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A Study of Blood Cells, Work and Function

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ABSTRACT

This paper proposes image processing algorithms to recognize Three types of blood cells in Origenism body. First one is RBC , Second one is WBC and third one is Platelets. Theas are three types of blood cells have a very important role on human body for transport of Gases, Body immunity and Blood clotting. On a human body the blood have a great importance of a life. The Blood provide a surface for gases exchange on lungs and cellular region. This gases are helpful for cellular respiration and produesed cellular energy like ATP(ATP is a energy coin of a cell). This energy are use in cellular activities and cellular repairing. Blood is a viscous fluid formed of cellular element suspended in plasma. The cellular composed of: Erythrocytes(R.B.C.), Leucocytes(W.B.C.) and Platelets. Plasma is a viscous, translucent, yellowish fluid composed of water (90%), protein (7%),organic salts(1%), and organic compound (2%) such as amino acids, lipids, and vitamins. The total blood volume is about 5L (depending on body size). Outside the blood vessels, blood undergoes a complex rection called coagulation or clot formation, which plays an importance role in repairing damaged blood vessels and preventing blood loss. The ability to provide all types of ancillary studies necessary to make specific diagnosis that will dictate treatment protocols will be demonstrated. A brief description of the general rule of circulation differentiating benign from malignant will be presented. It is hoped that this review will benefit all practicing clinicians that may face certain diagnostic challenges requiring the use of blood material. In the human embryo, the first site of blood formation is the yolk sac. Later in embryonic life, the liver becomes the most important red blood cell-forming organ, but it is soon succeeded by the bone marrow, which in adult life is the only source of both red blood cells and the granulocytes. Both the red and white blood cells arise through a series of complex, gradual, and successive transformations from primitive stem cells, which have the ability to form any of the precursors of a blood cell. Precursor cells are stem cells that have developed to the stage where they are committed to forming a particular kind of new blood cell. In a normal adult the red cells of about half a litre (almost one pint) of blood are produced by the bone marrow every week.

KEYWORDS: Blood cells, RBC, WBC, Platelets, Body Defence, Blood Clotting, Function.

INTRODUCTION-

A blood cell, also called a hematopoietic cell, hemocyte, or hematocyte, is a cell produced through hematopoiesis and found mainly in the blood. Major types of blood cells include red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes). Together, these three kinds of blood cells add up to a total 45% of the blood tissue by volume, with the remaining 55% of the volume composed of plasma, the liquid component of blood. Erythrocytes and blood platelets perform their functions inside the blood vessels, whereas leucocytes reside temporarily in the blood vessels and the connective tissues or lymphoid tissues. The ratio of erythrocytes to total blood volume is about 43% and is known as haematocrit. On the composition of blood plasma in water of 90% and 10% other

substance like organic component and inorganic salt. In other substance the plasma protein are soluble proteins. This are (1) Albumin (3.5-5 gm/dL of blood) and is mainly responsible for maintaining the osmotic pressure of blood. (2) Globulins (Alpha, beta and gamma globulins) are globular proteins dissolved in the plasma. The gamma globulins include the antibodies, or immunoglobulins, synthesizes by plasma cells. (3) Blood coagulation proteins such as prothrombin, fibrinogen which is converted into fibrin during clot formation. Fibrinogen is synthesized and secreted by the liver.Organic compounds are include nutrients such as amino acids and glucose, vitamins, and variety of regulatory peptides, steroid hormones, and lipids. Inorganic salts are constitutes 0.9% of plasma volume, include blood electrolytes such as sodium, potassium, and calcium salts. Serum portion of plasma that separates from coagulum after clotting. **reticulocyte**, non-nucleated stage in the development of the red blood cell, just before full maturity is reached. The cell is named for strands or a network of internal material that stains with a base. It develops from normoblasts in the red marrow and may be freed to the circulation before maturity.**phagocytosis**, process by which certain living cells called phagocytes ingest or engulf other cells or particles. The phagocyte may be a free-living one-celled organism, such as an amoeba, or one of the body cells, such as a white blood cell. In some forms of animal life, such as amoebas and sponges, phagocytosis is a means of feeding. Lymphoid tissue has several different structural organizations related to its particular function in the immune response. The most highly organized lymphoid tissues are in the thymus and lymph nodes, which are well-defined encapsulated organs with easily identifiable architectures.lood accounts for 7% of human body weight, with an average density of around 1060 kg/m^3, which is very close to the density of pure water, which is 1000 kg/m^3. The average adult's blood volume is approximately 5 litres (11 US pt) or 1.3 gallons, and it is made up of plasma and formed elements. The formed elements are two types of blood cells or corpuscles: red blood cells (erythrocytes) and white blood cells (leukocytes), as well as platelets, which are involved in clotting. Red blood cells account for approximately 45% of total blood volume, plasma for approximately 54.3%, and white cells for approximately 0.7%.Hemopoiesis (hematopoiesis) is the process by which blood elements are formed. Hemopoiesis occurs in the red bone marrow of the epiphyses of long bones (such as the humerus and femur), flat bones (such as the ribs and cranial bones), vertebrae, and the pelvis.Hemopoietic stem cells (hemocytoblasts) divide within the red bone marrow to produce various “blast” cells. Each of these cells matures into a distinct formed element.

OBJECTIVES-

To study of the blood types
To study of the Blood cells types
To study of Blood cells Function and structure

Research methods used – In the present research, research method in used Internet surveys, other Famous book, writers and authers.

ANALYSIS-

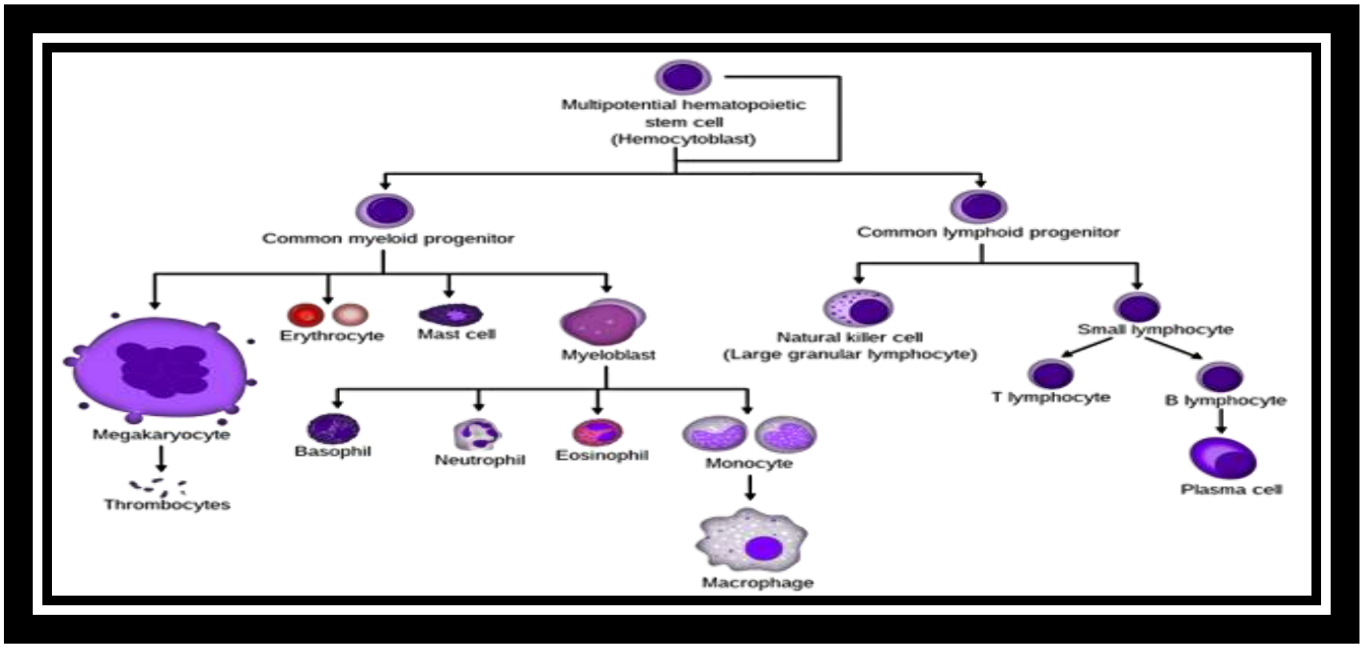


Fig. 1 Flow chart of Blood Cells Types

Red blood cells

Red blood cells or *erythrocytes*, primarily carry oxygen and collect carbon dioxide through the use of hemoglobin. Hemoglobin is an iron-containing protein that gives red blood cells their color and facilitates transportation of oxygen from the lungs to tissues and carbon dioxide from tissues to the lungs to be exhaled. Red blood cells are the most abundant cell in the blood, accounting for about 40-45% of its volume. Red blood cells are circular, biconcave, disk-shaped and deformable to allow them to squeeze through narrow capillaries. They do not have a nucleus. Red blood cells are much smaller than most other human cells.

RBCs are formed in the red bone marrow from hematopoietic stem cells in a process known as erythropoiesis. In adults, about 2.4 million RBCs are produced each second. The normal RBCs count is 4.5 to 5 millions per cu.mm. RBCs have a lifespan of approximately 100-120 days. After they have completed their lifespan, they are removed from the bloodstream by the spleen.

Mature red blood cells are unique among cells in the human body in that they lack a nucleus (although erythroblasts do have a nucleus).

The condition of having too few red blood cells is known as anemia, while having too many is polycythemia.

Erythrocyte sedimentation rate (ESR) is the rate at which RBCs sink to the bottom (when placed in a vertical column after adding an anticoagulant).

Normal values of ESR are:

• 3 to 5 mm per hour in males.
• 4 to 7 mm per hour in females.

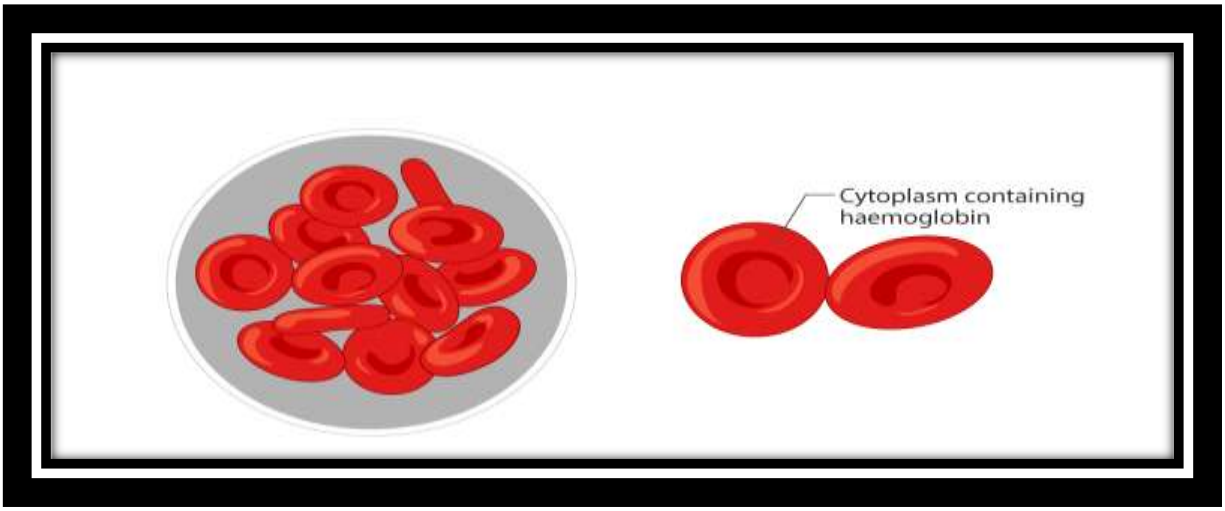


Fig.2 - Erythrocyte (RBC)

Function-

1. O_2&CO_2Exchange
2. $Body$ Glucose transport into the cell

White blood cells

White blood cells or *leukocytes*, are cells of the immune system involved in defending the body against both infectious disease and foreign materials. They are produced and derived from multipotent cells in the bone marrow known as hematopoietic stem cells. Leukocytes are found throughout the body, including the blood and lymphatic system. There are a variety of types of white bloods cells that serve specific roles in the human immune system. WBCs constitute approximately 1% of the blood volume.

White blood cells are divided into granulocytes and agranulocytes, distinguished by the presence or absence of granules in the cytoplasm. Granulocytes include basophils, eosinophils, neutrophils, and mast cells. Agranulocytes include lymphocytes and monocytes.

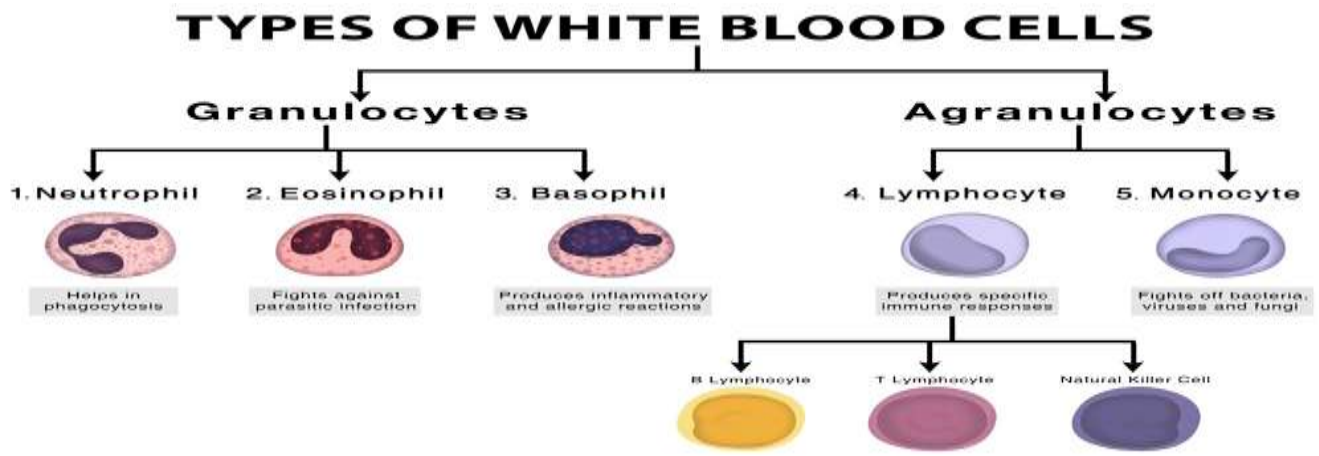
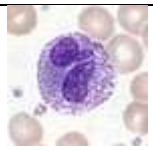


Fig.3- Leukocytes (WBC)

Type	Appearance (Micrograph)	Appearance (illustration)	Approx % in adult	Diameter (µm)	Main targets	Nucleus	Granules	Lifetime
Neutro Phill			62%	10-12	Bacteria Fungi	Multilobed	Fine, Faintly Pink(H&Estain)	6 hours
Eosino Phill			2.3%	10-12	Larger Parasites, Modulate allergic, inflammatory responses	Bi-lobed	Full of pink-orange	8-12 days
Baso phill			0.4%	12-15	Release histamine for inflammatory responses	Bi-lobed or tri-lobed	Large Blue	A few Hours to a few days
Lympho Cyte		B-Cell  T-Cell 	30 %	Small lumphocytes 7-8 Large lymphocytea 12-15	**B cell:** releases antibodies and assists activation of T cells **<u>T cells:</u>** **CD4+Th(T helper)cells :** activate and regulate T and B cells **CD8+Cytotoxic T cell:** virus infected and tumor cells. **Gamma Delta T cells:** bridge between innate and adaptive	Deeply staining, eccentric	NK-cells and cytotoxic (CD8+)T-cells	Years for memory cells, weeks for all else

					immune responses, phagocytosis **Regulatory T cells:** Returns the functioning of the immune system to normal operation after infection; prevents autoimmunity **Natural Killer cells:**virus-infected and tumor cells.			
Monocytes			5.3%	15-30	Migrate from the bloodstream to other tissues and differentiate into tissue resident macrophages, Kupffer cells in the Liver.	Kidney shaped	None	Hours to Days

Neutrophil

Neutrophils are the most abundant white blood cell, constituting 60-70% of the circulating leukocytes. They defend against bacterial or fungal infection. They are usually first responders to microbial infection; their activity and death in large numbers form pus. They are commonly referred to as polymorphonuclear (PMN) leukocytes, although, in the technical sense, PMN refers to all granulocytes. They have a multi-lobed nucleus, which consists of three to five lobes connected by slender strands. This gives the neutrophils the appearance of having multiple nuclei, hence the name

polymorphonuclear leukocyte. The cytoplasm may look transparent because of fine granules that are pale lilac when stained. Neutrophils are active in phagocytosing bacteria and are present in large amount in the pus of wounds. These cells are not able to renew their lysosomes (used in digesting microbes) and die after having phagocytosed a few pathogens. Neutrophils are the most common cell type seen in the early stages of acute inflammation. The average lifespan of inactivated human neutrophils in the circulation has been reported by different approaches to be between 5 and 135 hours.

Eosinophil

Eosinophils compose about 2-4% of white blood cells in circulating blood. This count fluctuates throughout the day, seasonally, and during menstruation. It rises in response to allergies, parasitic infections, collagen diseases, and disease of the spleen and central nervous system. They are rare in the blood, but numerous in the mucous membranes of the respiratory, digestive, and lower urinary tracts.

They primarily deal with parasitic infections. Eosinophils are also the predominant inflammatory cells in allergic reactions. The most important causes of eosinophilia include allergies such as asthma, hay fever, and hives; and parasitic infections. They secrete chemicals that destroy large parasites, such as hookworms and tapeworms, that are too big for any one white blood cell to phagocytize. In general, their nuclei are bi-lobed. The lobes are connected by a thin strand. The cytoplasm is full of granules that assume a characteristic pink-orange color with eosin staining.

Basophil

Basophils are chiefly responsible for allergic and antigen response by releasing the chemical histamine causing the dilation of blood vessels. Because they are the rarest of the white blood cells (less than 0.5% of the total count) and share physicochemical properties with other blood cells, they are difficult to study. They can be recognized by several coarse, dark violet granules, giving them a blue hue. The nucleus is bi- or tri-lobed, but it is hard to see because of the number of coarse granules that hide it.

They excrete two chemicals that aid in the body's defenses: histamine and heparin. Histamine is responsible for widening blood vessels and increasing the flow of blood to injured tissue. It also makes blood vessels more permeable so neutrophils and clotting proteins can get into connective tissue more easily. Heparin is an anticoagulant that inhibits blood clotting and promotes the movement of white blood cells into an area. Basophils can also release chemical signals that attract eosinophils and neutrophils to an infection site.

Lymphocyte

Lymphocytes are much more common in the lymphatic system than in blood. Lymphocytes are distinguished by having a deeply staining nucleus that may be eccentric in location, and a relatively small amount of cytoplasm. Lymphocytes include:

- B cells make antibodies that can bind to pathogens, block pathogen invasion, activate the complement system, and enhance pathogen destruction.
- T cells:
- CD4+ helper T cells: T cells displaying co-receptor CD4 are known as CD4+ T cells. These cells have T-cell receptors and CD4 molecules that, in combination, bind antigenic peptides presented on major histocompatibility complex (MHC) class II molecules on antigen-presenting cells. Helper T

cells make cytokines and perform other functions that help coordinate the immune response. In HIV infection, these T cells are the main index to identify the individual's immune system integrity.

- CD8+ cytotoxic T cells: T cells displaying co-receptor CD8 are known as CD8+ T cells. These cells bind antigens presented on MHC I complex of virus-infected or tumour cells and kill them. Nearly all nucleated cells display MHC I.
- Gamma delta T cells possess an alternative T cell receptor (different from the αβ TCR found on conventional CD4+ and CD8+ T cells). Found in tissue more commonly than in blood, γδ T cells share characteristics of helper T cells, cytotoxic T cells, and natural killer cells.
- Natural killer cells are able to kill cells of the body that do not display MHC class I molecules, or display stress markers such as MHC class I polypeptide-related sequence A (MIC-A). Decreased expression of MHC class I and up-regulation of MIC-A can happen when cells are infected by a virus or become cancerous.

Monocyte

Monocytes, the largest type of white blood cell, share the "vacuum cleaner" (phagocytosis) function of neutrophils, but are much longer lived as they have an extra role: they present pieces of pathogens to T cells so that the pathogens may be recognized again and killed. This causes an antibody response to be mounted. Monocytes eventually leave the bloodstream and become tissue macrophages, which remove dead cell debris as well as attack microorganisms. Neither dead cell debris nor attacking microorganisms can be dealt with effectively by the neutrophils. Unlike neutrophils, monocytes are able to replace their lysosomal contents and are thought to have a much longer active life. They have the kidney-shaped nucleus and are typically not granulated. They also possess abundant cytoplasm.

Function-

This cell determines that no external organism can enter the body.That is, this cell provides protection to the body of the organism from the diseases spread by the external organisms.

Platelets-

Platelets, or thrombocytes, are very small,irregularly shaped clear cell fragments, 2-3 µm in diameter, which derive from fragmentation of megakaryocytes. The average lifespan of a platelet is normally just 5 to 9 days. Platelets are a natural source of growth factors. They circulate in the blood of mammals and are involved in hemostasis, leading to the formation of blood clots. Platelets release thread- like fibers to from these clots.

The normal range (99% of population analyzed) for platelets is 150,000 to 450,000 per cubic millimeter. If the number of platelets is too low, excessive bleeding can occur. However, if the number of platelets is too high, blood clots can form thrombosis, which may obstruct blood vessels and result in such events as a stroke, myocardial infarction, pulmonary embolism, or blockage of blood vessels to other parts of the body, such as the extremities of the arms or legs. An abnormality or disease of the platelets is called a thrombocytopathy, which can be either a low number of platelets (thrombocytopenia), a decrease in function of platelets (thrombasthenia), or an increase in the number of platelets (thrombocytosis). There are disorders that reduce the number of platelets, such as heparin-

induced thrombocytopenia (HIT) or thrombotic thrombocytopenic purpura (TTP), that typically cause thromboses, or clots, instead of bleeding.

Platelets release a multitude of growth factors including platelet-derived growth factor (PDGF), a potent chemotactic agent, and TGF beta, which stimulates the deposition of extracellular matrix. Both of these growth factors have been shown to play a significant role in the repair and regeneration of connective tissues. Other healing-associated growth factors produced by platelets include basic fibroblast growth factor (bFGF), insulin-like growth factor 1 (IGF-1), platelet-derived epidermal growth factor, and vascular endothelial growth factor (VEGF). Local application of these factors in increased concentrations through platelet-rich plasma (PRP) has been used as an adjunct to wound healing for several decades.

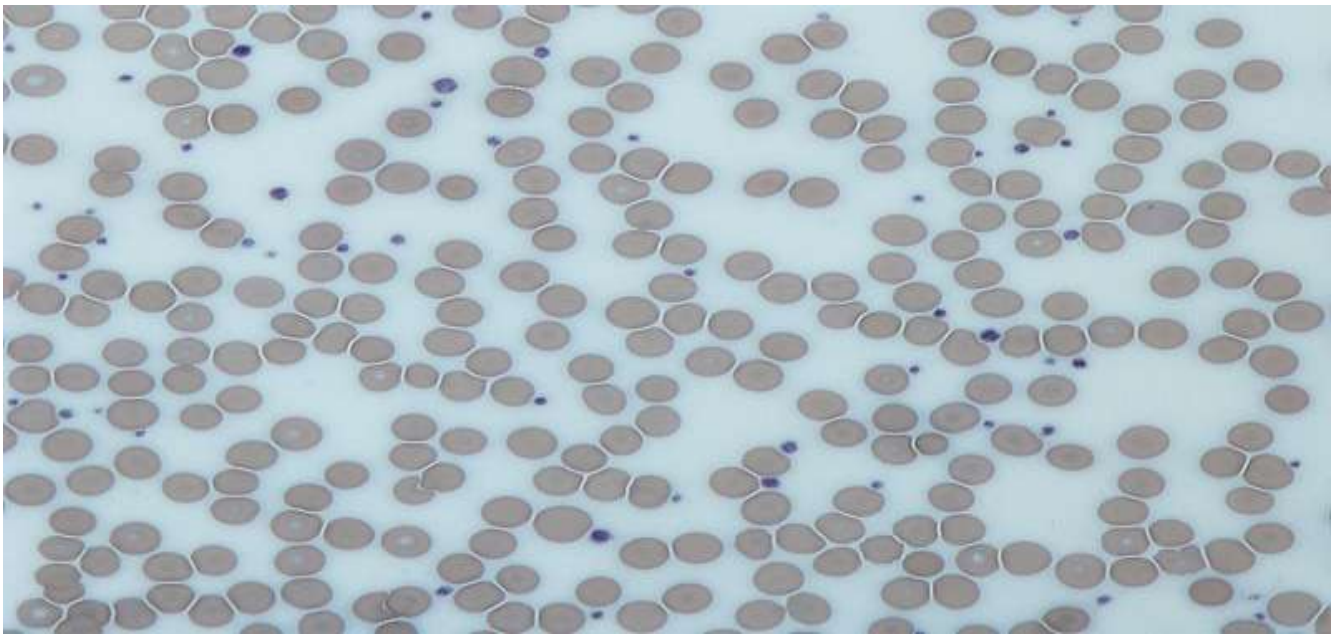


Fig.4-Platelets Function-

These molecule are participate in Blood clotting machnism.

CONCLUSION-

A Brife study on blood cells and their types and his function. The Blood have the two parts plasma and blood corpuscles. Plasma are found in 55% and blood corpuscles have 45% part in human body. Blood corpuscles are have three types on human body and have a great importance in life. They all are doing various work like gases exchange, body defence(immunity) and Blood clotting.

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