HAEMATOLOGY

Objectives

At the end of this lecture student should be able to:

1. Recognize functions of blood
2. Describe Cellular and non-cellular components of blood
3. Define Erythropoiesis; leukopoiesis, and thrombopoiesis.
4. Describe features of RBCs, WBCs, and Platelets.

What is Blood?

- Blood is a fluid connective tissue found within the cardiovascular system
- accounts for about 8% of TBW
- Its volume is 5-6 L in males and 4-5 L in females
- Much more dense than pure water
- It is slightly alkaline, with a pH of 7.35- 7.45
- Its color varies from bright to dark red
- It has a salty metallic taste

General Function of the Blood

1- Transportation:

A) Gases: O_2 , CO_2 , …..

B) Nutrient and metabolic Wastes: Glucose, amino acids, ….

C) Hormones and Enzymes

D) Antibodies

E) Electrolytes and Ions

General Function of the Blood Cont.

2- Regulation:

A) Temperature regulation

B) pH regulation: By buffering systems found in the blood that maintain the pH between 7.35 to 7.45

C) Electrolytes regulation (Na, K, Cl,…..)

D) Blood pressure regulation: by increasing or decreasing blood flow to the kidneys

General Function of the Blood Cont.

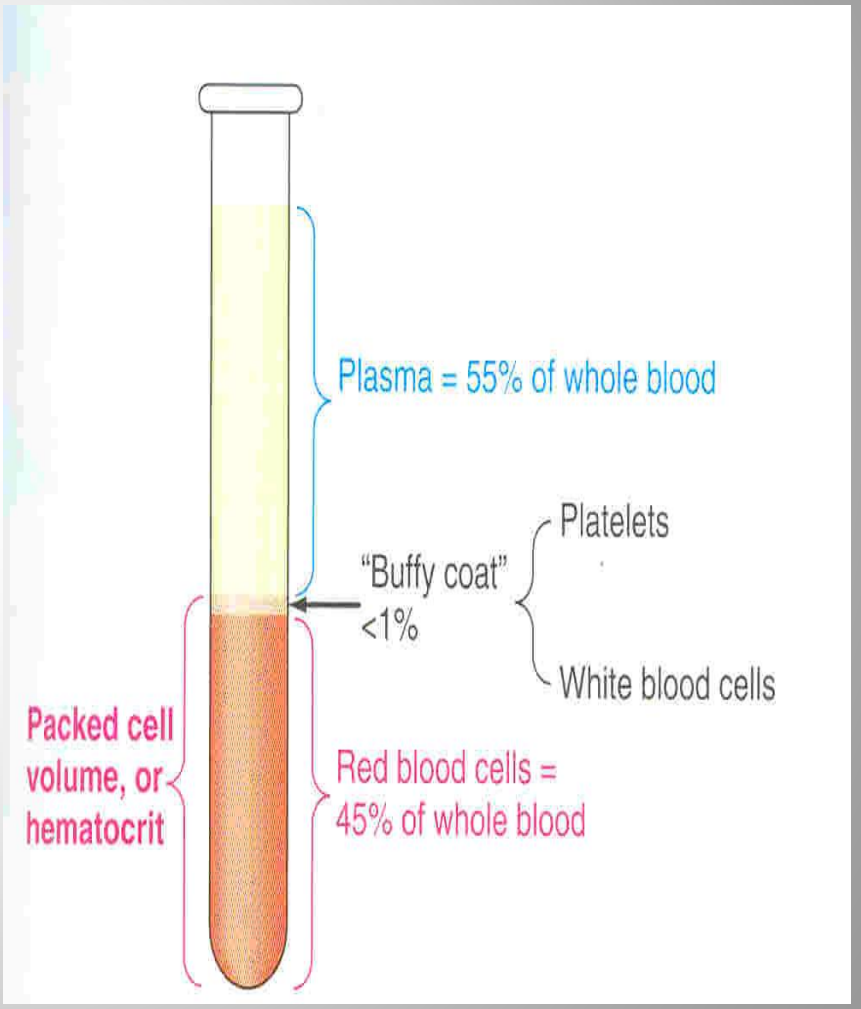
3- Protection:

A) Defense mechanism: By white blood cells

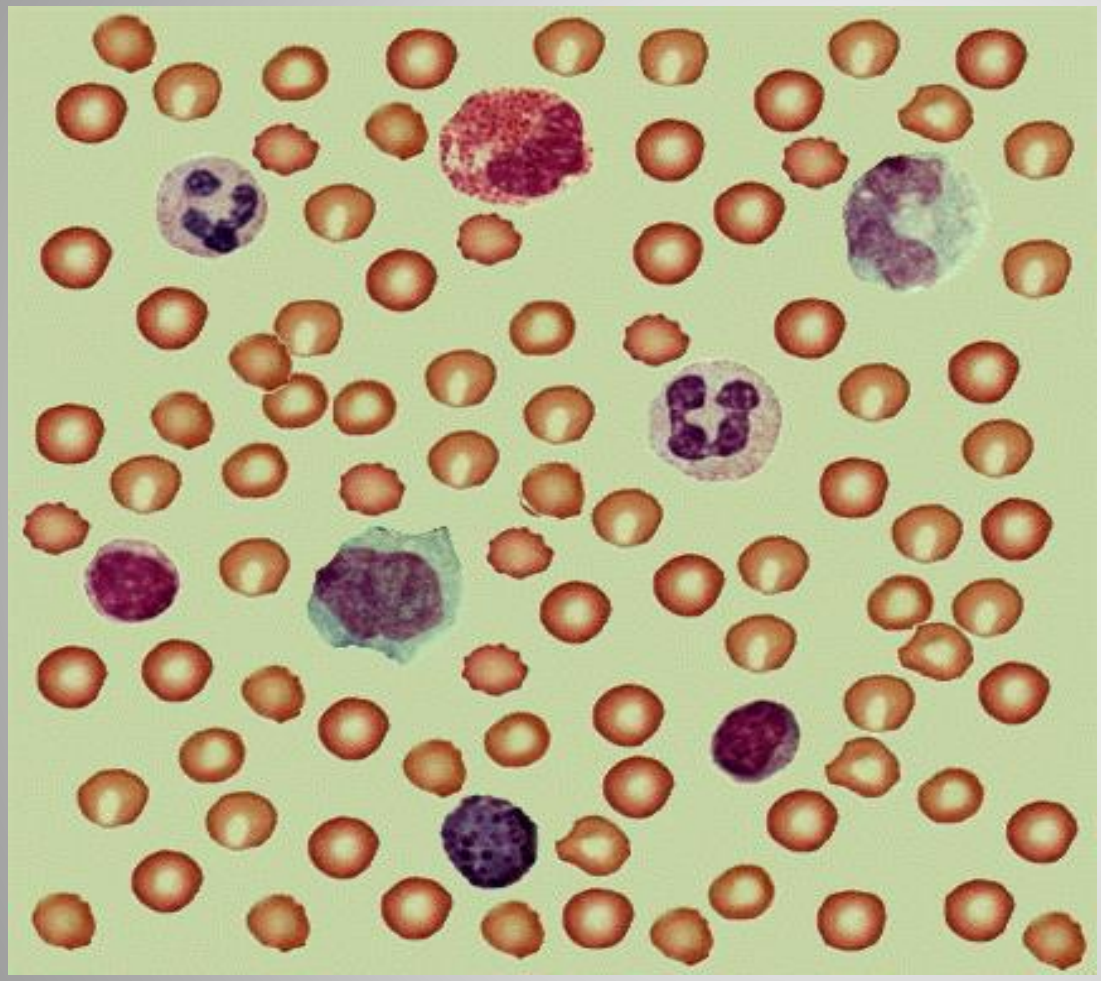
B) Clotting mechanism: Blood contains materials that stop bleeding when vessels are damaged (Hemostasis)

Composition of blood

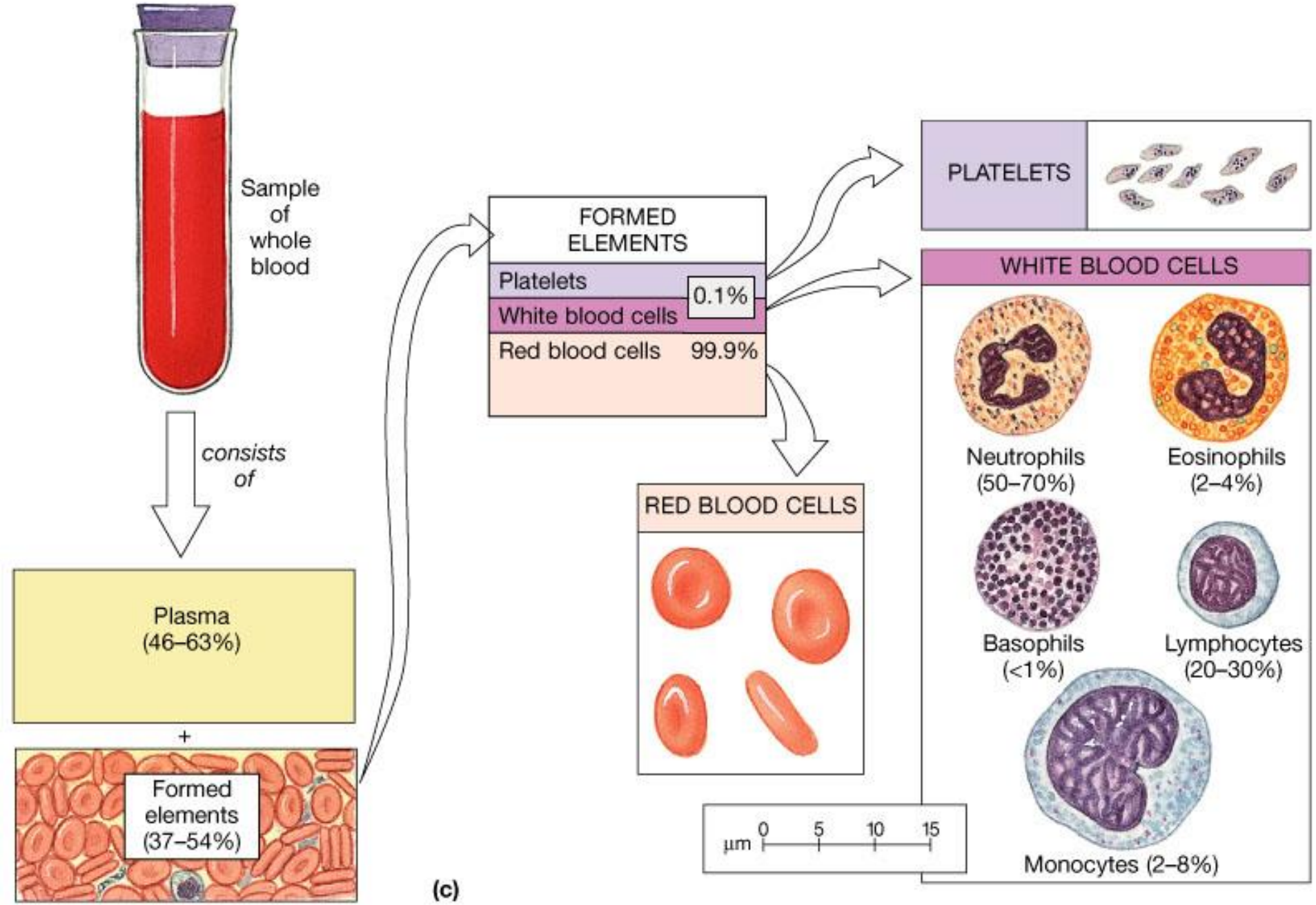
- Blood consists of formed elements that are suspended and carried in a fluid called plasma

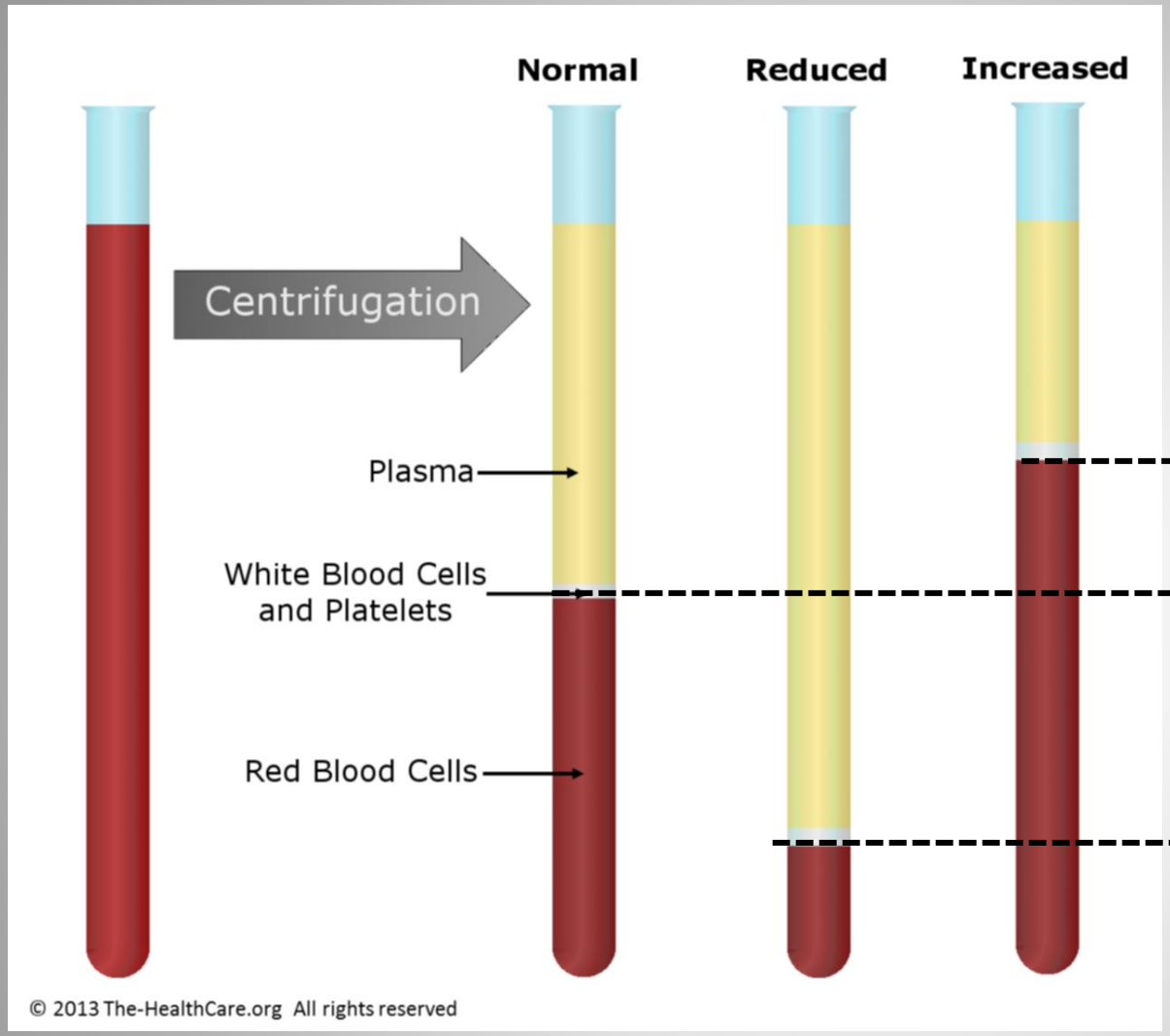


Blood Film

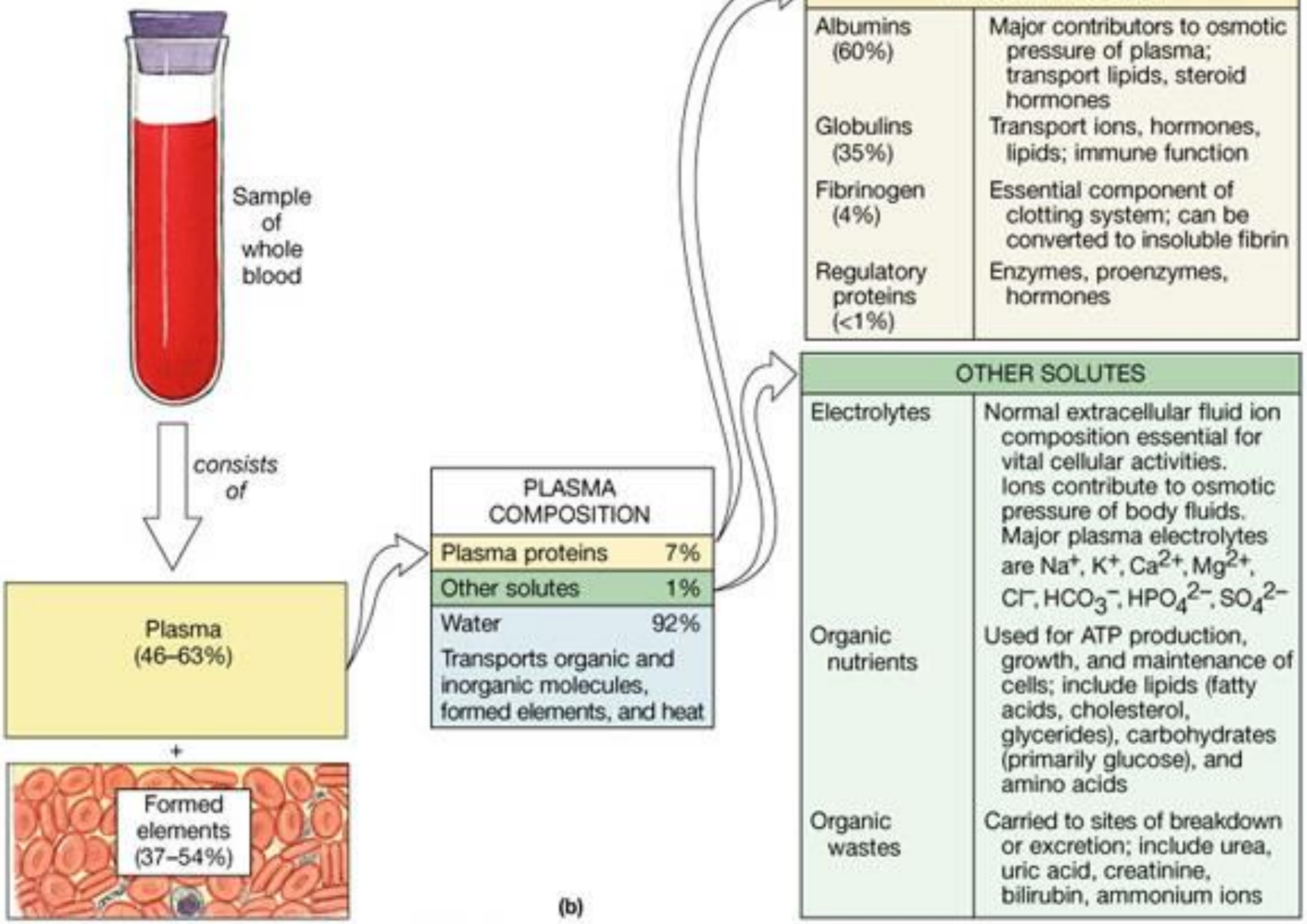


Formed Elements





Normal **Anemia** **Polycythemia**



Plasma

- Straw colored fluid made of water (~92%), other contents include:
- Proteins make the bulk of the solutes: manufactured in the liver

  - **Albumins** (60%), are the most abundant type of plasma proteins, maintain the plasma volume by osmotic pressure. (↓No → edema).

  - **Globulins** (35%), alpha and beta Globulins transport lipids and certain minerals through the bloodstream. Gamma Globulins are antibodies.

  - **Fibrinogen** (4%) for blood clotting

Plasma, cont.

- Nutrients: glucose, amino acids, lipids, cholesterol
- Electrolytes: Na^{+}, K^{+}, Ca^{++}, Mg^{++}, H^{+}, Cl^{-}, HCO_3^{-}, PO_4^{--}, SO_4^{--}
- Waste: urea, creatinine, uric acid, bilirubin
- Gases: O_2 , CO_2
- Protein bound hormones
- Plasma without clotting factors is called "serum"

BLOOD COMPOSITION

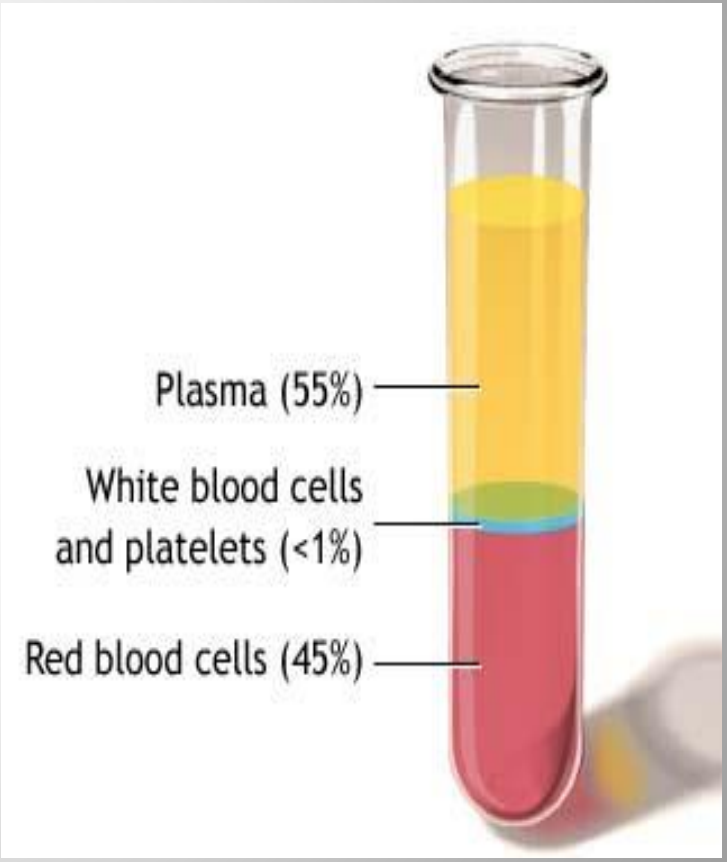
1. Cellular components
   - Red Blood Cells,RBCs (Erythrocytes)
   - White Blood Cells,WBCs (Leukocytes)
   - Platelets (Thrombocytes)

2. Plasma
   - 92% water, ions, plasma proteins (Albumin, globulin, Fibrinogen)
   - Same ionic composition as interstitial fluid

Blood Volume

5 liter in adult

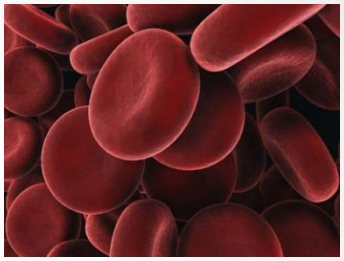
- 45% is packed cells volume (PCV)
- 55% is plasma volume



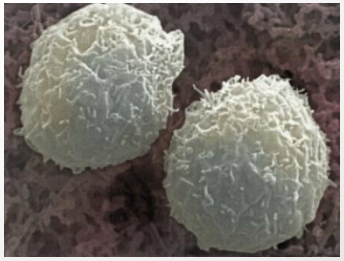
Blood Cells

- **Each type of blood cell performs a different function**

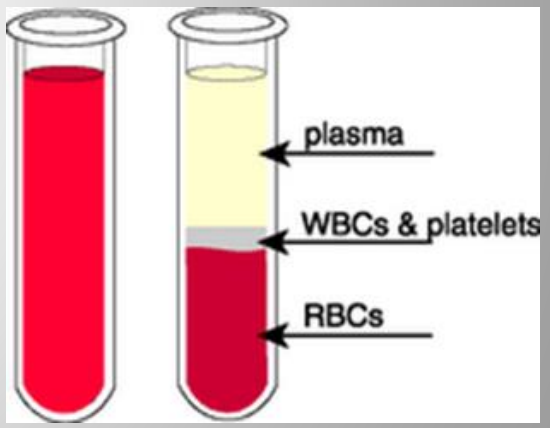
- Red blood cells (Erythrocytes)



- White blood cells (Leukocytes)



- Platelets (Thrombocytes)



Hematopoiesis

- Is a formation of blood cells from stem cells in the red bone marrow (myeloid stem cell) & lymphatic tissue (lymphoid stem cell)

- **Erythropoiesis** is formation of RBCs – Stimulated by erythropoietin (EPO) from kidney

- **Leukopoiesis** is formation of WBCs – Stimulated by variety of cytokines

- **Thrombopoiesis** is formation of platelets

Red Blood Cells

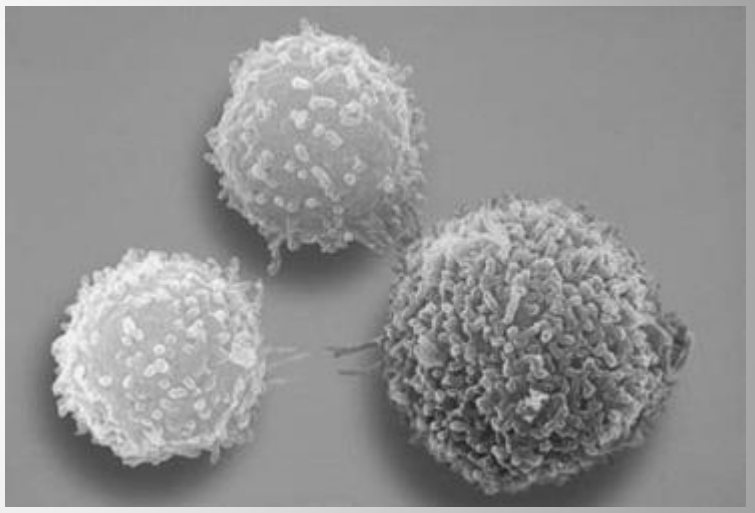
- Function
  - O_2 transport
  - CO_2 transport
  - Buffer

Red Blood Cells (Erythrocytes)

- **Shape & size**
  - Flattened Biconcave Disc
  - Lack nuclei and mitochondria
  - Diameter 7-8 μm
  - Flexible
  - Life span- 120 days
  - Number =4.7-5.2 million/ mm^3

White Blood Cells (Leukocytes)

- **Shape & size**
  - Have nucleus and mitochondria
  - Two types: granular and non-granular, Amoeboid
  - Number =4,000-11,000 / mm^3



Platelets (Thrombocytes)

- **Shape & size**
  - Are smallest of formed elements.
  - Lack nucleus
  - Irregularly shaped fragments.
  - Diameter: 2-3 µm
  - Life span- from 5 to 10 days
  - Essential for clotting
  - Number =250,000-500,000/ mm^3