# Medical

# Biology

## Blood

- Blood is a fluid connective tissue consisting of cells suspended in a liquid fibrous matrix. The cells are called formed elements, and the liquid matrix is known as plasma. The formed elements consist of erythrocytes (red blood cells), leukocytes (white blood cells) and platelets.
- If blood is centrifuged, it divides into 3 portions:
- (1) Plasma makes up roughly 55% (upper layer).
- (2) Packed RBCs make up roughly 45% (lower layer).
- (3) the buffy layer (containing WBCs and platelets) makes up <1% (middle layer).</li>



- The % of blood consisting of packed RBCs is known as the haematocrit.
- Blood's colour ranges from scarlet (oxygen-rich) to dark red (oxygen poor).
- Its viscosity is 5X that of water, due primarily to the presence of formed elements.
- Blood pH normally ranges from 7.35-7.45 (slightly alkaline).
- Blood temperature is typically 100°F.
- Typical blood volume is 4-5 L for females and 5-6 L for males.

#### **Blood functions:**

- Blood has 3 main distribution functions:
- Blood has 3 main regulatory functions:
- Blood has 2 main protective functions:

### Plasma:

- It is the straw-colour liquid part of blood. Blood plasma is about 55% of blood volume. 90% of plasma is water. Water acts as a solvent and suspending medium. Solutes dissolved in plasma include plasma proteins, nutrients, electrolytes, respiratory gases, hormones and wastes.
- Albumin
- Alpha, beta & gamma globulinsFibrinogen

### **Blood cells:**

The blood has 3 major formed elements:

Erythrocytes (RBC):

■ Leukocytes (WBC):

Thrombocytes (platelets):



- These are rounded biconcave disks, bright red in color due to the presence of hemoglobin.
- their biconcave shape will maximize their surface area/ volume ratio so facilitate the gaseous exchange.
- RBCs are about 7.5 µm. in diameter, those RBCs with a diameter more then 9 µm. are called Macrocytes, while those with a diameter less then 6µm. are called Microcytes.



RBC count in adult female is about 3.9-5.5 million/microliter, while in adult male it is about 4.1-6 million/microliter.

- Hemoglobin (iron containing protein) is contained in abundance within RBCs
- Oxyhemoglobin
- deoxyhemoglobin
- carbaminohemoglobin

- RBCs have no nuclei as they are lost during the process of formation.
- These cells are highly flexible (deformable) so they can pass through the irregular and smallest capillaries.
- RBCs have a short life span of only 100-120 days in the circulation, with aging RBCs become less deformable until they cannot pass through the splenic microcirculation and so they will be removed by phagocytosis.

The extracellular surface of the RBC plasmalemma have specific inherited antigens, and thus determine the blood group. The most notable of these are the A and B antigens, which determine the 4 blood groups, A, B, AB, and O.

#### ABO blood group





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# Disorders Involving Red Blood Cells

#### Anemia

Iron-deficiency anemia pernicious anemia Folic-acid-deficiency anemia Autoimmune hemolytic anemia Sick.le-cell anemia



**Iron-deficiency anemia (IDA)** can occur in children when they do not eat enough foods containing iron, which the body needs to make red blood cells (RBCs).

Fewer RBCs result in less oxygen for the body and may cause symptoms such as:

- Paleness or tiredness
- Irritability
- Shortness of breath
- Rapid heart rate
- Dizziness

IDA symptoms may not be obvious, so children should be screened using a finger prick or blood draw test.

Picky eating habits, too much cow's milk, or starting to drink cow's milk when younger than 1 year can increase the risk of IDA.

#### Iron-rich foods in a child's diet can help prevent IDA.

Meat, poultry, and fish



Fortified grain products

Dark-green leafy vegetables

Chickpeas, lentils, and white beans

L. Kethu



Citrus fruits and certain vegetables containing vitamin C help the body absorb iron from other foods

Iron supplements can be prescribed when a child still needs more iron.

# Complete Blood Count (CBC) Test

- A complete blood count (CBC) is a test that counts the cells that make up the blood: red blood cells, white blood cells, and platelets.
- It is done as a routine checkup or to:
- **1**. Check for anemia.
- 2. to explain symptoms like weakness, fever, bruising, or feeling tired.
- 3. See how medications, medical conditions, or treatments like chemotherapy are affecting the blood.

- What Does a CBC Measure?
- 1. White blood cells (WBCs).
- 2. Red blood cells (RBC).
- 3. Hemoglobin (Hb or Hgb).
- 4. Hematocrit (Hct). This test tells how much of the blood is made up of red blood cells. A low score may be a sign that there is no enough iron. A high score could mean dehydration or have another condition.
- 5. Mean corpuscular volume (MCV). This is the average size of the red blood cells.
- **6.** Platelets.

#### Complete Blood Cell Count (CBC) Example

Component	Patient Values	Reference Range
WBC Count	6500 /mm³	4000 -10000/mm <sup>3</sup>
Red Blood Cell Count	4.7 x 10 %mm³	3.9 – 5.20 x 10 <sup>6</sup> /mm <sup>3</sup>
Hemoglobin	15 g/dL	14 – 17 g/dL
Hematocrit	45%	41 – 51 %
Mean Cell Volume (MCV) ( <i>rbc size</i> )	85 fL	81-89 fL
Platelet Count	225,000/mm3	150,000 - 350,000/mm3
WBC Differential Count	60% Neutrophils, 5 % Bands, 2% Eosinophils, 1% Basophils, 25 % Lymphocytes, 7% Monocytes	50 - 70% Neutrophils 2 - 6% Bands 20 - 40% Lymphs 2 - 8% Monocytes 0 - 1% Basophils 1 - 3% Eosinophils



- Those are spherical cells that circulate in the blood until they migrate to the tissues.
- According to the presence or absence of granules in their cytoplasm & according to the shape of the nucleus, the WBCs are classified into two groups:
  - <u>*Granulocytes:*</u> (polymorphonuclear leukocytes)
  - <u>Agranulocytes:</u> (mononuclear leukocytes)

•The no. of leukocytes (WBC) is much smaller than that of RBCs, in fact in a normal adult there are only between (6000-10,000) WBCs per µL of blood.







Basophilic granulocyte



Eosinophilic granulocyte



Lymphocyte





# "Never Let Monkeys Eat Banana" (60,30,6,3,1)

@medicalgeeks

Neutrophils - 60% Lymphocytes - 30% Monocytes - 6% Eosinophils - 3% Basophils - 1%

# Thank You & Good Luck