Vascular System

- System made up of blood vessels and blood.
- Major function is to transport nutrients, gases and hormones to the cells and pick up wastes from cells to transport them to areas of body where they are excreted

Functions Of Blood

- **Transportation** -the blood transports dissolved gases, nutrients, hormones and metabolic wastes.
- **Protection** -the blood restricts fluid losses through damaged vessels. Platelets in the blood and clotting proteins minimize blood loss when a blood vessel is damaged.
- **Regulation**- Blood regulates the pH .

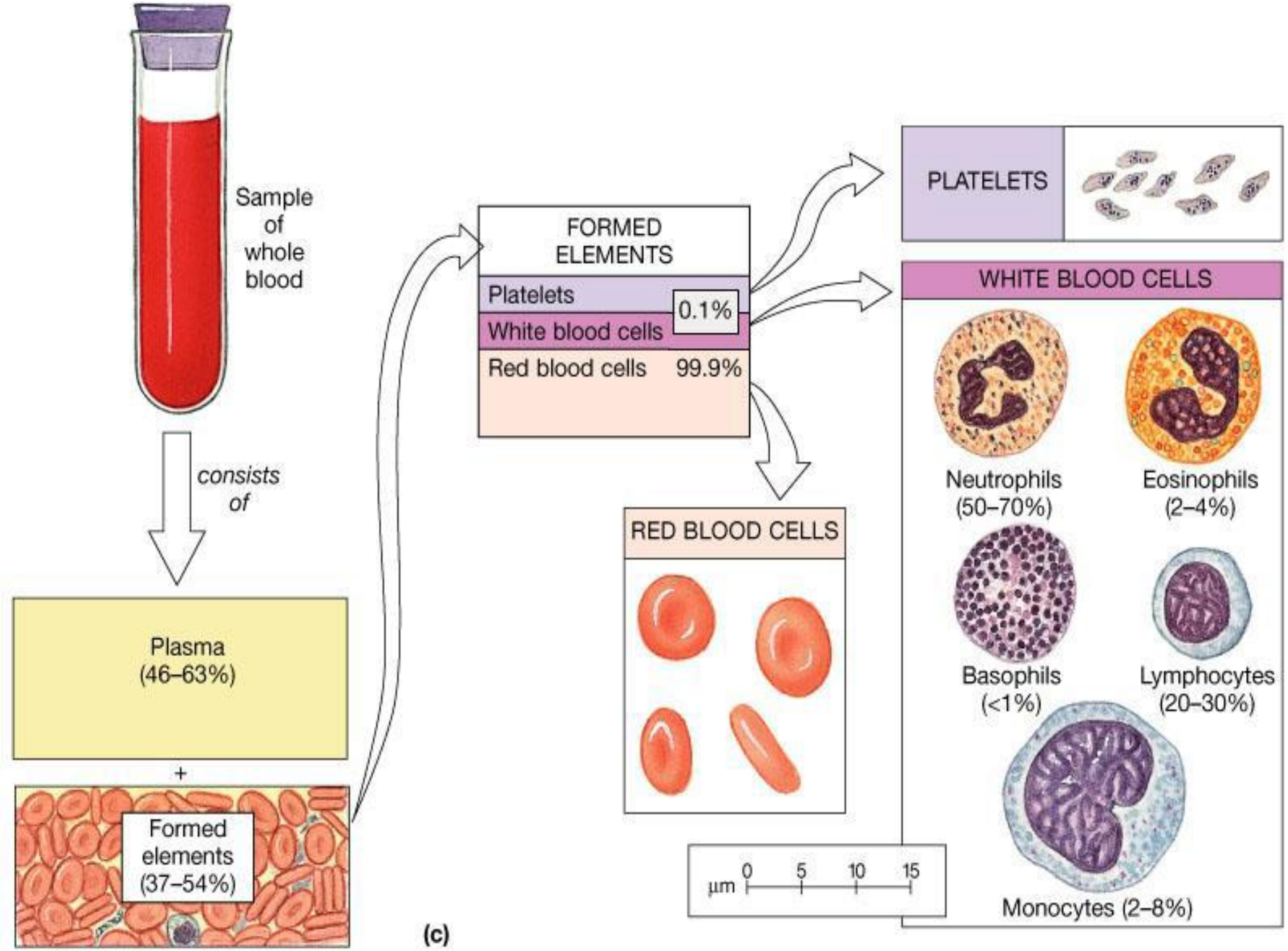
  Blood regulates body temperature.

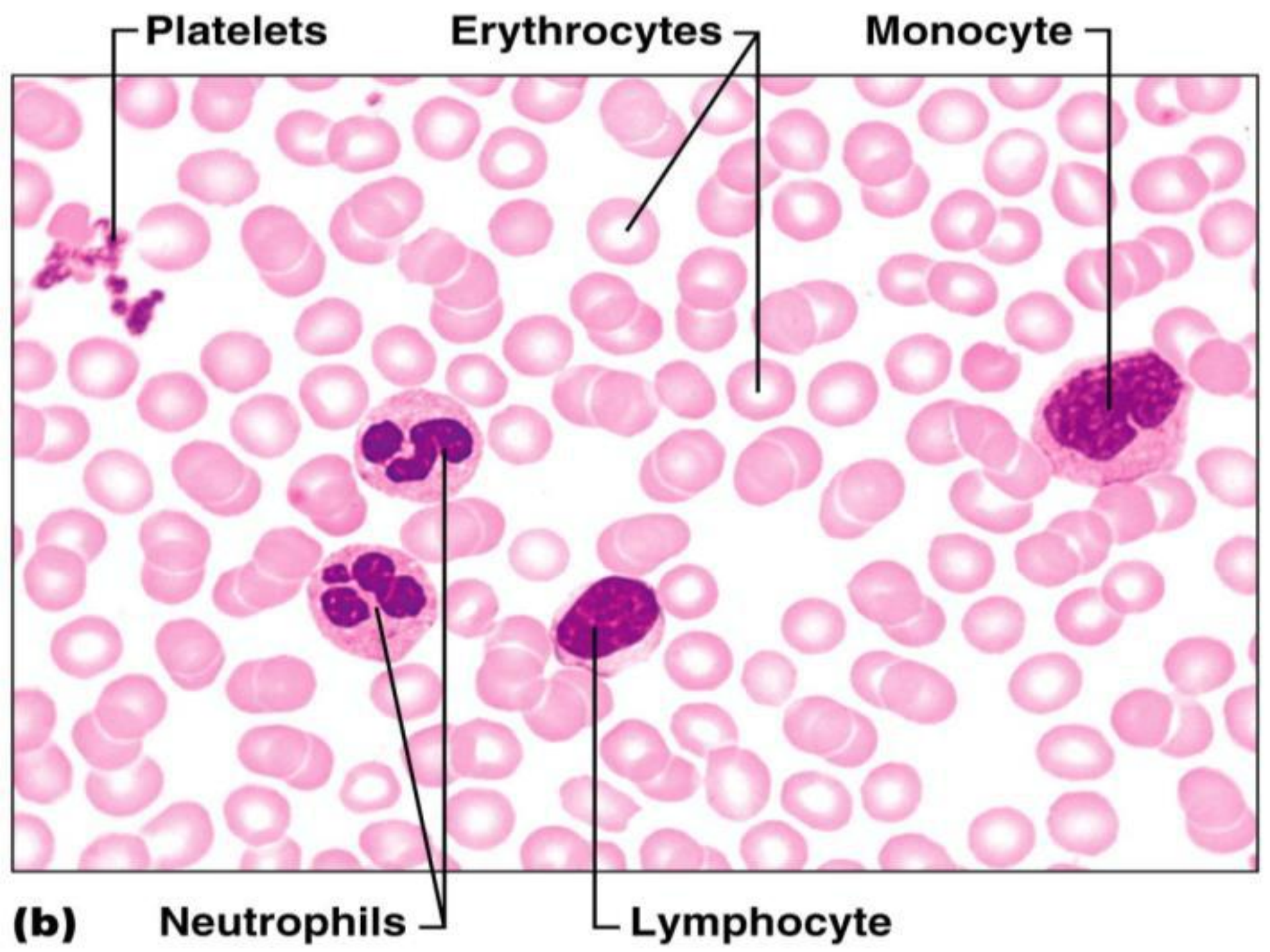
Composition Of Blood

- •Contains cellular and liquid components
- •A specialized connective tissue
  - Blood cells –formed elements
  - Plasma –fluid portion and fibrinogen

Formed Elements

- •Blood cells
  - Erythrocytes, leukocytes, and platelets
- •Blood Plasma
- •Straw-colored, sticky fluid portion of blood
- •Approximately 90% water


Sample of whole blood
consists of
Plasma (46–63%)
+
Formed elements (37–54%)
FORMED ELEMENTS
Platelets
0.1%
White blood cells
Red blood cells
99.9%
PLATELETS
WHITE BLOOD CELLS
Neutrophils (50–70%)
Eosinophils (2–4%)
Basophils (<1%)
Lymphocytes (20–30%)
Monocytes (2–8%)
RED BLOOD CELLS
μm 0 5 10 15
(c)


Platelets
Erythrocytes
Monocyte
(b)
Neutrophils
Lymphocyte

RBC Structure And Function

- Have no organelles or nuclei
- Hemoglobin –oxygen carrying protein

  Each RBC has about 280 million

  hemoglobin molecules

  - Biconcave shape .

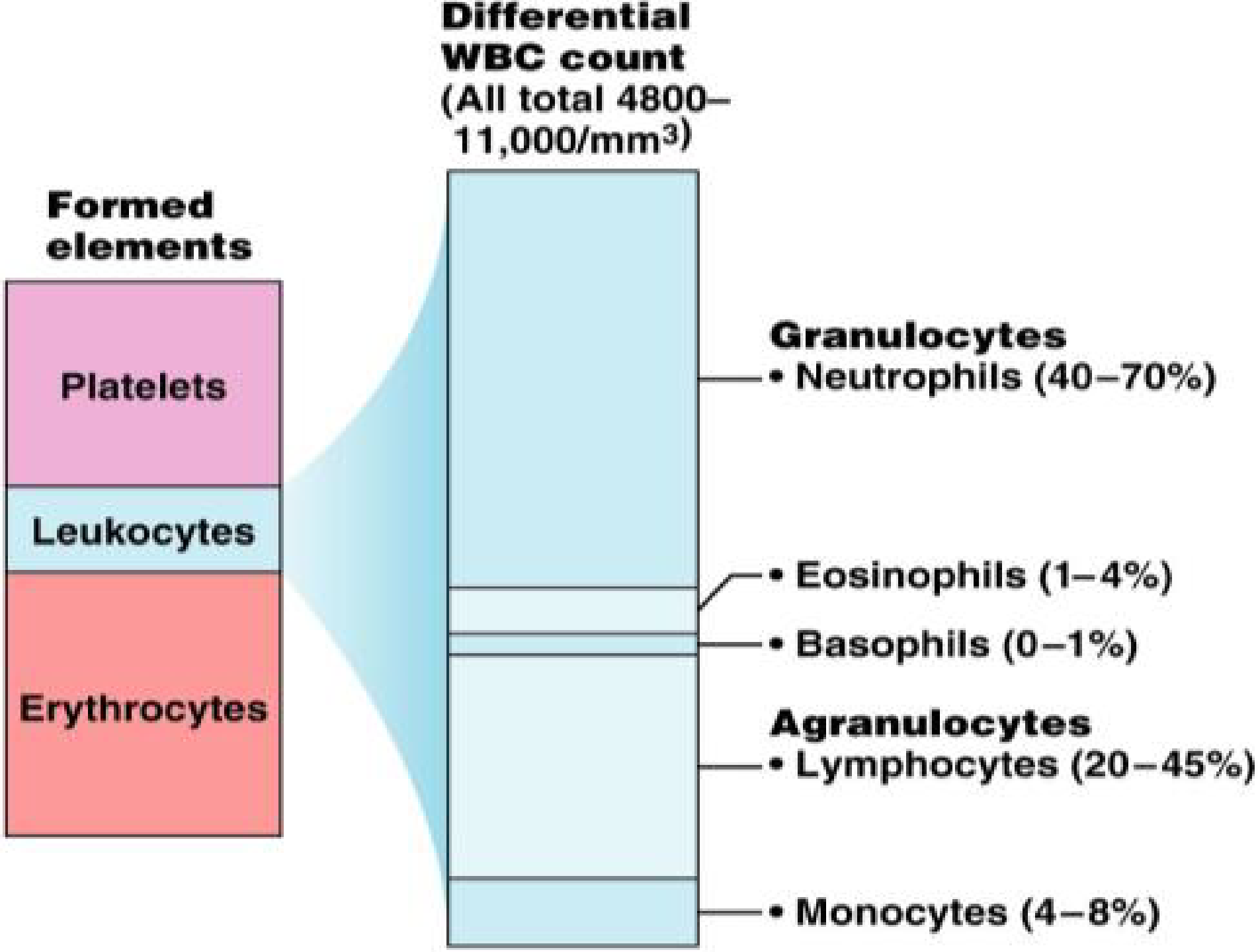
Leukocytes –White Blood Cells (WBCs)

- Protect the body from infectious microorganisms
- 4,800 –11,000/cubic millimeter
- WBCs have a nucleus and are larger than RBCs
- Most produced in bone marrow
- Lifespan of 12 hours to several years

Leukocytes –White Blood Cells (WBCs)

Two types of leukocytes

- Granulocytes
- Agranulocytes


Formed elements
Platelets
Leukocytes
Erythrocytes
Differential WBC count (All total 4800–11,000/mm3)
Granulocytes
• Neutrophils (40–70%)
• Eosinophils (1–4%)
• Basophils (0–1%)
Agranulocytes
• Lymphocytes (20–45%)
• Monocytes (4–8%)

White Blood Cells

Type Of White Blood Cells	% By Volume Of WBC	Description	Function
Neutrophils	60 – 70 %	Nucleus has many interconnected lobes; blue granules	Phagocytize and destory bacteria; most numerous WBC
Eosinophils	2 – 4 %	Nucleus has bilobed nuclei; red or yellow granules containing digestive enzymes	Play a role in ending allergic reactions
Basophils	< 1 %	Bilobed nuclei hidden by large purple granules full of chemical mediators of inflammation	Function in inflammation medication; similar in function to mast cells
Lymphocytes (B Cells and T Cells)	20 – 25 %	Dense, purple staining, round nucleus; little cytoplasm	the most important cells of the immune system; effective in fighting infectious organisms; act against a specific foreign molecule (antigen)
Monocytes	4 – 8 %	Largest leukocyte; kidney shaped nucleus	Transform into macrophages; phagocytic cells

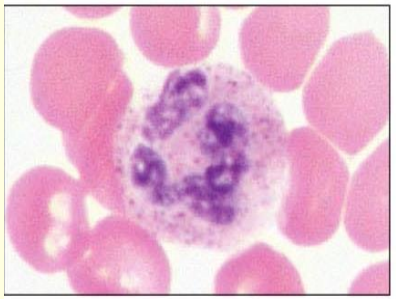
Granulocytes

- Neutrophils –most numerous WBC

  Phagocytize and destroy bacteria

  Nucleus –has two to six lobes

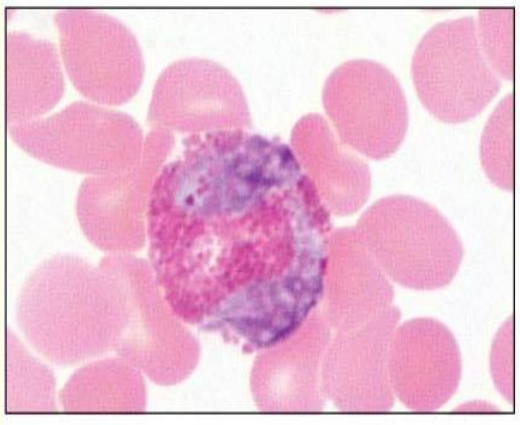
  Granules pick up acidic and basic stains



Granulocytes

Eosinophil- compose 1 –4% of all WBCs

Play roles in ending allergic reactions, parasitic infections



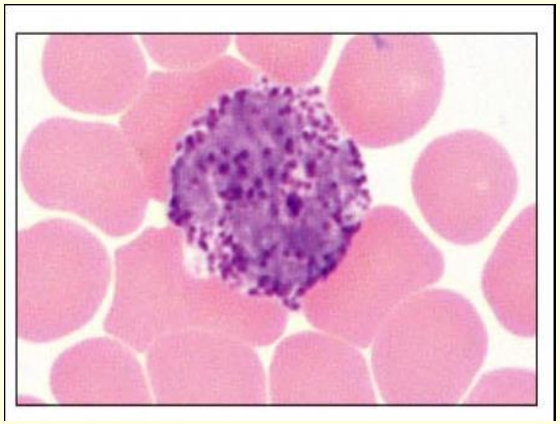
Granulocytes

- Basophils –about 0.5% of all leukocytes

  Nucleus –usually two lobes

  Function in inflammation mediation,

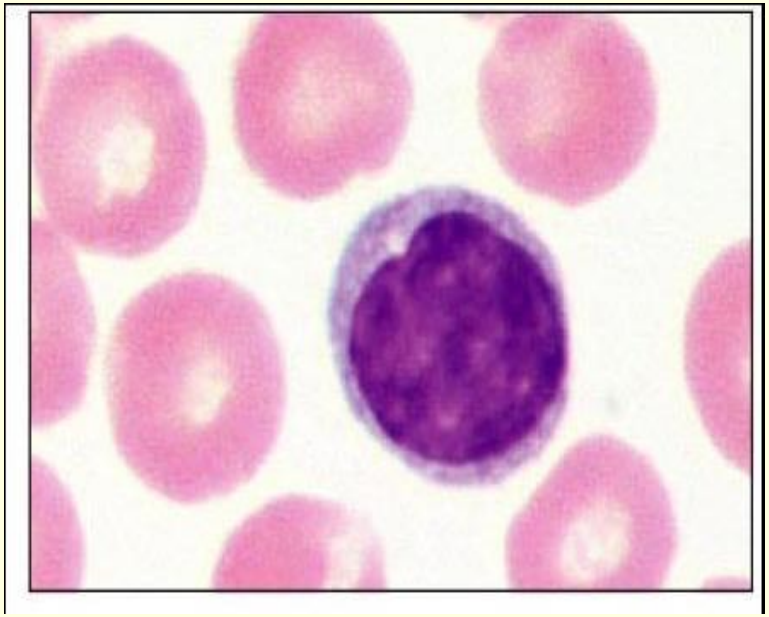
  similar in function to mast cells



Agranulocytes

- Lymphocytes –compose 20 –45% of WBCs
  - The most important cells of the immune system
  - Nucleus –stains dark purple
  - Effective in fighting infectious organisms
  - Act against a specific foreign molecule (antigen)
  - Two main classes of lymphocyte
  - T cells –attack foreign cells directly
  - B cells –multiply to become plasma cells that secrete antibodies

Lymphocytes



Agranulocytes

- Monocytes –compose 4–8% of WBCs
- The largest leukocytes
- Nucleus –kidney shaped
- Transform into macrophages

  Phagocytic cells

Platelets

- Structure

  Small cellular fragments; originate in bone marrow from giant cell megakaryocyte

  Contain several clotting factors –calcium ions, ADP, serotonin

- Function

  Involved in stopping bleeding when a blood vessel is damaged; Process is called hemostasis

TABLE

17.1 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					
• Neutrophils		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
• 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					
• Lymphocytes		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)
• 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.