

Function of Circulation

SBI 3U1

Mammalian Circulatory System

Mammals tend to have a complex body system with high energy demand.

Thus the circulatory system must:

- Take in a large quantity of O₂ quickly
- Remove CO₂ and other wastes quickly

Mammalian Circulatory System

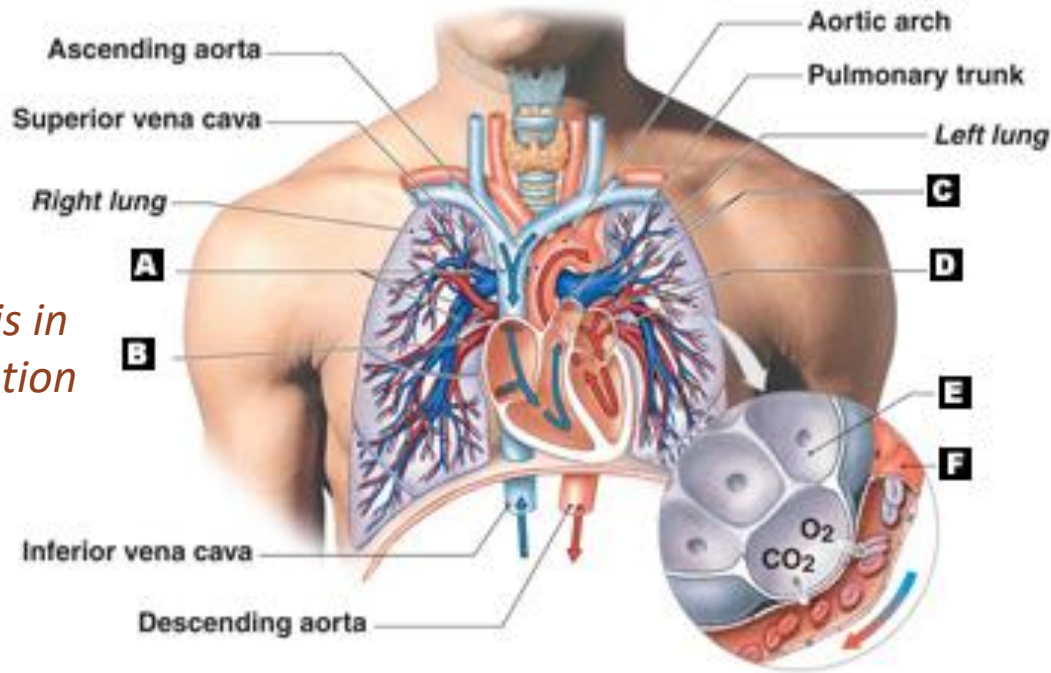
The mammalian circulatory system is subdivided into a double circulatory system:

- 1) **Pulmonary Circuit:** flow of blood between the heart and lungs.
- 2) **Systemic Circuit:** Flow of blood between heart and tissues

Pulmonary Circulation

Involves the movement of blood from *heart to lungs* (CO₂ blood).

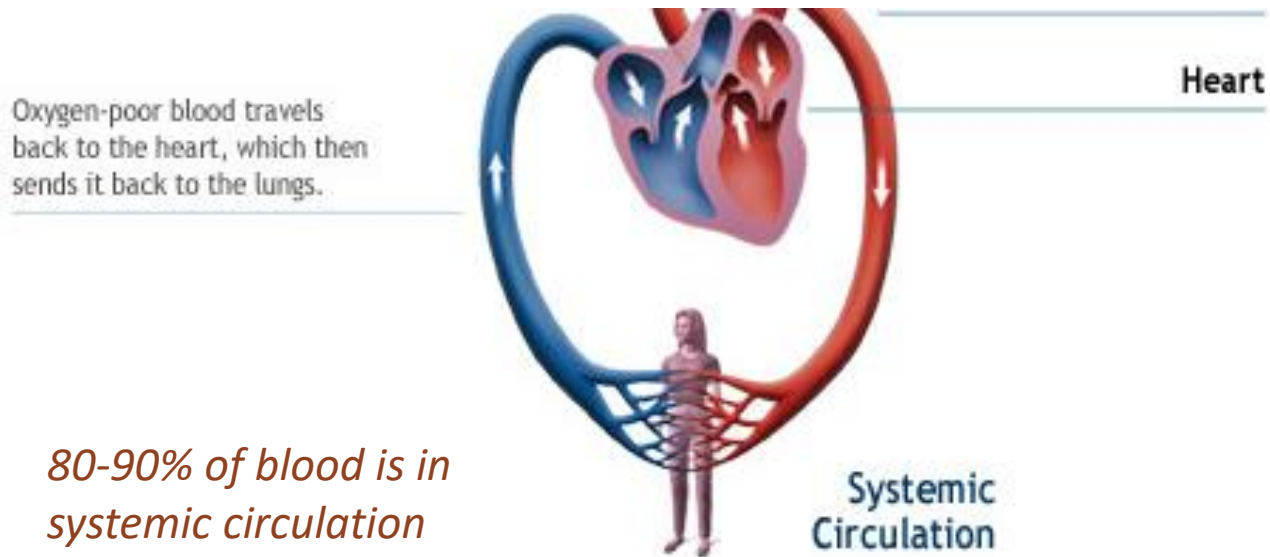
Also, involves movement of blood from the *lung to the heart* (O₂ rich blood).



10-20% of blood is in pulmonary circulation

Systemic Circulation

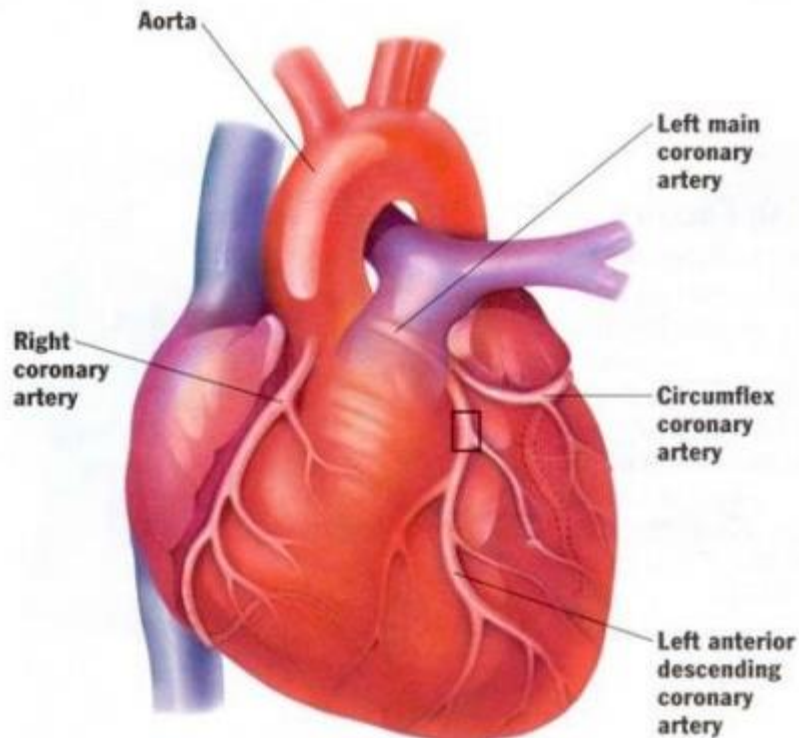
This circuit moves O₂ rich blood from the heart to other tissues and organs. The deO₂ blood is returned to the heart from the tissues.



Pulmonary Circulation

The remainder of the circulation must occur in the heart (*cardiac circulation*).

Cardiac Circulation: movement of blood through the heart tissues



The heart is surrounded by muscle tissue that must receive enough O_2 so that it can contract.

Components of Blood

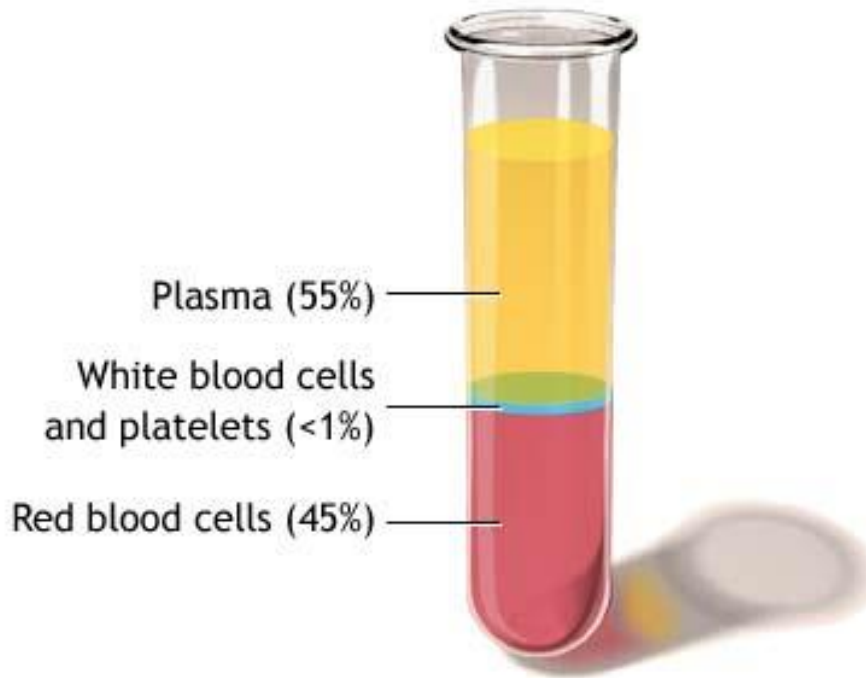
The average adult has approximately 5 L of blood in their circulatory system.

Plasma:

White Blood Cells:

Platelets:

Red Blood Cells:



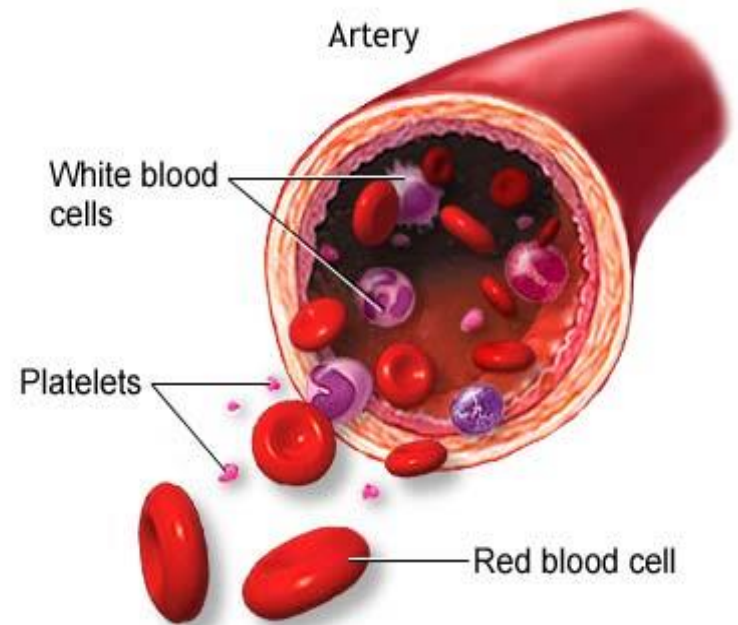
Components of Blood

Solid Portion: red blood cells, white blood cells, platelets

- *Makes up approximately 45% of the blood*

Liquid Portion: plasma – water, dissolved gases, proteins, sugars, vitamins, minerals waste products

- *Makes up approximately 55% of the blood.*



Function of Plasma

The plasma is a clear, yellowish fluid that is made up of water, proteins and salts.

Function of proteins in plasma (approx. 7 %):

- Maintains fluid balance in plasma, cells, and spaces between cells
- Maintains alkaline pH
- Fibrinogen helps clot blood
- Globulin (antibodies) for immunity

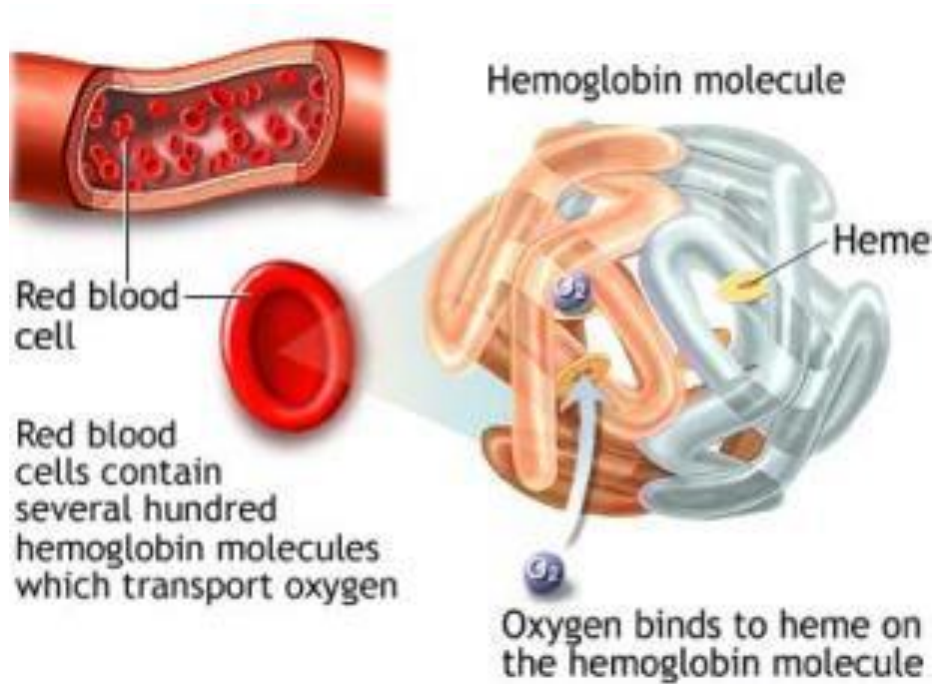
Function of Plasma

Function of salts in plasma (approx. 1 %):

- Salts consist of: *Bicarbonate, Ca, Cl, Mg, K, Na*
- Maintains fluid balance in plasma, cells, and spaces b/t cells
- Maintains alkaline pH
- Assist in nerve/muscle function

Function of Red Blood Cells

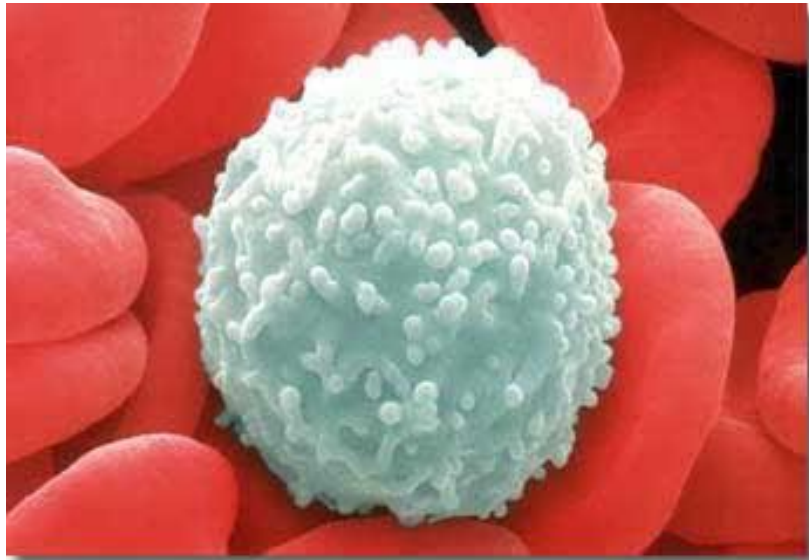
Red blood cells (RBC) are also known as erythrocytes and make up 44% of total volume of blood.



RBCs contain heme groups which hold an iron. The iron enables the hemoglobin to loosely hold onto O₂ or CO₂.

Function of White Blood Cells

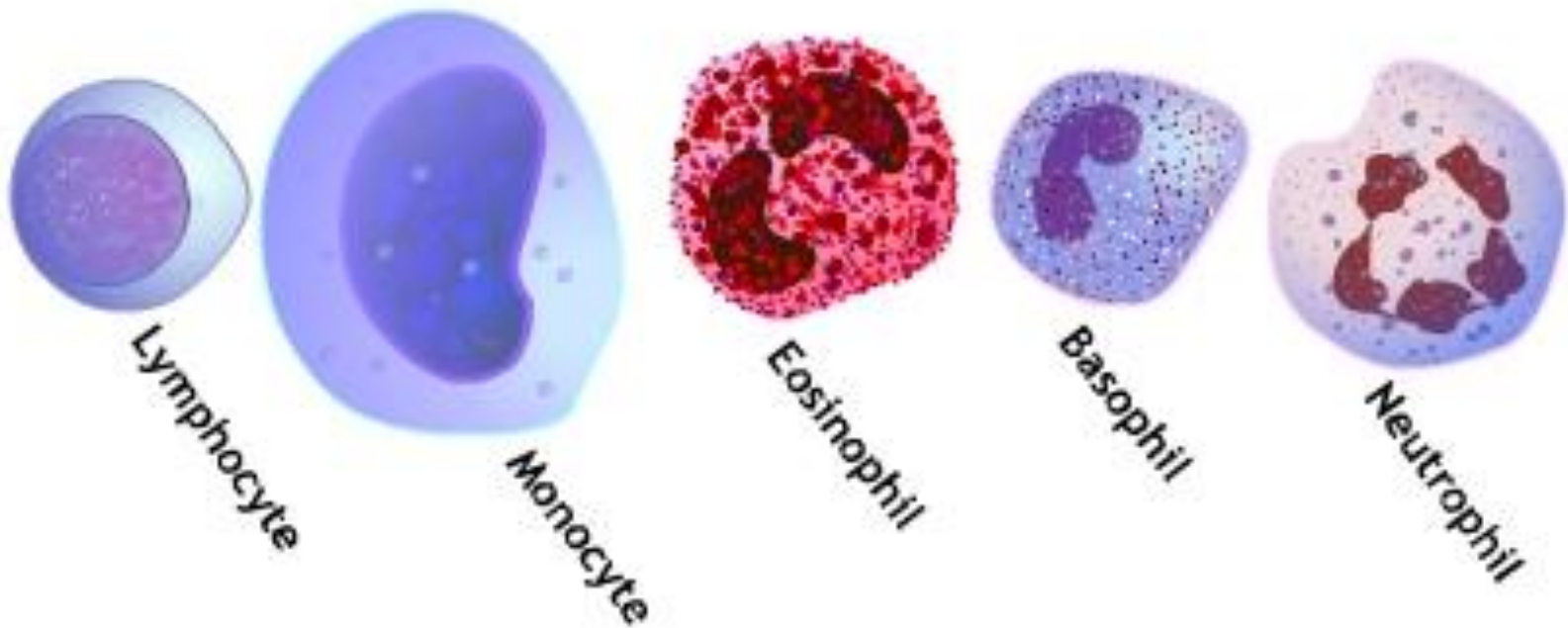
The white blood cells are part of the immune system and are also known as *leukocytes*. They help to fight off infection, and this will increase in number when there is a pathogen.



A White Blood Cell or Leukocyte

Function of White Blood Cells

There are five main types of leukocytes that all play a role in fighting off foreign pathogens.



Function of White Blood Cells

1. Neutrophil:

- Defence against bacteria (phagocytosis)
- Most abundant

2. Eosinophil:

- Kill parasites/allergic reactions
- Found in mucus lining of digestive/respiratory tracts

3. Basophil:

- Destroy pathogens
- Release histamine (allergic reactions)

Function of White Blood Cells

4. Lymphocyte:

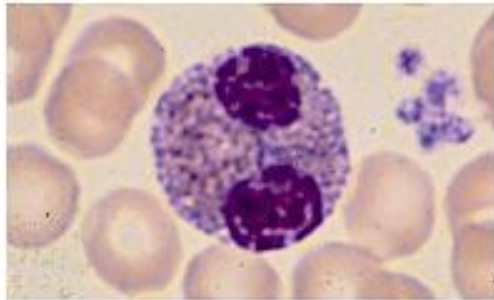
- Produce antibodies
- Neutralize bacteria and viruses

5. Monocyte:

- Become macrophages that destroy bacteria (phagocytosis)

grainy appearance of cytoplasm

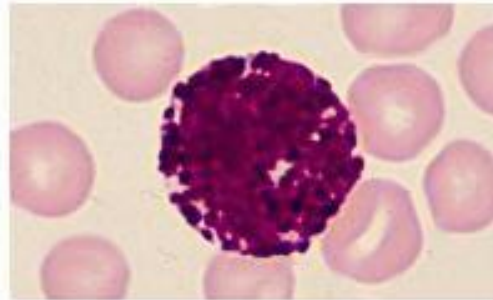
Granulocytes



Basophil 0.5–1%

LM

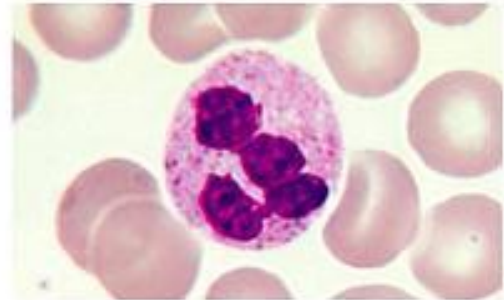
7.5 μ m



Eosinophil 2–4%

LM

7.5 μ m



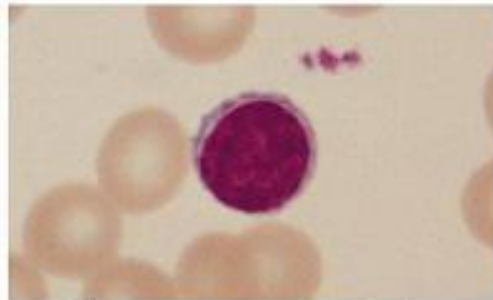
Neutrophil 60–70%

LM

7.5 μ m

(a)

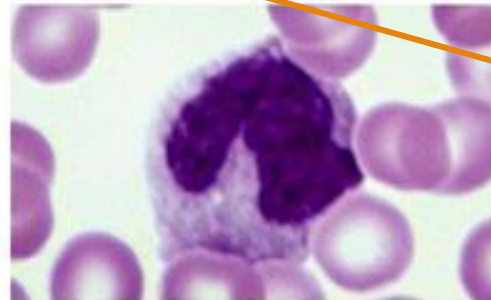
Agranulocytes



Lymphocyte 20–25%

LM

7.5 μ m



Monocyte 3–8%

LM

7.5 μ m

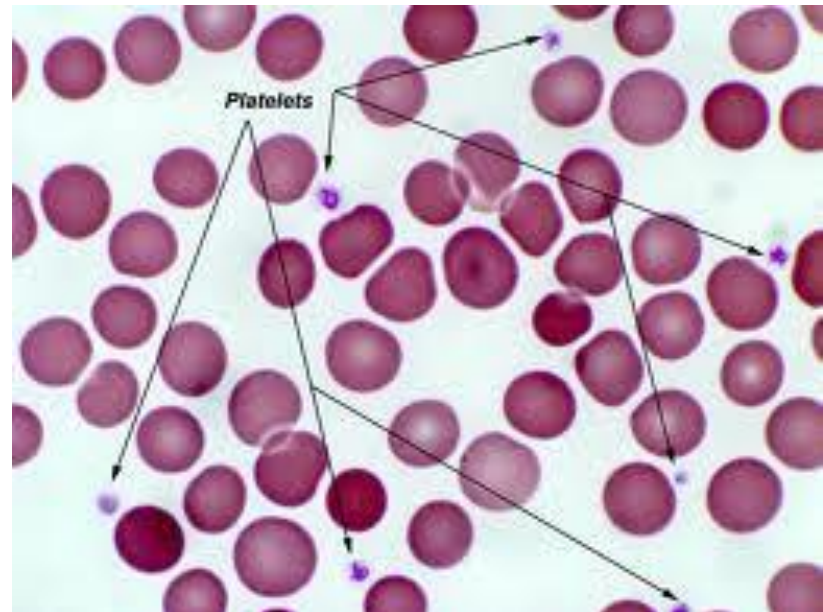
(b)

smooth appearance of cytoplasm

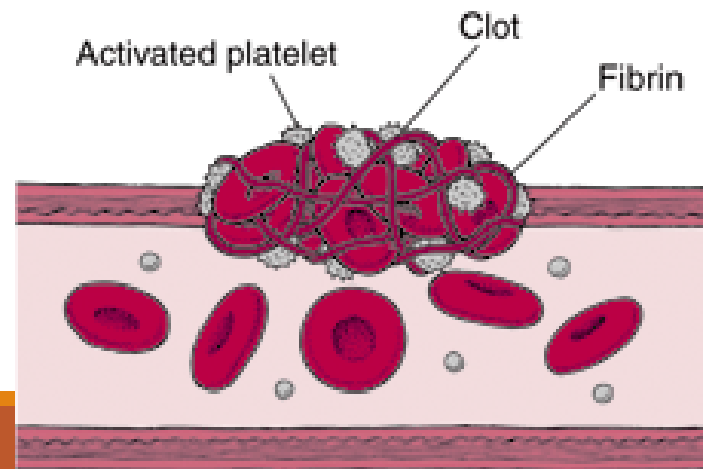
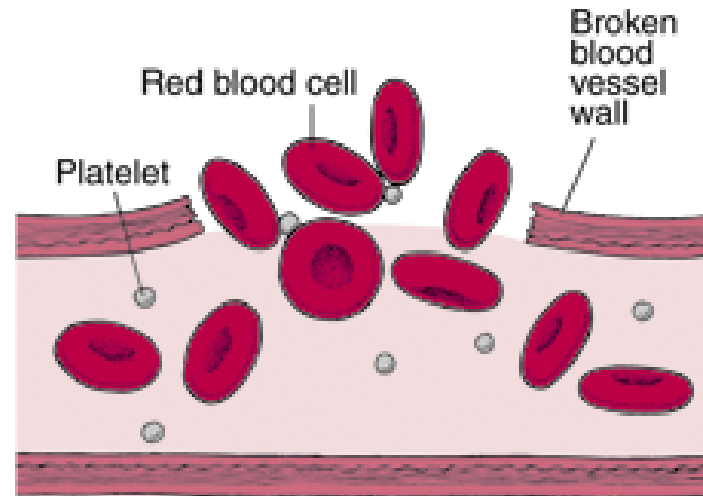
Function of Platelets

Platelets are found in the blood and they are also known as thrombocytes.

Membrane bound fragments of cells that are formed when cells in bone marrow break apart



Steps in Clotting Blood



Functions of Blood

The circulatory system, specifically the blood has two primary roles.

1. Transport
2. Temperature Regulation

Functions of Blood

Transport:

Blood capillaries line the walls of small intestine

- For absorption of nutrients

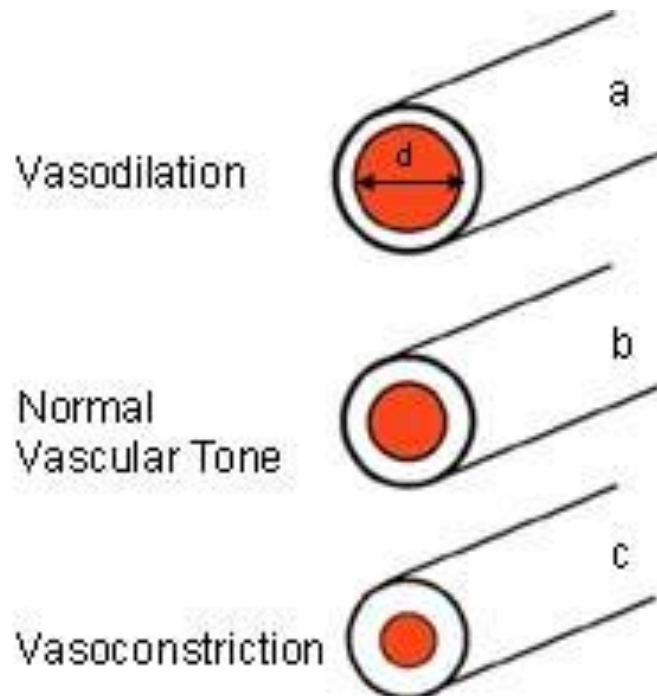
Blood capillaries surround alveoli in lungs

- For exchange of gas

Functions of Blood

Temperature Regulation:

The blood vessels help balance the loss of heat with the production of heat. This occurs by changing the volume of blood flowing near the body surface.



Functions of Blood

Temperature Regulation:

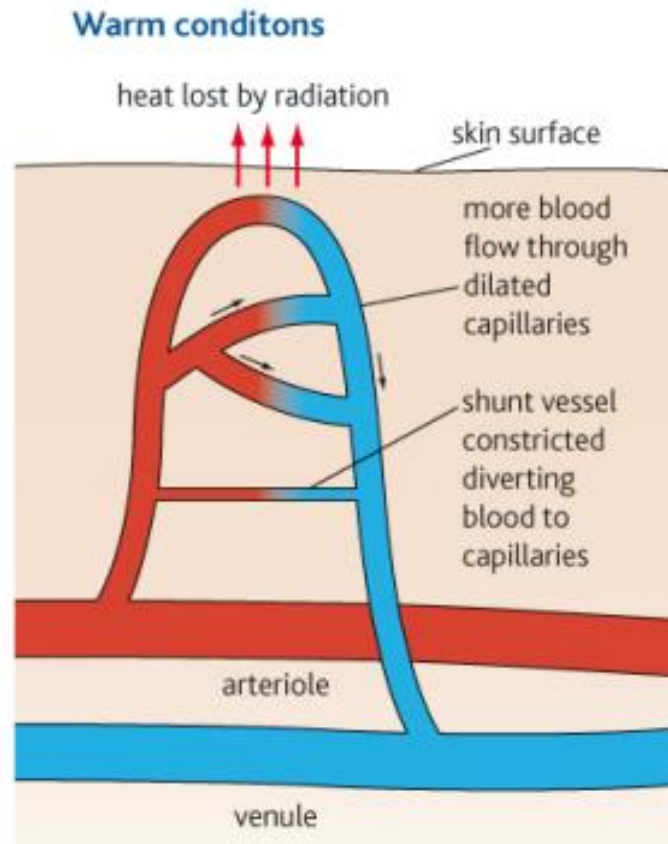
When it is hot outside:

- **Vasodilation:** widening of blood vessels. This helps the body reduce heat.

When it is cold outside:

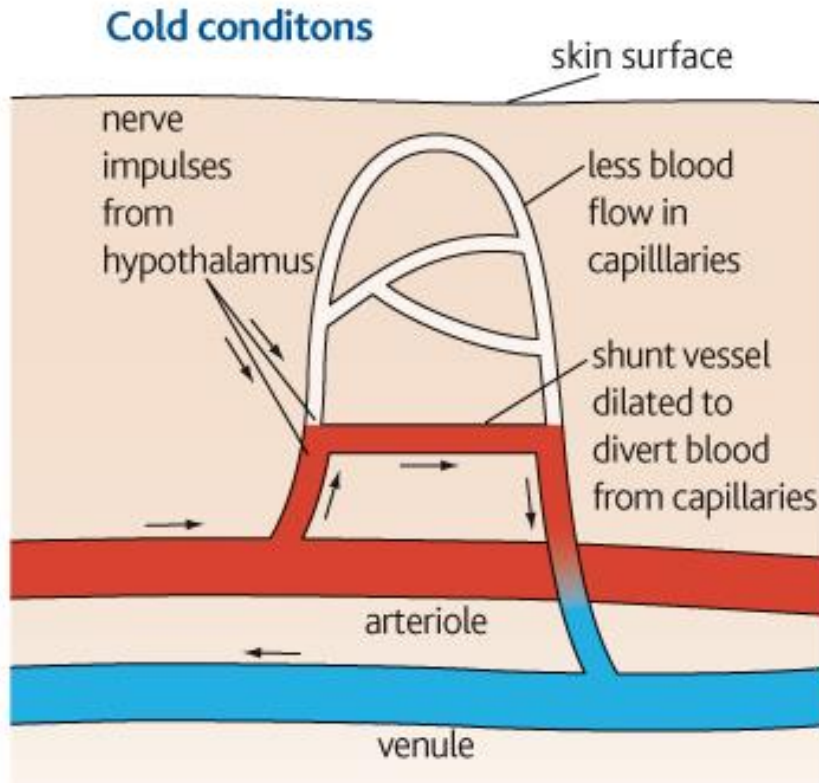
- **Vasoconstriction:** narrowing of blood vessels. This helps the body retain heat.

Functions of Blood



Vasodilation: the blood vessels widen to allow maximum blood flow to the surface of the skin and extremities.

Functions of Blood

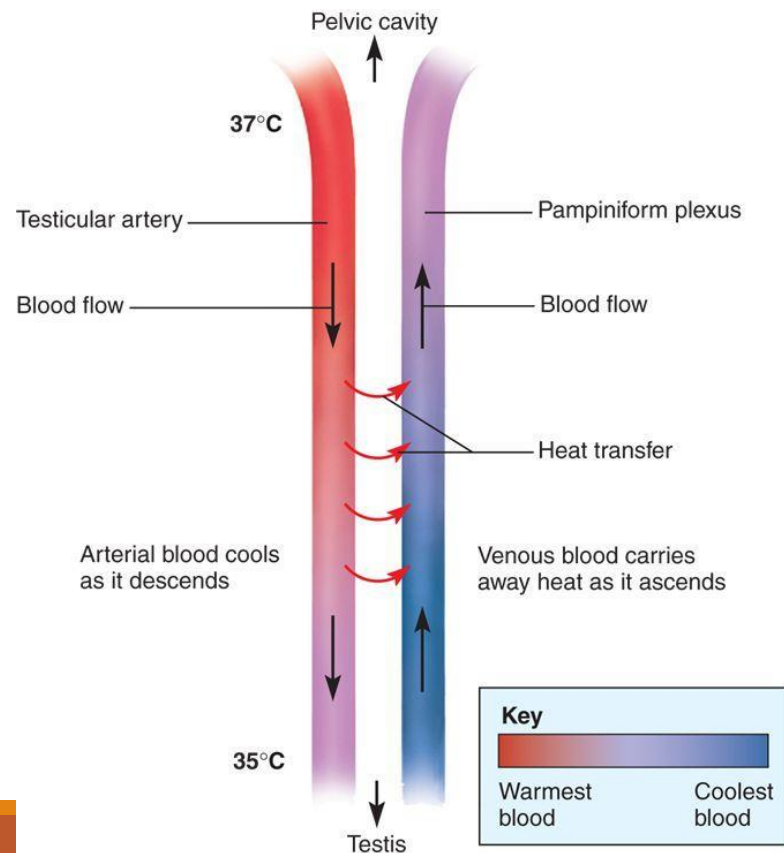


Vasoconstriction: the blood vessels become narrow to reduce the amount of blood flow. This helps to preserve the heat and prevent it from being lost to its surroundings.

Functions of Blood

Counter-current exchange: the arteries and veins that lie deep within the tissues run parallel to one another. This enable the heat from the arteries to transfer into the veins.

This system helps to ensure that the organs within the body remain at a constant temperature of 37 ° C.



Homework

Textbook: pg. 488 #1, 2, 4-9, 11-15