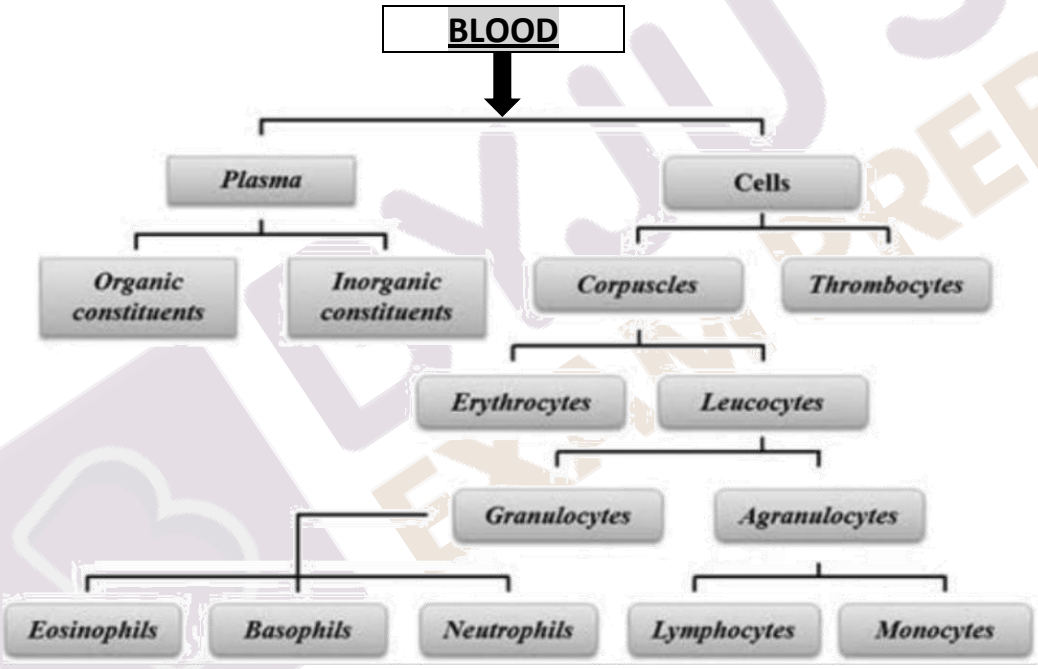
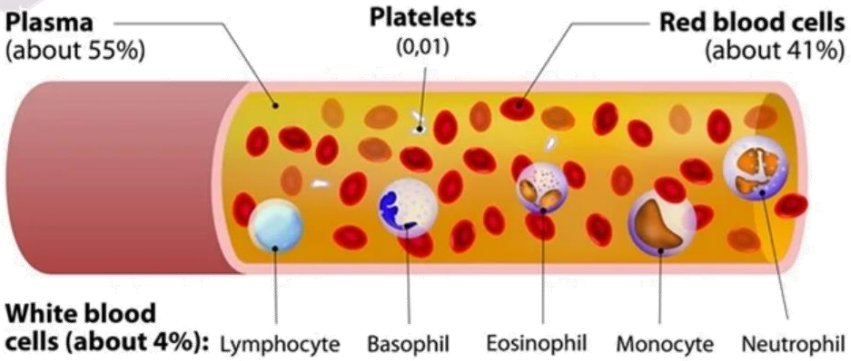
Blood and its Composition

BLOOD

- Blood is a constantly circulating fluid connective tissue, with numerous cells and proteins suspended in it providing the body with nutrition, oxygen and waste removal.
- The average person has about **5liter of blood**.
- Blood accounts for 7% of the human body weight.
- It is a **slightly alkaline fluid -pH7.4.** pH in arteries is more than in veins.
- **Blood volume: - Males:69ml/kg body wt., Females: 65ml/kg body wt.**
- **Plasma volume: - Males: 39ml/kg body wt., Females: 40 ml/kg body wt.**
- **Hemoglobin contents of blood: - Males: 14.5- 16.5mg/100ml of blood, Females :12-14.5 gm/100ml of blood.**
- **One gram of hemoglobin can carry 1.34ml oxygen** under optimal conditions.



COMPONENTS OF BLOOD



Whole blood has two components:

1. BLOOD PLASMA- A watery liquid extracellular matrix that contains dissolved substances.

2. FORMED ELEMENTS – These are cells and cell fragments.

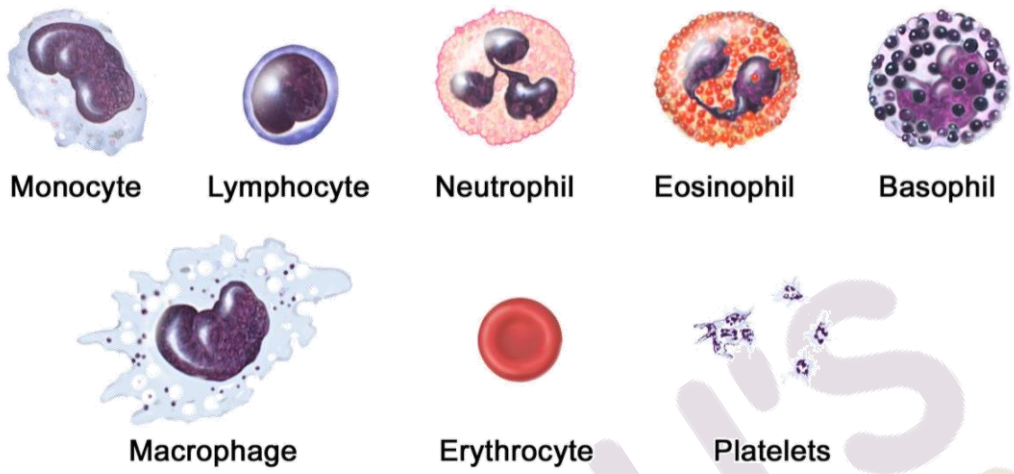
- Blood is about 45% formed elements and 55% blood plasma. Normally more than 99% of formed elements are cells named for their red color **RBC- RED BLOOD CELLS**, Pale colorless **WBCs- WHITE BLOOD CELLS** and **Platelets** occupy less than 1% of formed elements.

BLOOD PLASMA

- Blood plasma is about 91.5% water and 8.5% solutes, most of which 7% by weight are proteins.
- **PLASMA PROTEINS**- **HEPATOCYTES** (liver cells) synthesize most of the plasma proteins, which include **ALBUMINS -54% OF PLASMA PROTEINS, GLOBULINS- 38%, and FIBRINOGEN -7%.**
- Certain blood cells develop into cells that produce gamma globulins, an important type of globulins. These plasma proteins are also called **antibodies or immunoglobulins** because they are produced during certain immune responses.
- **Besides proteins other elements in plasma include: -**

1. **Electrolytes**
2. **Nutrients**
3. **Regulatory substances such as enzymes and hormones**
4. **Gases and waste products such as urea, uric acid, creatinine, ammonia and bilirubin.**

BLOOD CELLS



RBC (RED BLOOD CELLS) OR ERYTHROCYTES

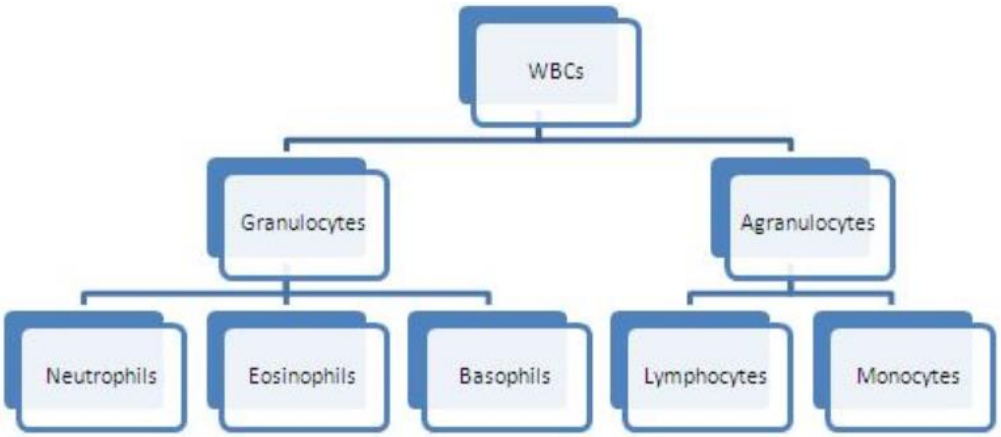
- RBSs contain oxygen carrying proteins **hemoglobin.**
- A healthy adult male has about 5.4 million red blood cells per microliter of blood, and a healthy female has about 4.8 million.

RBC ANATOMY

- **RBC** are **biconcave discs** with a diameter of 7-8 m, certain glycolipids in plasma membrane of RBCs are antigens and account for the various blood groups such as the ABO and RH groups.
- **RBCs lack nucleus and other organelles** and can neither reproduce and nor carry on excessive metabolic activities.
- The cytosol of RBCs contains hemoglobin molecules.

RBC PHYSIOLOGY

- RBCs are highly specialized for their oxygen transport function. Because **mature RBCs have no nucleus, all their internal space is available for oxygen transport**.
- Because **RBCs lack mitochondria and generate ATP anaerobically** (without oxygen), they do not use up any of oxygen they transport.



WBC (WHITE BLOOD CELLS) OR LEUCOCYTES

- The leucocytes are rounded or irregular in shape as they can change their shape. This enables them to squeeze out of blood capillaries into the tissues (diapedesis).
- It is larger than RBCs.
- The number of leucocytes varies from 6000 to 8000mm.
- The ratio of WBC:RBC in our body is 1:600
- **LEUCOCYTOSIS**- Raise in WBC count (indicate acute bacterial infection).
- **Leukemia**- Abnormal increase of WBCs (blood cancer).
- **Leukopenia**- Fall in WBC count.
- **Structure**- Consist of Cell Membrane, Nucleus and Cell organelles.

AGRANULOCYTES

LYMPHOCYTES

- They are smaller in size.
- Consist of Large rounded nucleus.
- They are non-motile and non-Phagocytic.
- They produce antibodies,
- They help in healing of injuries.
- These are B and T lymphocytes.
- Lymphocytes are 20 to 25% of leucocytes.

MONOCYTES

- They are largest.
- The nucleus is bean shaped.
- They are motile and phagocytic in nature.
- They change into macrophages after entering tissue spaces.
- It is generally 2 to 10% of leucocytes.

GRANULOCYTES

EOSINOPHILS

- The nucleus is two lobed.
- They have course granules that take acidic strains (e.g., eosin)
- Their number increases in people with allergic conditions such as asthma or hay fever.
- They help in dissolving blood clot.
- They are non – phagocytic.
- Can attach themselves to parasitic forms and cause their destruction by liberating lysosomal enzymes on their surface.
- 2-3% of leucocytes.

BASOPHIL

- The nucleus is **three lobed**.
- They have less number of course granules that take basic strain. (e.g., methylene blue) strongly
- Basophils release heparin, serotonin and histamine.
- They are generally least in number 0-1%.

NEUTROPHILS

- The nucleus is **many lobed.**
- They consist of fine granules that stain Weakley with both acidic and basic stains.
- They are most numerous.
- Certain neutrophils in female mammals possess a small spherical lobe attached to their nucleus by stalk called **drum stick or Barr body.**
- **Drumstick is formed by transformation of X-Chromosomes**. They eat harmful germs and are therefore, phagocytic in nature.
- They are 60-65% if leucocytes.

PLATELETS OR THROMBOCYTES

- Platelets are flat and non- nucleated fragments of cells.
- They are simply bits of protoplasm, bounded by membrane and contain a few cell organelles and secretary granules in cytoplasm.
- They are rounded and ovel disc like bodies.
- They are 2-3 micrometer in diameter.
- Blood normally contains 1,50,000- 3.50,000mm3 platelets of blood

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