بسم الله الرحمن الرحيم

Human Physiology 2nd stage كلية آشور الجامعة – قسم تقنيات المختبرات الطبية

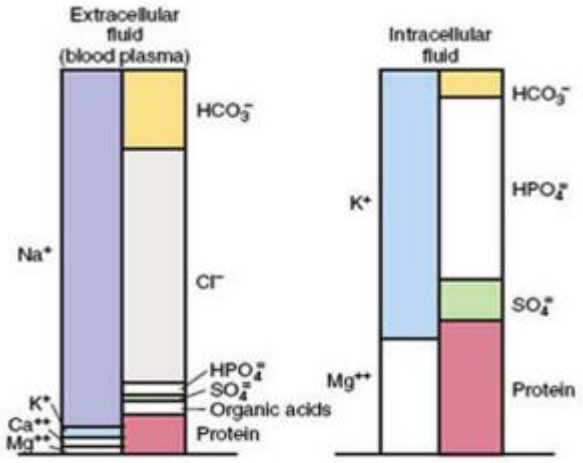
L2 د. صالح احمد 2021– 2022

Body fluid:

Are liquids within the bodies of living people. In normal healthy men, the total body water is about 60% of the total body weight; it is slightly lower in women. For example, a 70 kg man has 42 liters of water in his body. This is divided between (intracellular fluid) ICF and (extracellular fluid) ECF in a two-to-one ratio: 28 liters are inside cells and 14 liters are outside cells.

Types of Body Fluids:

The following points highlight the two types of fluids in human body. The types are: 1. Intracellular Fluid 2. Extracellular Fluid.



1 - **Intracellular Fluid (ICF):** Fluid present inside cells and makes approximately 60-65% of body water. It's contains relatively large amount of potassium (K^+); in addition to phosphate, protein, Mg^{+2} and Ca^{+2}. The ICF is separated from the Extracellular Fluid by the plasma membrane of each, individual cell.

2- **Extracellular fluid (ECF):** Fluid present outside cells, which makes up the other 35-40% of body water. It's contains

relatively large amount of sodium (Na^+); in addition to chloride (Cl^-) and bicarbonate (HCO_3^-). The ECF is sub-divided into two other fluid compartments includes the following:

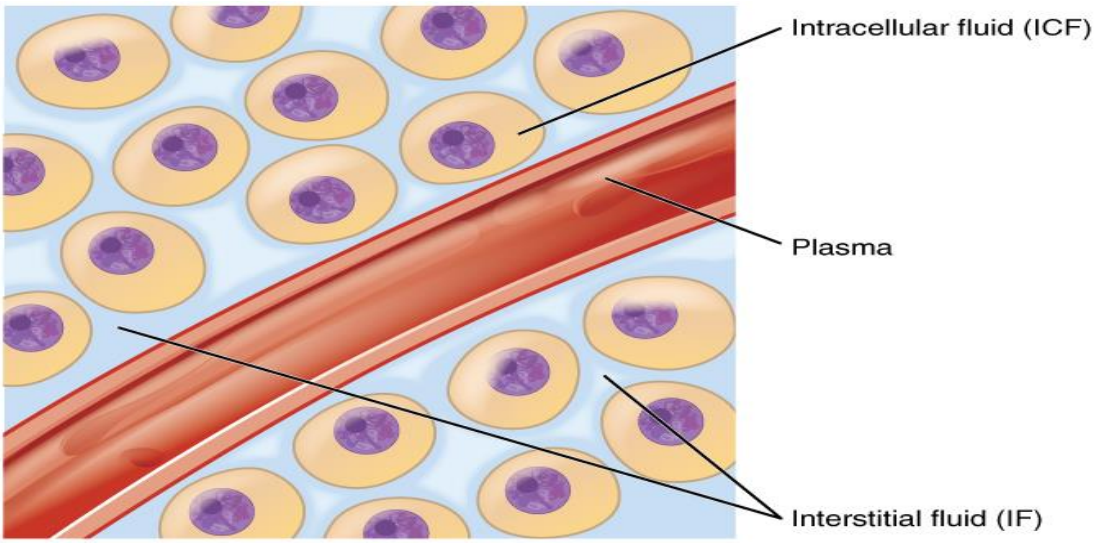
(i) Interstitial fluid (= tissue fluid): It is present in between the tissues.

(ii) Blood Plasma: It is found in the blood.

(iii) Lymph Plasma: It is present the lymph.

(iv) Cerebrospinal Fluid (CSF): It is present inside the ventricles of the brain.

(v) Intraocular Fluid: This fluid is found in the eye ball.



The Blood: Blood is a body fluid in humans and other animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells. In vertebrates, it is composed of blood cells suspended in blood plasma. Plasma, constitutes 45-55% of blood fluid, it is mostly water (92% by volume).

Composition of Blood: Blood of vertebrates is made up of blood plasma and various cells — red blood cells(also called RBCs erythropoiesis) , white blood cells(also called WBCs or leukocytes) and platelets (also called thrombocytes).

Blood plasma: is the yellow liquid in which blood cells float. Plasma is made up of nutrients, electrolytes (salts), gases, non-

protein hormones, waste, lipids, and proteins. These proteins are albumin, antibodies (also called *immunoglobulin*), clotting factors, and protein hormones. Plasma that does not have the protein fibrinogen is called serum and cannot clot. Adults have about 3 liters of plasma. Plasma is a liquid, mostly water (90%). Plasma takes up 55% of blood volume. Human serum is usually used for diagnostic testing. Other animal sera are used as anti-toxins and vaccinations.

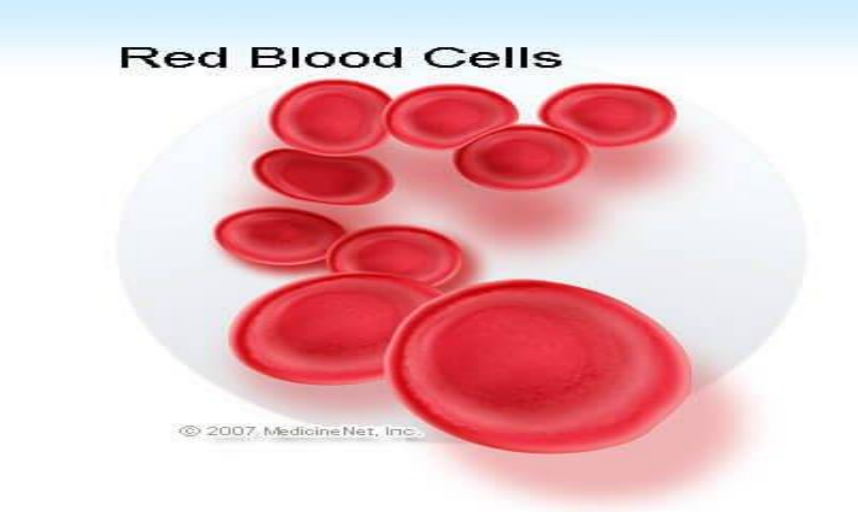
What is the difference between Plasma and Serum?

Both plasma and serum are derivatives of blood. Both contain electrolytes, other proteins, drugs, hormones and toxins. Both can be acquired from centrifugation and purity. Both can be used for diagnostic and therapeutic purposes. But plasma is serum with fibrinogen and clotting factors.

Red blood cell (RBC):

The blood cells, which carry oxygen, contains hemoglobin, the hemoglobin permits them to transport oxygen and carbon dioxide. Red blood cells (RBCs) are sometime simply called red cells. They are also called erythrocytes or, rarely today, red blood corpuscles.

Shape of Red blood cell: To enable the maximum O2 saturation of hemoglobin, red cells are shaped like biconcave disks. The shape provides more surface area for exposure of hemoglobin to dissolved oxygen. Red blood cells are also able to change shape to permit passage through small capillaries that connect arteries with veins.



The red blood cells can be compressed into many-sided, instead of their bi-concave disc shape.

Count of Red blood cell (RBC): The **RBC** is a count of the number of red blood cells per cubic millimeter of blood. Approximately a quarter of the cells in the human body are red blood cells. Normal red blood cells values at various ages are:

- Newborns: 4.8 - 7.2 million
- Adults: (males): 4.6 - 6.0 million
- Adults: (Females): 4.2-5.0 million
- Pregnancy: slightly lower than normal adult values
- Children: 3.8 – 5.5 million**.**

Function of the blood cells: The primary function of the red blood cells, or erythrocytes, is to **carry oxygen** from the lungs to body tissues and to **transfer carbon dioxide** from the tissues to the lungs.

Hemoglobin (Hb) Definition: Hemoglobin is a protein in red blood cells that carries iron. This iron holds oxygen, hemoglobin an essential component of the blood. When the blood doesn't contain enough hemoglobin, the cells don't receive enough oxygen.

Structure of Hemoglobin: Hemoglobin is a tetramer consisting of two dimmers that binds to oxygen. Hemoglobin is the oxygen transporting protein of red blood cells and is a globular protein with quaternary structure. Hemoglobin consists of four polypeptide subunits; 2 alpha chains and two beta chains. Hemoglobin transports oxygen in the blood from the lungs to the rest of the body. The structure of hemoglobin is very similar to the single polypeptide chain in myoglobin.

Normal values of hemoglobin: Normal hemoglobin values are related to the person's age and sex. Normal values may vary slightly between test systems. In adults, the average hemoglobin level is slightly higher for men than it is for women. It is measured in grams per deciliter (g/dL) of blood.

Sex	Normal hemoglobin range (g/dL)
Female	12.5–15.5
Male	13.5–17.5

Blood group: There are four main blood groups A, B, AB, and O. The blood group is determined by the genes inherit from the parents.

The term "Rh" was originally an abbreviation of "Rhesus factor." believed it to be a similar antigen found in rhesus monkey red blood cells, Red **blood** cells sometimes have another antigen, a protein known as the **RhD** antigen. If this is present, your **blood group** is **RhD** positive. If it's absent, your **blood group** is **RhD** negative. This means you can be one of eight **blood groups**: A **RhD** positive (A+). Each group can be either RhD positive or RhD negative. Blood group is identified by antibodies and antigens in the blood. Antibodies are proteins found in plasma. They're part of the body's natural defence**s**. They recognise foreign substances, such as germs, and

alert the immune system, which destroys them. Antigens are protein molecules found on the surface of red blood cells.

There are four main blood groups defined by the ABO system:

- **Blood group A –** has A antigens on the red blood cells with anti-B antibodies in the plasma.
- **Blood group B** – has B antigens with anti-A antibodies in the plasma.
- **Blood group O** – has no antigens, but both anti-A and anti-B antibodies in the plasma.
- **Blood group AB** – has both A and B antigens, but no antibodies.

  Receiving blood from the wrong ABO group can be life threatening. For example, if someone with group B blood is given group A blood, the anti-A antibodies will attack the group A cells. As group O red blood cells don't have any A or B antigen, it can safely be given to any other group.

If your blood type is:	**You can give to:**	**receive from:**
O Positive	O+, A+, B+, AB+	O+, O-
A Positive	A+, AB+	A+, A-, O+, O-
B Positive	B+, AB+	B+, B-, O+, O-
AB Positive	AB+ Only	All blood types