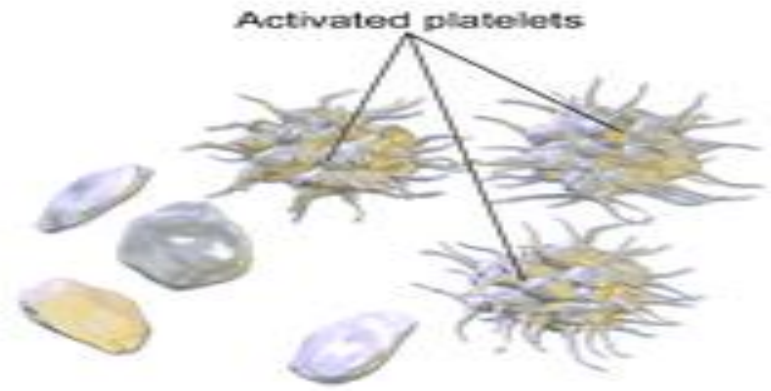
**Platelets or thrombocytes:** It's an irregular, disc-shaped element in the blood that assists in blood clotting to stop bleeding when there is an injury to our body. Although platelets are often classed as blood cells, they are actually fragments of large bone marrow cells called megakaryocytes.




Platelets

Platelets are cells do not have a nucleus, 2–3 μm in diameter, derived from fragmentation of precursor megakaryocytes. The average lifespan of a platelet is normally 5 to 9 days. They circulate in the blood of mammals and are involved in hemostasis, leading to the formation of blood clots.

**Platelet Function:** Platelet play a central role in the primary as well as in the secondary hemostasis, they are also deeply involved in wound healing. Platelets are a component of blood whose function is to stop bleeding from blood vessel injury by clumping, thereby initiating a blood clot. When bleeding occurs, the platelets swell, clump together, and form a sticky plug that helps stop the bleeding.

Platelets are the smallest type of blood cells, they are the lightest. Therefore they are pushed out from the center of flowing blood to the wall of the blood vessel. Then they roll along the surface of the vessel wall, which is lined by cells called endothelium. The endothelium is a very special surface, like Teflon, that prevents anything from sticking to it. However when there is an injury or cut, and the endothelial layer is broken, the platelets are reacting first to injury. The tough fibers surrounding the vessel wall, attract platelets like a magnet, stimulate the shape change then clump onto these fibers, to provide initial seal to prevent bleeding, the leak of red blood cells and plasma through the vessel injury.

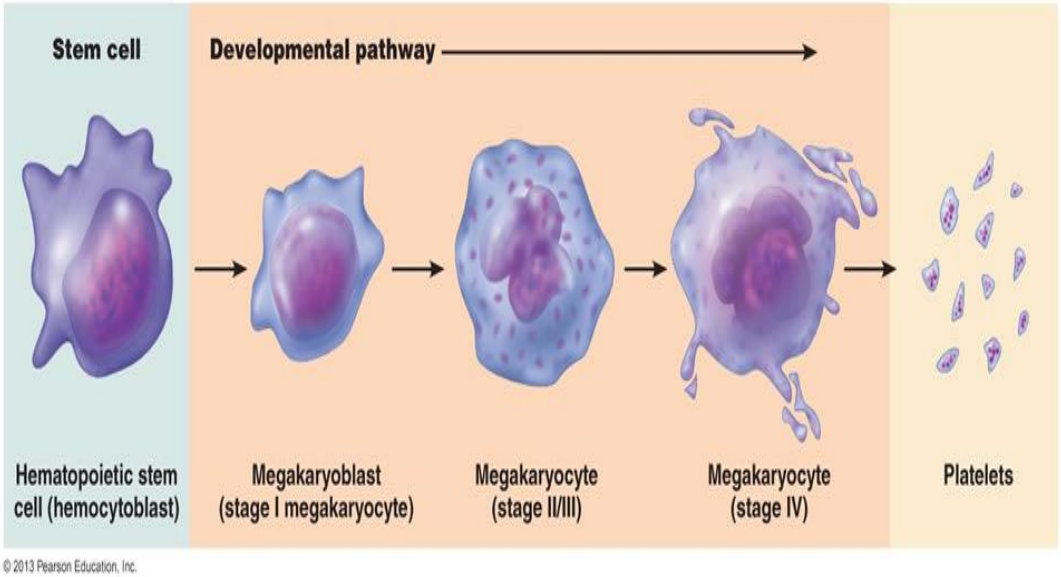
**Platelets number:** Platelets are only about 20% of the diameter of red blood cells. The normal platelet count is 150,000-350,000 per microliter of blood, but since platelets are so small, they make up just a tiny fraction of the blood volume.

If there are too few platelets, this called thrombocytopenias, it may be cause problems such as uncontrolled bleeding. This because the change in the way of stem cells work, which Leads to failure in produce normal numbers of platelets, also can be caused by increased destruction of platelets once they are produced and released into the circulating blood. Serious problems caused by thrombocyte disorders, include fatal blood loss and bleeding into the brain.

If there are too many platelets, there is a chance of a blood clot forming in a blood vessel, this called (thrombo**cytosis**). Also, platelets may be involved in hardening of the arteries (atherosclerosis).

## Platelet Production ( Thrombopoiesis ):

**Thrombopoiesis** is the process of thrombocyte generation. A megakaryocyte is responsible for the production of blood thrombocytes (platelets), which are necessary for normal blood clotting. Megakaryocytes undergo a process of fragmentation that results in release of over 10,000 bone marrow cells in normal people, but can increase in number nearly 10-fold during certain diseases.




**Hemostasis:** is a process, which causes bleeding to stop, meaning to keep blood within a damaged blood vessel. It is the first stage of wound healing. This involves coagulation, blood changing from a liquid to a gel. When endothelial injury occurs, the endothelial cells secrete von Willebrand factor which initiate the maintenance of hemostasis after injury. Hemostasis has three major steps: 1) vasoconstriction, 2) temporary blockage of a break by a platelet plug, and 3) blood coagulation, or formation of a fibrin clot. These processes seal the hole until tissues are repaired.

Platelets are produced in the bone marrow, the same as the red cells and most of the white blood cells. Platelets are

produced from very large bone marrow cells called **megakaryocytes**. The dominant hormone controlling megakaryocyte development is thrombopoietin (often abbreviated as TPO).

**Blood clotting:**

**Coagulation** (**thrombogenesis**) is the process by which blood forms clots. It is an important part of hemostasis, the cessation of blood loss from a damaged vessel, wherein a damaged blood vessel wall is covered by a platelet and fibrin to stop bleeding and begin repair of the damaged vessel. Disorders of coagulation can lead to an increased risk of bleeding (hemorrhage) or clotting (thrombosis).

Platelets immediately form a plug at the site of injury; this is called *primary hemostasis*. *Secondary hemostasis* which occurs simultaneously: Proteins in the blood plasma, called **coagulation factors** or **clotting factors**, respond in a complex cascade to form fibrin strands, which strengthen the platelet plug.

The platelets are accomplishing their goal of sealing up the wound. They continue to clump together with the fibrin; they form a complete barrier that keeps blood from escaping. This barrier is known as a blood clot.

**How Blood Clot Does Occurs:**

Blood must flow continuously and smoothly for an entire lifetime. Blood clot occurs and stops bleeding through complex interactions between substances in blood and the blood vessel walls. Blood clots are healthy and lifesaving when they stop bleeding. However, blood clots can also form abnormally, causing a **heart attack, stroke**, or other **serious medical problems**.

The blood clot is only a temporary solution to stop bleeding; vessel repair is therefore needed. The aggregated platelets help this process by secreting chemicals that invasion the wounded area to completely heal the wound or form a scar. The obstructing clot is slowly dissolved by the fibrinolytic enzyme and plasmin, the platelets are cleared by phagocytosis. As the damaged tissue heals, the body slowly degrades the blood clot and reabsorbs it. An enzyme called plasmin is responsible for dissolving the tough fibrin strands in a blood clot. Various other substances act together to activate plasmin and help it break down the clot.

**Anti-coagulants:**

**Anticoagulant:** medicine used to prevent the formation of blood clots. Anticoagulant solutions are used for the preservation of stored whole blood and to keep laboratory blood specimens from clotting. Some are used for the prevention or treatment of disorders characterized by abnormal blood clots and emboli. Below some of anticoagulant agents:

- **Heparin** is a potent anticoagulant that interferes with the formation of thromboplastin, with the conversion of prothrombin to thrombin, and with the formation of fibrin from fibrinogen.
- **Vitamin K** antagonists that prevent coagulation by inhibiting the formation of clotting factors dependent on vitamin K.
- **EDTA** strongly and irreversibly binds calcium. It is in a powdered form. Full Form of EDTA is Ethyinene Diamine Tetra acetic Acid.
- **Citrate** is in liquid form and used in blood transfusion bags. It binds the calcium, but not as strongly as EDTA.
- **Oxalate** has a mechanism similar to that of citrate. It is the anticoagulant used in fluoride oxalate tubes used to determine glucose and lactate levels.