**Circulatory system** (**Hematology)**

 Hematology ([American English](http://en.wikipedia.org/wiki/American_English)) or haematology ([British English](http://en.wikipedia.org/wiki/British_English)) is the branch of biology (physiology), hematology is defined as the study of the blood, and the term (hemo or hemato) is derived from the Greek word for blood.

**Selected scientific developments relevant to hematology:**

1. 1628 blood circulation described by William Harvey in England.
2. 1674 First description of red blood cells by Antony Van Leeuwen hoeck in Holland.
3. 1772 plasma clotting factors described by William Henson.
4. 1773 First description of white blood cells by William Henson in England.
5. 1851 Hemoglobin discovered by Otto Funke in Germany.
6. 1900 ABO blood groups discovered by Karl Landsteiner in Austria.

**The human blood:**

 Blood is one of the most important and unusual connective tissues with a liquid matrix in the animal body.

If the whole blood treated to prevent clotting ,is left standing in a test tube, the formed elements will settle down to the bottom, leaving the fluid plasma above .

**Blood volume:**

 An adult human has about 5 to 6 liters of blood, which is roughly 7 to 8 percent of total body weight. Infants and children have comparably lower volumes of blood, roughly proportionate to their smaller size.

**Role of blood**

**1-** Blood carries oxygen from the [lungs](http://encarta.msn.com/encyclopedia_761570316/Lung.html) to all the other tissues in the body and,

 in turn, carries waste products, predominantly carbon dioxide, back to the

 lungs where they are released into the air. When oxygen transport fails, a

 person dies within a few minutes.

**2-** Food that has been processed by the [digestive system](http://encarta.msn.com/encyclopedia_761575197/Digestive_System.html) into smaller

 components such as proteins, fats, and carbohydrates is also delivered to the

 tissues by the blood. These nutrients provide the materials and energy needed

 by individual cells for [metabolism](http://encarta.msn.com/encyclopedia_761569250/Metabolism_%28chemistry%29.html), or the performance of cellular function.

**3-** Waste products produced during metabolism, such as urea and uric acid, are

 carried by the blood to the [kidneys](http://encarta.msn.com/encyclopedia_761560819/Kidney.html), where they are transferred from the blood

 into urine and eliminated from the body.

**4-** In addition to oxygen and nutrients, blood also transports special chemicals,

 called [hormones](http://encarta.msn.com/encyclopedia_761573263/Hormone.html) that regulate certain body functions.

**5-** It is also responsible for the activities of the [immune system](http://encarta.msn.com/encyclopedia_761575681/Immune_System.html), helping fend

 off infection and fight disease.

**6-** In addition, blood carries the means for stopping itself from leaking out of

 the body after an injury. The blood does this by carrying special cells and

 proteins, known as the coagulation system, that start to form clots within a

 matter of seconds after injury.

**7-** Blood is vital to maintaining a stable body temperature; in humans, body

 temperature normally fluctuates within a degree of 37.0°C(98.6° F).

8-Regulation of Ph (hydrogen ion concentration) in the body.

**Composition of blood**

 The intracellular liquid matrix of blood is called plasma . There are three formed element in the plasma which are :

1-Red blood cells (erythrocytes)

2-White blood cells (leukocytes )

3-Platelets (thrombocyte).

 The % of formed elements is 40-50 % ;The % of plasma is 50-60 % in whole blood .

**The plasma:**  is the liquid part of the blood , yellow or colorless . It is about 55-70 % of the whole blood. It is consist of:

1-Water (91%).

2-Gases(O2, CO2,N)

3-Proteins (Albumin, Globulin, Fibrinogen).

4-Glucose, lactate , pyruvate .

5-Lipids (Fat, Lecithin, cholesterol).

6-Non proteinious nitrogenic product such as (Amino acids ,Urea, Uric acid ,

 keratin , ammonium salt).

7-Inorganic substances (Na, K, Ca, Mg, CI- ,S,P,Fe,Mn,Co,Cu,Zn,I2 ).

8-Enzymes . 9- Hormones . 10- Vitamins . 11- Pigments .

The division between albumin & globulin is based on molecular weight.

Function of plasma: The plasma contain number of proteins which play important role in following functions :

1-Plasma protein is in balance with tissues protein. It protein store.

2-Keep osmotic pressure of blood by re-transport of body fluid

 which escape from blood to tissues.

3-Keep blood pressure constant by keeping normal viscosity .

4-Affect on the suspension stability of RBC in blood & prevent its

 sedimentation.

5-Help in regulation of blood PH(7.4).

6-Provide the body with antibodies .

7-Play role in hormone & drug transport.

8-Play role in transport of minerals & vitamins .

**Blood serum :** is liquid residue of blood after clotting, it is plasma with no fibrinogen and clotting factor 11 ,V, VI11. And it contains serotonin.

**Cellular component of blood:**

1. **Red blood cells (95%):**

 Red blood cells make up almost 45 percent of the blood volume. Its non motile cells, with no nucleus, mitochondria, Golgi bodies, centrioles & RNA (Ribonucleic acid). It is circular disc, changes its shape in capillaries.

 Number of RBC changed according to these factors:

Age ,sex, exercise , feeding state , lactation, pregnancy haemodilution , estrous cycle , surrounding temperature , altitude , ecological factors .

 Their primary function is to carry oxygen from the lungs to every cell in the body. RBCs are composed predominantly of a protein and iron compound, called [hemoglobin](http://encarta.msn.com/encyclopedia_761567357/Hemoglobin.html) that captures oxygen molecules as the blood moves through the lungs, giving blood its red color.

 The membrane, or outer layer, of the red blood cell is flexible, like a soap bubble, and is able to bend in many directions without breaking. This is important because the red blood cells must be able to pass through the tiniest blood vessels, the capillaries, to deliver oxygen wherever it is needed. The capillaries are so narrow that the red blood cells, normally shaped like a disk with a concave top and bottom, must bend and twist to maneuver single file through them.

