UNIT-1

SECTION-A

1.What are the fluids of the body?

Body fluids are the fluids such as blood,lymph,milk,and saliva,which are produced in the body and then either circulated within the body or secreted outside it.

2. What is the function of hemoglobin?

Hemoglobin is contained in red blood cells, which efficiently carries oxygen from the lungs to the tissues of the body. Hemoglobin also helps in the transportation of carbon dioxide and hydrogen ions back to the lungs..
Haemoglobin is able to bind to gaseous nitric oxide (NO) as well as O2.

3.What is the composition of blood?

Blood is classified as a connective tissue and consists of two main components
Plasma**,** which is a clear extracellular fluid. Formed elements, which are made up of the blood cells and platelets.

4.What is extracellular fluid?

Extracellular fluid, in biology, body fluid that is not contained in cells. It is found in blood, in lymph, in body cavities lined with serous membrane, in the cavities and channels of the brain and spinal cord, and in muscular and other body tissues.

5.What is a lymph?

A colourless fluid containing white blood cells, which bathes the tissues and drains through the lymphatic system into the bloodstream.

SECTION –B

1.Explain the composition and function of body fluids.

Function:

- The body fluids facilitate the transportation of oxygen and nutrients throughout the body and remove the waste from the body.
- They help in regulating the body temperature.
- They maintain an efficient metabolism of the body.

Composition :

Body Fluids	**Composition**
Intracellular Body Fluids	70% water, ions, and molecules
Extracellular Body Fluids	Cations and Anions

Transcellular Fluid	Electrolytes such as sodium, bicarbonate and chloride ions.

2.What Are the Three Buffer Systems in Body Fluid?

Protein Buffer Systems:

Proteins are the most important and widely operating buffers in the body fluid. The protein buffer system is an integral component of the body's pH controlling mechanism. Protein buffers are either intracellular or extracellular.
Protein buffers include basic group, and acidic protein buffer groups, that act as hydrogen ion depletors or donors to maintain the pH level at 7.4.

Phosphate Buffer System:

The phosphate buffer system is comprised of two ions: hydrogen phosphate ions and dihydrogen phosphate ions. The pH level of the blood drops below 7.4 when the H+ ions in the bloodstream increase.
When the pH level of the blood increases above 7.4, the dihydrogen phosphate ions release additional hydrogen ions to reinstate the pH level of the blood to its optimal 7.4.

Bicarbonate Buffer System:

The bicarbonate buffer system functions to maintain the pH level in the blood of mammals

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3.What are ABO and Rh blood groups?

The ABO blood group system consists of 4 types of blood group – A, B, AB, and O and is mainly based on the antigens and antibodies on red blood cells and in the plasma.

1. ABO blood Group system:

The basis of ABO grouping is of two antigens- Antigen A and Antigen B. The ABO grouping system is classified into four types based on the presence or absence of antigens on red blood cells surface and plasma antibodies.

Group A – contains antigen A and antibody B.
Group B –contains antigen B and antibody A.
Group AB –contains both A and B antigen and no antibodies (neither A nor B).
Group O – contains neither A nor B antigen and both antibodies A and B.

2. Rh Blood Group System:

In addition to the ABO blood grouping system, the other prominent one is the Rh blood group system. About two-thirds of population contains the third antigen on the surface of their red blood cells known as ***Rh factor*** or *Rh antigen*; this decides whether the blood group is positive or negative.

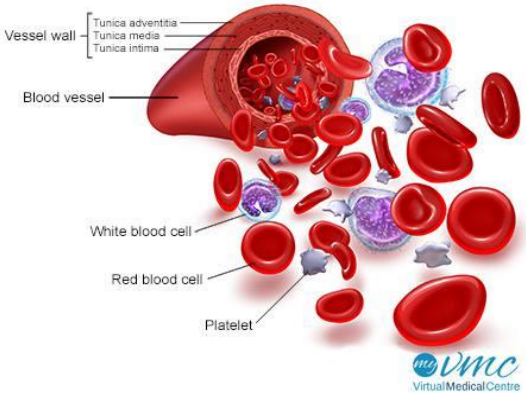
If Rh factor is present, an individual is *rhesus positive* . If an Rh factor is absent individual is *rhesus negative* as they produce Rh antibodies.

4.Write a note on composition of blood .

Composition of blood:

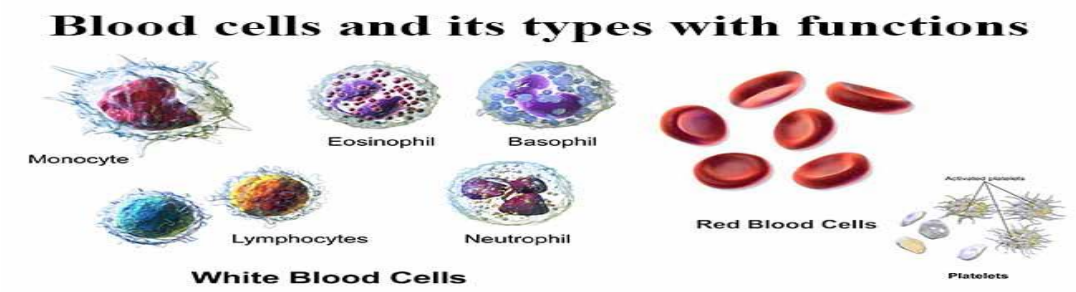
- Plasma, which is a clear extracellular fluid
- Formed elements, which are made up of the blood cells and platelets

- Formed elements are:
- Erythrocytes, also known as red blood cells (RBCs)
- Leukocytes, also known as white blood cells (WBCs)
- Platelets



SECTION-C

1.Explain about the blood cells.



Blood cells :

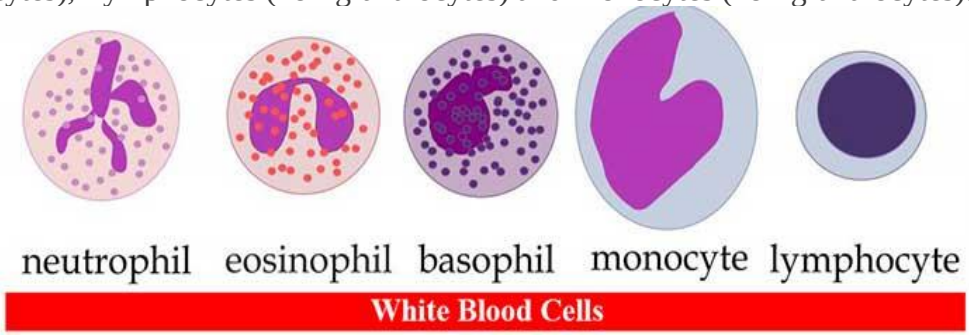
Blood cells are the cells which are produced during hematopoiesis and found mainly in the blood. Blood is composed of the blood cells which accounts for 45% of the blood tissue by volume, with the remaining 55% of the volume composed of plasma, the liquid portion of the blood.

1. Red Blood Cells (Erythrocytes)

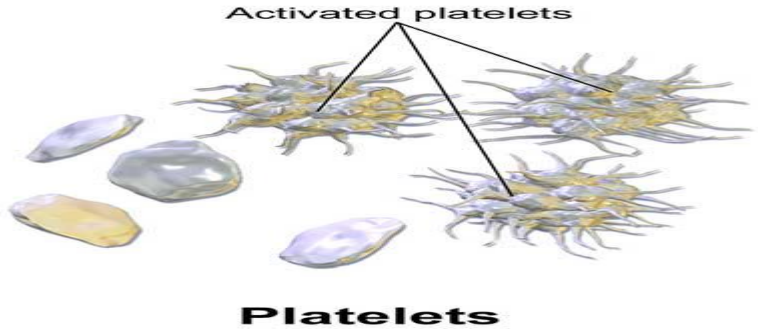
- Account for approximately 40 to 45 percent of the blood.
- Biconcave disc which is round and flat, sort of like a shallow bow
- Production of RBCs is controlled by erythropoietin.
- RBC contains hemoglobin (33%).
- The iron found in hemoglobin gives the blood its red color.
- Transport oxygen from the lungs to the cells of the body.
- Pick up carbon dioxide from other tissues and unload it in the lungs

2. White Blood Cells (Leukocytes)

- Account for only about 1% of the blood.
- It is the part of the body that protects itself against foreign substances and various types of infections.
- They are made in the bone marrow from multi-potent cells called hematopoietic stem cells.
- There are five main types of WBCs.: Neutrophils (granulocytes), Eosinophils (granulocytes), Basophils (granulocytes), Lymphocytes (non-granulocytes) and Monocytes (non-granulocytes).



3. Platelets (Thrombocytes)



- Nucleus Absent
- Do not reproduce.
- Small fragments of bone marrow cells.
- Platelets are the parts of cells that the body uses for clotting
- They secrete vasoconstrictors which constrict blood vessels, causing vascular spasms in broken blood vessels.
- They secrete growth factors to maintain the linings of blood vessels.

2.Write a note on body fluids.

Blood and lymph are the two most important body fluids in the human body. Blood comprises of plasma, white blood cells, red blood cells, and platelets.
Lymph is a colourless fluid that circulates inside the lymphatic vessels.

Types of Body Fluid:

Blood
The main components of blood include:

Plasma: Plasma is the liquid component of blood. It is a thick fluid containing 55% blood, 90% water, and 8% proteins. Albumin is the major protein in plasma. Other proteins include immunoglobulins and clotting factors.

Red Blood Cells: 40% of the blood contains red blood cells. RBCs contain protein haemoglobin that gives the red colour to the blood.

White Blood Cells: The white blood cells are very few in number.They mainly protect the body against infections.
Platelets:

These are fewer in number than the red blood cells. The platelets help in the clotting of blood at the site of a wound.

Lymph:

Lymph is a colourless fluid present in the interstitial tissues. It circulates throughout the lymphatic system. It can be defined as blood without the RBCs.

Functions :

- The body fluids facilitate the transportation of oxygen and nutrients throughout the body and remove the waste from the body.
- They help in regulating the body temperature.
- They maintain an efficient metabolism of the body.

3.Explain the Process of Blood Coagulation.

Step 1: Injury to blood vessels

Injury to a blood vessel results to exposure of materials that are not normally in direct contact with the flow of blood.

Step 2: Platelet adhesion

Platelets play a key role in blood clotting. Due to injury, platelets in the circulating blood is attracted to the injured surface and starts working to stop the bleeding.

step 3: Platelet activation

For hemostasis to occur properly, the platelets must adhere to the exposed collagen, release the contents of the granules, and aggregate.

The process of linking the platelet glycoprotein to the collagen results in the activation of the platelets integrin.

Step 4: Activation of protein kinase

The contents of the granules activate a protein receptor that is Gq-linked which results into the increased concentration of calcium in the cytosol of the platelets.

Step 5: The conversion of Kallikrein to Kinin

Kallikrein-kinin conversion system is a complex of proteins that when activated leads to the formation of vasoactive kinins.

Step 6: Blood coagulation cascade

The process of fibrin formation takes place in two different pathways of the coagulation cascade of the secondary hemostasis. The pathways are the contact activation and the tissue factor pathway.

step 7: Activation of prothrombin to thrombin

The final *common* pathway between the two is the conversion of prothrombin to thrombin.

Step 8: Control of Thrombin

Excess thrombin would lead to dangerous consequences.

There are *two mechanisms* of regulating the levels of thrombin in the blood system whenever a blood vessel is damaged.

step 9: Activation of fibrinogen to fibrin

Thrombin leads to the release of the fibrin peptides, which generates fibrin monomers with a sub-unit structure $(\alpha\beta\gamma)_2$.

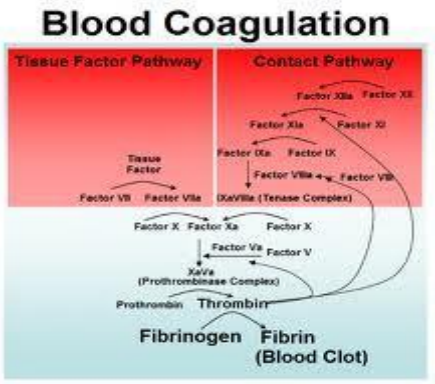
The monomers then spontaneously aggregate in a regular array, forming a weak fibrin clot.

Step 10: Dissolution of the fibrin clot

Dissolution of fibrin clots is the role of plasmin, a serine protease circulating as the inactive pro-enzyme and plasminogen.

The immediate process of stopping bleeding after injury is known as hemostasis and involves three events which are: blood vessel spasm, the formation of the platelet plug, and the blood clot formation process; known as blood coagulation.

Clotting of the blood occurs only when thrombin converts fibrinogen to fibrin clot.



UNIT-2

SECTION-A

1 What is the breathing mechanism?

Breathing is the process of **moving air into and out of the lungs** to facilitate gas exchange with the internal environment, mostly by bringing in oxygen and flushin**g out** co_2 .

2.How to determine heart rate from ECG?

To **determine** what area of the **ECG** represents one **heart** beat. From the length of a **heart** beat on the **ECG** trace, can be able to calculate the **heart rate**. A normal **heart** beat contains a P wave, a QRS complex, and an ST segment.

3.What is a circulation?

Circulation is the movement of blood through the vessels of the body that carries nutrients and gases along with it to and removes waste from the different parts of the body.

4.What is an artery?

An artery is an elastic blood vessel that transports blood away from the heart. This is the opposite function of veins, which transport blood to the heart. Arteries are components of the cardiovascular system

5.What is the role of the lungs in the body?

One mechanism the body uses to control blood pH involves the release of carbon dioxide from the lungs. Carbon dioxide, which is mildly acidic, is a waste product of the processing of oxygen and nutrients and, as such, is constantly produced by cells. It then passes from the cells into the blood.

6.What are the stages of the cardiac cycle?

- Filling phase – the ventricles fill during diastole and atrial systole.
- Isovolumetric contraction – the ventricles contract, building up pressure ready to pump blood
- Outflow phase – the ventricles continue to contract, pushing blood into the aorta .

7..What is the most important part of the heart?

Left ventricle is the strongest and most important chamber of the heart. It receives oxygenated blood from left atrium, and pumps it into the aorta.

8..How do you determine heart rate from ECG?

To **determine** what area of the **ECG** represents one **heart** beat. From the length of a **heart** beat on the **ECG** trace, can be able to calculate the **heart rate.** A normal **heart** beat contains a P wave, a QRS complex, and an ST segment.

9..What is known as Heart Failure?

When the heart stops pumping enough blood to meet the requirements of the body, it is known as heart failure. Chest pain, rapid breathing, and fainting are the symptoms of heart failure.

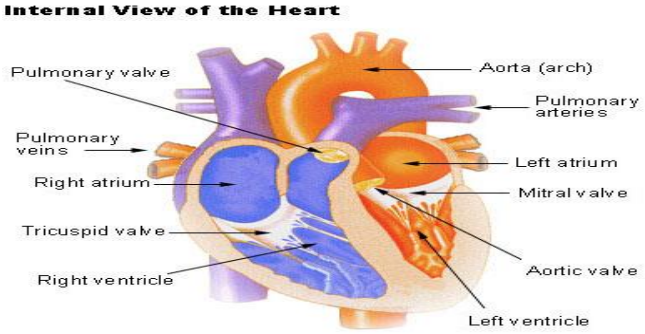
SECTION –B

1.Write the functions of blood.

- Tansport of nutrition
- Transport of respiratory gases
- Acts as a vehile
- Drainage of waste products
- Blood clotting
- Regulation of body temperature
- Defence actions and regulates blood pressure

2.Explain about the Chambers of the Heart.

The heart is a muscular organ about the size of a fist, located just behind and slightly left of the breastbone. The heart pumps blood through the network of arteries and veins called the cardiovascular system.

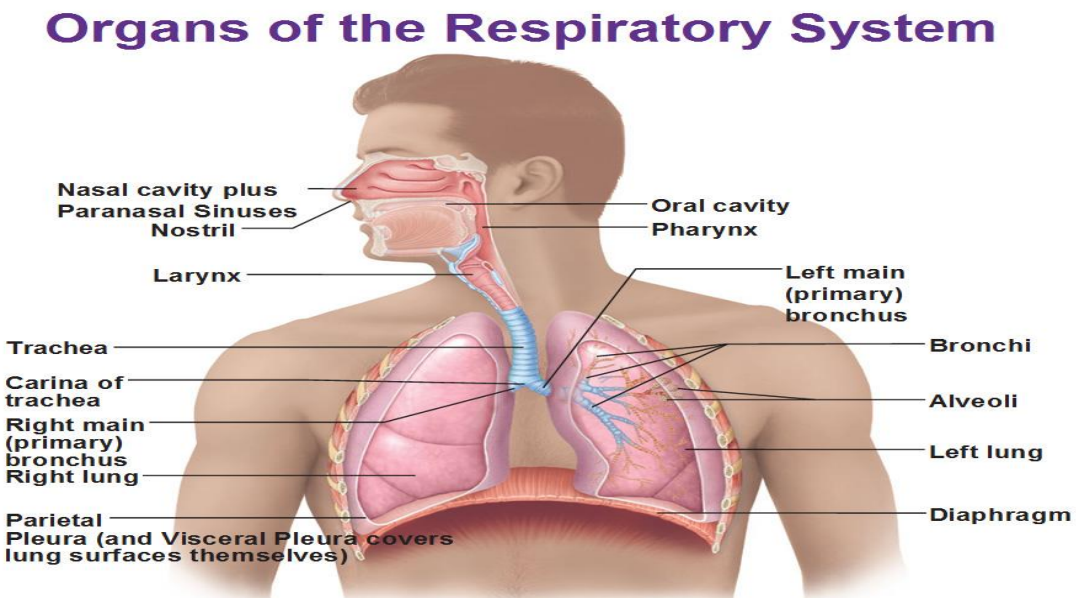


- The heart has four chambers:
- The right atrium receives blood from the veins and pumps it to the right ventricle.
- The right ventricle receives blood from the right atrium and pumps it to the lungs, where it is loaded with oxygen.
- The left atrium receives oxygenated blood from the lungs and pumps it to the left ventricle.
- The left ventricle (the strongest chamber) pumps oxygen-rich blood to the rest of the body. The left ventricle's vigorous contractions create our blood pressure.
- The coronary arteries run along the surface of the heart and provide oxygen-rich blood to the heart muscle. A web of nerve tissue also runs through the heart, conducting the complex signals that govern contraction and relaxation. Surrounding the heart is a sac called the pericardium.

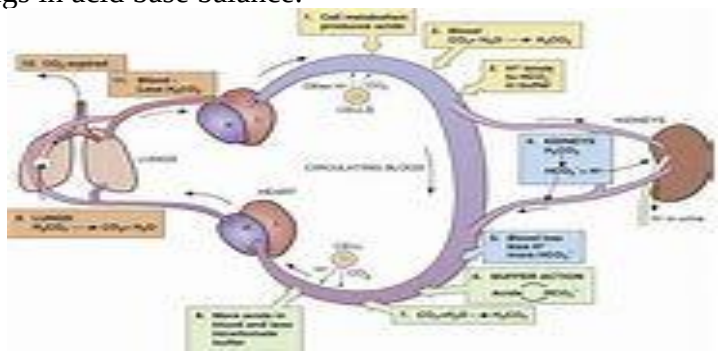
3..What are the organs involved in respiration?

- Nasal cavity.
- Oral cavity.
- Pharynx.

- Larynx.
- Left lung and right lung.
- Pulmonary blood vessels.
- Heart.
- Upper lobe ,middle lobe ,left lobe.



4..Describe the role of lungs in acid base balance.



Control of Acid-Base Balance
The **blood carries carbon dioxide to the lungs, where it is exhaled**
As carbon dioxide accumulates in the blood, the pH of the blood decreases (acidity increases).
The brain regulates the amount of carbon dioxide that is exhaled by controlling the speed and depth of breathing (ventilation).

SECTION-C

1.Write a note on circulation.

The transportation of nutrients, wastes, gases, and other substances is carried out by the blood.

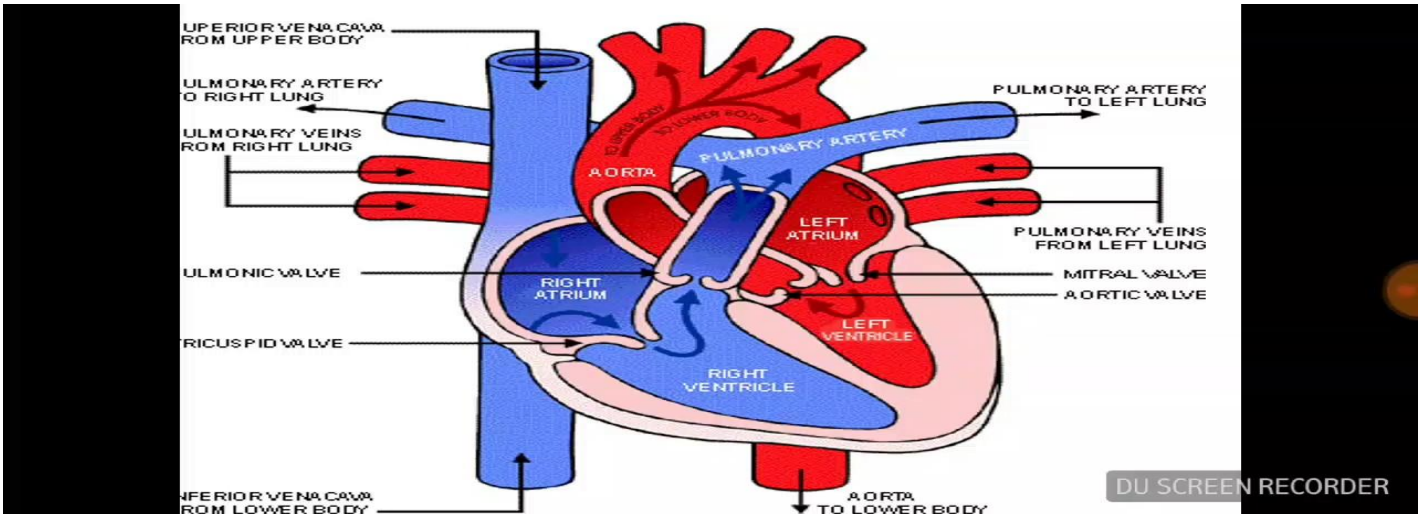
Functions:

- **Transport** of respiratory gases.
- Transport of nutrients to the cells.
- Transport of hormones from the endocrine glands to the respective organs.
- Destruction of pathogens.
- Transport of metabolic waste to the excretory organs for removal.
  Types of Circulatory Systems

The circulatory system is of two types:

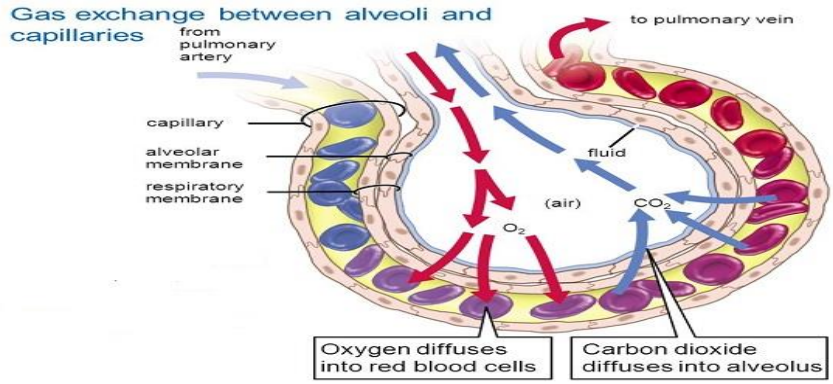
- Open Circulatory system
- Closed circulatory system

Open Circulatory System- Blood flows through parts of the body cavity, and not in closed vessels. This system is commonly found in insects.
Closed Circulatory System- Blood flows through closed tube-like vessels under sufficiently high pressure. This system is found in all the vertebrates.



2.Explain the mechanism of respiration in human.
Respiration is simply defined as the exchange of oxygen and carbon dioxide into the body.
phases:

- External respiration
- Transport of oxygen
- Internal respiration
- Transport of carbon dioxide



External respiration

- It occurs in lungs.It is the exchange of gases by diffusion between alveoli and blood in blood vessel, across respiratory membrane.
  During inspiration, oxygen is taken into the lungs. The partial pressure of oxygen in lungs is higher than that in blood capillaries.
  Therefore, oxygen diffuses from the lungs to the blood.
  Similarly, the venous blood contain high level of CO_2 in comparison to lungs.

Transport of oxygen

- Oxygen is transported from lungs to the tissue in bloodPlasma and RBC are helpful in transporting the oxygen.
  Water present in plasma has poor solubility for oxygen, so it carries only 3% of total oxygen.
  Most of the oxygen (about 97% of total oxygen) is transported by RBC.
  RBC has a respiratory pigment hemoglobin which combines with oxygen to form oxyhemoglobin due to high affinity of hemoglobin with oxygen.
  Almost all oxygen are transported in this form, from lungs to tissue.
  $Hb_4 + 4O_2$ ----------→ Hb_4O_8
  Oxyhemoglobin compound is highly unstable compound and thus can dissociate quickly as it reaches to tissue.

Internal respiration

- This process takes place inside the cells in various tissue, hence called tissue respiration.
  It includes two steps:

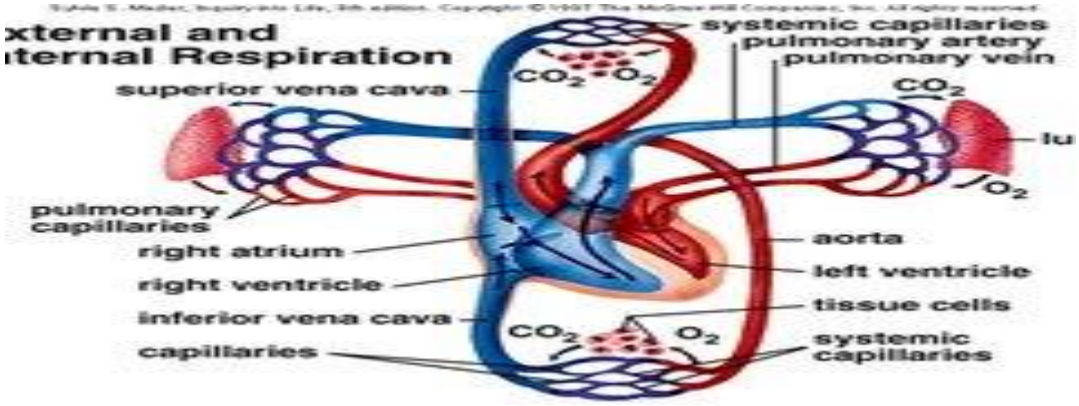
Transportation of carbon dioxide

Carbon dioxide is the waste product which is produced in the body as a result of tissue respiration. Since CO_2 is very toxic, it is essential to remove out from the body.

3.Explain the exchange between the lungs and blood.

External Respiration:

- Gas exchange between air and blood in the lungs



  - Gas exchange in the lungs Known as external respiration

    The process by which the deoxygenated blood in the pulmonary arteriole becomes oxygenated in the pulmonary venule.

    The inhaled air in the alveoli provides air that is high in oxygen and low in carbon dioxide.

    A capillary network surrounds the surface of each alveolus.

This capillary brings in deoxygenated blood, which is low in oxygen and high in carbon dioxide

Gas exchange:

- Takes place across the respiratory membrane, also called the air blood barrier, which is made of alveolar and capillary walls

  Oxygen moves from the alveolar into the capillary as carbon dioxide moves in the opposite direction

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4.Explain the mechanism involved in the blood circulation.

Mechanism of Circulation

- The heart is the main organ involved in blood circulation. The human heart consists of two upper chambers called atria or auricles and two lower chambers called ventricles.

- Arteries carry oxygenated blood away from the heart to the body while the veins carry deoxygenated blood from different parts of the body to the heart for purification. Pulmonary artery and pulmonary veins are an exception.

- The right auricle and right ventricle are separated by a tricuspid valve while the left auricle and left ventricle are separated by a bicuspid or mitral valve. These valves prevent the blood from flowing back into the auricles.

- Two semilunar valves are present, each between the right ventricle and pulmonary artery, and left ventricle and aorta. These valves prevent the blood from flowing back into the heart.
- The deoxygenated blood is pumped into the right ventricle through the superior vena cava and inferior vena cava . The oxygenated blood is carried by the pulmonary veins from the lungs to the left auricle

- Most of the auricular blood passes into the ventricles during diastole and the process is known as diastasis.

- The rest of the blood passes into ventricles during auricular systole.

- The blood from the left ventricle passes from the left ventricle into the systemic aorta and deoxygenated blood passes from the right ventricle into the pulmonary aorta during ventricular systole.

- The oxygenated blood is distributed to all the body parts by the systemic arch while pulmonary aorta carries deoxygenated blood to lungs.

i. Dissociation of oxyhemoglobin

As the oxyhemoglobin reaches to the tissue, it quickly dissociates into free oxygen and hemoglobin. Oxygen enters into tissue, whereas the hemoglobin returns back to the RBC to pick up more oxygen.

Hb_4O_8 ----------.> $Hb_4 + 4O_2$

ii. Oxidation of food/ Tissue respiration

The oxygen oxidizes the glucose in presence of respiratory enzyme and releases energy, water and CO_2. Energy is stored in the form of ATP in mitochondria to perform the metabolic activities whereas the CO_2 is expelled from the tissue.

$C_6H_{12}O_6$ ----------→ $6CO_2 + 6H_2O$ + Energy

i. In the form of carbonic acid

CO_2 combines with water of RBC to form carbonic acid. The process is catalyzed by an enzyme carbonic anhydrase found in RBC.

About 7% of the total CO_2 are transported in this form.

$CO_2 + H_2O$ carbonic anhydrase H_2CO_3 (carbonic acid)

ii. In the form of bicarbonates

Carbonic acid quickly ionizes to form ions i.e. bicarbonate and hydrogen ions.

Bicarbonates ions are pumped through RBC membrane into plasma.

CO_2 is carried from tissue to the lungs through plasma.

iii. In the form of carbamino hemoglobin compound

CO_2 combines with amino group of haemoglobin to form a complex caramino hemoglobin compound.

$CO_2 + HHb\text{-}NH_2$ ----------→ Hb-NH-COOH

UNIT-3

SECTION-A

1.How carbohydrates fats and proteins are digested and absorbed?

During the digestion process, carbohydrates are broken down into sugars, while protein is broken down into amino acids, and fats are broken down into fatty acids and glycerol. Simple carbohydrates are absorbed into the body relatively quicker than complex carbohydrates.

2.What are the products of digestion that are absorbed by the small intestine?

There are three carbohydrate products which are absorbed by the small intestine; glucose, galactose and fructose. Digestion of starch is initiated in the mouth, facilitated by salivary amylase. The majority of carbohydrate digestion occurs in the stomach and duodenum

.

3. **What is the role of saliva in the digestive system?**

Function. Saliva has many important roles within the gastrointestinal system. Not only does it help to lubricate and wet food but it also begins the digestion of carbohydrates. One of its most important roles is protection of the oral environment:

4.What protects the stomach from acidic gastric juices?

Bicarbonate is alkaline, a base, and neutralizes the acid secreted by the parietal cells, producing water in the process. This continuous supply of bicarbonate is the main way that your stomach protects itself from autodigestion and the overall acidic environment.

5.What is the function of HCl in the stomach?

HCL can **kill microorganisms in food**. This is another major function of hydrochloric acid in stomach. It can also keep food from fermenting in the recesses of the stomach, vital to preventing food poisoning.

6.What is the purpose of saliva?

The main purpose of the saliva is **lubrication of the food**, which makes it easy for us to swallow the food. The antibacterial property of the saliva prevents the unwanted bacteria present in the mouth to enter.

7.What is the bile?
The bile is a sticky fluid produced in the liver, stored in the gallbladder and delivered into the intestine, where it aids in the digestion of fat.

SECTION-B

1.Write a note on digestion of Carbohydrate.

- The primary goal of carbohydrate digestion is to break polysaccharides and disaccharides into monosaccharides, which can be absorbed into the bloodstream.
- After eating, nothing needs to happen in the digestive tract to the monosaccharide**s** in a food like grapes, because they are already small enough to be absorbed as is.
- Disaccharides in that grape or in a food like milk are broken down in the digestive tract to monosaccharides.
- Starch in food is broken down in the digestive tract to glucose molecules.
- Fiber in food is not enzymatically digested in the digestive tract, because humans don't have enzymes to do this. However, some dietary fiber is fermented in the large intestine by gut microbes.

2.Write the composition and function of gastric juice.

Composition :

Gastric acid, gastric juice, or stomach acid, is a digestive fluid formed in the stomach and is composed of **hydrochloric acid (HCl), potassium chloride (KCl), and sodium chloride (NaCl).** **Jul 4 2019**
Function:

- Gastric juices are used to digest food. Enzymes contained in gastric juice, such pepsin, in an acid environment of the stomach.
- Acid is needed to activate protease, an enzyme that breaks down.

3.Explain about the composition and function of saliva.

composition:

Saliva is composed of a variety of electrolytes, including **sodium, potassium, calcium, magnesium, bicarbonate, and phosphates**. Also found in saliva are immunoglobulins, proteins, enzymes, mucins, and nitrogenous products, such as urea and ammonia.
Function:

- **Saliva helps in recognition of taste.**
- Saliva partially digests carbohydrates due to salivary amylase enzyme. We feel the food to be sweet as starch breaks down to glucose.
- It moistens the food and makes a bolus by mucous. This helps in easy swallowing of the chewed food.
- There are many microbes in the buccal environment. Saliva helps to kill them.
- It keep the mouth clean by evacuating any remained food debris from mouth

- Saliva has immunoglobins IgA a sort of antibodies. These bind to microbes and prevent the pathogens from entering into deeper tissues and destroys them.

4.What are the functions and composition of the bile?

Functions:

1 Fat Emulsification and Digestion 2 Disposal of Wastes 3 Neutralization of Gastric Acid 4 Protection of the Intestine Against Infections

Composition:

Bile is composed of **bile acids and salts, phospholipids, cholesterol, pigments, water, and electrolyte chemicals** that keep the total solution slightly alkaline (with a pH of about 7 to 8).

SECTION-C

1.Explain about the digestion ,absorption of carbohydrates,proteins,lipids.

Carbohydrates:

Digestion

There are three carbohydrate products which are absorbed by the small intestine; glucose, galactose and fructose. Digestion of starch is initiated in the mouth, facilitated by salivary amylase. The majority of carbohydrate digestion occurs in the stomach and duodenum. The main enzyme is pancreatic amylase, which yields disaccharides from starch by digesting the alpha 1-4 glycosidic bonds. The diasaccharides produced are all converted to glucose by brush border enzymes.
Disaccharides occurring naturally in food do not require amylase to break them down. Brush border enzymes hydrolyse these compounds into molecules of glucose, galactose and fructose.

Absorption

Glucose and galactose are absorbed across the apical membrane by secondary active transport through the Sodium-Glucose cotransporter .Both glucose and galactose exit the cell via GLUT2 receptors across the basolateral membrane into the blood. Fructose enters the cell by facilitated diffusion via GLUT5 and is transported into the blood via GLUT2 receptors.

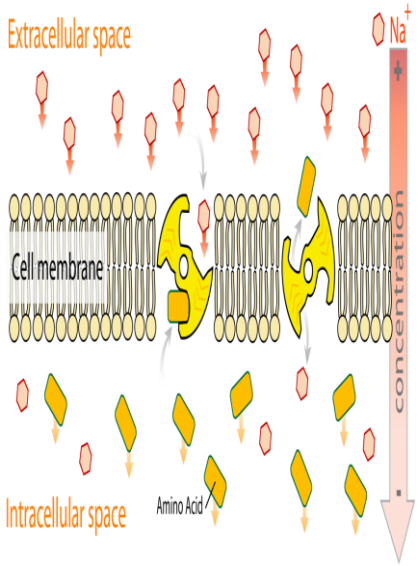
Protein:

Digestion

Protein digestion begins in the stomach with the action of pepsin, which breaks protein into amino acids and oligopeptides. The process of digestion is completed in the small intestine with brush border and pancreatic enzymes. They split the oligopeptides into amino acids, dipeptides and tripeptides.

Absorption

Amino acids are absorbed via a Sodium cotransporter, in a similar mechanism to the monosaccharides. They are then transported across the basolateral membrane via facilitated diffusion. Di and tripeptides are absorbed via separate H^+ dependent cotransporters and once inside the cell are hydrolysed to amino acids.



Lipids:

Digestion

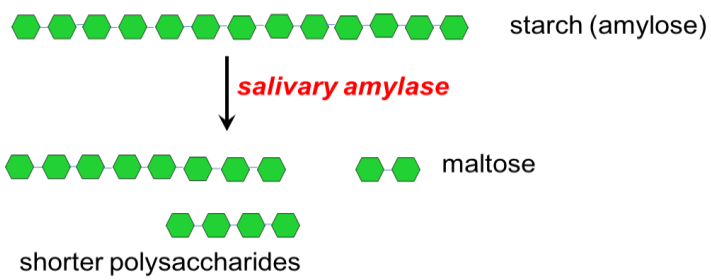
Lipids are hydrophobic, and thus are poorly soluble in the aqueous environment of the digestive tract. Their digestion is started by lingual and gastric *lipases*, but this only digests 10% of ingested lipids.
The remainder of the lipids are digested in the small intestine. Here, bile aids digestion by emulsifying the fat goblets into smaller chunks, called micelles, which have a much larger surface area.
Pancreatic lipase, phospholipase A2 and cholesterol ester hydrolase (3 major enzymes involved in lipid digestion) hydrolyse the micelles**,** breaking them down into fatty acids, monoglycerides, cholesterol and lysolecithin.

Absorption

The products from digestion are released at the apical membrane and diffuse into the enterocyte. Inside the cell, the products are re-esterified to form the original lipids, triglycerides, cholesterol and phospholipids. The lipids are then packaged inside apoproteins to form a chylomicron.

2.Explain briefly about the Digestion and Absorption of Carbohydrate

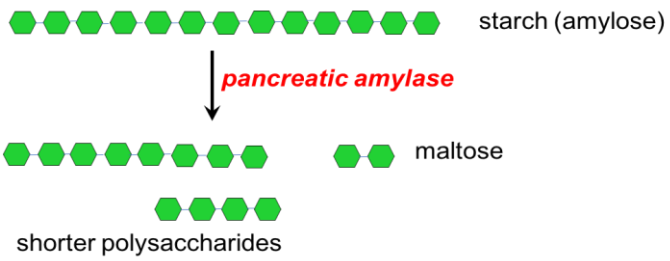
1 - Mouth or Oral Cavity
Mechanical digestion to begin to break it into smaller pieces and mix it with saliva, produced by several salivary glands in the oral cavity.
Some enzymatic digestion of starch occurs in the mouth, due to the action of the enzyme salivary amylase. This enzyme starts to break the long glucose chains of starch into shorter chains, some as small as maltose.



2 - Stomach
Although there's more mechanical digestion in the stomach, there's little chemical digestion of carbohydrates here.

3 - Small intestine

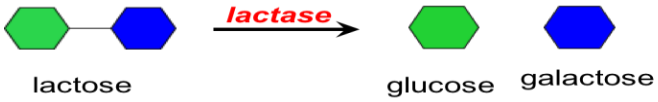
Most carbohydrate digestion occurs in the small intestine to a suite of enzymes. Pancreatic amylase is secreted from the pancreas into the small intestine, and like salivary amylase, it breaks starch down to small oligosaccharides and maltose.



The rest of the work of carbohydrate digestion is done by enzymes produced by the enterocytes, the cells lining the small intestine. When, these enzymes will break down the maltase formed in the process of starch digestion, the lactose from the cheese, and the sucrose present in the sauce.

Maltose is digested by maltase, forming 2 glucose molecules

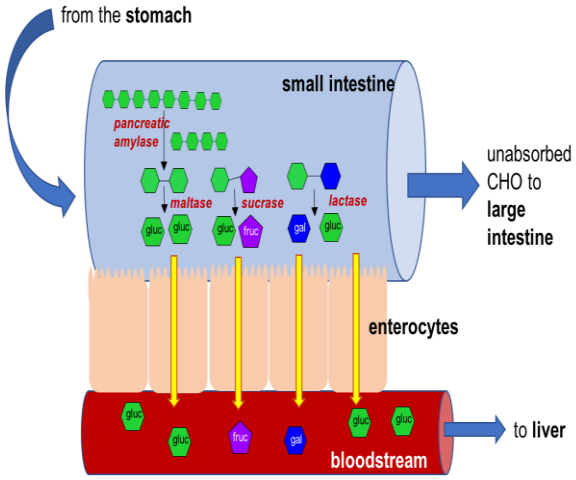
Lactose is digested by lactase, forming glucose and galactose



Sucrose is digested by sucrase, forming glucose and fructose

These three monosaccharides can now be absorbed across the enterocytes of the small intestine and into the bloodstream to be transported to the liver.

Digestion and absorption of carbohydrates in the small intestine are depicted in a very simplified schematic below.

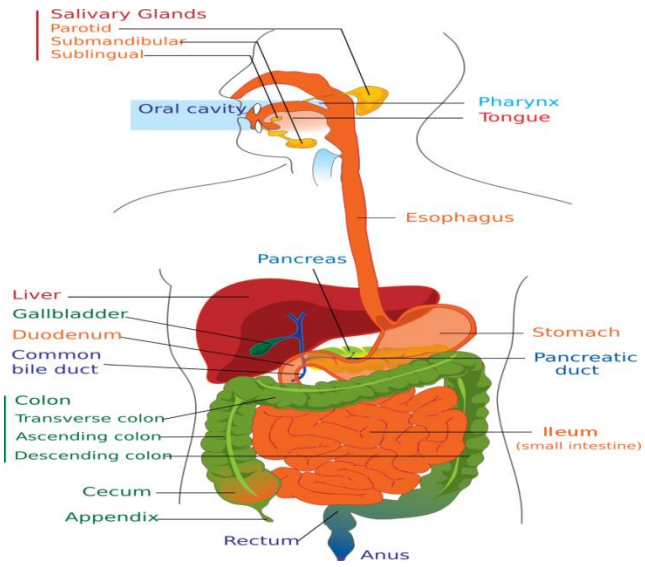


Fructose and galactose are converted to glucose in the liver. Once absorbed carbohydrates pass through the liver, glucose is the main form of carbohydrate circulating in the bloodstream.

4 - Large Intestine or colon

Any carbohydrates that weren't digested in the small intestine -- mainly fiber -- pass into the large intestine, but there's no enzymatic digestion of these carbohydrates here. Instead, bacteria living in the large intestine,ferment these carbohydrates to feed themselves. A diet high in whole food sources of fiber helps to maintain a population of healthy gut microbes.

3.Explain the anatomy of the digestive system.



- The human digestive system is the means by which tissues and organs receive nutrients to function. The system breaks down food, extracts nutrients from it, and converts them into energy.

- The digestive tract begins this involuntary process once food is consumed. Saliva begins the breakdown of food, and other enzymes in the digestive tract extend this process. As digestion continues, the food is propelled from organ to organ through muscular contractions called **peristalsis**.

The largest parts of the digestive system include:

- **Esophagus**: A hollow tubular organ in the neck and chest area that connects the mouth to the stomach.
- **Stomach**: A large organ that holds and digests food through a cocktail of enzymes and acids. Food remains here for two to eight hours.
- **Liver**: This organ helps filter toxins from the blood and produces bile, which helps break down proteins, carbohydrates, and fats.
- **Gallbladder**: This sac-like organ stores bile produced by the liver and then releases it as necessary.
- **Pancreas**: This organ produces insulin, which aids in the metabolism of sugars.
- **Small intestine**: The small intestine receives food from the stomach and begins to break down the food while absorbing the majority of its nutrients.
- **Large intestine**: This organ is filled with billions of harmless bacteria that turn food into feces while removing water and electrolytes for the body’s use.
- **Rectum**: At the end of the large intestine, this small space is a temporary storage area for feces.
- **Anus**: This is the external opening of the rectum, through which feces are expelled.

UNIT-4

SECTION-A

1.What are the major components of urine?

The biochemicals found in urine are predominately the end-products of the nitrogen metabolism process. These include **urea, uric acid, and creatinine**. Other components of urine include **sodium chloride** and over 100 other substances that are usually present, but only in trace quantities.

2 .what are the functions of kidney?

- maintaining overall fluid balance
- regulating and filtering minerals from blood
- filtering waste materials from food, medications, and toxic substances
- creating hormones that help produce red blood cells, promote bone health, and regulate blood pressure

3.What is secreted in tubular secretion?

The substances that are **secreted** into the **tubular** fluid include: Potassium ions (K+), Hydrogen ions (H+), Ammonium ions (NH 4 +), creatinine, urea, some hormones, and some drugs .

4.What is the importance of tubular secretion?

Tubular secretion occurs from the epithelial cells that line the renal tubules and collecting ducts. It is the tubular secretion of H+ and NH4+ from the blood into the tubular fluid (i.e. urine - which is then excreted from the body via the ureter, bladder, and urethra) that helps to **keep blood pH** at its normal level

5.W hat is peristalsis?

The involuntary constriction and relaxation of the muscles of the intestine or another canal, creating wave-like movements that push the contents of the canal forward

6.What is peristaltic action?

Peristalsis or “peristaltic action” is what **moves food** through **entire digestive tract**. When things go wrong with peristalsis, can end up with bowel cramps, constipation, diarrhea, abdominal pain, etc

7.How do acids and bases help maintain balance in the human body?

kidneys and lungs work to maintain the acid-base balance. Even slight variations from the normal range can have significant effects on vital organs. Acid and alkaline levels are measured on a pH scale. An increase in acidity causes pH levels to fall.

8.What are the substances secreted by the renal tubule?

Substances mainly secreted into renal tubule are; H+, K+, NH3, urea, creatinine, histamine and drugs like penicillin. Tubular secretion occurs at PCT and DCT;

9.What is the renal regulation of acid base balance?

Renal Regulation of Acid-Base Balance. Acid-Base Balance: KetoacidosisDiabetic acidosis, or ketoacidosis, occurs most frequently in people with poorly controlled diabetes mellitus. When certain tissues in the body cannot get adequate amounts of glucose, they depend on the breakdown of fatty acids for energy.

SECTION-B

1.Explain about the muscle contraction and relaxation.

Muscle Contraction

Muscle fibers contract in response to nerve stimuli from your central nervous system. This is an active process that involves the release of calcium at the cellular level of the muscle fiber, and causes a "ratcheting" effect that results in the shortening, or contracting, of individual muscle fibers.

Muscle Relaxation

Once your muscle contracts, the space between the motor end plate and the fibers releases an enzyme called acetylcholinesterase, which ends the stream of action. This causes the muscle to stop contracting and begin relaxation. When relaxation begins, the opposing muscle contracts and pulls the original contracting muscle back into place.

2.Write the functions of kidney.

- Regulating pH Balance
- maintaining overall fluid balance
- regulating and filtering minerals from blood
- filtering waste materials from food, medications, and toxic substances
- creating hormones that help produce red blood cells, promote bone health, and regulate blood pressure

---

3.Write the composition of urine.

Urinary solids are primarily made up of organic matter, largely volatile solids. Urine has large amounts of **nitrogen, phosphorus, and potassium**. Nitrogen content in urine is high, mostly in urea, which makes up more than 50 percent of the total organic acids.

Chemical Composition :

- Water (H_2O): 95%
- Urea (H_2NCONH_2): 9.3 g/l to 23.3 g/l
- Chloride (Cl^-): 1.87 g/l to 8.4 g/l
- Sodium (Na^+): 1.17 g/l to 4.39 g/l
- Potassium (K^+): 0.750 g/l to 2.61 g/l
- Creatinine ($C_4H_7N_3O$): 0.670 g/l to 2.15 g/l
- Inorganic sulfur (S): 0.163 to 1.80 g/l

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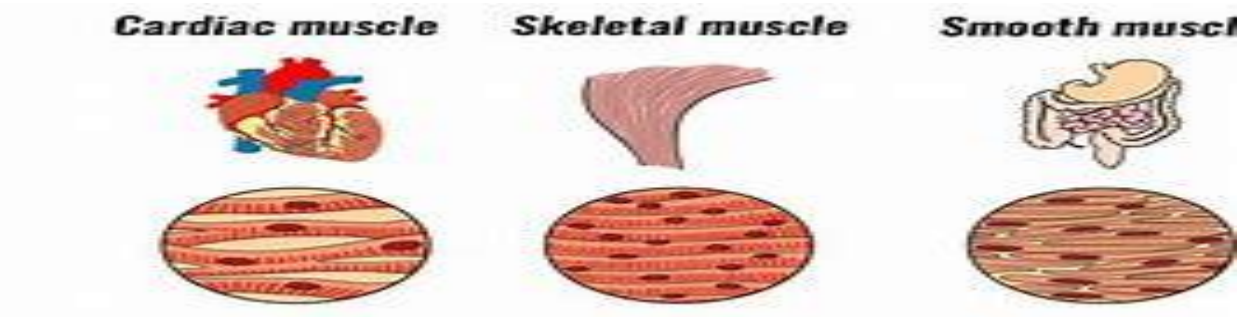
4 .Explain the **Kinds of muscle.**



There are three types of muscle found in the human body.

- **Skeletal Muscle**
- **Smooth Muscle**
- **Cardiac Muscle** (heart muscle)

Skeletal muscle

Skeletal Muscles are those which attach to bones and have the main function of contracting to facilitate movement of our skeletons. They are also sometimes known as striated muscles due to their appearance. The cause of this 'stripy' appearance is the bands of Actin and Myosin which form the Sarcomere, found within the Myofibrils.
Skeletal muscles are also sometimes called voluntary muscles.Contractions can vary to produce powerful, fast movements or small precision actions. Skeletal muscles also have the ability to stretch or contract and still return to their original shape.

Smooth muscle
Smooth muscle is also sometimes known as Involuntary muscle due to our inability to control its movements, or unstriated as it does not have the stripy appearance of Skeletal muscle. Smooth muscle is found in the walls of hollow organs such as the Stomach, Oesophagus, Bronchi and in the walls of blood vessels. This muscle type is stimulated by involuntary neurogenic impulses and has slow, rhythmical contractions used in controlling internal organs, for example, moving food along the Oesophagus or constricting blood vessels durings.

Cardiac muscle (heart muscle)
This type of muscle is found solely in the walls of the heart. It has similarities with skeletal muscles in that it is striated and with smooth muscles in that its contractions are not under conscious control. However, this type of muscle is highly specialised. It is under the control of the autonomic nervous system, however, even without a nervous input contraction can occur due to cells called pacemaker cells. Cardiac muscle is highly resistant to fatigue due to the presence of a large number of mitochondria, myoglobin and a good blood supply allowing continuous aerobic metabolism.

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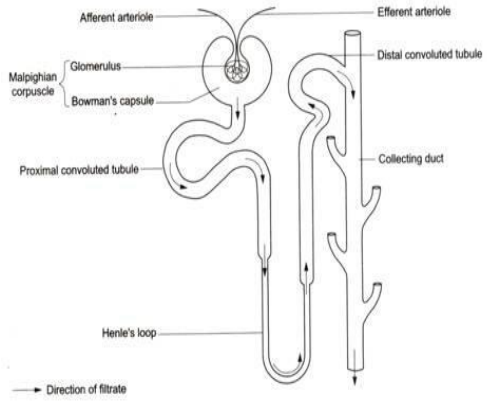
5. Explain the Anatomy of the Nephron.



Different parts of a nephron

The anatomy of the nephron is important to understand the urine formation process.

- Renal Corpuscle
- Renal Tubule

The renal corpuscle is divided into the glomerular capillaries or glomerulus and the Bowman's capsule. It is in the renal corpuscle that the blood is filtered at high pressure. The arteriole that brings blood into the glomerulus is called the afferent arteriole whereas the artery that takes blood away from the glomerulus is known as the efferent arteriole.

Between these arterioles forms, a network of capillaries called the glomerular capillaries of the glomerulus. The Bowman's capsule is a cup-shaped structure in which this glomerulus is located. The glomerulus along with the Bowman's capsule achieve the filtration of blood to form urine.

- The proximal convoluted Tubule(PCT)
- The U-shaped Loop Of Henle
- The Distal Convoluted Tubule(DCT)

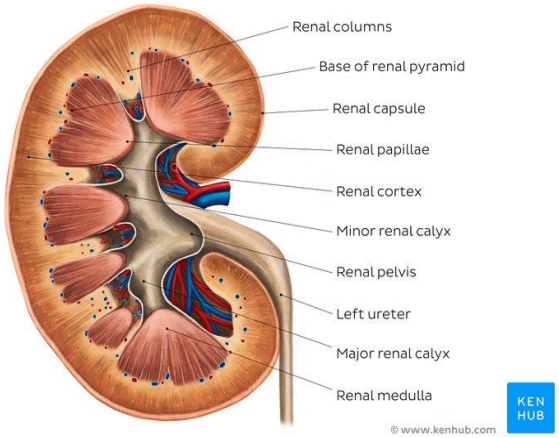
Once the blood is filtered in the renal corpuscle, the resultant fluid is called the glomerular filtrate. This glomerular filtrate now passes into the PCT. In the PCT, substances like NaCl, K+, water, glucose, and bicarbonate are reabsorbed into the filtrate whereas urea, creatinine, uric acid are added to the filtrate.

From the PCT, the filtrate enters the U-shaped Loop of Henle where reabsorption and secretion of water and various metabolites occurs. The filtrate then passes into the DCT. From the DCT, the filtrate passes into the collecting tubules, into the renal pelvis and the ureters as urine to be stored int he urinary bladder.

SECTION-C

1.Explain about the structure of kidney.

Kidney-Structure:



- The kidneys are two bean-shaped organs in the renal system.
- They help the body pass waste as urine.
- They also help filter blood before sending it back to the heart.

- Each kidney is enclosed by a thin tough fibrous connective tissue called renal capsule that protects it from infections and injuries. Around the capsule there is a layer of fat (adipose tissue) which is further enclosed by another layer of fibrous membrane known as **renal fascia**. The bean shaped kidney have outer convex surface and inner concave surface.
- **Location:** The kidneys lie on the posterior abdominal wall, one on each side of the vertebral column, behind the peritoneum and below the diaphragm.
- **Position:** It is situated at the level of T12-L3. The right kidney is usually slightly lower than the left, probably because of the considerable space occupied by the liver.

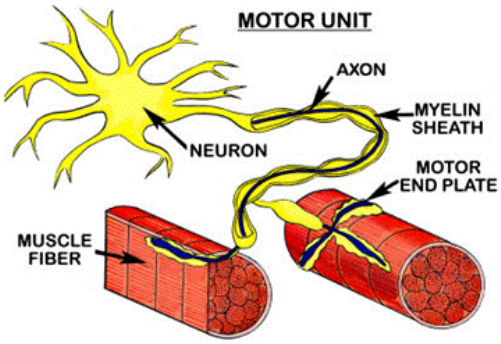
Longitudinal section of the kidney shows following parts.

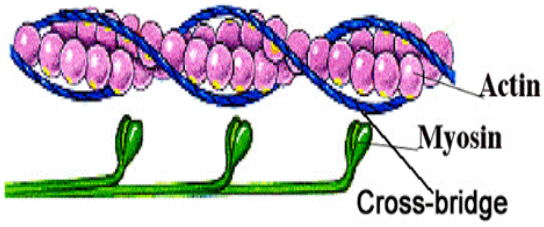
- **Capsule**: It is an outermost covering composed of fibrous tissue surrounding the kidney.
- **Cortex**: It is a reddish-brown layer of tissue immediately below the capsule and outside the renal It consists of renal corpuscles and convoluted tubules.
- **Medulla**: It is the innermost layer, consisting of conical areas called the renal pyramids separated by renal columns. There are 8-18 renal pyramids in each kidney. The apex of each pyramid is called a **renal papilla,** and each papilla projects into a small depression, called a **minor calyx** .
- Several minor calyces unite to form a **major calyx.** In turn, the major calyces join to form a funnel shaped structure called **renal pelvis** that collects urine and leads to ureter.

2.Explain about the sliding filament theory.

THE SLIDING FILAMENT THEORY :

For a contraction to occur there must first be a stimulation of the muscle in the form of an impulse from a motor neuron .





Note that one motor neuron does not stimulate the entire muscle but only a number of muscle fibres within a muscle. The individual motor neuron plus the muscle fibres it stimulates, is called a motor unit. The motor end plate is the junction of the motor neurons axon and the muscle fibres it stimulates.
When an impulse reaches the muscle fibres of a motor unit, it stimulates a reaction in each sarcomere between the actin and myosin filaments. This reaction results in the start of a contraction and the sliding filament theory.
The reaction, created from the arrival of an impulse stimulates the 'heads' on the myosin filament to reach forward, attach to the actin filament and pull actin towards the centre of the sarcomere. This process occurs simultaneously in all sarcomeres, the end process of which is the shortening of all sarcomeres.

stages:

1. Muscle activation: The motor nerve stimulates an action potential to pass down a neuron to the neuromuscular junction. This stimulates the sarcoplasmic reticulum to release calcium into the muscle cell.

2. Muscle contraction: Calcium floods into the muscle cell binding with troponin allowing actin and myosin to bind. The actin and myosin cross bridges bind and contract using ATP as energy
3. Recharging: ATP is re-synthesised allowing actin and myosin to maintain their strong binding state

4. Relaxation: Relaxation occurs when stimulation of the nerve stops. Calcium is then pumped back into the sarcoplasmic reticulum breaking the link between actin and myosin. Actin and myosin return to their unbound state causing the muscle to relax. Alternatively relaxation (failure) will also occur when ATP is no longer available.

In order for a skeletal muscle contraction to occur;

1. There must be a neural stimulus
2. There must be calcium in the muscle cells
3. ATP must be available for energy

UNIT-5

SECTION-A

1.What are the classifications of neurotransmitters?

Different types of neurotransmitters have been identified. Based on chemical and molecular properties, the major classes of neurotransmitters include **amino acids, such as glutamate and glycine; monoamines, such as dopamine and norepinephrine; peptides**, such as somatostatin and opioids; and purines, such as adenosine triphosphate .

2.What are motor neurons?

A nerve cell forming part of a pathway along which impulses pass from the brain or spinal cord to a muscle or gland.

3.What are any three neurotransmitters?

- Acetyl choline
- Noradrenalin (Nor-epinephrine)
- Adrenalin (Epinephrine)

4.What are Nerve Cells?

Neurons are nerve cells, or cells found in the nervous system. These are specialized cells designed to stimulate othercells in the body in order to communicate. Neurons are **excitable**, which means they function by using electrical stimulation.

5.What is a neurological cell?

Neuroglial cells are the supportive **cells** of nervous tissue. they outnumber neurons about 10 to 1. Like neurons, glial **cells** are composed of **cell** bodies and **cell** processes.

6.Write the composition of brain.

The brain is composed of **40% gray and 60% white matter**. The gray matter is made up of about 100 billion neurons that gather and transmit signals while the white matter is made of dendrites and axons that the neurons use to transmit signals.

7. What is Nerve Impulse?

The electrochemical wave that travels along nerve fibre and stimulates muscles, glands or other nerve cells is called nerve impulse.

8.What is the role of cAMP?

cAMP serves as an intracellular second messenger for numerous extracellular signals in the nervous system.

SECTION-B

1.Write a note on endorphin and enkephalin.

- Endorphin and enkephalin are the body's natural painkillers. When a person is injured, pain impulses travel up the spinal cord to the brain.
- The brain then releases endorphins and enkephalins. Enkephalins block pain signals in the spinal cord.
- Endorphins are thought to block pain principally at the brain stem. Both are morphine-like substances whose functions are similar to those of opium-based drugs.
- These naturally occurring opiates include enkephalins ,endorphins and a growing number of synthetic compounds.

2.E xplain the structure of Neurons.

Typical structure of neuron:

Neuron is the structural and functional unit of nervous system.It consists of a nerve cell body or soma and two types of processes-axon dendrite.

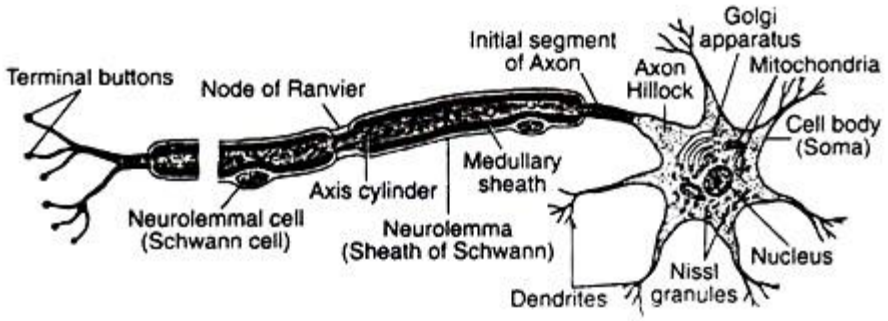


Fig. 8.29 : A neurone with all its processes and the formation of a medullated neurone

Soma:
It is an irregular- shaped structure in thecentre of which there lies a spherical nucleus with prominent nucleolus and nissl granules.

Dendrite:

It is the process of the cell body that carries impulse towards the cell body.It is usually short with many branches and contains nissl granules.

Axon:

It is the process of a nerve cell body that carries impulse away from it.It terminates into branches with terminal buttons

Nerves are made up special cells called the nerve cells or neurons. These neurons are the basic unit of the nervous system

Synapse is the junction between two nerve cells. It consists of a minute gap. Impulses or messages pass by diffusion of a neurotransmitter.

- Neurons have high energy requirements and are bundled with blood vessels.
- There are billions of neurons in the body, about 100 billion in the brain and 13.5 million in the spinal cord.
- Axons can transmit electrical signals at a rate of 2,500 per second.

SECTION-C

1. **Explain about the Nervous System.**

It consists of two main parts.

- The Central Nervous System (CNS)
- Peripheral Nervous System (PNS)

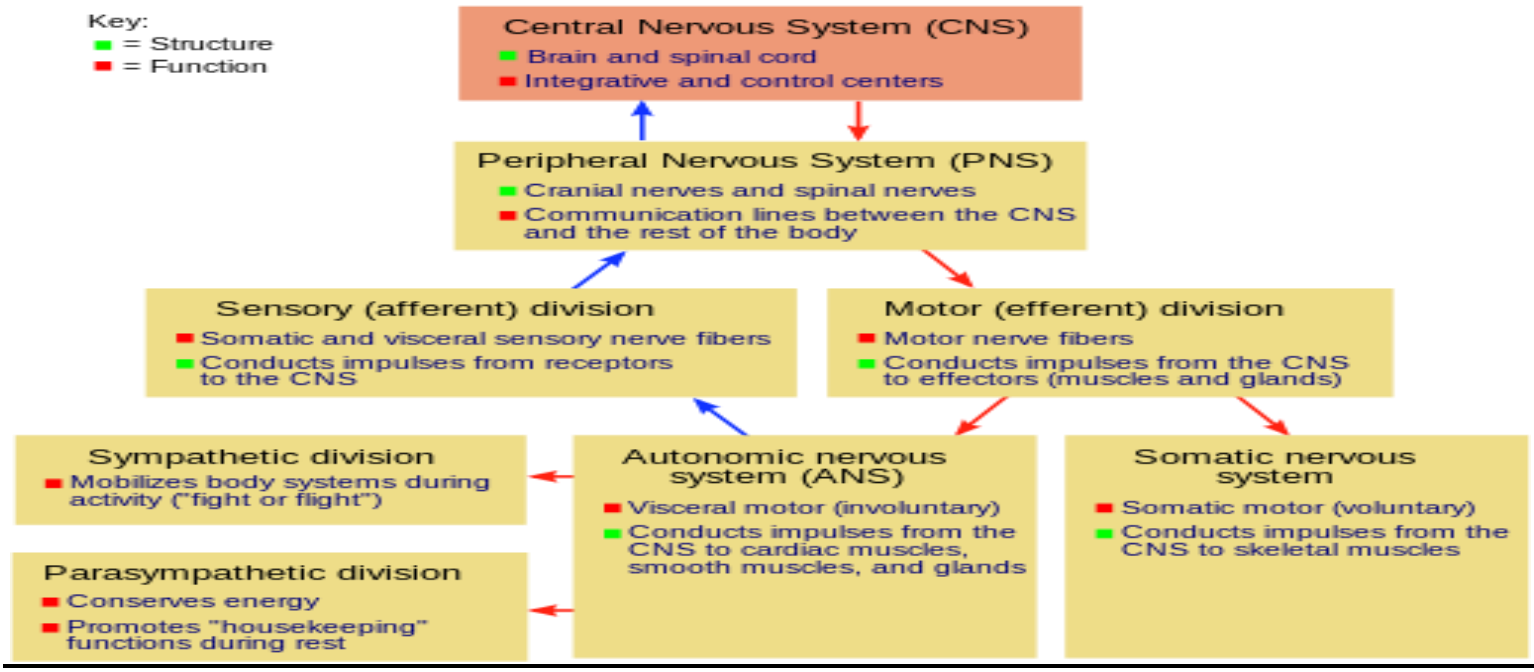
Central Nervous System

This system consists of the Brain and Spinal Cord. Find more about human brain in the related posts.

Peripheral Nervous System

It consists of the cranial nerves coming from the brain and the spinal nerves coming from the spine. There are 12 pairs of cranial nerves and 31 pairs of spinal nerves in humans.

The peripheral nervous system is made of up of the Autonomic nervous system and Somatic Nervous System. The Sympathetic nervous system and Parasympathetic nervous system fall under the autonomic nervous system.



2.Explain about the types of nerves.

Nerves :

A nerve is a thread like structure that comes out of the brain and the spinal cord. So these nerves branch out to all the parts of the body and are mainly responsible for carrying information and messages from part to the other. All the nerves make up the peripheral system. They carry information between the brain and spinal cord.

Types of Nerves

There are different types of nerves, according to the action they perform. They are:

- *Sensory Nerves* – These send messages to the brain from all the sensory organs,
- *Motor Nerves* – They carry messages from the brain to the muscles in the body.
- *Mixed Nerves* – They carry the sensory and motor nerves. They help in conducting the incoming sensory information and also the outgoing information to the muscle cells.

Based on which part the nerves connect to the Central Nervous System, they are classified as:

- *Cranial Nerves* – They start from the brain and carry messages from the brain to the rest of the body. Certain nerves are sensory nerves while some are mixed nerve
-
- *Spinal Nerves* – These nerves originate from the Spinal Cord. They carry messages to and from the central nervous system. They consist of mixed nerves.

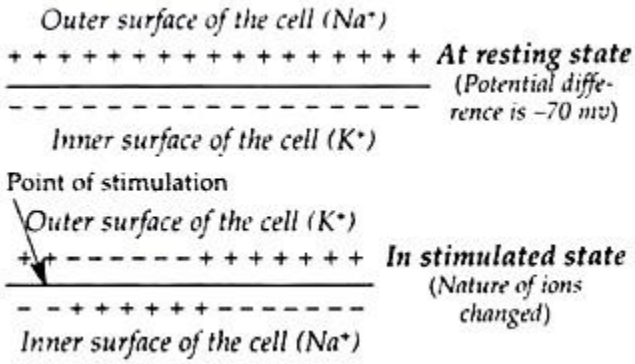
3.Explain the propagation conduction of nerve impulse.
Two major parts

1.Stimulation of nerve impulse 2.Travelling of nerve impulse

1.Stimulation of nerve impulse:

In resting nerve cells,the surface is positively charged and the interior is negatively charged.Positive ions and negative ions are accumulated along the outer and inner surface of the cell membrane,respectively.

This is achived by Na-outside and K-inside the cell membrane,and Na-is placed above the K-in the series



2.Travelling of nerve impulse:

According to the membrane, nerve impulse is a propagated wave of de –polarisation.

When the fibre is excited at appoint,the polarity is reversed.This is due to increased permeability of Na- to the membrane,which develops de-polarisation wave.
The de-polarisation wave travels in all direction along the length of the nerve fibre.

This in myelinated action jumps from one node ranvier to the next.This is known as salutatory conduction.

Rate of conduction of nerve impulse:

The basic principle of origin and propagation of nerve impulse is same,both fibres but the salutatory mechanism of conduction in fibre increases the velocity of conduction more than 500 times.
The rate of conduction of anerve impulse with an increase in the cross sectional diameter of the neuron with myelin sheath.The rate of transmission for a given neuron is a constant.

4.Write a short note on brain.

Composition:

The **adult human brain weights about 3 pounds** and the cerebrum accounts for about 85% of the brain. The brain is composed of 40% gray and 60% white matter. The gray matter is made up of about 100 billion neurons that gather and transmit signals while the white matter is made of dendrites and axons that the neurons use to transmit signals.
The **brain is composted of about 75% water** and **is the fattiest organ in the body, consisting of a minimum of 60% fat**. Humans have the largest brain to body ratio of any animal, and the blood vessels in the brain, if stretched end-to-end, would be about 100,000 miles long. The neocortex, or language center of the brain, comprises about 76% of the organ.

The: Developing Brain

Brain development begins very early in the life of a fetus. The brain grows at a rate of about a quarter million neurons per minute in the first trimester, with brain growth continuing through age 18. The brain of a newborn baby triples in size during the first year.

The amount of brain stimulation a child receives can effect brain growth by as much as 25%. If continued mental activity takes place, new neurons will develop throughout the life of a brain.

Brain Function :

Brains use about 20% of the total blood and 20% of the total oxygen that is circulating through the body at any given time.
If blood supply to the brain is cut off for more than 8 to 10 seconds, loss of consciousness will occur, yet the human brain can survive for between 4 and 6 minutes without any oxygen.
The information processing speed of the human brain can reach up to 120 meters per per second, and in a waking state can generate 10 - 23 watts of energy.
The brain is all this and more, providing us with the ability to bond socially with other humans and giving us the facilities for the creativity that makes us the innovators of the animal kingdom.

5.Write a note on neurotransmitters.

Neurotransmitters :

Neurotransmitters play an important role in neural communication. They are chemical messengers that carry messages between nerve cells and other cells in the body, influencing everything from mood to involuntary movements. This process is generally referred to as neurotransmission or synaptic transmission.

Specifically, excitatory neurotransmitters have excitatory effects on the neuron.

Neurotransmitters can act in predictable ways, but they can be affected by drugs, disease, and interaction with other chemical messengers.

To send messages throughout the body, neurons need to transmit signals to communicate with one another. But there is no physical connection with each other, just a minuscule gap. This junction between two nerve cells is called a synapse.

To communicate with the next cell, a neuron sends a signal across the synapse by diffusion of a neurotransmitter.

Neurotransmitters affect neurons in one of three ways:

1. **Excitatory neurotransmitters** have excitatory effects on the neuron. This means they increase the likelihood that the neuron will fire an action potential.
2. **Inhibitory neurotransmitters** have inhibitory effects on the neuron. This means they decrease the likelihood that the neuron will fire an action.
3. **Modulatory neurotransmitters** can affect a number of neurons at the same time and influence the effects of other chemical messengers.

Some neurotransmitters, such as dopamine, depending on the receptors present, create both excitatory and inhibitory effects.

Excitatory neurotransmitters :

The most common and clearly understood types of excitatory neurotransmitters include:

Acetylcholine

This is an excitatory neurotransmitter that is found throughout the nervous system. One of its many functions is muscle stimulation, including those of the gastrointestinal system and the autonomic nervous system.

Epinephrine

Also called adrenaline, epinephrine is an excitatory neurotransmitter produced by the adrenal glands. It is released into the bloodstream to prepare your body for dangerous situations by increasing your heart rate, blood pressure, and glucose production.

Glutamate

This is the most common neurotransmitter in the central nervous system. It is an excitatory neurotransmitter and usually ensures balance with the effects of gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter.

Histamine

This is an excitatory neurotransmitter primarily involved in inflammatory responses, vasodilation, and the regulation of immune response to foreign bodies such as allergens.

Dopamine

Dopamine has effects that are both excitatory and inhibitory. It is associated with reward mechanisms in the brain. _____