UNIT III

Chapter 7

Body Fluids and Circulation

Chapter Outline

7.1 Body fluids

7.2 Blood vessels – Arteries, Veins and capillaries

7.3 Circulatory path ways

7.4 Human circulatory system

7.5 Double circulation

7.6 Regulation of cardiac activity

7.7 Disorders of the circulatory system

7.8 Cardio pulmonary Resuscitation (CPR)

Stroke volume is dependent on venous return

Learning Objectives:

- *Understands the importance of body fluids.*
- *Identifies and describes the blood cells, different types of blood groups and blood coagulating factors.*
- *Differentiate the blood vessels and its properties*
- *Understands the human circulatory system.*
- *Understands the cardiac cycle and relate with the peaks of ECG.*
- *Identifies the disorders of circulatory system.*

6L4CBH

Animals particularly larger animals like mammals, are more active. They depend on locomotion to find food which is an energy consuming process. Nervous system is required to coordinate activities by sending nerve impulses that involves energy. All living cells have to be supplied with nutrients, oxygen and other substances and have to remove CO_2 and waste products from them. It is therefore essential to have efficient mechanisms for transport of these substances to and from the cells. Different groups of animals have evolved different methods of transport. Very small organisms like the sponges and coelenterates lack a circulatory system. Water from their surroundings enters their body cavity to facilitate the cells to exchange substances by diffusion. More complex organisms use special fluids and well organized transport systems within their body to transport such materials by **bulk flow** or connective

transport with pumps. The phenomenon of bulk flow is fundamental to many physiological processes like respiration, digestion and excretion. The bulk flow of fluids can transport substances to long distances faster than by diffusion. The human circulatory system can circulate a millilitre of blood from the heart to feet and back again within 60 sec, rather than 60 years which may be needed if it were by diffusion.

Within our body the transport system helps in the coordination of physiological processes by transporting chemical signals from one place to another and assisting in the defence of the body by transporting immune cells to the sites of infection. These processes contribute to overall homeostasis (maintenance of constant internal environment). Movement of respiratory gases, hormones, nutrients, wastes and heat are carried by the circulatory system as shown in Figure 7.1.

Oxygen and carbon dioxide are exchanged in the lungs and tissues whereas nutrients from the digestive system are carried to the liver and the wastes from the tissues are carried by the blood and finally removed by the kidneys. The hormones are transported to their target organs. Circulatory system helps to maintain the homeostasis of the body fluids and body temperature (heat exchange).

The homeostatic regulation of the cardio vascular system maintains blood flow, or perfusion, to the heart and brain. In vasovagal syncope (fainting), signals from the nervous system cause a sudden decrease in blood pressure, and the individual faints from lack of oxygen to the brain.

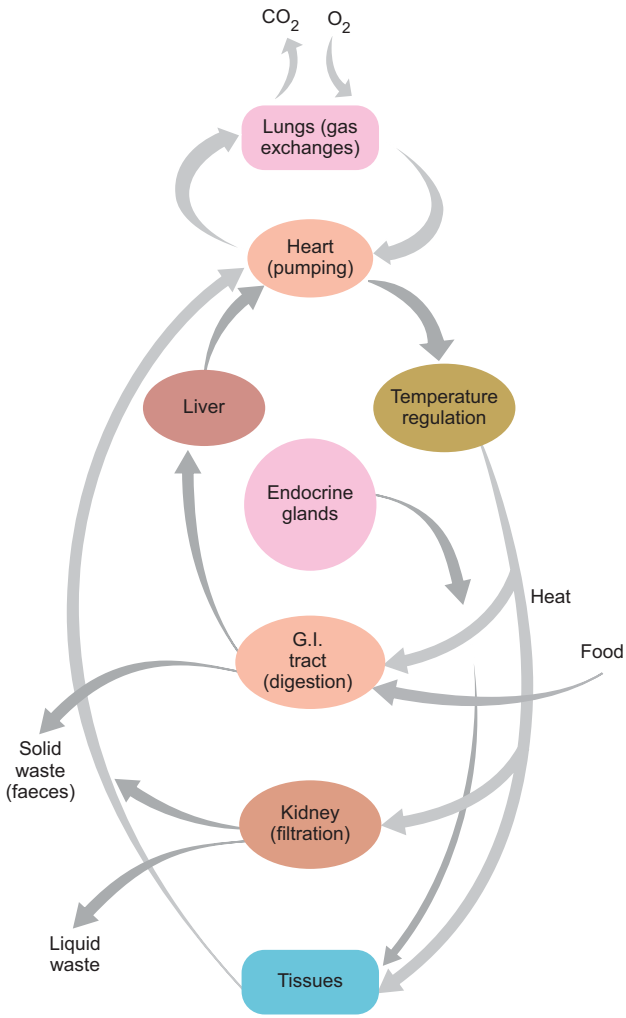


Figure 7.1 Schematic representations of the major functions of the circulatory system

In this chapter you will learn how the heart and blood vessels work together most of the time to prevent such problems.

7.1 Body fluids

The body fluid consists of water and substances dissolved in them. There are two types of body fluids, the intracellular fluid present inside the cells and the extracellular fluid present outside the cells. The three types of extracellular fluids are the **interstitial fluid** or tissue fluid (surrounds

the cell), the **plasma** (fluid component of the blood) and lymph. The blood flowing into the capillary from an arteriole has a high hydrostatic pressure. This pressure is brought about by the pumping action of the blood and it tends to force water and small molecules out through the permeable walls of the capillary into the tissue fluid.

The volume of fluid which leaves the capillary to form tissue fluid is the result of two opposing pressures. The water potential is lesser than hydrostatic pressure inside the capilary bed which is enough to push fluid into the tissues. The tissue fluid has low concentration of protien than that of plasma. At the venous end of the capillary bed, the water potential is greater than the hydrostatic pressure and the fluid from the tissues flows into the capillary and water is drawn back into the blood, taking with it waste products produced by the cells.

Composition of Blood

Blood is the most common body fluid that transports substances from one part of the body to the other. Blood is a connective tissue consisting of plasma (fluid matrix) and formed elements. The plasma constitutes 55% of the total blood volume. The remaining 45% is the formed elements that consist of blood cells. The average blood volume is about 5000ml (5L) in an adult weighing 70 Kg.

7.1.1 Plasma

Plasma mainly consists of water (80-92%) in which the plasma proteins, inorganic constituents (0.9%), organic constituents (0.1%) and respiratory gases are dissolved. The four main types of plasma proteins synthesized in the liver are albumin, globulin, prothrombin and fibrinogen. **Albumin** maintains the osmotic pressure of the blood. **Globulin** facilitates the transport of ions, hormones, lipids and assists in immune function. Both **Prothrombin** and **Fibrinogen are** involved in blood clotting. **Organic constituents** include urea, amino acids, glucose, fats and vitamins; and the **inorganic constituents** include chlorides, carbonates and phosphates of potassium, sodium, calcium and magnesium. The composition of plasma is not always constant. Immediately after a meal, the blood in the hepatic portal vein has a very high concentration of glucose as it is transporting glucose from the intestine to the liver where it is stored. The concentration of the glucose in the blood gradually falls after sometime as most of the glucose is absorbed. If too much of protein is consumed, the body cannot store the excess amino acids formed from the digestion of proteins. The liver breaks down the excess amino acids and produces urea. Blood in the hepatic vein has a high concentration of urea than the blood in other vessels namely, hepatic portal vein and hepatic artery.

Liver receives its blood supply from two sources: the hepatic artery brings oxygenated blood from the heart, while the hepatic portal vein brings blood from the intestine and other abdominal organs. The blood is returned from the liver to the heart by the hepatic veins.

7.1.2 Formed elements

Red blood cells/corpuscles (erythrocytes), white blood cells/corpuscles (Leucocytes) and platelets are collectively called formed elements.

Red blood cells

Red blood cells are abundant than the other blood cells. There are about 5 million to 5.5 millions of RBC mm^{-3} of blood in a healthy man and 4.5-5.0 millions of RBC mm^{-3} in healthy women. The RBCs are very small with the diameter of about 7μm (micrometer). The structure of RBC is shown in Figure 7.2. The red colour of the RBC is due to the presence of a respiratory pigment, haemoglobin dissolved in the cytoplasm. Haemoglobin plays an important role in the transport of respiratory gases and facilitates the exchange of gases with the fluid outside the cell (tissue fluid). The biconcave shaped RBCs increases the surface area to volume ratio, hence oxygen diffuses quickly in and out of the cell. The RBCs are devoid of nucleus, mitochondria, ribosomes and endoplasmic reticulum. The absence of these organelles accommodates more haemoglobin thereby maximising the oxygen carrying capacity of the cell. The average life span of RBCs in a healthy individual is about 120 days after which they are destroyed in the spleen (graveyard / cemetery of RBCs) and the iron component returns to the bone marrow for reuse. Erythropoietin is a hormone secreted by the kidneys in response to low oxygen and helps in differentiation of stem cells of the bone marrow to erythrocytes (erythropoiesis) in adults. The ratio of red blood cells to blood plasma is expressed as **Haematocrit** (packed cell volume).

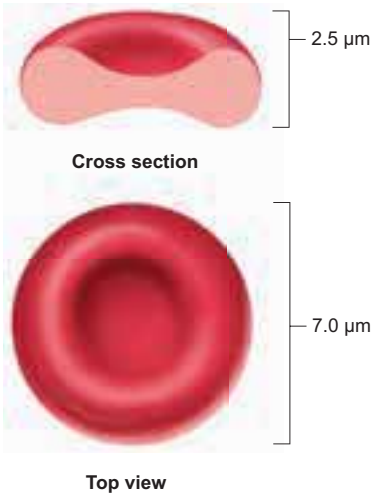


Figure 7.2 Structure of RBC

White blood cells (leucocytes) are colourless, amoeboid, nucleated cells devoid of haemoglobin and other pigments. Approximately 6000 to 8000 per cubic mm of WBCs are seen in the blood of an average healthy individual. The different types of WBCs are shown in Figure 7.3. Depending on the presence or absence of granules, WBCs are divided into two types, granulocytes and agranulocytes. Granulocytes are characterised by the presence of granules in the cytoplasm and are differentiated in the bone marrow. The granulocytes include neutrophils, eosinophils and basophils.

Neutrophils are also called heterophils or polymorphonuclear (cells with 3-4 lobes of nucleus connected with delicate threads) cells which constitute about 60%- 65% of the total WBCs. They are phagocytic in nature and appear in large numbers in and around the infected tissues.

Eosinophils have distinctly bilobed nucleus and the lobes are joined by thin

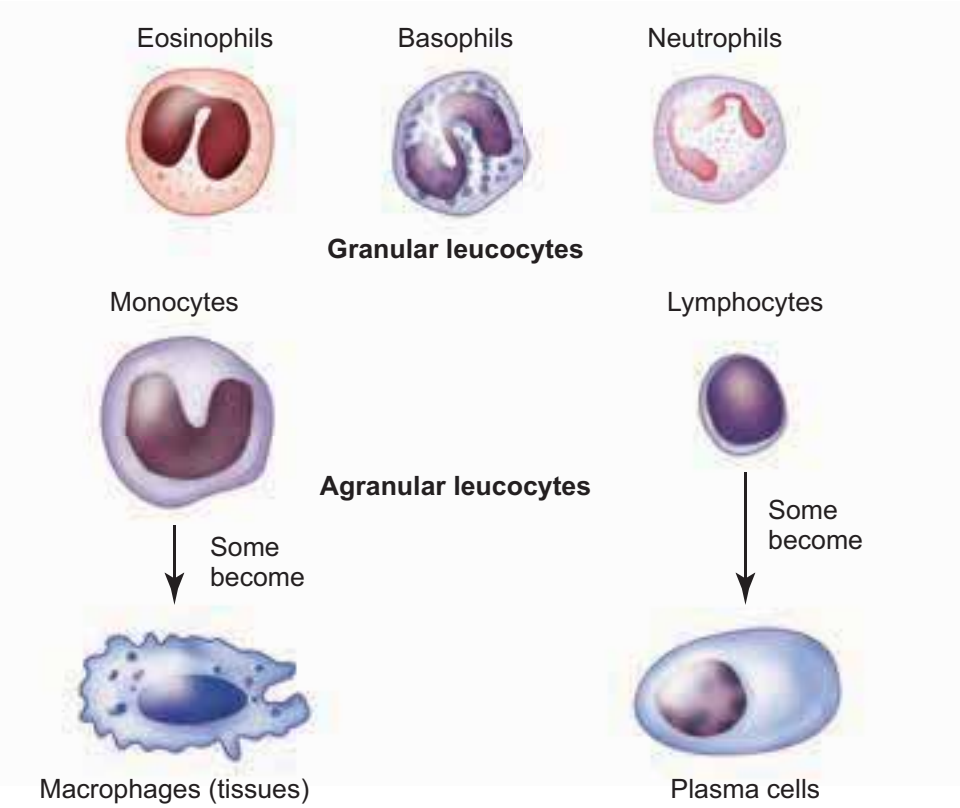


Figure 7.3 Different types of WBC

strands. They are non-phagocytic and constitute about 2-3% of the total WBCs. Eosinophils increase during certain types of parasitic infections and allergic reactions.

Basophils are less numerous than any other type of WBCs constituting 0.5%-1.0% of the total number of leucocytes. The cytoplasmic granules are large sized, but fewer than eosinophils. Nucleus is large sized and constricted into several lobes but not joined by delicate threads. Basophils secrete substances such as heparin, serotonin and histamines. They are also involved in inflammatory reactions.

Agranulocytes are characterised by the absence of granules in the cytoplasm and are differentiated in the lymph glands and spleen. These are of two types, lymphocytes and monocytes. Lymphocytes constitute 28% of WBCs. These have large round nucleus and small amount of cytoplasm. The two types of lymphocytes are B and T cells. Both B and T cells are responsible for the immune responses of the body. B cells produce antibodies to neutralize the harmful effects of foreign substances and T cells are involved in cell mediated immunity.

Monocytes (Macrophages) are phagocytic cells that are similar to mast cells and have kidney shaped nucleus. They constitute 1-3% of the total WBCs. The macrophages of the central nervous system are the 'microglia', in the sinusoids of the liver they are called 'Kupffer cells' and in the pulmonary region they are the 'alveolar macrophages'.

Platelets are also called thrombocytes that are produced from megakaryocytes (special cells in bone marrow) and lack nuclei. Blood normally contains 1, 50,000 -3, 50,000 platelets mm^{-3} of blood. They secrete substances involved in coagulation or clotting of blood. The reduction in platelet number can lead to clotting disorders that result in excessive loss of blood from the body.

7.1.3 Blood groups

Commonly two types of blood groupings are done. They are ABO and Rh which are widely used all over the world.

ABO blood grouping

Depending on the presence or absence of surface antigens on the RBCs, blood group in individual belongs to four different types namely, A, B, AB and O. The plasma of A, B and O individuals have natural antibodies (agglutinins) in them. Surface antigens are called agglutinogens. The antibodies (agglutinin) acting on agglutinogen A is called anti A and the agglutinin acting on agglutinogen B is called anti B. Agglutinogens are absent in O blood group. Agglutinogens A and B are present in AB blood group and do not contain anti A and anti B in them. Distribution of antigens and antibodies in blood groups are shown in Table 7.1. A, B and O are major allelic genes in ABO systems. All agglutinogens contain sucrose, D-galactose, N-acetyl glucosamine and 11 terminal amino acids. The attachments of the terminal amino acids are dependent on the gene products of A and B. The reaction is catalysed by glycosyl transferase.

Table 7.1 Distribution of antigens and antibodies in different blood groups

Blood group	Agglutinogens (antigens) on the RBC	Agglutinin (antibodies) in the plasma
A	A	Anti B
B	B	Anti A
AB	AB	No antibodies
O	No antigens	Anti A and Anti B

Rh factor is a protein (D antigen) present on the surface of the red blood cells in majority (80%) of humans. This protein is similar to the protein present in Rhesus monkey, hence the term Rh. Individuals who carry the antigen D on the surface of the red blood cells are Rh^+ (Rh positive) and the individuals who do not carry antigen D, are Rh^- (Rh negative). Rh factor compatibility is also checked before blood transfusion. When a pregnant women is Rh^- and the foetus is Rh^+ incompatibility (mismatch) is observed. During the first pregnancy, the Rh^- antigens of the foetus does not get exposed to the mother's blood as both their blood are separated by placenta. However, small amount of the foetal antigen becomes exposed to the mother's blood during the birth of the first child. The mother's blood starts to synthesize D antibodies. But during subsequent pregnancies the Rh antibodies from the mother (Rh^-) enters the foetal circulation and destroys the foetal RBCs. This becomes fatal to the foetus because the child suffers from anaemia and jaundice. This condition is called **erythroblastosis foetalis**. This condition can be avoided by administration of anti D antibodies (**Rhocum**) to the mother immediately after the first child birth.

7.1.4 Coagulation of blood

If you cut your finger or when you get yourself hurt, your wound bleeds for some time after which it stops to bleed. This is because the blood clots or coagulates in response to trauma. The mechanism by which excessive blood loss is prevented by the formation of clot is called blood coagulation or clotting of blood. Schematic representation of blood coagulation is shown Figure 7.4. The clotting process begins when the endothelium of the blood vessel is damaged and the connective tissue in its wall is exposed to the blood. Platelets adhere to collagen fibres in the connective tissue and release substances that form the platelet plug which provides emergency protection against blood loss. Clotting factors released from the clumped platelets or damaged cells mix with clotting factors in the plasma. The protein called prothrombin is converted to its active form called thrombin in the presence of calcium and vitamin K. Thrombin helps in the conversion of fibrinogen to fibrin threads. The threads of fibrins become interlinked into a patch that traps blood cell and seals the injured vessel until the wound is healed. After sometime fibrin fibrils contract, squeezing out a straw-

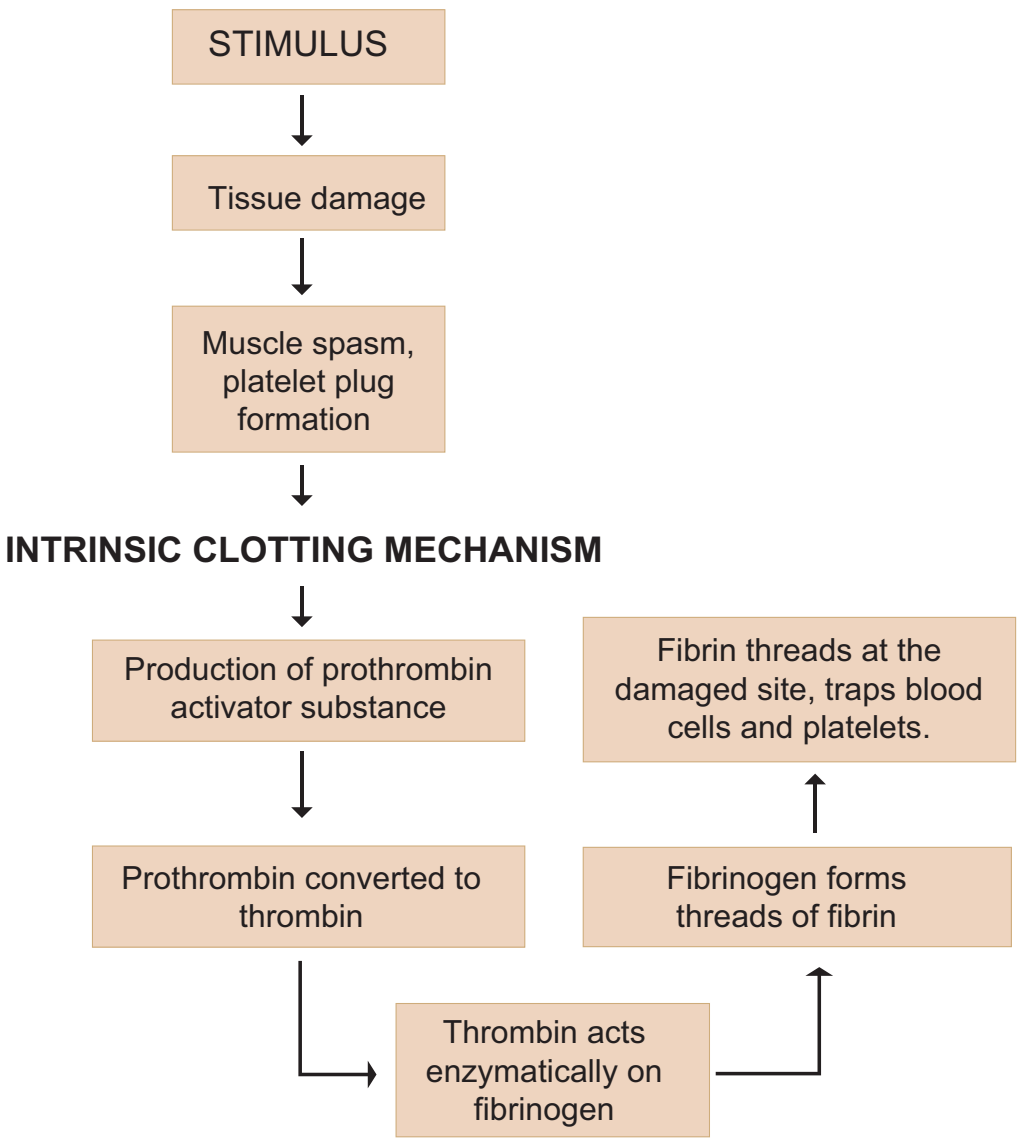


Figure 7. 4 Schematic representation of blood coagulation in an injured blood vessel

coloured fluid through a meshwork called **serum** (Plasma without fibrinogen is called serum). Heparin is an anticoagulant produced in small quantities by mast cells of connective tissue which prevents coagulation in small blood vessels.

7.1.5 Composition of lymph and its functions

About 90% of fluid that leaks from capillaries eventually seeps back into the capillaries and the remaining 10% is collected and returned to blood system by means of a series of tubules known as lymph vessels or lymphatics. The fluid inside the lymphatics is called lymph. The lymphatic system consists of a complex network of thin walled ducts (lymphatic vessels), filtering bodies (lymph nodes) and a large number of lymphocytic cell concentrations in various lymphoid organs. The lymphatic vessels have smooth walls that run parallel to the blood vessels, in the skin, along the respiratory and digestive tracts. These vessels serve as return ducts for the fluids that are continually diffusing out of the blood capillaries into the body tissues. The end of a vessel is shown in Figure 7.5. Lymph fluid must pass through the lymph nodes before it is returned to the blood. The lymph nodes that filter the fluid from the lymphatic vessels of the skin are highly concentrated in the neck, inguinal, axillaries, respiratory and digestive tracts. The lymph fluid flowing out of the lymph nodes flow into large collecting duct which finally drains into larger veins that runs beneath the collar bone, the subclavian vein and is emptied into the blood stream. The narrow passages in the lymph nodes are the sinusoids that are lined with macrophages. The lymph nodes successfully prevent the invading microorganisms from reaching the blood stream. Cells found in the lymphatics are the lymphocytes. Lymphocytes collected in the lymphatic fluid are carried via the arterial blood and are recycled back to the lymph. Fats are absorbed through lymph in the lacteals present in the villi of the intestinal wall.

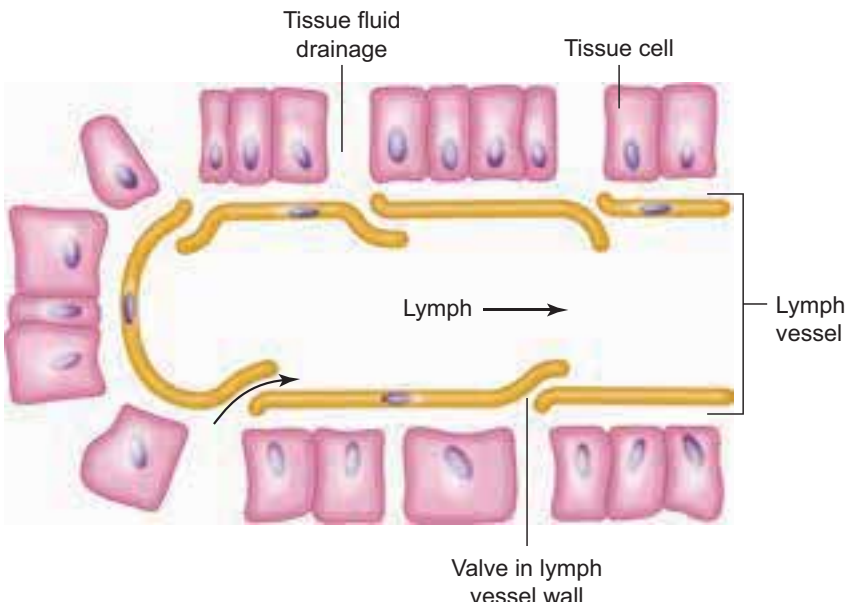


Figure 7.5 Drainage of tissue fluid into a lymph vessel

1. Why protein molecules of larger size can pass through the lymph vessel?
2. We have seen that capillary walls are not permeable to plasma proteins. Suggest where the protein comes from.
3. The disease kwashiorkor is caused by a diet which is very low in protein. The concentration of proteins in blood becomes much lower than usual. One of the symptoms of kwashiorkor is edema. Give reasons.

7.2 Structure of blood vessels

The vessels carrying the blood are of three types; they are the arteries, veins and capillaries. These vessels are hollow structures and have complex walls surrounding the lumen. The blood vessels in humans are composed of three layers, **tunica intima, tunica media** and **tunica externa**. The inner layer, tunica intima or tunica interna supports the vascular endothelium, the middle layer, tunica media is composed of smooth muscles and an extra cellular matrix which contains a protein, elastin. The contraction and relaxation of the smooth muscles results in vasoconstriction and vasodilation. The outer layer, tunica externa or tunica adventitia is composed of collagen fibres. The structure of blood vessels is illustrated in Figure 7.6.

Arteries

The blood vessels that carry blood away from the heart are called arteries. The arteries usually lie deep inside the body. The walls of the arteries are thick, non-collapsible to withstand high pressure. Valves are absent and have a narrow lumen. All arteries carry oxygenated blood, except the pulmonary artery. The largest artery, the aorta (2.5 cm in diameter and 2 mm thick) branch into smaller arteries and culminates into the tissues as feed arteries. In the tissues the arteries branches into arterioles.

As blood enters an arteriole it may have a pressure of 85 mm Hg (11.3 KPa) but as it leaves and flows into the capillary, the pressure drops to 35 mm Hg (4.7 KPa). (Note 1 mm Hg =0.13 KPa. SI unit of mm Hg is KiloPascal (KPa)). Arterioles are small, narrow, and thin walled which are connected to the capillaries. A small sphincter lies at the junction between the arterioles and capillaries to regulate the blood supply. Arteries do not always branch into arterioles, they can also form anastomoses.

What are anastomoses? These are connections of one blood vessel (arteries) with another blood vessel. They provide alternate route of blood flow if the original blood vessel is blocked. For e.g., Arteries in the joints contain numerous anastomoses. This allows blood to flow freely even if one of the arteries closes during bending of the joints.

Capillaries

Capillary beds are made up of fine networks of capillaries. The capillaries are thin walled and consist of single layer of

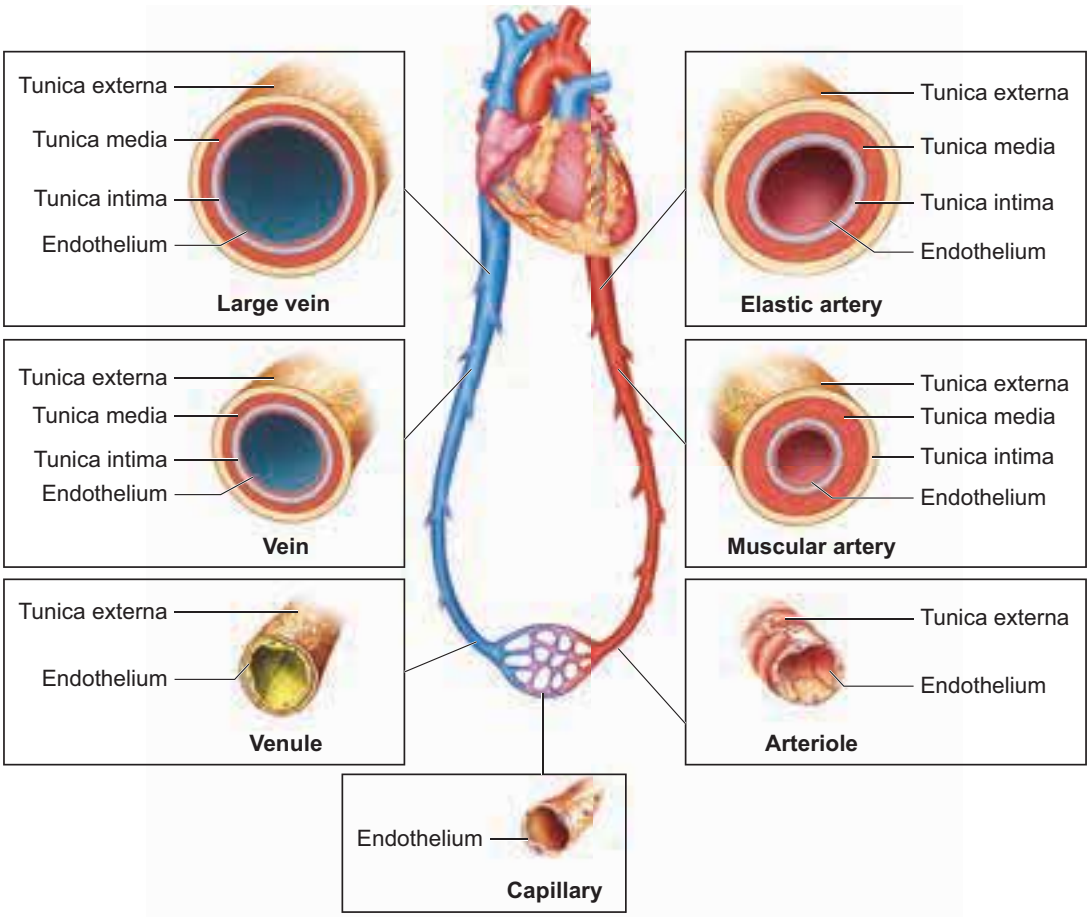


Figure 7.6 Structure of Blood vessels

squamous epithelium. Tunica media and elastin fibres are absent. The capillary beds are the site for exchange of materials between blood and tissues. The walls of the capillaries are guarded by semilunar valves. The blood volume in the capillaries is high but the flow of blood is slow. Mixed blood (oxygenated and deoxygenated) is present in the capillaries. The capillary bed may be flooded with blood or may be completely bypassed depending on the body conditions in a particular organ.

Why there are no blood capillaries in the cornea of the eye and cartilage? How are these regions supplied with the required nutrients?

Veins

Veins have thinner walls and a larger lumen and hence can be easily stretched. They carry deoxygenated blood except, the pulmonary vein. The blood pressure is low and the lumen has a wide wall which is collapsible. Tunica media is thinner in veins than in arteries. Unidirectional flow of blood in veins is due to the presence of semilunar valves that prevents backflow of blood. Blood samples are usually taken from the veins rather than artery because of low pressure in the veins.

7.2.1 Coronary blood vessels

Blood vessels that supply blood to the cardiac muscles with all nutrients and removes wastes are the coronary arteries

Suggest why arteries close to the heart have more elastic fibers in their walls than arteries further away from the heart?

When exercising vigorously, blood is rerouted from the digestive organ (food or no food) to the capillary beds of the skeletal muscles where it is needed immediately. This rerouting explains why vigorous exercise after a meal can cause indigestion or abdominal cramps.

The Law of Laplace is used to understand the structure and function of blood vessels and the heart. Laplace law states that the tension in the walls of the blood vessel is proportional to the blood pressure and vessel radius. Blood vessels such as aorta that is subjected to high pressures have thicker walls than the arterioles that are subjected to low pressures.

and veins. Heart muscle is supplied by two arteries namely right and left coronary arteries. These arteries are the first branch of the aorta. Arteries usually surround the heart in the manner of a crown, hence called coronary artery (L. *Corona* - crown).

Right ventricle and posterior portion of left ventricle are supplied by the right coronary artery. Anterior and lateral part of the left ventricle is supplied by the left coronary arteries.

7.3 Circulatory pathways

There are two types of circulatory systems, open and closed circulatory systems. **Open circulatory system has** haemolymph as the circulating fluid and is pumped by the heart, which flows through blood vessels into the sinuses. Sinuses are referred as haemocoel. Open circulatory system is seen in Arthropods and most Molluscs. In **closed circulatory system** blood is pumped by the heart and flows through blood vessels. Closed circulating system is seen in Annelids, Cephalopods and Vertebrates.

All vertebrates have muscular chambered heart. Fishes have two chambered heart. The heart in fishes consists of sinus venosus, an atrium, one ventricle and bulbus arteriosus or conus arteriosus. Single circulation is seen in fishes. Amphibians have two auricles and one ventricle and no inter ventricular septum whereas reptiles except crocodiles have two auricles and one ventricle and an incomplete inter ventricular septum. Thus mixing of oxygenated and deoxygenated blood takes place in the ventricles. This type of circulation is called incomplete double circulation. The left atrium receives oxygenated blood and the right atrium receives deoxygenated blood. Pulmonary and systemic circuits are seen in Amphibians and Reptiles. The Crocodiles, Birds and Mammals have two auricles or atrial chambers and two ventricles, the auricles and ventricles are separated by inter auricular septum and inter ventricular septum. Hence there is

complete separation of oxygenated blood from the deoxygenated blood. Pulmonary and systemic circuits are evident. This type of circulation is called complete double circulation.

7.4 Human circulatory system

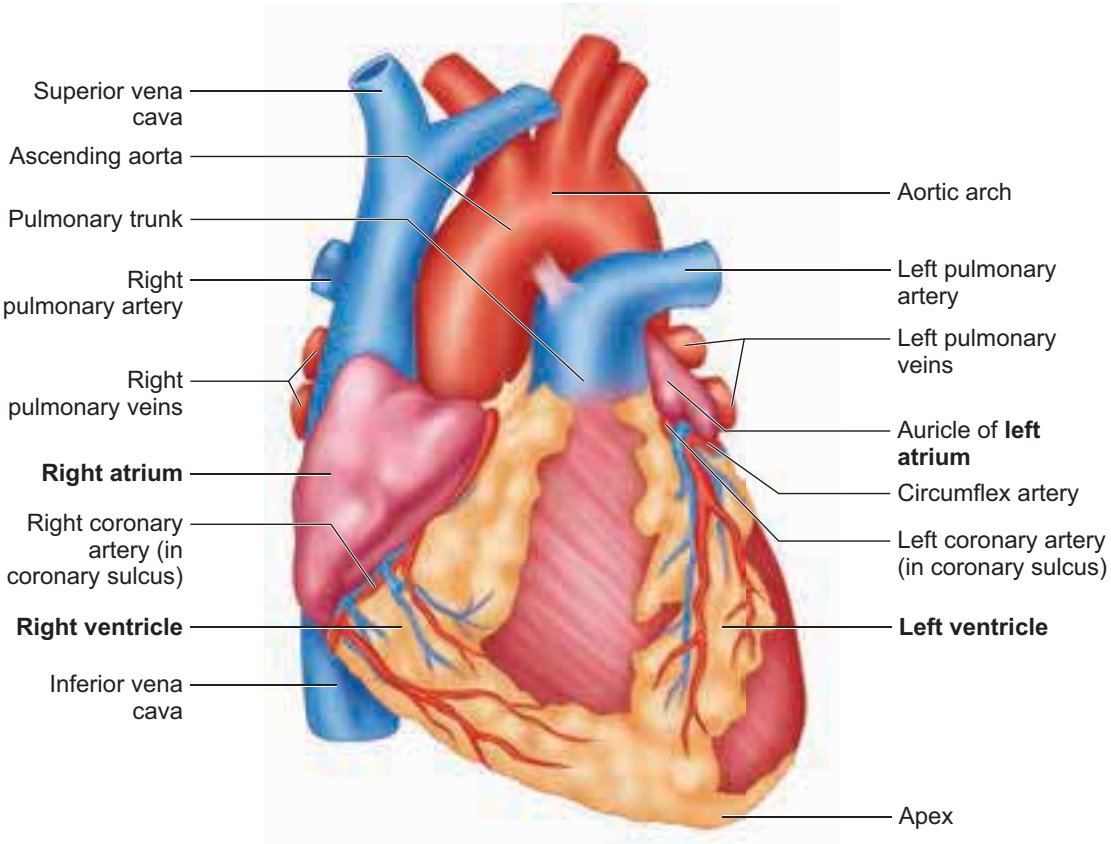
The structure of the heart was described by Raymond de viessens, in 1706. Human heart is made of special type of muscle called the cardiac muscle. It is situated in the thoracic cavity and its apex portion is slightly tilted towards left. It weighs about 300g in an adult. The size of our heart is roughly equal to a closed fist. The structure of heart and the L.S of heart are shown in Figure 7.7 (a) and (b). Heart is divided into four chambers, upper two small auricles or atrium and lower two large ventricles. The walls of the ventricles are thicker than the auricles due to the presence of papillary muscles. The heart wall is made up of three layers, the outer epicardium, middle myocardium and inner endocardium. The space present between the membranes is called pericardial space and is filled with pericardial fluid.

The two auricles are separated by inter auricular septum and the two ventricles are separated by inter ventricular septum The separation of chambers avoids mixing of oxygenated and deoxygenated blood. The auricle communicates with the ventricle through an opening called auriculo ventricular aperture which is guarded by the auriculo ventricular valves. The opening between the right atrium and the right ventricle is guarded by the **tricuspid valve** (three flaps or cusps), whereas a **bicuspid** (two flaps or cusps) or **mitral valve** guards the opening between the left atrium and left ventricle. The valves of the heart allows the blood to flow only in one direction, i.e., from the atria to the ventricles and from the ventricles to the pulmonary artery or the aorta. These valves prevent backward flow of blood.

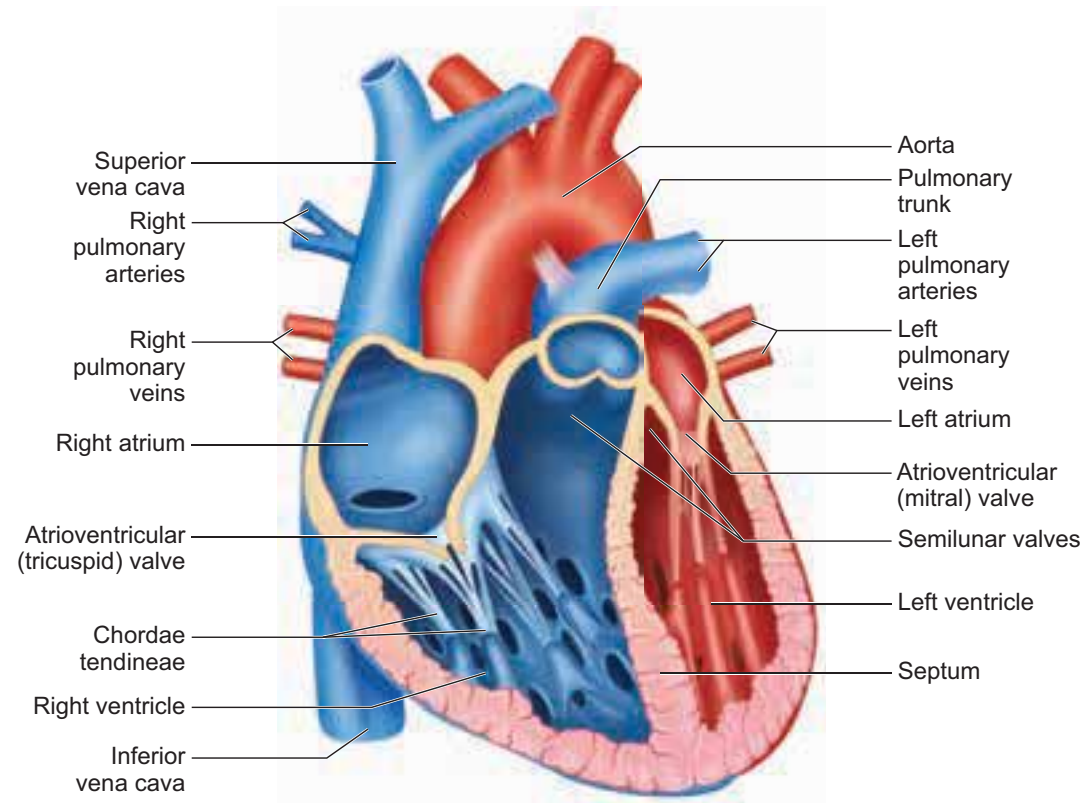
The opening of right and left ventricles into the pulmonary artery and aorta are guarded by aortic and pulmonary valves and are called **semilunar valves**. Each semilunar valve is made of three half-moon shaped cusps. The myocardium of the ventricle is thrown into irregular muscular ridges called **trabeculae corneae**. The trabeculae corneae are modified into **chordae tendinae**. The opening and closing of the semilunar valves are achieved by the chordae tendinae. The chordae tendinae are attached to the lower end of the heart by papillary muscles. Heart receives deoxygenated blood from various parts of the body through the inferior venacava and superior venacava which open into the right auricle. Oxygenated blood from lungs is drained into the left auricle through four pulmonary veins.

7.4.1 Origin and conduction of heart beat

The heart in human is myogenic (cardiomyocytes can produce spontaneous rhythmic depolarisation that initiates contractions). The sequence of electrical conduction of heart is shown in Figure 7.8. The cardiac cells with fastest rhythm are called the Pacemaker cells, since they determine the contraction rate of the entire heart. These cells are located in the right sinuatrial (SA) node/ Pacemaker. On the left side of the right atrium is a node called auriculo



(a)



(b)

Figure 7.7 (a) - Structure of the heart **(b)** L.S of Heart

ventricular node (AV node). Two special cardiac muscle fibres originate from the auriculo ventricular node and are called the bundle of His which runs down into the interventricular septum and the fibres spread into the ventricles. These fibres are called the Purkinje fibres.

Pacemaker cells produce excitation through depolarisation of their cell membrane. Early depolarisation is slow and takes place by sodium influx and reduction in potassium efflux. Minimum potential is required to activate voltage gated calcium (Ca+) channels that causes rapid depolarisation which results in action potential. The pace maker cells repolarise slowly via K^+ efflux.

HEART BEAT- Rhythmic contraction and expansion of heart is called heart beat. The contraction of the heart is called **systole** and the relaxation of the heart is called **diastole**. The heart normally beats 70-72 times per min in a human adult. During each cardiac cycle two sounds

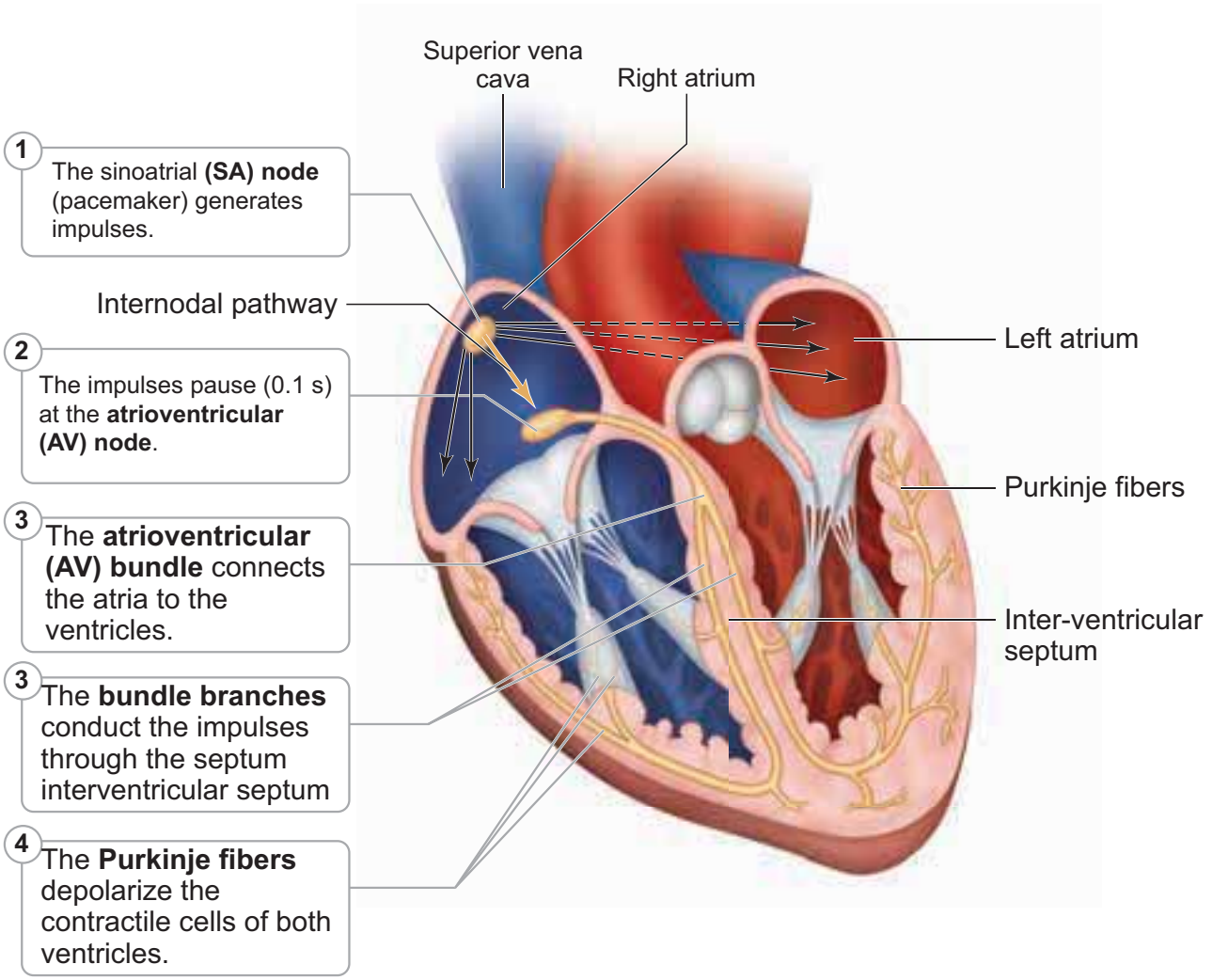


Figure 7.8 The sequence of electrical conduction of heart.

are produced that can be heard through a **stethoscope**. The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas second heart sound (dub) is associated with the closure of the semilunar valves. These sounds are of clinical diagnostic significance. An increased heart rate is called tachycardia and decreased heart rate is called bradycardia.

7.4.2 Cardiac Cycle

The events that occur at the beginning of heart beat and lasts until the beginning of next beat is called cardiac cycle. It lasts for 0.8 seconds. The series of events that takes place in a cardiac cycle.

PHASE 1: Ventricular diastole- The pressure in the auricles increases than that of the ventricular pressure. AV valves are open while the semi lunar valves are closed. Blood flows from the auricles into the ventricles passively.

PHASE 2: Atrial systole - The atria contracts while the ventricles are still relaxed. The contraction of the auricles pushes maximum volume of blood to the ventricles until they reach the end diastolic volume (EDV). EDV is related to the length of the cardiac muscle fibre. More the muscle is stretched, greater the EDV and the stroke volume.

PHASE 3: Ventricular systole (isovolumetric contraction) - The ventricular contraction forces the AV valves to close and increases the pressure inside the ventricles. The blood is then pumped from the ventricles into the aorta without change in the size of the muscle fibre length and ventricular chamber volume (isovolumetric contraction).

PHASE 4: Ventricular systole (ventricular ejection) - Increased ventricular pressure forces the semilunar valves to open and blood is ejected out of the ventricles without backflow of blood. This point is the end of systolic volume (ESV).

PHASE 5: (Ventricular diastole) -The ventricles begins to relax, pressure in the arteries exceeds ventricular pressure, resulting in the closure of the semilunar valves. The heart returns to phase 1 of the cardiac cycle.

7.4.3 Cardiac output

The amount of blood pumped out by each ventricle per minute is called cardiac output(CO). It is a product of heart rate (HR) and stroke volume (SV). Heart rate or pulse is the number of beats per minute. Pulse pressure = systolic pressure – diastolic pressure. Stroke volume (SV) is the volume of blood pumped out by one ventricle with each beat. SV depends on ventricular contraction. CO = HR X SV. SV represents the difference between EDV (amount of blood that collects in a ventricle during diastole) and ESV (volume of blood remaining in the ventricle after contraction). SV = EDV - ESV. According to Frank – Starling law of the heart, the critical factor controlling SV is the degree to which the cardiac muscle cells are stretched just before they contract. The most important factor stretching cardiac muscle is the amount of blood returning to the heart and distending its ventricles, venous return. During vigorous exercise, SV may double as a result of venous return. Heart's pumping action normally maintains a balance between cardiac output and venous return. Because the

heart is a double pump, each side can fail independently of the other. If the left side of the heart fails, it results in pulmonary congestion and if the right side fails, it results in peripheral congestion. Frank – Starling effect protects the heart from abnormal increase in blood volume.

When blood volume drops down abruptly, what happens to the stroke volume? State whether it increases or decreases?

Blood Pressure

Blood pressure is the pressure exerted on the surface of blood vessels by the blood. This pressure circulates the blood through arteries, veins and capillaries. There are two types of pressure, the systolic pressure and the diastolic pressure. Systolic pressure is the pressure in the arteries as the chambers of the heart contracts. Diastolic pressure is the pressure in the arteries when the heart chambers relax. Blood pressure is measured using a sphygmomanometer (BP apparatus). It is expressed as systolic pressure / diastolic pressure. Normal blood pressure in man is about 120/80mm Hg. Mean arterial pressure is a function of cardiac output and resistance in the arterioles. The primary reflex pathway for homeostatic control of mean arterial pressure is the baroreceptor reflex. The baroreceptor reflex functions every morning when you get out of bed. When you are lying flat the gravitational force is evenly distributed. When you stand up, gravity causes blood to pool in the lower extremities. The decrease in blood pressure upon standing is known as orthostatic hypotension. Orthostatic reflex normally triggers baroreceptor reflex. This results in increased cardiac output and increased peripheral resistance which together increase the mean arterial pressure.

7. 4. 4 Electrocardiogram (ECG)

An electrocardiogram (ECG) records the electrical activity of the heart over a period of time using electrodes placed on the skin, arms, legs and chest. It records the changes in electrical potential across the heart during one cardiac cycle. The special flap of muscle which initiates the heart beat is called as sinu-auricular node or SA node in the right atrium. It spreads as a wave of contraction in the heart. The waves of the ECG are due to depolarization and not due to contraction of the heart. This wave of depolarisation occurs before the beginning of contraction of the cardiac muscle. A normal ECG shows 3 waves designated as P wave, QRS complex and T wave as shown in Figure 7.9 and the stages of the ECG graph are shown in Figure 7.10.

P Wave (atrial depolarisation)

It is a small upward wave and indicates the depolarisation of the atria. This is the time taken for the excitation to spread through atria from SA node. Contraction of both atria lasts for around 0.8-1.0 sec.

PQ Interval (AV node delay)

It is the onset of P wave to the onset of QRS complex. This is from the start of depolarisation of the atria to the beginning of ventricular depolarisation. It is the time taken for the impulse to travel from the atria to the ventricles (0.12-0.21sec). It is the measure of AV conduction time.

QRS Complex (ventricular depolarisation)

No separate wave for atrial depolarisation in the ECG is visible. Atrial depolarisation occurs simultaneously with the ventricular depolarisation. The normal QRS complex lasts for 0.06-0.09 sec. QRS complex is shorter than the P wave, because depolarisation spreads through the Purkinjie fibres. Prolonged QRS wave indicates delayed conduction through the ventricle, often caused due to ventricular hypertrophy or due to a block in the branches of the bundle of His.

ST Segment

It lies between the QRS complex and T wave. It is the time during which all regions of the ventricles are completely depolarised and reflects the long plateau phase before repolarisation. In the heart muscle, the prolonged depolarisation is due to retardation of K+ efflux and is responsible for the plateau. The ST segment lasts for 0.09 sec.

T wave (ventricular depolarisation)

It represents ventricular depolarisation. The duration of the T wave is longer than QRS complex because repolarisation takes place simultaneously throughout the ventricular depolarisation.

7.5. Double circulation

Circulation of the blood was first described by William Harvey (1628). There are two types of blood circulation

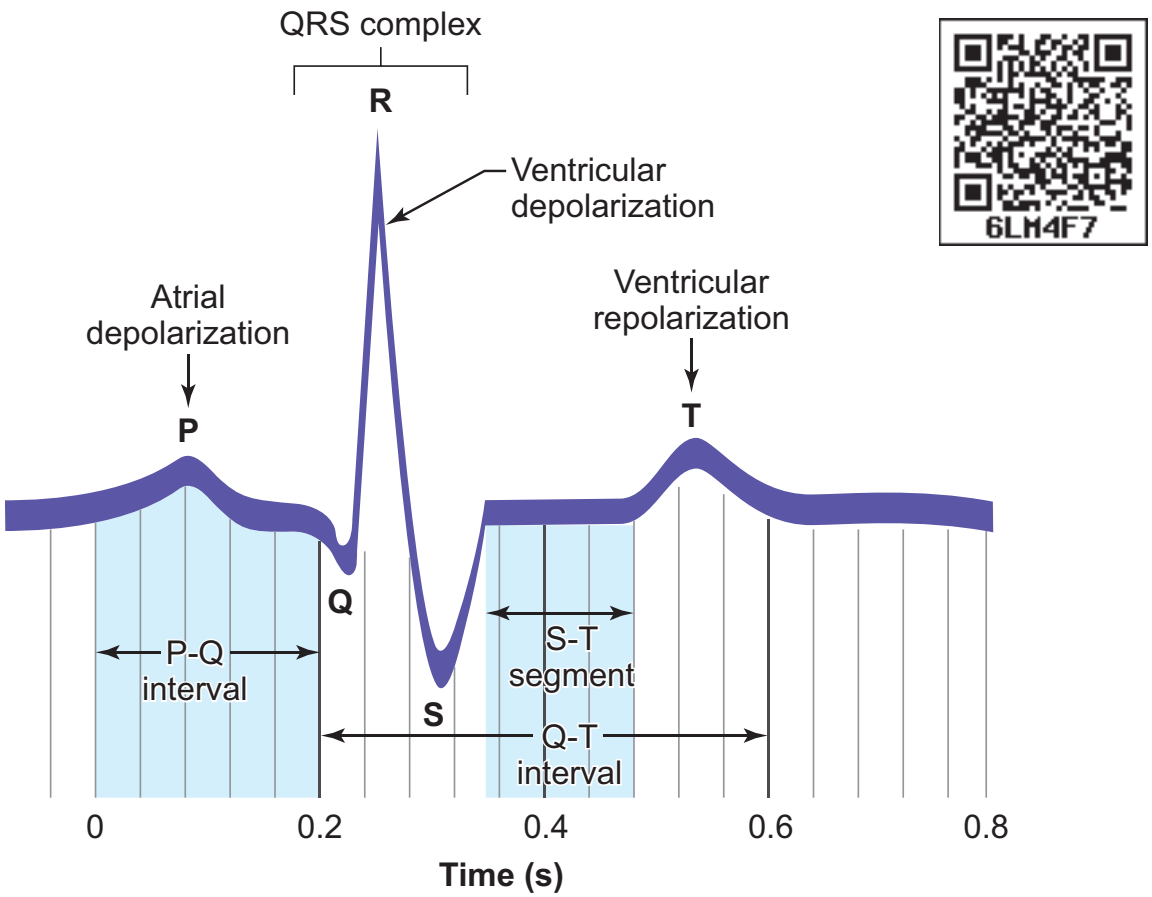


Figure 7.9 Graph of a normal ECG

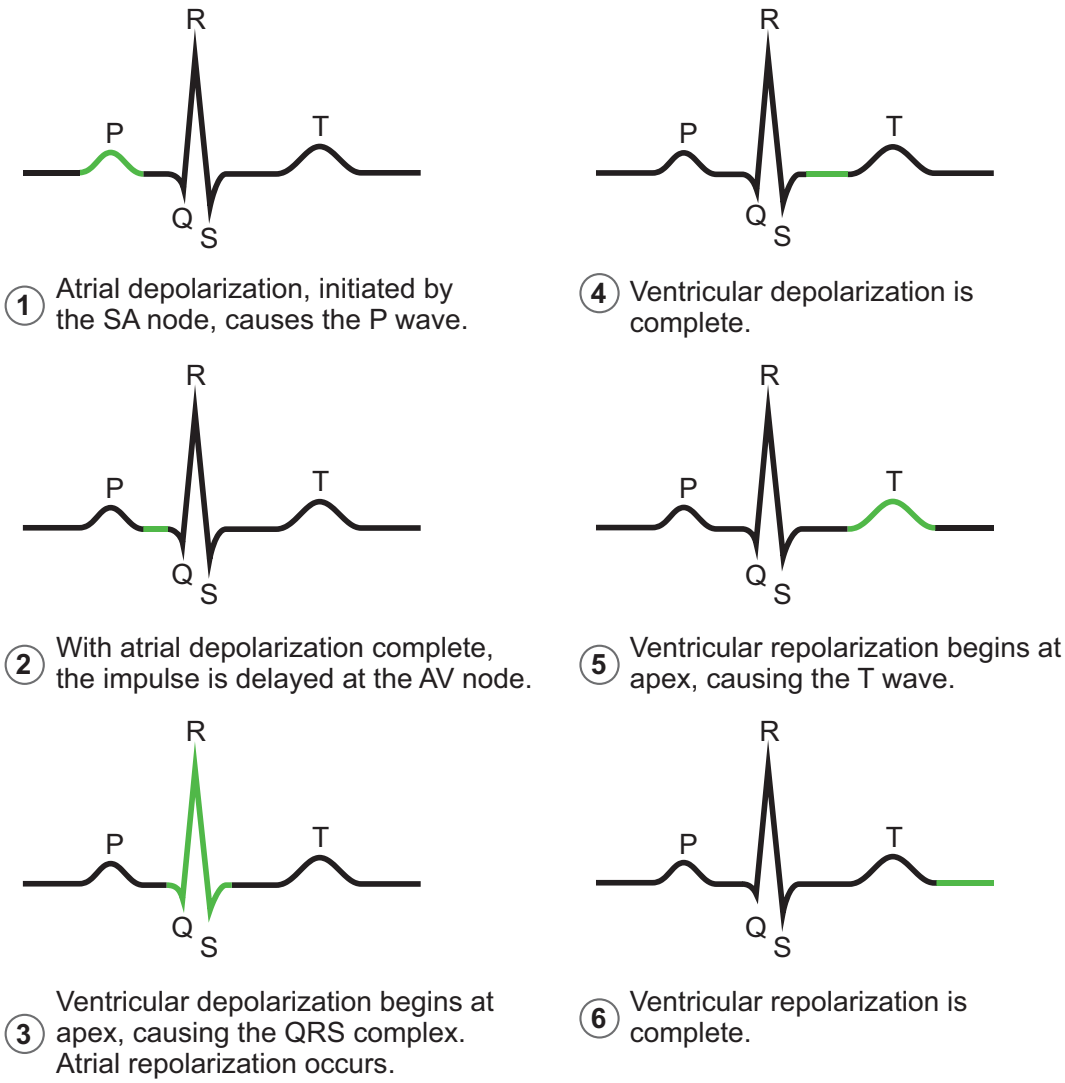


Figure 7.10 Stages of ECG graph

in vertebrates, single circulation and double circulation which is shown in Figure 7.11 (a and b) and 7.12.

The blood circulates twice through the heart first on the right side then on the left side to complete one cardiac cycle. The complete double blood circulation is more prominent in mammals because of the complete partition of all the chambers (Auricles and ventricles) in the heart.

In systemic circulation, the oxygenated blood entering the aorta from the left ventricle is carried by a network of arteries, arterioles and capillaries to the tissues. The deoxygenated blood from the tissue is collected by venules, veins and vena cava and emptied into the right atrium. In pulmonary circulation, the blood from heart (right ventricle) is taken to the lungs by pulmonary artery and the oxygenated blood from the lungs is emptied into the left auricle by the pulmonary vein.

Completely separated circuits have an important advantage. Different pressures are maintained in the pulmonary and systemic circulation. Why is this advantageous? In the lungs the capillaries must be very thin to allow gas exchange, but if the blood flows through these thin capillaries under high pressure the fluid can leak through or ruptures the

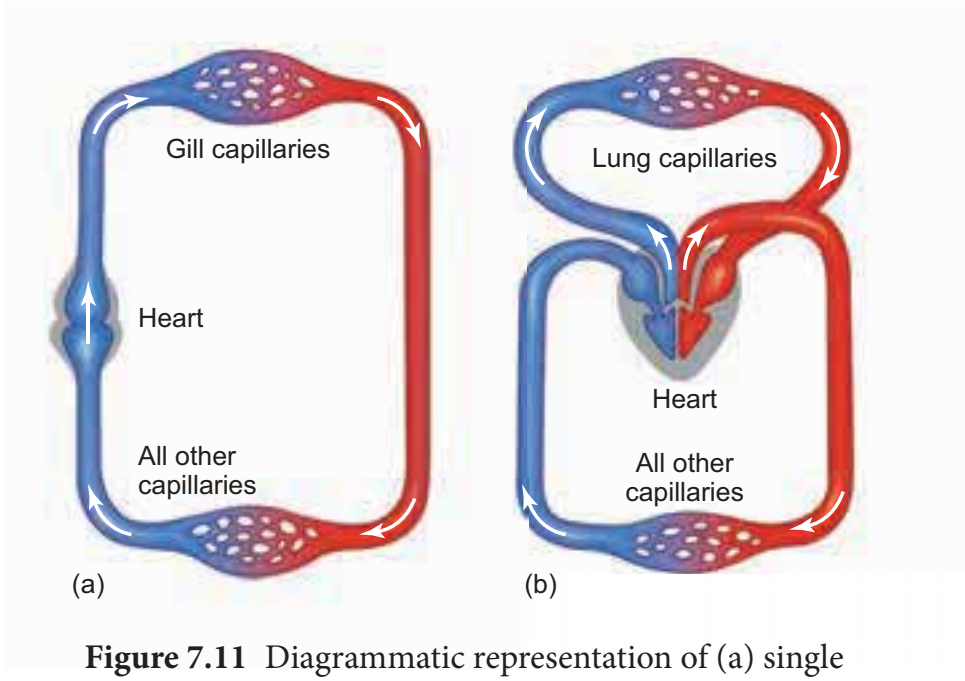


Figure 7.11 Diagrammatic representation of (a) single circulation (b) double circulation

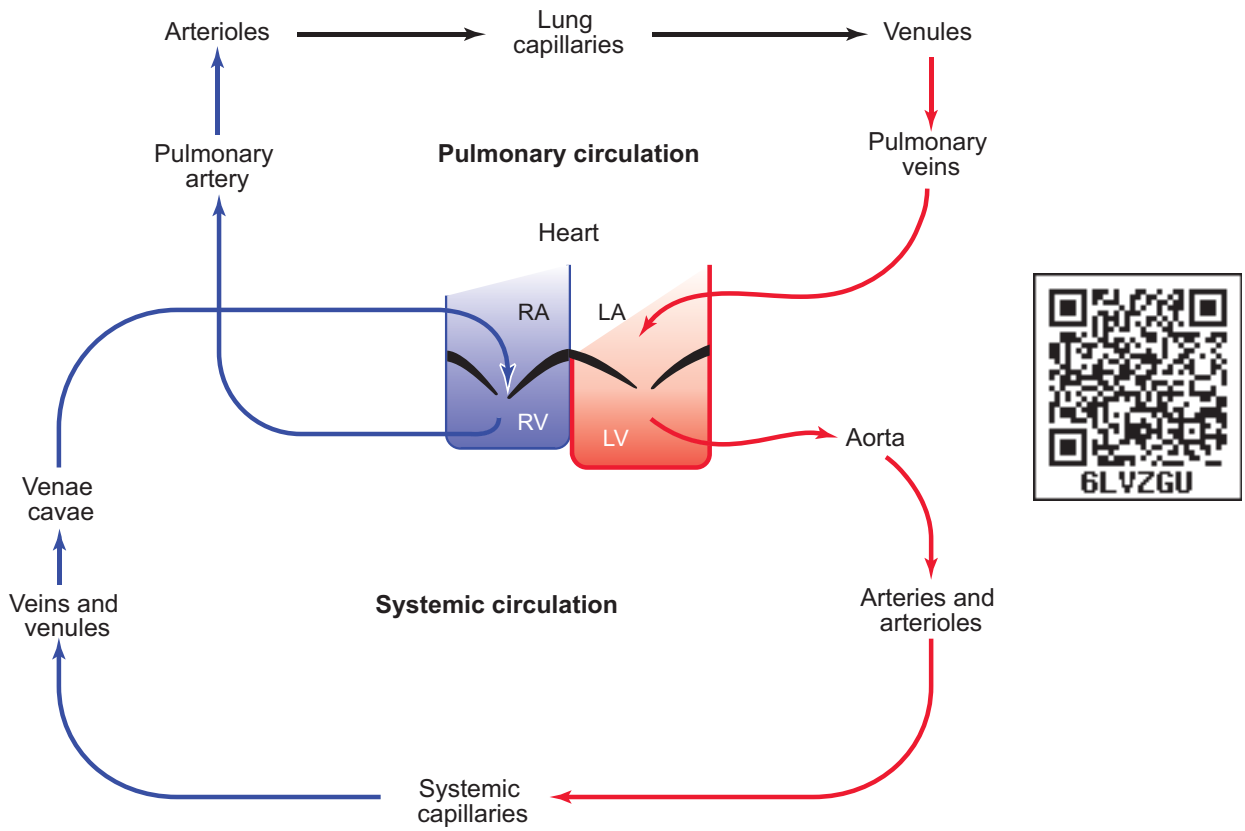


Figure 7.12 Diagrammatic representation of the Double circulation

capillary walls and can accumulate in the tissues. This increases the diffusion distance and reduces the efficiency of the gas exchange. In contrast high pressure is required to force blood through the long systemic circuits. Hence the arteries close to the heart have increased pressure than the arteries away from the heart. Completely separated circuits (pulmonary and systemic) allow these two different demands to be met with.

7. 6 Regulation of cardiac activity

The type of heart in human is myogenic because the heart beat originates from the muscles of the heart. The nervous and endocrine systems work together with paracrine signals (metabolic activity) to influence the diameter of the arterioles and alter the blood flow. The neuronal control is achieved through autonomic nervous system (sympathetic and parasympathetic). Sympathetic neurons release nor-epinephrine and adrenal medulla releases epinephrine. The two hormones bind to β – adrenergic receptors and increase the heart rate. The parasympathetic neurons secrete acetylcholine that binds to muscarinic receptors and decreases the heart beat. Vasopressin and angiotensin II, involved in the regulation of the kidneys, results in vasoconstriction while natriuretic peptide promotes vasodilation. Vagus nerve is a parasympathetic nerve that supplies the atrium especially the SA and the AV nodes.

7.7 Disorders of the circulatory system

Hypertension is the most common circulatory disease. The normal blood pressure in man is 120/80 mmHg. In cases when the diastolic pressure exceeds 90 mm Hg and the systolic pressure exceeds 150 mm Hg persistently, the condition is called hypertension. Uncontrolled hypertension may damage the heart, brain and kidneys.

Coronary heart disease occurs when the arteries are lined by **atheroma**. The build-up of atheroma contains cholesterol, fibres, dead muscle and platelets and is termed Atherosclerosis. The cholesterol rich atheroma forms plaques in the inner lining of the arteries making them less elastic and reduces the blood flow. Plaque grows within the artery and tends to form blood clots, forming coronary thrombus. Thrombus in a coronary artery results in heart attack.

Stroke

Stroke is a condition when the blood vessels in the brain bursts, (Brain haemorrhage) or when there is a block in the artery that supplies the brain, (atherosclerosis) or thrombus. The part of the brain tissue that is supplied by this damaged artery dies due to lack of oxygen (cerebral infarction).

Angina pectoris (ischemic pain in the heart muscles) is experienced during early stages of coronary heart disease. Atheroma may partially block the coronary artery and reduce the blood supply to the heart. As a result, there is tightness or choking with difficulty in breathing. This leads to **angina** or chest pain. Usually it lasts for a short duration of time.

Varicose veins The veins are so dilated that the valves prevent back flow of blood. The veins lose their elasticity and become congested. Common sites are legs, rectal-anal regions (haemorrhoids), the oesophagus and the spermatic cord.

Embolism is the obstruction of the blood vessel by abnormal mass of materials such as fragment of the blood clot, bone fragment or an air bubble. Embolus may lodge in the lungs, coronary artery or liver and leads to death.

Aneurysm The weakened regions of the wall of the artery or veins bulges to form a balloon like sac. Unruptured aneurysm may exert pressure on the adjacent tissues or may burst causing massive haemorrhage.

Myocardial infarction (Heart failure)

The prime defect in heart failure is a decrease in cardiac muscle contractility. The Frank- Starling curve shifts downwards and towards the right such that for a given EDV, a failing heart pumps out a smaller stroke volume than a normal healthy heart.

When the blood supply to the heart muscle or myocardium is remarkably reduced it leads to death of the muscle fibres. This condition is called heart attack or myocardial infarction. The blood clot or thrombosis blocks the blood supply to the heart and weakens the muscle fibres. It is also called **Ischemic** heart disease due to lack of oxygen supply to the heart muscles. If this persists it leads to chest pain or angina. Prolonged angina leads to death of the heart muscle resulting in heart failure.

Rheumatoid Heart Disease

Rheumatic fever is an autoimmune disease which occurs 2-4 weeks after throat infection usually a streptococcal infection. The antibodies developed to combat the infection cause damage to the heart. Effects include fibrous nodules on the mitral valve, fibrosis of the connective tissue and accumulation of fluid in the pericardial cavity.

7.8 Cardio pulmonary Resuscitation (CPR)

In 1956, James Elam and Peter Safar were the first to use mouth to mouth resuscitation. CPR is a life saving procedure that is done at the time of emergency conditions such as when a person's breath or heart beat has stopped abruptly in case of drowning, electric shock or heart attack. CPR includes rescue of breath, which is achieved by mouth to mouth breathing, to deliver oxygen to the victim's lungs by external chest compressions which helps to circulate blood to the vital organs. CPR must be performed within 4 to 6 minutes after cessation of breath to prevent brain damage or death. Along with CPR, defibrillation is also done. Defibrillation means a brief electric shock is given to the heart to recover the function of the heart.

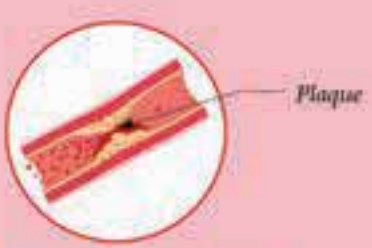
Activity

Ramu was 45 years old when he went to a doctor to check his blood pressure. His pressure was around 158/98mmHg. The doctor advised him to measure his blood pressure at home for two weeks. He came to the doctor saying his average blood pressure was around 160/100mmHg. Doctor concludes that Ramu has high blood pressure or hypertension. If not controlled, hypertension can lead to heart failure, stroke and kidney failure. He returned to the doctor after two months after taking the drug, ACH inhibitor. This chemical blocks the production of angiotensin II, a powerful vasoconstrictor, so his blood pressure returned back to normal.

1. Why are people with high blood pressure at greater risk for having a hemorrhagic stroke?
2. Without medication Ramu's blood pressure was around 160/100mmHg after two weeks. Why this pressure was referred to as hypertension by the doctor.
3. Blocking the action of vasoconstrictor lowers the blood pressure? Give reasons.
4. What is the role of ACH inhibitor in reducing blood pressure?
5. What conditions one might expect if the blood pressure is not controlled?

Heart Diseases

Heart disease includes any disorder of the heart, 50% of all heart attacks in Indians occur under 50 years of age and 25% of all heart attacks in Indians occur under 40 years of age.

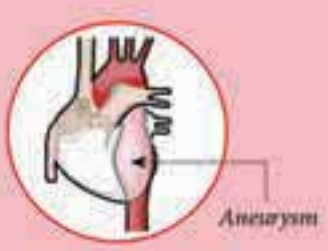


Coronary heart disease

Blocked or clogged arteries limit blood flow to the heart and starving it of oxygen and nutrients.

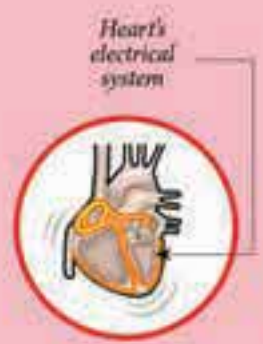
Vascular disease

Heart disease is often related to diseases of the circulatory system, including arteries, veins and lymph vessels, or blood disorders.



Aorta disease

A portion of the aortic wall weakens and balloons out, forming an aneurysm.



Arrhythmia

The heart beats irregularly.

Pericarditis

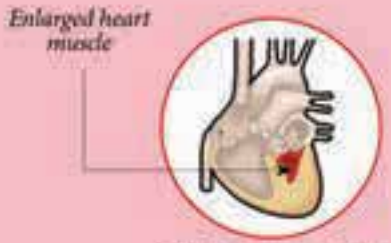
An inflammation of one or more layers of the pericardium, a thin membrane that lines the heart.

Heart failure

The heart cannot pump as powerfuly as it needs to, in order to supply the body with oxygen and nutrients, causing the heart muscles to overwork and weaken.

Heart valve disease

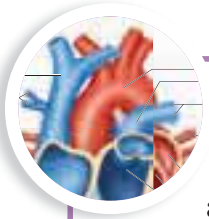
One of more of the hearts' valves - which control blood flow into and out of the heart - does not work.



Cardiomyopathy

An enlarged or abnormally stiff or thick heart, causing the heart to pump weaker than normal and sometimes leading to heart failure or arrhythmia.

The vital flow



Let's explore the **circulatory system** and learn the the 'Phases of Cardiac Cycle'.

Step – 1

Type the following URL in the browser. 'Circulatory System page will open. Select 'Phases of Cardiac Cycle' from the grid.

Step – 2

From the given Phases of Cardiac Cycle, Play one after another using 'Play' button and observe the valve movements and blood circulation in the heart.

Step – 3

The last animation shows the entire functions and flows of the Cardiac cycle. Use Play, Forward and Backward buttons and observe the nuances of Heart function.

Step – 4

Use the links below the Phases to get more details about the locations, size, chambers and pericardium structures.

Step 1

Step 2

Step 3

Step 4

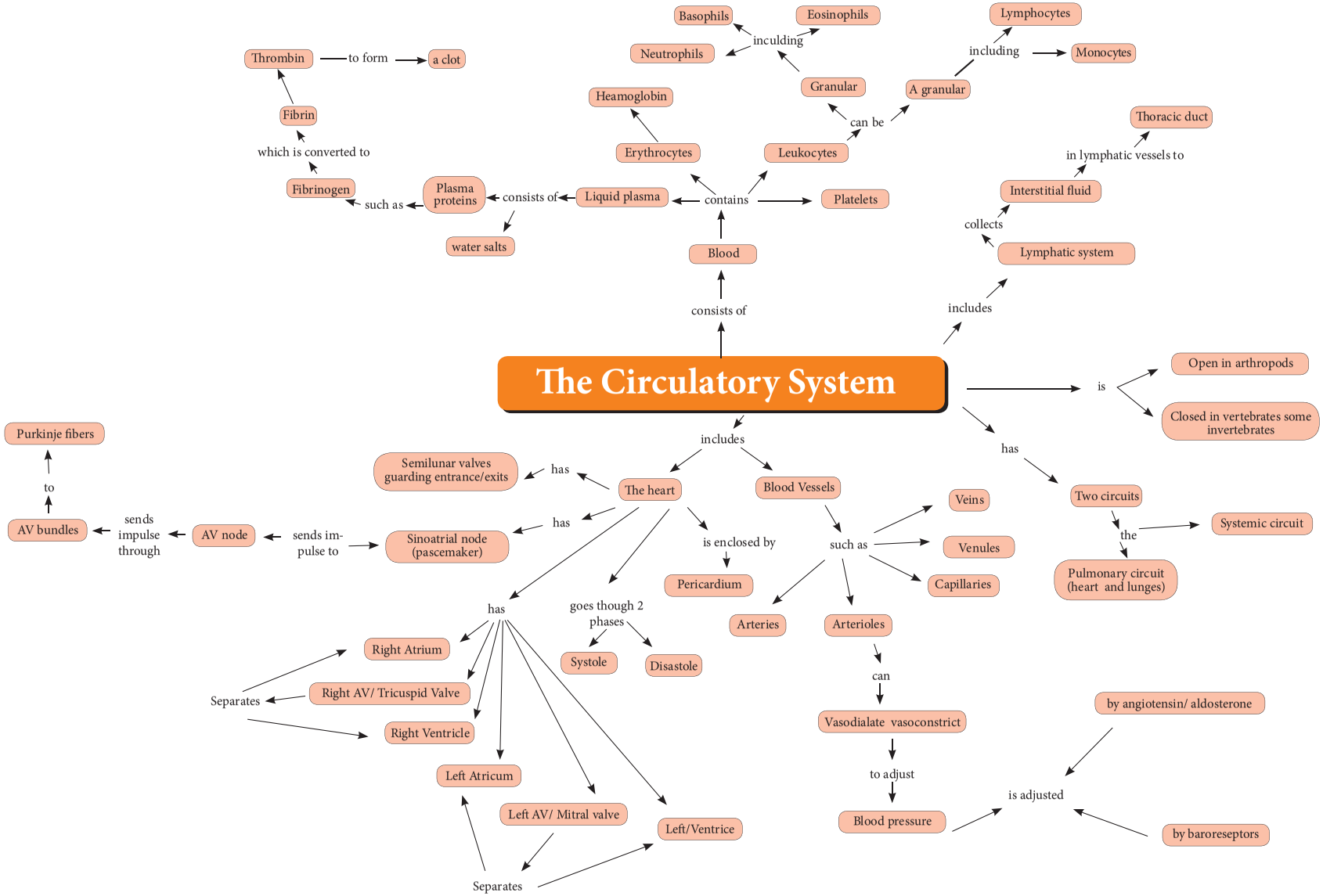
Phases of the Cardiac Cycle's URL:

https://www.getbodysmart.com/circulatory-system

B167_STD_11_ZOOLOGY_EM

* Pictures are indicative only

Concept Map


The Circulatory System
consists of
Blood
contains
Liquid plasma
consists of
Plasma proteins
such as
Fibrinogen
which is converted to
Fibrin
Thrombin
to form
a clot
water salts
Platelets
Erythrocytes
Heamoglobin
Leukocytes
can be
Granular
A granular
including
Basophils
Eosinophils
Neutrophils
Lymphocytes
Monocytes
includes
Lymphatic system
collects
Interstitial fluid
in lymphatic vessels to
Thoracic duct
is
Open in arthropods
Closed in vertebrates some invertebrates
has
Two circuits
the
Systemic circuit
Pulmonary circuit (heart and lunges)
includes
The heart
Blood Vessels
has
Semilunar valves guarding entrance/exits
has
Sinoatrial node (pascemaker)
sends im-pulse to
AV node
sends impulse through
AV bundles
to
Purkinje fibers
is enclosed by
Pericardium
such as
Veins
Venules
Capillaries
Arteries
Arterioles
can
Vasodialate vasoconstrict
to adjust
Blood pressure
is adjusted
by angiotensin/ aldosterone
by baroreseptors
has
goes though 2 phases
Systole
Disastole
Separates
Right Atrium
Right AV/ Tricuspid Valve
Right Ventricle
Left Atricum
Left AV/ Mitral valve
Left/Ventrice
Separates

Summary

Vertebrates circulate blood in their body, to transport essential substances to the cells and to carry waste substances from them. Blood is carried away from the heart, passes through tissues in capillaries and is returned to the heart in veins. Blood pressure drops gradually as it passes along this system. Arteries have thick, elastic walls which allow them to withstand high blood pressure. Arterioles are small arteries that help to reduce blood pressure and control the amount of blood flow to different tissues. Capillaries are only just wide enough to allow the passage of red blood cells, and have very thin wall to allow efficient and rapid transfer of materials between blood and cells. Veins have thinner walls than arteries and possess valves that allow blood to flow back to the heart even at low pressure.

Blood consist of plasma and formed elements. Blood plasma leaks from capillaries to form tissue fluid. This is collected into lymphatics as lymph, and returned to the blood in the subclavian veins. Tissue fluid and lymph are almost identical in composition. They contain fewer plasma protein molecules than blood plasma as these proteins are too large to pass through the pores in the capillary walls. The formed elements of blood constitute RBC, WBC and Platelets.

The mammalian heart has four chambers, right and left artia and right and left ventricles. The separation of chambers in the heart results in complete double circulation. The cardiac cycle is a continuous process but can be considered in five stages. Beating of the heart is initiated by the sinoatrial node (SAN) or pacemaker which has its own myogenic rhythm. Blood pressure is the force exerted by blood on the walls of blood vessels, and it is responsible for moving blood through the vessels.

Cardiovascular disease accounts for more deaths each year in the India. Cardiovascular conditions include systemic hypertension, atherosclerosis, coronary artery disease, angina pectoris, myocardial infarction and stroke. Cardiovascular diagnostic techniques and treatments include cardiac angiography, balloon angioplasty, and coronary artery bypass. The circulatory system contributes to homeostasis by transporting O_2, CO_2, wastes, electrolytes, and hormones from one part of the body to another.

Glossary

Blood vessels serve as a passage way through which the blood is directed and distributed from the heart to all parts of the body and subsequently returned to the heart.

Pulmonary circulation – consists of closed loop of vessels carrying blood between the heart and lungs.

Systemic circulation – is a circuit of vessels carrying blood between the heart and other parts of body systems.

Cardio pulmonary resuscitation (CPR) – Serves as a life saving measure until appropriate therapy can restore the heart to normal function.

Aorta – A single large artery carrying blood away from the left ventricle.

Bicuspid valve – also called mitral valve. Left Auricular ventricular valve with two flaps that is present between the left auricle and left ventricle.

Tricuspid valve – right auricular valve with three flaps that is present between the right auricle and right ventricle.

Chordate tendineae – these are chords that extend from the edge of each flap and attach to the papillary muscles that prevent the AV valves from being forced to open due to high ventricular pressure.

Papillary muscles – small nipple shaped muscles protrude from the inner surface of the ventricular walls. Papilla means 'nipple'.

Sinoatrial node (SA node), – a small, specialised region in the right atrial wall near the opening of the superior vena cava

Atrioventricular node (AV node), – a small bundle of specialized cardiac muscle cells locted at the base of the right atrium near the septum, just above the junction of the atria and ventricles.

Bundle of His – (atrioventicular bundle), a tract of specialized cells that originates at the AV node and enters the interventricular septum

Purkinje fibres – small terminal fibres that extend from the bundle of His and spread throughout the ventricular myocardium

Stroke volume (SV) – The amount of blood pumped out of each ventricle with each contraction, SV = EDV-ESV

Isovolumetric ventricular contraction – Isovolumetric means constant volume and length. During ventricular contraction, when all valves are closed, no blood can enter or leave the ventricle during this time. Because no blood leaves or enters the ventricles the ventricular chamber has a constant volume and the muscle fibres stay at a constant length.

End systolic volume (ESV) – The ventricles do not empty completely during ejection, only half of the blood within the ventricle at the end of diastole is pumped out during subsequent systole. The amount of blood left in the ventricle at the end of systole when ejection is complete is called ESV.

End diastolic volume (EDV) – The volume of blood in the ventricle at the end of diastole is known as the end diastolic volume.

Lub sound – is associated with the closure of the AV valves.

Dub sound – is associated with the closure of the semilunar valves.

Chordae tendinae – tendon like cords which are connected to the tip of the cuspid valves

Diastole – Relaxation of heart chambers

Endocardium – Inner cardiac muscle

Epicardium – outer cardiac muscle

Inter ventricular septum – Partition between right and left ventricle

Interatrial septum – Partition between right and left atria

Left atrioventricular valve – Bicuspid valve or Mitral valve

Evaluation

1. What is the function of lymph?
   a. Transport of O_2 into brain
   b. Transport of CO_2 into lungs
   c. Bring interstitial fluid in blood
   d. Bring RBC and WBC in lymph node
2. Which one of the following plasma proteins is involved in the coagulation of blood?
   a. Globulin b. Fibrinogen
   c. Albumin d. Serum amylase
3. Which of the following WBCs are found in more numbers?
   a. Eosinophil b. Neutrophil
   c. Basophil d. Monocyte
4. Which of the following is not involved in blood clotting?
   a. Fibrin b. Calcium
   c. Platelets d. Bilirubin
5. Lymph is colourless because
   a. WBC are absent
   b. WBC are present
   c. Heamoglobin is absent
   d. RBC are absent
6. Blood group is due to the presence or absence of surface
   a. Antigens on the surface of WBC
   b. Antibodies on the surface of RBC
   c. Antigens of the surface of RBC
   d. Antibodies on the surface of WBC
7. A person having both antigen A and antigen B on the surface of RBCs belongs to blood group
   a. A b. B c. AB d. O
8. Erythroblastosis foetalis is due to the destruction of
   a. Foetal RBCs
   b. Foetus suffers from atherosclerosis
   c. Foetal WBCs
   d. Foetus suffers from mianmata
9. Dub sound of heart is caused by
   a. Closure of atrio-ventricular valves
   b. Opening of semi-lunar valves
   c. Closure of semi-lunar values
   d. Opening of atrio-ventricular valves.
10. Why is the velocity of blood flow the lowest in the capillaries?
    a. The systemic capillaries are supplied by the left ventricle, which has a lower cardiac output than the right ventricle.
    b. Capillaries are far from the heart, and blood flow slows as distance from the heart increases.
    c. The total surface area of the capillaries is larger than the total surface area of the arterioles.
    d. The capillary walls are not thin enough to allow oxygen to exchange with the cells.
    e. The diastolic blood pressure is too low to deliver blood to the capillaries at a high flow rate.
11. An unconscious patient is rushed into the emergency room and needs a fast blood transfusion. Because there is no time to check her medical history or determine her blood type, which type of blood should you as her doctor, give her?
    a. A^- b. AB c. O^+ d. O^-
12. Which of these functions could or could not be carried out by a red blood cell? Briefly justify your answer.

a. Protein synthesis

b. Cell division

c. Lipid synthesis

d. Active transport

13. At the venous end of the capillary bed, the osmotic pressure is

a. Greater than the hydrostatic pressure
b. Result in net outflow of fluids

c. Results in net absorption of fluids

d. No change occurs.

14. A patient's chart reveals that he has a cardiac output of 7500mL per minute and a stroke volume of 50 mL. What is his pulse rate (in beats / min)

a. 50 b. 100 c. 150 d. 400

15. At any given time there is more blood in the venous system than that of the arterial system. Which of the following features of the veins allows this?

a. relative lack of smooth muscles

b. presence of valves

c. proximity of the veins to lymphatic's

d. thin endothelial lining

16. Distinguish between arteries and veins

17. Distinguish between open and closed circulation

18. Distinguish between mitral valve and semi lunar valve

19. Right ventricular wall is thinner than the left ventricular wall. Why?

20. What might be the effect on a person whose diet has less iron content?

21. Describe the mechanism by which the human heart beat is initiated and controlled.

22. What is lymph? Write its function.

23. What are the heart sounds? When and how are these sounds produced?

24. Select the correct biological term.

Lymphocytes, red cells, leucocytes, plasma, erythrocytes, white cells, haemoglobin, phagocyte, platelets, blood clot.

a. Disc shaped cells which are concave on both sides

b. Most of these have a large, bilobed nucleus

c. Enable red cells to transport blood

d. The liquid part of the blood

e. Most of them move and change shape like an amoeba.

f. Consists of water and important dissolved substances.

g. Destroyed in the liver and spleen after circulating in the blood for four months.

h. The substances which gives red cells their colour.

i. Another name for red blood cells.

j. Blood that has been changed to a jelly.

k. A word that means cell eater.

l. Cells without nucleus.

m. White cells made in the lymphatic tissue.

n. Blocks wound and prevent excessive bleeding.

o. Fragment of cells which are made in the bone marrow.

p. Another name for white blood cells.

q. Slowly releases oxygen to blood cells.

r. Their function is to help blood clot in wounds.

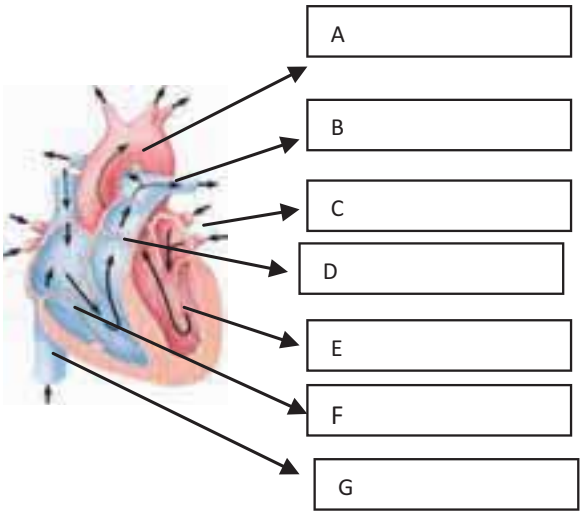
25. Select the correct biological term.

Cardiac muscle, atria, tricuspid systole, auricles, arteries, diastole, ventricles,

bicuspid valve, pulmonary artery, cardiac cycle, semi lunar valve, veins, pulmonary vein, capillaries, vena cava, aorta.

a. The main artery of the blood.
b. Valves between the left atrium and ventricle.
c. Technical name for relaxation of the heart.
d. Another name for atria.
e. The main vein.
f. Vessels which carry blood away from the heart.
g. Two names for the upper chambers of the heart.
h. Thick walled chambers of the heart.
i. Carries blood from the heart to the lungs.
j. Takes about 0.8 sec to complete.
k. Valves situated at the point where blood flows out of the heart.
l. Vessels which carry blood towards the heart.
m. Carries blood from the lungs to the heart.
n. The two lower chambers of the heart.
o. Prevent blood from re entering the ventricles after entering the aorta.
p. Technical name for one heart beat.
q. Valves between right atrium and ventricles.
r. Technical name for contraction of the heart.
s. Very narrow blood vessels.

26. Name and Label the given diagrams to show A, B, C, D, E, F, and G



References

1. Christopher D. Moyes and Patricia M. Schulte (2016), Principles of animal physiology 2nd edition Pearson publications.
2. Mary Jones, Richard Fosbery, Jennifer Gregory and Dennis Taylor, Cambridge International AS and A level Biology Course book 4th edition, Cambridge University Press.
3. Elaine N. Marieb and Katja Hoehn (2011), Anatomy and Physiology 4th edition Pearson publications.

Web links

1. Online and Interactive Resources
   a. www.fi.edu/learn/heart/blood/blood.html for information about blood.
   b. www. abpischools.org.uk it includes a glossary, questions and animations.
   c. www.youtube.com/watch?v+kcWNjt77uHc for description of cardiac cycle. www. brookerbiology.com

Chapter 1. LIVING WORLD

1. The smallest taxon among the following is …….(PMT-94)

a. class b. order

c. species d. genus

2. Taxonomically a species is ……. (PMT-94)

a. A group of evolutionary related population

b. A fundamental unit in the phylogeny of organisms

c. Classical evolutionary taxonomy

d. A community taken into considerationa. an evolutionary base

3. Species is …….

a. not related to evolution

b. specific class of evolution

c. specific unit of evolution

d. fertile specific unit in the evolutionary history of a race

4. Two words comprising the binomial nomenclature are ……. (DPMT-96)

a. Family & genus

b. order & family

c. genus & species

d. species & variety

5. A group of plants or animals with similar traits of any rank is kept under …. (PMT-96)

a. species b. genus

c. order **d. taxon**

6. Which of the following is the correct sequence in the increasing order of complexity ? (PMT-97)

a. molecules, tissues, community, population

b.cell, tissues, community, population

c. tissues, organisms, population, community

d.molecules, tissues, community, cells

7. New systematic and the concept of life was given by (BHU-98)

a. Huxley b. Odom

c. Elton d. Linnaeus

8. Two organisms of same class but different families will be kept under the same (CET-98)

a. genera b. species

c. order d. family

9. Which of the following will form a new species ? (PMT-98)

a. inter breeding

b. variations

c. differential reproduction

d. none of the above

10. A community includes ……. (CET-98)

a. a group of same genera

b. a group of same population

c. a group of individuals from same species

d. different populations interacting with each other

11. Binomial nomenclature was given by ……. (BHU-97)

a. Huxley b. Ray

c. Darwin **d. Linnaeus**

12. In classification the category below the level of family is ……. (CET-98)

a. class b. species

c. phylum **d. genus**

13. Taxon is ……. (CET-2000)

a. species

b. unit of classification

c. highest rank in classification

d. group of closely related

14. One of the following includes most closely linked organisms (PMT-2001)

a. species b. genus

c. family d. class

15. Which of the following taxons cover a greater number of organisms ? (PMT-2001)

a. order b. family

c. genus **d. phylum**

16. Inbreeding is possible between two members of ……. (AMU-2005)

a. order b. family

c. genus **d. species**

17. Which of these is correct order of hierarchy? (WARDHA-2002)

a. kingdom, division, phylum genus & species

b. phylum, division, genus & class

c. kingdom, genus, class, phylum & division

d. phylum, kingdom, genus, species &class

18. Which is not a unit of taxonomic category? (BVP-2002)

a. series **b. glumaceae**

c. class d. phylum

19. Which is the first step of taxonomy ? (MGIMS-2002)

a. nomenclature b. classification

c. identification d. hierarchical arrangement

20. The five kingdom classification was given by ……. (BYP-2002)

a. Whittaker b. Linnaeus

c. Copeland d. Haeckel

21. Taxon includes ……. (PMT-2002)

a. Genus and species

b. kingdom and division

c. all ranks of hierarchy

d. none of the above

22. Binomial nomenclature refers to ……. (CET-2000)

a. Two names of a species

b. one specific and one local name of a species

c. two words for the name of a species

d. two life cycles ofa. organism

23. Carl Linnaeus is famous for ……. (GGSPU-2002)

a. coining the term 'systematics'

b. introducing binomial nomenclature

c. giving all natural system of classification

d. all of these

24. True species are …….

a. interbreeding b. sharing the same niche

c. feeding on the same food

d. reproductively isolated

25. The smallest unit of classification is ……. (GGSPU-2002)

a. species b. sub-species

c. class d. genus

26. Who coined the term 'taxonomy' ? (BVP-2003)

a. Candolle b. Waksman

c. Leuwenhoek d. Louis Pasteur

27. Basic unit of classification of organisms is ……. (CET-2003)

a. species b. population

c. class d. family

28. The unit of classification containing concrete biological entities is ……. (WARDHA-2003)

a. taxon b. species

c. category d. order

29. Species are considereda. …….

a. real basic units of classification

b. the lowest units of classification

c. artificial concept of human mind which cannot be defined in absolute terms

d. real units of classification devised by taxonomists

30. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for ……..

a. interaction with the environment and progressive evolution

b. reproduction

c. growth and movement

d. responsiveness to touch

31. Taxonomic category arrange in descending order ……. (MH-01)

a. key b. hierarchy

c. taxon **d. taxonomic category**

32. In which of the animal dimorphic nucleus is found? (PMT 2002).

a. Amoeba proteus

b. Trypanosoma gambiense

c. Plasmodium vivax

d. Paramecium caudatum

33. When a fresh-water protozoan possessing a contractile vacuole, is placed in a glass containing marine water, the vacuole will. (PMT 2004)

a. increase in number b. disappear

c. increase in size **d. decrease in size**

34. Which form of reproduction is correctly matched? (AIIMS 2007)

a. Euglena transvers binary fission

b.Paramecium longitudinal binary fission

c. Amoeba multiple fission

d. Plasmodium binary fission

35. The presence of two types of nuclei, a macronucleus and a micronucleus, is characteristic of protozoans are grouped under the class. (BHU 1994, 1999)

a. sporozoa b. flagellate

c. sarcodina **d. ciliata**

36. Which class of protozoa is totally parasitic? (BHU 1994)

a. sporozoa b. mastigophora

c. ciliate d. sarcodina

37. Reproduction in paramecium is controlled by (BHU 1999).

a. flagella b. cell wall

c. micronucleus d. macronucleus

38. In the life cycle of plasmodium exflagellation occurs in (BHU 2007)

a. sporozoties **b. microgametes**

c. macrogametes d. signet ring

39. Excretion in Amoeba occurs through (DPMT 1997)

a. lobopodia b. plasma membrane

c. uroid portion **d. contractile vacuole**

40. Method of dispersal in Amoeba is (DPMT 1995)

a. locomotion **b. encystment**

c. sporulation d. binary fission

41. Mode of feeding in free living protozoans is (DPMT 2007).

a. holozoic b. saprozoic

c. both (a) and (b) d. none of these

42. Infection of Entamoeba is caused (UP- CPMT 1996, 1999).

a. by kissing

b. by wearing clothes of patient

c. by contaminated food

d. none of these

43. Choose the correct statement

a. All reptiles have a three chambered heart.

b. All Pisces have gills covered bya. operculum

c. All mammals are viviparous

d. All cyclostomes do not posses jaws and paired fin

44. Which of the following characteristics is mainly responsible for diversification of insects on land?

a. Segmentation b. Bilateral symmetry

c. Exoskeleton d.Eyes.

45. The primitive prokaryotes responsible for the production of biogas from the ruminant animals Include the (2016)

a. Thermoacidophiles

b. methanogens

c. Eubacteria

d. Halophiles.

46. Methanogens belong to (2016)

a. Dino flagellates

b. Slime moulds

c. Eubacteria

d. Archaebacteria

Chapter 2 KINGDOM ANIMALIA

1. Classification of sponges is primarily based on the (JCECE-2003)

a. body organization b. body plan

c. skeleton d. canal system

2. Symmetry is cnidaria is (AMU-2009)

a. radial b. bilateral

c. pentamerous d. spherical

3. Cavity of coelenterates is called (BHU-2008)

a. coelenteron b. coelom

c. cavity d. none of these

4. Sea anemone bolongs to phylum (BCECE-2005)

a. protozoa b. porifera

c. coelenterata d. echinodermata

5. Medusa is the Reproductive organs of (BHU-2008)

a. Hydra **b. Aurelia**

c. obelia d. sea anemone

6. The excretory cells, that are found in platyhelminthes. (J & K CET- 2007)

a. Protonephridia **b. flame cells**

c. Solenocytes d. All of these

7. In which of the following organisms, self fertilization is seen. (CCET-2007)

a. fish b. Round worm

c. Earthworm **d. Liver fluke**

8. Nephridia of Earthworms are performing same function as. (J & K CET-2003)

a. gills of prawn

b. flame cells of planaria

c. trachea of insects

d. nematoblasts of Hydra

9. Phylum of *Taenia solium* is (BCECE-2004)

a. Aschelminthes b. Annelids

c. platylyelminthes d. mollusca

10. Ascaris is found in (RPMT-2004)

a. body cavity b. lymph nodes

c. tissue **d. alimentary canal**

11. Which of the following animals has a true coelom ? (J & K CET-2007)

a. Ascaris **b. pheretima**

c. sycon d. Taenia solium

12. Metameric segmentation is the main feature of

a. Annelida

b. Echinodermata

c. Arthropoda

d. Coelenterata

13. Body cavity lined by mesoderm is called (J & T CET-2005)

a. coelenteron b. pseudocoel

c. coelom d. blastocoel

14. Which of the following have the highest number of species in nature? (AIPMT-2011)

a. Insects b. Birds

c. Angiosperms d. Fungi

15. Which of the following is a crustacean ? (Guj-CET-2011)

a. prawn b. snail

c. sea anemone d. Hydra

16. The respiratory pigment present in cockroach is (OJEE-2010)

a. Haemoglobin

b. Haemocyanin

c. oxyhaemoglobin

d. None of these

17. Book lungs are respiratory organs in (AMU-2008)

a. Insects b**. Aarachnids**

c. Molluscans d. Echinoderms

18. The exerctory organ in cockroach is (Kerala-CEE-2007)

a. malplghian corpuscle

b. Malpighian tubules

c. green gland

d. Metanephridia

19. Exoskeleton of which phylum consists of chitinous cuticle ? (J & K CET-2007)

a. Annelida

b. porifera

c. Arthropoda

d. Echinodermata

20. In cockroach, vision is due to (PMET-2005)

a. one compound eye

b. two compound eyes

c. two simple eyes

d. two compund and two simple eyes.

21. Which of the following respires through gills? (J & K CET-2005)

a. whale b. Turtle

c. frog d**. Prawns**

22. Animals which active at night are called. (J & K CET-2004)

a. diurnal b**. nocturnal**

c. parasites d. nocto-diurnal

23. Salient features of Arthropoda is (RPMT-2003)

a. aquatic and free living

b. chitinous exoskeleton and jointed appendages

c. radulla

d. none of those

24. The second largest number of species containing phylum in the animal kingdom is (J & K CET-2008)

a. Annelida b. Arthropoda

c. Mollusca d. Chordata

25. Mollusca is (JCECE-2006)

a. Triploblastic, acoelomate

b**. Triploblastic, coelomate**

c. Diploblastic, acoelomate

d. Diploblastic, coelomate

26. Tube feet are the locomotory organs of

a. platyhelminthes

b. Echinodermata

c. Mollusca

d. Arthropoda

27. Given below are four matchings of a animal and its kind of respiratory organ (PMT 2003)

(A) Silver fish - Trachea
(B) Scorpion - Book lung
(C) Sea squirt - Pharyngeal gills
(D) Dolphin - Skin

The correct matchings are

a. A and B b**. A,B and C**

c. B and D d. C and D

28. Which one of the following is a matching pair of ananimal and a certain phenomenon it exhibits? (PMT 2003)

a) Pheretima - Sexual dimorphism

b) Rana - Complete metamorphosis

c) Chameleon - Mimicry

d) Taenia - Polymorphism

29. Two common characters found in centipede, cockroach, and crab and (PMT 2006)

a. book lungs and antennae

b. compound eyes and anal cerci

c. joint legs and chitinous exoskeleton

d. green gland and tracheae

30. Which one of the following groups of animals is bilaterally symmetrical and triploblastic? (PMT 2009)

a. aschelminthes (round worms)

b. ctenophores

c. sponges

d. coelenterates (cnidarians)

31. Which one feature is common to leech, cockroach and scorpion? (AIIMS 2004)

a. nephridia

b. ventral nerve cord

c. cephalization

d. antennae

32. Whch one of the following features is common in silverfish, scorpion, dragonfly and prawn?

a. Three pairs of legs and segmented body

b. Chitinous cuticle and two pairs of antennae

c. Jointed appendages and chitinous exoskeleton

d. Cephalothorax and trachea

33. Peripatus is known as a connecting link, because it has the characters of both (BHU 1993).

a. Fishes & amphibians

b. Reptiles & birds

c. Aves & fishes

d. Arthropoda & annelids

34. Osphradium of *Pila globosa* is (BHU 1994, 2000, 2007)

a. thermoreceptor

b. Pheretima

c.chemoreceptor

d. tangoreceptor

35. Green glands present in some arthropods help in (BHU 1998, 2007)

a. respiration **b. excretion**

c . digestion d. none of these

36. Squid, cuttle fish and Octopus belongs to class of (BHU 1998, 2001)

a. decapoda b. scaphopoda

c. cephalopoda d. apods

39. The canal system is a characteristic feature of (BHU 1999, 2002)

a. **sponges** b. echinoderms

c . helminthes d. coelenterates

40. Malpighian tubules are (BHU 2006)

a**. excretory organs of insects**

b. excretory organs of frog

c. respiratory organs of insects

d. endocrine glands of insects

41. Caterpiller and maggot are (BHU 2007

a. larvae b. nymphs

c. adults d. pupa

42. Excretory organ of platyhelminths is (BHU 2008)

a. gills **b. flame cells**

c. nephridia d. trachea

43. Water vascular system is a characteristic of (BHU 2008)

a. ctenophore

b. annelid

c. echinodermata

d.arthropoda

44. Tube feet are the characteristic structures of (DPMT 1993, 2008)

a. jellyfish **b. starfish**

c. cuttlefish d. crayfish

45. Horomone, which helps in metamorphosis in insects is (DPMT 1996)

a.pheromone **b. ecdysone**

c. thyroxine d.all of these

46. The muscles associated with the heart of insects are (DPMT 1996, 2006)

a. alary b. striped

c. radial d.pericardial

47. Which of the following organisms is pseudocoelomate? (DPMT 2001, 2006)

a. hookworm b. liver fluke

c. jelly fish d. leech

48. Which of the following is not reported to have any fresh water forms? (DPMT 2003)

a. Mollusca b. Sponges

c. Coelenterates **d. echinoderms**

49. Pseudocoelom is not found in (DPMT 2004)

a. *Ascaris* b. *Ancylostoma*

c. *Fasciola* d. none of these

50. Animals devoid of respiratory, excretory and circulatory organs are belongs to phylum (DPMT 2004)

a. echinodermata

b. platyhelminthes

c. porifera d. mollusca

51. Cilia of gills of bivalve molluscs help in (DPMT 2005)

a. protection **b. respiration**

c. excretion d. feeding

52. All flat worms differ from all round worms in having(DPMT 2009)

a. triploblastc body

b. solid mesoderm

c. bilateral symmetry

d. metamorphosis in the life istory

53. Parthenogenesis can be seen in (UP-CPMT 1995)

a. frog **b. honey bee**

c. moth d. all of these

54. The endocrine gland of insects, wich secretes they juvenile hormone, is (UP-CPMT 1995)

a. corpora allata

b. corpora albicans

c. corpora myecaena

d. all of these

55. Malpighian tubules are (UP-CPMT 1996, 2008)

a. excretory organs of insects

b. respiratory organs of insects

c. excretory organs of frog

d. endocrine glands of insects

56. In mollusca, eye is present over a stalk called (UP-CPMT 2000, 2007)

a. osphradium b. ostracum

c. ommatophore d. operculum

57. Which of the following symmetries is found in adult sea anemone? (UP - CPMT 2004)

a. radial b. biradial

c. bilateral d. spherical

58. Feeding in sponges takes place through (UP-CPMT 2005)

a**. choanocytes** b. nurse cells

c. ostia d.osculum

59. Osphradium is meant for (UP-CPMT 2005)

a. excretion b. nutrition

c. selection and rejection of food

d. grindingof food

60. Excretory product of spider is (UP-CPMT 2007)

a. uric acid b. ammonia

c**. guanine** d. none of these

61. Which of the following is not the charcter of *Taenia solium* (UP-CPMT 2007)

a. polysis b. proglottid

c. metamerism d. strobila

62. Daphnia is commonly known as (UP-CPMT 2007)

a. clam shrimp b. fairy shrimp

c. water fleas d. tadpole shrimp

63. Wuchereria is found in (UP-CPMT 2007)

a**. lymph nodes** b. lungs

c. eye d. gonds

64. "Turbellarians" are free living (UP-CPMT 2008)

a**. flatworms** b. trematodes

c. nematodes d. cesrtodes

65. Polyp phase is absent in (UP-CPMT 2008)

a. Physalia b. Obselia

c. Hydra d**. Aurelia**

66. Animals having pseudocoelomate and triploblastic nature are present in phyla (UP-CPMT 2008).

a. annelida

b. arthropoda

c. aschelminthes

d. platyhelminthes

67. Primitive nervous system is formed in (UP-CPMT 2009)

a. sponge

b**. cnidaria (coelenterate)**

c. echinodermata

d. annelida

68. Tissues are absent in the body of (UP-CPMT 2009)

a**. sponge**

b. annelida

c. platyhelminthes

d. arthropoda

69. Linmulus belongs to class

a. onychophora b. insect

c**. merostomata** d. crustacea

70. Ambulacral system is mainly useful for

a. locomotion **b. feeding**

c. circulation d. defence

71. Which of the following isa. excretory organ in mollusca?

a. Keber's organ b. nephridia

c. Malphingan organ d. Flame cells

72. Mouth parts of housefly are

a. Piercing and sucking type

b. Biting and sucking type

c. Sponging and sucking type

d. biting and chewing type

73. Anus is absent in

a. Periplaneta b. Unio

c. Fasciola d. Pheretima

74. Asymmetry in gastropoda is due to

a. twistig **b. torsion**

c. coiling c. none of these

75. The pigment haemocyanin is found in

a. mollusca b.chordate

c. echinodermata d.annelida

76. The development of adult characteristics in a moulting insect is promoted by

a. pheromone b. thyroxine

c. juvenile hormone **d. ecdysone**

77. If you are given an insect, a spider, a Peripatus, and a crab, basing on which character you can identify an arachnid from others?

a. one pari of legs

b. sense organs

c. four pairs of legs

d. number of wings

78. Choanocytes perfom

a. reproduction

b. nutrition

c. dsecretion of spicules

d. excretion

79. Common characteristics of cockroach, housefly and mosquito are

a. one pair each of wings and halters

b. three pairs of legs and one pair of developed wings

c. two pair of legs and two compound eye

d. compound and simple eyes

80. The secondary host of *Taenia* is

a. snail **b. pig**

c.man d. dog

81. The exoskeleton of insect is made up of

a. pectin b. lignin

c. chitin d. suberin

82. Collar cells are found in

a. aschelminthes b. cnidaria

c. arthropoda **d. sponges**

83. Ommatidia are the units that constitute the compound eyes in (AMU 1995).

a. Fish **b. Insects**

c. Mammals d. birds

84. Which of the following animals possesses ink gland? (AMU 2003)

a. blue whale
b. scorpion
c. sea urchin
d. **cuttle fish**

85. Comb plates are present in (AMU 2004)

a. echinoderms
b. **ctenophores**
c. annelids
d. molluscs

86. Which of the following does not belong to phylum cnidaria?(AMU2004).

a. Sea-pen
b. **Sea lily**
c. Sea-fan
d. Sea anemone

87. Protonephridia are the excretory structures present in (AMU2005)

a. **Planaria**
b. Roundworm
c. Tapeworm
d. Prawn

88. Which of the following is not an annelid? (AMU2007)

a. Leech
b. Earthworm
c. Sea mouse
d. **Sea cucumbers**

89. Blood worms are the larvae of (AMU 2007)

a. Hirudinaria
b. **Chironomus**
c. Limulus
d. Daphnia

90. Pick the odd pair: (AMU 2008)

a. Porifera : spicules
b. **Scyphozoan: coral reef**
c. Nematode : pseudocoelomate
d. Cestoda: proglottid

91. Insect metamorphosis having larval stage is called (AFMC 1994)

a. Incomplete metamorphosis
b. Retrogressive metamorphosis
c. Heteromorphosis
d. **Complete metamorphosis**

92. Which of the following is not an insect? (AFMC 1996)

a. Cockroach b**. Spider**
c. Mosquito d. bedbug

93. Which of the following enters intestine by penetrating through skin (AFMC 2003)

a. **hook worm**
b. Ascaris
c. Pin worm
d. filarialworm

94. In nemathelminthes the coelom is not lined by peritoneum is (AFMC 2004)

a. acoelom
b. **pseudocoelom**
c. enterocoelom
d. haemocoel

95. Leech secretes which of the following anticoagulant? (AFMC 2004)

a. **hirudin** **b.** heparin
c. serotonin d. histamine

96. Canal system in porifera is not concerned with (AFMC 2005)

a. respiration
b. nutrition
c. **sexual reproduction**
d. none of these

97. Johnston's organ is present in (AFMC 2007)

a. **antenna of insect**
b. head of cockroach
c. abdomen of housefly
d. abdomen of spider

98. Which of the following is not an arachnid? (AFMC 2007)

a. spider b. itchmite

c. louse **d.** tick

99. *Fasciola hepatica* is (AFMC 2007)

a. hermaphrodite. Self fertilizing
b. hermaphrodite, cross fertilizing
c. unisexual
d. **both (a) and (b)**

100. Match the excretory organs listed under column I with the animals given under column II. Choose the answer which gives the correct combination of alphabets of the column.

Column I	Column II
A Nephridia	P *Hydra*
B Malpighian tubules	q Leech
C protonephridia	r Shark
D kidneys	s Round worms
	t Cockroack

a. A = q; B = t; C= s; D = r

b. A =s ; B= q; C= p; D= t

c. A = t; B = q; C = s; D = r

d. A = q; B = s ; C =t ; D= p

101. Entomology is concerned with the study of ….

a. formation and properties of soil

b. agricultural practices

c. various aspects of human life

d. various aspects of insects.

102. Which phylum of the animal Kingdom is exclusively marine? (orissa 2003,2006)

a. porifera b. arthropoda

c. echinodermata d. molluscs

103. Study of ticks and mites is

a. Acarology b. Entomology
c. Malacology d. Carcinology

104. Larva of mosquito is

a. maggot b. caterpillar

c. grub **d. none of these**

105. Transparent hairs on catkins and caterpillars function to ?

a. trap heat

b. trap moisture

c. reflect light

d. drink water.

106. Which of the following traits is not the characteristic of echinodermat?

a. water vascular system

b. trochophore larva

c. Aristotle's lantern

d. radial and indeterminate cleavage

107. which of the following is pseudocoelomate ?

a. nematode b. chordate

c. echinodermata d. arthropoda

108. Which is not correct for sponges ?

a. internal fertilization

b. external fertilization

c. gemmule formation

d. gametes are formed from epidermal cells.

109. Triploblastic , schizocoelic, unsegmented soft bodied animals belongs to the phylum (J&K 1998)

a. annelid **b. mollusca**

c. nemathelminthes d. none of the above

110. Which one of the following animals belongs to the phylum cnidaria ? (J&K1998)

a. silver fish b. *squid*

c. jelly fish d. *Echidna*

111. *Palaemon* (prawn) is a (J & K 2000)

a. fish b. insect

c. soft shell mollusc **d. crustacean**

112. Tapeworm occurs as a parasite in (J&K 2001)

a.liver b. stomach

c. intestine d. all of these.

113. What distinguishes an insects from crustacean ? (J&K 2002, 2005)

a. number of eyes

b. arrangement of nerve cords

c. number of appendages

d. presence of wings.

114. Leeches are usually (J&k 2005)

a. herbivorous b. insectivorous

c. carnivorous **d. sanguvorous**

115. *Wichereia bancrofit* is a common filarial worm. It belongs to the phylum (J&K 2007)

a. Platyhelminthes

b. Nemathelminthes

c. Annelid

d. Coelenterate

116. The dioecius animal is (J&K 2008)

a. Liver fluke **b. Aurella**

c. Tapeworm d. Earthworm

117. Malpighian tubles remove excretory products from

a. Mouth

b. Haemolymph

c. Oesophagus

d. Alimentary canal

118. Which of the following cell type is capable of giving rise to other cell types in sponges?

a. Pinacocytes

b. Archaeocytes

c. Thesocytes

d. Collencytes

119. The infective stage of *Entamoeba histolytica* is

a. **cyst**
b. spore
c. egg
d. **trophozoite**

120. Gonads of Obelia occur in

a. on blastocyst
b. inhydrula stage
c. **radial canals of medusa**
d. bases of entacles of medusa

121. Which one of the following features is common to leech, cockroach and scorpion?

a. nephridia
b. **ventral nerve cord**
c. cephalization
d. antennae

122. Excretory organs of flatworms are

a. Malpighian tubules
b. Neprons
c. **Protonephridia**
d. Nnepridia

123. Sea cucumbers belong to class

a. Echinoidea
b. **Holothuroidea**
c. Ophiuroidea
d. Asteroidean

124. One of the following is a very unique feature of the mammals (PMT2004, DPMT 1996. 1998)

a. Homeothermy
b. **Presence of diaphragam**
c. Four chambered heart
d. Rib cage

125. Uricotelisum is found in (PMT2004)

a. Mammals and birds

b. Fishes and fresh water protozoans
c. **Birds, reptiles and insects**
d. Frogs and toads

126. Which one of the following characters is not typical of the class mammalian? (PMT2004)

a. Thecodont dentition
b. Alveolar lungs
c. **Ten pairs of cranial nerves**
d. Seven cervical vertebrate

127. Which one of the following in birds, indicates their reptilian ancestry? (PMT 2008)

a. Two specialchambers crop and gizzard intheir digestive tract
b. Egs with a calcareous shell
c. **Scales on their hind limbs**
d. Four-chambered hear

128. Which one of the following pairs of animals comprises 'Jawless fishes'? (PMT2009)

a. Mackerals and rohu
b. **Lampreys and hag fishes**
c. Guppies and hag fishes
d. Lampreys and eels

129. Camouflage of chameleon is associated with (AIIMS1995)

a. Chromoplast
b. Chromosome
c. **Chromatophore**
d. Chromomere

130. In fast swimming fishes, propulsion is due to(AIIMS 2000)

a. Pelvic fin
b. Pectoral fin
c. Dorsal fin
d. **Caudal fin**

131. Body temperature of cold blooded animals (AIIMS2000)

a. Is constant
b. **Fluctuates with surrounding temperature**
c. Becomes very lowa. times
d. Is very cold

132. Which of the following is an egg laying mammal?(AIIMS2001)

a. Kangaroo
b. **Platypus**
c. penguin
d. whale

133. Which of the following are uricotelic animals? (AIIMS2002)

a. rohu and frog
b. camela. frog
c. **lizard and crow**
d. earthworm and eagle

134. Which of the following does not come under the class mammals?(AIIMS2007)

a. flying fox
b. hedgehog
c. manatee
d. **lamprey**

135. which of the following is concerned with the formation of urea in rabbit ?(BHU 1994,2007)

a. spleen
b. kidney
c. blood
d. **liver**

136. Lateral line is present in (BHU 1996)

a. **dog fish**
b. jelly fish
c. starfish
d. none of these

137. The largest and heaviest mammals in the world is (BHU1994)

a. **blue whale**
b. elephant
c. lion
d. tiger

138. Ichithyophis is a member of (AIIMS 1997)

a. **amphibian**
b. mollsca
c. reptilian
d. annelid

139. Renal portal system is absent in (AIIMS 1998,2008)

a. reptiles
b. amphibians
c. reptiles and amphibians
d. **birds**

140. Bone marrow is absent in (AIIMS 2000)

a. reptilian
b. amphibian
c. fishes
d. **birds**

141. Urea is formed in which organ in rabbit? (AIIMS 2001)

a. **liver**
b. kidney
c. spleem
d. lung

142. Which of the following is not classified amphibian?(AIIMS2003)

a. frog
b. salamander
c. **tortoise**
d. ichthiophis

143. The excretory material of bony fish is (AIIMS 2004)

a. urea
b. protein
c. **ammonia**
d. amino acid

144. Limbless amphibians belong to the order (AIIMS 2007)

a. anura
b. urodela
c. **gymnophiona**
d. lissamphibia

145. Which of the following snakes is non-poisonous?(AIIMS 2007)

a. cobra
b. krait
c. viper
d. **python**

146. Placoid scales are found in (AIIMS 2008)

a. reptilia
b. bony fishes
c. **cartilaginous fishes**
d. amphibians

147. Which of the following is a correct sequence of decreasing order of number of species? (AIIMS 2008)

a. aves, pisces, reptiles, amphibians, mammals
b. **pisees, aves, reptiles, mammals, amphibians**
c. pisees, mammals, reptile, amphibians, aves
d. amphibians aves, pisces, mammals, reptiles

148. Excretory organ in Balanoglossus are (DPMT 1991,2008)

a. nephridia
b. antennary gland
c. collar cord
d. **proboscis gland**

149. Reptiles share which of the following character with birds and mammals?(DPMT 1994)

a. **Amnion**
b. Homeothermy
c. Diaphragm
d. Hipple

150. Cowper's gland is present in (DPMT 1996)

a. Frog
b. Earthworm
c. **Rabbit**
d. Cockroach

151. Which of the following pairs belong to the category of cold blooded animals? (DPMT 1998)

a. bat & rate
b. snakes & birds
c. **frog & snakes**
d. birds & monke

152. The character of birds without exception is (UP-CPMT 1995)

a. omnivorous
b. **beak without teeth**
c. flying wings
d. lay eggs with calcareous shells

153. Quill feathersa. the base of quill wings are called (UP-CPMT 1995)

a. **remiges**
b. coverts
c. barbules
d. down feathers

154. Which of the following pair of orgaisms are uricotelic? (UP-CPMT 2000)

a. cartilaginous fishes and mammals
b. reptiles and mammals
c. **birds and insects**
d. bony fishes and lizards

155. In the urinogenital organs of rabbit which one of following part is present in male but not in female? (UP-CPMT 2005)

a. Urethra
b. Fallopian tube
c. Vagina
d. **Vas deferens**

156. Which one of the following features is present in some stage of the life history of all chordates? (UP-CPMT 2000)

a. Blood flowing forward in dorsal blood vessel
b. **Phyaryngeal gill slits**
c. A ventral hollow nerve cord
d. Heart lying dorsally

157. Thoracic cage in rabbit is made up of (UP-CPMT 2006)

a. Ribs, vertebral column & diaphragm
b. Ribs, diaphragm & sternum
c. Vertebral column, diaphragm & sternum
d. **Ribs, vertebral column & sternum**

158. Which of the following has exoskeleton of scales and paired copulatory organ or penis?(UP-CPMT 2007)

a. Sharks
b. **Lizards**
c. Urodela
d. Urochordata

159. Laterally compressed tail is found in

a. Fresh water snakes
b. Terrestrial snakes
c. Marine non-poisonous snakes
d. **Marine poisonous snakes**

160. Which of the following is characteristic feature of fishes?

a. Tail and venous heart
b. Epidermal scales and tail
c. **Venous heart and gills**
d. Epidermal scales and gills

161. Similarity between fish and tadpole is

a. Scales b. Legs
c. **Lateral line** d. Fins

162. Four-chambered heart is present in

a. frog
b. **crocodile**
c. shark
d. lizard

163. Right aortic arch is present in

a. reptiles only
b. mammals only
c. **birds only**
d. both birds and mammals

164. Kidney of adult reptiles are (AMU 1996)

a. measonephric
b. **metanephric**
c. pronephric
d. both (a) and (b)

165. Marine fishes drink sea water to (AMU 2001)

a. meet their body salt requirements
b. compensate loss of water from their body
c. flush out nitrogenous wastes from their body
d. **achieve all of the above**

166. In which of the following fishes the males have brood pouch, where eggs laid by the female remain till they hatch? (AMU 2002)

a. Lung fish
b. Climbing perch
c. Salmon
d. **Sea horse**

167. Match the names of branches of science listed under column- I with the field study given under column-II choose the choice which gives the correct combination of the alphabets. (AMU2000)

Colum – I (Branch of Science)	Colum –II (Field of study)

A	Mycology	p	Study of birds
B	Ornithology	q	Study of worms
C	Herpetology	R	Study of fishes
D	lethylogy	S	Study of fungi
		t	Study of reptiles

a. **A=s, B=p, C=t, D=r**
b. A=q, B=s C=r, D=t
c. A=s, B=t, C=p, D=r
d. A=p, B=s, C=r, D=t

168. Identify the edible fresh water teleosts (AMU2001)

a. Sharks
b. Rays and skates
c. Hilsa ilisha
d. **Catla catla**

169. Turtles are (AMU2002)

a. Pisces
b. **Repties**
c. Molluscans
d. Arthropods

170. Harversian systems are found in the bones of (AMU2002)

a. Pigeon
b. **Panther**
c. Pipe fish
d. Python

171. Choose the correct combination of alphabets which matches the zoological names given under column I with their common names given under clumnII(AMU 2002)

Column – I		Column –II	
A	Labeo rohita	E	Jungle fow I
B	Gallus gallus	F	Carp
C	Bos indicus	G	Tussar silkmoth
D	Antheraea mylitta	H	cattle

a. A=F, B=G, C=E, D=H
b. A=G, B=E C=H, D=F
c. **A=F, B=E, C=H, D=G**
d. A=F, B=E, C=G, D=H

172. Which of the following statements is true?(AMU 2003)

a. All chordates are vertebrates
b. **All vertebrates are chordates**
c. Invertebrates possess a tubular nerve cord
d. Nonchordates a have a vertebral column

173. Chosse the cat fish from the following (AMU 2004)

a. *Cirrhina mrigala*
b. ***Wallago attu***
c. *Labeo rohita*
d. *Catla catla*

174. A four chambered heart is not found in…….(AMU2004)

a. Mammals
b. Birds
c. **Snake**
d. Crocodile

175. Calotes versicolor is a (AMU 1997)

a. House lizard
b. Rock lizard
c. **Garden lizard**
d. Flying lizard

176. Scientific name of king cobra is (AMU 2002)

a. Naja naja
b. Amphiliabs
c. **Naja Hannah**
d. Vipera russelli

177. Branch of zoology dealing with the study of amphibians and reptiles is called (AMU 2003)

a. Ichthyology
b. Ornithology
c. **Herpetology**
d. Malacology

178. Adaptation of colour vision is found in (AMU 2006)

a. Mammals
b. Aves
c. Reptiles
d. **All of these**

179. Epidermal scale is the characteristic feature of class reptilian, which of the following class is without epidermal scale?(AMU2006)

a. Fish
b. Aves
c. Mammals
d. **Amphibians**

180. Duck-billed platypus is a connecting link between (AMU 2007)

a. Reptile & bird
b. Living andnonliving
c. **Reptile & mammal**
d. Echinodermata & chordate

181. Which of the following isa. egg laying mammal?(J&K 2005)

a. Dolphin
b. **Platypus**
c. Whale
d. Walrus

182. In sharks, one of the following is absent (J&K 2008)

a. Claspers
b. Placoid scales
c. Cartilaginous endoskeleton
d. **Air bladder**

183. Which one of the following animals belongs to cyclostomata? (J&K2008)

a. Channa
b. Loris
c. Dodo
d. **Pertomyzon**

184. Which of the following is dominant in desert?

a. **Lizard**
b. Tiger
c. Leopard
d. hyla

185. Two examples in which the nitrogenous wastes are excreted from body in the form of uric acid are

a. **birds and lizards**
b. insects and bony fishes
c. mammals andmolluscs
d. frogs andcartilaginous fishes

186. The arrangement of ear ossicles in mammalian ear is

a. stapes malleus, incus
b. **malleus, incus, stapes**
c. incus, malleus, stapes
d. columella, malleus, incus

187. Snake has

a. movable eyelids
b. **immovable eyelids**
c. no cyclids
d. eyelids in pouches

188. Which among these is correct combination of aquatic mammals? (NEET 2017)

a. Dolphins, seals, Trogon

b. Whales, Dolphin, Seals.

c. Trygon, Whales, Seals

d. Seals, Dolphin, Sharks.

189. In case of poriferance, the spongocoel is lined with flagellated cells called, (NEET 2017)

a. Oscula **b. Coenocytes**

c. Mesenchymal cells d. Ostia.

190. Which is the National Aquatic animal of India (NEET 2016)

a. River Dolphin b. Blue whale

c. Sea horse d. Gangetic shark

191. An important characteristic that Hemichordates share with chordates is (NEET 2017)

a. Ventral tubular nerve chord

b. Pharynx with gill slits.

c. Pharynx without gill slits.

d. Absence of notochord.

Chapter 3 ANIMAL TISSUES

1. Transitional epithelium occurs in : (MHTCET 2008)

a. Blood vessels

b. Trachea

c. Kidney

d. **Ureter/urinary bladder**

2. The study of tissues is known as : (MPPMT 2010)

a. Physiology

b. Ecology

c. **Histology**

d. Anatomy

3. Find out the wrong match :

a. Eosinophils Allergic response

b. Basophils Secrete histamine and serotonin

c. Monocytes Secrete heparin

d. Lymphocytes Immune response

4. The outer covering of cartilage is called. (WB 2010)

a. Peritoneum

b. Periosteum

c. Endosteum

d**. Perichondrium**

5. Skin is : (CPMT 2010)

a. Cubiodal epithelium

b. Stratified epithelium

c. Coloumnar epithelium

d. Pseudostratified epithelumn

6. Match the animals listed in column-I to blood listed in column-II. (KCET 2010) Column-I Column-II (P) Man (i) Plasma and cells are colourless (Q) Earth worm (ii) Plasma colourless and nucleated RBC (R) Cockroach (iii) Plasma colourless and enucleated RBC

(S) Frog (iv) Plasma red and nucleated colourless RBC

(v) Plasma and RBS have haemoglobin

a. (P-iii), (Q-iv), (R-i), (S-ii)

b. (P-iv), (Q-v), (R-iii), (S-ii)

c. (P-i), (Q-iv), (R-ii), (S-iii)

d. (P-v), (Q-iii), (R-i), (S-iv)

7. Matrix of bone and cartilage can be distinguished by the presence of :

a. Lacunae

b. Chromatophares

c**. Haversian canals**

d. Adipose cells

8. Which type of tissue forms glands : (MPPMT 2010)

a. Epithelial

b. Muscular

c. Nervous

d. Connective

9. Which of the following blood cells help in blood coagulation.

a. RBCs

b. Lymphocytes

c**. Thrombocytes**

d. Basophils

10. Fibroblasts macrophages and mast cells are present in :

a. Cartilage tissue

b**. Areolar tissue**

c. Adipose tissue

d. Glandular epithelium

11. Which type of epithelium is involved in a function to move particles or mucus in specific direction : (HPPMT 2010)

a. Squamous epithelium

b. Cuboidal epitheliumc.

c. Columnar epitheliumd**.**

d. Ciliatal epithelium

12. Which of these is not found in connective tissue : (MPPMT 2010)

a. Collagen fibres

b**. Basement membrane**

c. Hyaluronic acid

d. Fluid

13. Multi-lobed nucleus and granular cytoplasm are characteristics of which of the WBCs :

a. Neutrophils

b. Monocytes

c. Lymphocytes

d. Eosinophils

14. Which one of the following plasma proteins is involved in the coagulation of blood. (2011)

a. globulin

b**. Fibrinogen**

c. albumin

d. Serum amylase

15. Which of the following is not a connecting tissue. (CPMT 2010)

a. Blood

b. bone

c. Lymph

d**. Nerve**

16. The ciliated columnar epithelial cells in humans are knows to occur in.

a. Bile duct and oesophagus

b. Fallopian tubes and urethra

c. Eustachian tube and stomach lining

d. Bronchioles and fallopian tubes

Chapter 4 Organ And Organ Systems

1. The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of NEET 2015

a. Calcium carbonate

b. Ammonia

c**. Potassium urate**

d. Urea

2. Frog's heart when taken out of the body continues to beat for sometime. Select the best option from the following statements. NEET 2017

(a) Frog is a poikilotherm.

(b) Frog does not have any coronary circulation.

(c) Heart is "myogenic" in nature.

(d) Heart is autoexcitable Options:

(1) Only(d) (2) (a) and (b) **(3) (c) and(d)** (4) Only(c

Chapter 5

Digestion and Absorption

1. How pepsin is differing from trypsin ? (DPMT – 1993)

a. It digests protein in acidic medium

b. It digests protein in alkaline medium

c. It digests carbohydrate in acidic medium

d. It digests carbohydrate in alkaline medium

2. Human intestine large because….. (DPMT – 1996)

a. Bacteria in the food moves slowly

b. Substances of food digest slowly

c. It provide more space for the absorption of digested food

d. It provide more space for the storage of food

3. How the epidermal cells in the stomach of vertebrate animal is protect stomach against HCl ? (NCERT -1981)

a. HCl is dilute

b. Epidermal cells defense the function of HCl

c. HCL is neutralized in stomach

d**. Epidermal cells covered with secretion of mucous**

4. By what the major part of mammalian teeth is made up ? (CPMT – 1984)

a. Root

b. Pulp

c**. Dentin**

d. Enamel

5. Enterokinase takes part in the conversion of what ? (BHU-2000)

a. Pepsinogen into pepsin

b**. Trypsinogen into trypsin**

c. Protein into polypetide

d. Caseinogen into casein

6. Secretin stimulates production of (M.P.PM.T. 2002)

a. Saliva

b. Gastric juice

c. Bile

d**. Pencreatic juice**

7. Pepsin acts in (H.P.P.M.T.-2001)

a. Basic medium

b.Acidic meduim

c. Neutral meduim

d. All type of medium

8. Enzyme trypsin is secreted by (A.F.M.C. -2003)

a. Duodenum

b. Liver

c**. Pancreas**

d. Stomach

9. The number of teeth that grow twice in the human life is (A.F.M.C. -2002,2004)

a. 4

b. 12

c**. 20**

d. 28

10. The number of teeth that grow once in the human life is (D.P.M.T, B.H.U.-1986)

a. 4

b. 12

c. 20

d**. 28**

11. Cholesterol is synthesised in (M.P.P.M.T. – 2000)

a. Brunner's glands

b. Liver

c. Spleen

d. Pancreas

12. Largest gland in human body is (J.K. C.M.E.E- 2003)

a. Liver

b. Pancreas

c. Pituitary

d. Thyroid

13. Muscular contraction of alimentary canal are (C.M.C- 2003)

a. Circulation

b. Deglutition

c. Churning

d**. Peristalsis**

14. Fatty acids and glycerol are first absorbed by (B.V.- 2000)

a. Lymph vessels

b. Villi

c. Blood capillaries

d. Hepatic portal vein

15. Trypsin changes (M.P.P.M.T. – 1995)

a. Proteins into peptones

b. Fats into fatty acids

c. Starch and glycogen into maltose

d. Maltose into its components

16. Secretin hormone is produced by (M.P.P.M.T. – 1995)

a. Stomach

b. Liver

c**. Intestine**

d.Pancreas

17. Narrow distal part of stomach is (M.P.P.M.T. – 1995)

a. Cardiac

b. Pharynx

c. Duodenum

d**. Pylorus**

18. pH suitable for ptyalin actions is (A.F.M.C. -1996)

a. 6 – 8

b. 7 – 8

c. 3 – 2

d. 9 – 3

19. What will happen if bile duct gets choked ? (D.P.M.T. – 1996)

a. Faeces become dry

b**. Acidic chyme will not be neutralised**

c. There will be little digestion in intestine

d. Little absorption of fat will occur

20. Digestion of both starch and protein is carried out by (A.F.M.C. -1996)

a. Gastric juice

b. Gastric lipase

c. Pancreatic juice

d**.** Ptyalin

21. What is common among amylase, renin and trypsin ? (C. P. M.T. -2000)

a. All proteins

b. Proteolytic enzymes

c. Produced in stomach

d. Act at pH lower then 7

22. Enterokinase is (B.H.U. -1997)

a. Pancreatic hormone

b. Intestine hormone

c. Pancreatic enzyme

d**. Component of Intestinal juice**

23. Which enzyme initiates protein digestion ? (M.P. P. M.T. -1997)

a. Pepsin

b. Trypsin

c. Aminopeptidase

d. Carboxypeptidase

24. Enzyme which does not directly act upon food substrate is

a. Trypsin b. Lipase

c. Enterokinase d. Amylopsin

25. Pepsin is secreted by (CPMT-1997)

a. Peptic cells

b. Zymogen cells of stomach

c. Zymogen cells of duodenum

d. Pancreas

26. Pepsinogen is activated by

a. Chymotrypsin

b. Trypsin

c. HCl

d. Pepsin

27. Contraction of gall bladder is induced by

a. Gastrin

b. Cholecystokinin

c. Secretin

d. Enterogastrone

28. Hormone that stimulates stomach to secrete gastric juice is

a. Renin

b. Enterokinase

c. Enterogastrone

d. Gastrin

29. Water is largely absorbed in (C. P. M.T. -1999)

a. Stomach

b. Oesophagus

c. Small intestine

d**. Colon**

30. HCl is secreted by (D. P. M.T. -2002)

a. Zymogen cells

b. Kupffer's cells

c. Oxyntic cells

d. Mucous cells

31. Jundice is a disease of (A. P. M.E.E. -1999)

a. Kidney

b. Liver

c. Pancreas

d. Duodenum

32. Which is different ? (B.H.U. -1999)

a. Gastrin

b. Secretin

c. Ptyalin

d. Glucagon

33. Gastrin is (B.H.U. -1999)

a. Hormone

b. Enzyme

c. Nutrient

d. Digestive secretion

34. Saliva contains enzyme (C. P. M.T. -2003)

a. Enterokinase

b. Ptyalin/ Amylase

c. Chymotrypsin

d. Lipase

35. In human being cellulose is digested by

a. Enzyme

b**. Symbiotic bacteria**

c. Symbiotic protozoans

d. None of the above

36. Enzyme lactase occurs in (M.P.P.M.T. -2000)

a. Saliva

b. Pancreatic juice

c. Intestinal juice

d. Stomach

37. Protein / enzyme is absent in (M.P.P.M.T. -2000)

a. Saliva

b. Bile

c. Pancreatic juice

d.Intestinal juice

38. Dental formula shows (M.P.P.M.T. -2000)

a. Structure of teeth

b. Monophyodont or diphyodont condition

c. Number and type of teeth in both jaws

d. Number and type of teeth in one half of both jaws

39. pH of gastric juice / stomach is

a. 1.5 -3.0

b. 5.0 – 6.8

c. 7.0 – 9.0

d. 6.0 -8.0

40. In case of taking food rich in lime juice, the action of ptylin on starch is (A.I.I.M.S. -2000)

a. Enhanced

b. Reduced

c. Unaffected

d. Stopped

41. Bile salts take part in (A.M.U. -2000)

a. Digestion of carbohydrates

b. Brokedown of proteins

c. Emulsification of fat

d. Absorption of glycerol

42. Digestive juice contains catalytic agents called (P.M.T. -2000)

a. Vitamins

b. Hormones

c**. Enzymes**

d. Nitrates

43. Which is not the function of liver (D.P.M.T. -2001)

a. Production of insulin

b. Detoxification

c. Storage of glycogen

d. Production of bile

44. Fat absorbed from gut is transported in blooda.

a. Micelles

b. Liposomes

c. Chemomicrons

d. Chlymicrons

45. In small intestine, active absorption occurs in case of (A.M.U. -2001)

a. Glucose

b. Amino acids

c. Na+

d**. All the above**

46. Which one is not matched (Har.P.M.T. -2002)

a. Pepsin – stomach

b. Renin – liver

c. Trypsin – intestine

d. Ptyalin – mouth

47. What is cholecystokinin

a. Bile pigment

b. Gastro-intestinal hormone

c. Enzyme

d. Lipid

48. Secretion of gastric juice is controlled by (C.P.M.T. -2002)

a. Enterogesterone

b. Cholecystokinin

c**. Gastrin**

d. Pepsin

49. Which one is wisdom teeth (C.P.M.T. -2002)

a. Third molar, four in number

b. Third molar, two in number

c. Second molar, four in number

d. Second molar, two in number

50. In humans, digestion is (B.H.U. -2002)

a. Intercellular

b. Intracellular

c. Extracellular

d. Both A and B

51. Gall bladder takes part in (R.P.M.T. -2002)

a. Secretion of bile

b. Storage of bile

c. Formation of bile salts

d. Formation of enzymes

52. Rennin acts on milk protein and changes (J.I.P.M.E.R. -2002)

a. Caesinogen into caesin

b. Caesin into paracaesin

c. Caesinogen into paracaesin

d. Paracaesin into Caesinogen

53. Glucose is stored in liver as (A.F.M.C. -2003)

a. Starch

b**. Glycogen**

c. Cellulose

d. Sucrose

54. Absorption of glycerol, fatty acids and monoglycerides takes place by

a. Lymph vessels within villi

b. Walls of stomach

c. Colon

d. Capillaries within villi

55. Which ones are bile salts

a. Haemoglobin and biliverdine

b. Bilirubin and biliverdine

c. Bilirubin and Haemoglobin

d. Sodium glycolate and taurocholate

56. Ptyalin is inactivated by a component of gastric juice called (Har.P.M.T. -2003)

a. Pepsin

b. HCl

c. Rennin

d. Mucus

57. Epithelial cells involved in absorption of digested food have on their free surface. (A.I.E.E.E.-2003)

a. Zymogen granules

b. Pinocytic vesicles

c. Phagocytic vesicles

d**. Microvilli**

58. First step in digestion of fat is (B.H.U. -2003)

a. Emulsification

b. Enzyme action

c. Absorption by lacteals

d. Storage in adipose tissue

59. DNA-ase and RNA-ase are enzymes produced by (B.H.U. -2003)

a. Salivary glands b**. Pancreas**

c. Stomach d. Intestine

60. Carboxypeptidase is secreted by

a. Pancreas

b. Stomach

c. Salivary glands

d. Intestine

61. Secretin and Cholecystokinin are digestive hormone, They are secreted in

a. Pyloric stomach

b**. Duodenum**

c. Ileum

d. Oesophagus

62. Crown of teeth is covered by (AFMC-2005)

a. Dentin

b**. Enamel**

c. A and B both

d. Non of these

63. Both the crown and root of a theeth is covered by a layer of bony hard sub stance called (J&K CET-2005)

a. Enamel

b. Dentin

c. Bony socket

d**. Cementum**

64. Lysozymes are found in (MPPMT-2004)

a. Saliva

b. Tears

c**. A and B both**

d. Mitochondria

65. Which of the following is not present in pancreatic juice (HPPMT-2005)

a. Trypsinogen

b. Chymotrypsin

c. Parasitic

d. lipase

66. Which of the following statement is not correct ?(NEET 2015)

a. Bruner's glands are present in the submucosa of stomach and secrete pepsinogen

b. Goblet cells are present in the mucosa of intestine and secrete mucus.

c. Oxyntic cells are present in the mucosa of stomach and secrete Hcl.

d. Acini are present in the pancreas and secrete carboxypeptidse.

67. Which hormonesd. stimulate the production of pancreatic juice and bicarnates ? **(NEET 2016)**

a. Cholycystokinin and secretin

b. Insulin and glucogon

c. Angiotensin and epinephrine

d. Gastrin and Insuline

68. In the stomach, gastric acid is secreted by the (AIPMT / NEET 2016)

a. Gastrin secreting cells
b. **parietal cells**
c. peptic cells
d. acidic cells

69. The enzymes that is not present is succus entericus is (RE-AIPMTNEET 2015)

a. Lipase
b. maltase
c. **nucleases**
d. nucleosidase

70. Which of the following are not polymerase? (NEET 2017)

a. proteins
b. Polysaccharides
c. **Lipids**
d. Nucleic acids.

71. A baby aged two years is admitted to play school and passes through a dental check-up . The dentist observed that the boy had twenty teeth . Which teeth were absent. **(NEET 2017)**

a. Canines
b. **Pre- Molars**
c. Molars
d. Incisors.

72. Which cells of Crypts of Lieberkuhn' secrete antibacterial lysozyme ? **(NEET 2017)**

a. **paneth cells**
b. Zymase cells
c. Kupffer cells.
d. Argentaffin cells

73. The hepatic portal veins drains blood to liver from (NEET 2017)

a. Stomach b. Kidneys

c. Intestine d. Heart.

74. Which of the following options best represents the enzyme composition of pancreatic juice? **(NEET 2017)**

a. 1.Amylase, pepsin, trypsinogen, maltase

b. Peptidase, Amylase, pepsine , renine

c. Lipase, amylase, trypsinogen, procarboxypeptidase

d. Amylase, peptidase, trypsinogen, rennin.

75. Good vision depends on adequate intake of carotene rich food. Select the best option from the following statements. (NEET 2017)

a. Vitamin A derivatives are formed from carotene.

b. The photo pigments are embedded in the membrane discs of the inner segments.

c. Retinal is a derivative of vitamin A

d. Retinal is light absorbing part of all the visual photopigments.

OPTION

a. a, c and d

b. a and c.

c. b, c and d

d. a and b

Chapter 6

Respiration

1. The length of human trachea is about (Gujarat C.E.T.Q.B.)

a. 6 inches b**. 12c.**

c. 12 inches d. 18 cm

2. Hamburger's phenomenon is also known as (CPMT.1988, 1991,AMU.2001,J.LPME.R.2002)

a. HCO3 – shift b. Na+ shift

c. H+ shift d**.Chloride shift**

3. Oxygen carrying capacity of blood is (CPMT.1990)

a. 20% b. 30%

c. 40% d. 50%

4. Respiratory movements are controlled by (A.P.M.E.E.1978, C.P.M.T.1998)

a. Cerebelluam

b. Cerebrum

c**. Medulla oblongata**

d. Crura cerebri

5. At higher CO2 condtcentration, oxygen dissociation curve of haemoglobin will (CPMT.1990)

a. Move to left

b**. Move to right**

c. Become irregular

d. Move upwardly

6. Chloride shift is required for transport of (CPMT.1990)

a. Nitrogen b. Oxygen

c**. Carbon dioxide**

d. Carbon dixide and oxygen

7. Volume of air inspired or expired with each normal breath is known

a. (CMPT.1992,AMU.2000)

a. Inspiratory capacity

b. Total Lung capacity

c**. Tidal volume**

d. Residual volume

8. Oxygen haemoglobin dissociation curve will shift to right on decrease of (AMU.1992)

a. Acidity

b. Carbon dioxide concentration

c. Temperature d. **pH**

9. Is Double membrane pleural sac is situated…… (J.K.C.M.E.E.1992)

a. Envelops the kidneys

b. Envelops the brain

c. Envelops the lungs

d. Lines the nasal passage

10. Volume of air remaining in lungs after maximum respiratory effort is (J.K.C.M.E.E.1992,Har.PMT.2003)

a. Vital capacity

b**. Residual volume**

c. Total lung capacity

d. Tidal volume

11. In expiration, diaphragm becomes (C.P.M.T.1993)

a. Flattened

b**. Relaxed**

c. Straightened

d. Arched

12. Carbon dioxide is transported from tissues to respiratory surface by only

a. Plasma and erythrocytcs

b. Plasma

c. Erythrocytes

d. Erythrocytes and leucocytes.

13. Respiratory centre is situated in CPMT.1980,2002, B.H.U.1995,M.P.P.M.T.1998,R. PMT.2006)

a. Cerebellum

b**. Medulla oblongata**

c. Hypothalamus

d. Cerebrum

14. Air is breathed through (A.P.M.E.E.1 999)

a. Trachea -> lung -> larynx -> pharynx -> alveoli

b. Nose -> larynx -> pharynx -> alveoli -> bronchioles

c. Nostrils -> pharynx -> larynx -> trachea -> bronchi -> bronchioles -> alveoli

d. Nose -> mouth -> lungs.

15. Which is false ?

a. Blood from right side of heart is carried to lungs by pulmonary artery

b. Pleura is double covering of kindey

c. Pancreas is both exocrine & endocrine gland

d. Scurvy is due to vitamin C deficiency.

16. Volume of air breathed in and out during effortless respiration is

a. residual volume

b. vital volume

c.tidal volume

d. normal volume

17. Body tissue obtain oxygen from haemoglobin due to its dissociation in tissues is caused by (M.P.PMT.1995)

a. Low oxygen concentration and high carbon dioxide concentration

b. Low oxygen concentration

c. Low carbon dioxide concentration

d. High carbon dioxide concentration.

18. Lungs have a number of alveoli for (M.P.PMT.1995)

a. Having spongy texture and proper shape

b. More surface area for diffusion of gases

c. More space for increasing volume of inspired air

d. More nerve supply.

19. Presence of large number of alveoli around alveolar ducts opening into bronchioles in mammalian lungs is

a. Inefficient system of ventilation with little of residual air

b. Inefficient system of ventilation with high percentage of residual air

c. An efficient system of ventilation with no residual air

d. An efficient system of ventilation with little residual air.

20. During transport of CO_2 blood does not become acidic due to

a. Neutralisation of H_2CO_3 by Na_2CO_3

b. Absorption by leucocytes

c. Blood buffers

d. Non accumulation

21. At high altitude, RBCs of human blood will (PMT.1999,J. LPM.E.R.2000)

a. Increase in number

b. Decrease in number

c. Decrease in size

d. Increase in size

22. CO_2 is transported

a. dissolved in blood plasma

b. As carbonic acid

c. In carbaminohaemoglobin

d**. As carbaminolaemoglobin and carbonic acid**

23. Maximum amount 70-75% of carbon dioxide transport occursa. (R.P.M.T.1996,1998,M.P.PMT.1998, C.P.M.T.1998,B.V.2002)

a. Dissolved in plasma

b. Carbaminohaemoglobin complex

c. Bicarbonate

d. None of the above

24. Trachea is lined with incomplete rings of (D.P.M.T.1996)

a. Fibrous cartilage

b. Calcified cartilage

c. Elastic cartilage

d**. Hyaline cartilage**

25. Oxygen and carbon dioxide are transported in blood through

a. Platelets and corpuscles

b. RBCs and WBCs

c. WBCs and serum

d**. RBCs and plasma**

26. About 1500 ml of air left in lungs is called

a. Tidal volume

b. Inspiratory reserve volume

c. Residual volume

d. Vital capacity

27. Which one protects the lungs? (B.H.U.1990)

a. Ribs

b. Vertebral column

c. Sternum

d**. All the above**

28. Which one has the lowest value?

a. Tidal volume

b.Vital capacity

c. Inspiratory reserve volume

d. Expiratory reserve volume

29. A child was killed through asphyxiation. Post morturm confirmed it because a piece of lung put in water (M.P.PMT.1996)

a. Settled dowm

b**. Kept floating**

c. Had blood spots

d. None of the above

30. Amount of oxygen present in one gram of haemoglobin is (A.I.I.M.S.1997,Har.PMT,2000)

a. 20 ml b**. 1-34 ml**

c. 13-4 ml c. None of the above

31. A molecule of haemoglobin carries how many oxygen molecules (M.P.P.M.T.1997,C.F.M.T.2002,J. CM.E.E.2004)

a. 1 b.2 c. 3 d**. 4**

32. In carbon monoxide poisoning there is (A.F.M.C 1997)

a. Increase in carbon dioxide concentration

b. Decrease in oxygen availability

c. Decrease in free haemoglobin

d. None of the above.

33. Exchange of gases in lung alveoli occurs through (A.FMC.2002)

a. Active transport

b.Osmosis

c.Simple diffusion

d. Passive transport

34. Haemoglobin is

a. Vitamin b. Skin pigment

c. Blood carrier **d.Respiratoy pigment**

35. Vocal cords occur in

a.Pharynx b**. Larynx**

c.Glottis d. Bronchial tube

36. The cells which do not respire (A.FMC.2001)

a. Epidermal cells b. Sieve cells

c.Cortical cells **d.Erythocytes**

37. Hiccough (hiccup) is due to activity of

a.Intercostal muscles

b. Food in air tract

c. Diaphragm

d. Inadequate oxygen in environment

38. Bicarbonate formed inside erythrocytes moves out to plasma while chloride of plasma pass into erythrocytes. The phenomenon is called

a. Bicarbonate shift

b. Carbonation

c. Hamburger phenomenon

d. None of the above

39. Respiratory centre of brain is stimulated by (A.I.I.M.S 2000)

a. Carbon dioxide content in venous blood

b. Carbon dioxide content in arterial blood

c. Oxygen content in venous blood

d**. Oxygen content in arterial blood**

40. A higher CO_2 concentration of blood causes (AM U.2001)

a. Slow diffusion of CO_2 from blood

b. Slow transport of CO_2 from blood

c. Slow diffusion of O_2 from blood

d. Both A and B

41. Gases diffuse over the respiratory surface because of

a. O_2 is more in alveoli than in blood

b. O_2 is more in blood than in tissues

c. CO_2 is more in alveoli than in blood

d. PCO_2 is more in blood than in tissues

42. Dissociation curve of O_2 (which is dissociation from Hb) shifts to the rights….

a. O_2 concentration decrease

b. CO_2 concentration decreases

c. CO_2 concentration increase

d. Chloride concentration increases

43. Thoracic cage of man is formed of (M.P.P.M.T.2002)

a. Ribs and sternum

b. Ribs, sternum and thoracic vertebrae

c. Ribs,sternum and lumbar vertebrae

d. Ribs and thoracic vertebrae.

44. Vital capacity of lung is equal to

a. IRV+ERV+TV

b. IRV+ERV+TV-RV

c.IRV+ERV+TV+RV

d.IRV+ERV

45. Dead space is

a. Upper respiratory tract

b. Nasal chambers

c. Alveolar space

d. Lower respiratory tract.

46. Carbon monoxide contained in Tobacco smoke (A.I.E.E.E.2003)

a. Is carcinogenic

b. Causes gastric ulcers

c. Reduces oxygen carrying capacity of blood

d. Raises blood pressure

47. What is correct ?

a. Pulomonary ventilation is equal to alveolar ventilation

b. Alveolar ventilation is less than pulmonary ventilation

c. Alveolar ventilation is more than pulmonary ventilation

d. Both are variable.

48. Increase in CO_2 concentration shall cause

a. Slower and shallower breathing

b. Slower and deeper breathing

c. Faster and deeper breathing

d. No effect on breathing

49. Alveoli become enlarged and damaged with reduced surface area in heavy smokers. the condition is called

a. Silicosis b**. Emphysema**

c. Asthma d. Bronchitis

50. SARS is caused by a variant of (A.I.I.M.S 2004)

a. Pneumococcus pneumonia

b. Common cold by Corona virus

c. Asthma d. Bronchitis

51. During inspiration (J.I.PME.R.2004,R.PMT.2005)

a. Diaphragm and external muscles relax

b. Diaphragm and internal intercostal muscles relax

c. Diaphragm and external intercostal muscles contract

d. Diaphragm and internal intercostal muscles contract.

52. Mountain sickness at high altitude is due to (C.P.M.T.2005)

a. Excess CO2 in blood

b. Decreased CO_2 in air

c. Decreased partial pressure of oxygen

d. Decreased efficiency of haemoglobin

53. Capacity of human lungs for air in a healthy person is

a. 3000 ml

b. 1500 ml

c. 1000 ml

d. 500 ml

54. Rate of breathing is controlled by

a. Amount of freely avilable oxygen

b**. Carbon dioxide in blood**

c. Muscular functions of body

d. All the above

55. During strenous exercise,glucose is converted into (B.H.U.2005)

a. Glycogen

b. Pyravic acid

c. Starch

d**. Lactic acid**

56. How much pulmonary air is expired normally (Har.P.M.T.2005)

a. 70% b. 20%

c. 25% d**. 32%**

57. Which is incorrect ?

a. Presence of nonrespiratory air sacs increases efficinency of respiration in birds

b. In insects, circulation body fluids serve to distribute oxygen to tissues

c. Principle of counter – current flow facilitates efficient respiration in gills of fishes

d. Residual air in lungs slightly decreases the efficiency of respiration in mammals

58. Percenatage of oxygen being carried by blood plasma is

a. 6-9% b. 3-6%

c. 2-3% d. 1-2%

59. Name of the pulmonary disease in which alveolar surface area involved in gas exchange is drastically reduced due to damage in the alveolar walls: (RE-NEET 2015)

a. Astthma b. Pleurisy

c. Emphysema d. Pneumonia

60. Asthma may be attributed to (AIPMT/NEET 2016)

a. bacterial infection of the lungs

b. allergic reaction of the mast cells in the lungs

c. inflammation of the trachea

d. accumulation of fluid in the lungs

61. Name the chronic respiratory disorder caused mainly by cigarette smoking: (RE-NEET 2016)

a. Emphysema b. Asthma

c. Respiratory acidosis

d. Respiratory alkalosis

62. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration. (NEET 2017)

a. Inspiratory Reserve Volume

b. Tidal Volume

c. Expriatory Reserve Volume

d. Residual Volume

Chapter – 7
BODY FLUIDS AND CIRCULATION

1. What is the life span of RBC in humans ? (AFMC – 90)

   a. 120 days **b**. 210 days

   c. 220 days d. 200 days

2. What is found in the surrounding of wall of heart ? (AFMC – 93)

   a. Pericardial cavity b. Perineural cavity

   c. Pericardium d. None of the above

3. By which cause Dubb sound arises ? (CBSC-94)

   a. Closing of semilunar valve

   b. Closing of bicuspid valve

   c. Closing of tricuspid valve

   d. Both b and c

4. Which is the pacemaker heart ? (CBSC – 94)

   a. AV Node b**. SA Node**

   c. Purkinje fiber d. Bundle of His muscle

5. Where granular WBCs are produced ? (DPMT-95)

   a. Kidney

   b. Liver

   c. Small interstine

   d**. Bone marrow**

6. Which type of WBCs are found in maximum number ?

   a. Monocytes b. Basophils

   c. Acidophils d**. Neutrophils**

7. Which of the following is not useful in blood clotting. (AFMC-96)

   a. Fibrin b. Calcium

   c. Platelets **d. Bilirubin**

8. In which of the following close circulation is found ? (CBSC-94)

   a. Cockroach b. Mosquito

   c. Housefly d**. Tadpole**

9. The wall of which part of the heart is very thich ? (AIIMS-99)

   a. Left atrium b**. Left ventricle**

   c. Right atrium d. Right ventricle

10. What is right for all veins ? (CBSC-2000)

    a. They carry oxygenated blood

    b. They carry Deoxygenated blood

    c. They directly open into vena cave

    d**. None of the above**

11. How lymph differs from blood ? (CPMT – 73,84)

    a. More RBC and less WBC

    b. Less RBC and more WBC

    c. RBC absent and less RBC

    d. RBC absent and more WBC

12. Which type of WBCs are found in maximum number ? (CPMT-88, DPMT -96)

    a. Eosiophil b**. Nutrophil**

    c. Acidophil d. Monocyte

13. What is pacemaker ?

    a. Instrument measuring Heartbeats

    b. Instrument measuring big arteries

    c. Atrio – ventricular node, which provides stimulation for heart beating

    d. Artificial sinuauricular node, which provides stimulation for heart beating

14. Which of the following statement is correct ? (BHU-93)

a. All veins carry deoxygenated blood

b. All arteries carry deoxygenated blood

c. All veins carry deoxygenated blood except one

d. All arteries carry deoxygenated blood except one

15. Regulation and initiation of heartbeat is indicated by

a. AV Node – bundle of His muscule – SA node – purkinje fiber

b. SA Node – purkinje fiber – AV Node – Bundle of His muscle

c. Purkinje fiber – AV Node – SA node – Bundle of His muscle

d. SA Node – AV Node – Bundle of His muscle – Purkinje fiber

16. Where Mitral valve is located and it join, (BHU-86, 2000, DPMT-86)

a. Left atrium and left ventricle

b. Left atrium and Right ventricle

c. Right atrium and Left ventricle

d. Right atrium and Right ventricle

17. What is responsible for systole ? (BHU-86,2000,DPMT-86,)

a. Entry of blood in lungs

b. Entry of blood in heart

c. Blood flow out of heart

d. Blood flow out of vein

18. What is the function of lymph ? (MPPMT-95)

a. Transport of O2 into brain

b. Transport of CO2 into lungs

c. Bring interstitial fluid in blood

d. Bring RBC and WBC in lymph node

19. Which is the correct statement for blood ? (APMEE – 96)

a. WBC is more than RBC

b**. RBC is more than WBC**

c. RBC is less than platelets

d. Platelets is less than RBC

20. Hepatic portal system starts from

a. Digestive system to liver

b. Kidney to liver

c. Liver to heart

d. Liver to Kidney

21. Blood circulation that stats in capillaries and ends in capaillaries is called (J & K CET 2010)

a. Portal circulation

b. Hepatic circulation

c. Cardic circulation

d. None of these

22. Which of the following carries glucose from digestive tract to liver (PMT-1999,BHU 2001)

a. Hepatic artaery

b. Hepatic portal vein

c. Pulmonary vein

d. None of these

23. Lymph (nodes) glands form

a. Hormones

b. Lymphs

c. Antigens

d**. Antibodies**

24. Which of the following is not a major organ of lymphatic system (MP PMT 2010)

a. Lymph nodes b. Thymus

c**. Kidney** d. Spleen

25. Lymph is colourless because (MP PMT 1999)

a. WBC are absent

b. WBC are present

c. **Heamoglobin is absent**

d. RBC are absent

26. Immunoglobulins are produced by

a. Lymphocytes b. Spleen

c. Leucocytes d. Monocytes

27. Which of the following human organs is often called the "graveyard" of RBC ? (AIIPMT 2012-M)

a. Spleen b. kidney

c. Pancreas d. Liver

28. There is no DNA in

a. Mature RBCs

b. Mature spermatozoa

c. Hair root

d. Ovum

29. In the ABO system of blood groups, if both antigens are present but no antibody, the blood group of the individual would be ? (AIPMT 2011)

a. B b. O **c. AB** d. A

30. Which of the following are granular WBCs ?

a. Neutrophils,Basophils, Lymphocytes

b. Eosinophil, Basophil, Monocytes

c. Basophils, Monocytes, Lymphocytes

d. **Neutrophils, Eosinophils, Basophils**

31. What P indicates in ECG ?

a. End of atrium systole

b. **Starting of atrium systole**

c. End of ventricle systole

d. Starting of ventricle systole

32. Reduction in pH of blood will. (AIPMT/NEET 2016)

a. reduce the rate of heart beat

b. reduce the blood supply to the brain

c. decrease the affinity of hemoglobin with oxygen

d. release bicarbonate ions by the liver

33. Blood pressure in the pulmonary artery is. (AIPMT/NEET 2016)

a. same as that in the aorta

b. more than that in the carotid

c. more than that in the pulmonary vein

d. less than that in the venae cavae

34. A decrease in blood pressure/volume will not cause the release of. (NEET 2017)

a. Atrial natriuretic factor

b. Aldosterone

c. ADH

d. Renin