Human anatomy & physiology - I

Unit-3

✱ Body fluids and blood :-

→ In an average adult the body fluids constitute between 55% and 60% of total body mass in female and male.

① Intracellular fluid (ICF) :-

About 2/3 of body fluid is ICF or cytosol, the fluid within the cell.

② Extracellular fluid (ECF) :-

About 1/3 of body fluid is ECF is outside cells and includes all other body fluids.

→ ECF is divided into interstitial fluid and plasma.

→ About 80% of ECF is interstitial fluid which occupies the microscopic spaces b/w tissue cells.

Blood :-

Hematology : It is the branch of science concerned with the study of blood, blood forming tissue and disorder associated with them.

Defination : It is the liquid connective tissue. It is composed of an extracellular matrix called as blood plasma that dissolve and suspends various cells and cell fragment.

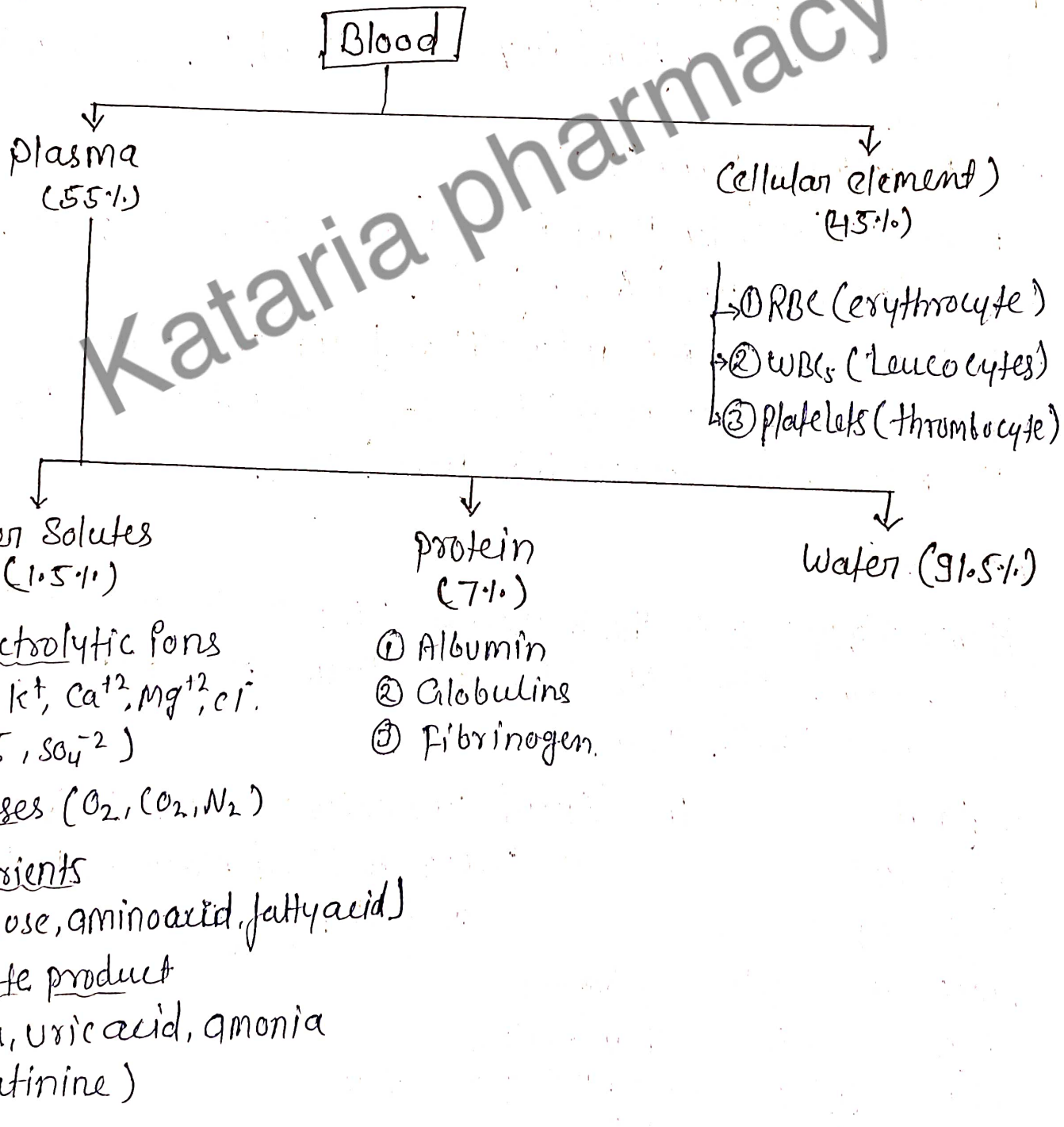
Physical properties of blood :-

- It is more viscous than water.
- It is slightly alkaline pH is 7.35 - 7.45.
- Temperature of blood is 38°c
- The color of blood varies with its oxygen content

✯ Functions of blood :-

→ Deliver O_2.
→ Remove metabolic wastes.
→ Maintain temperature, pH, and fluid volume..
→ protection from blood loss - platelets..
→ prevent infection - ~~antibiotic~~ antibodies and WBC.
→ Transport hormones.

✯ Composition of blood :-



☆ Hemopoeisis :-

Hemo - Refering to blood Cells.
poiesis - "The development or production of".

The word Hemopoiesis refers to the production & development of all the blood Cells.

- Erythrocytes: Erythropoiesis
- Leucocytes: Leucopoiesis
- Thrombocytes: Thrombopoiesis

Erythropoiesis :-

RBM (Red bone marrow)
↓
Myeloid tissue → Modification
↓
Myeloblast Cells
↓
proerthroblast Cell → Mitosis
↓
Erythroblast Cell
↓
Reticulocyte → Hb (↓)
→ Stromatin (↓)
→ Cell organels (x)
→ Nucleus (x)
↓
Normocyte
↓
Erythrocyte

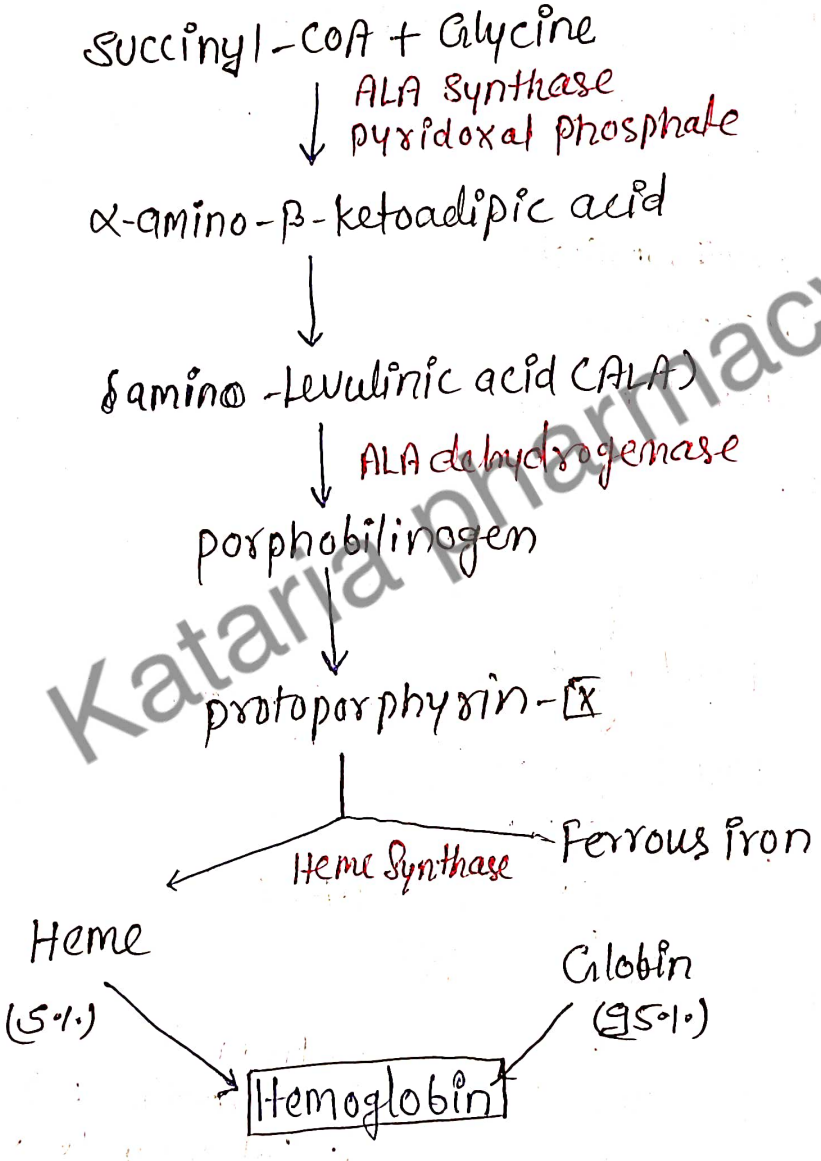
Cell organels (↓)
Nucleus (↓)
Hb (x)
Stromatin (x)

Vit. B12 / folic acid

Note :- Haemopoietic organs are - Bone marrow, thymus, lymph nodes
- lymph follicles, Spleen and Liver.

Formation of Haemoglobin :-

→ It is a Red pigment.
→ present in RBC of Blood.
→ It is a conjugated protein & chromoprotein.
→ It is made up of Iron and protein.
→ It's Molecular weight is 68000.



Functions :-

→ Transport oxygen to tissue
→ Transport of Co_2 to Lungs
→ maintain acid base balance (As a buffer)

Anemia :-

→ Anemia is a major killer in India.
→ Statistics reveal that every second indian woman is anemic.
→ Anemia affects both adults and children of both sexes, although pregnant women and adolescent girls are most susceptible and most affected by this disease.

 # Defination:- Anemia (An-without, emia-blood) is a decrease in the RBC count, hemoglobin and/or Hematocrit values resulting in a lower ability for the blood to carry oxygen to body tissue.

Normal amount of red blood cells

Anemic Amount of red blood cells.

pathophysiology :-

↓es in RBCs, Hb, or Hct Level
↓
Diminished O_2-Carrying Capacity
↓
Hypoxia and hypoxia-induced effects on organ function
↓
Signs and Symptoms of anemia

Type of Anemia :-

- Iron deficiency Anemia
- megaloblastic anemia
- pernicious anemia
- Hemorrhagic anemia
- Hemolytic anemia
  - Thalassemia
  - Sickle cell anemia
- Aplastic anemia

Signs & Symptoms :-

- Easy fatigue and loss of energy.
- Unusually rapid heart beat, particularly with exercise.
- Shortness of breath and headache, particularly with exercise.
- Insomnia
- Yelbwis eyes.

☆ Mechnism of Coagulation :-

Defination :- Coagulation or clotting is defined as the process in which blood losses its fluid and becomes a jelly like mass few minutes after it is shed out at collected in a container.

Mechnism :-

Ruptured platelets and damaged tissues

↓ Ca^{++}

Thromboplastin

↓

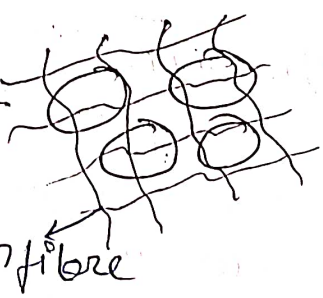
prothrombin (inactive) ⟶ Thrombin (active)

↓

Fibrinogen (soluble) ⟶ fibrin (insoluble)

↓

Red blood cell trapped in meshworks of fibres



Fibrin fibre

Blood Clotting factors :-

I - Fibrinogen
II - prothrombin
III - Tissue factor
IV - Ca^{+2}
V - proaccelerin
VI - proconvertin
VII - Stable factor
VIII - Antihemophilic factor
IX - Christmas factor
X - Stuart factor
XI - Plasma thromboplastin antecedent
XII - Hageman factor
XIII - Fibrin stabilizing factor (FSF)

☆ Blood grouping :-

→ A blood group also called a blood type.

→ Classification of blood is based on the presence or absence of inherited antigenic substances on the surface of RBC.

→ These antigens may be protein, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system.

Blood group system :-

- ABO blood group system
- Rh blood group system

① ABO blood group system :-

→ Karl Landsteiner discovered the ABO blood group system in 1901.

→ Adriano Sturli and Alfred von Decastello who were working under Landsteiner discovered type AB a year later in 1902.

→ Jansky is credited with the first classification of blood into the four types (A, B, AB, O) in 1907, which remains in use today.

→ Based on the presence or absence of antigen A and antigen B, blood is divided into four groups:
'A, B, AB and 'O' group.

→ Blood having antigen A belong to 'A' group. This blood has β-antibody in the serum.

→ Blood with antigen B and α-antibody belongs to 'B' group.

→ If both the antigens are present, blood group is called 'AB' group and serum of this group does not contain any antibody.

→ If both antigens are absent, the blood group is called 'O' group and both α and β antibodies are present in the serum.

Blood group	Agglutinogen (Antigen	Agglutinogen (Antibody)	Donet blood	Reciver blood
A	A	b	A, AB	A, O
B	B	a	B, AB	B, O
AB	A, B	—	AB	A, B, AB, O
O	O	a, b	O, A, B, AB	O

Doner ↓

Blood group	O^-	O^+	B^-	B^+	A^-	A^+	AB^-	AB^+
AB^+	✓	✓	✓	✓	✓	✓	✓	✓
AB^-	✓	✗	✓	✗	✓	✗	✓	✗
A^+	✓	✓	✗	✗	✓	✓	✗	✗
A^-	✓	✗	✗	✗	✓	✗	✗	✗
B^+	✓	✓	✓	✓	✗	✗	✗	✗
B^-	✓	✗	✓	✗	✗	✗	✗	✗
O^+	✓	✓	✗	✗	✗	✗	✗	✗
O^-	✓	✗	✗	✗	✗	✗	✗	✗

Reciver

② Rh factor :-

An antigen occuring on the red blood cells of many humans (around 85%) and some other primates.

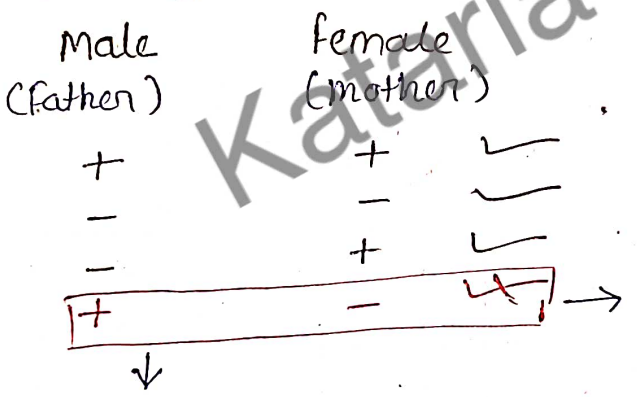
→ It is particularly important as a cause of haemolytic disease of the newborn and of incompatibility in blood transfusion.

present (+)
Rh positive

absent (-)
Rh negative

India 97% (+) 3% (-)
World 80% (+) 20% (-)

Note :- It Cause Erythroblastosis fetalis (hemolytic disease of the newborn)



→ Red blood cells agglutination (clumping of RBC)

→ The baby has inherited the Rh-positive antigen from the father and the mother develops anti-Rh agglutinins from exposure to the fetus's Rh antigen

→ In turn, the mother's agglutinins diffuse through the placenta into the fetus and cause RBC agglutination.

Note :- Discovered in Rhesus monkeys so it is called Rh factor

☆ Blood transfusion :-

Defination :- Blood transfusion is the transfusion of the whole blood or its components such as blood cells or plasma from one person to another person.

→ It can be life saving in some situation. such as massive blood loss due to trauma, or can be used to replace blood lost during surgery.

Significance of blood transfusion :-

→ Restore blood volume.
→ Replace clotting factor
→ Improve oxygen carring capacity
→ Restore blood element that are depleted.
→ prevent complications
→ To rise the haemoglobin level
→ To provide antibodies.

☆ Disorder of blood :-

① Anemia – short of RBC
② Hemophilia – Defect in the blood Coagulation mechnism
Defect in factor (VIII).
③ Thrombocythemia – Abnormal small number of platelets in the circulating blood.
④ Hodgkin's Disease – marked by chronic enlargement of the lymph nodes.

⑤ Leukemia – progressive proliferation of abnormal leukocytes.

⑥ Non-Hodgkin's lymphoma :- Lymphoma other than hodgkin disease.

#Diagnosis :-

- Additional blood tests.
- X-ray of the chest, bones, liver and spleen.
- Biopsy of the lymph nodes.

☆ Lymphatic System :-

The lymphatic system, or lymphoid system, is an organ system in vertebrates that is part of the circulatory system and the immune system.

→ It is made up of a large network of lymph, lymphatic vessels lymph nodes, lymphatic or lymphoid organs and lymphoid tissue.

① Lymph organ :-

→ Several other organs contribute to lymphatic function.

- Spleen
- Thymus
- Tonsil

Spleen :- → Filter blood
→ Destroys worn out blood cells
→ Forms blood cells in the fetus
→ Acts as a blood reservoir.

Thymus :- → Function at peak levels only during childhood.
→ produces hormones (like thymosin) to program lymphocytes.

Tonsil :- small masses of lymphoid tissue around the pharynx.
→ Trap and remove bacteria and other foreign materials.
→ Tonsillitis is caused by congestion with bacteria.

✱ Lymph :-

After blood travels through capillary beds and is moved to the venous system, some of its fluid is left behind in the tissue is called lymph.

→ Lymph is a clear, colorless liquid with a composition similar to blood plasma.

→ It contain oxygen, proteins, glucose and white blood cells.

✱ Lymph node :-

They are widely distributed throughout the body along the lymphatic pathways.

→ Lymph nodes are not present in the central nervous system.

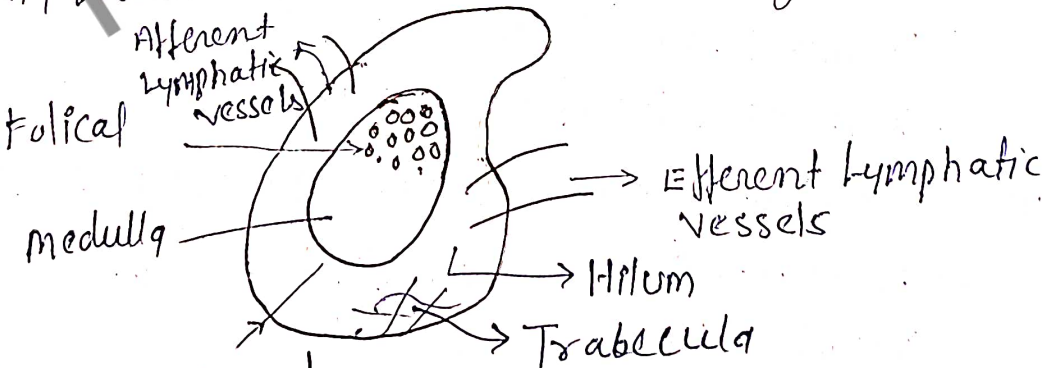
→ Composed of lymphoid tissue.

Structure of lymph node :-

→ Small bean-shaped structure

→ usually less than 2.5 cm (1 inch) in length.

→



Function of lymph node :-

→ filter the lymph before it is returned to the blood.

→ preventing foreign particles from entering the blood stream.

→ They also produce Lymphocytes.