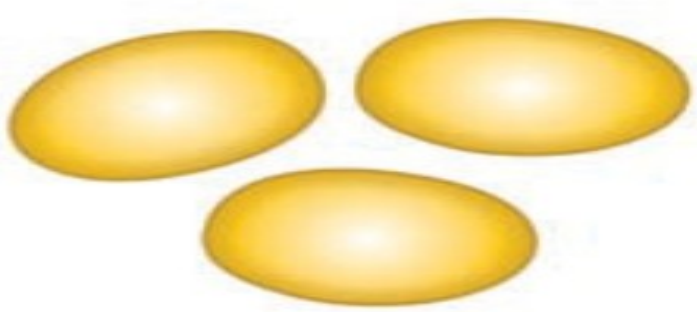
PLATELETS

By Dr. Dinesh Chouhan

PLATELETS



INTRODUCTION

- Platelets or thrombocytes are the formed elements of blood.
- Platelets are small colorless, non-nucleated and moderately refractive bodies.
- These formed elements of blood are considered to be the fragments of cytoplasm.

SIZE OF PLATELETS

- Diameter : 2.5 μ (2 to 4 μ)
- Volume : 7.5 cu μ (7 to 8 cu μ)

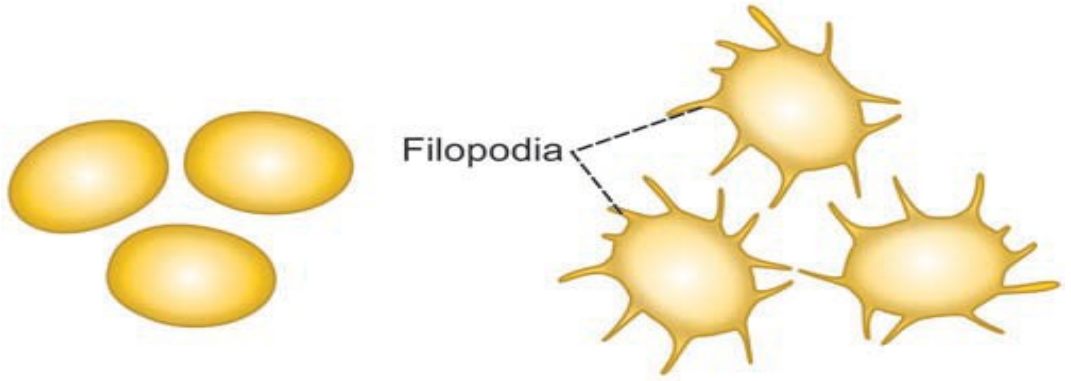


FIGURE: A. Inactive platelets. **B.** Activated platelets.

SHAPE OF PLATELETS

- Normally, platelets are of several shapes, viz. spherical or rod-shaped and become oval or disk-shaped when inactivated.
- Sometimes, the platelets have dumbbell shape, comma shape, cigar shape or any other unusual shape.
- Inactivated platelets are without processes or filopodia and the activated platelets develop processes or filopodia.

STRUCTURE AND COMPOSITION

Platelet is constituted by:

1. Cell membrane or surface membrane
2. Microtubules
3. Cytoplasm.

1. CELL MEMBRANE

- Cell membrane of platelet is 6 nm thick.
- Extensive invagination of cell membrane forms an open **canalicular system**.
- This canalicular system is a delicate tunnel system through which the platelet granules extrude their contents.

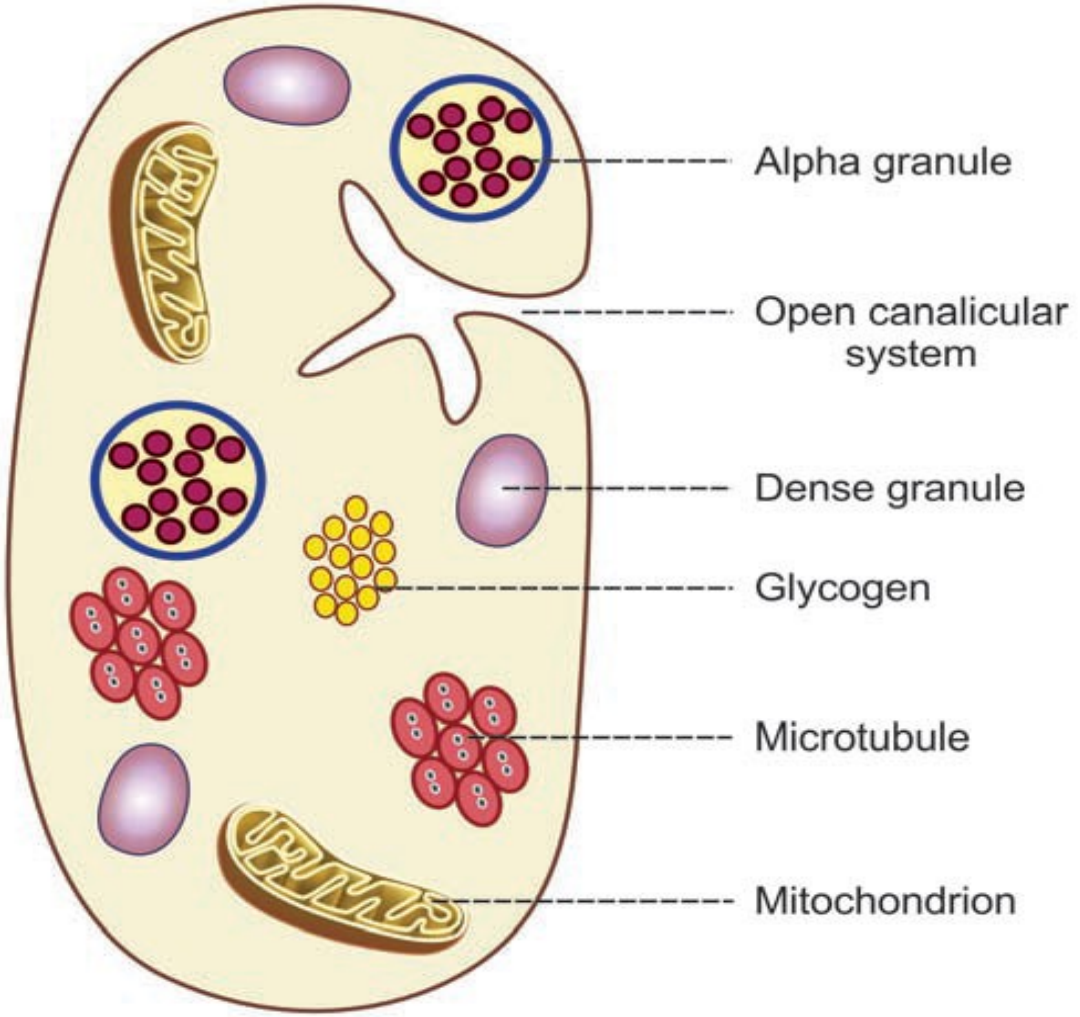


FIGURE: Platelet under electron microscope

- Cell membrane of platelet contains lipids in the form of phospholipids, cholesterol and glycolipids, carbohydrates as glycocalyx and glycoproteins and proteins.
- Among all of these substances, glycoproteins and phospholipids are functionally important.

2. MICROTUBULES

- Microtubules form a ring around cytoplasm below the cell membrane.
- Microtubules are made up of polymerized proteins called **tubulin.**
- These tubules provide structural support for the inactivated platelets to maintain the disk like shape.

3. CYTOPLASM

- Cytoplasm of platelets contains the cellular organelles, Golgi apparatus, endoplasmic reticulum, mitochondria, microtubule, microvessels, filaments and granules.
- Cytoplasm also contains some chemical substances such as proteins, enzymes, hormonal substances etc.

NORMAL COUNT

- Normal platelet count is 2,50,000/cu mm of blood.
- It ranges between 2,00,000 and 4,00,000/cu mm of blood.

PROPERTIES OF PLATELETS

Platelets have three important properties (three 'A's):

1. Adhesiveness
2. Aggregation
3. Agglutination.

1. ADHESIVENESS

- Adhesiveness is the property of sticking to a rough surface.
- During injury of blood vessel, endothelium is damaged and the subendothelial collagen is exposed.
- While coming in contact with collagen, platelets are activated and adhere to collagen.
- Other factors which accelerate adhesiveness are collagen, Thromboxane A2, calcium ions.

2. AGGREGATION (GROUPING OF PLATELETS)

- Adhesion is followed by activation of more number of platelets by substances released from dense granules of platelets.
- During activation, the platelets change their shape with elongation of long filamentous pseudopodia which are called processes or filopodia. Filopodia help the platelets aggregate together.
- Activation and aggregation of platelets is accelerated by ADP, thromboxane A2.

3. AGGLUTINATION

- Agglutination is the clumping together of platelets.
- Aggregated platelets are agglutinated by the actions of some platelet agglutinins and platelet-activating factor.

FUNCTIONS OF PLATELETS

- Normally, platelets are inactive and execute their actions only when activated.
- Activated platelets immediately release many substances. This process is known as platelet release reaction.
- Functions of platelets are carried out by these substances.
- Functions of platelets are:

1. ROLE IN BLOOD CLOTTING

- Platelets are responsible for the formation of intrinsic prothrombin activator.
- This substance is responsible for the onset of blood clotting.

2. ROLE IN CLOT RETRACTION

- In the blood clot, blood cells including platelets are entrapped in between the fibrin threads.
- Cytoplasm of platelets contains the **contractile proteins,** namely actin, myosin and thrombosthenin, which are responsible for clot retraction.

3. ROLE IN PREVENTION OF BLOOD LOSS (HEMOSTASIS)

- Platelets accelerate the hemostasis by three ways:

i. Platelets secrete 5-HT, which causes the constriction of blood vessels.
ii. Due to the adhesive property, the platelets seal the damage in blood vessels like capillaries.
iii. By formation of temporary plug, the platelets seal the damage in blood vessels.

4. ROLE IN REPAIR OF RUPTURED BLOOD VESSEL

- Platelet-derived growth factor (PDGF) formed in cytoplasm of platelets is useful for the repair of the endothelium and other structures of the ruptured blood vessels.

APPLIED PHYSIOLOGY

PHYSIOLOGICAL VARIATIONS

1. Age*:* Platelets are less in infants (1,50,000 to 2,00,000/cu mm) and reaches normal level at 3rd month after birth.
2. Sex*:* There is no difference in the platelet count between males and females. In females, it is reduced during menstruation.
3. High altitude*:* Platelet count increases.
4. After meals*:* After taking food, the platelet count increases.

PATHOLOGICAL VARIATIONS

- Platelet disorders occur because of pathological variation in platelet count and dysfunction of platelets.

Platelet disorders are:

1. Thrombocytopenia
2. Thrombocytosis
3. Thrombocythemia
4. Glanzmann's thrombasthenia.

1. Thrombocytopenia

- Decrease in platelet count is called thrombocytopenia.
- Thrombocytopenia occurs in the following conditions: like Acute infections, Aplastic and pernicious anemia, Smallpox, Splenomegaly, Typhoid, Tuberculosis etc.

2. Thrombocytosis

- Increase in platelet count is called thrombocytosis.
- Thrombocytosis occurs in the following conditions like: Allergic conditions, Hemorrhage, Bone fractures, Surgical operations, Splenectomy, Rheumatic fever, Trauma etc.

3. Thrombocythemia

- Thrombocythemia is the condition with persistent and abnormal increase in platelet count.
- Thrombocythemiaoccurs in the following conditions like: Carcinoma, Chronic leukemia etc.

4. Glanzmann's Thrombasthenia

- Glanzmann's thrombasthenia is an inherited hemorrhagic disorder, caused by structural or functional abnormality of platelets.
- However, the platelet count is normal. It is characterized by normal clotting time, normal or prolonged bleeding time but defective clot retraction.