrombocytes)

- **Origin:** They are non nucleated cytoplasmic fragments derived from giant cells in the bone marrow called **megakaryocytes**.
- **Shape:** cytoplasmic fragments
- **Size:** 2-4 micron
- **Count:** 150,000 – 400,000 / cubic millimeter of blood.
- **Life span:** 5-10 days.



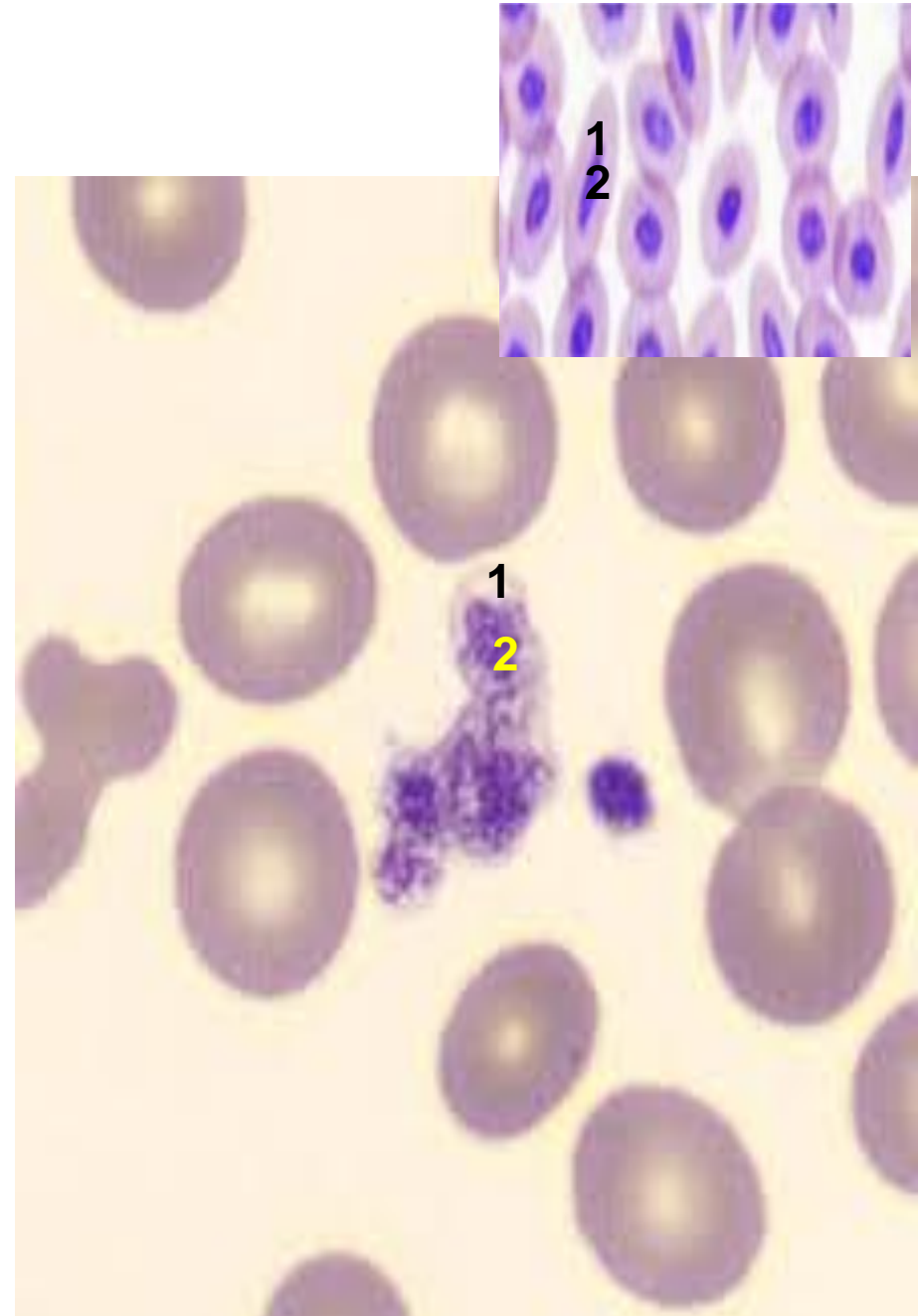
megakaryocytes.



- Structure:

- L/M:

- in stained blood smears, they often appear in clumps.
- *Each platelet:*
 - ✓ is formed of ovoid non-nucleated mass of cytoplasm surrounded by a cell membrane.
 - ✓ has a **peripheral** light blue-stained transparent zone called **hyalomere (1)**.
 - ✓ and a **central zone** containing purple granules called **granulomere (2)**.



E/M: platelets are surrounded by cell membrane, covered by a thick glycocalyx (cell coat).

➤ The **hyalomere** contains 4:

1. An open canalicular system of vesicles connected to invaginations of the plasma membrane for facilitating the liberation of the stored contents of the platelets.
2. A dense tubular system: Electron dense irregular tubules derived from the ER.
3. A bundle of microtubules which are arranged parallel to the cell membrane. They act as internal skeleton that maintains the oval shape of platelets.
4. Actin and myosin filaments (help in platelet movement and aggregation).

• The **granulomere** contains 4:

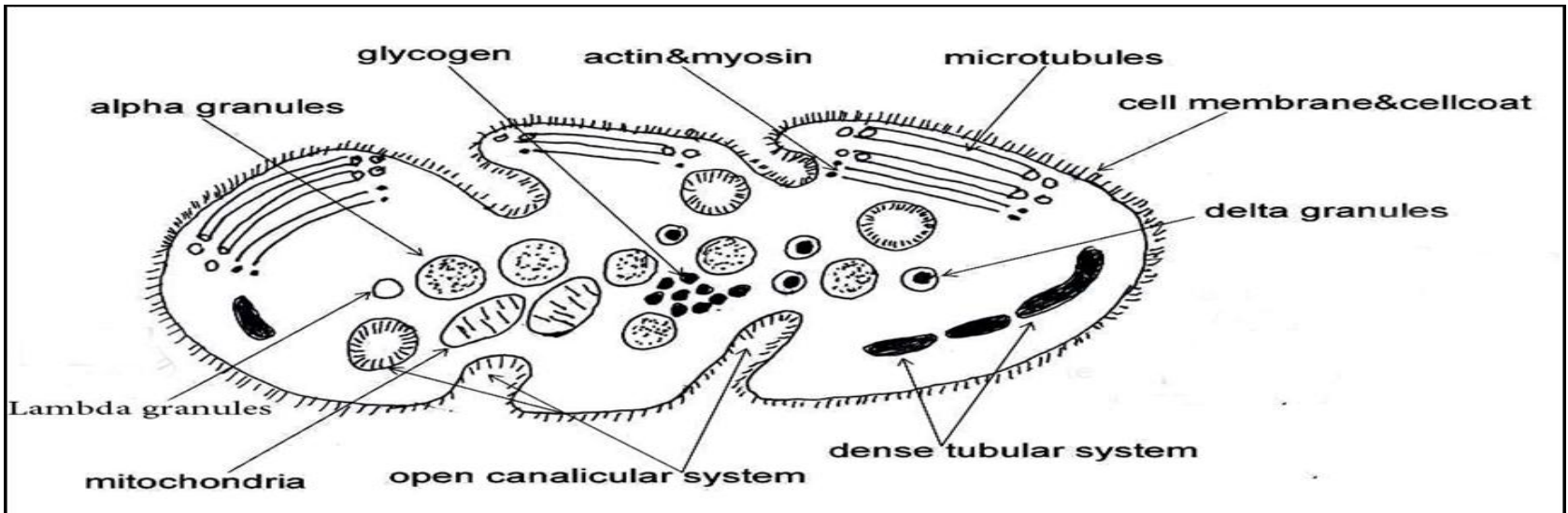
1. *Mitochondria and peroxisomes.*

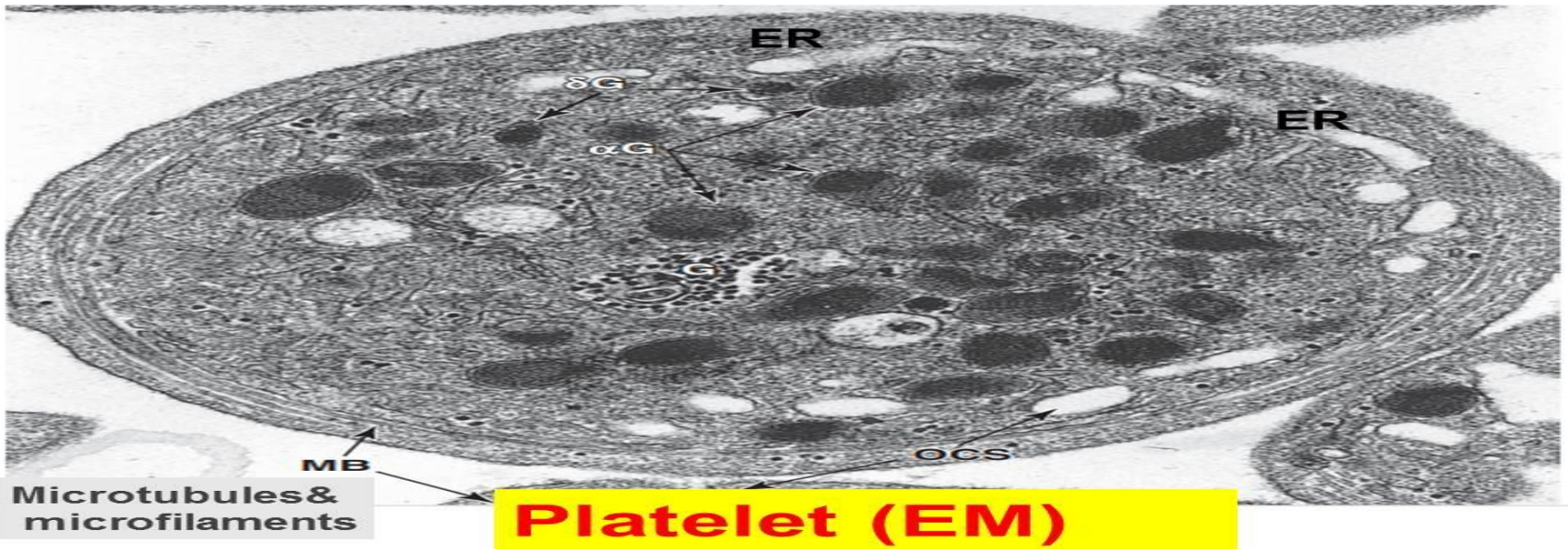
2. *Glycogen granules.*

3. *Numerous vesicles which are invaginations of the cell membrane and cell coat.*

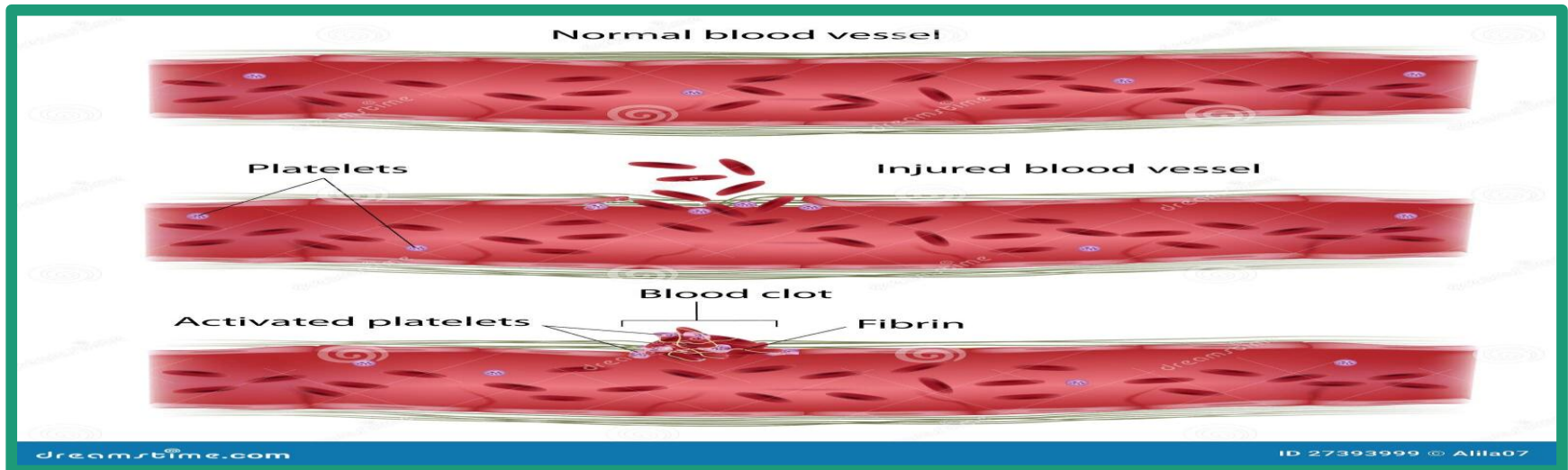
4. **Membrane-bounded dense granules named:**

- **Alpha granules** contain fibrinogen, platelet derived growth factor and platelet specific proteins.
- **Delta granules** contain calcium ions, ADP, ATP, epinephrine and serotonin.
- **Lambda granules** containing lysosomal enzymes.

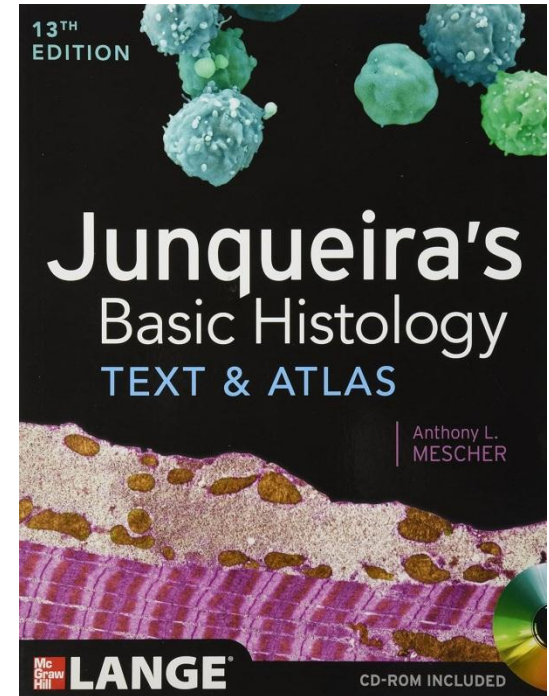
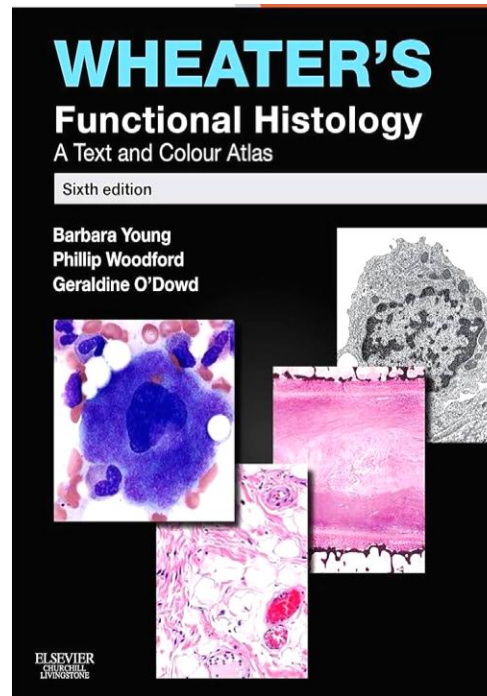
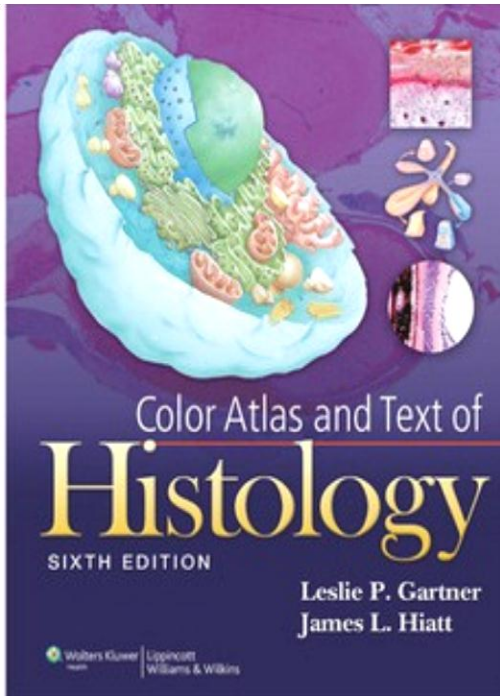




Function: Promote blood clotting, so preventing loss of blood.



References



A vibrant watercolor splash background in shades of yellow, orange, red, purple, and blue. The text 'Thank you' is written in a white, cursive font with a purple shadow effect. The background is decorated with various colored dots and splatters.

Thank you