Class 1:

Blood Physiology

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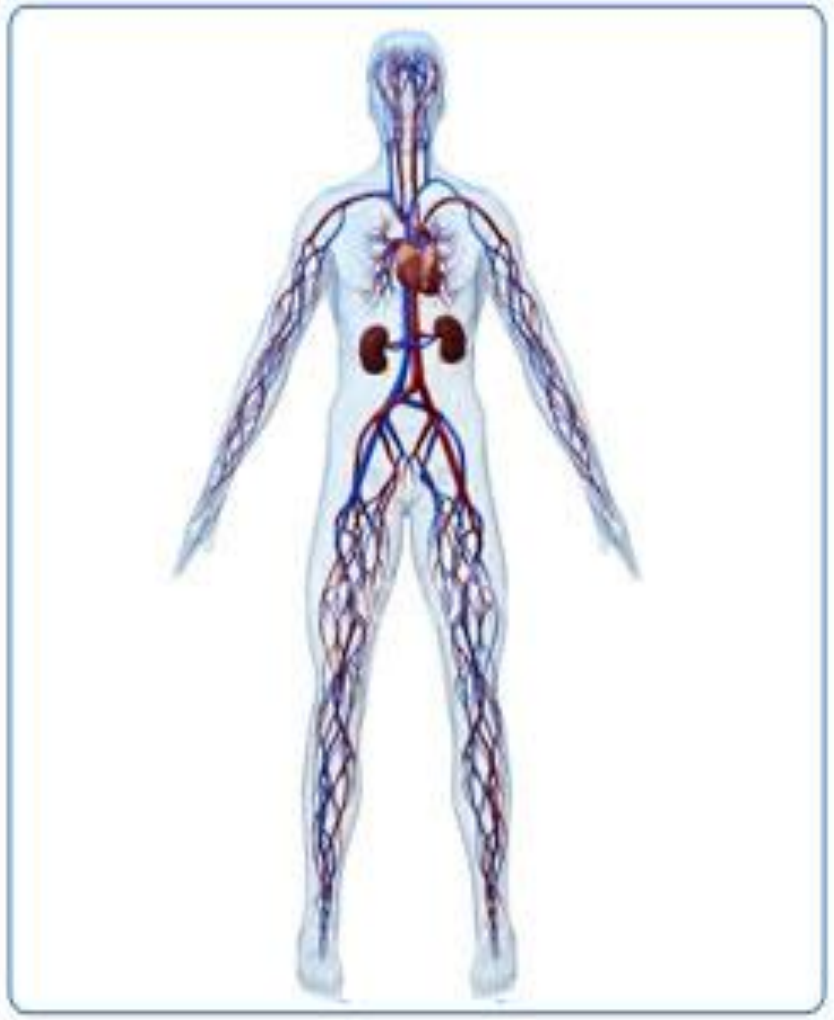
Objectives for this lecture

- Discuss the physical properties, function of blood.
- Identify the different types of the blood components.

Cardiovascular System

- circulating transport system:
  - a pump *(heart)*
  - a conducting system *(blood vessels)*
  - a fluid medium *(blood)*



Function of blood

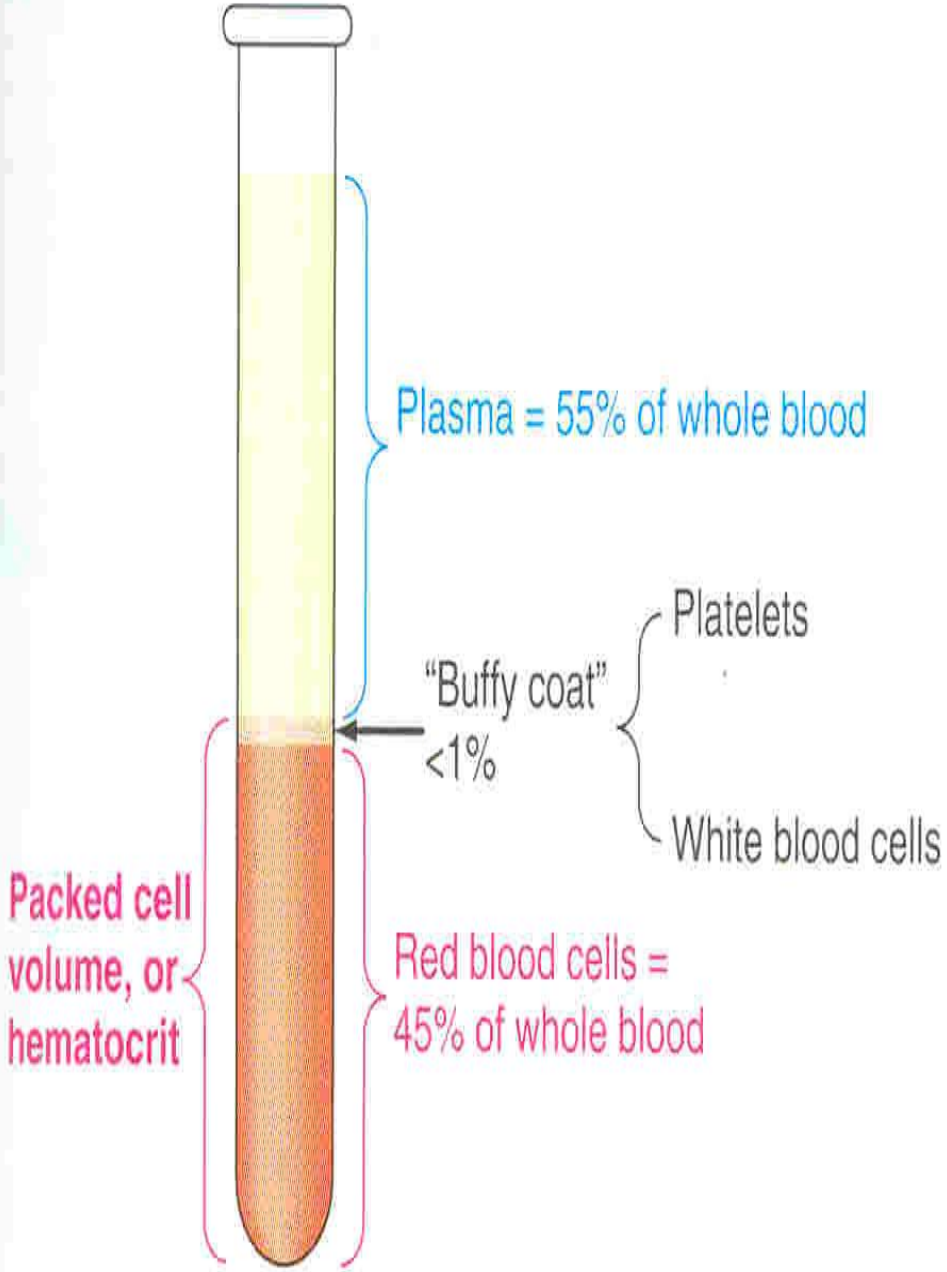
- Transport of gases (O_2 & CO_2)
- Transport of nutrients
- Transport of metabolic waste to kidney, lung, skin, intestine
- Transporting hormones

Function of blood……. Cont.

- Stopping bleeding from vessel injury by coagulation
- Defense of the body against infection
- Acid-base balance in the body
- Stabilization of body temperature

General Characteristics of Blood

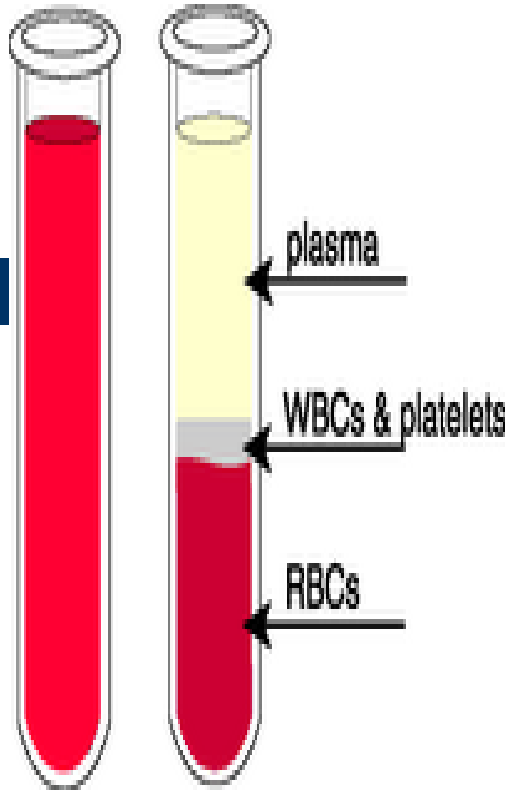
- 38°C (100.4°F) is normal temperature
- High viscosity
- Slightly alkaline pH (7.35–7.45)



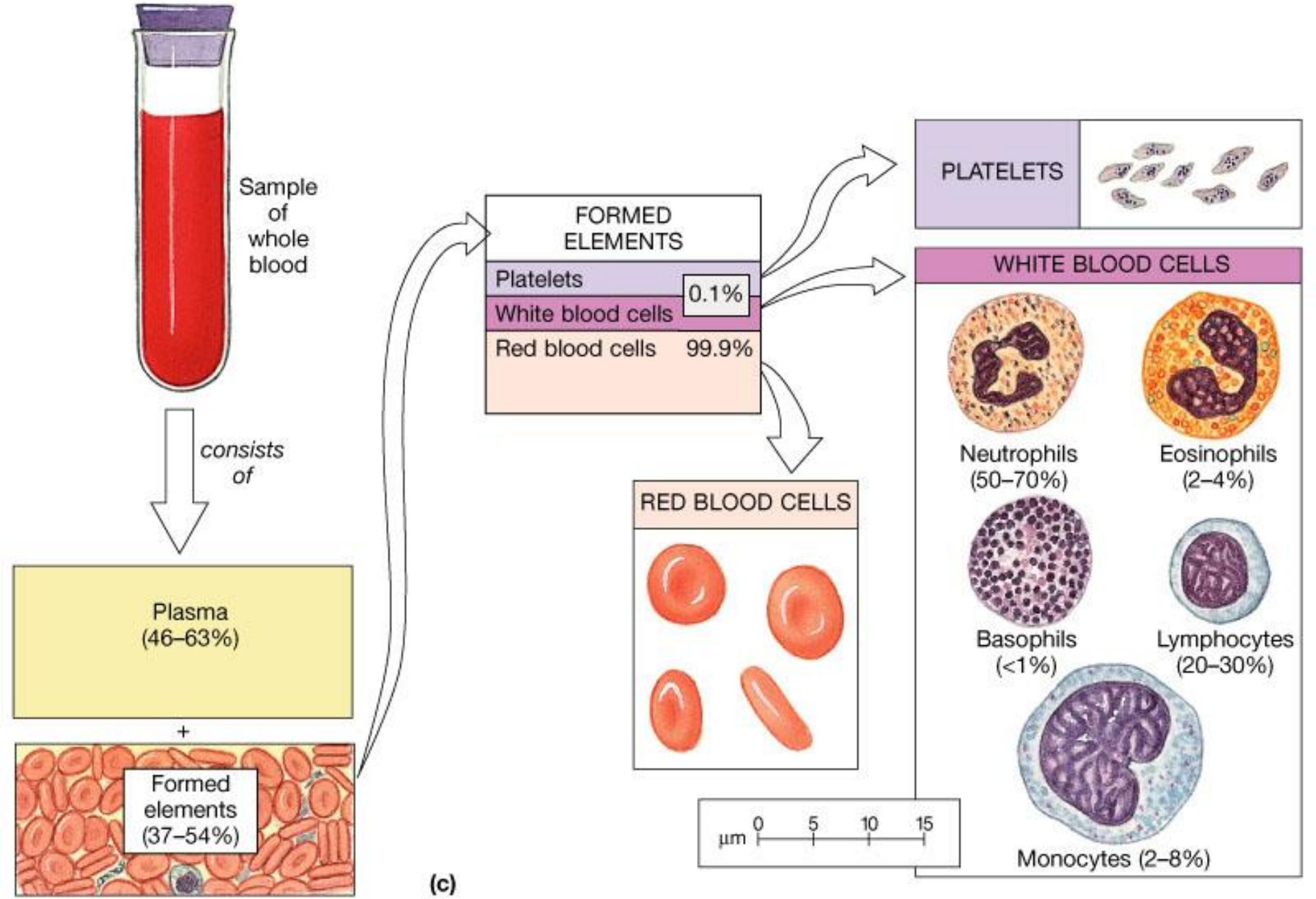
Blood Volume

- ✓ Blood makes up 6–8% of our total body weight.
- ✓ Normal adult volume is 5 L.
- ✓ Contains cells suspended in liquid called plasma.

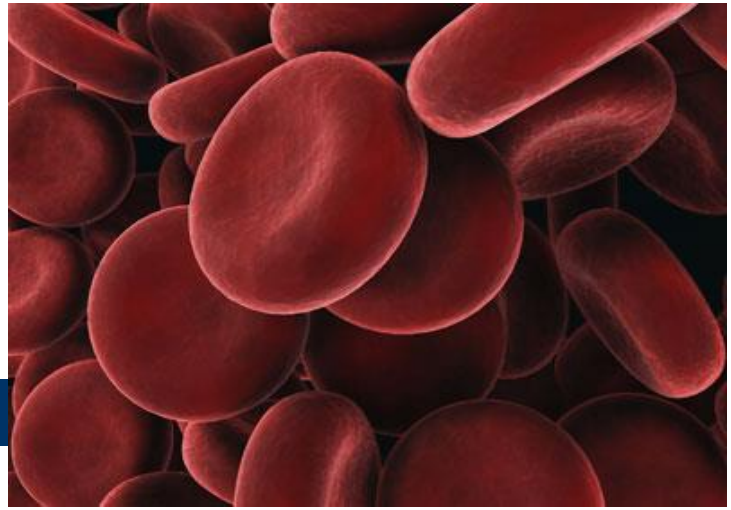
BLOOD COMPOSITION



1. ***Cellular components***
   - ✓Red Blood Cells **(Erythrocytes)**
   - ✓White Blood Cells **(Leucocytes)**
   - ✓Platelets **(Thrombocytes)**
2. ***Plasma***
   - ✓98% water, electrolytes, plasma proteins *(Albumin, globulin, Fibrinogen)*
   - ✓Same ionic composition as interstitial fluid



Red Blood Cells



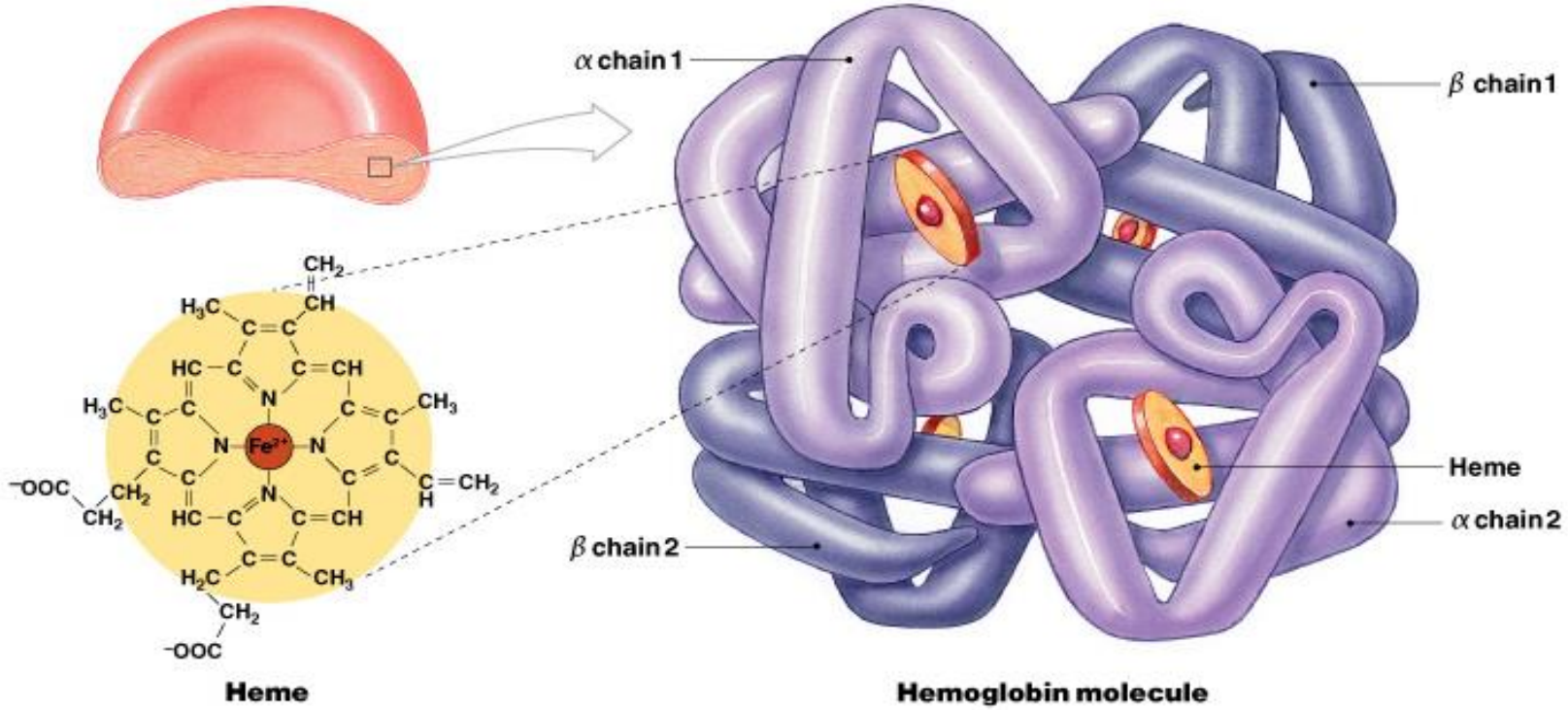
- Erythrocytes or RBCs.
- Most abundant cell in the blood
  (4 million – 6 million per microliter of blood).
- Formed in the bone marrow.
- Life span of about 120 days.
- Mature forms do NOT have a nucleus, mitochondria, and ribosomes.

Red Blood Cells

- Hemoglobin (iron protein) is found in the RBC.
- Hemoglobin carries oxygen from the lungs to the rest of the body and carbon dioxide binds to the RBC and is taken to the lungs to be exhaled.
- Hemoglobin made of 4 globular protein:
  - each with 1 molecule of *heme*
  - each heme contains 1 *iron ion*

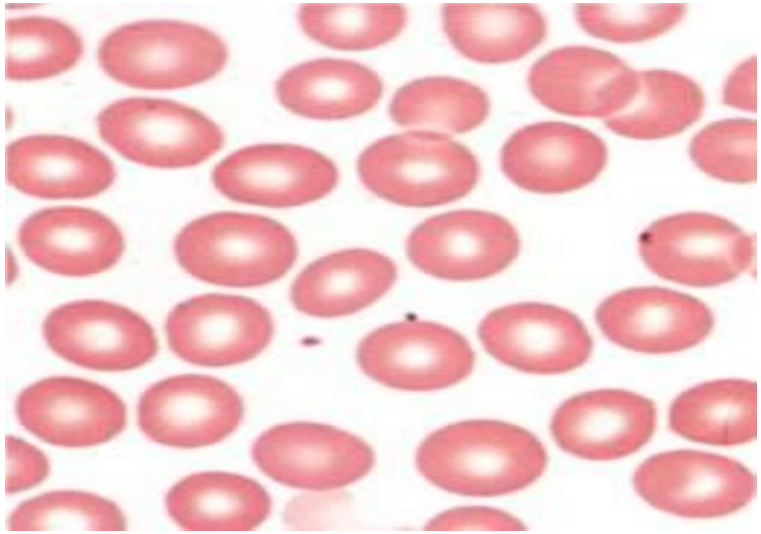
Red Blood Cells

- Hemoglobin complex quaternary structure



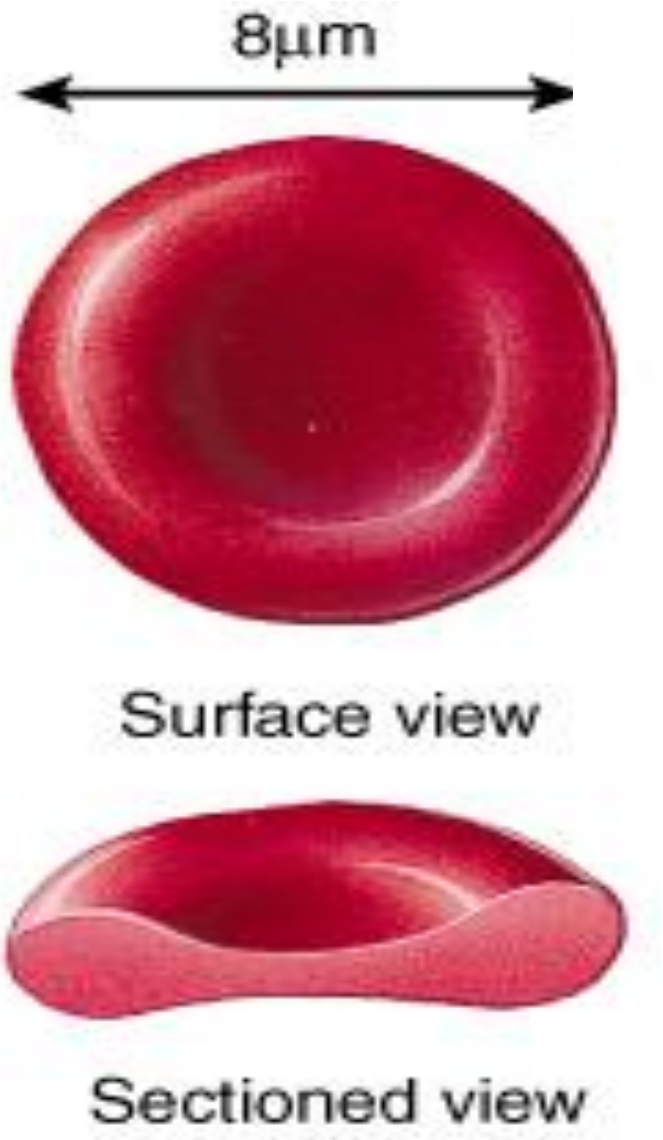
Red Blood Cells

- Hemoglobin Iron ions easily:
  - associate with oxygen *(oxyhemoglobin)*
  - or dissociate from oxygen *(deoxyhemoglobin)*



Red Blood Cells

- Thin in middle and thicker at edge.
- Discs bend and flex entering small capillaries
  - *7.8 µm RBC passes through 4 µm capillary*

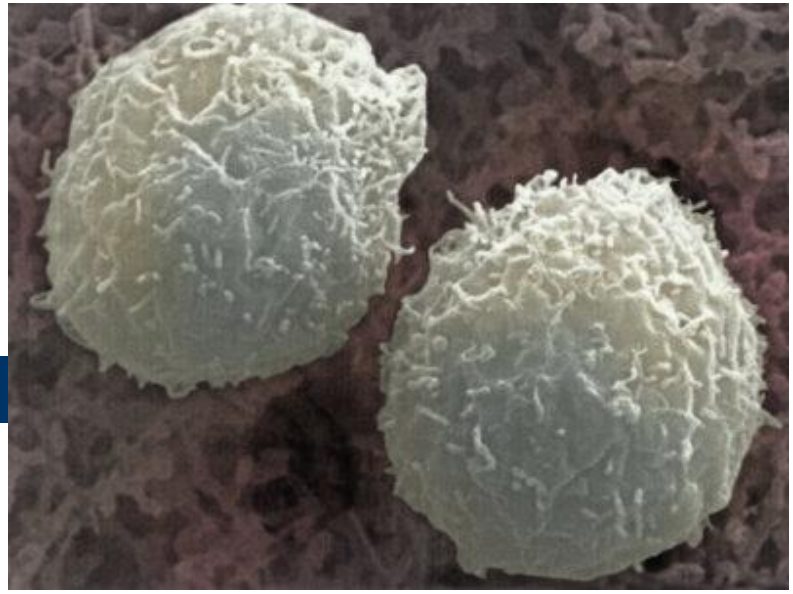


White Blood Cells

- Leukocytes or WBCs
- Largest sized blood cells
- Lowest numbers in the blood

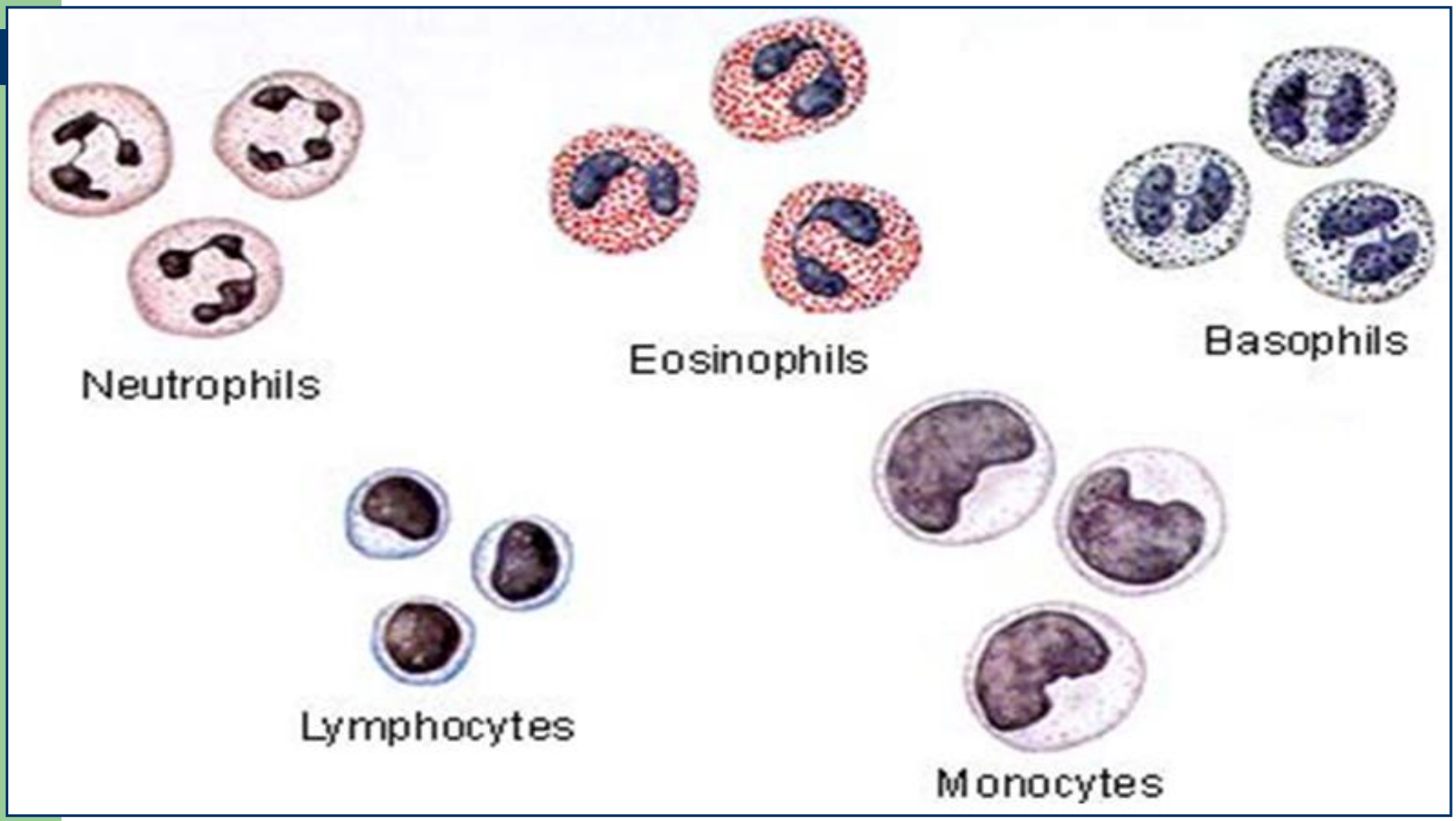
  (4,500 – 11,000 per microliter of blood)
- Formed in bone marrow and some in lymph glands
- Life span is from 24 hours to several years
- Primary cells of the immune system
- Certain WBCs produce antibodies

White Blood Cells



- Most WBCs in:
  - connective tissue proper
  - lymphatic system organs
- Small numbers in blood.
- Migrate out of bloodstream
- Have amoeboid movement
- Some are phagocytic:
  - neutrophils, eosinophils, and monocytes
- Nuclei shape depends on type of cell *(5 types).*

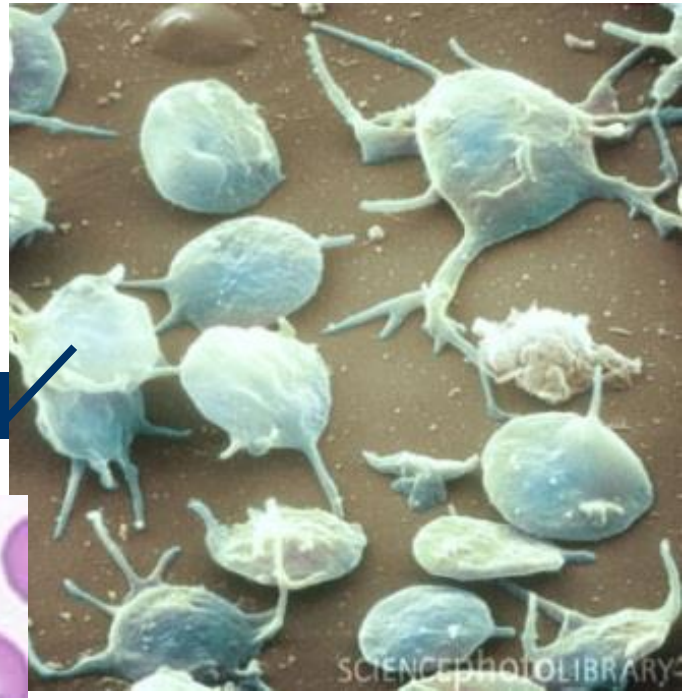
White Blood Cells

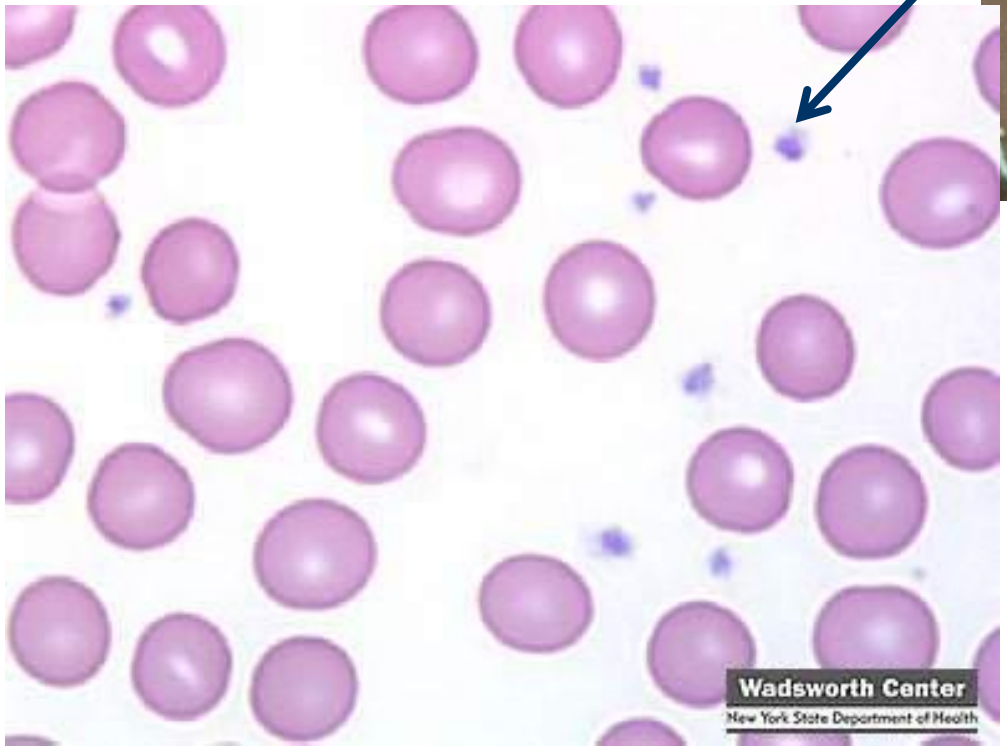


Platelets

- Thrombocytes or PLTs
- Smallest of the blood cells
  (150,000 – 400,000 per microliter of blood)
- Formed in the bone marrow
- Life span of around 8-12 days
- Involved in the clotting process (haemostasis)
- Shape can be round, oval, or appear spiky

Platelets


SCIENCEphotoLIBRARY


Wadsworth Center
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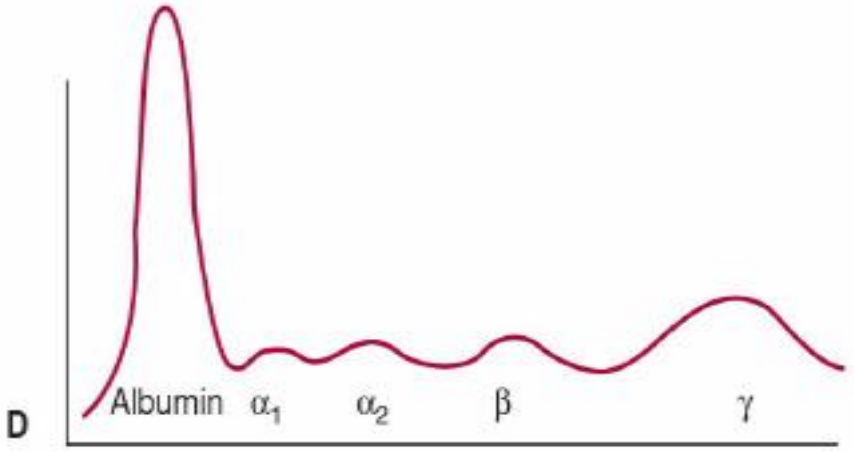
Blood PLASMA



- three groups, *fibrinogen*, *albumin*, and *globulins*, on the basis solubility.
- rich in disulfide bonds.
- contain bound : - carbohydrate *(glycoproteins)*
  - or lipid *(lipoproteins).*
- Synthesized in: - 70% in Liver (Albu. 12 g/day),
  - vascular endothelium,
  - lymphocytes.

Blood PLASMA…… cont.

- half-lives in healthy adults: - albumin 20 days
  - haptoglobin 5 days.
- albumin transport: fatty acids, Ca++, certain steroid hormones, bilirubin, Cu, tryptophan, and a variety of drugs.
- ferroportin plays role in *iron* absorption by the intestine and iron secretion from macrophages.
- Plasma proteins play a role in the body's response to *inflammation*.

References

- Victor A Hoffbrand, Paul Moss, J Pettit; Essential Haematology (Essentials Series Blackwell Science, New York; 2008.