CHAPTER- 8 CIRCULATORY SYSTEM

Good morning students
The following lesson is of Class 9 for the subject of Biology; Topic - Cellular elements of blood which is covered in Chapter 8 titled Circulatory System starting on Page no 90 of your text book titled Concise Biology - Selina Publications and is being submitted to you on 18.11.2024
This voice is of Nidhi Rana.
So dear children, please open your book at Page No 90 and pay attention as I am going to explain you the various cellular components of blood As we learnt in the last class that the cellular elements of blood are of 3 types - Erythrocytes, Leukocytes & Thrombocytes So today we will discuss these cellular elements in detail Let us first start with erythrocytes

Erythrocytes or Red Blood Cells. RBCs

Erythrocytes are minute biconcave, disc like structures having no nucleus in them. Lack of nucleus makes them flat in the centre and thick and rounded at the periphery Further these erythrocytes are very small about 7 microns in diameter For your information children 1 micron is one thousandth of a milimeter
Thus children the small size plus the biconcave shape provide a large surface area to erythrocytes which makes them very efficient in absorbing oxygen

About 3 million RBCs are destroyed each day and about 4 times of this number are formed everyday. Mammalian RBCs are devoid of certain organelles which makes them more efficient in carrying out their task of picking up and delivering oxygen The factors making them more efficient in this work are as follows -

i Loss of Nucleus - makes the RBCs biconcave, thus increasing their surface area to volume ratio for more oxygen absorption. Loss of nucleus gives RBCs the biconcave shape, because of which spaces in between the cells are increased, hence more RBCs can be accomodated in the same space Further More RBCs means more absorption of oxygen.

ii Loss of Mitochondria means the RBCs can not use oxygen for themselves for carring out cellular respiration occuring in mitochondria of cells. Thus all oxygen, absorbed by RBCs is transported and delivered to the tissues unconsumed. without any loss. Secondly lack of mitochondria means full transport of glucose in blood plasma, unused by the RBCs.

iii Loss of Endoplasmic Reticulum. enable the RBCs to be more flexible for its movement in narrow capillaries.

Now before going further, let us recapitulate quickly about the RBCs by means of a short test.

Listen to the following questions carefully and then pause the audio for 3 minutes to write their answers in your notebooks -

Q1 What is the shape of Erythrocytes ?

Q2 Name the compound formed when haemoglobin combines with carbon monoxide

Q3 Name the 3 organelles which the mammalian RBCs are devoid of.

Children you may pause the audio for 3 minutes 3 minutes break is over children First listen to the answers of the questions being asked to you

A1 Erythrocytes have biconcave shape

A2 Carboxyhaemoglobin is formed when haemoglobin combines with carbon-monoxide

A3 RBCs are devoid of -
Nucleus, Mitochondria and Endoplasmic reticulum

Now Let us continue further with the discussion of Leukocytes or White blood cells.

Leukocytes differ from erythrocytes in having a nucleus and not having haemoglobin WBCs are fewer in number than the RBCs They are larger than RBCs in size & posses the power of amoeboid movement. Children you may please see Fig 8.3 showing the WBCs producing pseudopodia with which they squeeze through the walls of the capillaries into the tissues Thus process of oozing out of the WBCs from blood capillaries by producing pseudopodia is called diapedesis

DIAPEDESIS

Based on shape and other characteristics the WBCs are of different types. Children please look at Table 8.1 on Page No 95 as I explain you the different types of WBCs.

WBCs are of 5 distinct types which are classified into two major categories based on the presence or absence of granules in the cytoplasm. as -

i Granulocytes:- are the WBCs in which cytoplasm contains granules. Also the nucleus of granulocytes is usually constricted into lobes Granulocytes are produced in bone marrow. Granulocytes are of 3 types.

a) Neutrophils:- have a nucleus with 3-4 lobes and get stained with neutral dyes They protect the body from microbial invasion by engulfing the microbes The process of engulfing (taking in/eating) the microorganisms is called Phagocyotsis

b) Eosinophils: have bilobed nucleus i.e. with 2 lobes where each lobe is connected by a thin strand. Eosinophils get stained with acid dyes (For eg eosin) Increase in the number of eosinophils in blood indicates allergies. in the body. Eosinophil also engulf bacteria and secrete antitoxins, protecting the body from infections.

c) Basophils: have large nucleus which is indistinctly lobed. and has affinity for basic dyes and thus get stained with basic dyes (eg methylene blue) It produces a chemical histamine which dilates blood vessels making their wall leaky for leukocytes to fight germs

They also produce heparin which prevents clotting of blood in the blood vessels.

Now let us talk about agranulocytes

ii Agranulocytes are the WBCs whose cytoplasm lacks granules Agranulocytes possess a single large nucleus and are produced in bone marrow and lymph glands Agranulocytes are of two types

a) Lymphocytes are smallest of all WBCs They produce antibodies and provide immunity to the body against disease causing germs.

b) Monocytes are largest of all WBCs They have large kidney shaped nucleus They ingest microbes and other foreign bodies Thus provide protection to the Body.

All children may please learn this Table 8.1 given on Pg 95 of your text book

To add to your information children - WBCs have an average life of about 2 weeks The neutrophils live for only a few hours and about 125 billion neutrophils are produced each day. Old and worn out WBCs are destroyed in spleen, liver and bone marrow.

Leukemia is a type of blood cancer, where the number of WBCs increase manifold at the cost of RBCs It is a fatal disease and the only treatment is blood transfusion

Leukopenia is an abnormal decrease in the number of WBCs.

Break is over First listen to the correct answers.

A1 Ribosomes are the site of protein synthesis

A2 Mitochondria are called the Power house of the cell

A3 Lysosomes are called the suicidal bags.

Now let us resume with the discussion of cell organelles Next organelle is -

6. Centrosome and centrioles These are present in animal cell only. Centrosome is a small structure situated close to the nucleus It is the area in which short bundles of microfilaments, called the centrioles, are arranged at right angles to each other. function During cell division the centrioles develop a number of radiating threads or rays - called spindle fibres. thus, they initiate and regulate cell division.

7 Plastids. are present only in Plant cell. and are the largest cytoplasmic organelle ... readily visible under a light microscope. On the basis of pigments present in plastids plastids are of 3 types -

i Leucoplast - Leucoplasts are colourless plastids They have no pigments. They store starch For eg - Cells of potato have lots of leucoplasts in them.

ii Chromoplasts. These are variously coloured plastids - yellow, orange, red etc. They are mostly present in petals of flowers, and in fruits Colouring pigments associated with plastids

Now it is the break time children. Answer the following questions during the break -

Q1 Name the phenomenon by which WBCs squeeze out of the walls of capillaries.

Q2. Name the 3 types of granulocytes

Q3 Name the leukocyte with kidney shaped nucleus.

Children you may now pause the audio for 3 minutes now and write down the answers to the above questions in the notebooks.

Break is over. Welcome back children listen to the correct answers of the questions asked to you.

A1 Diapedesis is the phenomenon by which WBCs squeeze out of the walls of capillaries

A2 3 types of granulocytes are - Neutrophils, Eosinophils and Basophils

A3 Lymphocytes have kidney shaped nucleus.

Now let us resume the discussion with 3rd type of blood cells i.e. Thrombocytes

Thrombocytes or Blood Platelets are minute oval or round structures, non nucleated, floating in the blood. and have a very short life span of 3-5 days They are destroyed mainly in spleen and are derived from some cells in red bone marrow. They help in clotting of blood.

Blood coagulation or clotting of blood.

When a blood vessel is cut, blood escapes from it. But soon a clot is formed on the cut and flow of blood is stopped, otherwise the injured person would bleed to death due to loss of blood. Blood clotting or coagulation involves a series of steps as follows -

1) The injured tissue cells and the platelets which disintegrate at the site of wound release a substance Thrombokinase or Thromboplastin
2) Thrombokinase acts as an enzyme and with help of Ca^{2+} ions present in the plasma, it converts a substance prothrombin of the plasma into thrombin Prothrombin is inactive plasma protein which is converted to active thrombin. Also Vitamin K is essential for production of prothrombin.
3) Thrombin in presence of Calcium ions reacts with the soluble fibrinogen of the plasma to convert it into insoluble fibrin. Fibrin is a solid substance that forms threads These microscopic threads of fibrin are sticky and form network at the wound.
4) The blood cells get trapped in the network of the fibrin The network then shrinks and squeezes out the rest of the plasma which is in the form of a clear liquid - the serum. Serum is thus the blood plasma from which fibrinogen is removed.

The solid mass which is left behind is called clot or thrombus. It is a wrong notion that clotting is dependent on the exposure of blood to air. In fact, clotting can be caused by the movement of blood over a rough surface as on cholesterol deposit on the inside of a blood vessel.

Haemophilia is a genetic disorder in which blood of a haemophilic person clots very slowly or does not clot at all. There are two reasons why this happens. Either the haemophilic person has too few platelets or the platelets can not produce the chemical which causes fibrinogen to change to fibrin. Number of platelets falls to an abnormally low count in the viral dengue fever.

Students, this finishes with the topic - Cellular elements of blood. Hope you have all understood the different types of blood cells and their characteristics. Now all students are required to answer the following home assignment questions in the notebooks.

Home assignment questions are as follows -

Q1 Draw various types of blood cells (Fig 8.2 of text book) in your note books.

Q2 Define - Diapedesis and Phagocytosis

Q3 Learn and write Table 8.1 - Different types of WBCs in your note book