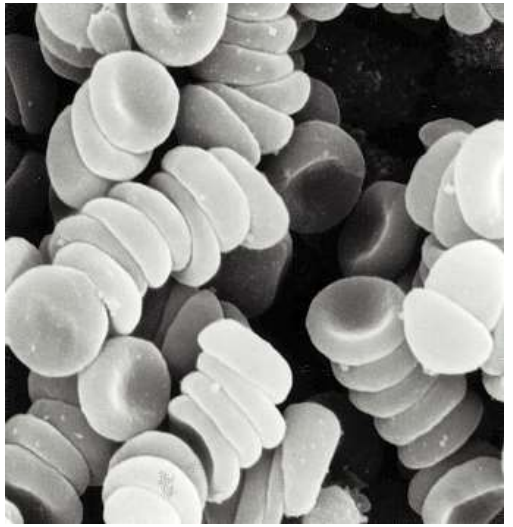
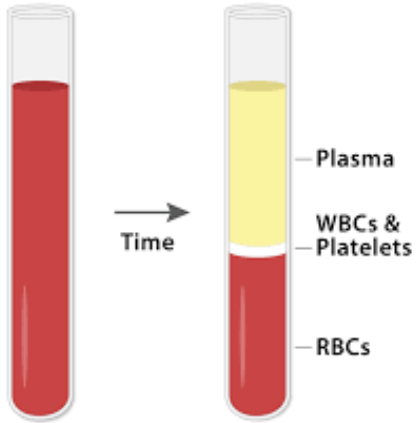
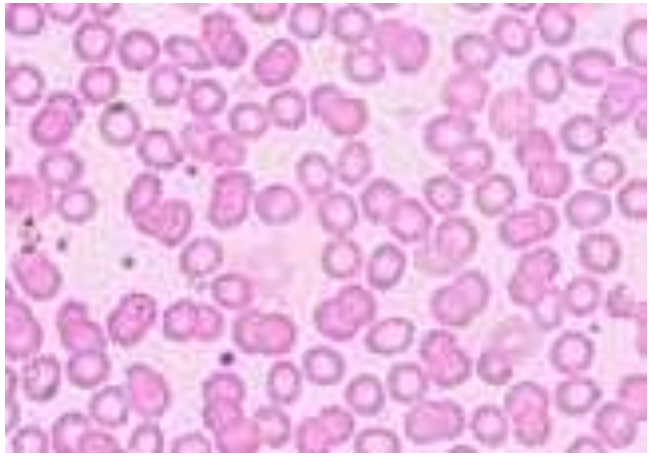

The Blood

Blood

- It is the red fluid which fills the heart and the blood vessels
- Consists of formed elements and plasma
- Formed elements are: Erythrocytes, Leukocytes, Lymphocytes, Monocytes, and Platelets
- Hematocrit
- Buffy coat
- Functions of the blood







Composition of Plasma

- **It is an aqueous solution that contains**

  7% plasma proteins (albumin, Globulins, immunoglobulins, Lipoproteins, Coagulation factors, and some regulatory proteins)

  0.9% inorganic substances

  2% organic substances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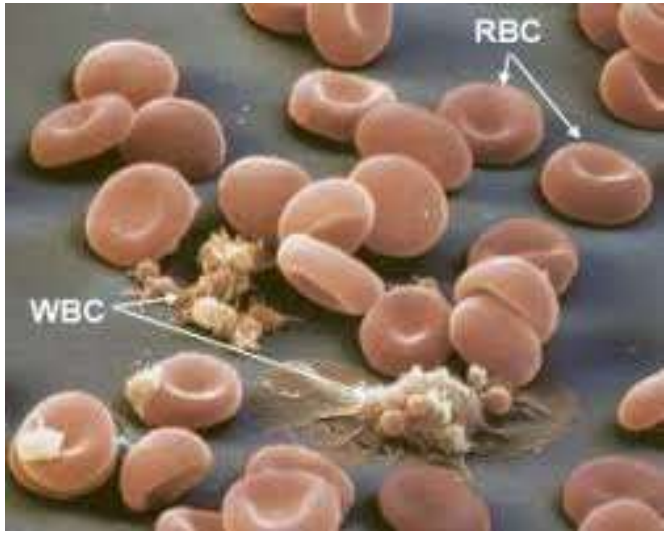
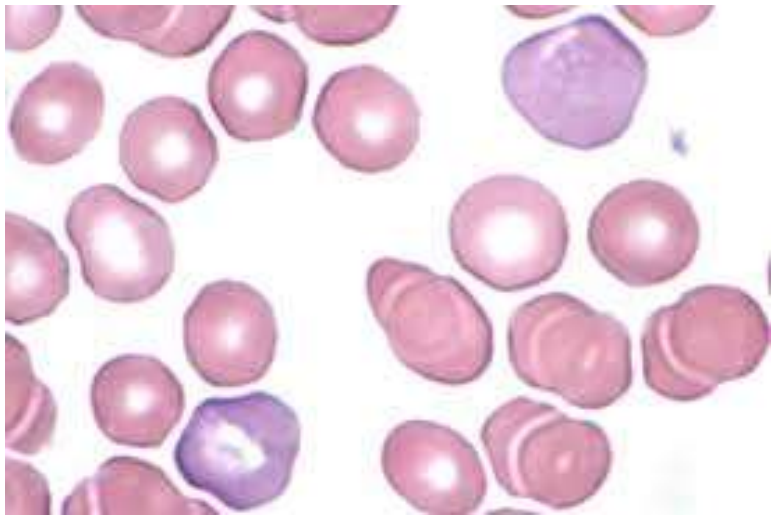
Erythrocytes

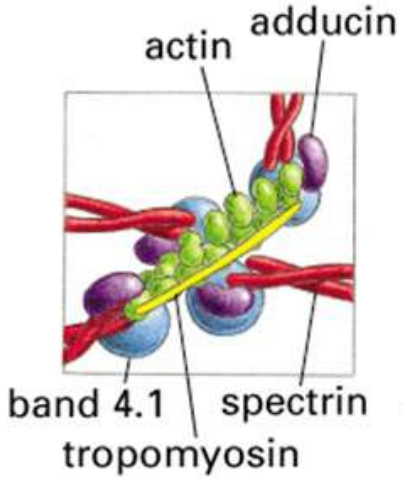
- Anucleated cell packed with O_2 - carrying HB
- It is a biconcave disc 7.5 µm in diameter, 2.6 µm at the periphery, 0.75 µm at the center.
- Microcyte- diameter <6 µm
- Macrocyte- diameter > 9µm
- Anisocytosis-variation in size
- Poikilocytosis- variation in shape
- Anemia- decrease number of RBCs
- Polycaethemia- increase the number of RBCs

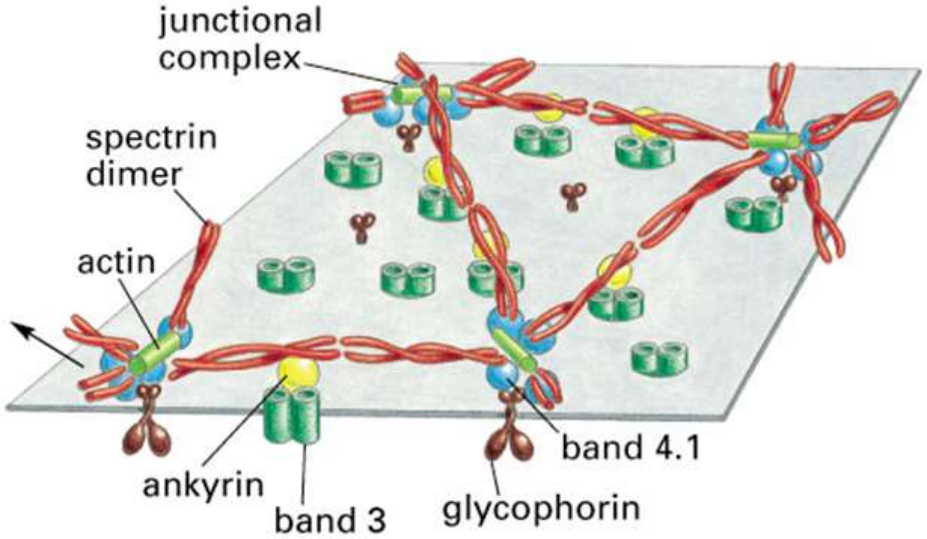




Erythrocytes Cont.,

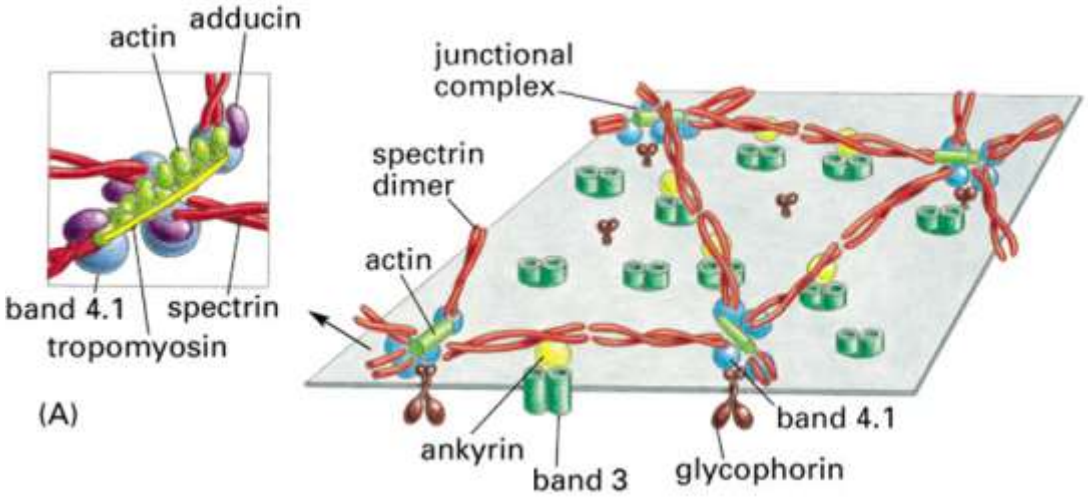
- Erythrocyte is flexible which permits adaptation to irregular and narrow diameters of capillaries
- Surrounded by a plasmalemma and supported by proteins which determine the shape of RBC.
- Spectrin links several membrane proteins with cytoskeletal elements

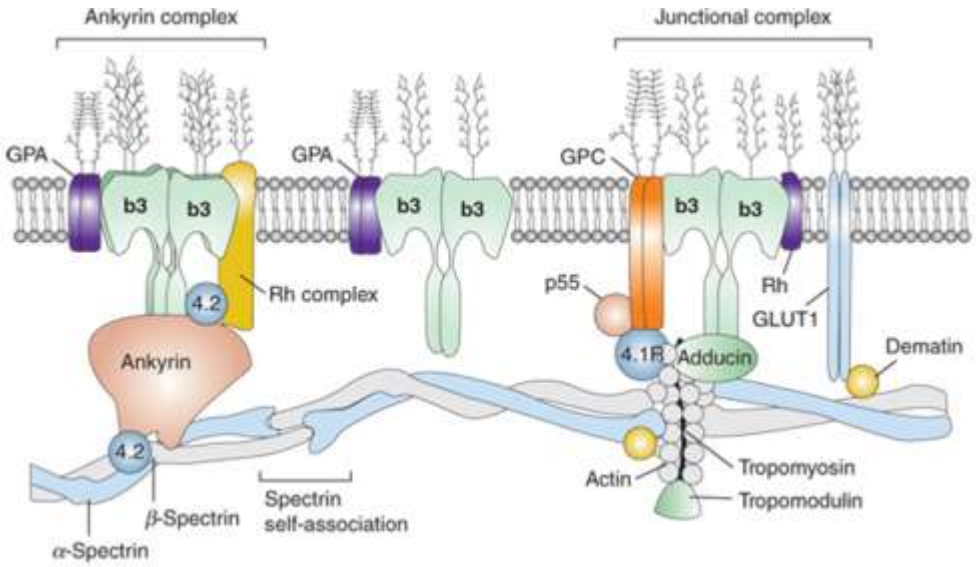




Red Blood Cell Membrane Skeleton

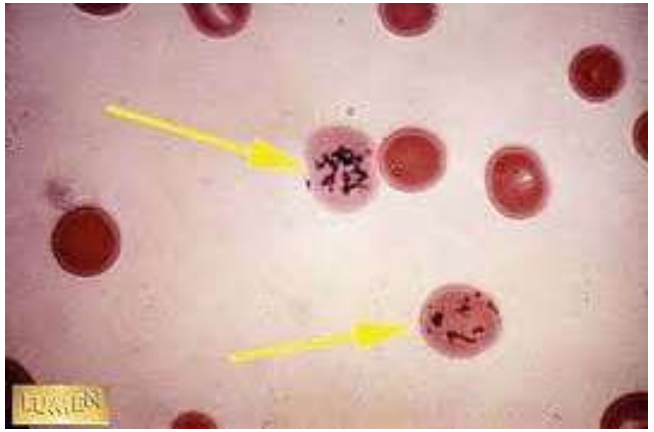
- Glycophorin A and Band 3 act as ion channels and anion transport
- Ankyrin, Adducin, and Band 4.1 anchor spectrin to glycophorin C and band 3 proteins
- Spectrin forms a lattice and bound to actin filaments
- Glygocylated domains of Glycophorin A and Band 3 includes antigenic sites for ABO blood typing

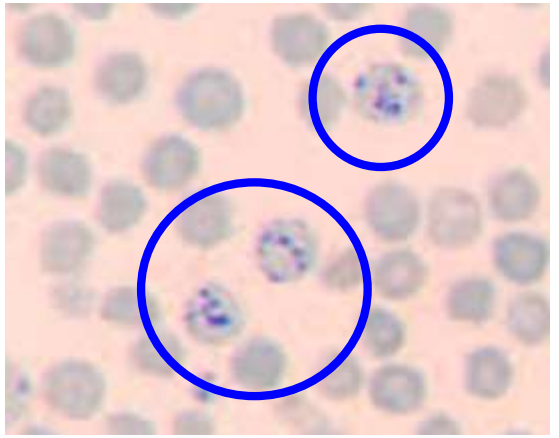


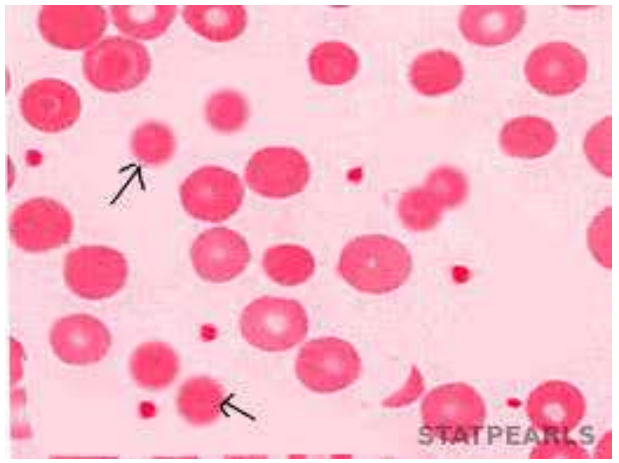


Erythrocytes Cont.,

- Hb constitutes 33% of RBC which accounts for acidophilia
- Reticulocytes
- Sickle Cell Anemia
- Hereditary spherocytosis





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Leukocytes

- Leave blood to become functionally active
- Divide into granulocytes and agranulocytes depending on the density of distribution of granules
- They are spherical in plasma and become motile and amoebic in tissues
- Granulocytes possess Azurophilic granules (Lysosomes) and specific granules that stain specifically with neutral, basic, and acidic stains
- They are terminally differentiated cells with a short life span (a few days)
- RER and Golgi are poorly developed
- Most white blood cells undergo apoptosis

Leukocytes

Divided into:

- **Granulocytes containing specific granules**
- **Agranulocytes containing no specific granules**
- **Granulocytes include:**

  Neutrophils

  Eosinophils

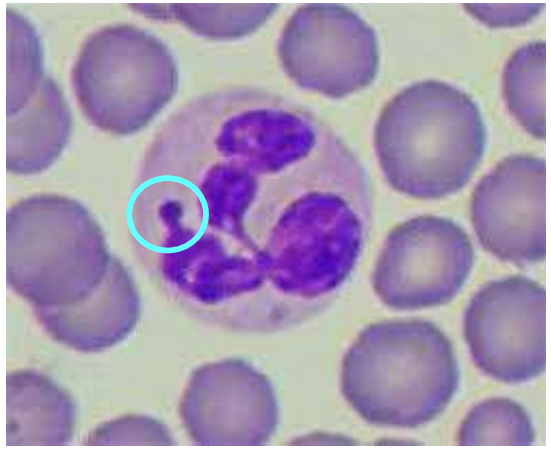
  Basophils
- **Agrnulocytes include:**

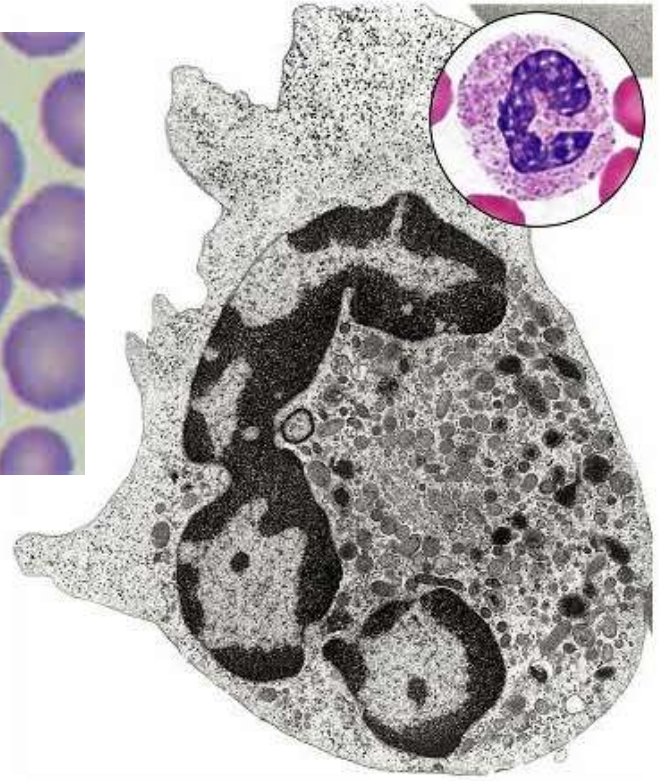
  Lymphocytes

  Monocytes

Neutrophils

- Constitute 60-70% of leukocytes in blood
- They live 4-6 hours in blood and 1-4 days in tissue
- Nucleus with 2-5 lobes
- In females, inactive X chromosome may appear on one lobe as drumstick extension





Azurophilic granules:

- Large dense granules with many enzymes and proteases
- They secrete:

  Myeloperoxidase (hypochlorite)

  Lysozyme

  Defensins

Neutrophils Cont.,

Specific granules

- Small and less dense
- Stain faintly pink
- Contain many ECM components degrading enzymes
- Secrete many chemokines that attract other leukocytes and cytokines
- Secrete lipid mediators
- They kill bacteria by:

  O_2^-

  H_2O_2

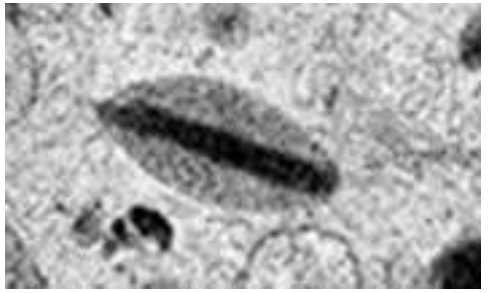
  Lactoferrin

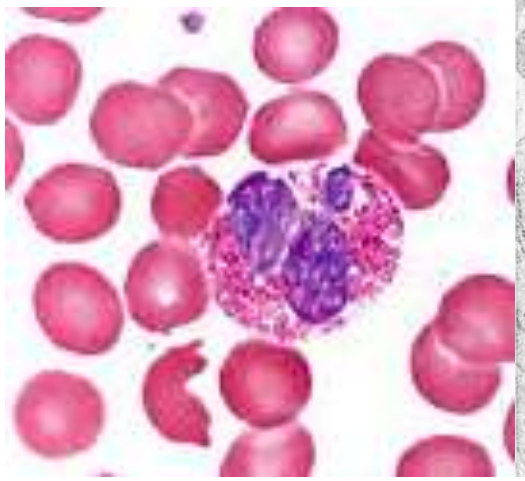
Eosinophils

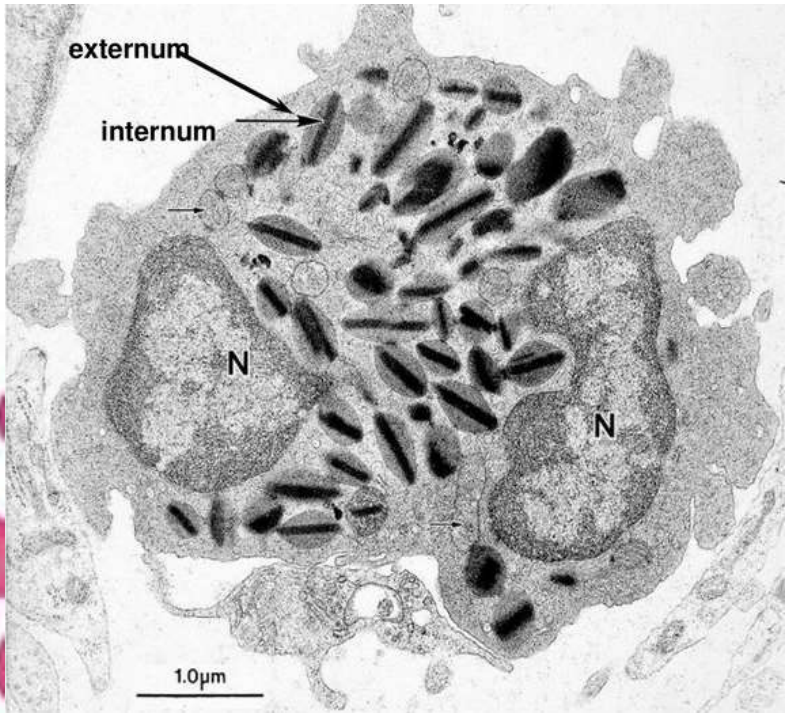
- Constitute 1-4% leukocytes
- Nucleus with 2 lobes
- Contain specific acidophilic granules (200).

  Internum with major basic protein (Arginine Rich)

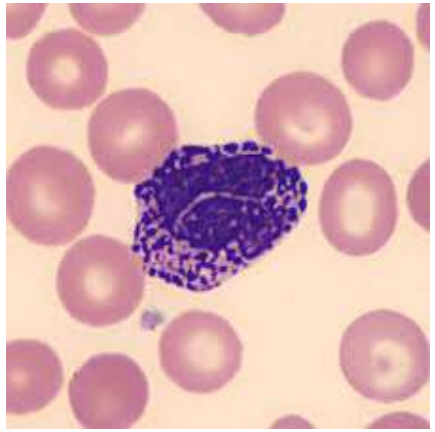
  Externum
- Removal of antigen-antibody complex
- Eosinophilia
- Eosinopenia



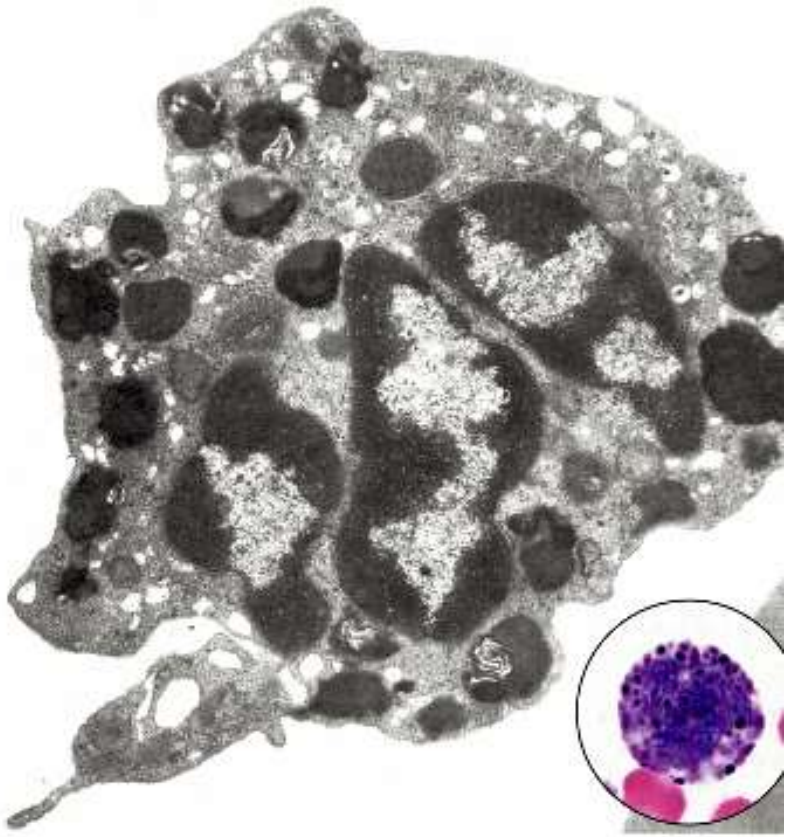




Basophils



- Constitute <1% of leukocytes
- Nucleus with irregular lobes
- Contain specific basophilic granules (0.5 µm)
- Granules are large, fewer in number and irregular in shape
- They stain purple obscuring the nucleus
- Contain histamine, heparin (Metachromasia), other mediators of inflammation (platelet-activating factor, eosinophilic chemotactic factor, and phospholipase A)



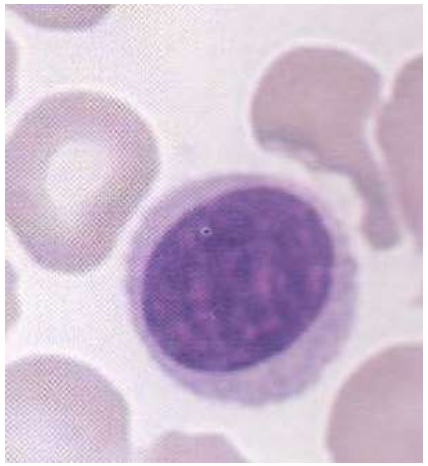
Lymphocytes

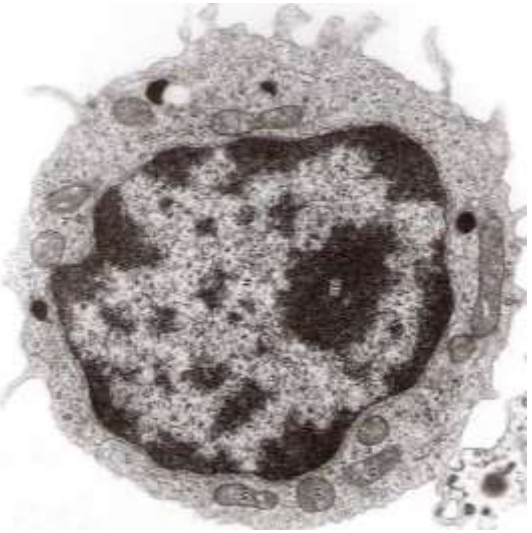
- Constitute 30% of leukocytes
- Round or indented nucleus
- Divide into:

  Small lymphocytes 6-8 µm

  Medium lymphocytes >9 µm

  Large lymphocytes 18 µm

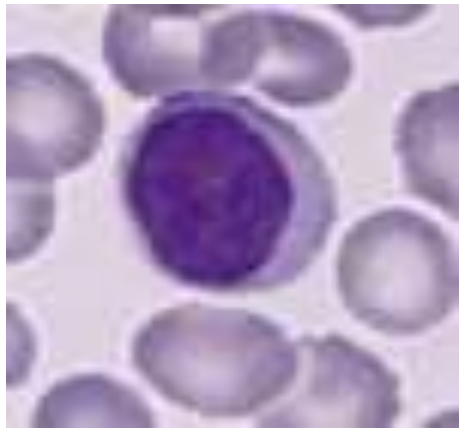


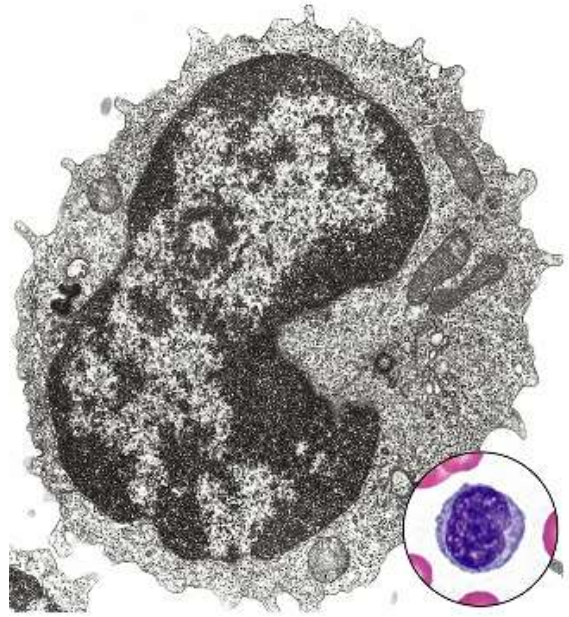


- They are differentiated by cell surface receptors into:

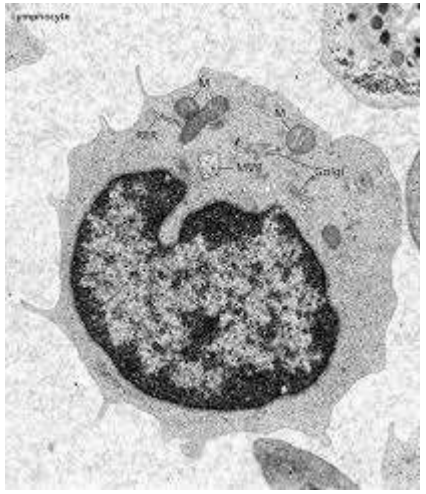
  B-lymphocytes

  T-lymphocytes (CD_4, CD_8 , CD_{25})

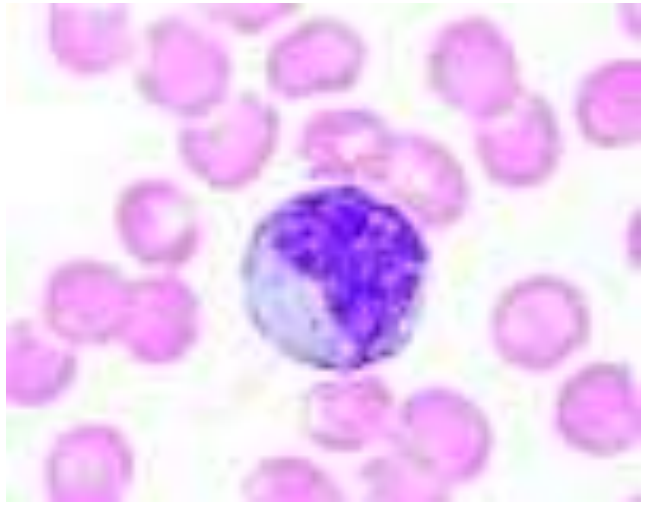


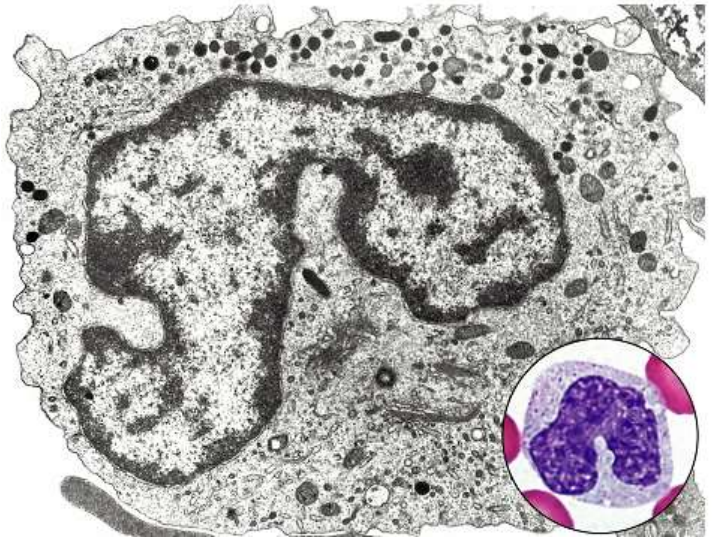


Monocytes



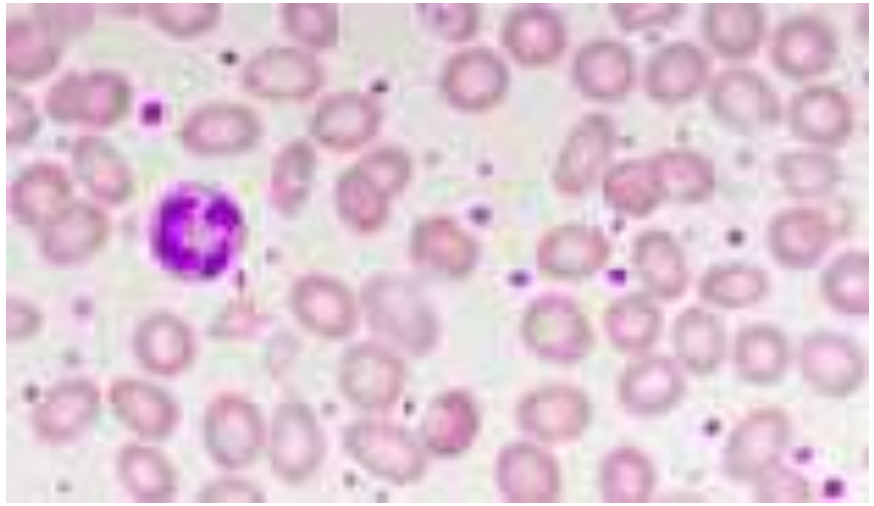
- Constitute 2-8% of leukocytes
- Oval, horse-shoe, or kidney-shaped nucleus
- Differentiate into macrophages in connective tissue
- It is difficult to differentiate between monocyte and large lymphocyte

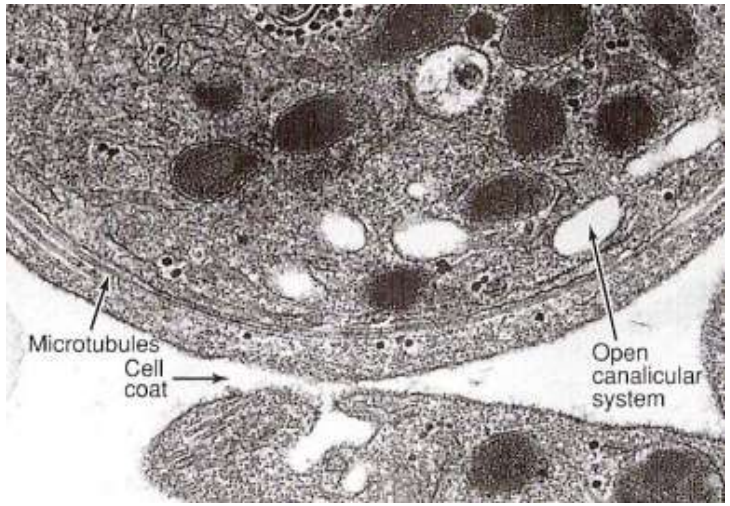




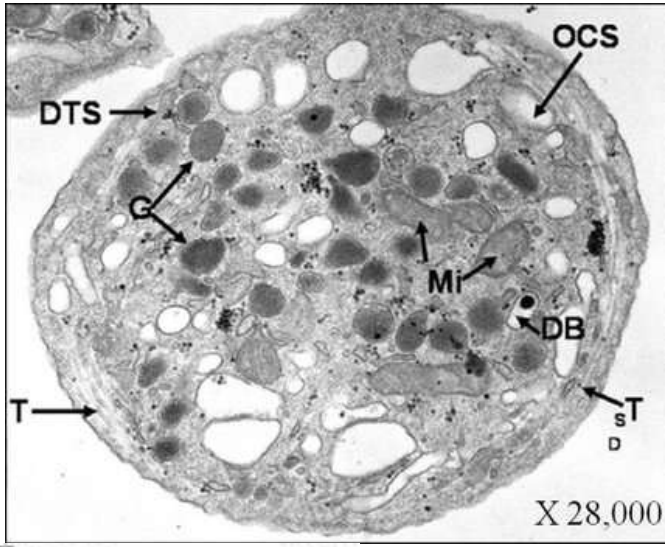
Platelets

- A cell fragment 2-4 µm, non-nucleated
- Promote blood clotting and repair small tears in blood vessels
- They are 150,000-400,000/ml
- They live for 10 days
- Each platelet is discoid in shape
- It has a lightly stained peripheral zone called Hyalomere
- Also has a central dark-stained zone called Granulomere
- Spares Glycocalyx surrounding plasmalemma for adhesion and activation during coagulation





Platelets Cont.,



Hyalomere contains:

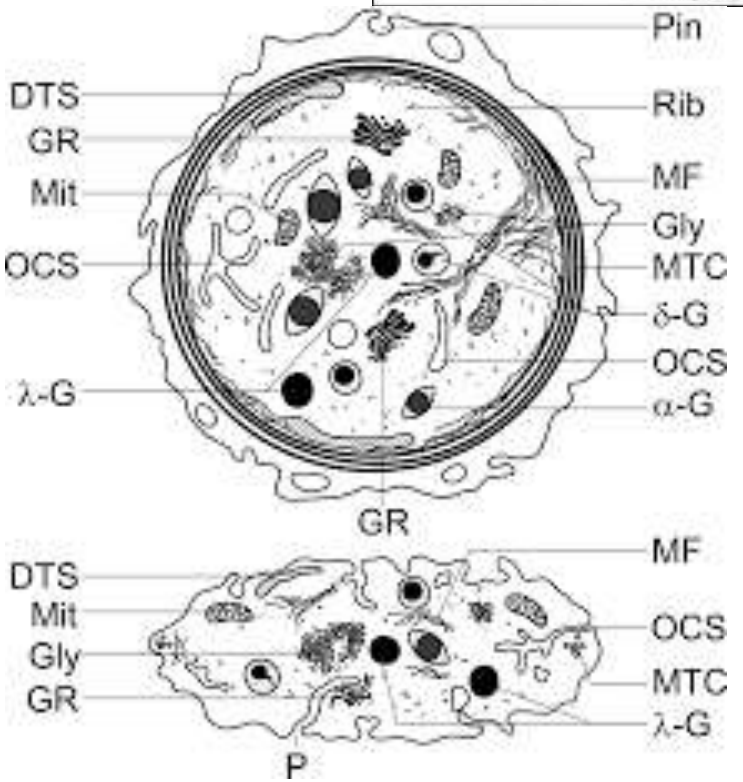
- Marginal bundle of microtubule and microfilaments
- Open canalicular system
- Dense tubular system

Granulomere contains:

- δ granules: Serotonin, ADP, ATP

  α granules: fibrinogen, platelet-derived growth factor, platelet specific proteins, platelet factor 4

  λ granules: lysosomes




Thank You