Biology

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Blood

Agranulocytes:

- **Lymphocytes:**

Lymphocytes make up 20-30% of WBCs. They are groups of spherical cells with similar morphological characters, they have an ovoid nucleus, the cytoplasm of the cell is scanty and can be seen as a thin rim around the nucleus. there are two main types of lymphocytes: T lymphocytes & B lymphocytes and those lymphocytes are responsible for immune surveillance to detect any foreign particle in the tissues.

Activation of B lymphocytes after an immune response to a foreign particle leads to their differentiation into plasma cells. Those cells are large cells with eccentric rounded nucleus, and they are responsible for active synthesis of immunoglobulins. In health plasma cells are not found in the blood but they are seen in small population in lymphoid organs.

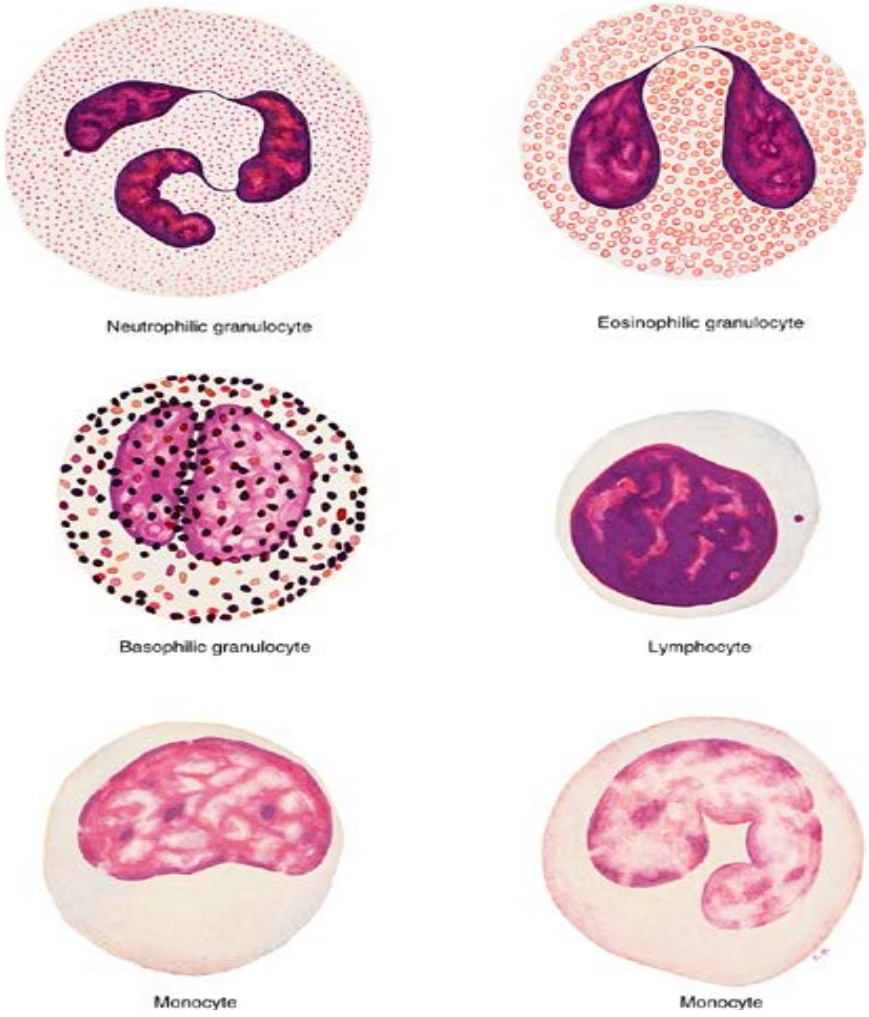
- **Monocytes:**

They constitute 3-8% of the blood leukocytes. They are spherical cells with oval or kidney shaped nucleus which is often placed eccentrically. Their cytoplasm is basophilic. Monocytes can live in the blood for 8 hours, after which they move in to the connective tissue, where they may remain for a few months or longer. Blood monocytes are the precursor cells of tissue macrophages and other cells of the mononuclear phagocytic system such as kupffer cells in the liver and pulmonary and alveolar macrophages.

Clinical notes:

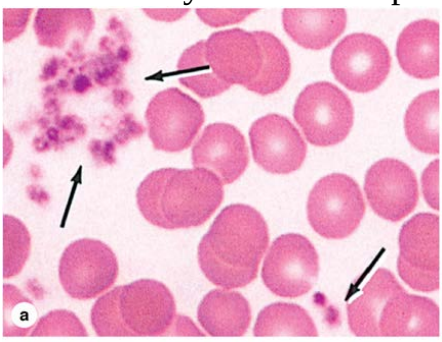
Increased numbers of white cells appear in the peripheral blood in a variety of disorders and provide a useful clue to underlying disease. For example:

- An increase of circulating neutrophils in bacterial infections (neutrophilia)
- An increase of circulating eosinophils in parasitic infestations and some allergies (eosinophilia)
- An increase in circulating lymphocytes in certain viral infections (lymphocytosis)



Platelets (thrombocytes):

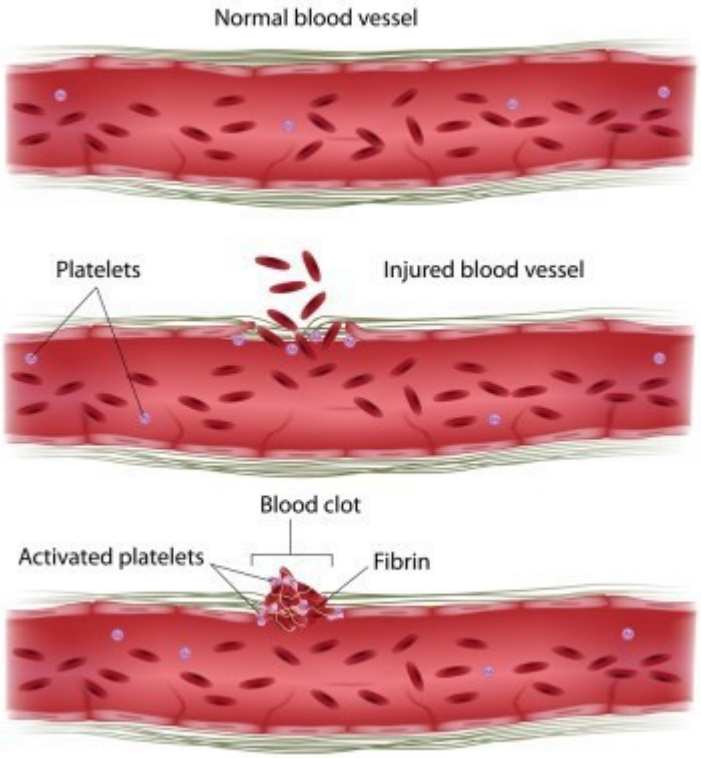
Accounts (150-400 $\times 10^3/mm^3$) of blood elements. Are non-nucleated, small, disk like cells formed from fragmentation of a giant cell in the bone marrow called megakariocytes. Platelets will promote blood clotting & help in repairing gaps in the wall of blood vessels. They have a life span of only 10 days.



Blood Clotting:

The blood-clotting process helps the body maintain homeostasis in the cardiovascular system by ensuring that the plasma and formed elements remain within the blood vessels. At least 12 clotting factors (two important are factor VIII & IX) and calcium ions (Ca2+) participate in the formation of a blood clot. Clot formation is initiated when a blood vessel is damaged. At the site of the break in the blood vessel, platelets aggregate at the site and adhere to the damaged wall. The platelets are activated and form a plug to occlude the site of damage. The platelets in the plug release adhesive glycoproteins that increase the plug size, which is then reinforced by a polymer fibrin formed from numerous plasma proteins. Fibrin forms a mesh around the plug, trapping other platelets and blood cells to form a blood clot.

A fibrin clot is temporary. Once blood vessel repair starts, an enzyme called plasmin destroys the fibrin network so tissue cells can grow. After blood clots, a yellowish fluid called **serum** escapes from the clot. It contains all the components of plasma except fibrinogen and prothrombin.



Disorders Related to Blood Clotting

An insufficient number of platelets is called **Thrombocytopenia**.

Thrombocytopenia is either due to low platelet production in bone marrow or

increased breakdown of platelets outside the marrow. A number of conditions, including leukemia, can lead to thrombocytopenia. It can also be drug-induced. Symptoms include bruising, rash, and nose bleeds or bleeding in the mouth. Gastrointestinal bleeding or bleeding in the brain are possible complications. **Hemophilia** A and B are clinically identical, differing only in the deficient factor. Both are due to sex-linked recessive inherited disorders. Blood from hemophiliac patients does not coagulate normally: the blood clotting time is prolonged. Persons with this disease bleed severely even after mild injuries, such as a skin cut, and may bleed to death after more severe injuries. The blood plasma of patients with hemophilia A is deficient in clotting factor VIII or contains a defective factor VIII, one of the plasma proteins involved in fibrin generation; in hemophilia B, the defect is in factor IX. In severe cases the blood is incoagulable. There are spontaneous hemorrhages in body cavities, such as major joints and the urinary tract. Generally, only males are affected by hemophilia A, because the recessive gene to factor VIII is on the X chromosome. Females may have one defective X chromosome, but the other one is usually normal. Females develop hemophilia only when they have the abnormal gene in both X chromosomes, a rare event. However, women with a defective X chromosome may transmit the disease to their male children.