

VISWASS SCHOOL & COLLEGE OF NURSING

GNM 1ST YEAR

ANATOMY AND PHYSIOLOGY

UNIT-3

BLOOD

LONG QUESTION AND ANSWER

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1.a)What is blood? (2+5+8)

b)Write down the composition of blood?

c)Describe blood grouping and cross matching?

a)blood:

- Blood is a fluid connective tissue.
- It circulates constantly around the body, propelled by the pumping action of the heart. It transports:
 - Oxygen
 - Nutrients
 - Hormones
 - Heat
 - Antibodies and cells of the immune system
 - Clotting factors
 - Wastes
- Blood is composed of a clear, straw coloured, watery fluid called plasma, in which several different types of blood cell are suspended.
- Plasma normally constitutes 55% of the volume of blood and the cell fraction 45%.
- Blood cells and plasma can be separated by centrifugation(spining) or by simple gravity when blood is allowed to stand.

- Blood makes up about 7% of body weight.(about 5.6 litres in a 70 kg man)
- This proportion is less in women and considerably greater in children, gradually decreasing until the adult level is reached.
- The total blood volume in adult is about 80ml/kg body weight in male and 70ml/kg in females.
- The continual blood flow is maintains a fairly constant environment for body cells.
- Blood volume and the concentration of blood constituents are kept with in narrow limits by homeostatic mechanisms.
- Heat produced from metabolically active organs, such as working skeletal muscles and the liver, is distributed around the body by the bloodstream, maintaining core body temperature.

B)Composition of blood:

- **Blood** is a connective tissue that helps in the transportation of substances, protects against diseases and regulates the temperature of the body.
- It is red in colour due to a red pigment called **haemoglobin** present in its red cells. The components of Blood are Plasma, Red blood corpuscles (Red blood cells or RBCs), White blood corpuscles (White blood cells or WBCs) and platelets.
- Plasma is a liquid also known as the fluid matrix and consists of three types of cells that keep floating in it namely red blood cells, white blood cells, and platelets

Plasma

- The fluid or liquid part of blood is called plasma.
- It is a colourless liquid that contains 90% water, protein, and inorganic salts.
- It also contains some organic substances in dissolved forms like glucose, amino acids, fats, urea, hormones; enzymes, etc.
- It carries these dissolved substances from one part to another part in the body.
- The protein in plasma includes antibodies to assist in the body's defence system against disease and infection.

Red Blood Corpuscles (RBC)

- RBC is also known as erythrocytes.
- They are disc-shaped cells concave in the middle and visible under a microscope.
- RBC carries oxygen from the lungs to all the cells of the body.
- They have no nucleus and contain a pigment called haemoglobin which is made up of an iron-containing pigment known as haema and a protein called globin.
- RBCs are produced in the spleen and the bone marrow and live for about four months because they lack a nucleus.
- So, when we donate blood to save the life of a person, then the loss of blood from our body is recovered within a day because red blood cells are made very fast in the bone marrow.
- The life of the RBC is about 100-120 days.

Functions:

- Haemoglobin in RBC picks up oxygen in the lung tissues by forming a chemical compound with it.
- This oxygen is carried to the tissues where it is used in the chemical reactions to produce energy.
- It then combines with carbon dioxide which is produced in these reactions and returns to the lungs with the heart where the cycle starts again.

White Blood Corpuscles (WBC):

- WBC is also known as leukocytes.
- They fight with infection and protect us from diseases because they eat up the germs which cause diseases.
- That is why they are also known as ‘soldiers’ of the body’s defence system.
- They are round or irregular, semi-transparent cells containing a nucleus and visible under a microscope.
- They are a little larger than RBC. Some White blood cells make chemicals called ‘antibodies’ to fight against infection i.e why they provide immunity in our body.
- WBC in the blood is much smaller in number than red blood cells.

Functions

- Broadly, WBC acts as a defence system in the body.
- There are several varieties of WBC performing specific functions such as, Neutrophils (65 to 70% of the total WBC) attack the invading bacteria and engulf them. Lymphocytes (25% of WBC) produces antibodies which protect the body against antigen and thus provide immunity against infection.
- Basophils secrete anticoagulant called heparin which prevents clot within the blood cells.
- Eosinophils and monocytes also assist in defence mechanism of the body by becoming active against specific antigens.

Blood platelets

- Blood Platelets are also known as thrombocytes.
- They are tiny, circular or oval colourless cells formed in the bone marrow.
- They lack a nucleus and help in the coagulation of blood (clotting of blood) in a cut or wound, due to which bleeding stops.
- All the blood cells are made in the bone marrow from the cells called stem cells.
- Blood clotting is a body's defence system to combat bleeding.
- Plasma contains soluble protein fibrinogen of the blood which produces the insoluble protein called fibrin essential for blood coagulation which is formed in the liver.

C)Blood grouping and cross matching:

Blood grouping:

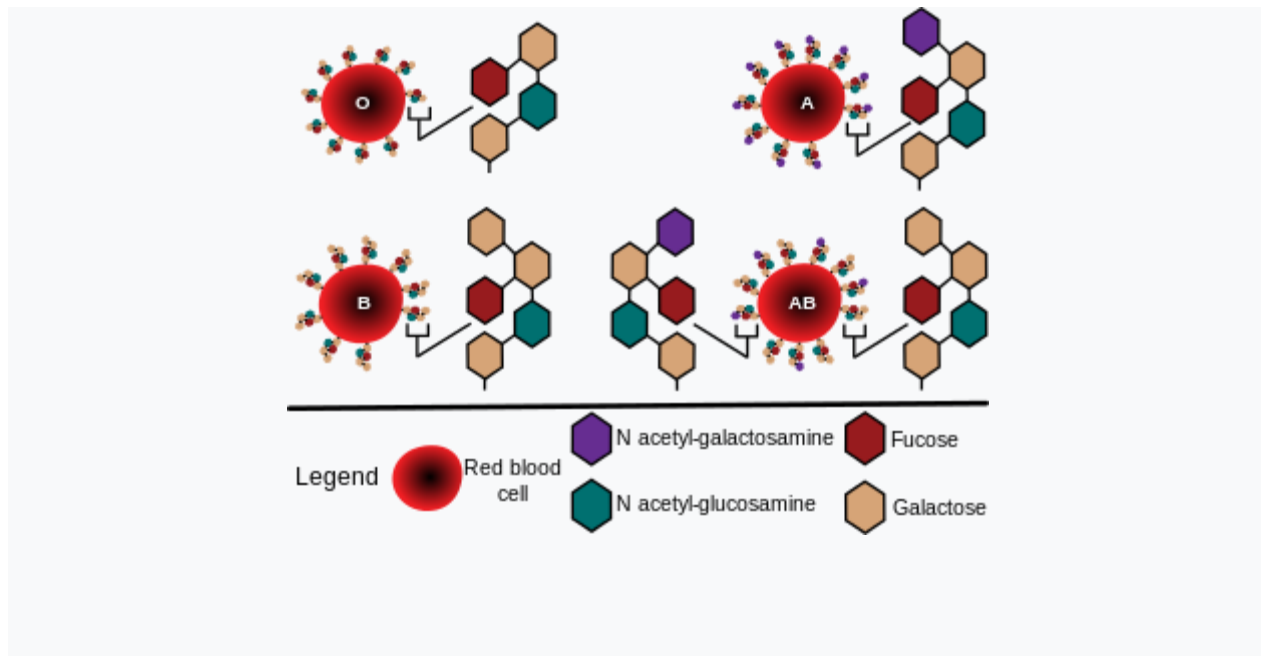
- A **blood type** (also called a **blood group**) is a classification of blood, based on the presence and absence of antibodies and inherited antigenic substances on the surface of red blood cells (RBCs).
- These antigens may be proteins, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system. Some of these antigens are also present on the surface of other types of cells of various tissues.
- Several of these red blood cell surface antigens can stem from one allele (or an alternative version of a gene) and collectively form a blood group system.

- Blood types are inherited and represent contributions from both parents.
- A total of 36 human blood group systems and 346 antigens are now recognized by the International Society of Blood Transfusion (ISBT).
- The two most important blood group systems are ABO and Rh; they determine someone's blood type (A, B, AB, and O, with +, – or null denoting RhD status) for suitability in blood transfusion.

Blood group systems

- A complete blood type would describe a full set of 30 substances on the surface of red blood cells, and an individual's blood type is one of many possible combinations of blood-group antigens.
- Across the 36 blood group systems, 308 different blood-group antigens have been found.
- Almost always, an individual has the same blood group for life, but very rarely an individual's blood type changes through addition or suppression of an antigen in infection, malignancy, or autoimmune disease.
- Another more common cause of blood type change is a bone marrow transplant. Bone-marrow transplants are performed for many leukemias and lymphomas, among other diseases.
- If a person receives bone marrow from someone who is a different ABO type (e.g., a type A patient receives a type O bone marrow), the patient's blood type will eventually convert to the donor's type.
- Some blood types are associated with inheritance of other diseases.
- Certain blood types may affect susceptibility to infections, an example being the resistance to specific malaria species seen in individuals lacking the Duffy antigen.
- The Duffy antigen, presumably as a result of natural selection, is less common in population groups from areas having a high incidence of malaria.

ABO blood group system



- The ABO blood group system involves two antigens and two antibodies found in human blood.
- The two antigens are antigen A and antigen B.
- The two antibodies are antibody A and antibody B. The antigens are present on the red blood cells and the antibodies in the serum.
- Regarding the antigen property of the blood all human beings can be classified into 4 groups, those with antigen A (group A), those with antigen B (group B), those with both antigen A and B (group AB) and those with neither antigen (group O).
- The antibodies present together with the antigens are found as follows:
 1. Antigen A with antibody B
 2. Antigen B with antibody A
 3. Antigen AB has no antibodies
 4. Antigen nil (group O) with antibody A and B.
- There is an agglutination reaction between similar antigen and antibody

- (for example, antigen A agglutinates the antibody A and antigen B agglutinates the antibody B). Thus, transfusion can be considered safe as long as the serum of the recipient does not contain antibodies for the blood cell antigens of the donor.
- The ABO system is the most important blood-group system in human-blood transfusion. The associated anti-A and anti-B antibodies are usually immunoglobulin M, abbreviated IgM, antibodies.
- It has been hypothesized that ABO IgM antibodies are produced in the first years of life by sensitization to environmental substances such as food, bacteria, and viruses, although blood group compatibility rules are applied to newborn and infants as a matter of practice.

Rh blood group system

- The Rh system (Rh meaning Rhesus) is the second most significant blood-group system in human-blood transfusion with currently 50 antigens.
- The most significant Rh antigen is the D antigen, because it is the most likely to provoke an immune system response of the five main Rh antigens.
- It is common for D-negative individuals not to have any anti-D IgG or IgM antibodies, because anti-D antibodies are not usually produced by sensitization against environmental substances.
- However, D-negative individuals can produce IgG anti-D antibodies following a sensitizing event: possibly a fetomaternal transfusion of blood from a fetus in pregnancy or occasionally a blood transfusion with D positive RBCs.

Cross matching:

- **Crossmatching** is a way for your healthcare provider to test your **blood** against a donor's **blood** to make sure they are fully compatible.
- **Crossmatching** takes 45 minutes to an hour. It's essentially a trial transfusion done in test tubes to see exactly how your **blood** will react with potential donor **blood**
- Blood typing is the first step. This test finds out whether you have blood type A, AB, B, or O. Your blood is also tested to find out whether your Rh type is negative or positive.

- An intermediate step between blood typing and crossmatching is called a recipient antibody screen.
- This test checks for unexpected antibodies in your blood. If unexpected antibodies are found, this can delay the selection of compatible donor blood.
- Crossmatching takes 45 minutes to an hour.
- It's essentially a trial transfusion done in test tubes to see exactly how your blood will react with potential donor blood.
- It's important for donor blood to match your own as closely as possible.
- Otherwise, your immune system might create antibodies against the donor blood cells.
- In this case, your immune system correctly views the donor cells as foreign, but incorrectly views them harmful.
- This can lead to a dangerous and possibly fatal reaction.

Blood Typing Chart

Blood Type	Antigen	Antibody	Receive from	Donate to
A	A	Anti – B	A, O	A, AB
B	B	Anti – A	B, O	B, AB
AB	A, B	None	A, B, AB, O	AB
O	None	Anti – A Anti – B	O	A, B, AB, O

