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Paper – IV - A

The Circulatory System : (Vertebrates)

Introduction

In most animals, the circulatory system is used to transport blood through the body. Some primitive animals use diffusion for the exchange of water, nutrients, and gases. However, complex organisms use the circulatory system to carry gases, nutrients, and waste through the body. Circulatory systems may be open (mixed with the interstitial fluid) or closed (separated from the interstitial fluid). **Closed circulatory systems are a characteristic of vertebrates;** however, there are significant differences in the structure of the heart and the circulation of blood between the different vertebrate groups due to adaptations during evolution and associated differences in anatomy. Fish have a two-chambered heart with unidirectional circulation. Amphibians have a three-chambered heart, which has some mixing of the blood, and they have double circulation. Most non-avian reptiles have a three-chambered heart, but have little mixing of the blood; they have double circulation. Mammals and birds have a four-chambered heart with no mixing of the blood and double circulation.

Vertebrates have the most highly evolved circulatory system in the animal kingdom.

The **circulatory system** is a network consisting of blood, blood vessels, and the heart. This network supplies tissues in the body with oxygen and other nutrients, transports hormones, and removes unnecessary waste products.

The circulatory system varies from simple systems in invertebrates to more complex systems in vertebrates.

Open and Closed Circulatory Systems

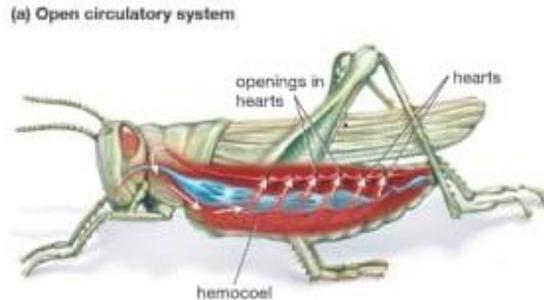
The circulatory system can either be open or closed, depending on whether the blood flows freely in a cavity or is contained in vessels.

Types of circulatory systems

- 1) **Open:** In an open circulatory system, the blood is not enclosed in the blood vessels, but is pumped into a cavity called a hemocoel. The blood is called hemolymph.
- 2) **Closed:** In a closed circulatory system, blood is contained inside blood vessels, circulating unidirectionally (in one direction) from the heart around the systemic circulatory route, then returning to the heart again.

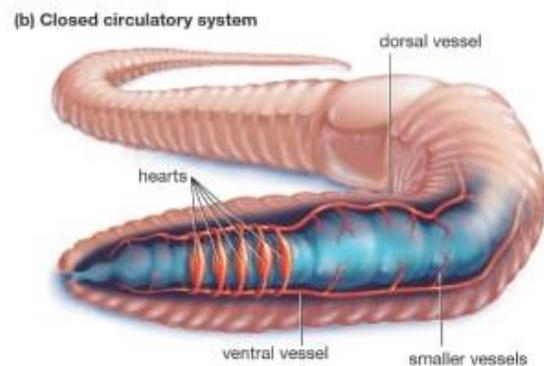
Open system

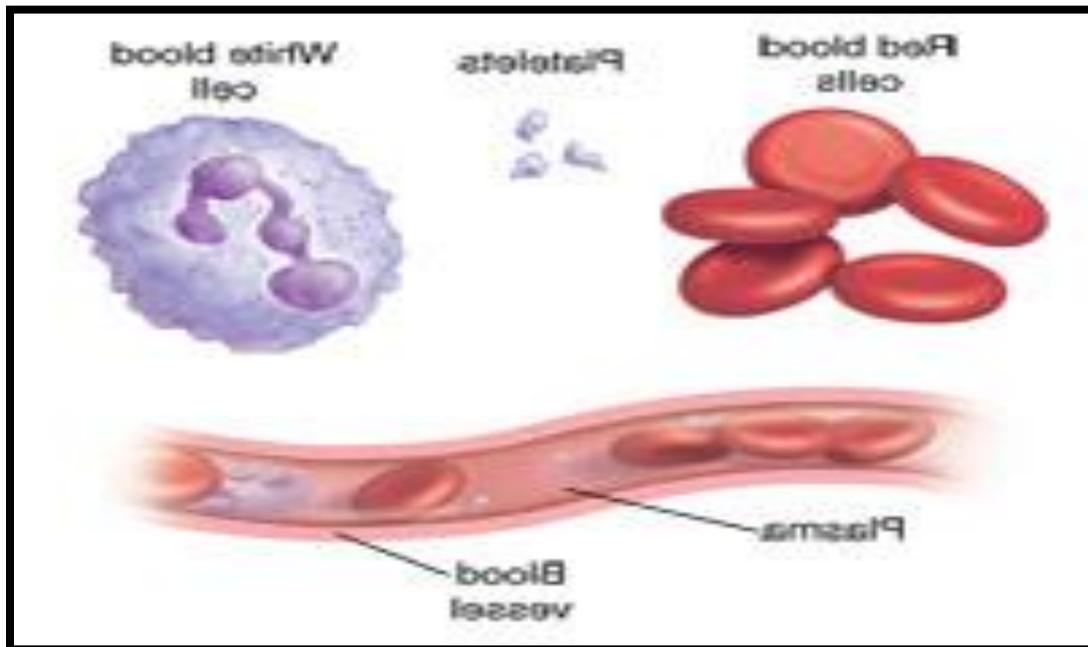
- Arthropods and most mollusks have an open circulatory system.
- Hemolymph is contained in a body cavity, the hemocoel. A series of hearts circulates the fluid.



Closed system

- Vertebrates, annelid worms, and a few mollusks have a closed circulatory system.
- Blood is moved through blood vessels by the heart's action. It does not come in direct contact with body organs.





Blood in Vertebrates :

Blood is a special fluid in humans and other animals that delivers the essential materials for life to the body's cells. that is actually a **liquid connective tissue**.

We can call it a transport liquid which is pumped by the heart to different parts of the body, after which it comes back again to the heart. This is a process that happens continuously in your body, till your heart beats. The cells of the body are highly susceptible and they need a constant supply of blood. If its flow stops, death can occur within minutes. In humans, the role of blood is very significant and it has a very complex working structure. Its circulation helps in **maintaining** its constancy in the composition. Circulation is a process through which blood travels all around the body, to different organs through specialized blood vessels.

The components of blood are produced mainly in the bone marrow, where special cells produce red cells, white cells, and platelets.

Blood is divided into two constituents :

- 1. Cellular composition**
- 2. Non- cellular composition**

The Blood cells and The Plasma (fluid matrix) Main

Components of Blood:

A. The Blood Cells. There are three main types

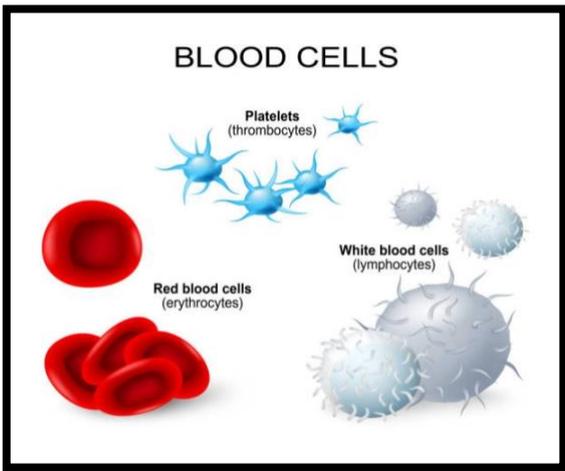
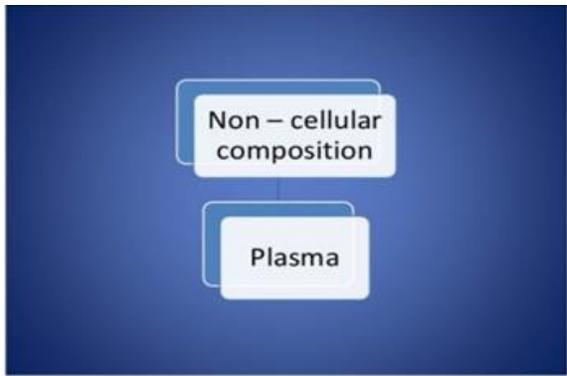
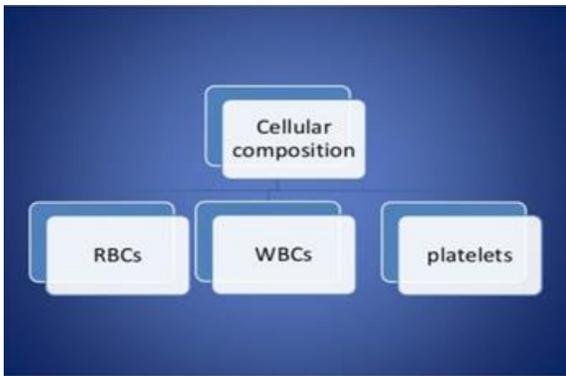
These constitute the other half, around 45%. There are three types of cells, namely:

- Erythrocytes or Red Blood cells (RBC)
- Leucocytes or White Blood Cells (WBC)
- Thrombocytes or Platelets

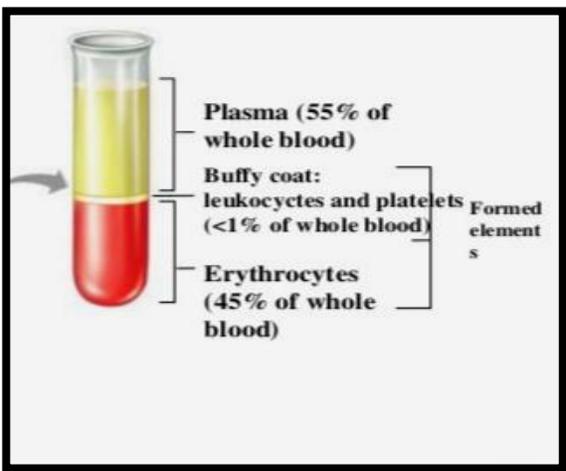
B. The Plasma

It is a clear, slightly sticky, yellowish coloured liquid that contains the dissolved proteins, mineral ions, glucose, hormones, carbon dioxide, including the blood cells. Around 90% of the plasma is made up of water and around 6 % of it constitutes the proteins. Albumin is the main protein in the plasma, which regulates the osmotic blood pressure. **55% of the blood fluid is made up of plasma.**

Blood is divided into two constituents,
1. cellular composition
2. non-cellular composition



A.



B.

Cont.....