

Blood

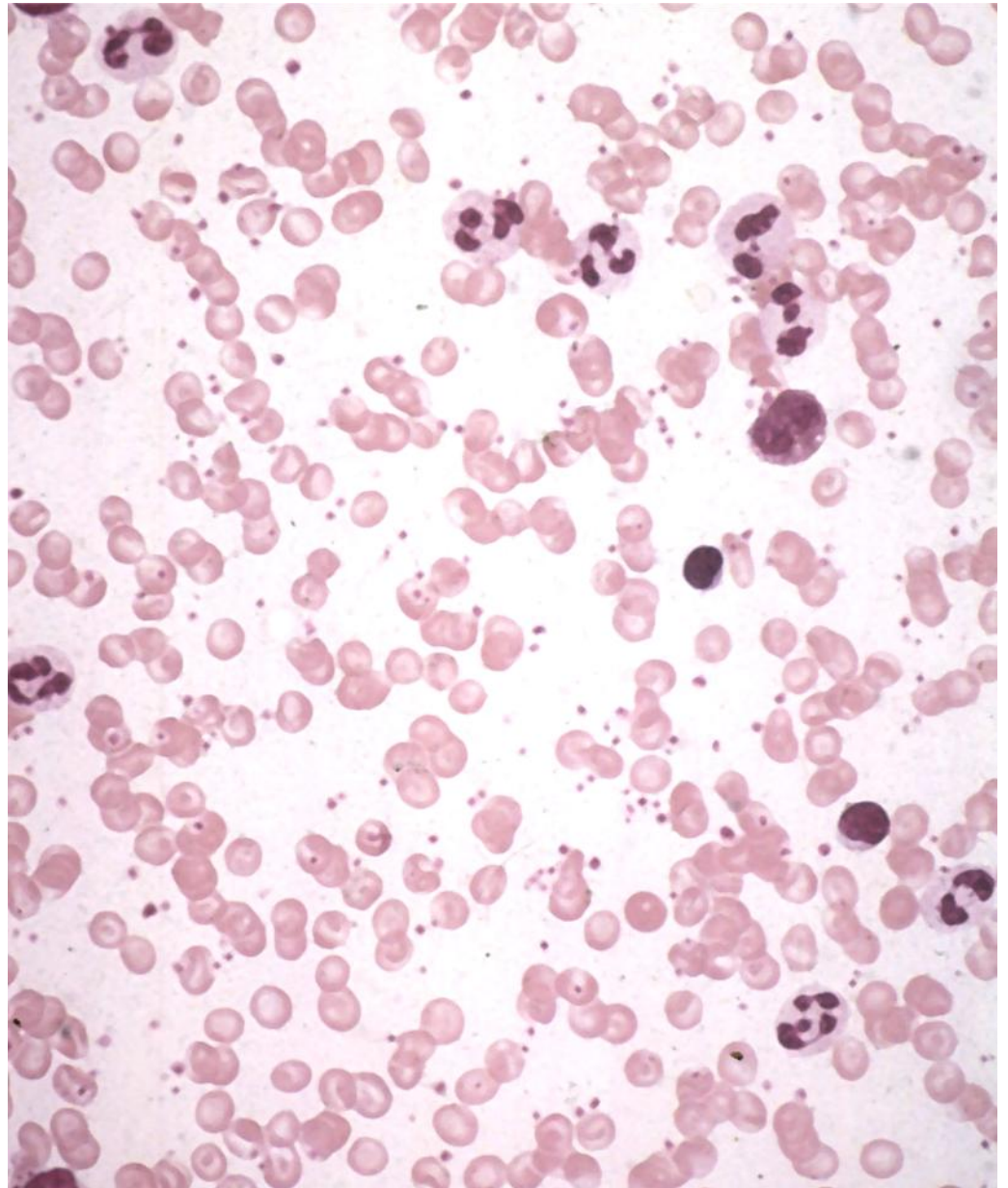
Plasma/Serum

Cells

Erythrocytes

Leukocytes

Platelets



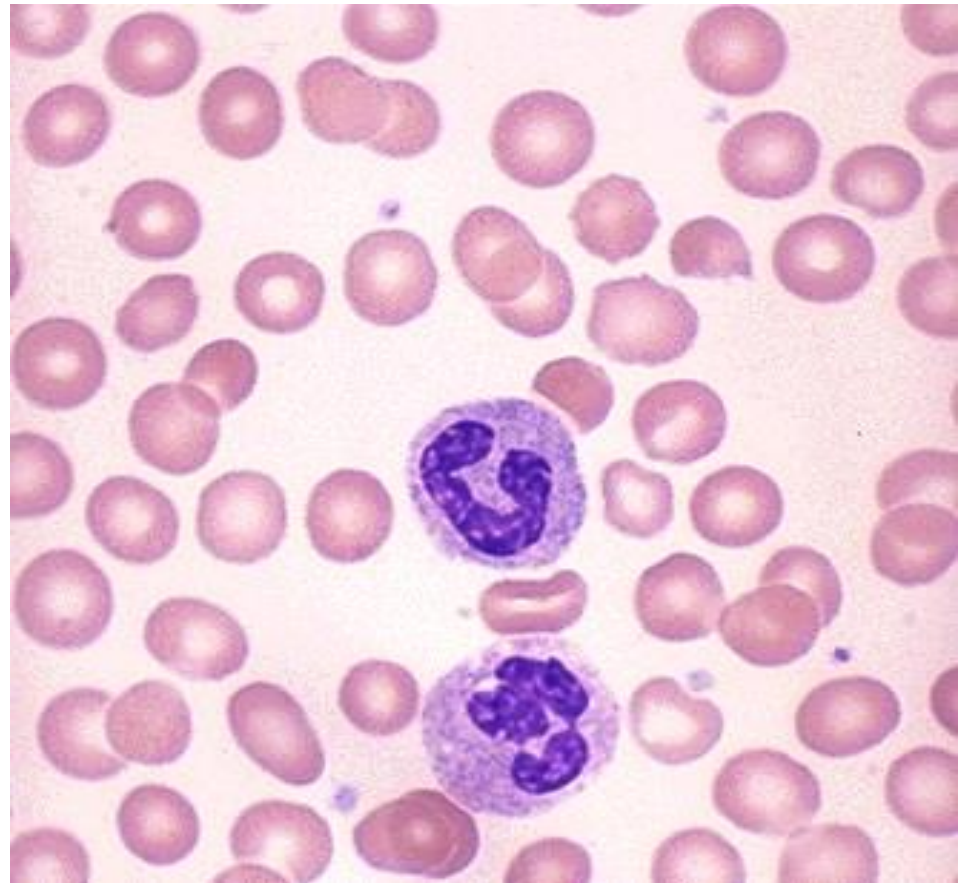
Blood

A connective tissue (CT proper, cartilage, bone)

About 5 quarts

Constituents

1. Plasma
2. Cells



Plasma

Serum + clotting proteins

Serum

90% water

7% protein

0.9% inorganic salts

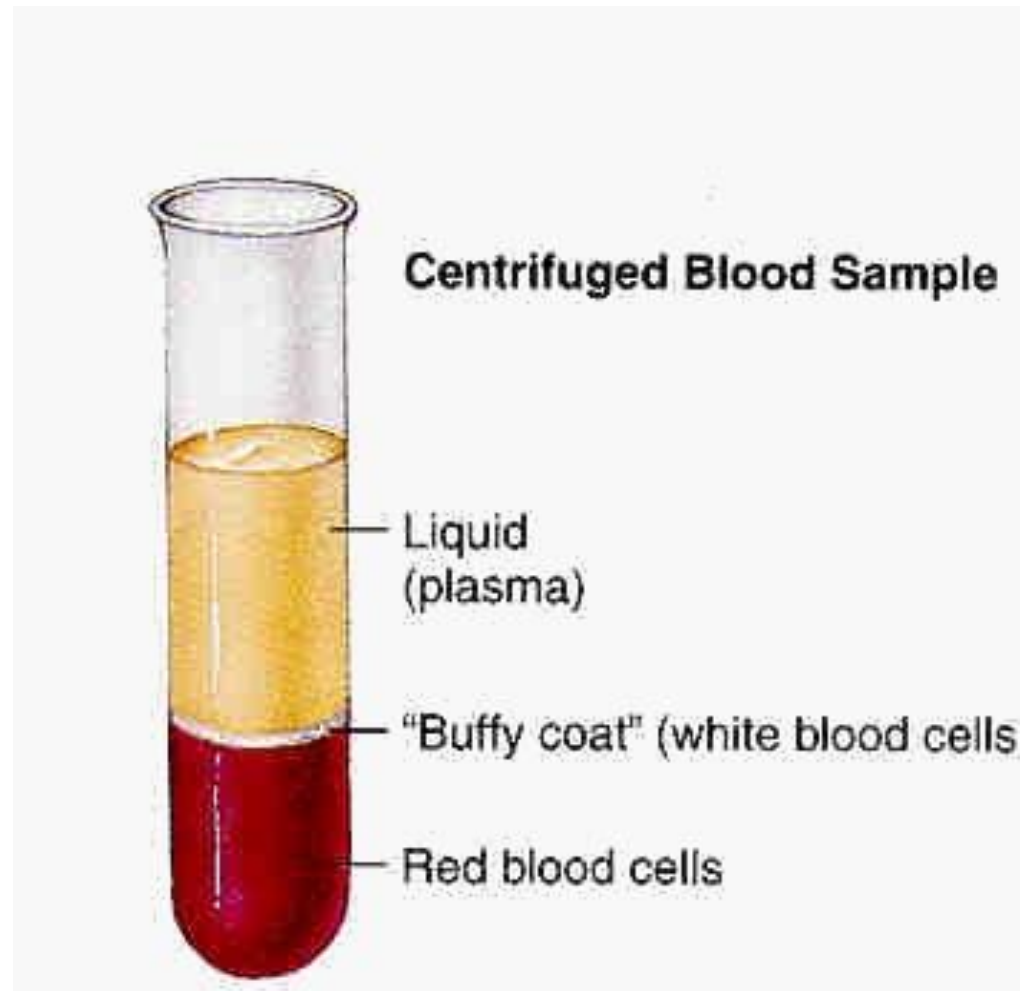
Amino acids

Vitamins

Lipids

Hormones

Sugars



Formed Elements/Cells

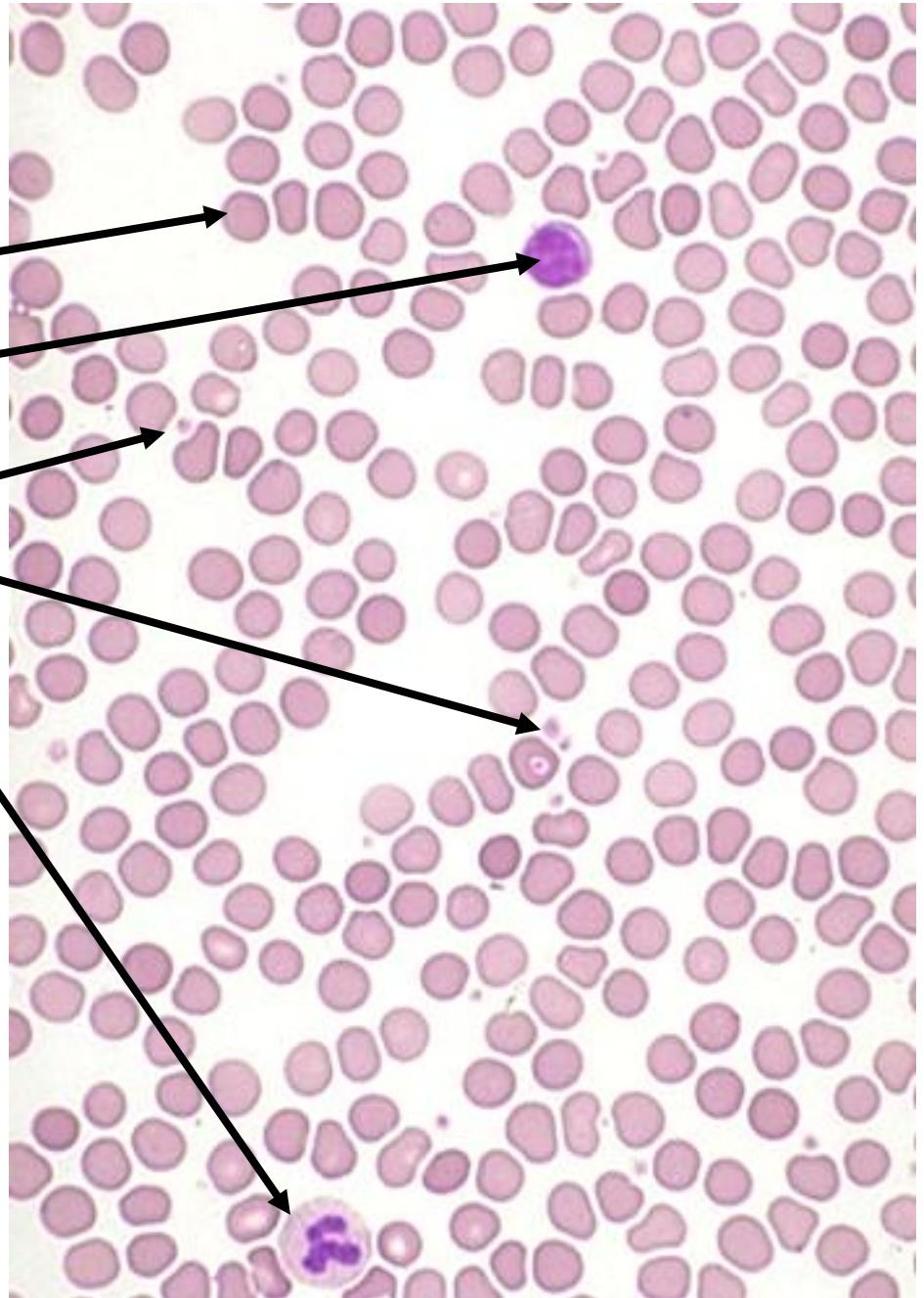
Erythrocytes

Leukocytes

Cell fragments

= platelets

(thrombocytes)



Erythrocytes

Red blood cells = RBCs

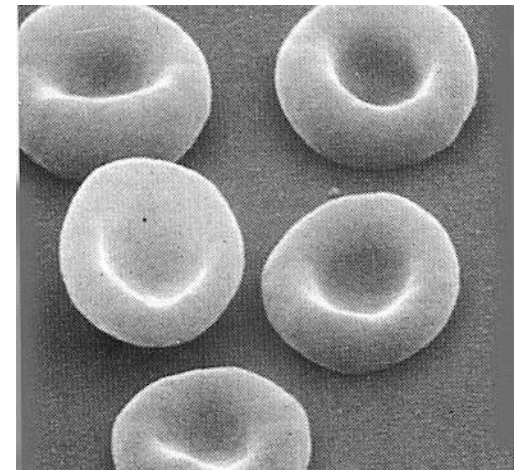
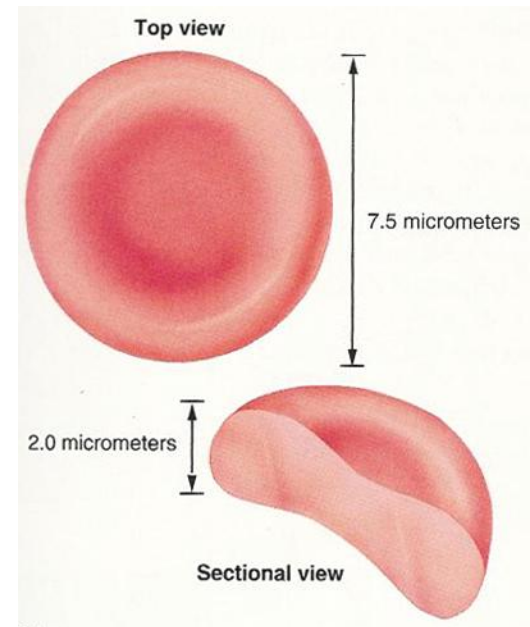
Transport oxygen via hemoglobin

7 micron diameter

Biconcave disc

Soft and flexible

Can squeeze through capillaries,
the smallest blood vessels



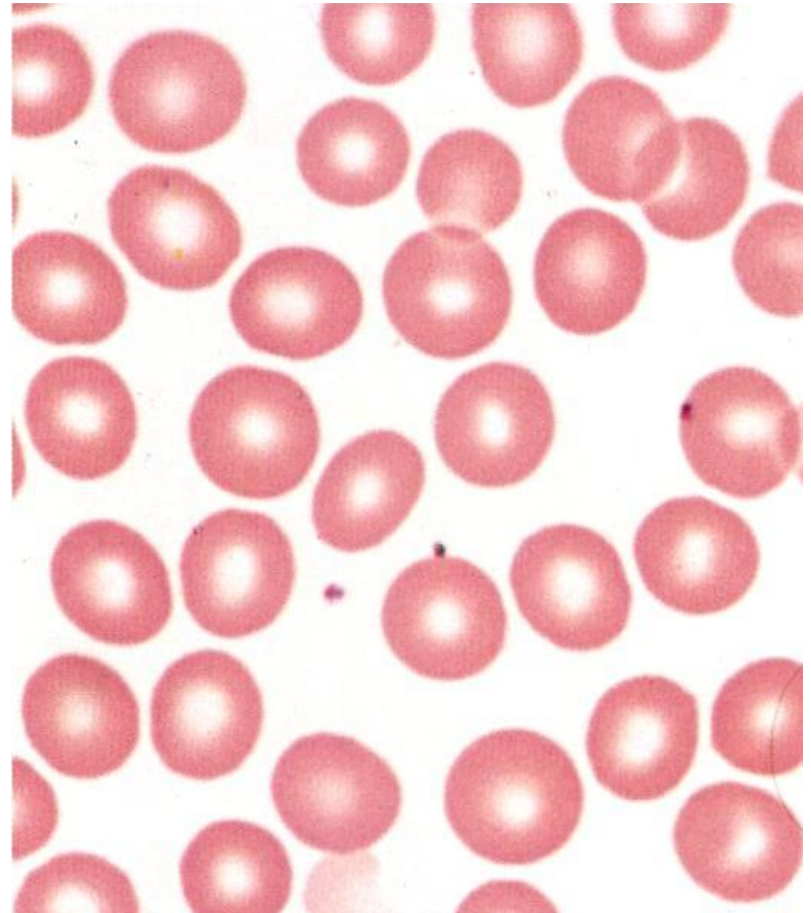
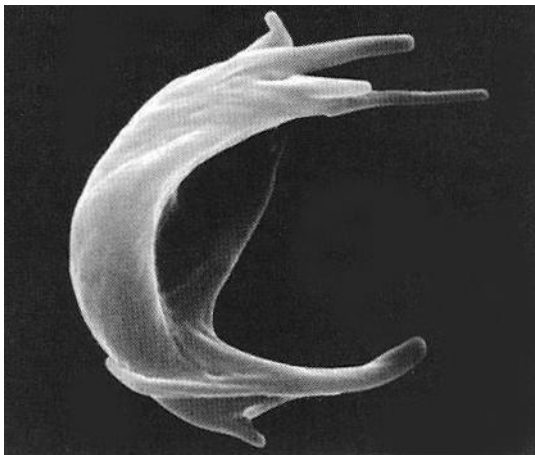
Erythrocytes

No nucleus, ER, mitochondria,
ribosomes, etc.

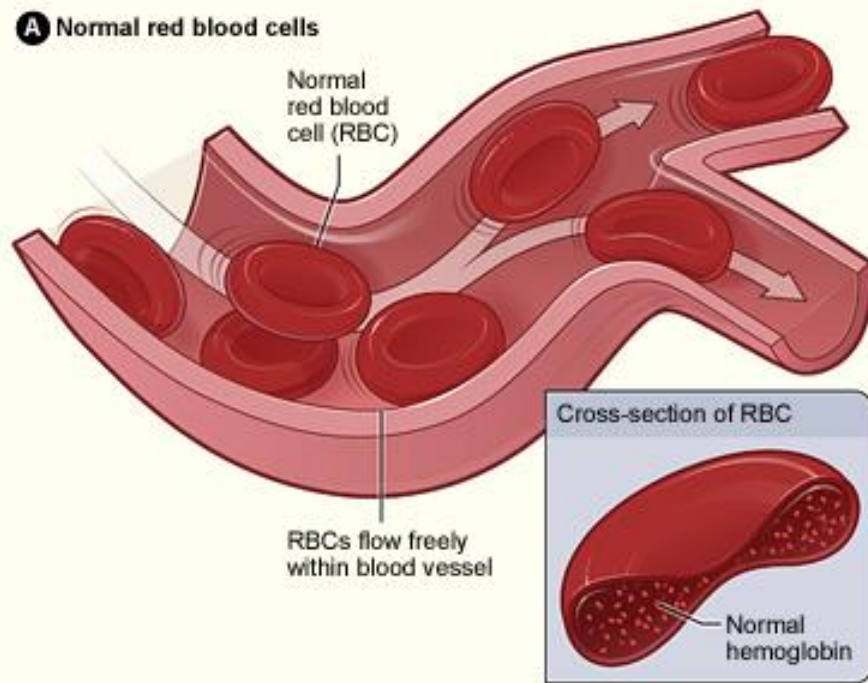
Cannot grow or divide

120 day lifespan

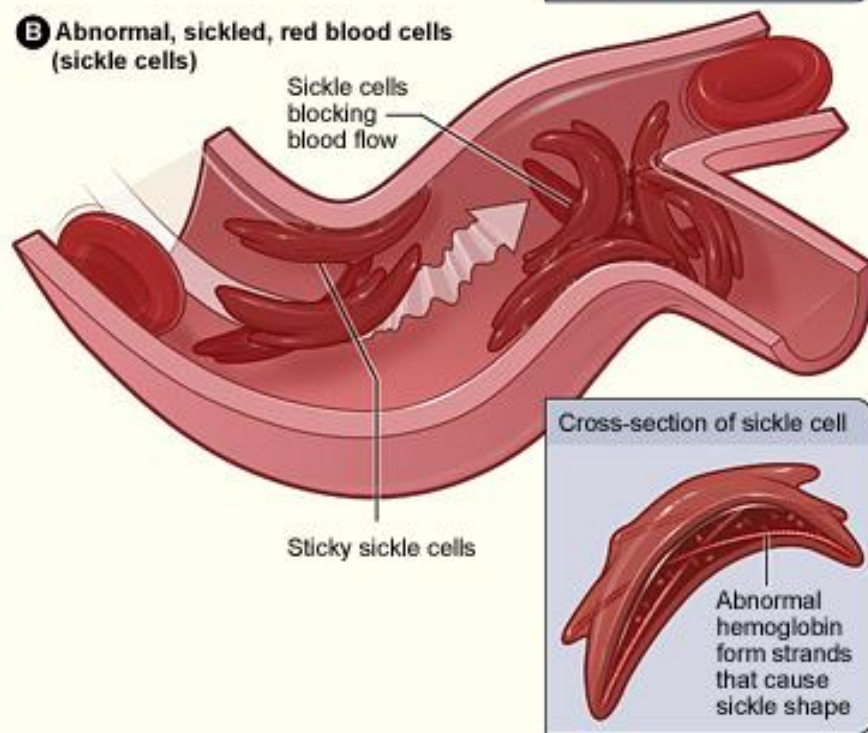
Captured and destroyed by
macrophages in spleen (and liver)
when worn out



A Normal red blood cells



B Abnormal, sickled, red blood cells (sickle cells)



Leukocytes

4800-11000/mm³

Granulocytes

Neutrophils – 65%

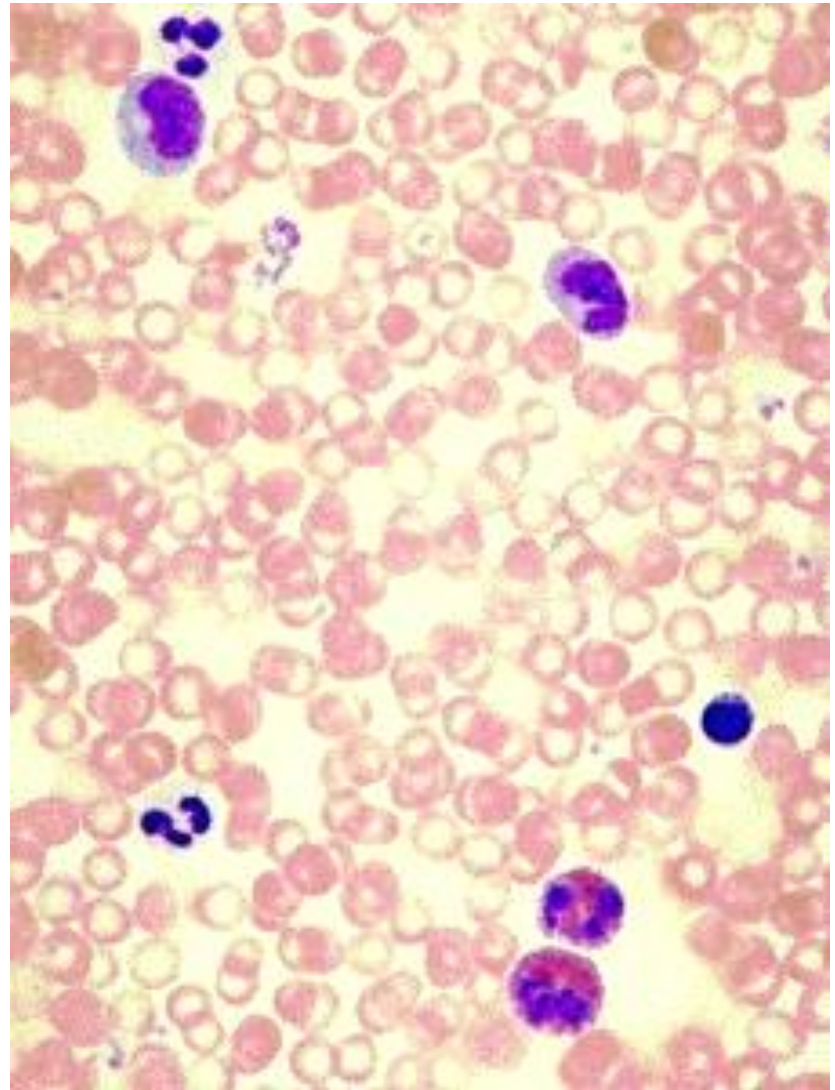
Eosinophils – 2%

Basophils – 0 to 1%

Agranulocytes

Lymphocytes – 30%

Monocytes – 2 %

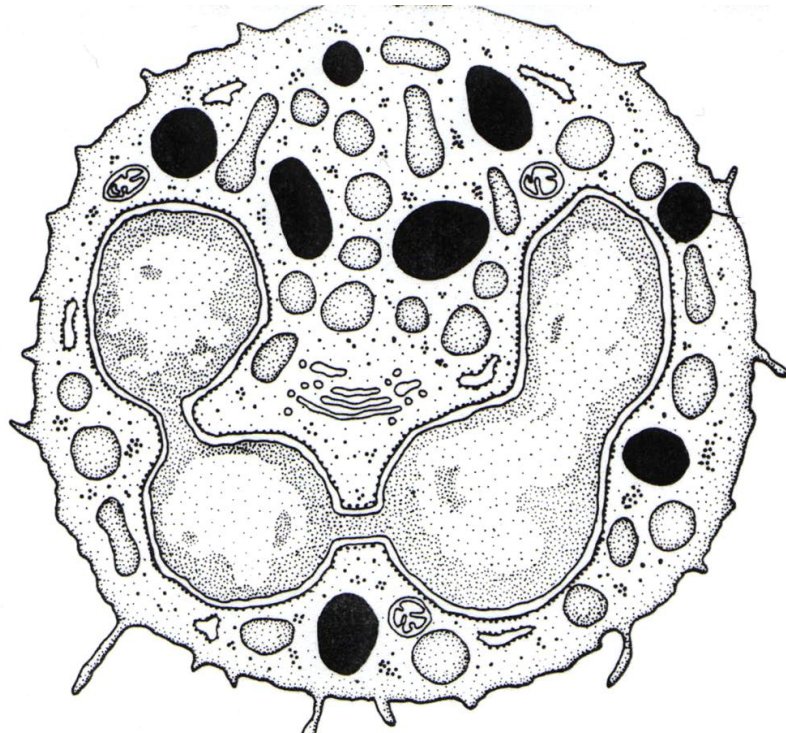


Neutrophils

Polymorphonuclear leukocytes

12 micron diameter

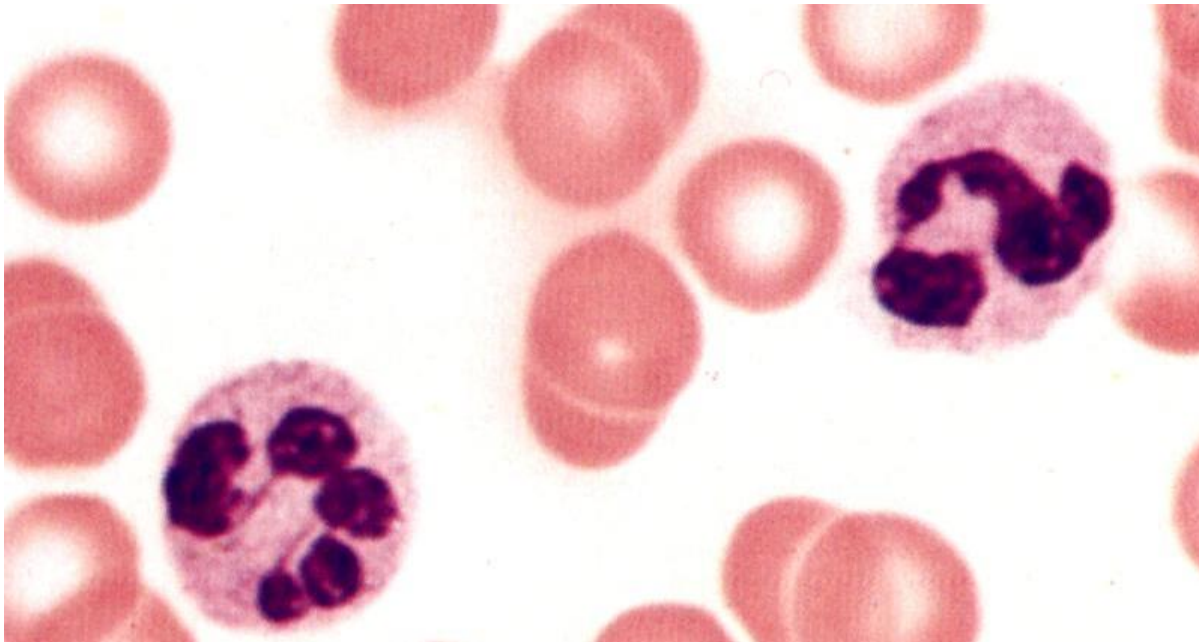
lobulated nucleus, 2 to 5 lobes



Neutrophils

1st line of defense

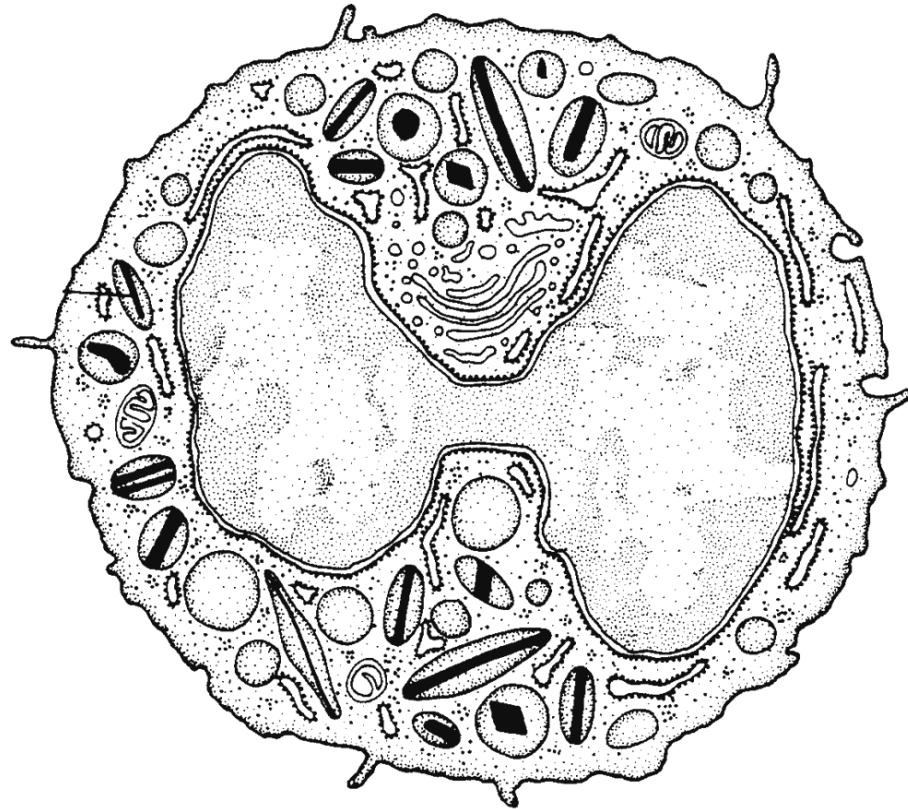
- Granules contain enzyme (lysozyme) which can lyse bacterial cell walls
- Phagocytic: engulf and digest bacteria and small particles
- Chemotactic
- Form pus when die after degranulation



Eosinophils

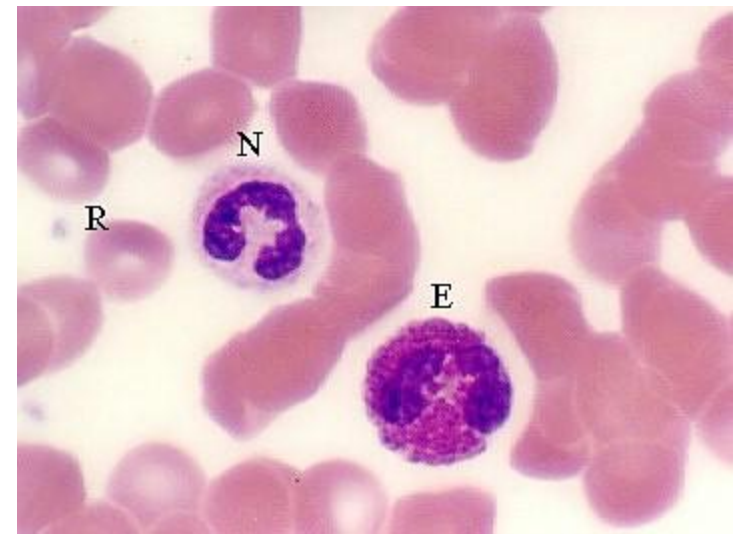
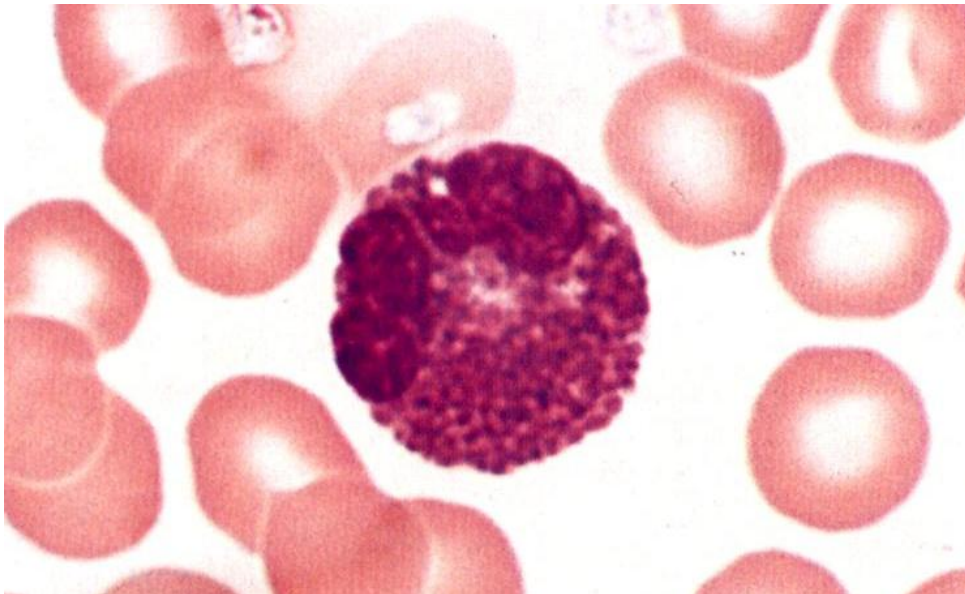
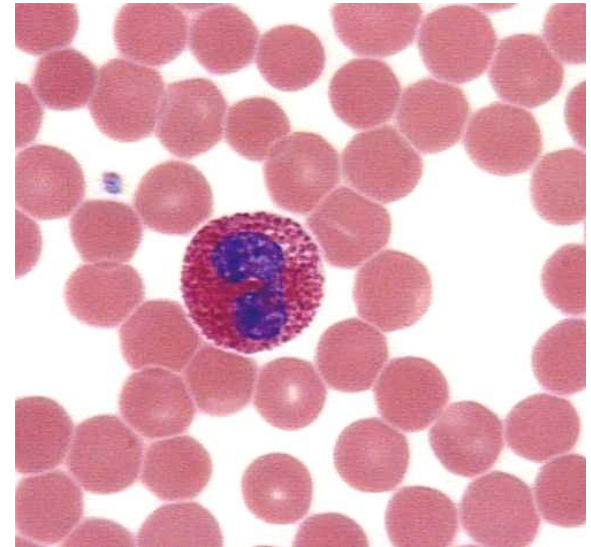
9 micron diameter

Bilobed nucleus



Eosinophils

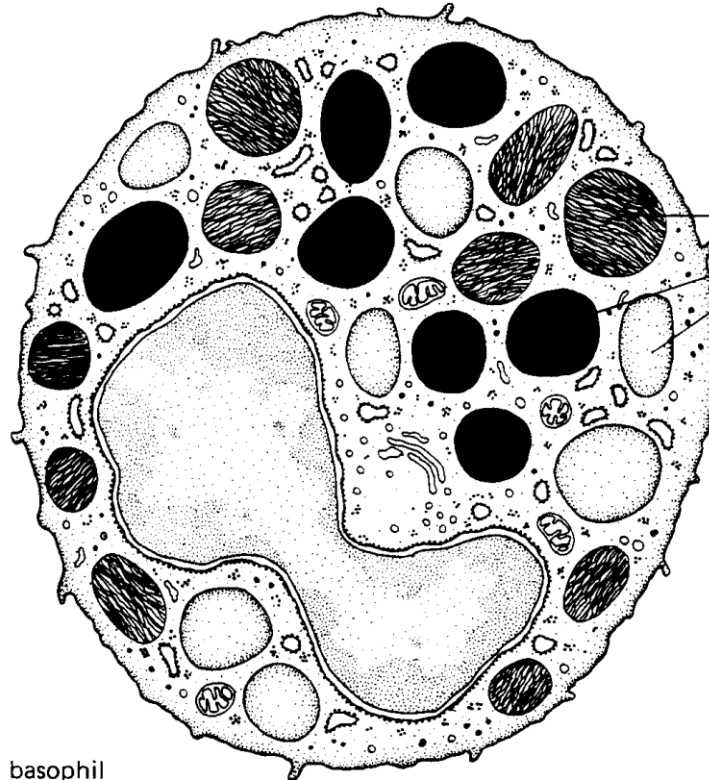
- Granules contain enzyme which kill and destroy parasite infections
- Increased in allergic situations
- Phagocytic against antigen-antibody complexes



Basophils

12 microns

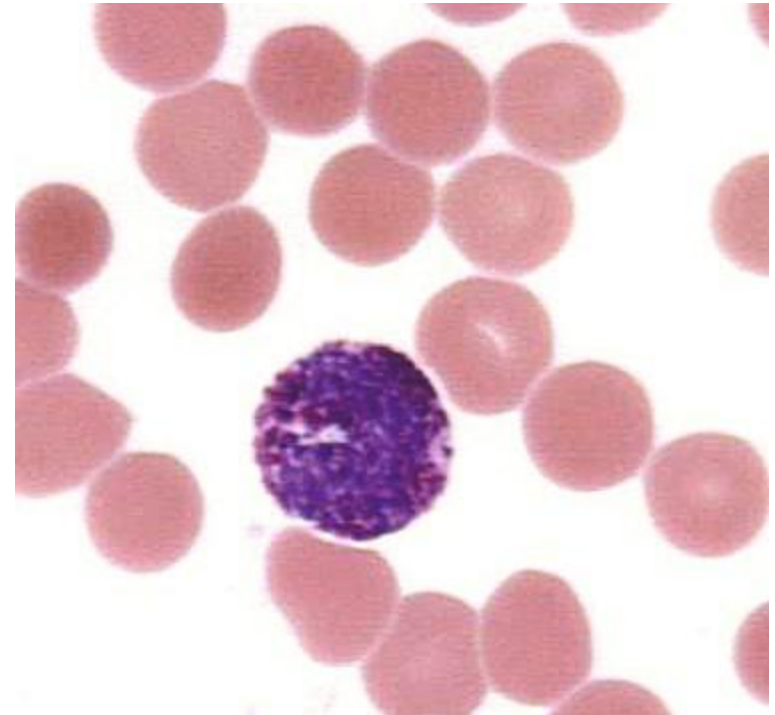
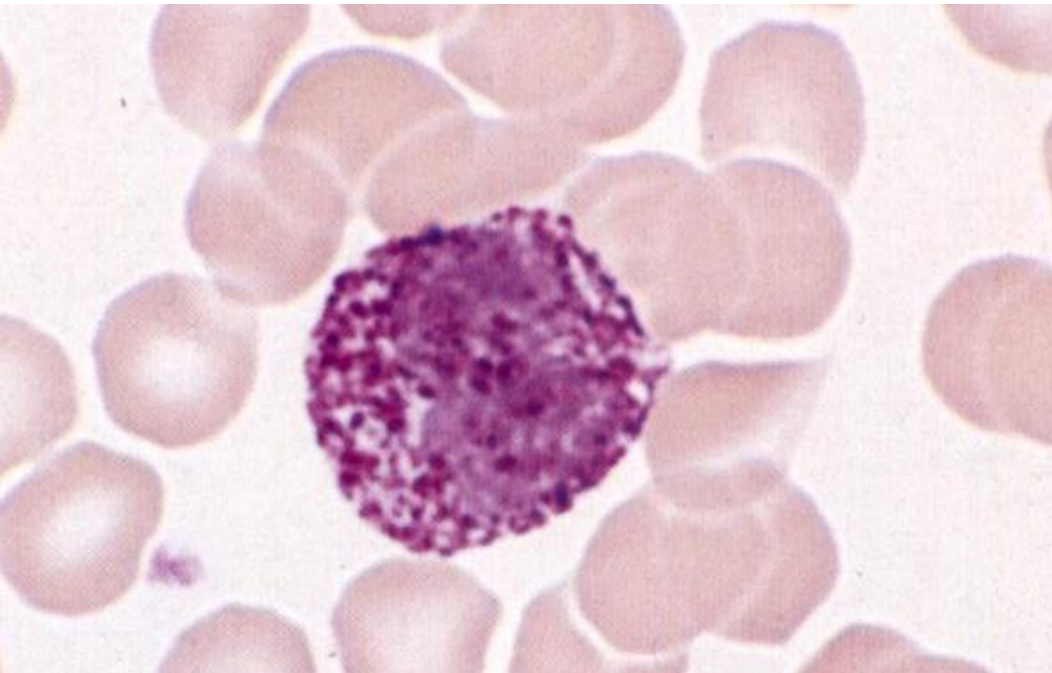
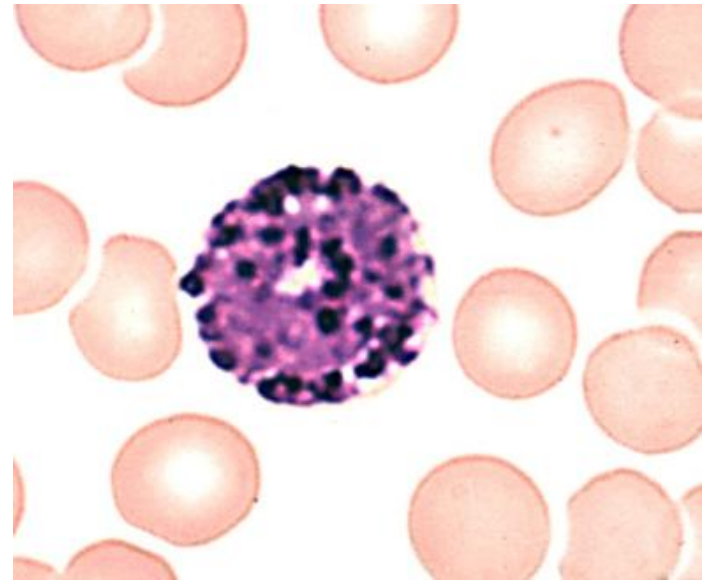
Large irregular nucleus



basophil

Basophils

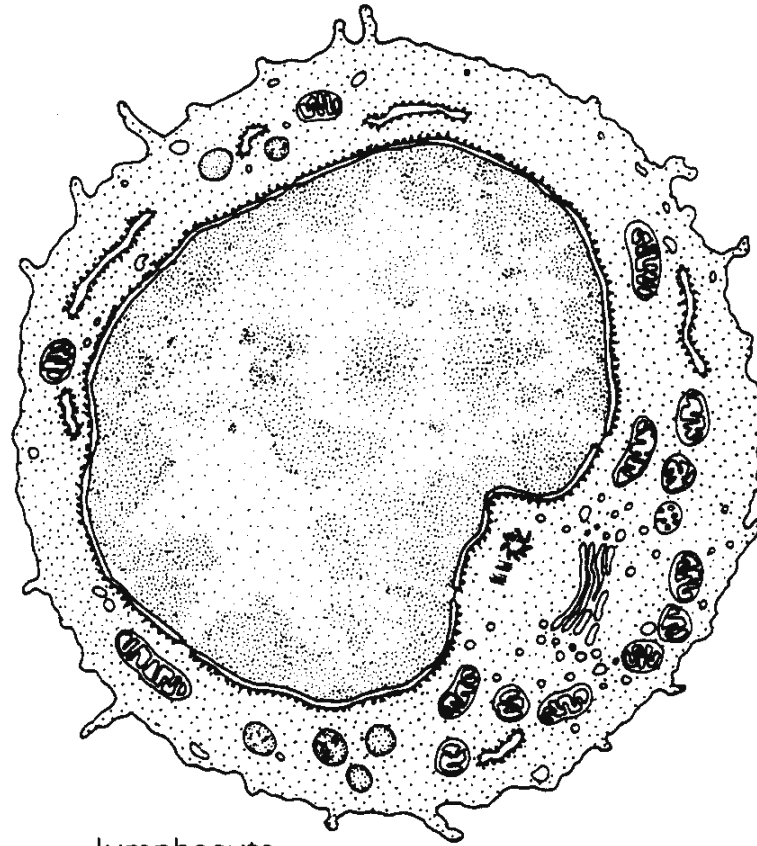
- Granule contain histamine (as do mast cells) which increases capillary leakiness causing edema, facilitating movement of WBCs and proteins to site
- Respond to antigen-antibody complexes
- Chemotactic to other granulocytes



Lymphocytes

6 to 8 micron diameter

Spherical nucleus



Lymphocytes

Immune response

B cells - Differentiate into plasma cells which secrete antibodies

T cells - 80 to 90% circulating lymphocytes

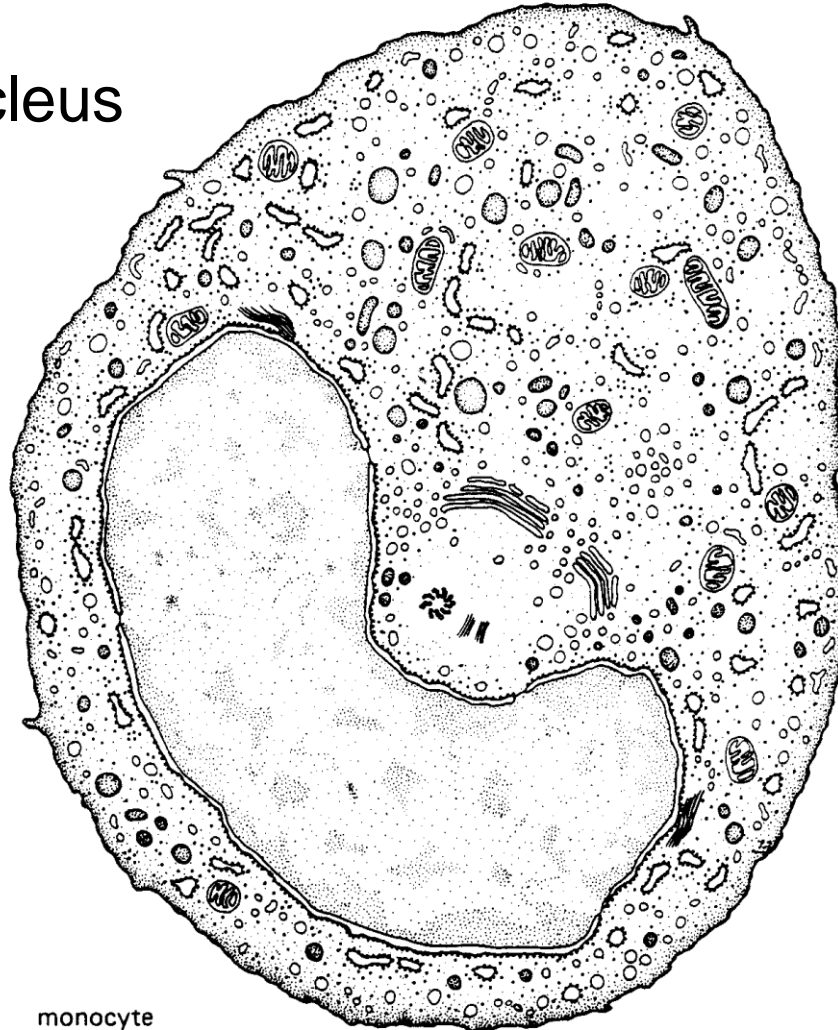
Differentiate into killer cells, directly kill infected or foreign cells; helper cells



Monocytes

9 to 12 microns

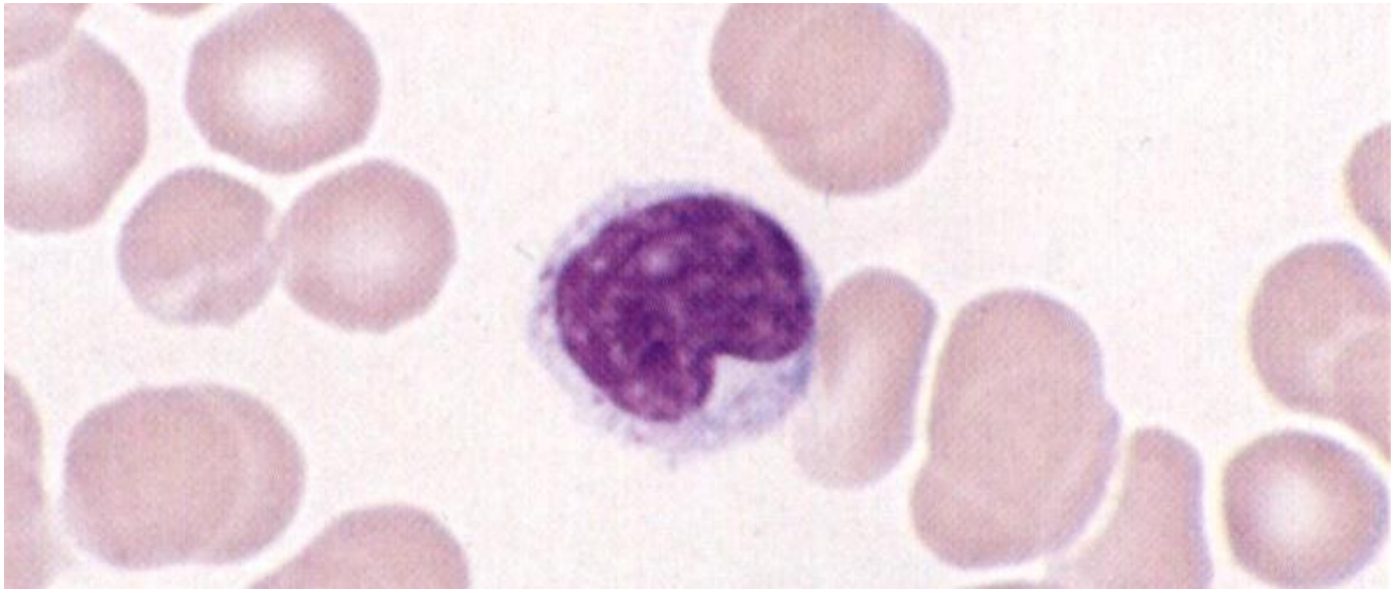
Oval or U-shaped nucleus



monocyte

Monocytes

Differentiate to macrophages in CT

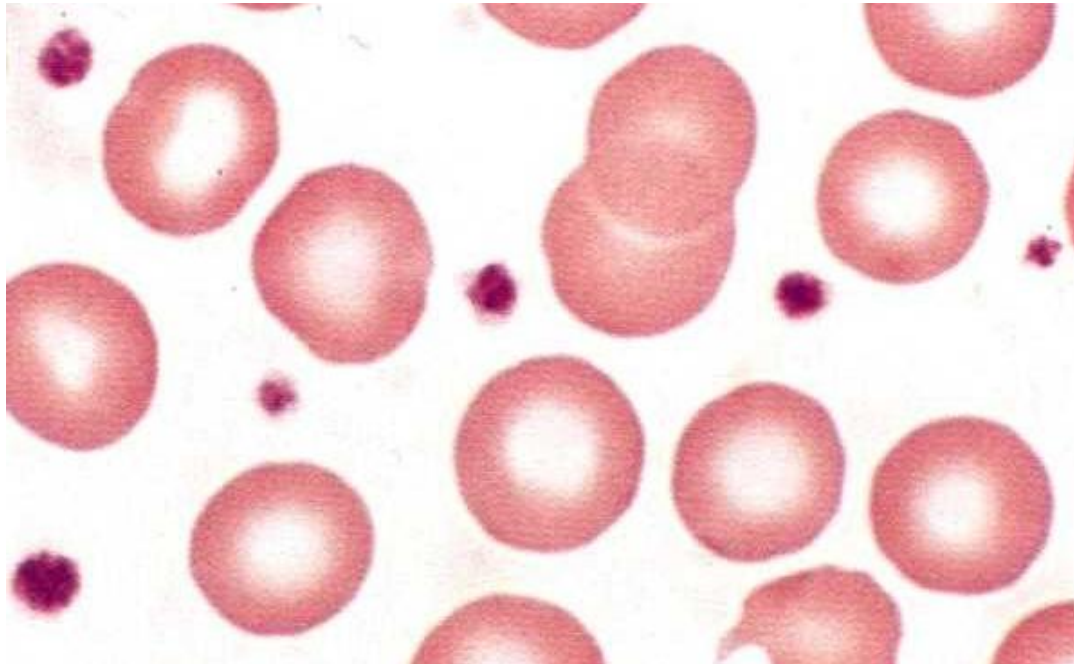


Platelets

= thrombocytes

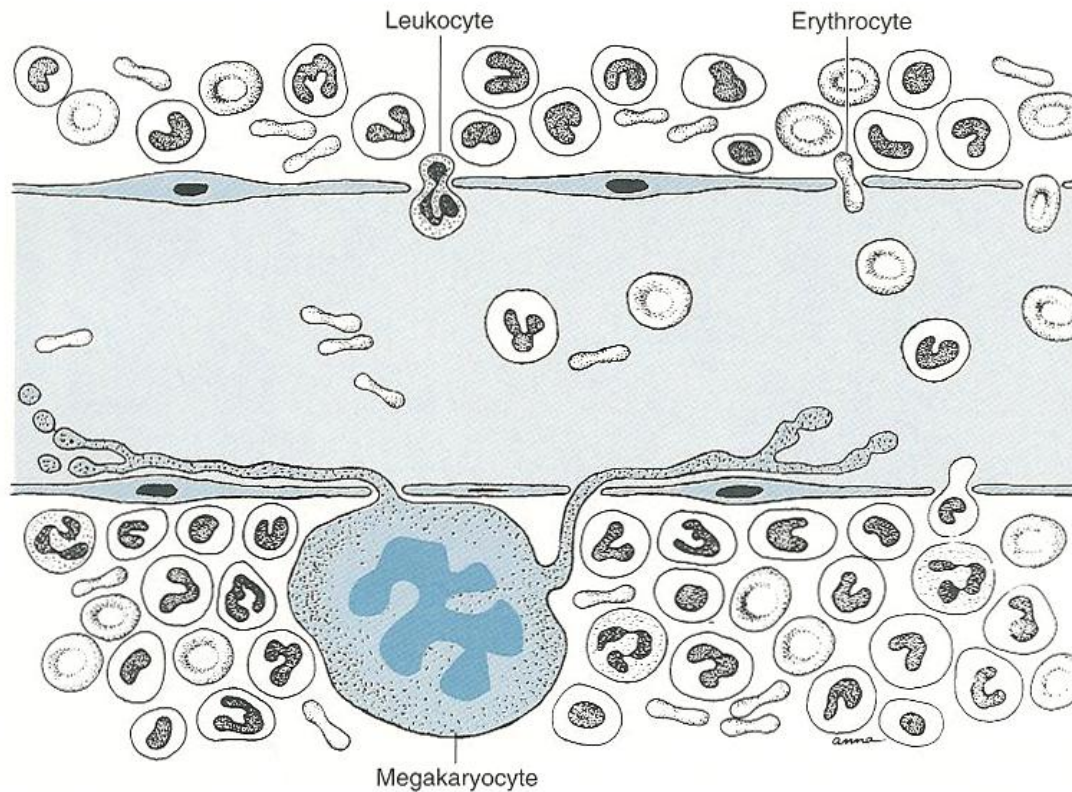
Cell fragments

2 to 5 micron diameter



Platelets

Derived from megakaryocytes, large cells in bone marrow



Platelets

Initiate blood clotting (thrombus)

1. Form plug = agglutination
2. Secrete a clotting factor, thromboplastin, initiating a clot
3. After clot forms, contract to tighten seal

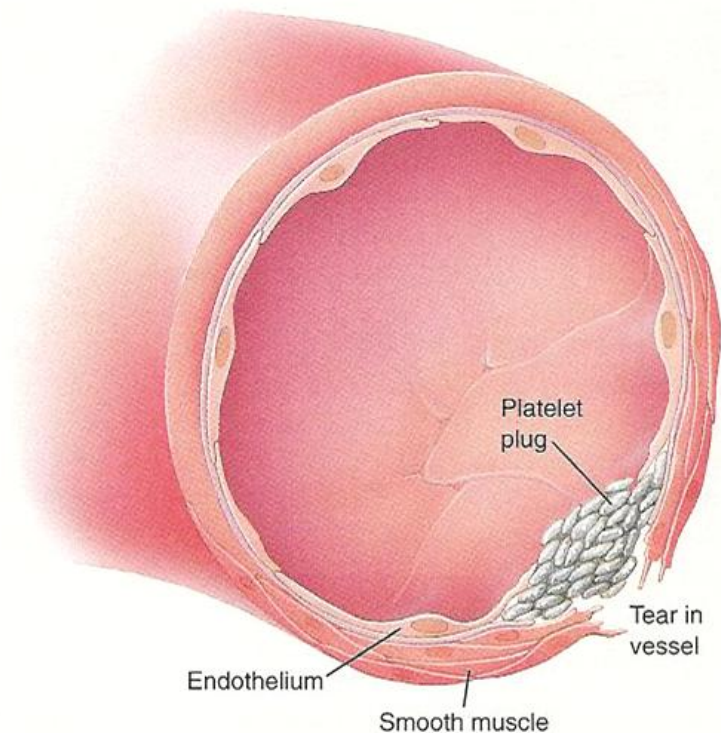









TABLE 18.1

Summary of Formed Elements of the Blood

Cell Type	Illustration	Description*	Number of Cell per mm^3 (μl) of Blood	Duration of Development (D) and Life Span (LS)	Function
ERYTHROCYTES (red blood cells; RBCs)		Biconcave, anucleate disc; salmon-colored; diameter 7–8 μm	4–6 million	D: 5–9 days LS: 100–120 days	Transport oxygen and carbon dioxide
LEUKOCYTES (white blood cells, WBCs)		Spherical, nucleated cells	4800–11,000		
Granulocytes		Nucleus multilobed; inconspicuous cytoplasmic granules; diameter 12–14 μm	3000–7000	D: 7–11 days LS: 6 hours to a few days	Destroy bacteria by phagocytosis
• Neutrophils					
• Eosinophils		Nucleus bilobed; red cytoplasmic granules; diameter 12–15 μm	100–400	D: 7–11 days LS: about 5 days	Turn off allergic responses and kill parasites
• Basophils		Nucleus bilobed; large blue-purple cytoplasmic granules; diameter 10–14 μm	20–50	D: 3–7 days LS: a few hours to a few days	Release histamine and other mediators of inflammation
Agranulocytes		Nucleus spherical or indented; pale blue cytoplasm; diameter 5–17 μm	1500–3000	D: days to weeks LS: hours to years	Mount immune response by direct cell attack (T cells) or via antibodies (B cells)
• Lymphocytes					
• Monocytes		Nucleus U- or kidney-shaped; gray-blue cytoplasm; diameter 14–24 μm	100–700	D: 2–3 days LS: months	Phagocytosis; develop into macrophages in tissues
PLATELETS		Discoid cytoplasmic fragments containing granules; stain deep purple; diameter 2–4 μm	150,000–500,000	D: 4–5 days LS: 5–10 days	Seal small tears in blood vessels; instrumental in blood clotting

*Appearance when stained with Wright's stain.