# Blood pathology 2

# Platelets and Platelet disorders

LEC 5

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- **PLATELETS**

- Platelets also called **thrombocytes** are irregular, extremely small and discshaped elements, 2-4um in diameter. The normal platelet count is approximately 150-400x$10_9$/L , and the normal platelet life span is 7-10 days. They play an important role in **blood coagulation**. Produced in bone marrow, by fragmentation of the cytoplasm of megakaryocytes.

- **Platelet structure**

- The glycoproteins of the surface coat are particularly important in the platelet reaction of adhesion and aggregation, which are the **initial events** leading to **platelet plug formation** during hemostasis.

- The platelet contains three types of **Storage granules**: alpha, dense and lysosomes.

- The specific **alpha granules** are more frequent contain a **heparin antagonist** (PF4), platelet derived growth factor, β thromboglobulin , fibrinogen , Von Willebrand Factor (VWF) and other clotting factors.

- **Dense granules** are less common and contain adenosine di phosphate (ADP), adenosine tri phosphate (ATP) and calcium.

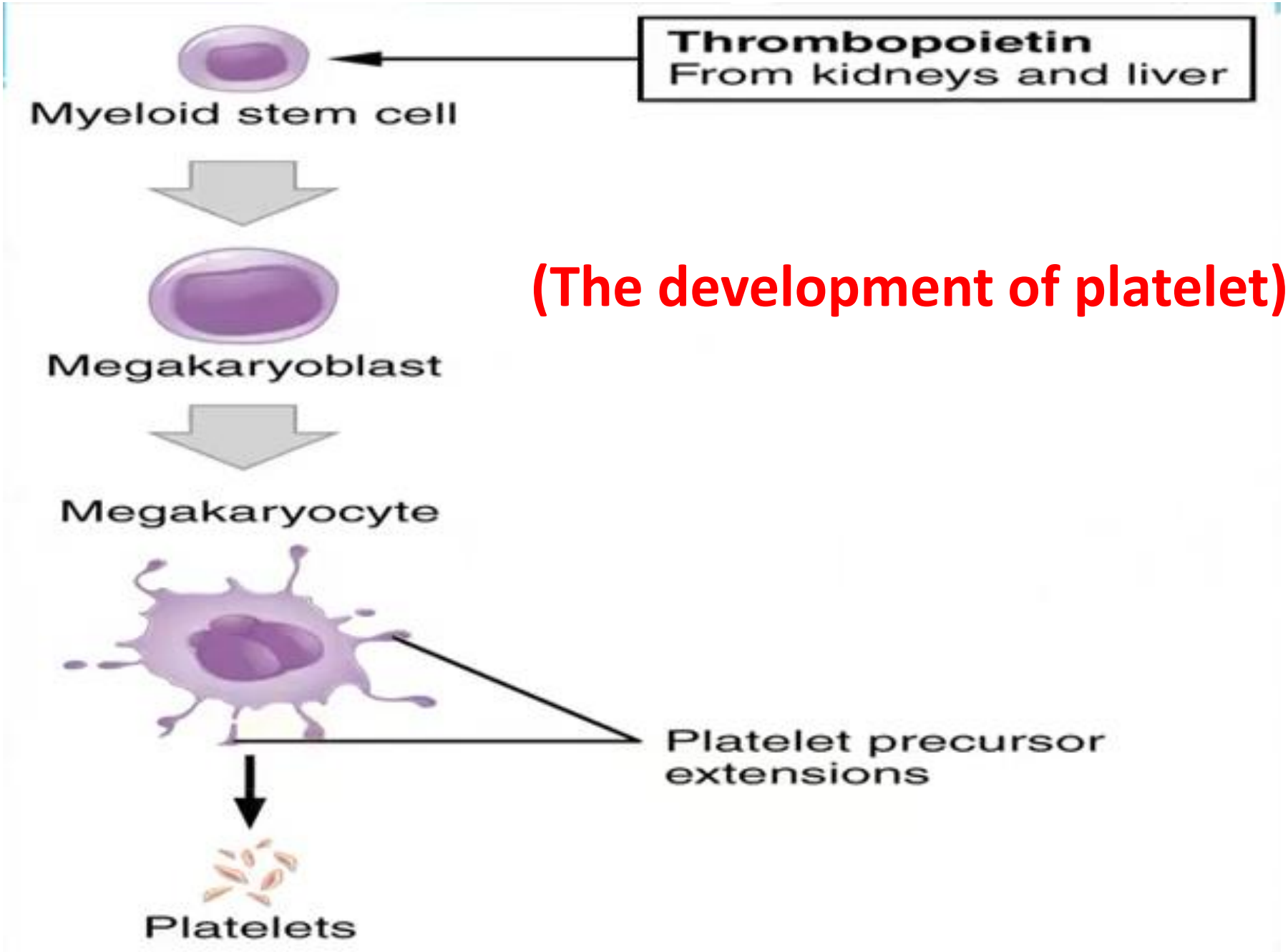
- **Lysosomes** contain hydrolytic enzymes and peroxisomes contain catalase.

- Platelets are also rich in signaling and cytoskeletal proteins which support the rapid switch from quiescent to activation that follows vessel damage

- **Platelets production (Thrombopoiesis)**

- Platelets are produced in the bone marrow by fragmentation of the cytoplasm of megakaryocytes , one of the largest cells in the body (80 - 150μ). Platelets arises from **megakaryocyte** by stem cell which differentiation into the megakaryoblast then into megakaryocyte which by a process nuclear replication and enlarging the megakaryocyte cytoplasmic volume with the number of nuclei increases.

- The **time period** from differentiation of the human stem cell to the production of platelets averages about 10 days.
- **Thrombopoietin** is a hormone produced by the liver and kidney which regulates the production of platelets . Thrombopoietin increases the number and rate of maturation of megakaryocytes.
- Up to one-third of the **marrow output** of platelet may be trapped at any one time in the **normal spleen**, but this rises to 90% in cases of massive splenomegaly.



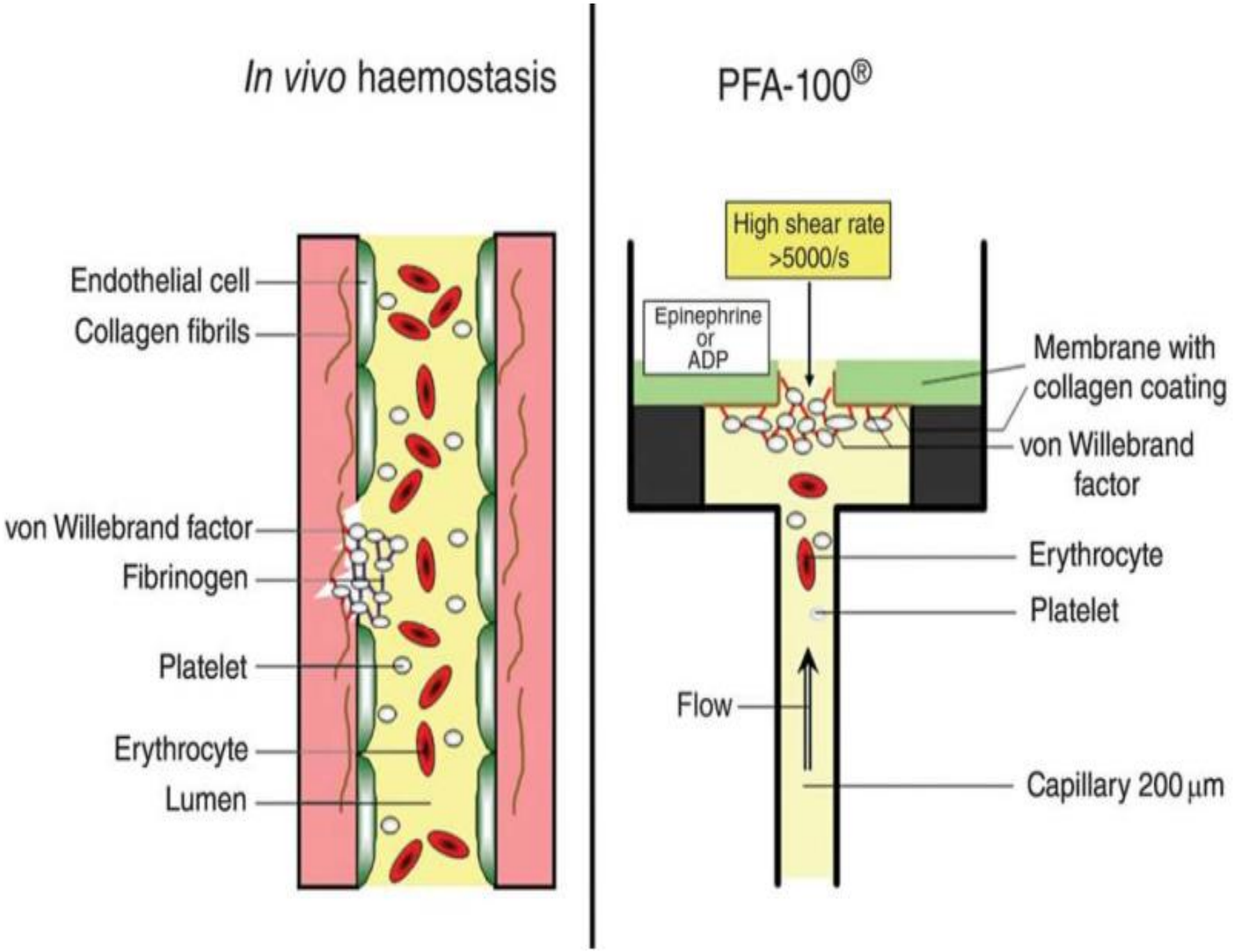

**(The development of platelet)**

- **Platelet function**

The main function of platelets is the formation of **mechanical plugs** during the normal hemostatic response to vascular injury. In the absence of platelets, spontaneous leakage of blood through small vessels may occur. platelets anchorage at the sites of vascular injury requires specific interactions between the **vessel wall** (adhesion) and **platelet-platelet** (aggregation) and **coagulation factors** .

- **Laboratory evidence:**

- Normal platelet count and morphology
- Markedly prolonged bleeding time or PFA-100

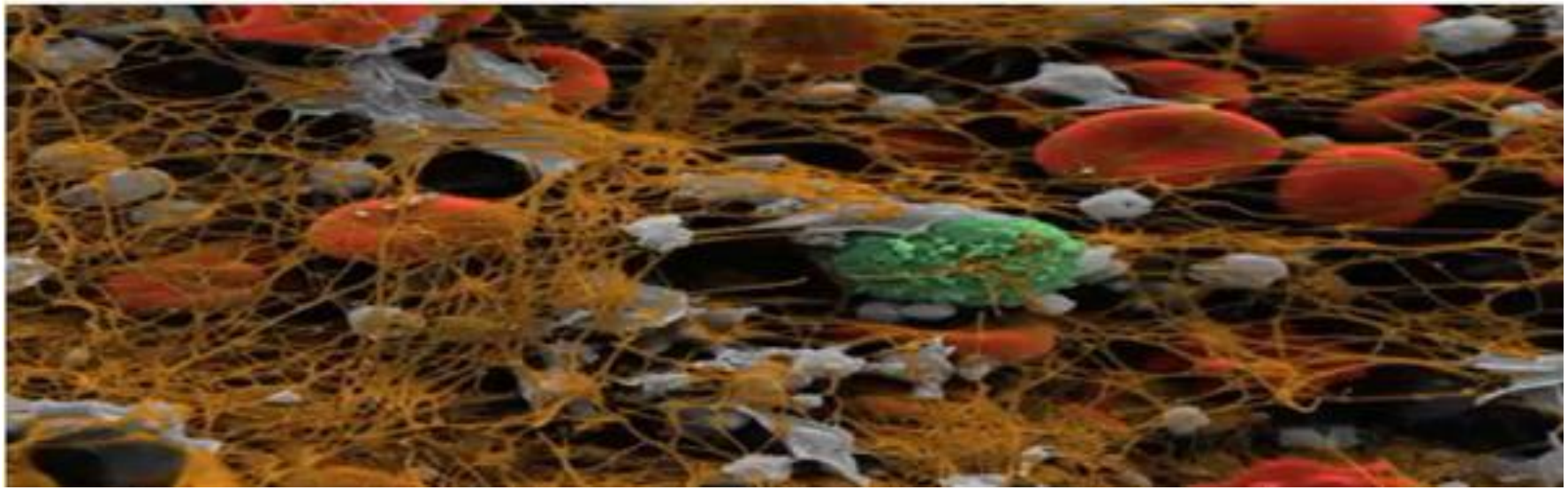

*In vivo* haemostasis
PFA-100®
Endothelial cell
Collagen fibrils
von Willebrand factor
Fibrinogen
Platelet
Erythrocyte
Lumen
High shear rate
>5000/s
Epinephrine
or
ADP
Membrane with
collagen coating
von Willebrand
factor
Erythrocyte
Platelet
Flow
Capillary 200 μm

- **Platelet function:**

- The main function of the platelet is the formation of the mechanical plugs during the normal hemostatic response to vascular injury.

- **Which take place as follows:-**

- **1- platelet adhesion:**
- The platelet adhere to the exposed sub-endothelial connective tissues, this function depend upon the **factor VII** also depend on a **surface membrane glycoprotein.**

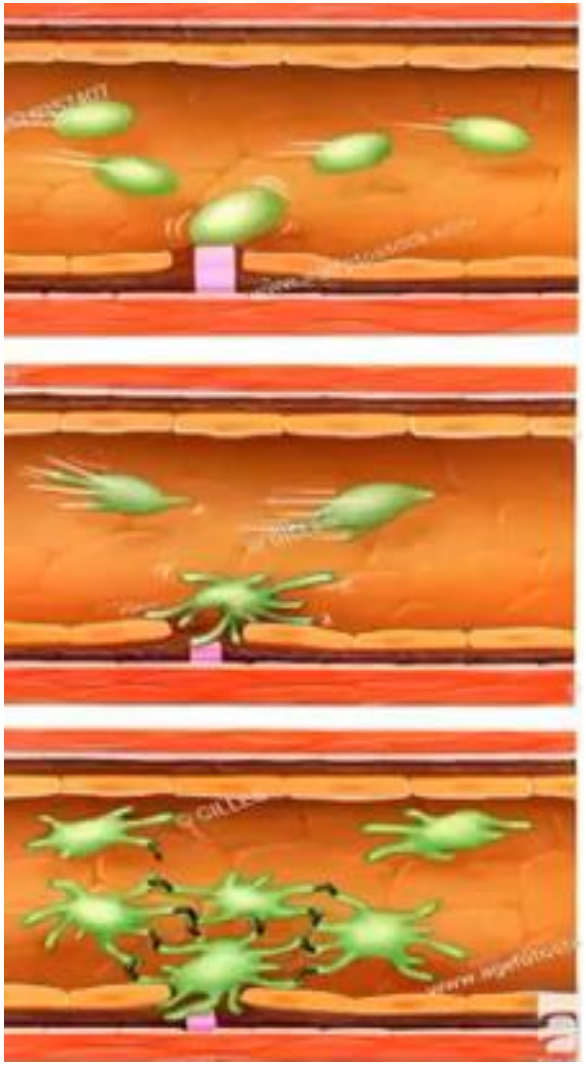


- **2-The release reaction:**

- collagen exposure or thrombin action results in the release of platelet granule contents which include ADP, serotonin, fibrinogen, lysosomal enzymes and heparin neutralizing factor, platelet prostaglandin lead to formation of **thromboxane A2** which lowers platelet Cyclic AMP level and initiates the release reaction.

- **3- platelet aggregation:**

released ADP and thromboxane A2 lead to aggregate **additional platelet** at the site of vascular injury results in the formation of platelet mass.

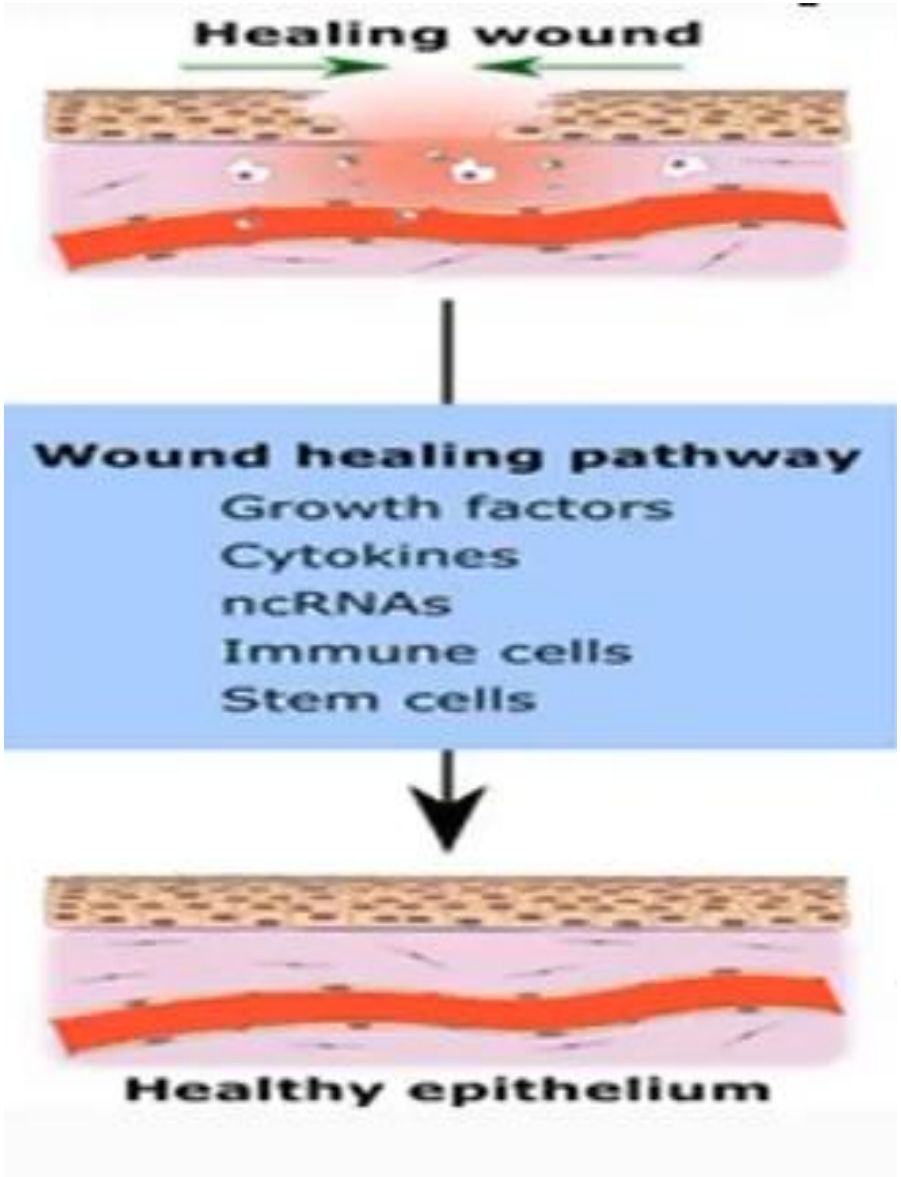


- **4- platelet pro coagulant activity.**

- **5- platelet fusion**

- High concentration of ADP and enzymes released during the reaction and thromboplastin **contribute** to the irreversible fusion of platelet aggregated at the site of vascular injury.

- **6-** The **growth factor** found in the specific granules of platelets **stimulate** vascular healing.



- **Thrombocytopenia:**

- It means the presence of very low numbers of platelets in the circulating blood.

- People with thrombocytopenia have a tend to bleeding.

- **Some of the medical conditions that are associated with thrombocytopenia include:**

- Bone marrow disorders, such as aplastic anemia
- Viral infection such as HIV and Liver cirrhosis
- Vitamin B12 and Folate deficiency
- Alcohol use  disorder and  enlarged spleen
- Disseminated intravascular coagulation (DIC),
- Chemotherapy and Radiation therapy for cancer
- Some Drugs that suppress the immune system after organ transplantation
- Bacterial sepsis
- Blood thinners, including heparin
- Lupus or other autoimmune diseases

- **Causes of thrombocytosis**

- Blood loss.
- Cancer.
- Infections.
- Iron deficiency.
- Removal of your spleen.
- Hemolytic anemia - a type of anemia in which your body destroys red blood cells faster than it produces them.
- Inflammatory disorders, such as rheumatoid arthritis.
- Surgery and other types of traumas.
- changes in certain genes  (genitic agent)

- **Complications of thrombocytosis**
- thrombocytosis can lead to a variety complications, such as:

- **Strokes:** blood clot occurs in the arteries that supply the brain.
- **Heart attacks:** blood clot occurs in the arteries that supply the heart.
- **Cancer:** Rarely .

# Thank You For Listening