Learning outcomes

On completion of this course, the student can be able to:

- Define Hematology
- Classify the branches of hematology
- Types of Laboratory tests in done in laboratory
- Composition of blood &
- Components of Blood

Course outcomes

On completion of this course, the student can be able to:

- Perform ESR, PCV, & Teach blood cell functions

Functions of blood

1. **Gas transport** – blood carries oxygen from lung to the tissues and carbon dioxide in reverse direction.

2. **Transport of nutritional substances for all cells** (glucose, amino acids, fatty acids, vitamins, ketone bodies, microelements etc.). Blood carries final products of metabolism (urea, uric acid, bilirubin, creatinin etc.) from tissues to kidney, where from they excreted with urine.

3. **Regulation of different processes.** Blood creates and carries local hormones (hormonoids) to the target organs.

FUNCTIONS OF BLOOD

TRANSPORTATION

- Respiration
- Nutrient carrier from GIT
- Transportation of hormones from endocrine glands
- Transports metabolic wastes

REGULATION

- Regulates pH
- Adjusts and maintains body temperature
- Maintains water content of cells

PROTECTION

- WBC protects against disease by phagocytosis
- Reservoir for substances like water, electrolyte etc.
- Performs haemostasis

GALGOTIAS UNIVERSITY

WHAT IS HAEMATOLOGY ?

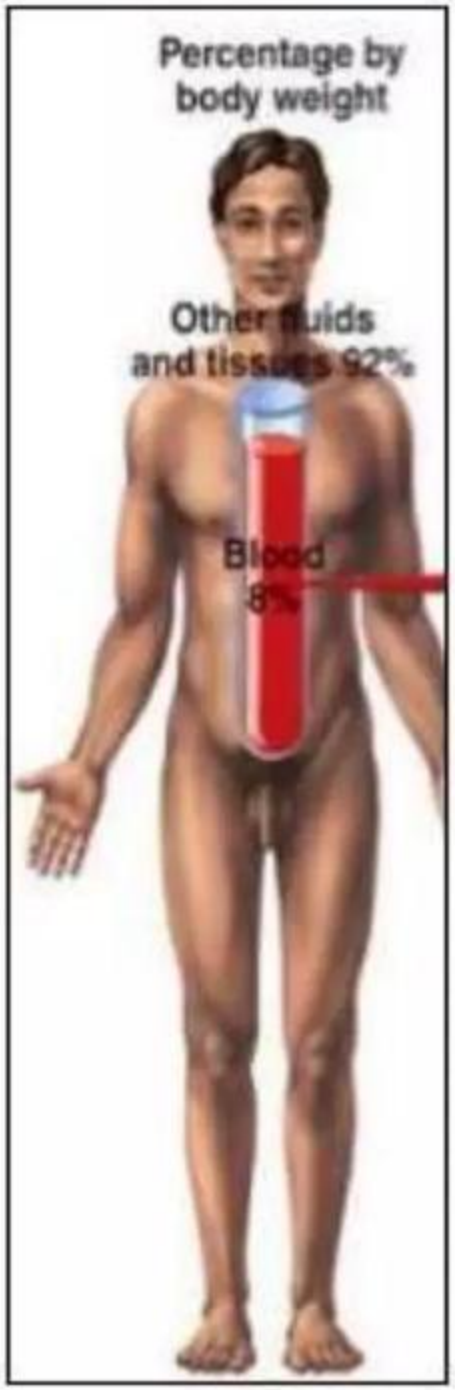
Is the branch of biology, concerned with the study of blood, the blood-forming organs, and blood diseases.

WHAT IS BLOOD ?

Is a specialized bodily fluid in animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells.

Volume of blood

How much blood is in the human body?



- In average person blood accounts for approximately 8% of body weight
- So, average person of 70kg will have $\frac{8\times70}{100}$=5.4L of blood volume
- Average volume of blood is 5–6 L for males, and 4–5 L for females

PROPERTIES OF BLOOD

- **1. *Color:*** Blood is red in color. Arterial blood is scarlet red because it contains more oxygen and venous blood is purple red because of more carbon dioxide.

- **2. *Volume:*** Average volume of blood in a normal adult is 5 L. In a newborn baby, the volume is 450 ml. It increases during growth and reaches 5 L at the time of puberty. In females, it is slightly less and is about 4.5 L. It is about 8% of the body weight in a normal young healthy adult, weighing about 70 kg.

- **3. *Reaction and pH:*** Blood is slightly alkaline and its pH in normal conditions is 7.4.

- **4. *Specific gravity:***
- Specific gravity of total blood : 1.052 to 1.061
- Specific gravity blood cells : 1.092 to 1.101
- Specific gravity of plasma : 1.022 to 1.026

- **5. *Viscosity:*** Blood is five times more viscous than water. It is mainly due to red blood cells and plasma proteins.

Functions of blood

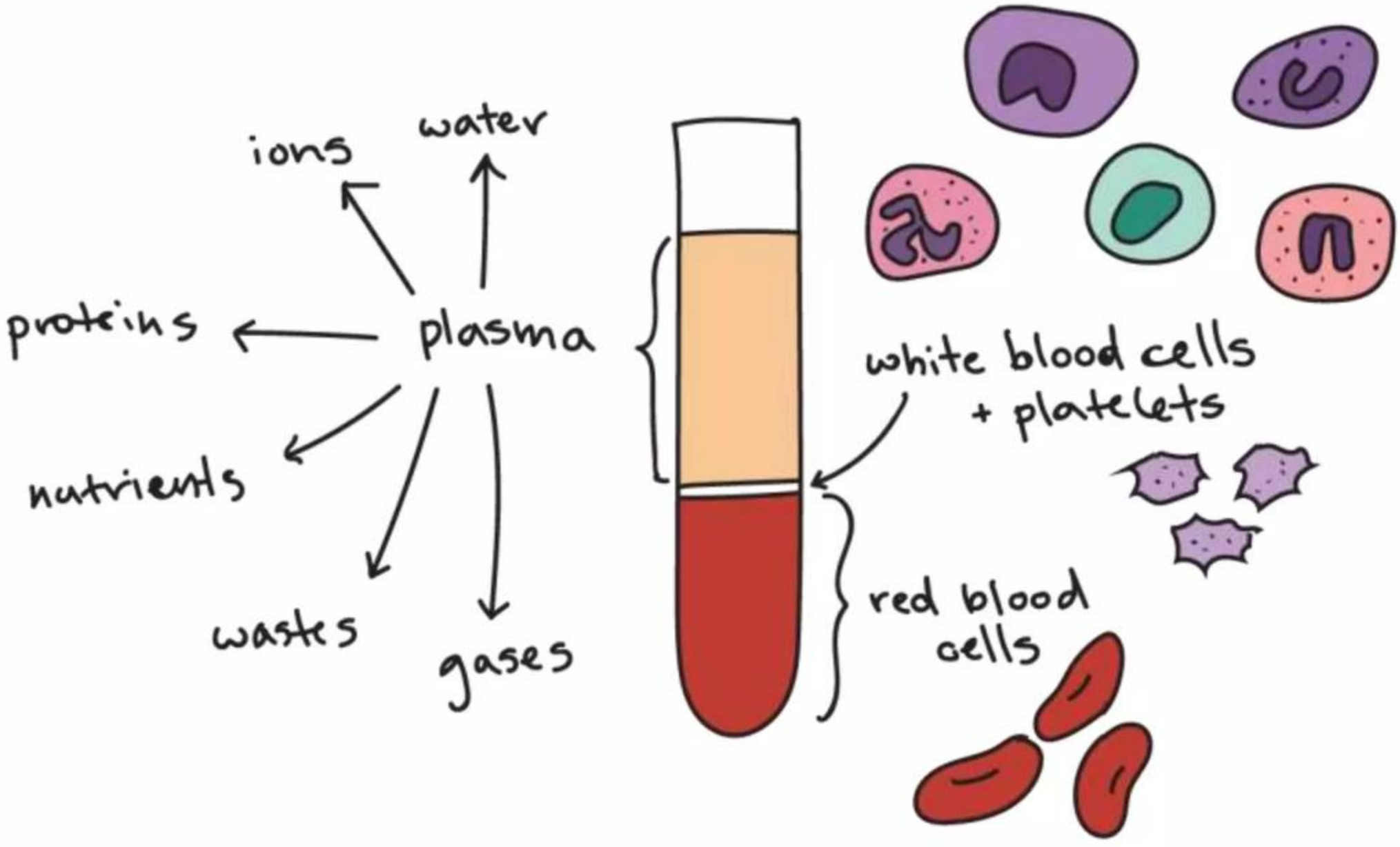
4. **Thermoregulation** – heat change between tissues and blood.

5. **Osmotic function** – maintenance of the osmotic pressure in blood vessels.

6. **Protective function** – blood has antibodies and leucocytes, which perform phagocytosis.

7. **Detoxification** – blood enzymes can neutralize (split) different toxic substances.

Composition of blood



Composition of blood

- **Blood**
  - **Plasma** 55–60% v/v
    - **Water** (91%)
    - **Solid** (9%)
      - Inorganic components (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, HCO_3^-, HPO_4^-, etc.)
      - (6-8%) Organic components (Proteins, hormones, vitamins, lipids and other organic metabolites, e.g. glucose, amino acids, urea, uric acid, etc.)
  - **Cellular components** (RBCs, WBCs & platelets) 40-45% v/v

Percentage by body weight

Other fluids and tissues 92%

Blood 8%

Percentage by volume

Plasma 55%

Formed elements 45%

Plasma (percentage by weight)

Proteins 7%

Water 91%

Other solutes 2%

Albumins 58%

Globulins 38%

Fibrinogen 4%

Ions

Nutrients

Waste products

Gases

Regulatory substances

Formed elements (number per cubic mm)

Platelets 250–400 thousand

White blood cells 5–9 thousand

Red blood cells 4.2–6.2 million

White blood cells

Neutrophils 60%–70%

Lymphocytes 20%–25%

Monocytes 3%–8%

Eosinophils 2%–4%

Basophils 0.5%– 1%

Composition of Blood

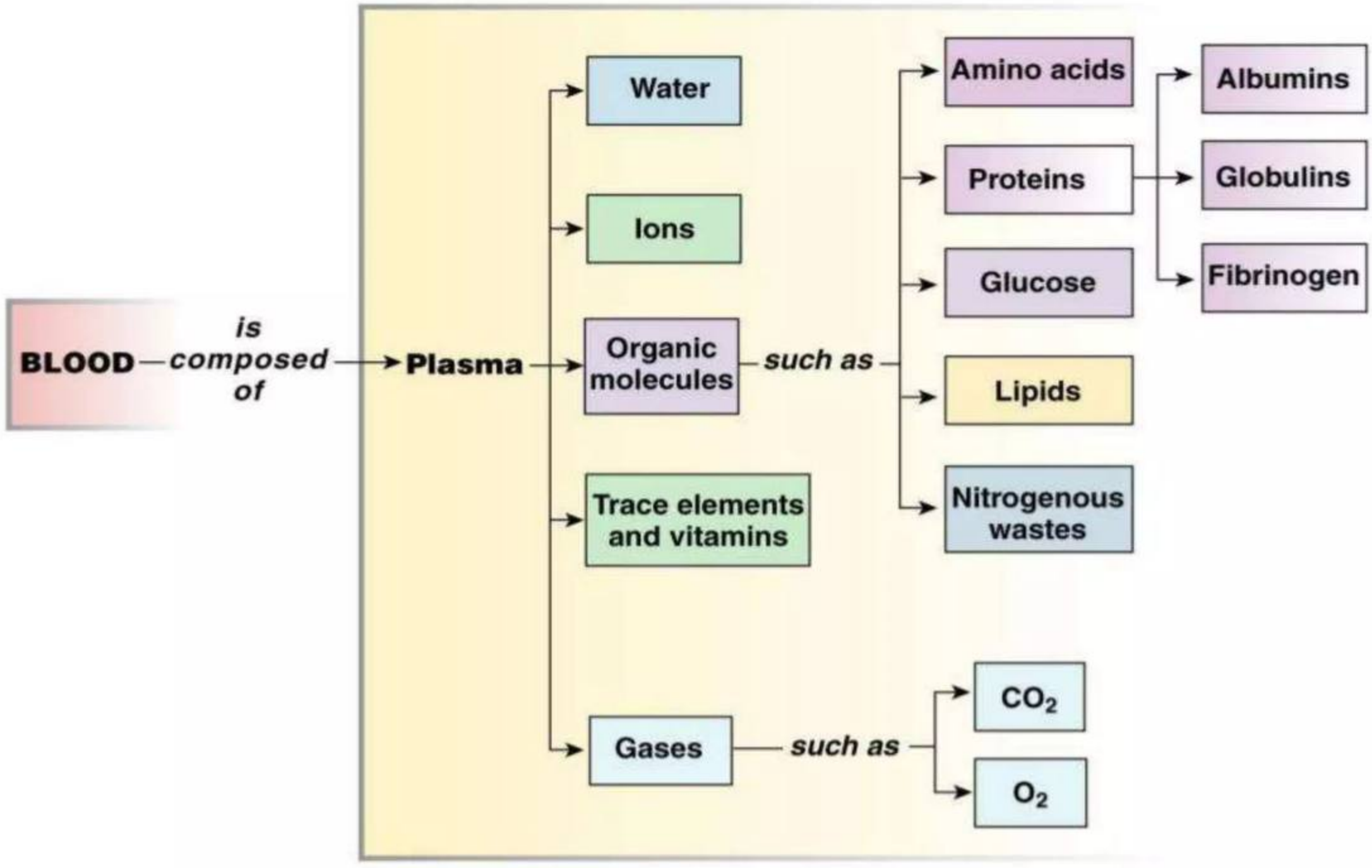
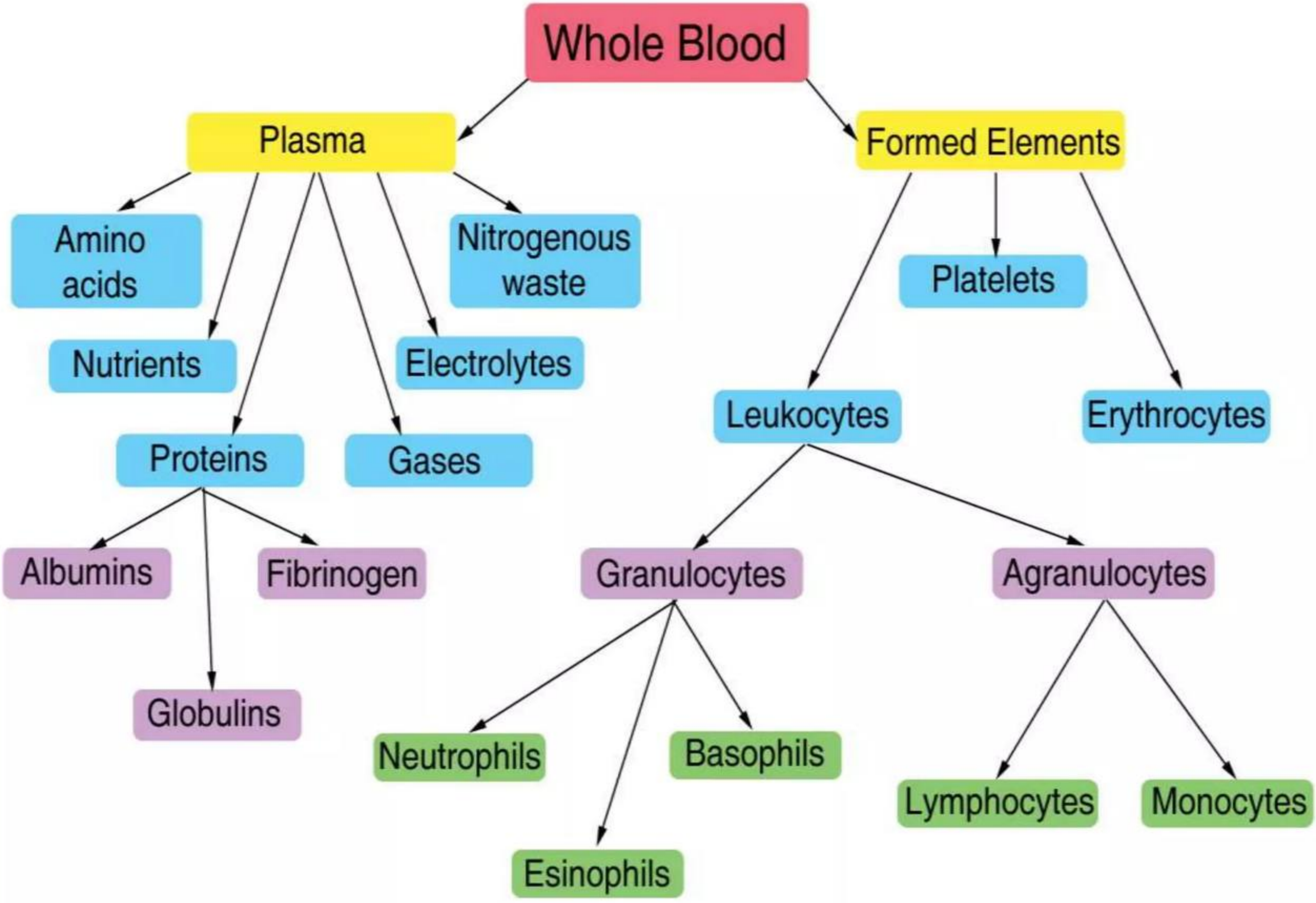


Figure 16-1 (1 of 2)

Blood composition

- **Plasma**
  - **Solids: 7% – 8%**
    - **Organic substances**
      - **I. Plasma proteins**
        1. Albumin
        2. Globulin
        3. Fibrinogen
      - **II. Amino acids**
        1. Essential amino acids
        2. Non-essential amino acids
      - **III. Carbohydrate**
        1. Glucose
      - **IV. Fats**
        1. Triglycerides
        2. Cholesterol
        3. Phospholipids
      - **V. Internal secretions**
        1. Hormones
      - **VI. Enzymes**
        1. Amylase
        2. Carbonic anhydrase
        3. Acid phosphatase
        4. Alkaline phosphatase
        5. Lipase
        6. Esterase
        7. Protease
        8. Transaminase
      - **VII. Non-protein nitrogenous substances**
        1. Ammonia
        2. Creatine
        3. Creatinine
        4. Xanthine
        5. Hypoxanthine
        6. Urea
        7. Uric acid
      - **VIII. Antibodies**
    - **Inorganic substances**
      1. Sodium
      2. Calcium
      3. Potassium
      4. Magnesium
      5. Bicarbonate
      6. Chloride
      7. Phosphate
      8. Iodide
      9. Iron
      10. Copper
  - **Water: 92% – 93%**
  - **Gases**
    1. Oxygen
    2. Carbon dioxide
    3. Nitrogen


Whole Blood
Plasma
Formed Elements
Amino acids
Nitrogenous waste
Platelets
Nutrients
Electrolytes
Leukocytes
Erythrocytes
Proteins
Gases
Albumins
Fibrinogen
Granulocytes
Agranulocytes
Globulins
Neutrophils
Basophils
Lymphocytes
Monocytes
Esinophils

Summary

Plasma

- Fluid obtained when anti-coagulated blood has been centrifuged
- Anti-coagulants are needed for separation
- Fibrinogen is present in plasma
- Does not need "standing"; it could be centrifuged as soon as it has been mixed thoroughly.
- plasma is delivered to the patients who lack blood cells

Serum

- Fluid obtained when coagulated blood has been centrifuged
- Anti-coagulants are not needed
- Fibrinogen is absent
- Serum takes a longer time to prepare
- Serum is the most preferred part of blood used in checking blood groups and diagnosis of diseases