



BODY FLUIDS AND CIRCULATION

- 1. composition of blood**
- 2. Lymph (Tissue Fluid)**
- 3. Human circulatory system**
- 4. Circulatory Pathways**
- 5. Double Circulation**
- 6. Regulation of Cardiac Activity**
- 7. Disorders of Circulatory System**

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BLOOD

- Blood is a special connective tissue consisting of a fluid matrix, plasma, and formed elements.
- Plasma is a straw coloured, viscous fluid constituting nearly 55 per cent of the blood.



BLOOD

- Plasma contains water, proteins such as fibrinogen, globulins and albumins, minerals like Na^+ , Ca^{++} , Mg^{++} , HCO_3^- , Cl^- , etc. Glucose, amino acids, lipids,
- Factors for coagulation or clotting of blood are also present in the plasma
- Plasma without the clotting factors is called serum.

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Formed Elements

- Erythrocytes, leucocytes and platelets are called formed elements and they constitute nearly 45 per cent of the blood.
- Erythrocytes or red blood cells (RBC) are the most abundant of all the cells in blood.
- A healthy adult man has, on an average, 5 millions to 5.5 millions of RBCs mm^{-3} of blood.

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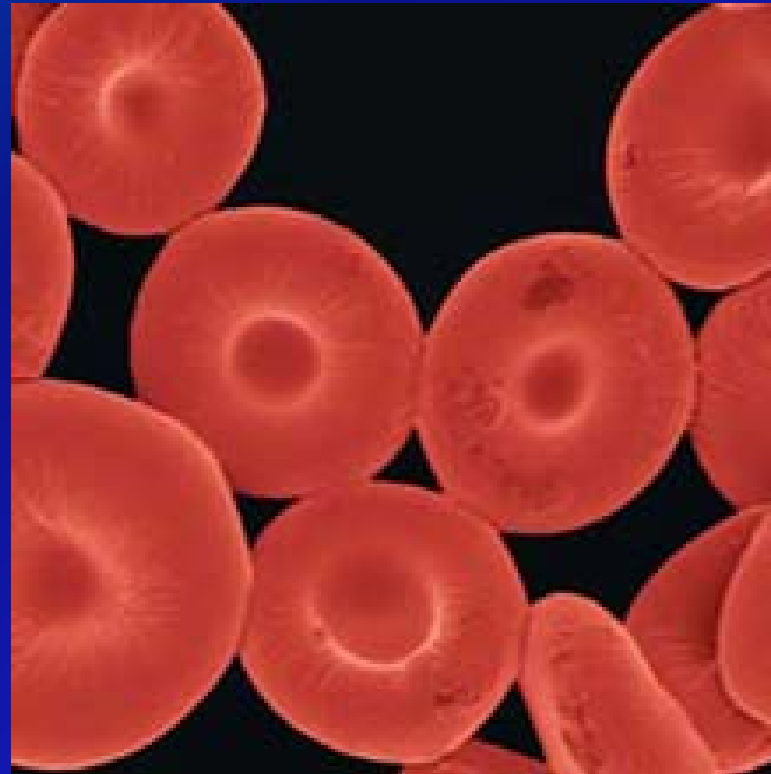
Formed Elements

- RBCs are formed in the red bone marrow in the adults.
- RBCs are devoid of nucleus in most of the mammals and are biconcave in shape.
- They have a red coloured, iron containing complex protein called haemoglobin.
- RBCs have an average life span of 120 days

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Erythrocytes or red blood cells



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white blood cells

- white blood cells are colourless and are nucleated
- W.B.C averages about 6000-8000 cells per mm⁻³ of blood.

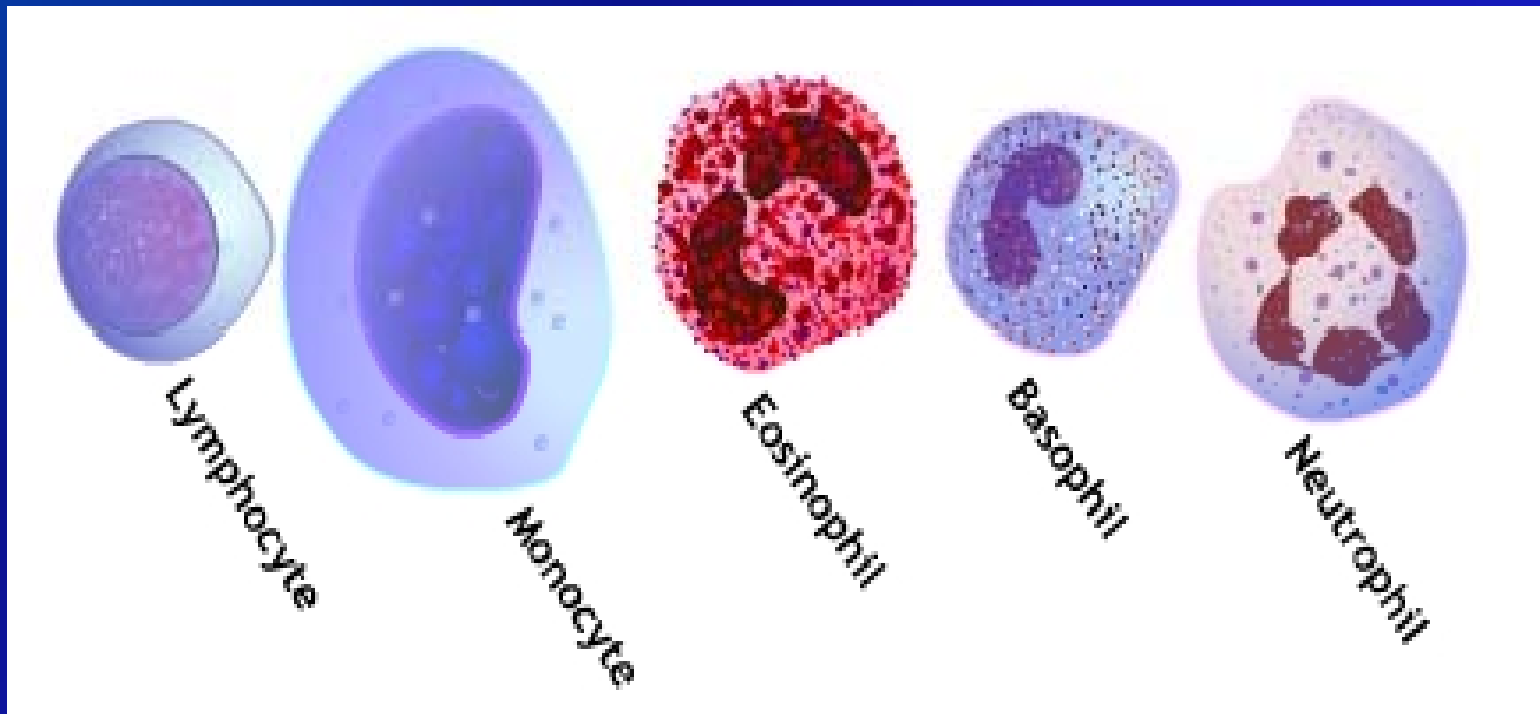


white blood cells

- **We have two main categories of WBCs granulocytes and agranulocytes.**
- **Neutrophils, eosinophils and basophils are different types of granulocytes**
- **lymphocytes and monocytes are the agranulocytes.**



W.B.C



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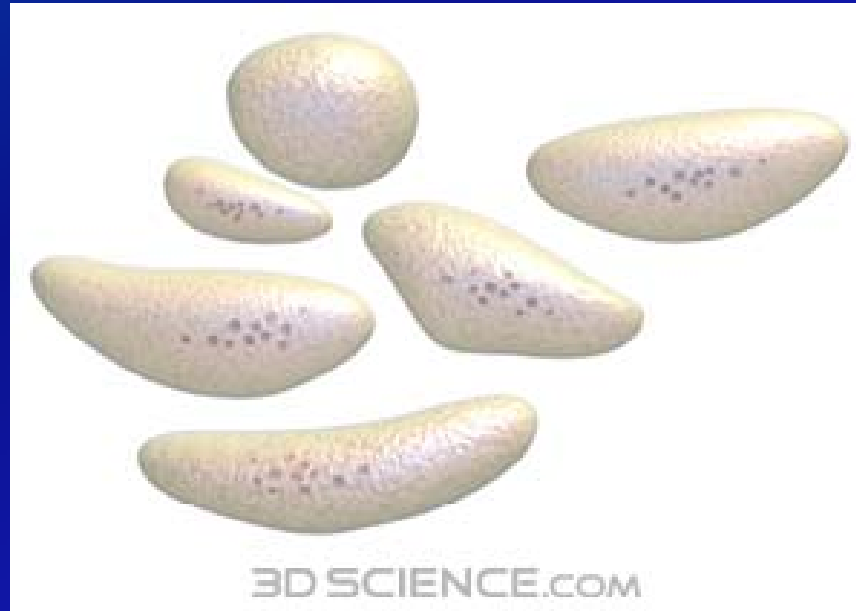
Platelets

- Platelets also called thrombocytes, are cell fragments produced from megakaryocytes
- Blood normally contains 1,500,00-3,500,00 platelets mm^{-3} .
- Platelets can release a variety of substances most of which are involved in the coagulation or clotting of blood.

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Platelets



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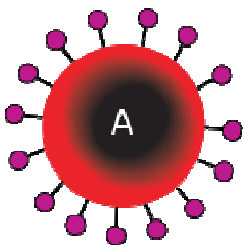
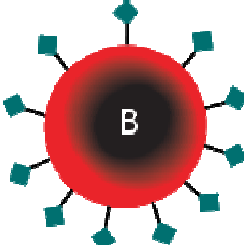
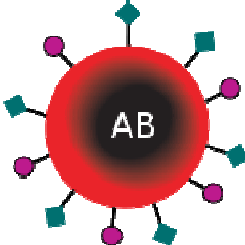
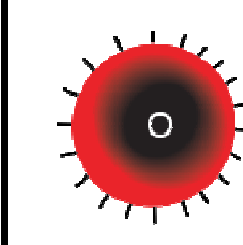








Blood Groups

- Two types of blood groupings – the ABO and Rh – are widely used all over the world.
- ABO grouping is based on the presence or absence of two surface antigens on the RBCs namely A and B.
- Similarly, the plasma of different individuals contain two natural antibodies .

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Blood groups

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	 A antigen	 B antigen	 A and B antigens	None



- Group 'O' blood can be donated to persons with any other blood group and hence 'O' group individuals are called 'universal donors'.
- Persons with 'AB' group can accept blood from persons with AB as well as the other groups of blood. Therefore, such persons are called 'universal recipients'.



Rh grouping

- Rh antigen is observed on the surface of RBCs of majority of humans. Such individuals are called Rh positive (Rh+ve)
- Those in whom this antigen is absent are called Rh negative (Rh-ve).
- An Rh-ve person, if exposed to Rh+ve blood, will form specific antibodies against the Rh antigens.

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Rh grouping

- A special case of Rh incompatibility has been observed between the Rh-ve mother with Rh+ve foetus.
- In subsequent pregnancies, the Rh antibodies from the mother (Rh-ve) can leak into the blood of the foetus (Rh+ve) and destroy the foetal RBCs.
- This condition is called erythroblastosis foetalis.



Coagulation of Blood

- Blood exhibits coagulation or clotting in response to an injury or trauma.
- This is a mechanism to prevent excessive loss of blood from the body.
- Thrombokinase activates prothrombin to thrombin, which convert fibrinogen in to fibrin in which dead and damaged formed elements of blood are trapped.

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LYMPH (TISSUE FLUID)

- The fluid released out of the capillaries is called the interstitial fluid or tissue fluid.
- It has the same mineral distribution as that in plasma.



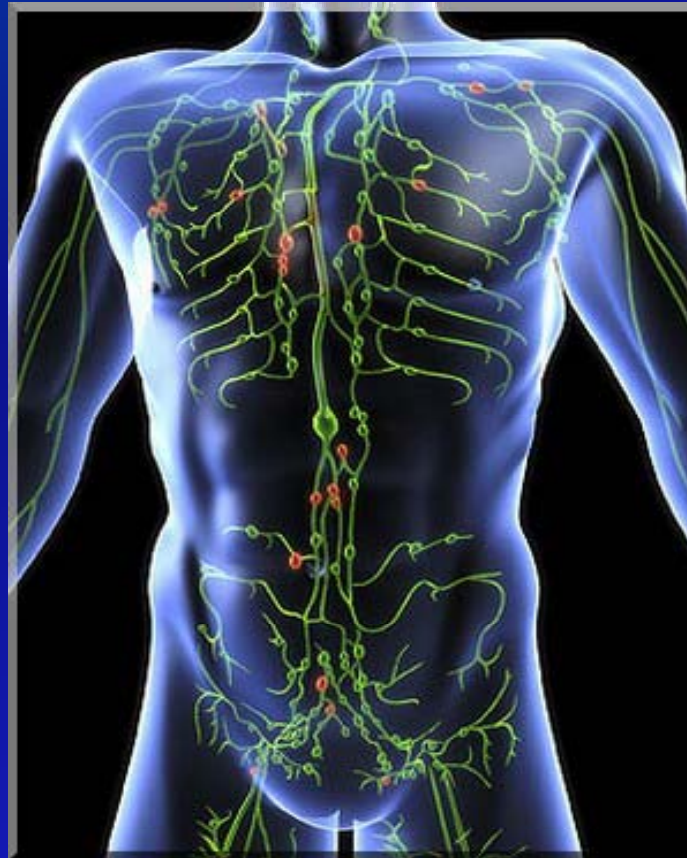
LYMPH (TISSUE FLUID)

- An elaborate network of vessels called the lymphatic system collects this fluid and drains it back to the major veins.
- The fluid present in the lymphatic system is called the lymph.
- Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune responses

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lymphatic system



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Circulatory Pathways

- The circulatory patterns are of two types – open or closed.
- In open circulatory system blood pumped by the heart passes into open spaces or body cavities
- In closed circulatory system the blood is always circulated through a closed network of blood vessels.

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Human circulatory system

- Human circulatory system system consists of a muscular chambered heart, a network of closed branching blood vessels and blood.
- Heart is situated in the thoracic cavity, in between the two lungs, slightly tilted to the left.

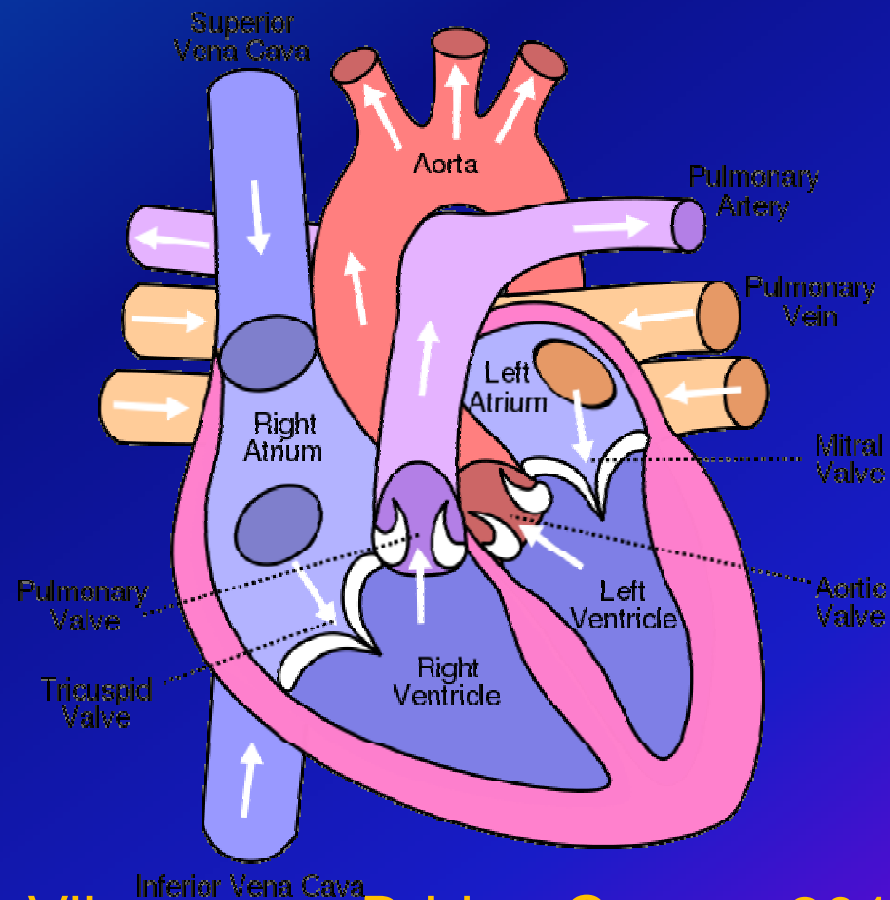


Human circulatory system

- It has the size of a clenched fist.
- It is protected by a double walled membranous bag, pericardium, enclosing the pericardial fluid.
- Our heart has four chambers, two relatively small upper chambers called atria and two larger lower chambers called ventricles.



V.S. of Human heart



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Cardiac Cycle

- To begin with all the four chambers of heart are in a relaxed state, i.e., diastole.
- blood flows into the left and the right ventricle respectively through the left and right atria due to simultaneous contraction of atria – the atrial systole.
- the ventricular muscles contract i.e ventricular systole, the atria undergoes relaxation (diastole),

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Cardiac Cycle

- the closure of tricuspid and bicuspid valves takes place
- the semilunar valves are forced open, allowing the blood in the ventricles into the circulatory pathways.
- The ventricles relax and the ventricular pressure falls causing the closure of semilunar valves prevents the backflow of blood into the ventricles.



- This sequential event in the heart which is cyclically repeated is called the cardiac cycle and it has systole and diastole of both the atria and ventricles.
- 72 cardiac cycles are performed per minute. the duration of a cardiac cycle is 0.8 seconds.
- During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume.

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- The stroke volume multiplied by the heart rate gives the cardiac output.
- the volume of blood pumped out by each ventricle per minute is cardiac output and averages 5000 mL or 5 litres
- During cardiac cycle two sounds are produced . The first sound (lub) is due to closure of the tricuspid and bicuspid valves, second heart sound (dub) is due to closure of the semilunar valves.

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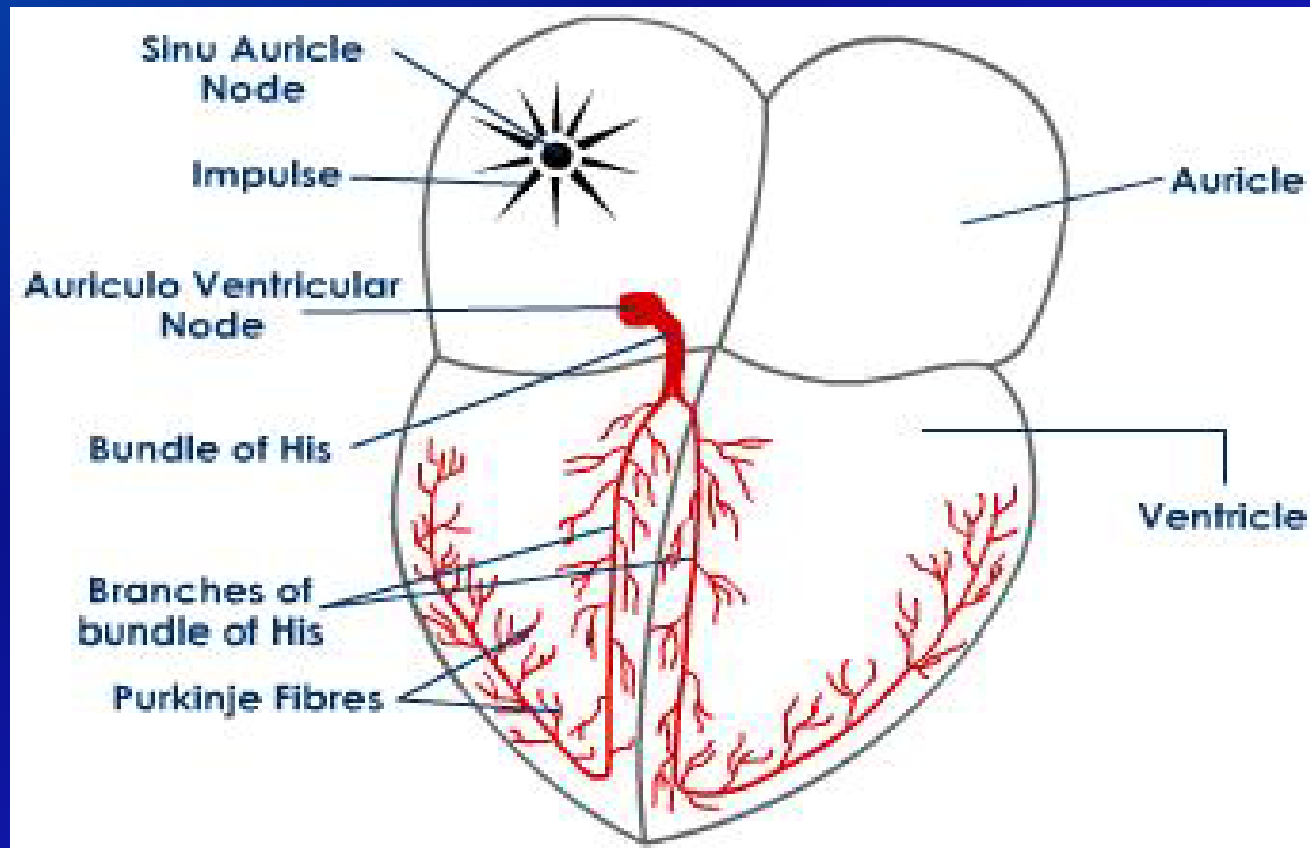
Origin and conduction of heart beat

- **The SAN generates an action potential which stimulates both the atria to undergo a simultaneous contraction – the atrial systole.**
- **The action potential is conducted to the ventricular side by the AVN and AV bundle from where the bundle of His transmits it through the entire ventricular musculature. This causes ventricular systole.**

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Origin and conduction of heart beat



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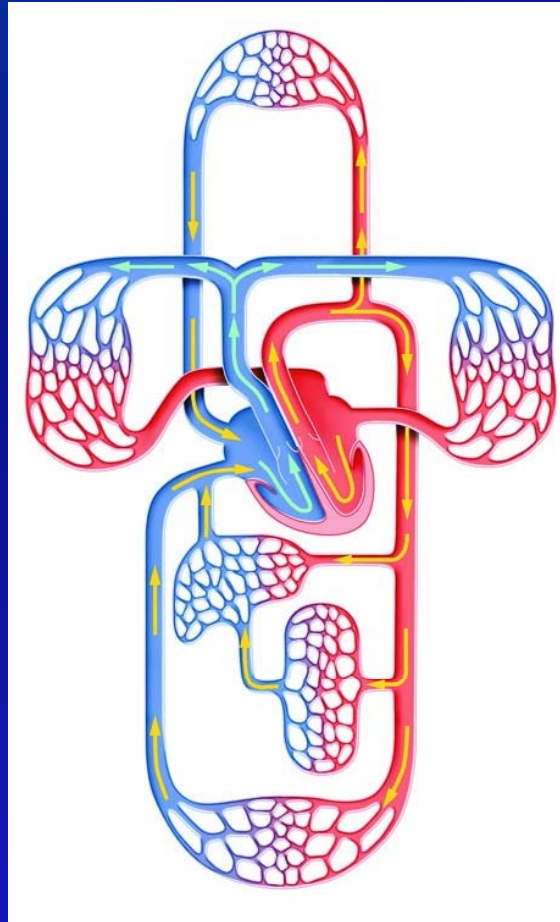


double circulation

- **oxygenated and deoxygenated blood received by the left and right atria respectively passes on to the ventricles of the same sides.**
- **The ventricles pump it out without any mixing up, i.e., two separate circulatory pathways are present. Hence, it is called double circulation.**



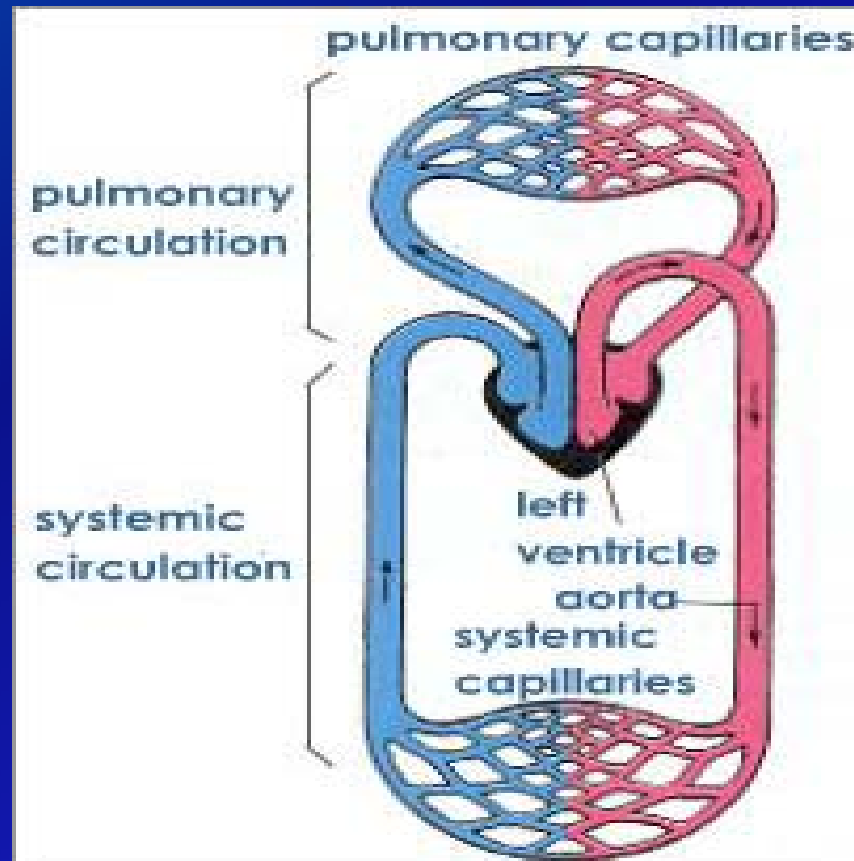
double circulation



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double circulation



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REGULATION OF CARDIAC ACTIVITY

- Normal activities of the heart is auto regulated by SAN
- Neural signals from sympathetic nerves can increase the rate of heart beat,
- parasympathetic neural signals decrease the rate of heart beat,
- Adrenal medullary hormones can also increase the cardiac output.

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DISORDERS OF CIRCULATORY SYSTEM

- **High Blood Pressure (Hypertension):**
Hypertension is the term for blood pressure that is higher than normal
- **Coronary Artery Disease (CAD):**
- **Angina:** it is also called 'angina pectoris'. A symptom of acute chest pain.
- **Heart Failure:** the state of heart when it is not pumping blood effectively.



● **THANK YOU**

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