According to New Book Biology Sindh board

11TH GRADE
BIOLOGY

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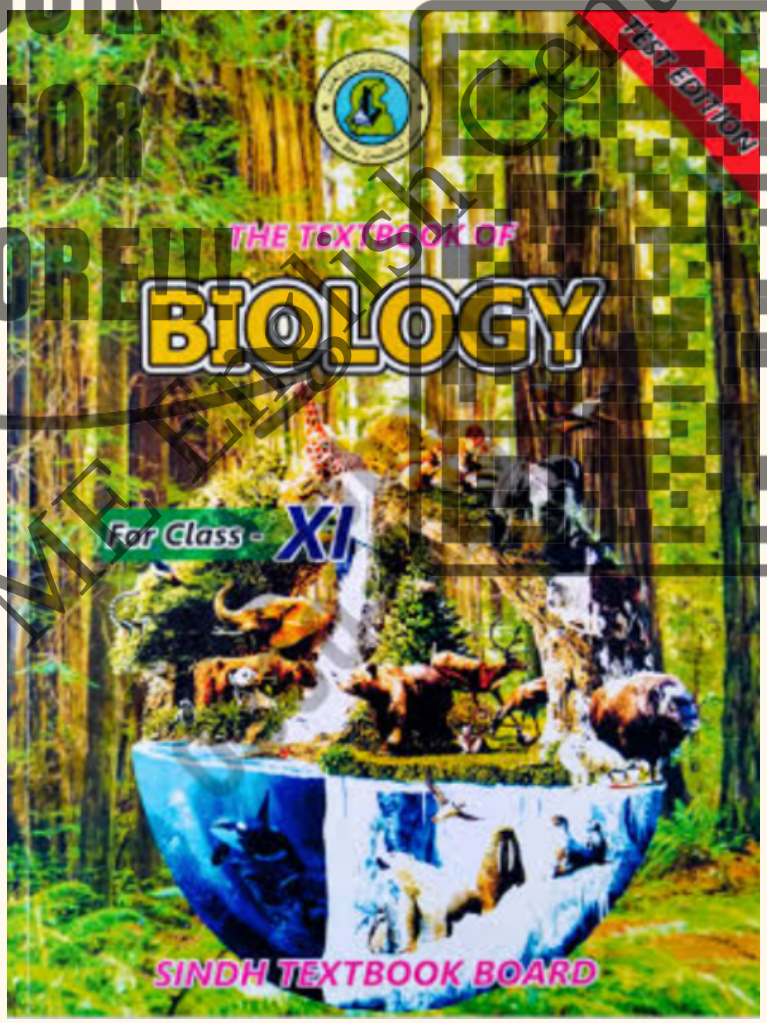


Chapter #01	*Biological Molecules*	*Zoology*

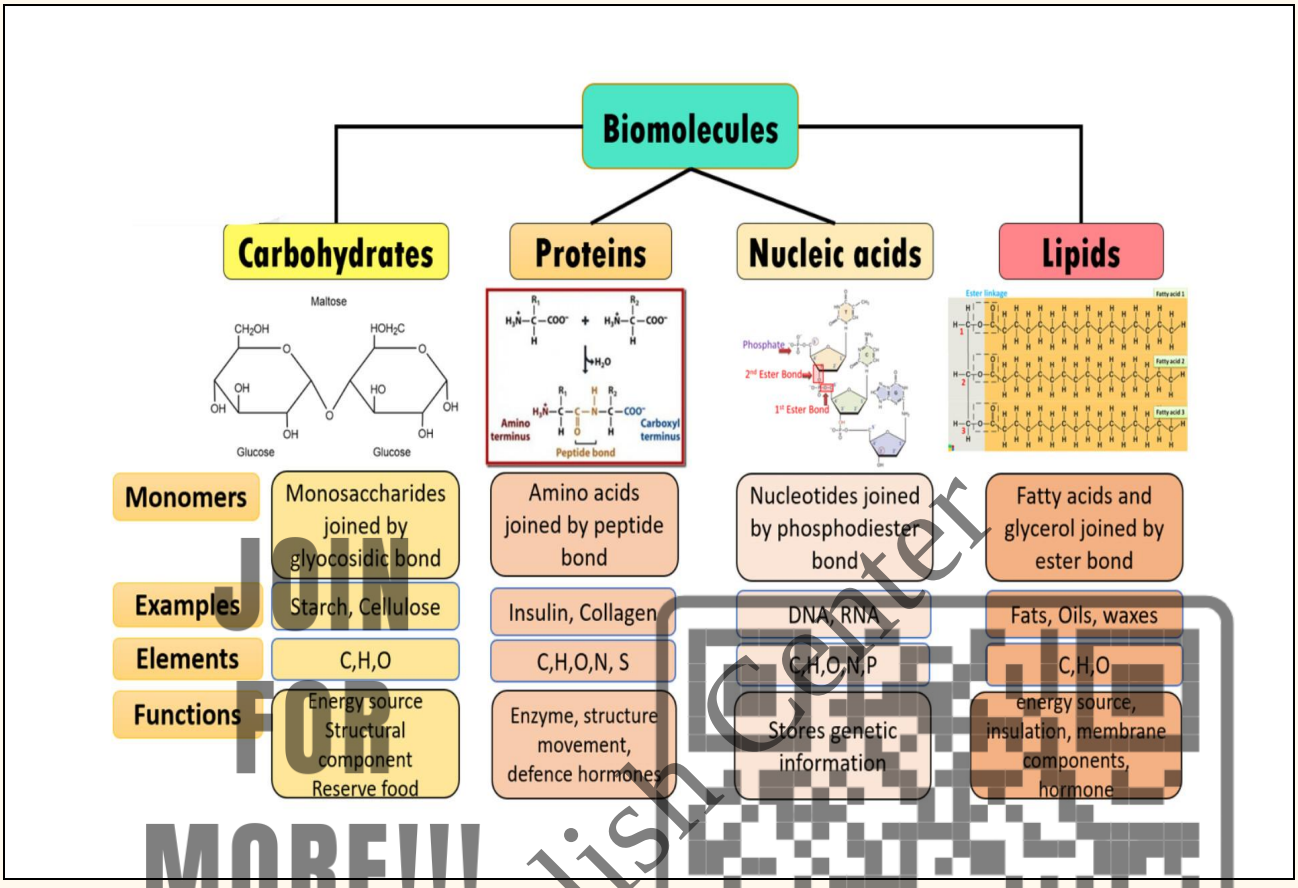
INTRODUCTION OF BIOCHEMISTRY:

The branch of biology which explains the biochemical basis of life is called **Biochemistry**. It is one of the most important branch of biology due some reasons given below:

- It provides information about all the processes carried out in the living organism from construction of body structures to flow of information from nucleus especially DNA for enzyme/ protein synthesis and control of all the mechanisms
- It provides information about abnormal mechanisms which lead to diseases. ultimately open doors to the development of medicines and medical equipment to elucidate these abnormalities.
- The recent concept and technologies of biochemistry enabled us to investigate and understand most challenging and fundamental problems of biology and medicine e.g. how does cells find each other to form a complex organ? How does the growth of cells controlled? What are the causes of cancer? What is the mechanism of memory? Biochemistry is the only branch of science which answer these questions properly.

As we know that organisms are made up to tissues and cells while cells are made up of molecules, molecules are chemically bonded atoms. It means that fundamentally living things or organisms are made up of chemicals which explains the second postulate of cell theory i.e. structure and function of cells are dependent upon their chemical composition.

Therefore it is necessary to study the chemical composition of cell and reactions which carry down in these cells to understand the different structures and metabolisms of an organism.



Encircle the correct choice:

(i) The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule.What is the attraction called ?

a) Covalent bond
b) Hydrogen bond ✓
c) Ionic bond
d) Hydrophilic bond

(ii) Tendency of water to coalesce oil drop into large droplet called

a) Hydrophilic force
b) Hydrophobic exclusion ✓
c) Hydrophilic exclusion
d) Hydrogen bonding

(iii) The covalent bond between two monosaccharides is called

a) Peptide bond
b) Ester bond
c) Phosphodiester bond
d) Glycosidic bond ✓

(iv) Most abundant carbohydrate found in nature?

a) Glucose
b) Maltose
c) Cellulose ✓
d) Glycogen

(v) Most important organic compound of the cell which carries out virtually all of the cell's activities.

a) Protein ✓
b) Carbohydrates
c) Nucleic acids
d) Lipids

(vi) All amino acids have same formula except

(a) Alpha carbon
(b) Hydroxyl group
(c) Radical group ✓
(d) Amino acids

(vii) A trihydroxy alcohol made up of three carbon atoms called

(a) Glucose

(b) Glycerol ✓
(c) Maltose
(d) Acylglycerols

(viii) large and important class of lipids made up of isoprenoid unit called
(a) Phospholipid
(b) Terpenoids ✓
(c) Waxes
(d) Acylglycerols

(ix) How many molecules of water are needed to completely hydrolyze a polymer that is 21 monomers long?
(a) 10
(b) 20 ✓
(c) 21
(d) 2

(x) Which of the following is true of both starch and cellulose?
(a) They are both polymer of glucose ✓
(b) They are geometric isomers of each other
(c) They can both be digested by humans
(d) They are both used for energy storage in plants

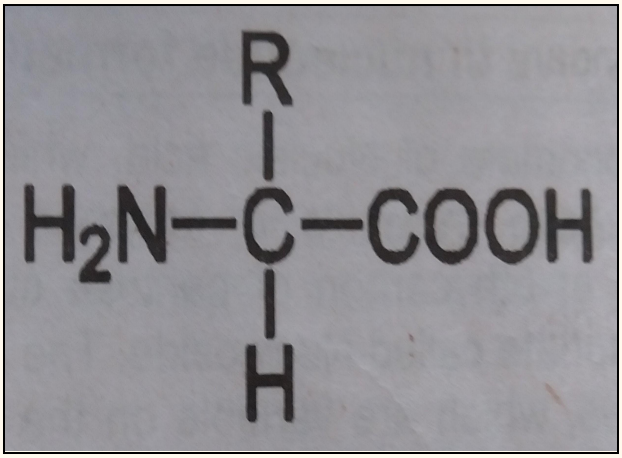
Short Question Answer :

Q1.Why water molecules are called amphoteric?

Ans: Water molecules are called amphoteric in nature Due to ionization property H20 dissociate in to H+ and OH-. Acid is a substance that can donate H+ and base is a substance that can donate OH-. That's why water molecules can act as both acid
and base.

Q2. Why are amino acids named so?

Ans. An amino acid, the name comes from the amine (amino) and the carboxylic acid (carboxyl group). Amines are weak bases, so the acid portion of the name must come from the carboxylic acid.



Q3. How are monosaccharides classified?

Ans:

Classification of Monosaccharides				
No. of Carbon	Type of sugar	Aldoses	Ketoses	Formula
3	TRIOSES	Glyceraldehydes	Dihydroxyacetone	$C_3H_6O_3$
4	TRIOSES	Erythrose	Erythrulose	$C_4H_8O_4$
5.	PENTOSES	Ribose, Xylose	Ribulose, Xylulose	$C_5H_{10}O_5$
6.	HEXOSES	Glucose, Galactose	Fructose	$C_6H_{12}O_6$
7.	HEPTOSES	Glucoheptose	Sedoheptulose	$C_7H_{14}O_7$

Q4. Enlist Bio- elements make 98% of the living system ?

Ans: Six elements that share 98% of the mass of living organisms are :

- Carbon
- Hydrogen
- Nitrogen
- Oxygen
- Sulphur
- Phosphorus

Q5. Why do fats provide more energy than carbohydrates ?

Ans: Fats provide more energy than carbohydrates because fats is the class of lipids and lipids have high proportion of C-H bonds which stores the high energy contant of organic molecules is in the carbon-Hydrogen covalent bonds .

Carbohydrates on the other hand, have high ratio of C-O bonds because of glycosidic linkage so they do not store as much energy in their bonds .

Q6. How many steps involved in nucleotide formation?

Ans: Nucleotide are the monomers of nucleic acid, which is Penrose sugar based where a nitrogenous base molecule is attached at the first carbon and a phosphate is attached at 5th carbon of pentose sugar as shown below. The nucleotide without phosphate called Nucleoside. The DNA and RNA are made up four types of nucleotides, which are variable on the basis of nitrogenous basis. There are two groups of nitrogenous bases i.e Purine and Pyrimidine. Purines are of two types Adenine **(A)** and **Guanine (G)** while Pyrimidine includes three nitrogenous bases **Cytosine (C) , Thymine (T)** and **Uracil (U)**.

Q7: Distinguish between saturated acylglycerol and unsaturated acylglycerols ?

Ans:

SATURATED ACYLGLYCEROL	UNSATURATED ACYLGLYCEROL
These acids consists of a single chain of corbon atoms and there is no double bond.	These acids consists of carbon atoms and they have one or more double bond.
At room temperature they are solid	At room temperature they are liquid.
The melting point of saturated fatty acids is relatively higher.	The melting point of unsaturated fatty acids is relatively lower.
The have a straight chain.	At double point, they have bend chains.
They are soluble in vitamins.	They are insoluble in vitamins.
Palm oil, coconut oil, and animal fats.	Sunflower oil, walnuts , plant oil, vegetable oil, canola oil, fla, and fish.

Detailed Question Answer:

Q1. Describe the properties of starch, glycogen, cellulose and chitin?

Ans.

Starch:

It is the most important and abundant reserve food material of higher plants, found in cereals, legumes, tubers and other vegetables. It is made up of many glucose molecules joined together in straight chain amylose that is soluble in hot water and a branched chain amylopectin, which is insoluble in hot and cold water. It gives blue color to iodine.

Glycogen:

It is also a polymer of glucose. Its molecular structure is starch but found in animals therefore it is commonly called animal starch. It is mainly found in bacteria, fungi, in animals abundantly found in the liver and muscles.

Cellulose:

It is also a polymer of glucose, the most abundant carbohydrate found in nature. It is highly insoluble in water. It is not digested in the human body. In cellulose the glucose units are joined in a straight chain and no branch chain present in it. This straight chain becomes spirally coiled and condensed to form tubes. These tubes of cellulose form the cell-wall of plant cells. Cellulose give no color to iodine.

chitin:

It is a long chain polymer of N-acetyl glucosamine, an amide derivative of glucose. The structure of chitin is similar to cellulose, forming crystalline Nano fibrils. Functionally, it is comparable to Keratin protein. Chitin is modified polysaccharide containing Nitrogen which allows for increased hydrogen bonding between adjacent polymers, giving it more strength.

Q2. What is nucleic acid? Describe structure of a mononucleotide (ATP) and a dinucleotide (NAD).

Ans.

NUCLEIC ACIDS:

Friedrich Miescher, a Swiss physician, isolated a new compound, the nucleus of pus cells, which was quite different from other biomolecules, therefore named "Nuclein" it was found that the nuclein had acidic Properties and hence it was renamed nucleic acid. The nucleic acids are polymers of five sugar based compound nucleotides. These polymers have high molecular weight. These are present in all living things from viruses to man. There are two kinds of nucleic acids i.e. Deoxyribonucleic Acid and Ribonucleic Acid (RNA).

Mononucleotide:

Generally, nucleotides are found in the nucleic acids as polynucleotides but sometimes a single nucleotide also works independently as a mono nucleotide. These mononucleotides have an extra phosphate group as ADP (Adenosine phosphate) or ATP as (Adenosine Triphosphate). ATP works as energy storing, carrying and energy providing molecules to metabolic reactions. This energy is utilized to derive energy demanding reactions such as synthesis of proteins, lipids, carbohydrates, mechanical energy for cyclosis, contractility, cell-divisions, movement of flagella, active transport etc. During conversion of ATP into ADP, 7.3 Kcal/mole or 31.81 kj/ mole energy is released.

Dinucleotide:

Sometimes two nucleotides are covalently bonded together to form a compound called dinucleotide; one of the well-known dinucleotides is NAD (Nicotinamide Adenine Dinucleotide). A vitamin Nicotine is attached with these two nucleotides in NAD. It works as a coenzyme for Redox reaction.

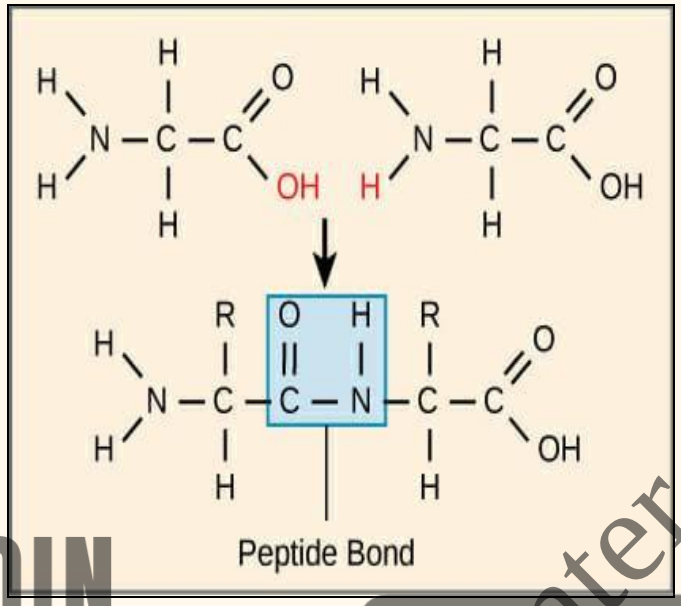
Q3.What is amino acid? Explain peptide linkage formation?

Ans: One of the amino acids gives a carboxyl group to the reaction and loses a hydroxyl group (hydrogen and oxygen). The other amino acid loses hydrogen from the NH2 group. The hydroxyl group is substituted by nitrogen thus forming a peptide bond.

Peptide Bond Formation or Synthesis:

A peptide bond is formed by a dehydration synthesis or reaction at a molecular level. This reaction is also known as a condensation reaction which usually occurs between amino acids. The two amino acids bond together to form a peptide bond by the dehydration synthesis. During the reaction, one of the amino acids gives a carboxyl group to the reaction and loses a hydroxyl group (hydrogen and oxygen).

The other amino acid loses hydrogen from the NH2 group. The hydroxyl group is substituted by nitrogen thus forming a peptide bond. This is one of the primary reasons for peptide bonds being referred to as substituted amide linkages. Both the amino acids are covalently bonded to each other.



Q4.Explain classification of protein and list structural and functional protein?

Ans.

Classification of Protein:

Protein can be classified in many ways i.e. on the basis of structure or on the basis of function etc. Proteins can also be classified on the basis of shape in two following groups.

(i) Fibrous Protein (ii) Globular Proteins

• Fibrous Protein:

These are long fibers of proteins. The secondary protein (spiral) chains intertwine with each other; they consist of more polypeptide chains in the form of fibrils; these proteins are insoluble in water, non-crystalline and elastic in nature. They perform structural roles in cells and organisms e.g. silk, spider web, myosin in muscles, fibers and clothing, Keratin of nails and hairs etc.

• Globular Proteins:

These are spherical or ellipsoidal due to three dimensional fold of secondary protein. These are either tertiary or quaternary in structure. They are soluble in salt, acid or base containing aqueous medium or alcohol. They can be crystalized. These proteins work as enzymes, antibodies, hormones and hemoglobin.

- **<u>list of structural protein:</u>**

Actin.
Muscles forming protein

Amyloid.
Work as cell surface protein

Caddisfly (Fibroin).
Used to bind debris like rocks sticks twigs and shells for net of prey

Condrocalein Collagen.
Form extracellular matrix

Elastin.
Provide resilience and elasticity to tissues and organs

Gelatin.
Nutritious protein derived from collagen of skin and bones

- **<u>List of Functions of proteins</u>**

1.Type
Structural
Examples
Actin, tubulin, keratin
Functions
Construct different structures, like the cytoskeleton

2.Type
Hormones
Examples
Insulin, thyroxine
Functions
Coordinate the activity of different body systems

3.Type
Defense

Examples

Immunoglobulins

Functions

Protect the body from foreign pathogens

Q5.What are lipids? Explain acylglycerol and waxes?

Ans:

LIPIDS:

Lipids are the important diverse group of biological molecules widely distributed among plants and animals. The term lipid was proposed by Bloor in 1943, for those molecules which are insoluble in water and soluble in organic solvents like ether and alcohol etc. These compounds are made up of C, H, 0 like carbohydrates but contain a much lesser ratio of oxygen than carbohydrates e.g. stearin is a fat. Due to the high quantity of carbon and hydrogen, they contain almost double the amount of energy than carbohydrates.

Acylglycerol (Fats and oil):

These are the condensation products of glycerol and three fatty acids. commonly called fats and oils. They can be defined as the esters of glycerol and fatty acid. Ester is the bond or linkage formed between alcohol and organic acid by removing water, this reaction is called esterification.

Fatty acids are carboxylic acids (or organic acid), usually with long aliphatic tails (long chains), either unsaturated or saturated.

Saturated fatty acids:

Lack of carbon-carbon double bonds indicate that the fatty acid is saturated. The saturated fatty acids have higher melting points compared to unsaturated acids of the corresponding size due to their ability to pack their molecules together thus leading to a straight rod-like shape.

Unsaturated fatty acids:

Unsaturated fatty acid is indicated when a fatty acid has more than one double bond. "Often, naturally occurring fatty acids possesses an even number of carbon atoms and are unbranched." On the other hand, unsaturated fatty acids contain a cis-double bond(s) which create a structural kink that disables them to group their molecules in straight rod-like shape.

Glycerol is a trihydroxy alcohol, made of three carbon atom each contain on OH- group, while a fatty acid is a type of organic acid containing one carboxylic acid group with long hydrocarbon

chain. When three fatty acids combine with glycerol each at one -OH, they form three ester bonds. A compound called Triglyceride (triglyceride) is formed. Their triglycerides are neutral in nature because all three OH groups of glycerol become bonded with fatty acids and no charge bearing OH is left.

Waxes:

They are esters of long chain mono-alcohol and long chain fatty acids. These are simple lipids and found as protective coating on stem, stalks, leaves, petals, fruits skin, animal skin, fur and feathers etc, these are water repellant and non-reactive due to its non-polar nature i.e. hydrophobic compounds. These are chemically inert and resistant to atmospheric oxidation. There are two types of waxes i.e. Natural, like bee's wax and cutting form cuticles of leaves and synthetic waxes, generally derived from petroleum or polyethylene. Waxes are of considerable commercial importance because they act as superior machine lubricants. Sperm whales were the principal source of these wax.

Q6.Explain terpenoids and their types?

Ans: The terpenoids, also known as isoprenoids, are a large and diverse class of naturally occurring organic chemicals derived from the 5-carbon compound isoprene, and the isoprene polymers called terpenes.

Steroids:

It is a type of Terpenoid which forms a steroid nucleus made up of isoprenoid units containing 17 Carbon atoms arranged in four attached rings, three of them are hexagonal and one is pentagonal in shape. The radical attached with them as side chains distinguish them from one another cholesterol is one of the types of steroid. Cholesterol is the precursor for the synthesis of a number of steroids i.e. testosterone, progesterone and estrogens.

Carotenoids:

Carotenoids are pigments found in plants and microorganisms, but not synthesized in animals. Fewer than 10% of the carotenoids can function as vitamin A precursors in mammals. Carotenoids and retinoids have chemical and metabolic similarities and differences, and some overlap in biological activities. It is polyterpenes, consisting of a long chain of isoprenoid units which contain isoprenoid rings at both or at one terminal. These compounds are carotene pigments producing red, orange, yellow and brown color in plants. Some important carotenoids are plant pigments, like chlorophyll, cytochromes, phytochromes, latex, rubber etc.

Prostaglandins:

The prostaglandins are a group of lipids made at sites of tissue damage or infection that are involved in dealing with injury and illness. They control processes such as inflammation, blood flow, the formation of blood clots and the induction of labor.

Q7.What are conjugated molecules? Explain types of conjugated molecules?

Ans: Conjugated molecules are formed biomolecules of two different groups combine chemically with each other glycolipids, glycoproteins, lipoproteins acting as one unit.

- ***Glycolipids or Cerebrosides:***

These are conjugates of lipids and carbohydrates. They are also Nucleoproteins. cerebrosides because they are present in white matter of the brain and myelin sheath of nerve fiber. They are also found in the inner membrane of chloroplast.

- ***Glycoproteins or Mucoids:***

Glycoproteins are formed by combining a molecule of carbohydrates with a protein molecule. Most of the oligo and polysaccharide in animal and plant cells are linked covalently to protein molecules. They perform functions such as transporting proteins, receptors, antigens of blood groups etc.

- ***Lipoprotein:***

They are conjugate of lipids and proteins. They transport lipids in blood plasma. They also occur as component membranes of mitochondria, endoplasmic reticulum, nucleus, egg yolk and chloroplast membrane.

- ***Nucleoprotein:***

Nucleoprotein are formed by simple basic protein and nucleic acids They are the main component of chromatin material, chromosomes and ribosomes.

Chapter #02	*Enzymes*	*Zoology*

INTRODUCTION OF ENZYMES:

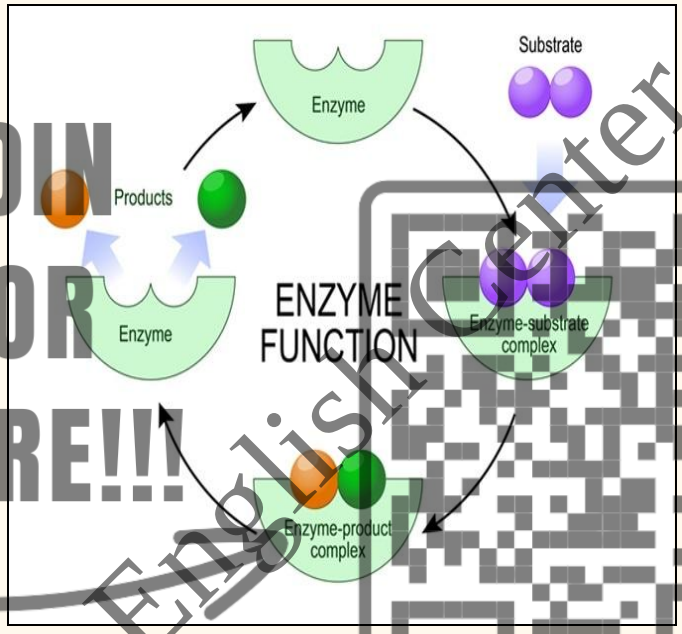
Life would not be possible without metabolic activities of the cell. This in turn is dependent upon the catalytic molecules called the enzymes. Without enzymes, the dynamic, steady state of the cell would cease to exist.

Life is a mesh work involving a perfect co-ordination of a vast majority of chemical relations Some of these reactions result in synthesizing large molecules others in cleaving large molecules and still others either utilize energy or liberate energy. All these reactions would occur very slowly at low temperature and atmospheric pressure. The conditions under which living cells carry on their life processes. In the living system these reactions proceed at extremely high rates. This is due to the presence of some specialized substances or biocatalysts which are synthesized inside the living cells. The catalysts are called enzymes (Gr. En, inside, zyme-yeast) the term enzyme was coined by Friedrich Wilhelm Kuhn (1878) Enzymes may be defined as organic substances capable of catalyzing specific chemical reactions in the living system.

Just a few years ago, it was considered that all enzymes were proteins. During the 1980s Thomas Cech and Sidney Altman discovered that certain molecules of ribonucleic acid also function as enzymes. These molecules are called Ribozymes which catalyze reactions involved in processing genetic information to be used by a cell but generally enzymes are proteinaceous in nature Following are some characteristics of enzymes.

- Enzymes are catalysts produced in the protoplasm, synthesized in the cell.
- Most of the enzymes are proteinaceous in nature, macromolecules of globular proteins with high molecular weight.
- They either consist of protein e g. amylase or pepsin or may contains, along with protein, a non-protein part e g. Acetyl CoA.
- Enzymes within the cell where they have been produced are called endo- enzymes and the enzymes which act outside the cell are called exo-enzymes.
- They are specific in nature and function.
- They are much greater in size than the substrate.
- They have particular sites to react with substrate, these sites are called Active sites.

- Enzyme activity can be accelerated by certain ions or salts called activators e.g. Mn, Mg, Cl etc.
- Enzymes can be inhibited by certain factors called inhibitors. e.g. substrate concentration, enzyme concentration, pH and temperature.
- They are sensitive i.e. they work at specific pH.
- They remain chemically unchanged during and after the chemical reactions.



Encircle the correct choice

(i)Which of the following statements is (are) true about enzyme catalyzed reactions?

(a) The reaction is faster than the same reaction in the absence of enzymes ✓
(b) The free energy change of the reaction is opposite from the reaction in the absence of the enzyme
(c) The reaction always goes in the direction toward chemical equilibrium.
(d) Both a and b.

(ii) The active site of an enzyme is the region that

(a) Binds allosteric regulators of the enzyme
(b) Is involved in the catalytic reaction of the enzyme
(c) Binds the products of the catalytic reaction ✓
(d) Is inhibited by the presence of a coenzyme or a cofactor.

(iii) According to the induced fit hypothesis of enzyme catalysis, Which of the following is correct?

(a) The binding of the substrate depends on the shape of the active site
(b) Some enzymes change their structure when activators bind
(c) A competitive inhibitor can outcompete the substrate for the active site.
(d) The binding of the substrate changes the shape of the enzymes active site ✓

(iv) Which curve represents the behavior of an enzyme taken from a bacterium that lives in hot springs.
1. Curve 1 II. Curve 2. III. Curve 3

(a) I only
(b)II only
(c) III only
(d) I and II
(e)II and III

(v) Increasing the substrate concentration in an enzymatic reaction could overcome which of the following?

(a) Denaturation of the enzyme
(b) Allosteric inhibition
(c) Competitive inhibition ✓
(d) Saturation of the enzyme activity

(vi) Competitive inhibitors block the entry of substrate into the active site of an enzyme. On which of the following properties of an active site does this primarily depend?

(a) The ability of an enzyme to form a template for holding and joining molecules ✓
(b) The enzyme's ability to stretch reactants and move them toward a transition state
(c) The enzyme providing an appropriate microenvironment conducive to a reaction's occurrence
(d) The enzyme forming covalent bonds with the reactants

(vii) A series of enzymes catalyze the reaction XYZ A. Product A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme. What is substance X?

(a) A coenzyme
(b) A substrate
(c) An allosteric inhibitor ✓
(d) An intermediate

(viii) If an enzyme is added to a solution where its substrate and product are in equilibrium, what would occur?

(a) Additional products would be formed.
(b) Additional substrate would be formed.
(c) The free energy of the system would change ✓
(d) Nothing; the reaction would stay at equilibrium.

(ix) Which one of the following is the mechanism of action of enzymes?

(a) They act upon substrate molecules to release new substrate molecules.
(b) They actually increase the amount of energy of activation.
(c) Enzymes dramatically decrease the amount of energy of activation.
(d) Enzymes break product molecules to release new product molecules ✓

(x) How does a noncompetitive inhibitor decrease the rate of an enzyme reaction?

(a) By binding at the active site of the enzyme ✓
(b) By changing the shape of a reactant
(c) By changing the free energy change of the reaction
(d) By acting as a coenzyme for the reaction

Short Question Answer

Q1. Why are enzymes specific in nature?
Ans. Enzymes are specific because different enzymes have differently shaped active sites. The shape of the active site of an enzyme is complementary to the shape of its specific substrate.

Q2. Why is enzyme activity directly proportional to enzyme concentration?
Ans. The enzyme activity depends on the availability of substrate and enzyme molecules. If the substrate concentration is very high the enzyme concentration is directly proportional to the concentration of enzyme but in real condition the concentration of substrate is always limited so the enzyme activity increases with the increase in the enzyme concentration initially but after some time remains constant.

Q3.Why are they called temperature sensitive?
Ans. The proteins in enzymes are usually globular. The intra- and intermolecular bonds that hold proteins in their secondary and tertiary structures are disrupted by changes in temperature and pH. This affects shapes and so the catalytic activity of an enzyme is pH and temperature sensitive.

Q4.How enzymes reduce the energy of activation? Lowering of activation energy by enzymes:

Ans. Activation energy is the minimum energy required for the activation of atoms or molecules to undergo a chemical transformation/reaction. They bring reactants close enough so that they don't need to dissipate extra energy when they collide at random.

- Binding reactants at the active site, allows the molecules to interact with less energy.
- Reactions also occur via a different mechanism to lower activation energy.
- Enzyme activities depend on the nature of substrate, temperature, ionic concentration, and pH of the surroundings.
- Digestive enzymes secreted in the acidic environment (low pH) of the stomach help break down proteins into smaller molecules.

Q5. How enzyme activity affects the substrate concentration?

Ans: The rate of reaction increases with an increase in the concentration substrate in a condition where enzyme concentration remains constant. This increase remains until the available enzyme becomes saturated with substrate. There will be no- increase in the enzyme activity to a certain higher level of substrate concentration. At very high concentration the substrate exerts a retarding effect upon enzyme action.

Q6.What do you mean by prosthetic group?

Ans: Prosthetic groups are cofactors that bind tightly to proteins or enzymes. It is a specific non-polypeptide required for the biological function of some proteins. The prosthetic group may be organic (such as vitamin, sugar or lipid) or inorganic (such as metal ion), but is not composed of amino acids.

Q7. Differentiate between the activators and inhibitors.

Ans:

ACTIVATOR	***INHIBITOR***
Enzyme activators are species that can bind with an enzyme to increase Its activity	Enzyme Inhibitors are 'chemical species that can tend with an enzyme to decrease its activity.
Can incense the activity of an enzyme	Can decrease the activity of an enzyme
Examples of activators include hexokinase and glucokinase	Examples of inhibitors Include drugs, ribonuclease Inhibitor etc

Detailed Question Answer

Q1.What is enzyme? explain characteristics of enzymes?

Ans. Enzymes are basically proteins that are produced by living organisms to bring about certain metabolic and biochemical reactions in the body. They are biological catalysts that speed up reactions inside the body.

Characteristics of Enzyme:

- They have high catalytic power and can quickly catalyze a chemical reaction with a tiny quantity.
- They accelerate reactions while remaining unaltered during the process.
- Temperature, pH, and inhibitors can all have an impact on enzyme performance and function.
- Enzymes are often quite specialized, catalyzing only one type of substrate.
- Speed up chemical reactions.
- They are required in minute amounts.
- They are highly specific in their actions.
- They are inhibited by inhibitors.

Q2. Describe the effect of temperature on the rate of the enzyme action?

Ans. The chemical reactions depend on the molecular motion, i.e. higher the number of substrate molecules reach to enzyme higher will be the chances of reaction or vice versa. It is estimated that increase in 100C of temperature double this rate of reaction. Enzymes are also sensitive to temperature due to their proteinaceous composition. The temperature where enzyme work maximumly or rate of enzyme activity is maximum called optimum temperature, below and above this temperature the enzyme activity increases. In other words Raising temperature generally speeds up a reaction, and lowering temperature slows down a reaction. However, extreme high temperatures can cause an enzyme to lose its shape (denature) and stop working. pH: Each enzyme has an optimum pH range. Changing the pH outside of this range will slow enzyme activity.

Q3. Describe mechanism of enzyme action?

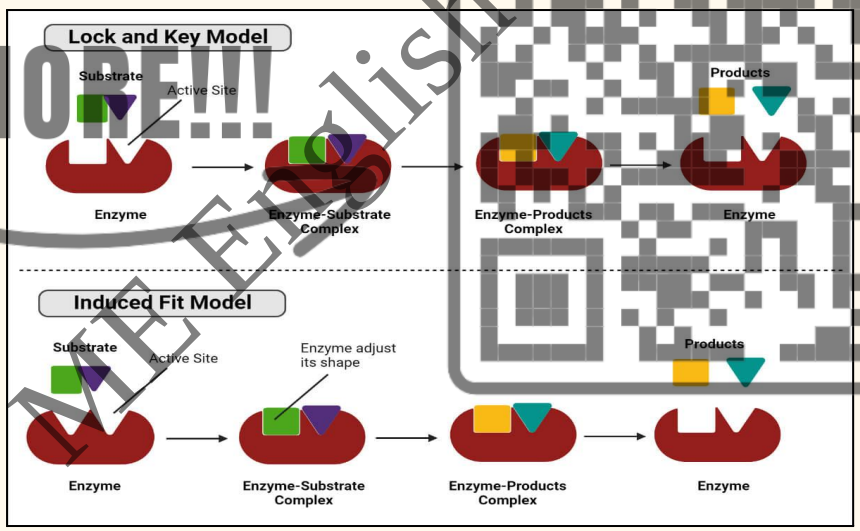
Ans.

MECHANISM OF ENZYME ACTION:

As We have discussed, all metabolic reactions are catalyzed by e flies. During these reactions the substrate binds to the active site of the enzyme and forms enzyme substrate complex (ES) that the substrate converts into product but remains attached with enzyme and form enzyme-product complex and then product release from the active site of enzyme. The quantity and shape of enzymes remain the same before and after chemical reactions.

Lock and key model:

Emil Fischer 1898 proposed this model, according to this model E Particular enzyme acts on a particular substrate like a particular lock can be unlocked by a particular key. This theory depends upon physical contact between substrate and enzyme molecule. The active site of each enzyme has a distinct shape (Rigid) and distribution of charge which is complementary to its substrate like lock and key, where a lock allows very few keys to fit in. Similarly enzymes allow complementary molecules to fit in and react while rejecting even fairly similar molecules. These enzymes work in absolute specificity i.e. catalyze only one substrate.



INDUCED FIT MODEL:

Koshland in 1959 proposed another model with the name of in (fit) model. He stated that when a substrate combined with an enzyme induces change in the enzyme structure, this change enables the enzyme to perform the catalytic activity more efficiently. It means according to him the active site is flexible.

Q4.Describe the classification of enzymes?

Ans. They can be classified in following group

1) Oxidoreductase

Enzymes require to perform oxidation and reduction reaction by removal and addition of and addition of He respectively eg. Ferredoxin reducing substance

2) Triumferase

Enzymes responsible to transfer a group from one substance to other transfer of phosphate from ATP to hexose

3) Hydrolyse:

These are digestive enzyme responsible to break the bond by H20 convert oligomers into monomers

4) Lyase:

These enzymes catalyze the breakdown of specific covalent bonds and removal of group without hydrolysis

5) Isomerase:

Enzyme catalyzed intramolecular rearrangement of atoms in the molecules to form another

Q5.Describe enzymatic inhibition, its types and its significance?

Ans. A decrease in enzyme-related processes, enzyme production, or enzyme activity is referred to as enzyme inhibition. Competitive, Non-competitive, and Uncompetitive are the three types of inhibition reactions.

- ***Competitive Inhibition***

A molecule other than the substrate binds to the enzyme's active site, causing competitive inhibition. The inhibitor (molecule) has a structural and chemical similarity to the substrate (hence able to bind to the active site). The competitive inhibitor hinders substrate binding by blocking the active site. Since the inhibitor competes with the substrate, increasing the substrate concentration reduces the inhibitor's actions.

- ***Non-Competitive Inhibition***

A chemical binds to a location other than the active site in non-competitive inhibition (an allosteric site). When the inhibitor binds to the allosteric site, the enzyme's active site undergoes a structural shift. The active site and substrate no longer share affinity as a result of this alteration, preventing the substrate from binding. Increased substrate levels will not be

able to reverse the inhibitor's action since the inhibitor is not in direct competition with the substrate.

- ***Uncompetitive Inhibition***

The inhibitor binds only to the substrate-enzyme complex in uncompetitive inhibition. In reactions involving two or more substrates or products, uncompetitive inhibition is common. Non-competitive inhibition can occur with or without the presence of the substrate, whereas uncompetitive inhibition requires the formation of an enzyme -substrate complex.

Q6. Describe structure of enzymes.

Ans. Enzymes are made up of amino acids which are linked together via amide (peptide) bonds in a linear chain. This is the primary structure. The resulting amino acid chain is called a polypeptide or protein. The specific order of amino acid in the protein is encoded by the DNA sequence of the corresponding gene.

- ***Polypeptide Chains*:**

Some enzymes consist of a single polypeptide chain; in most cases these are secreted enzymes like ribonuclease. Other enzymes, in a much larger number, are composed of several chains (or sub-units), identical or different.

- ***Co-Factors:***

Some enzymes need a cofactor to exert their catalytic action.

- ***Prosthetic Groups:***

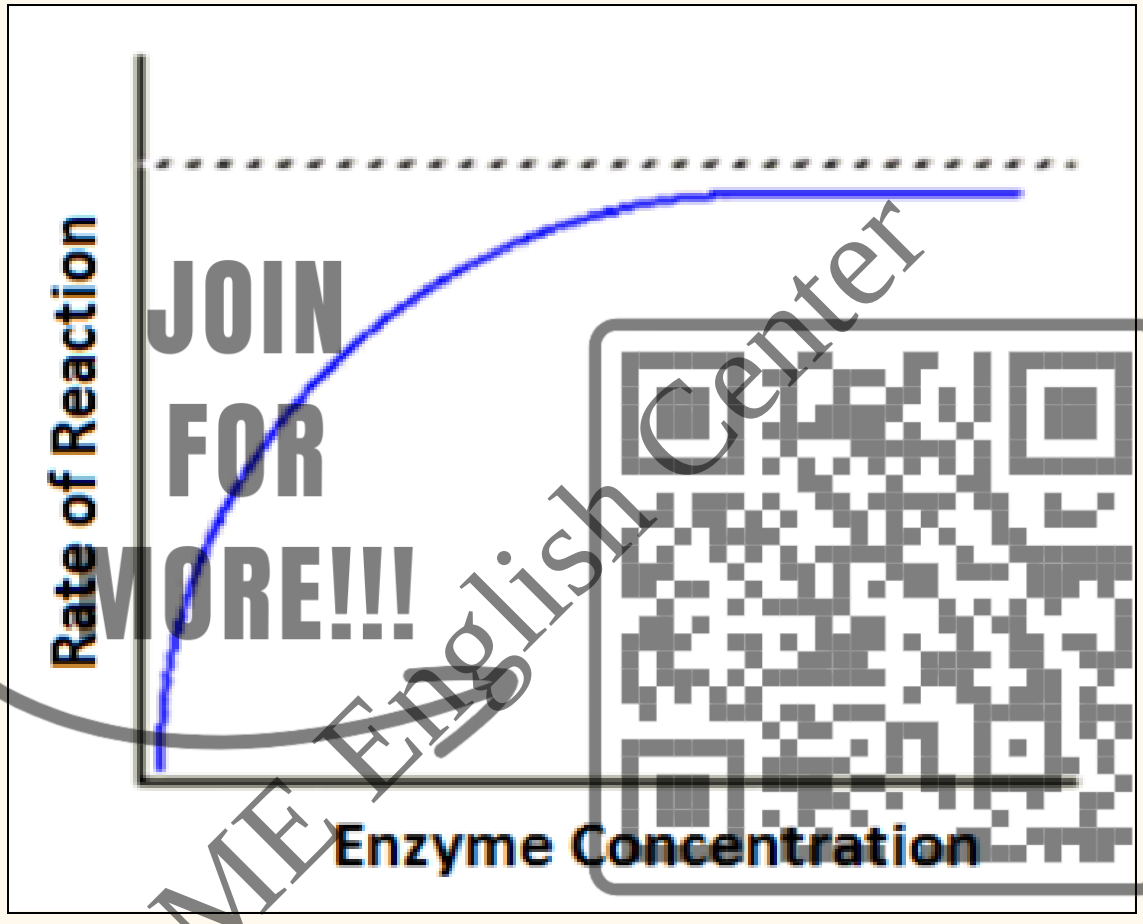
These are organic cofactors of non-protein nature strongly bound to the enzymatic protein, and whose presence is indispensable for catalytic activity.

- ***coenzyme***

A coenzyme is defined as an organic molecule that binds to the active sites of certain enzymes to assist in the catalysis of a reaction. More specifically, coenzymes can function as intermediate carriers of electrons during these reactions or be transferred between enzymes as functional groups.

Q7. Explain the effect of substrate and concentration on the rate of enzyme action.

Ans. The rate of reaction increases with an increase in the concentration substrate in a condition where enzyme concentration remains constant. This increase remains until the available enzyme becomes saturated with substrate. There will be no- increase in the enzyme activity to a certain higher level of substrate concentration. At very high concentration the substrate exerts a retarding effect upon enzyme action.



Chapter #03	*Cell Structure and Function*	*Botany*

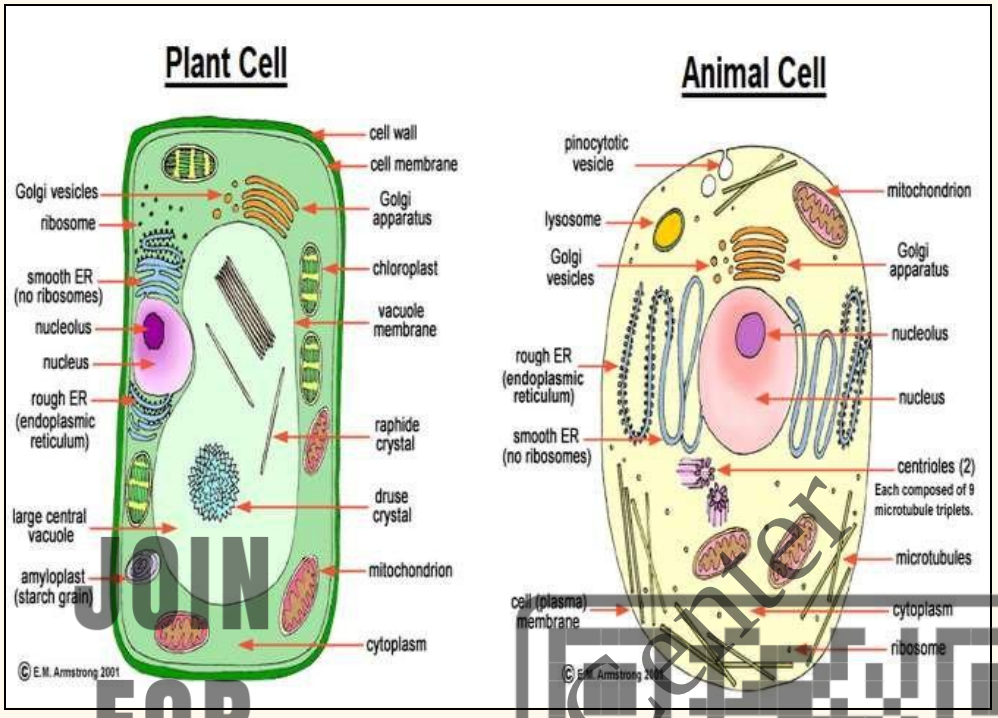
INTRODUCTION CELL STRUCTURE AND FUNCTION:

We are studying cells from our early classes and know that it is the basic structural and functional unit of all living organisms. As a student of biology we must study cells in detail. For this study we must know about the techniques of its studies because it is a microscopic structure. The isolation, magnification and other basic needs should be understood clearly before this study.

Here comes the introduction to Cell. The cell is the smallest structural unit of a living organism. So, everything that we are able to do is possible because of the 10 trillion cells present in our body. The number is huge and of course, the function performed by them is even bigger. In this topic here, we'll introduce you to cells. Let's begin.

The introduction to the cell began back in the year 1655 when a revolutionary observation was made by an English scientist Robert Hooke. This observation made by him was so huge that it went on to change the basic biological theory and research forever. So, how was the cell discovered?

Robert Hooke was examining a dried section of the cork tree using a crude light microscope. In this analysis, he observed multiple small chambers which he named the cells. Thereafter, over the next 175 years, several kinds of research were made which led to the formation of the cell theory that we know today.The first such theory was proposed by the German botanist Matthias Jacob Schleiden and the German physiologist Theodore Schwann in 1838. This theory was formalized in the year 1858 by the German researcher Rudolf Virchow.



Encircle the correct choice

(i) A primary objective of cell fractionation is to

(a) View the structure of cell membranes.
(b) Identify the enzymes outside the organelles.
(c) Determine the size of various organelles.
(d) Separate the major organelles so that their particular functions can be determined. ✓

(ii) The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that

(a) Plant cells are capable of having a much higher surface to volume ratio than animal cells.
(b) Plant cells have a much more highly convoluted plasma membrane than animal cells.
(c) Plant cells contain a large vacuole that reduces the volume of the cytoplasm. ✓

(d) Animal cells are more spherical, while plant cells are elongated.

(iii) Large numbers of ribosomes are present in cells that specialize in producing which of the following molecules?

(a) Lipids
(b) Starch
(c) Proteins ✓
(d) Steroids

(iv) In animal cells, hydrolytic enzymes are packaged to prevent general destruction of cellular components. Which of the following organelles functions in the compartmentalization?

(a) Chloroplast
(b) Peroxisome
(c) Lysosome ✓
(d) Glyoxysome

(v) Tay-Sachs disease is a human genetic abnormality in cells accumulating and becoming clogged with very large and complex lipids. Which cellular organelle must be involved in this condition?

(a) Endoplasmic reticulum
(b) Golgi complex
(c) Lysosomes ✓
(d) Mitochondria

(vi) Which is one of the main energy transformers of cells?

(a) Endoplasmic reticulum
(b) Golgi complex
(c) Lysosome
(d) Mitochondria ✓

(vii) Organelles other than the nucleus that contain DNA

1. Ribosomes
II.Chloroplast
III. Mitochondria

(a) I only
(b) II only
(c) II and III
(d) I and II ✓

(viii) Which structure is common to plant and animal cells?
(a) Chloroplast
(b) Cell wall
(c) Central vacuole
(d) Mitochondria ✓

(ix) Cell organelle is mainly concerned with the detoxification of alcohol.
(a) Chloroplast
(b) Peroxisome ✓
(c) Central vacuole
(d) Mitochondria

(x) Clarity of image is generally known as
(a) Magnification
(b) Resolution ✓
(c) Contrast
(d) Sedimentation

Shorts Question Answer:

Q1. Why lysosome is called suicidal sacs?

Ans. Lysosomes are the organelles that have digestive enzymes. When lysosomes burst, the digestive enzymes released start digesting their own cells. That is why they are known as suicidal bags.

Q2. Why is plasma membrane differentially permeable in nature?

Ans. The differentially or selective permeability is due to the presence of channel proteins which permit only specific molecules to pass through them. The protein is carrier protein embedded in phospholipid layer some extrinsic proteins also work as enzymes e.g. ATPase complex to synthesize ATP

Q3. Why is the plant cell wall rigid?

Ans. Primary layer of cell-wall is the first product of cell, the material of primary layer is synthesized by protoplast deposit on either side of middle lamella. In young dividing and enlarging cells this layer remain thin and elastic. It becomes thick and rigid when cell reach at maturity. It contain hemicellulose (a polysaccharide that have beta (1-4) linked backbones with cross linked) microfibril of cellulose arranged in criss-cross manner and pectin.

Q4. Why is chloroplast called an energy converting cell organelle?

Ans. Chloroplasts are plant cell organelles that convert light energy into relatively stable chemical energy via the photosynthetic process. By doing so, they sustain life on Earth. Chloroplasts also provide diverse metabolic activities for plant cells, including the synthesis of fatty acids, and membrane lipids.

Q5. How a prokaryotic ribosome is different from a eukaryotic ribosome.

Ans:

Prokaryotic Ribosome	Eukaryotic Ribosome
Free ribosomes in prokaryotes	Large ribosomes that facilitate translation in eukaryotes
Cell has primitive type of nucleus i.e. does not bounded by nuclear membrane	Cell has true type of nucleus i.e. It is bounded by nuclear membrane
Only one circular, long, interwoven DNA is	Number of DNA are present which may

present as chromatin material	appear in the form of chromosomes during cell-division.
The chromatin material does not contain histone protein	The chromatin material contains histone protein with DNA.
Mesosomes are present.	Mesosomes are absent.

Q6.How is mitochondria similar to bacteria?

Ans. Mitochondria and chloroplasts have striking similarities to bacteria cells. They have their own DNA, which is separate from the DNA found in the nucleus of the cell. And both organelles use their DNA to produce many proteins and enzymes required for their function.

Q7.Why mitochondria is called the powerhouse of the cell?

Ans. Mitochondria are tiny organelles inside cells that are involved in releasing energy from food. This process is known as cellular respiration. It is for this reason that mitochondria are often referred to as the powerhouses of the cell.

Q8.Differentiate between peroxisome and glyoxysome.

Ans.

Peroxisome	Glyoxysome
Peroxisomes are single membrane microbodies found in photosynthetic cells of plants and liver and kidney cells of vertebrates.	Glyoxysomes are also single membrane microbodies but found only in plant cells.
It contains enzymes like peroxides, oxidases and catalases.	It contains many enzymes like isocratic lyase, malate syntheses, glycolate oxidases, etc. for glyoxylate cycle (i.e., metabolism of glycolic acid). 3. It is involved in photorespiration and conversion of fats into carbohydrates.
It is involved in formation and degradation of hydrogen peroxide and detoxification of poisons in the cell.	It is involved in photorespiration and conversion of fats into carbohydrates.

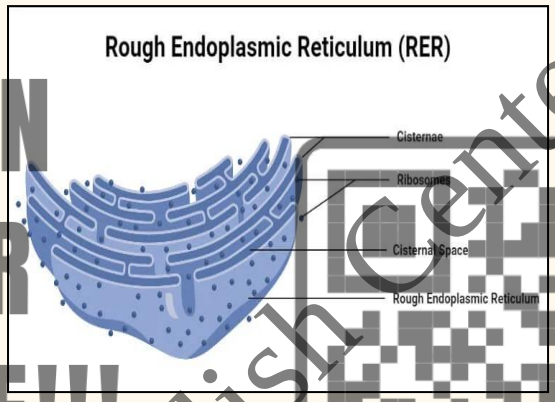
Long Question Answer:

Q1. Describe structure and functions of rough and smooth endoplasmic reticulum?

Ans.

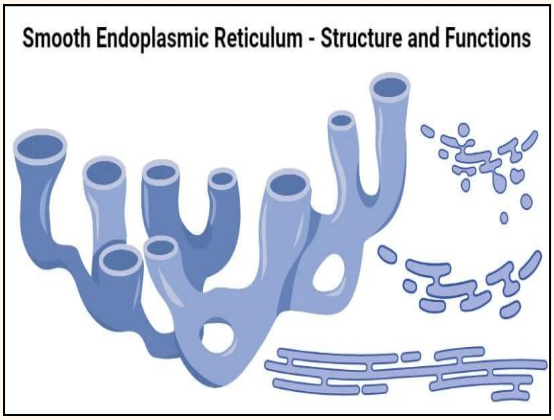
Rough endoplasmic reticulum(RER):

It is a type of endoplasmic reticulum which is heavily coated with ribosomes on its outer surface towards the cytoplasmic face. It occurs mostly in protein synthesizing cells in high proportion. The process of translation during protein synthesis takes place here. After synthesis, the protein is either stored in the cytoplasm or exported out of the cell through these channels.



Smooth Endoplasmic Reticulum (SER):

The smooth endoplasmic reticulum named due to smooth surface i.e. ribosomes are not present on it. It is found in steroid producing cells like adipose cells, interstitial cells, glycogen storing cells of liver and muscles. It Is involved in the synthesis of oil, phospholipids and different types of steroids. The smooth E.R also provides mechanical support to the cell.

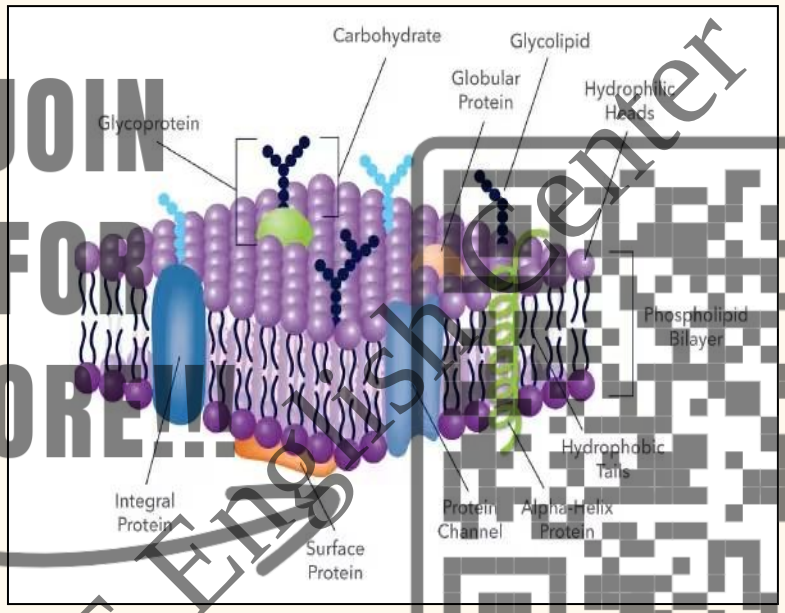


Q2.Explain the chemical composition and functions of plasma membrane in regulating cell's interactions with the environment?

Ans.

Structure of Plasma membrane:

Number of biologists presented different models of cell-membrane. One of the models is a sandwich model. According to this model the cell-membrane is composed of lipids bilayer sandwiched between inner and outer layers of protein. This basic structure is called the unit membrane and is present in all the cellular organelles. Modern technology has revealed that lipid bilayer is not sandwiched between two protein layers.



Function of Plasma membrane:

The plasma membrane performs several functions like platform f receptor, channels, enzymes, antigen fluidity etc, but the main and most important function are protection of cell cytoplasm, to regulate flow of solutions and material in and out of the cell with certain limitation These limitations are checked by in flow of materials across the membrane which is necessary to maintain suitable pH, ionic concentration for e activity and excrete toxic substances etc. The lipid bilayer controls the fluidity in variable tempera conditions by increasing or decreasing unsaturated fatty acids in them. movement of polar molecules and ions. fluidity also increases the flexibility of cell-membrane. It also controls The differentially or selective permeability is due to presence of specific proteins which permit only specific molecule to pass through them. The protein is carrier protein embedded in phospholipid throw extrinsic proteins also work as enzymes e.g. ATPase complex to leer' synthesize ATP. Some proteins are conjugated proteins

work as receptor for different hormones and other molecules. While other proteins work as antigen like IV protein of RBCs.

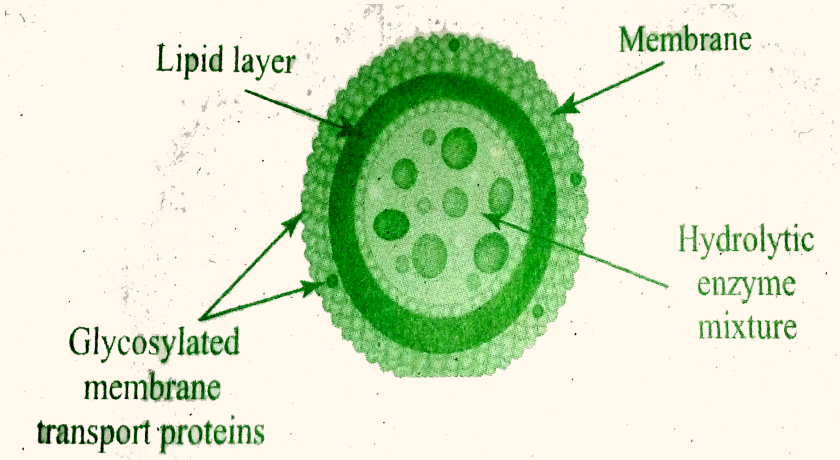
Role of plasma membrane in regulating cells interaction with its Role environment
For entry and exit there are two main processes of transport.

Passive transport:
It is a transport of molecules by diffusion and osmosis without consumption of ATP.

Active Transport:
Movement of molecules against concentration gradients by using the energy of ATP. There are two other phenomena i.e. endocytosis and exocytosis. Endocytosis is the process of intake of material in bulk by infolding the cell membrane. It may be intake of solid material i.e. phagocytosis or intake of fluid or liquid i.e. pinocytosis, whereas exocytosis is the process of membrane fusion and inolding to exit the material from the cell. Cholesterol helps to regulate membrane fluidity over the range of temperature.

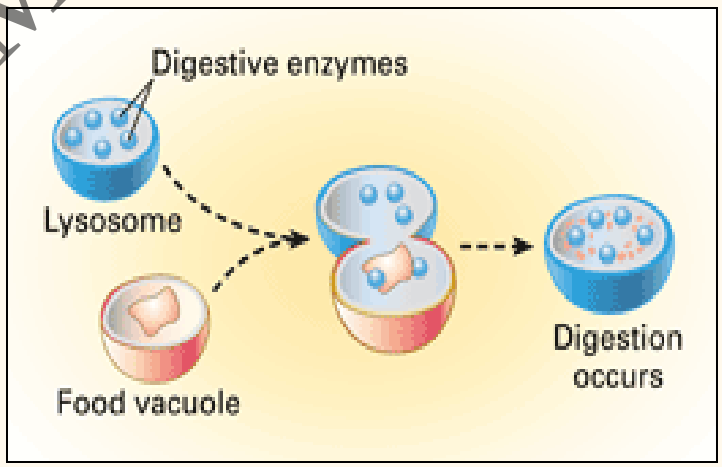
Q3. Explain the structure and functions of lysosomes?
Ans.

Lysosome (Lysis = breakdown; soma = bodies):
These are spherical, single, membrane bounded bodies, a few micrometers in diameter, originated by Golgi-bodies, containing hydrolytic enzymes. They occur only in the cytoplasm of animal cells and function in the digestion of material taken into cells by phagocytosis. Normally, they function as destroyers of foreign particles and worn out cellular components. The newly formed lysosomes before starting their functions are called the primary lysosome. lysosomes are generally called secondary lysosomes. but specifically they are endosomes, the process by which unwanted structures within the cell are engulfed and digested by lysosome ted respectively. They also perform autophagy, a self-eating process of the cell.



Structure of Lysosome

The body sometimes eliminates old cells or unwanted cells at embryonic stage according to their genetic information, this process is called apoptosis. During this self destruction process the membrane of lysosome is ruptured at a particular time. As a result the hydrolytic enzyme become free in cell and cell undergoes chemical breakdown or lysis, which cause a cell to destroy itself by digesting its own macromolecules, so the lysosome is referred as "suicidal sac" and this process is called autolysis. Lysosome is also important in a way that it contains a variety of enzymes which maintains metabolic balance of cells. If a cell becomes unable to synthesize any one of these enzymes due to heredity and congenital reason. The substrate of that enzyme accumulates in these cells as well as organs which lead to metabolic imbalance at last become fatal at early childhood. These types of diseases caused due to lack of lysosomal enzymes are called lysosomal storage diseases.



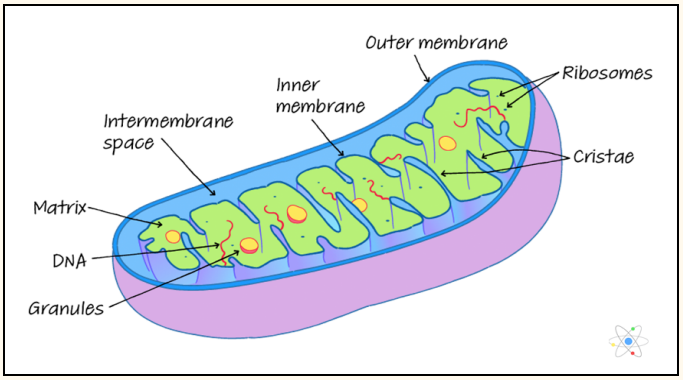
Q4. Describe the structure of mitochondria with a suitable diagram?

Ans.

Mitochondria (Powerhouse of the cell):

Mitochondria or chondrocytes are universities present in the cytoplasm of eukaryotic cells. They appear Minute granular, vesicle, rodlets, thread or strings, depending on the nature of cells, but usually it is considered that it is found in bean shape. They are seen to be in constant motion in living cells. These are the centers of aerobic respiration. Each mitochondrion is approximately about 0.5 to 1.0 nm in diameter and about 10mm long. They are double membrane bounded organelles. Both membranes are formed of lipids and proteins. The outer membrane is smooth and having pores like sieve made up of proteins called Porins.

These pores are responsible for transport of molecules across the membrane; therefore this outer membrane is permeable for all. The inner membrane forms irregular, incomplete partition due to inward folding. These folds are called cristae which increase the surface area to attach number of proteins containing molecules. These molecules are ATPase complex, variable types of cytochrome, NAD, FAD etc. These complexes and molecules acid (lipids) serves as electron carrier, which metabolize carbohydrates (starch), fatty acids and amino acids (protein) into carbon dioxide and water with energy in the form of ATP which is stored in mitochondria. The folds formed by inner membrane is filled with a fluid like organic matrix, with a number of compounds and enzymes in it, is due to production of high amount of energy for all cell organs and their activities. Mitochondria is known as the powerhouse of the cell, where energy is stored and released wherever required by an organism. Mitochondria have a semi-autonomous existence in the cell. They have their own DNA, all kinds of RNA ribosomes of the 70s. It means it has its own genetic system to synthesize its own enzyme (proteins) for its metabolic function. They can divide half and thus reproduce dependently of the cell's normal cell-division.



Q5.Explain the structure and composition of the cell wall.

Ans.

CELL WALL AND PLASMA MEMBRANE CELL WALL.

The outer surface of some cells is covered with a non-living, stiff layer called cell- wall. This cell wall is present in bacterial, fungal, algal and plant cells. Bacterial cell-wall is made up of peptidoglycan, and fungal cell wall is made up of modified polysaccharide chitin, while plant and algal cell wall is made up of cellulose. Cell wall is composed of cellulose, pectin and other polysaccharides. These materials of cell-wall arc are always synthesized by protoplasm, secreted out of the cell and deposited around the outer (surface of the plasma membrane. We will discuss only plant cell walls here. A plant cell-wall is mainly differentiated into three layers.

- Middle lamella
- Primary wall
- Secondary wall

Middle lamella

It works as a cementing layer between two daughter cells called middle The first formed cell-plate lamella. It is a common layer between two cells. These two cells will separate when middle lamella can be dissolved. It is mainly made up of calcium and magnesium pectates. This layer is formed during cytokinesis of cell- division.

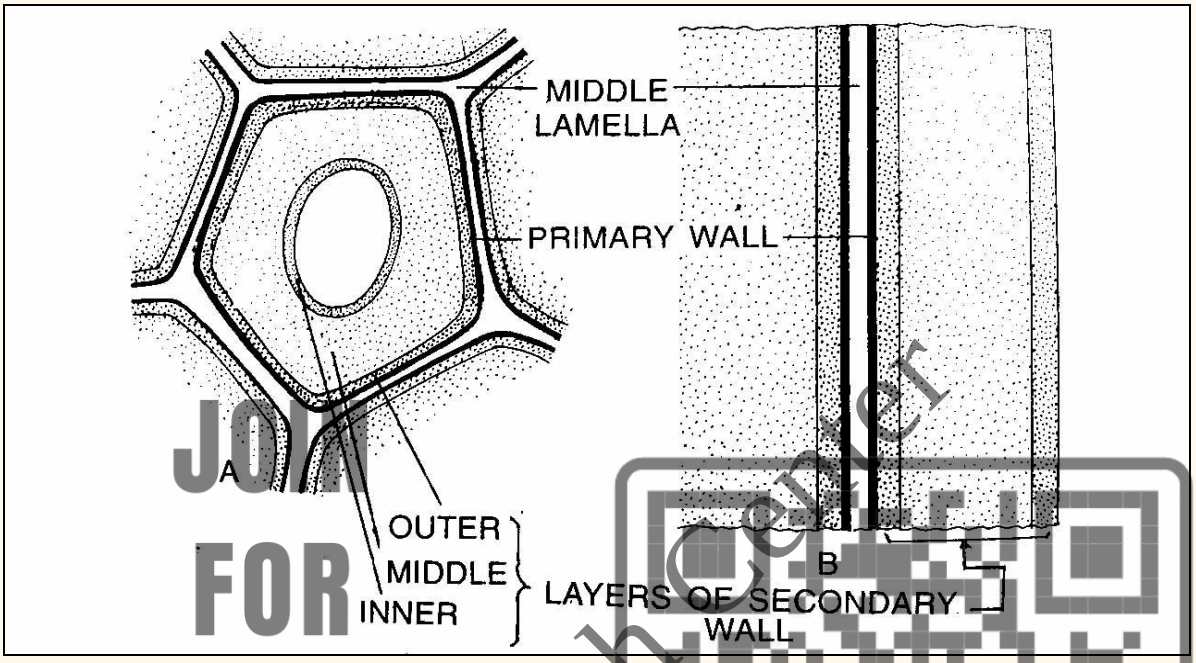
Primary cell wall

Primary layer of the cell-wall is the first product of the cell; the material of the primary layer is synthesized by protoplast deposit on either side of the middle lamella. In young dividing and enlarging cells this layer remains thin and elastic. It becomes thick and rigid when cell reach at maturity. It contain hemicellulose (a polysaccharide that have beta (1-4) linked backbones with cross linked) microfibril of cellulose arranged in criss-cross manner and pectin. The criss-cross arrangement of cellulose increases the strength of the cell-wall. At some places in the cell-wall the deposition of wall material does not take place. These places are known as plasmodesmata (singular, plasmodesma) through which cellular content of neighboring cells remain in communication with each other.

Secondary cell wall

The layer of wall developed in between plasma membranes and does not hard tissues i.e, deposit in every plant cell. It does not deposit in every plant cell, only deposited in hard tissues i.e. sclerenchyma. The cells become dead at their maturity. Secondary wall deposits after

complete maturation of primary cell-wall. It is very thick and rigid due to deposition of lignin, inorganic salts and some waxes.



Q6.Describe the structure and functions of the Golgi complex?

Ans.

Golgi Apparatus:

The Golgi body comprises 5 to 8 cup-shaped, series of compartments known as cisternae. Cisternae is a flattened, disk-shaped, stacked pouches that make up the Golgi apparatus. A Golgi stack mostly contains 4 to 8 cisternae. However, -60 cisternae are found in some protists. A mammalian cell contains -40 to 100 stacks of cisternae. Animal cells generally contain around 10 to 20 Golgi stacks per cell, which are connected by tubular connections. Golgi complex is mostly found near the nucleus. Creation, or evolution, whichever one you hold a belief in has worked in wondrous ways to evolve or design the various living beings in this world in the most optimum ways. For example, take the Golgi complex, it has been designed in such a way, to ensure a sufficient number of Golgi bodies are present in the cell as per the requirement.

Golgi Bodies Functions Its main packaging and secretion of proteins. It receives proteins from Endoplasmic Reticulum. It packages it into membrane- bound vesicles, which are then transported to various destinations, such as lysosomes,
plasma membrane or secretion. They also take part in the transport of lipids and the formation of lysosomes. Post-translational modification and enzymatic processing occur near the

membrane surface in Golgi bodies, e.g. phosphorylation, glycosylation, etc. Golgi apparatus is the site for the synthesis of various glycolipids, sphingomyelin, etc.

Q7. Describe the types, structure, composition and functions of cytoskeleton?

Ans.

The cytoskeleton is the network of fibers forming the eukaryotic cells, prokaryotic cells and archaeans. These fibers in the eukaryotic cells contain a complex mesh of protein filaments and motor proteins that help in cell movement. It provides shape and support to the cell, organizes the organelles and facilitates transport of molecules, cell division and cell signaling.

Cytoskeleton Structure

A cytoskeleton structure comprises the following types of fibers:

- Microfilaments
- Microtubules
- Intermediate Filaments

Microtubules

Microtubules appear like small, hollow, round tubes with a diameter of about 24 nanometers. They are made up of a protein, tubulin. Thirteen tubulins link to form a single tube. Microtubules are very dynamic structures, which reveal that they can change quickly. They keep growing or shrinking steadily. These help in transporting cellular materials and dividing chromosomes during cell division.

Microfilaments

Microfilaments are thread-like protein fibers, 3-6 nm in diameter. They are particularly found in muscle cells. They consist of the protein actin, responsible for muscle contraction. These are also responsible for cellular movements including cytokinesis, contraction, and gliding.

Intermediate Filaments

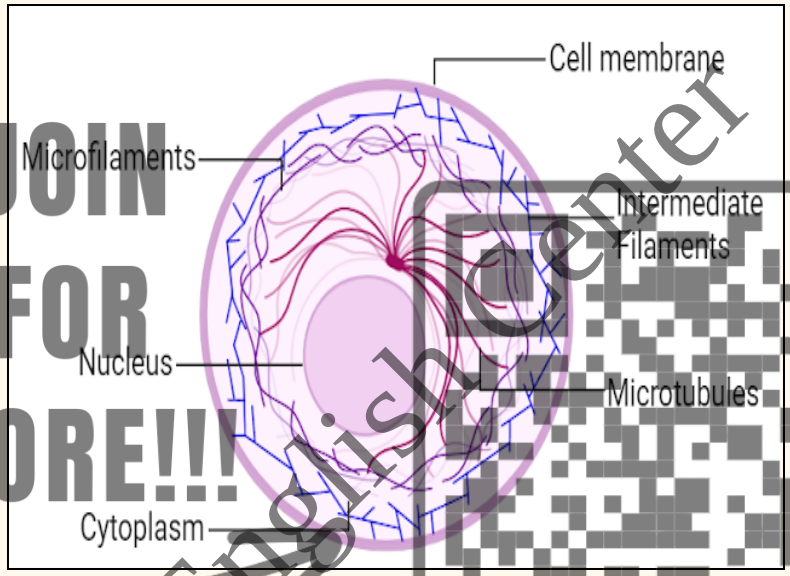
The intermediate filaments are about 10 nm in diameter and provide tensile strength to the cell. They facilitate the formation of keratins and neurofilaments.

The cytoskeleton is also made up of certain motor proteins. These include:

Cytoskeleton Functions

The important cytoskeleton functions are mentioned below:

1. It provides shape and support to the cell.
2. It helps in the formation of vacuoles.
3. It holds different cell organelles in place.
4. It assists in cell signaling.
5. It supports intracellular movements like the migration of cell organelles, transportation of vesicles in and out of the cell, etc.



Chapter #04	*Bioenergetics*	*Botany*

INTRODUCTION OF BIOENERGETICS:

All living things and cells carry out numerous activities eg. They generally assemble macromolecules from raw materials, waste products are produced and excreted, genetic instructions flow from the nucleus to cytoplasm, vesicles to Golgi bodies and then to plasma membrane; ions are pumped across the membranes etc. For these activities, a cell needs energy. The energy is used as fuel for life, this energy is derived from light energy which is trapped by plants and converted into energy rich compounds like ATP, NADPH, and FADH which then stored in food molecules like carbohydrates and lipids. Other organisms, which do not have the ability to trap light energy and its conversion, obtain their energy by eating plants or by eating those organisms which eat plants. Capturing and conversion of this energy from one form to another in the living system and its utilization in metabolic activities is called Bioenergetics. In other words, bioenergetics is the quantitative study of energy relationships and conversion into biological systems. This biological energy transformation obeys the laws of thermodynamics.

The whole biological energy transformation contains, formation and utilization of energy rich molecule ATP Plant trap light energy and utilize it in the formation of ATP. In living organisms some organic molecules are oxidized to produce energy, some of this energy is used to produce ATP This process of ATP formation from ADP and phosphate is called phosphorylation. There are three types of phosphorylation found in living organisms.

- ***Photophosphorylation:***

The type of ATP formation which utilizes energy of light (photon). It occurs in the thylakoid membrane of chloroplast.

ADP+ Pi+ Energy of light → ATP

- ***Oxidative Phosphorylation:***

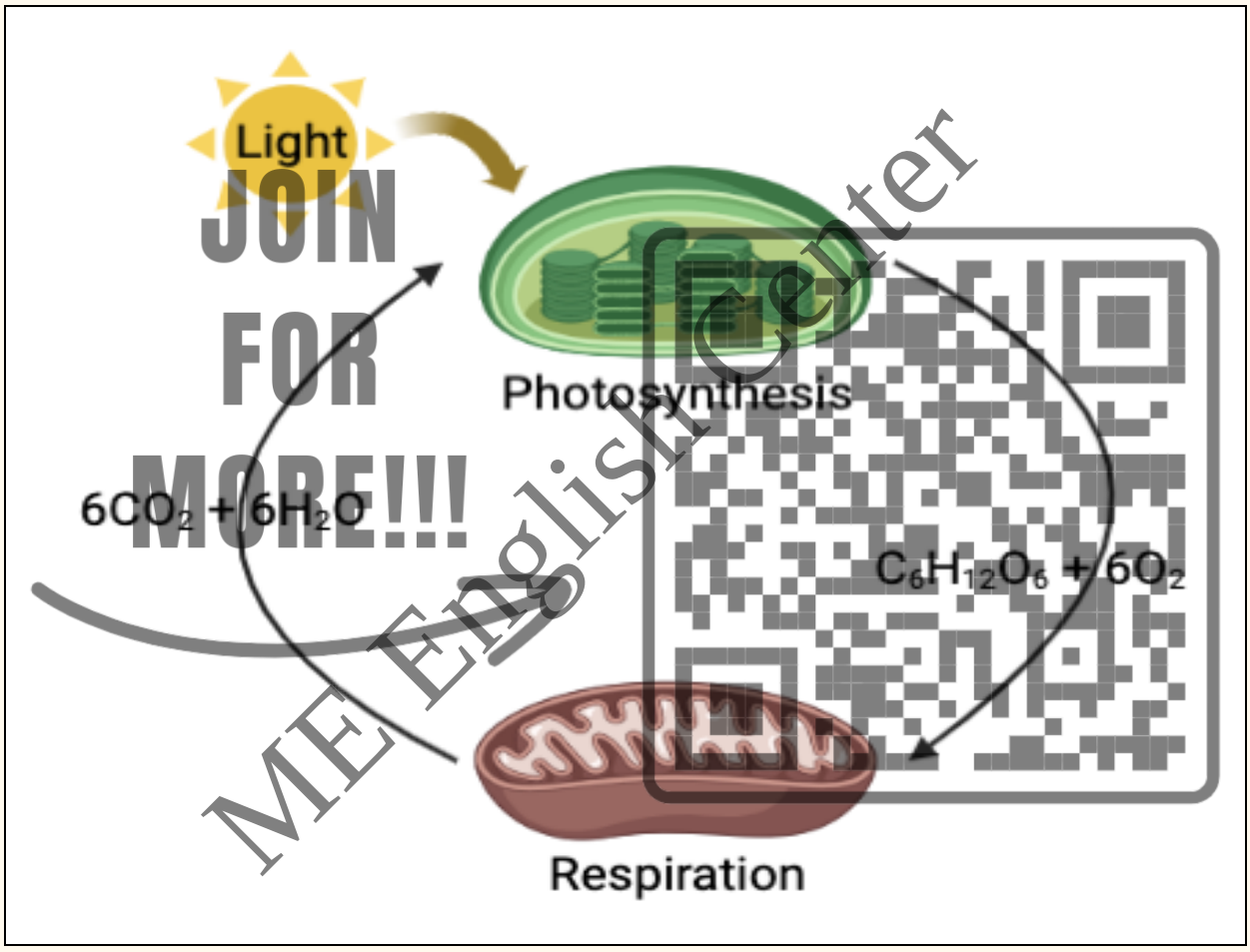
Type of phosphorylation where ATP is formed by using energy of oxidation, produced during metabolic reactions in cells. It occurs in cristae of mitochondria.

ADP+ Pi + Energy of oxidation →ATP

- ***Substrate level phosphorylation:***

Type of phosphorylation where one substrate provides phosphate and energy to another substrate.

Under cellular conditions ATP formation requires 7.3 Kcal/mole energy, whereas Pi means phosphate from an inorganic source (molecule) like HPO4. For ATP formation living organisms have two processes i.e. photosynthesis and respiration.



Encircle the correct choice

(i) Chlorophyll-a is almost identical
to chlorophyll-b but slight structural difference between them is enough to give

(a) Similar energy during the light reaction
(b) Different absorptive spectrum ✓
(c) Different product during the Calvin cycle
(d) All of these

(ii) Chlorophyll is organized along with other molecules into photosystem, which has light gathering

(a) Reaction Centre
(b) Antenna complex ✓
(c) Carotenoid compound
(d) Cytochrome

(iii) Select the correct statement

(a) PSI and ATP synthase complexes are located in the appressed part of thylakoid ✓
(b) PSI and NADP reductase are located in the appressed part of thylakoid membrane
(c) Appressed part Contain NADP reductase and ATP synthase
(d) Non appressed (non-stacked) Having PSI

(iv) The linear flow of electrons from water to NADP+ coupled to ATP synthesis is

(a) Cyclic photophosphorylation
(b) Non-Cyclic photophosphorylation ✓
(c) Chemiosmotic phosphorylation
(d) Oxidative phosphorylation

(v) The intermediate carbon fixing compound in the member of grass family to pass CO2 to calvin cycle is

(a) Citric acid

(b) Oxaloacetic acid
(c) Pyruvic acid
(d) Crassulacean acid ✓

(vi) Oxidative decarboxylation of isocitrate form?

(a) a-ketoglutarate ✓
(b) Succinate
(c) Cis-aconitate
(d) Fumarate

(vii) How many ATP molecules are forms during substrate level phosphorylation in krebs cycle when one glucose is consumed?

(a) One
(b) Two ✓
(c) Three
(d) Four

(viii) Enzyme involves during carboxylation

(a) Rubisco oxygenase
(b) Rubisco carboxylase ✓
(c) Rubisco dehydrogenase
(d) No need of enzyme during carboxylation

(ix) The oxygen consumed during cellular respiration is involved directly in which process or events?

(a) Glycolysis
(b) Accepting electrons at the end of the electron transport chain ✓
(c) The citric acid cycle
(d) The oxidation of pyruvate to acetyl CoA

(x) How many carbon atoms are fed into the citric acid cycle as a result of the oxidation of one molecule of pyruvate?

(a) 4
(b) 2 ✓
(c) 6
(d) 8

Short Question Answer

Q1. Why do antenna complexes contain other pigments with chlorophyll?
Ans. The antennae complex is a series of pigment (chlorophyll) molecules that aid in trapping energy from light and transferring this light to the reaction center. Essentially, light is captured by plants as energy-carrying photons. Chlorophyll is the pigment that can capture these photons and transfer their energy from molecule to molecule until it reaches the reaction center.

Q2. Why is photosynthesis called the redox process?
Ans. Photosynthesis is a process in which plants containing chlorophyll convert the carbon dioxide into sugars in the presence of sunlight by a set of redox reactions. The Calvin cycle represents a set of reactions which are used to remove electrons from water which are then used to turn carbon dioxide into organic compounds.

Redox reactions during photosynthesis:
It involves two major steps -

- The first step is the oxidation in oxygen in water molecule in the presence of light

$$2H_2O \rightarrow O_2 + 4H^+$$

- The second step is the reduction step where hydrogen ions reduce the carbon in carbon dioxide

$$4H^+ + CO_2 \rightarrow (CH_2O) + H_2O$$

- The net reaction is

$$CO_2 + H_2O \rightarrow (CH_2O) + H_2O$$

Q3. Why is cyclic photophosphorylation helpful in photosynthesis?
Ans. The photophosphorylation process which results in the movement of the electrons in a cyclic manner for synthesizing ATP molecules is called cyclic photophosphorylation. In this process, plant cells just accomplish the ADP to ATP for immediate energy for the cells.

Q4. Why is ATP called the common energy currency of the living system?
Ans. ATP is commonly referred to as the "energy currency" of the cell, as it provides readily releasable energy in the bond between the second and third phosphate groups.

Q5. Why is the Calvin cycle also called the C3 cycle?
Ans. Since the first stable compound in the Calvin cycle is a 3-carbon compound (3 phosphoglyceric acid), the cycle is also called the C3 cycle. The reactions of Calvin's cycle occur in three phases.

Q6. Why' CAM plants close stomata in the daytime?
Ans. In CAM plants, the stomata in the leaves remain shut during the day to reduce transpiration through evaporation, but open at night to collect carbon dioxide (CO_2).

Q7. Why does oxidation of pyruvate provide more energy than lactic acid fermentation?
Ans. In this type of anaerobic respiration three carbon containing Pyruvate breaks its one carbon. as carbon dioxide and remaining two carbon formed another compound i.e. Acetyl. In the next step this Acetyl converted into Ethyl Alcohol. Finally one molecule of carbon dioxide and one molecule of ethyl alcohol is formed from one molecule of Pyruvate, with these products one molecule of NAD is reduced to $NADH_2$ in the first step which is ionized into NAD again in the next step. So the large amount of energy is produced in comparison to lactic acid fermentation.

Detail Question Answer

Q1. Explain in detail the light independent phase of photosynthesis?
Ans.

Light Independent Reaction or Calvin Benson Cycle

The second phase of photosynthesis, where carbohydrate molecules are formed by fixing atmospheric carbon dioxide. This part of photosynthesis does not require light energy directly, it requires chemical energy of ATP and NADPH2 therefore it is a light independent reaction of previously called dark reaction. The details of this phase were discovered by Melvin Calvin and his colleague Benson therefore it is also called Calvin cycle. During this cycle CO is reduced to triose phosphate Le. 3 phosphoglycerate or dihydroxyacetone phosphate and subsequently and other metabolic pathways to hexoses sucrose and starch.

Calvin cycle is divided into three phase

carboxylation

It is the combination of an organic compound with carbon monoxide and carbonylation refers to reactions that introduce carbon monoxide into organic and inorganic compounds. Carboxylation is the first step of the Calvin cycle. It is the fixation of CO_2 into a stable organic intermediate. In this, CO_2 is utilized for the carboxylation of RuBP. This reaction is catalyzed by the enzyme RuBisCO and it results in the formation of two molecules of 3-PGA (3-Phosphoglyceric acid). It is the first stable product of photosynthesis.

Reduction

Reduction is the transfer of electrons between species in a chemical reaction where there is a process of gaining electrons or a decrease in the oxidation state by an element. This stage obtains energy from ATP and NADPH formed during the light-dependent reactions of photosynthesis. In this way, the Calvin cycle becomes a pathway in which plants convert sunlight energy into long-term storage molecules, such as sugars. The energy from the ATP and NADPH is transferred to the sugars. This step is known as reduction since electrons are transferred to 3-PGA molecules to form glyceraldehyde-3 phosphate.

Regeneration

It is the third stage of the Calvin cycle and is a complex process that requires ATP. In this stage, some of the G3P molecules are used to produce glucose, while others are recycled to regenerate the RuBP acceptor.

Q2. What is cellular respiration? Explain types of respiration in detail?

Ans. Cellular respiration is a set of metabolic reactions occurring inside the cells to convert biochemical energy obtained from the food into a chemical compound called adenosine

triphosphate (ATP). Metabolism refers to a set of chemical reactions carried out for maintaining the living state of the cells in an organism.

These can be divided into two categories:

Catabolism - the process of breaking molecules to obtain energy.

Anabolism - the process of synthesizing all compounds required by the cells.

Types of Respiration

There are two types of respiration:

Aerobic respiration

It is a type of cellular respiration that takes place in the presence of oxygen to produce energy. It is a continuous process that takes place within the cells of animals and plants. This process can be explained with the help of the chemical equation:

Glucose ($C_6H_{12}O_6$) + Oxygen (602) ➡️ Carbon dioxide (6CO_2) + Water(6H_2O)+ Energy (ATP)

Anaerobic respiration

It is a type of cellular respiration that takes place in the absence of oxygen to produce energy. The chemical equation for anaerobic respiration is

Glucose(C&H12O6) ➡️ Alcohol 2(C_2H_5OH) + Carbon dioxide 2(CO_2) + Energy(ATP)

Phases of Respiration In Organisms:

Respiration occurs in the cytosol and around the plasma membrane in prokaryotic cells. In eukaryotic cells, respiration takes place in the mitochondria, which is also considered as the powerhouse of the cells. This process is very much similar to internal combustion of the car engine, wherein organic compounds and oxygen go in, while water and carbon dioxide comes out. The energy that is liberated powers the automotive (or cell).

The three phases of Respiration are:

Glycolysisr

The molecules of glucose get converted into pyruvic acid which is oxidized to carbon dioxide and water, leaving two carbon molecules, known as acetyl-CoA. During the process of glycolysis, two molecules of ATP and NADH are produced. Pyruvate enters the inner matrix of mitochondria and undergoes oxidation in the Krebs cycle.

Oxidative Phosphorylation

Oxidative phosphorylation is the process in which ATP molecules are formed as a result of the transfer of electrons from NADH or FADH2 to 02 by a series of electron carriers. This process takes place within the mitochondria of a cell.

Preparatory Phase

Energy in glucose cannot be readily released unless energy from ATP is added first. In this phase, 2 ATP are added to the reaction, producing a glucose molecule with two phosphate groups. The phosphate groups make glucose less stable and ready for chemical breakdown.

Q3. Explain that the event takes place in the breaking of glucose in cytosol?

Ans. It is anaerobic breakdown of Glucose into two molecules of Pyruvate. It takes place in a series of steps, each catalyzed by a specific enzyme. All these enzymes are found in cytosol with these enzymes,ATP and d MD (Nicotinamide adenine Dinucleotide) are also Nuked-Glycolysis can be divided into two phases:

- A Preparatory Phase Glucose to the formation of phosphorylated Tnose.
- Oxidative Phase Phosphorylated most to the formation of Pyruvate.

Glycolysis:

Glycolysis is the breakdown of glucose upto the formation of pyruvic acid. Glycolysis can take place both in the absence of oxygen (anaerobic condition) or in the presence of oxygen (aerobic condition.

Glycolysis can be divided into two phases, a preparatory phase and an oxidative phase in the preparatory phase breakdown of glucose occurs and energy is expended. In the oxidative phase high energy phosphate bonds are formed and energy is stored.

Preparatory phase:

The first step in glycolysis is the transfer of a phosphate group from ATP to glucose. As a result a molecule of glucose-6-phosphate is formed. An enzyme catalyzes the conversion of glucose-6-phosphate to its isomer, fructose-6- phosphate.

The next step in glycolysis is the enzymatic splitting of fructose 1,6-bisphosphate into two fragments. Each of these molecules contains three carbon atoms. One is called

3-phospo-glyceraldehyde, 3-PGAL or Glyceraldehyde 3-phosphate (G3P) while the other is dihydroxyacetone phosphate. These two molecules are isomers and in fact, are readily interconverted by yet another enzyme of glycolysis.

Oxidative (payoff) phase:

The next step in glycolysis is crucial to this process. Two electrons or two hydrogen atoms are removed from the molecule of 3-phosphoglyceraldehyde (PGAL) and transferred to a molecule of NAD. This is, of course, an oxidation- reduction reaction, with the PGAL being oxidized and the NAD being reduced.

During this reaction, a second phosphate group is donated to the molecule from inorganic phosphate present in the cell. The resulting molecule is called 1,3

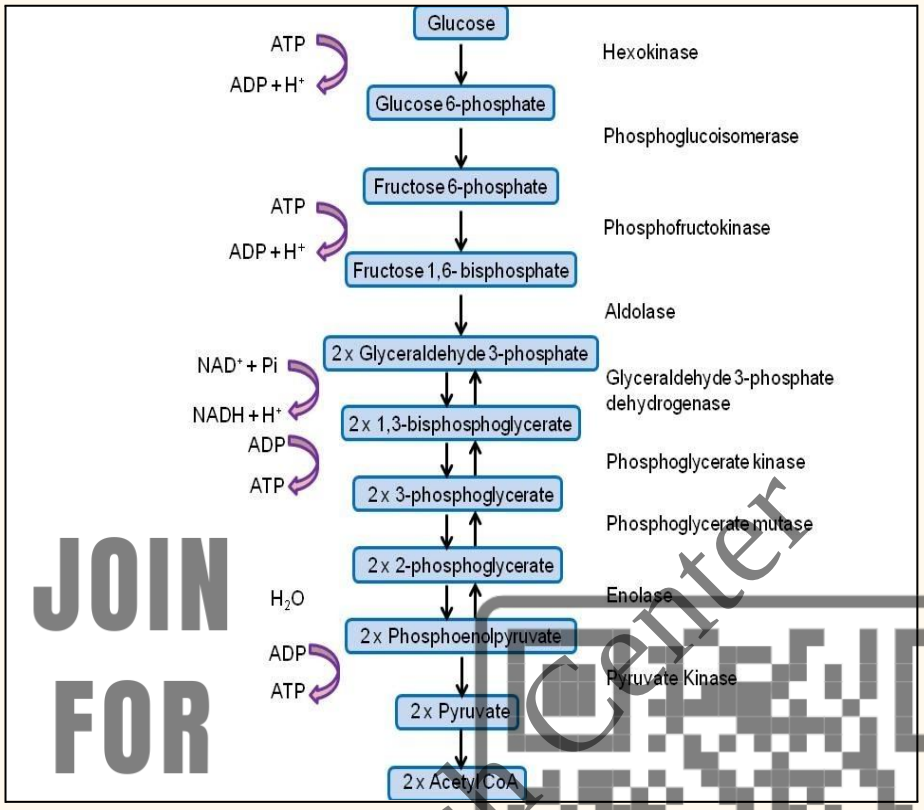
Bisphosphoglycerate (BPG). The oxidation of PGAL is an energy yielding process. Thus a "high energy phosphate bond is created in this molecule.

At the very next step in glycolysis this phosphate group is transferred to a molecule of adenosine diphosphate (ADP) converting it into ATP. The end product of this reaction is 3-phosphoglycerate (3-PG).

In the next step 3-PG is converted to 2-Phosphoglycerate (2PG).

From 2PG a molecule of water is removed and the product phosphoenol pyruvate is formed.

PEP then gives up its high energy phosphate to convert a second molecule of ADP to ATP. The product is pyruvate, pyruvic acid (C3H403). It is equivalent to half glucose molecule that has been oxidized to the extent of losing two electrons (as hydrogen atoms).



Q4.Discuss cyclic and non-cyclic photophosphorylation during light reaction?

Ans.

Light reaction:

The light reaction takes place in the grana of the chloroplast. Here, light energy gets converted to chemical energy as ATP and NADPH. In this very light reaction, the addition of phosphate in the presence of light or the synthesizing of ATP by cells is known as photophosphorylation.

Dark reaction:

While in the dark reaction, the energy produced previously in the light reaction is utilized to fix carbon dioxide into carbohydrates. The location where this happens is the stroma of the chloroplasts.

Photophosphorylation:

Photophosphorylation is the process of utilizing light energy from photosynthesis to convert ADP to ATP. It is the process of synthesizing energy-rich ATP molecules by transferring the phosphate group into ADP molecules in the presence of light.

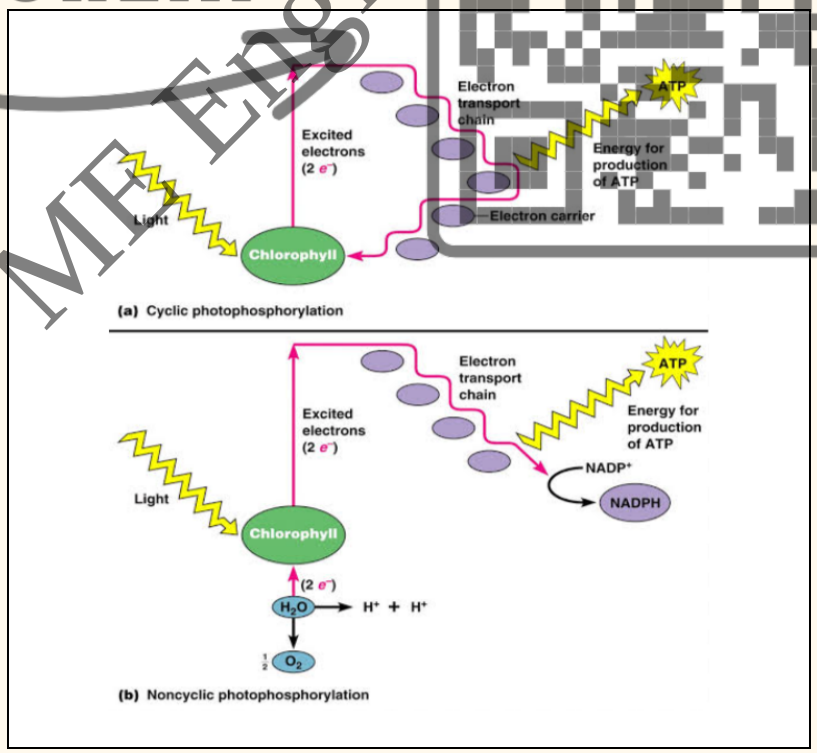
Photophosphorylation is of two types:

- Cyclic Photophosphorylation
- Non-cyclic Photophosphorylation

<u>Cyclic Photophosphorylation & Non Cyclic Photophosphorylation:</u>

- The photophosphorylation process which results in the movement of the electrons in a non-cyclic manner for synthesizing ATP molecules using the energy from excited electrons provided by photosystem II is called non-cyclic photophosphorylation. This process is referred to as non- cyclic photophosphorylation because the lost electrons by P680 of Photosystem II are occupied by P700 of Photosystem I and are not reverted to P680. Here the complete movement of the electrons is in a unidirectional or in a non-cyclic manner.

- During non-cyclic photophosphorylation, the electrons released by P700 are carried by the primary acceptor and are finally passed on to NADP. Here, the electrons combine with the protons - H+ which is produced by splitting up of the water molecule and reduces NADP to NADPH2.



Q5. Describe the tricarboxylic acid cycle in detail?

Ans.

Tricarboxylic Acid Cycle:

"TCA cycle is the series of chemical reactions used by all aerobic organisms to release stored energy through the oxidation of acetyl CoA derived from carbohydrates, fats, and proteins into ATP." TCA cycle or Tricarboxylic Cycle is also known as Kreb's Cycle or Citric Acid Cycle. It is the second stage of cellular respiration that occurs in the matrix of mitochondria. All the enzymes involved in the citric acid cycle are soluble. It is an aerobic pathway because NADH and FADH2 produce and transfer their electrons to the next pathway which will use oxygen. If the transfer of electrons does not occur, no oxidation takes place. Very little ATP is produced during the process directly.

Steps of TCA Cycle:

Following are the important steps of the TCA cycle:

Step 1:

Acetyl Co-A combines with a four-carbon compound, oxaloacetate, and releases the CoA group resulting in a six-carbon molecule called citrate.

Step 2:

In the second step, citrate gets converted to isocitrate, an isomer of citrate. This is a two-step process. Citrate first loses a water molecule and then gains one to form isocitrate.

Step 3:

The third step involves oxidation of isocitrate. A molecule of carbon dioxide is released leaving behind a five-carbon molecule, -ketoglutarate. NAD+ gets reduced to NADH. The entire process is catalyzed by the enzyme isocitrate dehydrogenase.

Step 4:

Here, -ketoglutarate is oxidized reducing NAD to NADH and releasing a molecule of carbon dioxide. CoA is picked up by the remaining four-carbon molecules forming an unstable compound succinyl CoA. dehydrogenase catalyzes the entire process.

Step 5:

CoA from succinyl CoA is replaced with a phosphate group. It is then transferred to ADP to make ATP. Succinate, a four-carbon molecule is produced in this step.

Step 6:

Succinate is oxidized to fumarate. Two hydrogen atoms are transferred to FAD to produce FADH2. FADH2 transfers its electrons directly to the electron transport chain since the enzyme carrying out the reaction is embedded in the inner membrane of mitochondria.

Step 7:

A water molecule is added to fumarate which is then converted to malate.

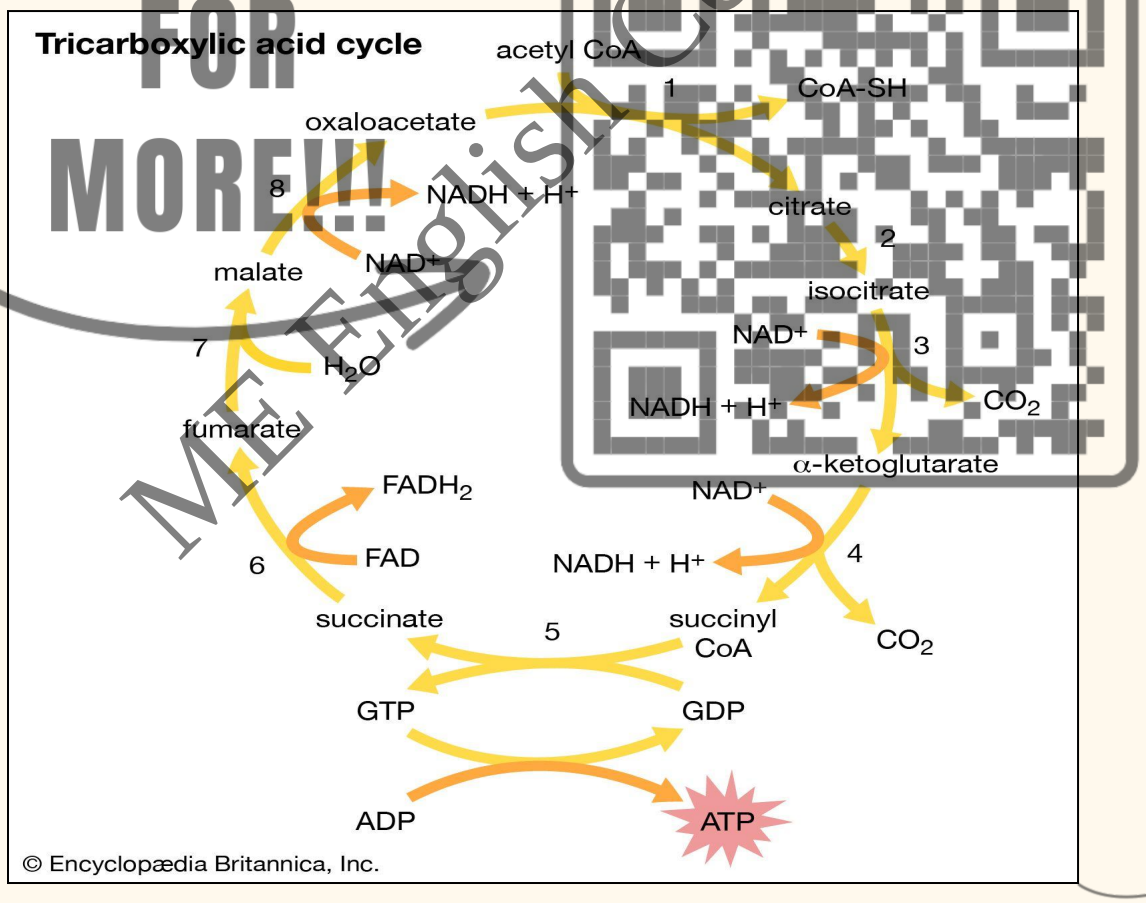
Step 8:

The oxidation of malate regenerates oxaloacetate, a four-carbon compound, and another molecule of NAD+ is reduced to NADH in this step.

End Products of TCA Cycle:

Following are the end products of TCA cycle:

- 6 NADH
- 2 ATPs
- 2 FADH2



Q6.Explain alternative mechanism of CO2 fixation in plants?

Ans.

"***Carbon fixation is the process by which plants fix atmospheric carbon to form organic compounds."***

In the CAM pathway, plants take CO2 during the night through the stomatal opening. It is converted to malic acid (4 carbon compound) and stored in vacuoles. During the daytime, malic acid is transported to chloroplast and CO2 is released, which enters the Calvin cycle.

Carbon Fixation Process:

Photosynthesis is the main process of carbon fixation. Carbon fixation occurs in the dark reaction or light-independent reaction of the photosynthesis process. The process of carbon fixation slightly differs in C3, C4, and CAM plants but the Calvin Cycle or C3 pathway is the main biosynthetic pathway of carbon fixation.

Carbon Fixation in C3 Plants

Carbon fixation in C3 plants occurs in the dark reaction or light-independent reaction of photosynthesis. It is also known as the Calvin Cycle.

Calvin cycle occurs in all the plants, be it C3, C4, CAM or any other plants.

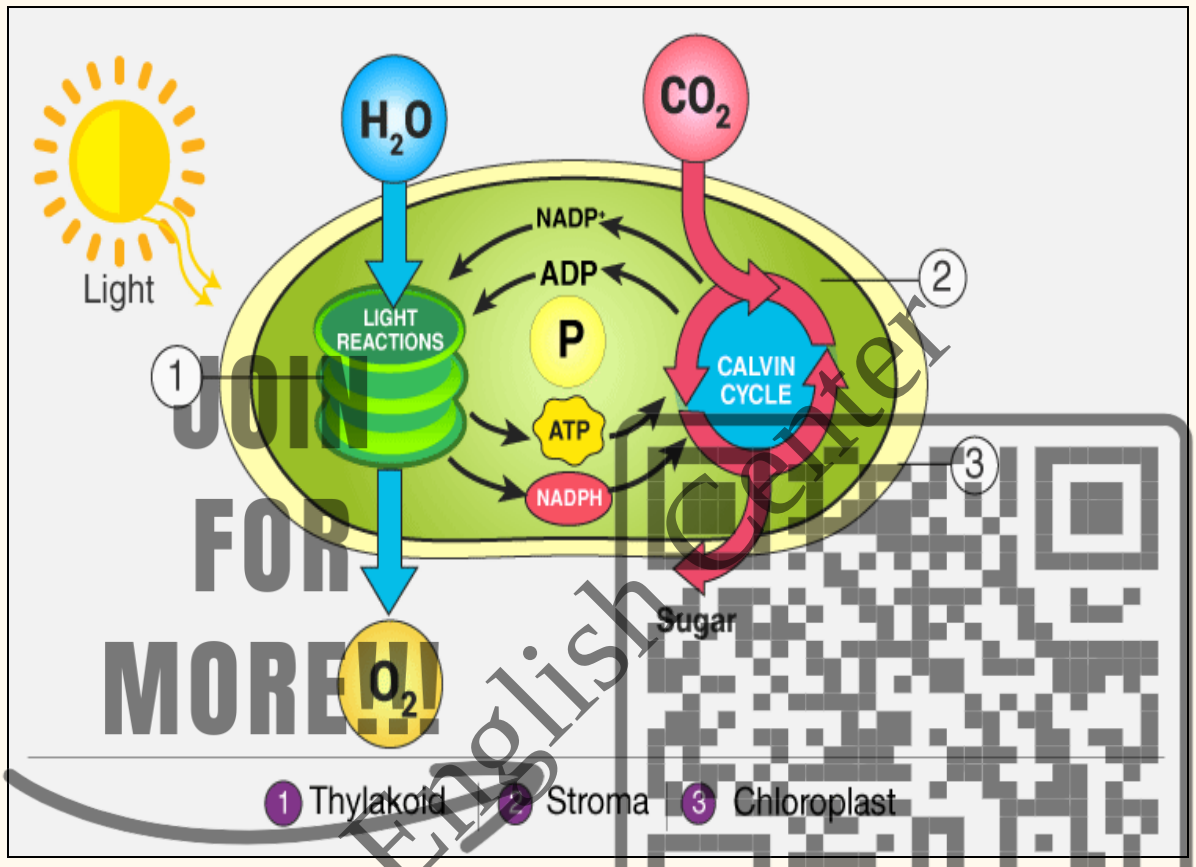
- It occurs in the stroma of chloroplasts
- The first product of carbon dioxide fixation is 3 carbon compound known as 3-phosphoglyceric acid or PGA
- CO2 acceptor is a 5 carbon compound ribulose biphosphate or RUBP
- Calvin cycle has three main steps:

1. Carboxylation - In this process CO2 fixation takes place. Enzyme RUBP carboxylase oxygenase or RuBisCO catalyzes the carboxylation of RUBP to form PGA.
2. Reduction - Formation of carbohydrate or glucose takes place by reduction. ATP and NADPH formed during light reaction are used in the process. 2 ATP and 2 NADPH are used per cycle.
3. Regeneration - Regeneration of RUBP is an important step for the cycle to continue, 1 ATP molecule is used for phosphorylation.

Carbon Fixation in C4 Plants:

The C4 pathway of carbon fixation is adapted by plants found in a dry tropical region, e.g. maize, sorghum, etc. C3 and C4 pathways differ in the first product of carbon fixation. In C3

plants, 3 carbon compound 3-phosphoglyceric acid (PGA) is produced, whereas, in C4 plants, 4 carbon compound oxaloacetic acid (OAA) is produced. In C4 plants also the C3 pathway is used in the formation of a glucose molecule.



Q7. Explain chemiosmosis and oxidative phosphorylation?

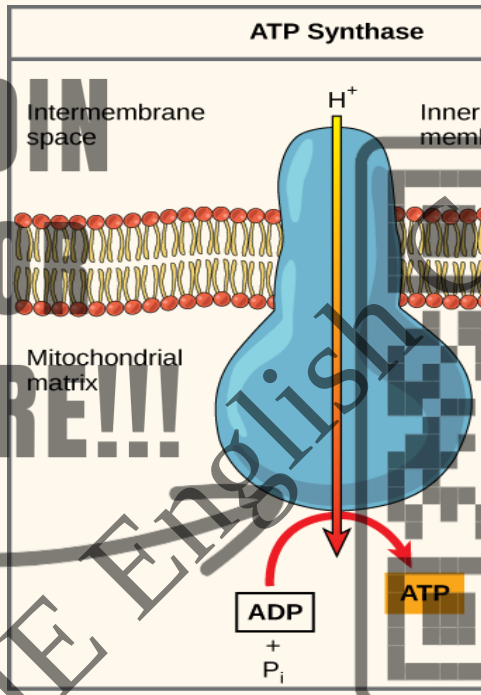
Ans. During chemiosmosis, electron carriers like NADH and FADH donate electrons to the electron transport chain. The electrons cause conformational changes in the shapes of the proteins to pump H+ across a selectively permeable cell membrane. The uneven distribution of H' ions across the membrane establishes both concentration and electrical gradients (thus, an electrochemical gradient) owing to the hydrogen ions' positive charge and their aggregation on one side of the membrane.

If the membrane were open to diffusion by the hydrogen ions, ions would tend to diffuse back spontaneously across into the matrix, driven by their electrochemical gradient. However, many ions cannot diffuse through the nonpolar regions of phospholipid membranes without the aid of ion channels. Similarly, hydrogen ions in the matrix space can only pass through the inner mitochondrial membrane through a membrane protein called ATP synthase. This protein

acts as a tiny generator turned by the force of the hydrogen ions diffusing through it, down their electrochemical gradient. The turning of this molecular machine harnesses
the potential energy stored in the hydrogen ion gradient to add a phosphate to ADP, forming ATP.

Oxidative phosphorylation :

It is the process by which ATP synthesis is coupled to the movement of electrons through the mitochondrial electron transport chain and the associated consumption of oxygen.

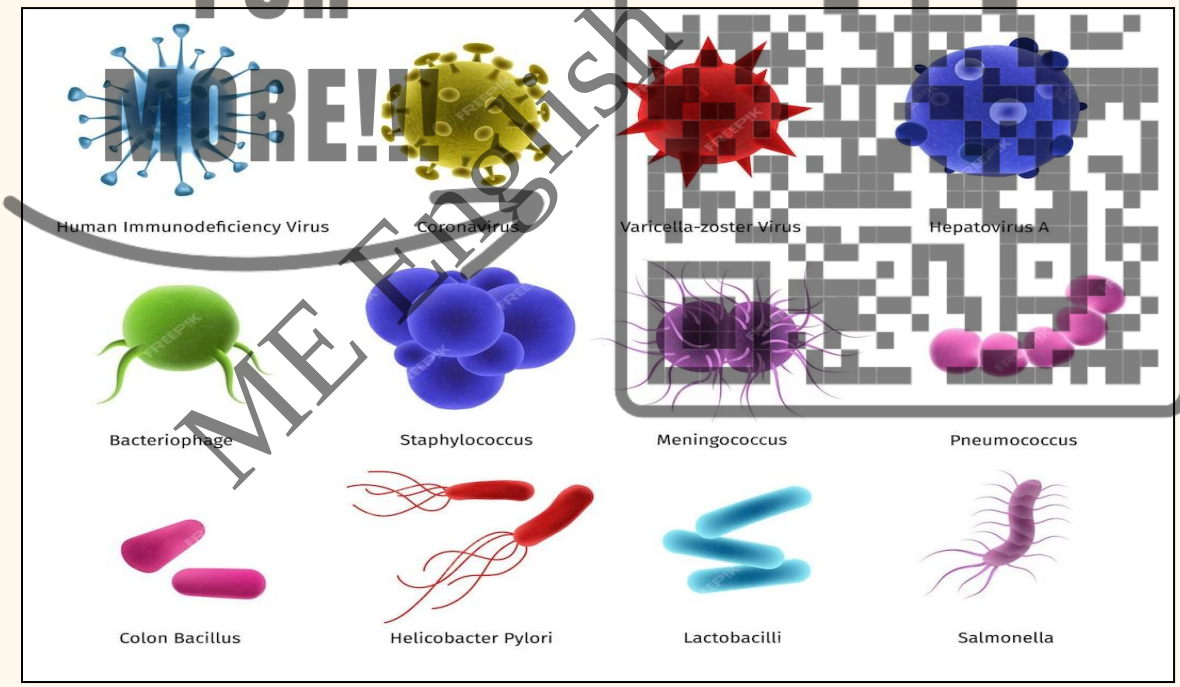


Chapter #05	*Acellular life*	*Botany*

INTRODUCTION OF ACELLULAR LIFE:

Evolution reveals that life originated on earth at the level of variety of molecules like DNA and protein which later on evolved into cellular life. In the beginning some structures emerged which lack intact cells or a living entity without cells called non cellular living things, such as viruses, prions and viroids. Living things are categorized into two groups, firstly, living entities or molecules and secondly the complete cell-based organisms.

Viruses are a major threat to human health and the country's economy. Viruses like smallpox and influenza caused millions of deaths in different eras. Recently due to Corona world has suffered millions of deaths and massive decrease in industrial productions of different goods by the year 2022. Many viruses also damage crops and livestock.



Encircle the correct choice

(i) Viruses evolve by using the
- (a) Cellular organelles
- (b) Cellular energy
- (c) Cellular enzymes
- (d) All of them ✓

(ii) The pathogenicity of a virus depends upon
- (a) the immunity of the host body ✓
- (b) the effective penetration of its genome
- (c) the overall environment inside the body
- (d) the overall environment outside the body

(iii) Bacteriophages escape from host cell by the activity of
- (a) Lysozyme ✓
- (b) Ribozyme
- (c) Peroxisomes
- (d) Glyoxysomes

(iv) The smaller proteins are cut down and forms a new virus structure by the process called
- (a) Integration
- (b) Transcription
- (c) Budding
- (d) Assembly ✓

(v) Virus that severely damage motor neurons and causes paralysis called
- (a) HIV
- (b) Dengue
- (c) Polio ✓
- (d) Herpes

(vi) Proteins that cause pathogenicity in humans and animals called
- (a) Prions ✓
- (b) Viroids
- (c) Antigen

(d) Antibodies

(vii) Smaller than viruses having single stranded RNA with some double stranded regions are called

(a) Prions
(b) Viroids
(c) Minus strand viruses
(d) Double stranded DNA viruses ✓

(viii) Dengue fever, encephalitis and yellow fever are caused by which group of viruses?

(a) Arbo-viruses ✓
(b) Retro-viruses
(c) Rhabdo-viruses
(d) Rhino-viruses

(ix) Aedes mosquito is the vector of

(a) Dengue virus ✓
(b) Ebola virus
(c) Hepatitis virus
(d) Measles virus

Shorts Question Answer

Q1.Discuss the living and nonliving status of viruses?

Ans.Viruses replicate like living organisms by using host cellular contents of their own nucleic acid either DNA or RNA, as their genome and undergo. Viruses also contain certain proteins which work as enzymes in the host cell. Viruses interact all and physiologically with the host organisms they infect. Now Viruses may become inactive for indefinite periods of time without replication. They lack cellular organelles. They can't perform metabolism and energy molecules either. They can crystalize and store. They do not express vital activities like respiration. excretion, movement etc.

Q2.What do we mean by positive and negative sense viruses?

Ans: **Positive Sense RNA Virus:**

- It is a type of virus containing a positive sense single-stranded RNA
- It is capable of operating as mRNA and can be directly translated into the protein in the host
- In the hosts, once the viral proteins are produced, it recruits RNA for the production of viral replication complexes
- The replication of virus advances through the double-stranded intermediates of RNA
- Some examples are - echovirus, poliovirus,

Negative Sense RNA Virus:

- It refers to the type of single-stranded RNA virus with genetic content being the antisense strand of the viral mRNA
- It comprises a genome that is complementary to the viral mRNA
- Consequently, the genome of the virus cannot translate readily into the viral proteins. As a result, the virion must be packed with RNA-dependant RNA polymerase enzyme, which helps in the transcription of the viral RNA
- Some examples are - Ebola virus, influenza virus

Q3.Name the groups of viruses from Baltimore classification?

Ans. The seven classes of viruses in the Baltimore Classification System are as follows:

- ***Class I:*** Double stranded DNA (dsDNA) Viruses.
- ***Class II:*** Single stranded DNA (ssDNA) viruses.
- ***Class III:*** Double stranded RNA (dsRNA) viruses.
- ***Class IV:*** Single stranded RNA (ssRNA) viruses.
- ***Class V:*** Single stranded RNA (ssRNA) viruses.

Q4. How does bacteriophage virus infect bacteria?

Ans: A phage attaches to a bacterium and injects its DNA into the bacterial cell. The bacterium then turns into a phage factory, producing as many as 100 new phages before it bursts, releasing the phages to attack more bacteria.

Q6. Differentiate lyric and lysogenic life cycle?

Ans:

Lytic Cycle	Lysogenic Cycle
The DNA of the virus does not integrate into the host DNA	The DNA of the virus integrates into the host DNA
Host DNA hydrolyzed	Host DNA not hydrolyzed
Absence of prophage stage	Presence of prophage stage
DNA replication of virus takes place independently from the host DNA replication	DNA replication of the virus takes place along with the host DNA replication
Occurs within a short period of time	Takes time
Symptoms of viral replication are evident	Symptoms of viral replication not evident

Q6.What is reverse transcription? How is HIV performed in humans?

Ans.

***Reverse Transcription*:**

The viral RNA makes a new DNA; this process is called reverse transcription. In this process the virus uses its own enzyme called reverse transcriptase. (RT) is essential for HIV replication because the viral RNA genome on its own is highly susceptible to degradation by intracellular RNases. RT rapidly makes a much more nuclease-resistant double-stranded DNA copy of the RNA template that later integrates to form the proviral DNA.

Q7. List down any five animal and plant viruses with their vector transmission and symptoms .

Ans:

***(I) Name of Virus*:**

Dengue virus

vector/host.

Aedes/ Mosquito

Transmission.

Blood

Symptoms

Headache , Vomiting , Rashes with pain, Nausea

(II) Name of Virus :

Ebola virus

Vector/host.
Canid animal bats, dogs etc
Transmission.
Body fluid
Symptoms .
Hemorrhagic fever

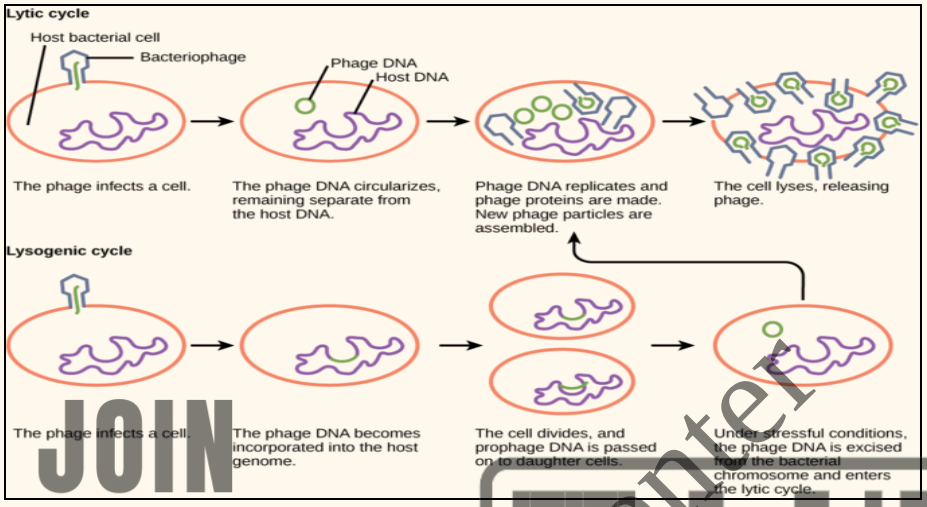
(III) Name of Virus :
Hepatitis C Virus
Vector/host
Human infected people
Transmission
Transmission of hepatitis c virus occurred mainly during blood transfusion.
Symptoms
Fever, yellow skin, fatigue muscle and joint pain

(IV) Name of Virus:
Coronavirus
Vector/host.
Bats
Transmission.
Airborne droplets
Symptoms.
Labored breathing pressure inside the chest with pain

(V) Name of Virus:
Measles virus
Vector/host.
Airborne droplets from nose and throat mucus in humans .
Transmission.
Sneezing and coughing of injected person
Symptoms.
Fever, cough, and rashes on body

Q8. List down the sequences involved in the lytic and lysogenic life cycle of bacteriophage?

Ans: In the lytic cycle, the phage replicates and lyses the host cell. In the lysogenic cycle, phage DNA is incorporated into the host genome, where it is passed on to subsequent generations.



Q9. How does a virus survive without the host discussing it?

Ans. Virus survive outside our bodies because of how they are built. Specifically, they are pieces of genetic material (RNA or DNA) contained in a special coating of proteins called capsids. Viruses cannot replicate unless absorbed by cells in our body. Once a virus is outside the body, its capsid starts to degrade, and the more degraded its capsid is, the less likely it is to survive. When outside the body, these capsids degrade faster in cold, dry environments. They also degrade faster on soft, rather than on hard surfaces. That's because they need moisture to survive and soft surfaces absorb that moisture.

Q10. What are the symptoms of AIDS?

Ans. Symptoms of AIDS can include:

- Rapid weight loss.
- Recurring fever or profuse night sweats.
- Extreme and unexplained tiredness.
- Prolonged swelling of the lymph glands in the armpits, groin, or neck.
- Diarrhea that lasts for more than a week.
- Sores of the mouth, anus, or genitals.
- Pneumonia

Q11. What are the prevention and control of AIDS?

Ans. ***Prevention Of HIV/AIDS***

- Educate yourself and others.
- Know the HIV status of any sexual partner.
- Consider male circumcision.
- Use a clean needle.
- Be cautious about blood products.
- Get regular screening tests.

Q12. Differentiate Prions and Viroids?

Ans

Prions	Viroids
Viroids are infectious RNA molecules.	Prions are infectious protein particles
Viroids are smaller than viruses.	Prions are smaller than the viroids.
Nucleic acids are present.	Nucleic acids are not present
Protein Components are absent.	Protein Components are present
Viroids mostly infected the plants.	Prions mainly cause neurodegenerative disease.

Detailed Question Answer

Q1. Explain the lytic life cycle of Bacteriophage with a labeled diagram?

Ans.

Bacteriophage:

A bacteriophage is a virus that infects a bacterial cell and reproduces inside it They vary a lot in their shape and genetic material. A bacteriophage may contain DNA or RNA. The genes range from four to several thousand. Their capsid can be isohedral, filamentous, or head-tail in shape.

Bacteriophage Structure

The bacteriophage consists of a polyhedral head, a short collar and a helical tail.

Head-The head consists of 2000 capsomeres with double-stranded DNA enclosed within.

Tail- The tail consists of an inner hollow tube which is surrounded by a contractile sheath with 24 annular rings. The distal end consists of a basal plate with tail fibres at each corner. The bacteriophage attaches to the bacteria with the help of these tail fibres.

Bacteriophage Life Cycle

Bacteriophage exhibits two major types of life cycles:

- Lytic Cycle or Virulent Cycle
- Lysogenic Cycle or Temperate Cycle

Lytic Cycle

In the Lytic Cycle, a bacteriophage infects a bacteria and kills it to release progeny virus.

This cycle takes place in the following steps:

Step 1: Phage attachment:

Bacteriophage virus starts lytic phase of life cycle by attach itself to the bacterium. At this stage virus interacts with specific bacterial surface receptors. This attachment is reversible and specific to the host bacterium.

Step 2: Genome penetration:

Bacteriophage strikes by its contractile tail sheath on the surface wall of bacterium and break it down. Virus injects its DNA in to the bacterium through a hollow tube and phage head and remaining components remain outside the bacteria and called the "ghost".

Step 3: Biosynthesis Replication of Phage DNA

The cells metabolic machinery directed by phage DNA, produces phage

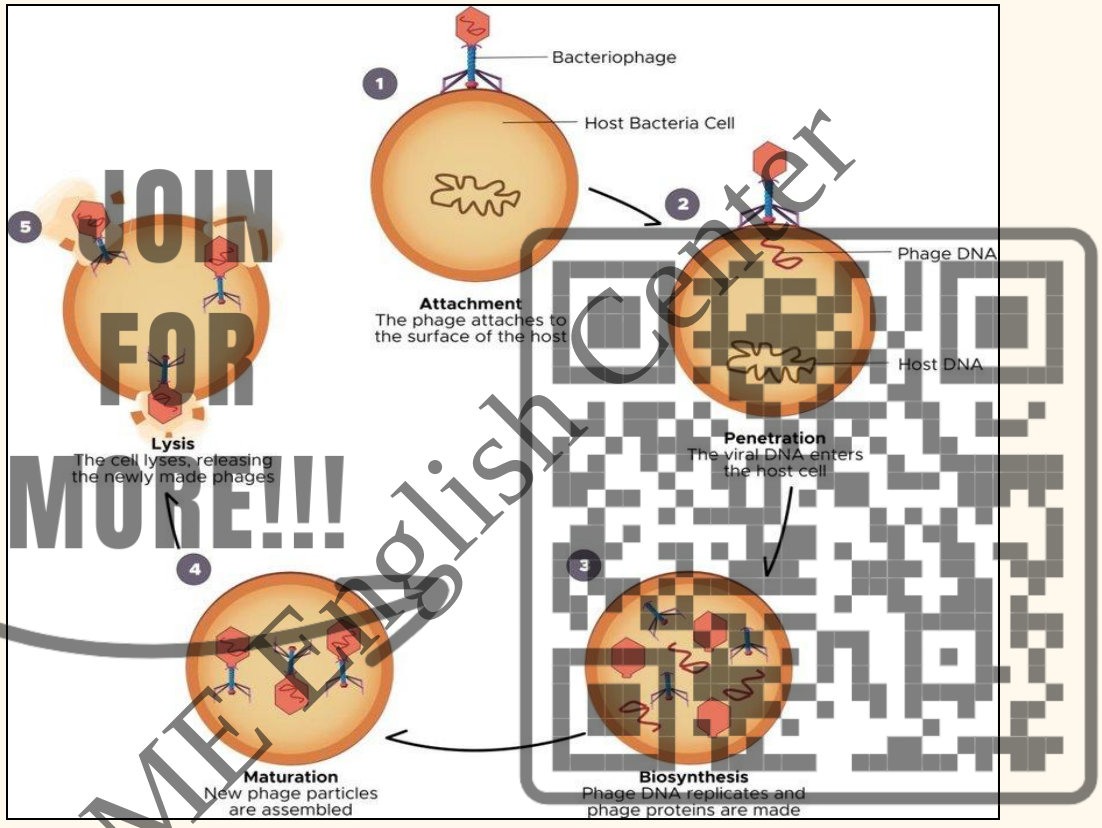
Protein and nucleotide from the cells' degraded DNA, are used to make copies of the phage genome.The phage parts come together. Three separate sets of proteins assemble to form phage head, tails, and tail fibers forming daughter phages.

Step 4: Maturation

When all the components of phage structure are synthesized including proteins and nucleic acid then assembling of these components begins to form new phages During this phase new phage DNA is created called virions.

Step 5 Lysis and release of phage

The newly formed bacteriophages releases and enzyme lysozyme to break bacterial walls and cause lysis releasing 100-200 phage progeny into the surrounding and infecting new bacterium.



Q2. Explain the life cycle of HIV with a labeled diagram?

Ans.

HIV (Human Immunodeficiency Virus) Diagram

HIV life cycle Life cycle of HIV consists of series of steps to multiply in the body which are:

1) binding
2) fusion
3) reverse transcription

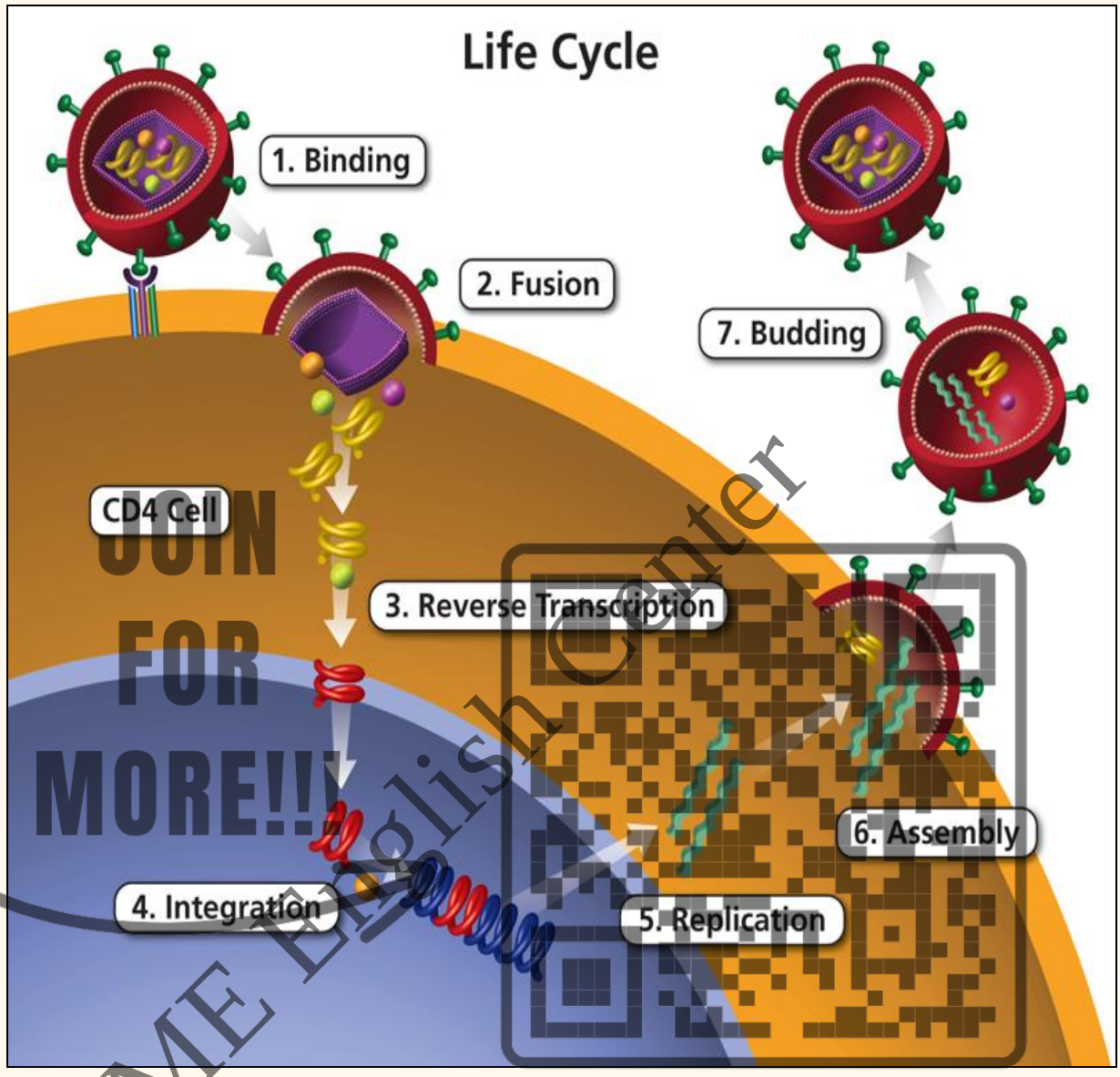
4) integration
5) replication
6) assembly
7) budding

1) **Attachment:** At first the virus attaches with a lymphocyte cell surface glycoprotein receptor that allows HIV to enter the cell.
2) **Fusion:** While remaining attached the virus injects its RNA into the host cell.
3) **Reverse Transcription:** The viral RNA makes a new DNA this process is called reverse transcription. In this process the virus uses its own enzyme called reverse transcriptase.
4) **Integration:** The viral DNA enters the host cell's nucleus, where it integrates with host DNA by an enzyme integrase. This DNA is called provirus, which may remain inactive for several years, producing few or no new copies of HIV.
5) **Transcription:** Now integrated host DNA develops mRNA for the process of protein synthesis to make viral protein and also by using host cell enzyme called RNA polymerase it creates the copies of HIV genomic material as mRNA which is used to direct the making of long chains of HIV proteins.
6) **Assembly:** When proteins are formed HIV uses another enzyme called protease to cut down protein into small fragments that later join together with the HIV genome and develop new progeny.
7) **Budding:** New progeny of virus when it matures it connects with the cell membrane and forms a small projection as bud from the infected cell. The bud acquired some of the glycoprotein part of the cell membrane for its own covering. They are released from the cell and move on to infect other cells.

Transmission of HIV:

Up till now, there are four main method of transmission of HIV that are known, they are;

- Sexual intercourse
- Use of contaminated syringes, needles and other piercing instruments.
- Use of contaminated blood and its products, organs and tissues.
- Mother to child transmission.



Q3.Explain the pathogenicity and economic losses caused by viruses to humans?

Ans: Pathogenicity is the quality or state of being pathogenic, the potential ability to produce disease, whereas virulence is the disease producing power of an organism, the degree of pathogenicity within a group or species.

Economic losses due to viral diseases:

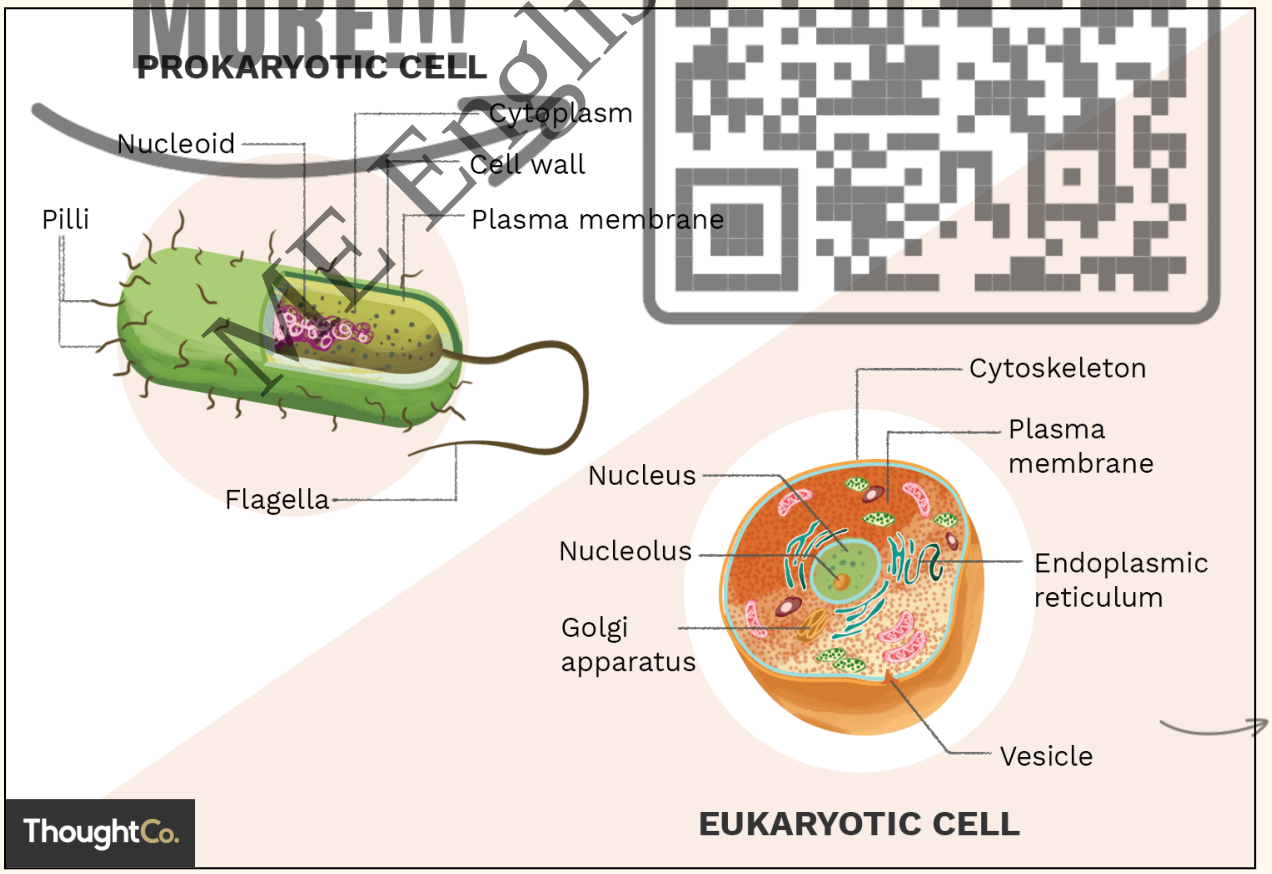
Viral diseases always remain a significant threat to the world economy. These are responsible for the sizable losses of agricultural products as well as livestock commodities. For example, Pakistan ranks fourth in area and production of cotton in the world. It has 9.36% of total world cotton area, 10.18% of production, 8.06% of

consumption and 4.55% of total world export of raw cotton. The impact of the cotton leaf curl virus on the Pakistan national economy cannot be forgotten as the country has lost Rs. 50 to 55 billion since 1992 and it is essential to maintain vigilance over the disease. Similarly, bird flu viral disease caused around 700 to 800 million Rupees. Huge loss at one time during its peak time.

Chapter #06	*Prokaryotes*	*Botany*

INTRODUCTION OF PROKARYOTES:

Prokaryotes were the earliest organisms and they lived and evolved all alone on Earth for 2 billion years. They have continued to adapt and flourish on an evolving Earth and in turn they have helped to change the Earth. In this chapter you will become more familiar with prokaryotes by studying their structure and function, their origins and evolution, their diversity and their ecological significance. Prokaryotae is a group of living organisms which are unicellular, having a prokaryotic or primitive nucleus. Prokaryotes are unicellular organisms, called bacteria, in which each cell contains a single DNA molecule coated in a loop and not enclosed in a nucleus. They are almost everywhere, indispensable links in the recycling of chemical elements in ecosystems and humans use them in research and technology. Antony Van Leeuwenhoek (1673), was the first to observe microorganisms.



Encircle the correct choice

(i) The prokaryotes may have evolved from ancestors called

(a) Protobionts

(b) Virion

(c) eukaryote ✓

(d) RNA

(ii) The earliest undisputed evidence of life on earth dates at least from

(a) 3.5 billion years ago ✓

(b) 4.5 billion years ago

(c) 2.5 billion years ago

(d) 5.5 billion years ago

(iii) Gram positive bacterial peptidoglycan layer is

(a) Thick ✓

(b) Moderate

(c) Thin

(d) No

(iv) When habitat conditions become harsh and nutrients are exhausted

the development is initiated called

(a) capsule

(b) cell wall

(c) endospore ✓

(d) pathogenicity

(v) Bacteria show several types of movements such as flexing, spinning, free swimming and creeping are called

(a) bacillus

(b) spirochaetes ✓

(c) vibrio

(d) Phycocyanin

(vi) Photoautotrophic anaerobe bacteria have bacteriochlorophyll and another pigment

(a) Biliverdin

(b) Phycoerythrin

(c) Bacterioviridin ✓

(d) coccus

(vii) Nitrogen-fixing bacterium lives in the roots of such plants as Pea is

(a) Rhizobium leguminosarum ✓

(b) Erwinia amylovora,

(c) Streptococcus pyogenes

(d) Xanthomonas

(viii) Cholera is caused by the bacteria

(a) Mycoplasmas

(b) Clostridium

(c) Vibrio ✓

(d) Enterococcus

(ix) One of the first chemical to be used for disinfection

(a) Phenol ✓

(b) Heavy metals

(c) Halogens

(d) Aldehydes

(x) Exposure to flame or destroy bacteria by burning called

(a) Lyophilization

(b) Incineration ✓

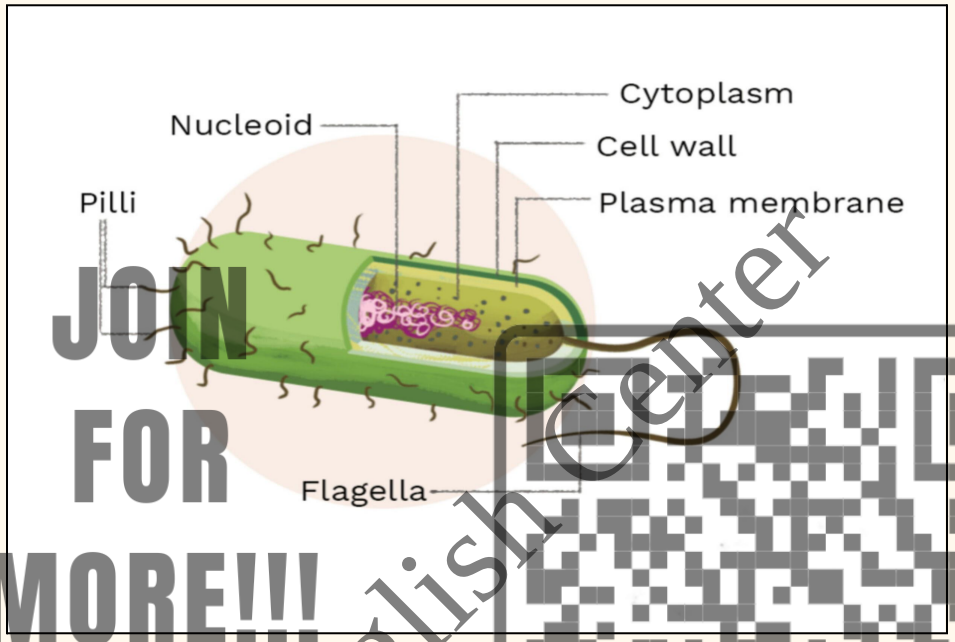
(c) Autoclave

(d) desiccation

Shorts Question Answer

Q1. Explain the structure of bacteria in detail with a labeled diagram?

Ans. Bacteria are unicellular organisms belonging to the prokaryotic group where the organisms lack a few organelles and a true nucleus.



Q2. Explain the Autotrophic mode of nutrition in bacteria?

Ans. Autotrophic bacteria synthesize their own food. They derive energy from light or chemical reactions. They utilize simple inorganic compounds like carbon dioxide, water, hydrogen sulfide, etc. and convert them into organic compounds like carbohydrates, proteins, etc. to supplement their energy requirements.

Q3. Explain the photosynthesis mechanism in bacteria?

Ans. Process of bacterial photosynthesis: Bacterial photosynthesis is based on cyclic photophosphorylation mechanism and only one pigment system (PS-1) is involved. During the process, bacteriochlorophyll absorbs light and this light energy raises the chlorophyll molecule to an excited state.

Q4.Explain the economic importance Man?

Ans. Bacteria are economically important as these microorganisms are used by humans for many purposes. The beneficial uses of bacteria include the production of traditional foods such as fudge, yogurt, cheese, and vinegar.Microbes are also important in agriculture for the compost and fertilizer production. Bacteria are used in genetic engineering and genetic changes.

Q5.Explain the bacterial diseases in Man with their signs, symptoms, treatment and prevention?

Ans: Bacterial diseases are diseases caused by bacteria. There are a number of bacteria found in the human body. A variety of these do not cause any infections and are known as "good bacteria". The bacteria that cause diseases in humans are called "harmful bacteria

Bacterial Diseases Causes:

The bacteria enter the human body through various sources and cause bacterial diseases. Bacterial diseases are communicable diseases. Bacteria can be transmitted through direct contact or through food, water, air, etc. These sources include:

- Through contaminated food and water.
- By having sexual contact with an infected person.
- By sharing contaminated needles, or needles for tattooing or infected surgical equipment.
- Through infected feces or body fluids.

Bacterial Disease Symptoms:

Following are the major symptoms of bacterial diseases:

- Bloody and painful urine
- Irritability
- Diarrhea
- Vomiting and nausea
- Weakness
- Stiffness in neck
- Flu-like symptoms
- Rashes and lesions

Prevention of Bacterial Diseases:

Managing and preventing bacterial diseases is much easier compared to viral diseases. Bacterial diseases in humans can be prevented by maintaining proper hygiene. Bacterial diseases can be prevented by taking the following measures:

- Timely vaccination.
- Use of surface disinfectants of bleach to kill pathogenic bacteria.
- Cooking food properly.
- Consuming hygienically prepared food.

- Proper sterilization of needles and other surgical equipment.
- Washing and sanitizing hands at regular intervals.

Q6. Explain the bacterial diseases in plants with their signs, symptoms, treatment and prevention?

Ans.

Some bacterial diseases of plants

disease	causative agent	hosts	symptoms and signs	additional features
Granville wilt	*Pseudomonas solanacearum*	tobacco, tomato, potato, eggplant, pepper, and other plants	stunting, yellowing, and wilting of parts above ground; roots decay and become black or brown	occurs in most countries in temperate and semitropical zones; causes crop losses of hundreds of millions of dollars
fire blight	*Erwinia amylovora*	apple and pear	blossoms appear water-soaked and shrivel; spreads to leaves and stems, causing rapid dieback	first plant disease proved to be caused by a bacterium
wildfire of tobacco	*Pseudomonas syringae*	tobacco	yellowish green spots on leaves	wildfire of tobacco occurs worldwide; causes losses in seedlings and field plants
blight of beans	*Xanthomonas campestris*	beans (common blight)	yellowish green spots on leaves	most phytopathogenic xanthomonads and pseudomonads cause necrotic spots on green parts of susceptible hosts; may be localized or systemic

Q7. What do you mean by bacterial growth? Describe its phases."?

Ans. Bacterial growth is the increase in the number of bacterial cells rather than the increase in their cell size. The growth of these bacterial cells takes place in an exponential manner, i.e., one cell divides into 2, then 4, then 8, 16, 32 and so on. The bacterial growth curve represents the number of live cells in a bacterial population over a period of time. There are four distinct phases of the growth curve: lag, exponential (log), stationary, and death. The initial phase is the lag phase where bacteria are metabolically active but not dividing.

Detailed Question Answer

Q1. What are the domains of classification? Differentiate them.

Feature	Archaea	Eubacteria	Eukaryotes
Cell type	Prokaryotic	Prokaryotic	Eukaryotic
Chromosome	Circular	Circular	Linear chromosomes + circular mtDNA and cpDNA
Cell membrane lipids	Glycerol–ether lipids	Glycerol–ester lipids	Glycerol–ester lipids
Ribosomes	70S ribosomes but small subunit is more similar to eukaryotic ribosomes	70S ribosomes	Larger 80S ribosomes in cytosol and 70S ribosomes in mitochondria and chloroplasts
Cell walls	Always present (without peptidoglycan)	Always present (with peptidoglycan)	Sometimes present (without peptidoglycan)
Histones	Yes	No	Yes
Introns	Sometimes	Rarely	Yes

Domain Archaea:

Archaea is a very diverse group in a domain system of classification They were initially classified as Archaebacteria but this classification is obsolete now they are a separate domain. They are present in different shapes like spherical, rod, lobed, square etc their diameter ranging 0.1 to over 15um. Archaea are slightly different from bacteria. They don't have peptidoglycan in their cell wall as it is present in bacteria and also some metabolic activities are different from bacteria. Archaea reproduce asexually by binary fission, fragmentation or budding.

Q2.What are protobionts? Discuss their relationship with prokaryotes?

Ans. A protobiont is defined as an aggregate of abiotically produced organ molecules surrounded by a non unit membrane. For example, Coacervates (the large spherical colloidal aggregates of macromolecules), microspheres (colloidal aggregates of protein bubbles) are protobionts. Protobionts were transformed into a first living prokaryotic organism with gradual improvement in metabolism growth and reproduction.

Prokaryotes are the most primitive and first inhabitant on earth. These mats are few centimeters thick, due to the secretion of extracellular matrix from fool Prokaryotes present in every habitat and each comprising several smaller taxonomic groups. The domain Bacteria of the Prokaryote also include cyanobacteria or blue-green algae. This primitive prokaryotic alga can perform photosynthesis and are called photoautotrophs. Higher phototrophic autotrophs are thought to have evolved from this group. They have a well developed pigment system and can reproduce by fragmentation. Bacteria also exist as decomposers or saprotrophs and symbionts. Prokaryotes have tremendous ability to adapt according to the changing environment. Their genome has a large role in developing this ability extending up to genetic level for example, the bacterial species Escherichia coli contains approximately 5,000 genes. On average, about one in every 200 bacteria is likely to have a mutation in at least one of the genes.

Q3. What are the extreme conditions Archaea called?

Ans. ***ARCHAEA:***

Archaea is a very diverse group in a domain system of classification They were initially classified as Archaebacteria but this classification is obsolete now they are a separate domain.

Shapes of archaea:

They are present in different shapes like spherical, rod, lobed, square etc. their diameter ranging 0.1 to over 15um.

Archaea and Bacteria:

Archaea are slightly different from bacteria. They don't have peptidoglycan in their cell wall as it is present in bacteria and also some metabolic activities are different from bacteria.

Reproduction of archaea:

Archaea reproduce asexually by binary fission, fragmentation or budding.

Extreme Condition:

Archaea can live in different habitats of extreme condition and classified accordingly like those living in hot springs called thermophiles, high acidic conditions dwellers called acidophiles and methanogens art found in marshy areas and in gut produces biogas to obtain energy another group includes halophiles that live in high salt concentration environment as they require high salt for their growth.

Although they are almost similar to bacteria in shape and size but genetically, they also have some affinity with eukaryotes like they have genes that produce enzymes particularly polymerase used in metabolic activities during translation and transcription as present in eukaryotic organisms.

Archeal Membrane:

Archeal membrane composition is different from bacterial membranes marking a unique character. They have hydrocarbons attached to glycerol by ether linkage rather than ester linkages this combination is also called archaeol specially in methanogens while in bacterial membrane glycerol ester lipids are present. Example Methanococcus, Halobacterium

Uses Of Archaea:

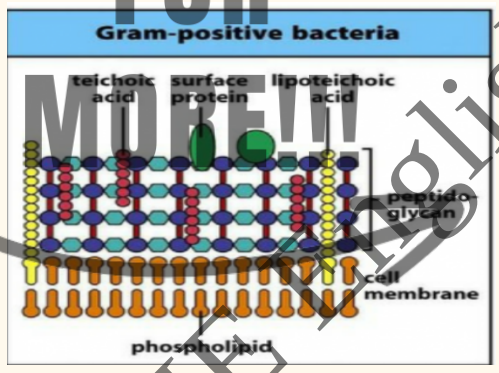
They do not live as pathogens or parasites instead they develop useful associations with others as mutualists or commensals

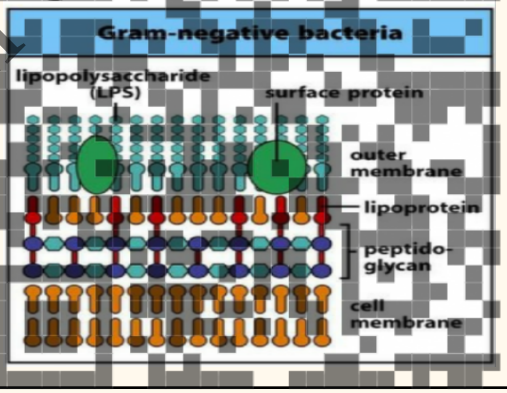
for example methanogenic archaea They do not live as pathogens or parasites instead they develop useful associations with others as mutualists or commensals for example methanogenic archaea E.coli live in human intestine and helps in digestions marine archean Cenarchaeum symbiosum lives within sponge Anel mexicana as symbiont, some thermophilic archaea used in biotechnology due to their endurance of high temperature. EColi lives in the human intestine and helps in digestion marine archean Cenarchaeum symbiosum lives within sponge Anel mexicana as symbiont, some thermophilic archaea used in biotechnology due to their endurance of high temperature.

Q4. Differentiate between gram-positive and gram-negative bacteria.

Ans:

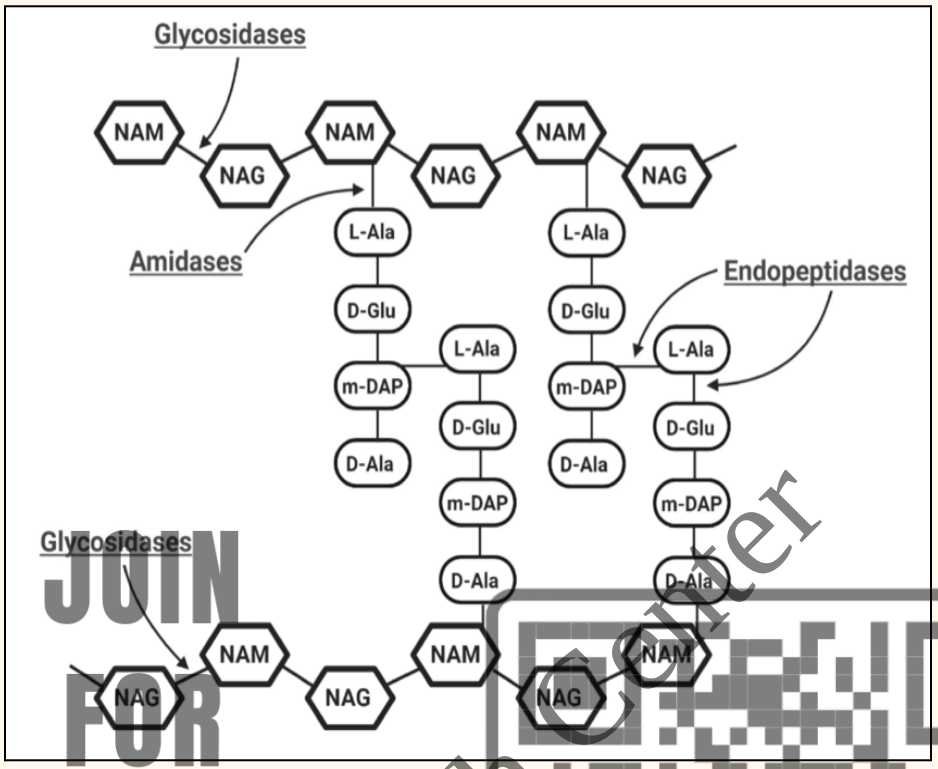
Gram-Positive bacteria	Gram-Negative bacteria
• A single-layered, smooth cell wall • The thickness of the cell wall is 20 to 80 nanometres. • It is a thick layer/ also can be multilayered • Presence of teichoic acids • The outer membrane is absent • Porins is Absent • Mesosome is more prominent. • Cocci or spore-forming rods	• A double-layered, wavy cell-wall • The thickness of the cell wall is 8 to 10 nanometres • It is a thin layer often single-layered. • Absence of teichoic acids • The outer membrane is present (mostly) • Porins • Occurs in Outer Membrane • Mesosome is less prominent. • Non-spore forming rods.





Q5. Give the structure of peptidoglycan of bacterial cell walls?

Ans. The peptidoglycan (murein) sacculus is a unique and essential structural element in the cell wall of most bacteria. Made of glycan strands cross-linked by short peptides, the sacculus forms a closed, bag-shaped structure surrounding the cytoplasmic membrane. There is a high diversity in the composition and sequence of the peptides in the peptidoglycan from different species. Furthermore, in several species examined, the fine structure of the peptidoglycan significantly varies with the growth conditions. Limited number of biophysical data on the thickness, elasticity and porosity of peptidoglycan are available. The different models for the architecture of peptidoglycan are discussed with respect to structural and physical parameters.



Q6. Differentiate between transformation and transduction in bacteria?

Ans. ***Transformation:***

Fred Griffith, a medical officer in the British Ministry of Health in London, discovered the process of transformation in 1928. It is the mechanism by which bacteria uptake DNA fragments from the environment and incorporate it into their chromosomes. After a successful transformation, the recipient cell (transformant) gains some characteristics which were not present previously within it. In prokaryotes like bacteria, transformation occurs regularly when the cells exist in great numbers, such as in the human intestinal tract or in rich soil.

In order to carry out a successful transformation, the bacterium should be competent enough. Thus, the transformation or the ability of a cell to uptake extracellular DNA from the environment depends on the competence of the bacterium. The competence depends on variable properties among bacterial species. Transformation can be done artificially; sometimes it even occurs naturally. If it occurs naturally, it increases the potential of causing disease more often.

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environment depends on the competence of the bacterium. The competence depends on variable properties among bacterial species. Transformation can be done artificially; sometimes it even occurs naturally. If it occurs naturally, it increases the potential of causing disease more often.

Transduction

Unlike transformation, transduction requires a virus as an agent to carry DNA fragments from donor to recipient cell. These viruses are bacteria-infecting viruses or bacteriophages. Like all viruses, these bacteriophages have a core of DNA or RNA surrounded by a coat of protein. Bacteriophages attach to the surface receptors of the bacteria and directly inject the viral DNA into the bacteria. Transduction happens in two ways: lytic cycle or lysogenic cycle. In the lytic cycle, the viral phage penetrates a host cell, destroys the host's chromosome and replicates itself within the host cell. In the end, these phages destroy (lyse) the same host cell; hence, we call them virulent phages. Unlike in the lytic cycle, the direct lysis of the bacterial cell does not occur in the lysogenic cycle. In the lysogenic cycle, phage DNA integrates with the host chromosome as a prophage. After integration, the host cell undergoes DNA replication and binary fission, resulting in copies of the host cell with prophages. Finally, these prophages will excuse themselves from hosts' chromosomes and go to the lytic cycle.

Q7.Why are bacteria called recycling agents in nature?

Ans. The numerous species of bacteria that help to recycle nutrients are known as decomposers. These microscopic, single-celled creatures sustain life on Earth by decomposing dead organisms so that their nutrients are returned to the ecosystem in a form that can be utilized by future generations.

Q8. How bacteria increase soil fertility? Give an example?

Ans. Bacteria helps in fixing atmospheric nitrogen and increases the nitrogen available for the plants. Bacteria decompose the decaying matter and increase the nutrient content. They also help in improving the texture and quality of the soil.

Example: Rhizobium is an example of a symbiotic bacterium that attaches to the roots of leguminous plants and it increases soil fertility by converting atmospheric nitrogen into organic compounds.

Q9.How cholera and typhoid spread in human population bacteria?

Ans. ***Cholera:***

Its transmission is closely linked to inadequate access to clean water and sanitation facilities. Typical at-risk areas include peri-urban slums, and camps for water and sanitation are not met.

internally displaced persons or refugees, where minimum requirements of clean water and sanitation are not met.

Typhoid:

These diseases are spread through sewage contamination of food or water and Through person-to-person contact.

Human Population Bacteria:

We humans have an exceptional age structure compared to other animals: Our children remain dependent on their parents for an unusually long period and our elderly live an extremely long time after they have stopped procreating.

Could the microscopic fellow travelers that consider the human body to be their home-collectively known as the microbiome - have played an active role in shaping and maintaining this unusual aspect of human nature?

That is the speculative proposition advanced by Martin Blaser, professor of medicine and microbiology at NYU's Langone Medical Center, and supported by mathematical models produced by Glenn Webb, professor of mathematics at Vanderbilt University. They present their argument in a paper titled, "Host demise as a beneficial function of indigenous microbiota in human hosts," published online today in mBio, the journal of the American Society for Microbiology.

Q10. What do we mean by normal flora of bacteria?

Ans. ***THE BACTERIAL FLORA OF HUMANS:***

The human body is not sterile, we become colonized by bacteria from the moment we are born. We are covered with, and contained within our intestines. approximately one hundred trillion bacteria that form the normal flora of our bodies. This normal flora helps to prevent us becoming colonized with more dangerous bacteria, which might lead to infection.

The normal flora:

Normal flora are the microorganisms that live on another living organism (human or animal) or inanimate object without causing disease. In a healthy animal, the internal tissues, e.g. blood, brain, muscle, etc., are normally free of microorganisms. However, the surface tissues, Le, skin and mucous membranes, are constantly in contact with environmental organisms and become readily colonized by various microbial species. The mixture of organisms regularly found at any anatomical site is referred to as the normal flora. The normal flora of humans consists of a few

eukaryotic fungi and protists, but bacteria are the most numerous and obvious microbial components of the normal flora.

Significance of the normal flora:

These normal floras provide us with many benefits. They prevent colonization by pathogens by competing for attachment & nutrients. They stimulate production of antibodies. Since the normal flora behave as antigens in an animal, they induce low levels of antibodies that cross react with similar antigens on pathogens, preventing infection or invasion. In the large intestine some synthesize vitamins that are absorbed as nutrients by the host (eg, vitamin K & B12). Some bacteria produce substances that inhibit pathogenic species.

Q11. List down the physical and chemical methods to control?

Ans. ***CONTROL OF HARMFUL BACTERIA:***

The chemical and physical methods used to control harmful bacteria.

Chemical methods to control harmful bacteria:

Bacterial harmful activities can be controlled by certain chemicals married as disinfectants, antiseptics, antibiotics, and antimicrobial chemicals.

1) ***Sterilization***:

Is the process of destroying all living organisms and viruses.

2) Disinfection:

Disinfection is the elimination of microorganisms, but not necessarily endospores, from inanimate objects or surfaces. An ideal disinfectant or antiseptic (chemical agent) kills microorganisms in the shortest possible time without damaging the material treated. There are different chemical that are used as disinfectant some are as follows:

Phenol: One of the first chemicals to be used for disinfection was phenol. First used by Joseph Lister in the 1860s, it is the standard for most other antiseptics and disinfectants.

Halogens: Among the halogen antiseptics and disinfectants are chlorine and iodine.

Heavy metals: A number of heavy metals have antimicrobial ability.

For example, silver is used as silver nitrate in the eyes of newborns to guard against infection by Neisseria gonorrhoeae.

Soaps and detergents: Soaps and detergents decrease the surface tension between microorganisms and surfaces, and thereby help cleanse the surface.

Aldehydes :Two aldehydes, formaldehyde and glutaraldehyde, inactivate microbial proteins by crosslinking the functional groups in the proteins.

Ethylene oxide: Sterilization can be achieved with a chemical known as ethylene oxide (ETO). This chemical denatures proteins and destroys all microorganisms, including bacterial spores.

Oxidizing agents: Oxidizing agents such as hydrogen peroxide kill microorganisms by releasing large amounts of oxygen, which contributes to the alteration of microbial enzymes.

Food preservatives: Foods can be preserved by using a number of organic acids to maintain a low microbial population. Benzoic acid, Sorbic acid etc.

Physical methods to control harmful bacteria:

Bolling: 100 C denatures proteins and alters bacteria ex. Cooking.

Dry-heat oven: 170 °C for 2 hours, denature proteins and alters membranes. Incineration: Exposure to flame or destroy bacteria by burning.

Autoclave: Heating at very high temperatures like 121 °C for 15-40 minutes at 15 psi, denature proteins and alter membranes.

Pasteurization: 72 °C for 15 seconds 138 °C for 2 seconds (UHT), Denatures proteins and alters membranes it prevents spoilage of milk, apple pie, honey, and other ingestible liquids Refrigeration: Temperature 0 °C to 7 °C, Inhibits metabolism, Preservation of food or laboratory materials.

Freezing: Below -2 °C, stops metabolism, may kill microbes, Long-term storage of food, laboratory cultures, or medical specimens.

High-pressure processing: Exposure to pressures of 100-800 MPa, denatures proteins and can cause cell lysis, Preservation of food Hyperbaric oxygen *therapy*: Inhalation of pure oxygen at a pressure of 1-3 am, Inhibits metabolism and growth of anaerobic microbes, Treatment of certain infections (e.g., gas gangrene).

Chapter #07	*Protoctistsa and Fungi*	*Zoology + Botany*

INTRODUCTION OF PROTOCTISTA AND FUNGI:

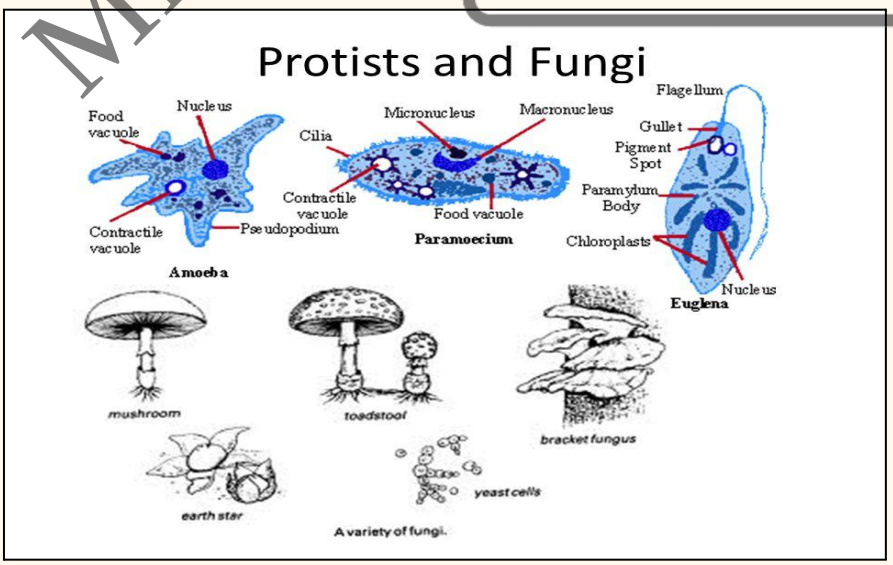
Protoctistsa:

Protists are simple eukaryotic organisms that are neither plants nor animals or fungi. Protists are unicellular in nature but can also be found as a colony of cells. Most protists live in water, damp terrestrial environments or even as parasites. The term 'Protista' is derived from the Greek word "protistas", meaning "the very first". These organisms are usually unicellular and the cell of these organisms contains a nucleus which is bound to the organelles. Some of them even possess structures that aid locomotion like flagella or cilia.

Fungi:

Fungi are eukaryotic organisms that include microorganisms such as yeasts, molds and mushrooms. These organisms are classified under kingdom fungi. The organisms found in Kingdom fungi contain a cell wall and are omnipresent. They are classified as heterotrophs among the living organisms.

To name a few – the appearance of black spots on bread left outside for some days, the mushrooms and the yeast cells, which are commonly used for the production of beer and bread are also fungi. They are also found in most skin infections and other fungal diseases. If we observe carefully, all the examples that we cited involve moist conditions. Thus, we can say that fungi usually grow in places which are moist and warm enough to support them.



Encircle the correct choice

(i) Which of the following is true about the Kingdom Protoctista

(a) All organisms are prokaryotes
(b) All organisms are eukaryotes ✓
(c) All organisms are autotrophic
(d) All organisms are heterotrophic

(ii) All members of green algae have the pigment combination

(a) Chlorophylls a and b ✓
(b) Chlorophylls a and c
(c) Chlorophyll a and Phycobilins
(d) Chlorophylls a, b and c

(iii) The major grouping of protozoa is based upon their

(a) Feeding habits
(b) Mode of reproduction
(c) Mode of Nutrition
(d) Mode of locomotion ✓

(iv) Protoctista having isomorphic alternation of generation

(a) Chlorella
(b) Ulva ✓
(c) Euglena
(d) Phytophthora

(v) The amoeboid stage of slime mold is

(a) Plasmodium ✓
(b) Fruiting bodies
(c) Euglena
(d) Merozoites

(vi) Trypanosomes and Leishmania are disease causing

(a) Viruses ✓
(b) Bacteria
(c) Protoctists
(d) Fungi

(vii) Ulva is commonly called

(a) Bacteria
(b) Virus
(c) Mushroom
(d) Sea lettuce ✓

(viii) The study of fungi is called

(a) Zoology
(b) Microbiology
(c) Botany
(d) Mycology ✓

(ix) The most important cellulose degraders in ecosystem are

(a) Ascomycota
(b) Zygomycota
(c) Basidiomycota ✓
(d) Deuteromycota

Shorts Question Answer

Q1. Why is the kingdom Protoctista considered to be an artificial taxon

Ans. The protists are a category of miscellaneous eukaryotes, not closely related to each other and not sharing many characteristics, but not fitting any other kingdom of life. Hence, protista is an artificial grouping of organisms.

Q2. Why do we say that ulva has isomorphic alternation of generation?

Ans. In ulva the haploid zoospores give rise to the gametophytes. Both kinds of plants are morphologically identical and therefore ulva shows an isomorphic alternation of generations.

Q3. Why asexual and sexual ulva plants called sporophyte and gametophyte?

Ans. Asexual reproduction takes place by the formation of quadri-flagellate zoospores in the diploid asexual plant or the sporophyte which is morphologically similar to the gametophyte. Therefore, the alternating generations of the life-cycle of U show that an asexual plant is diploid.

Q4. Protoctista are the link between prokaryotes and the more modern Eukaryotic- like plants and animals explain why?

Ans. Protista forms a link between prokaryotes and eukaryotes as it contains single celled organisms like that of prokaryotes but are actually eukaryotes.

Q5. Name various classes of Protozoa and how each moves?

Ans. Protozoa are unicellular, eukaryotic, heterotrophic organisms. They are either free-living or parasites. s. They lack a cell wall. There are many different cell organelles that perform various tasks performed by different organs in higher animals, e.g. mouth, anus, intestinal tract, etc. There are many protozoa that cause various diseases in animals and humans, e.g. Plasmodium (malarial parasite), Trypanosoma (sleeping sickness), Trichomonas (trichomoniasis), etc. The cyst stage is dormant and resistant to environmental stress, the trophozoite stage is reproductive and causes disease

Q6.Describe some of the unusual features of nuclear behavior in fungi?

Ans. A characteristic feature of fungal hypha is the presence of a large number of nuclei in a common cytoplasmic environment. Where it has been examined, the coenocytic mycelium is commonly heterokaryotic. The nuclei cooperate, compete or combat.

Q7. What features allow fungi to survive in all environments where life is possible

Ans. Like plant cells, fungal cells have a thick cell wall, but in fungi, it is made of complex polysaccharides called chitin and glucans. Chitin, also found in the exoskeleton of insects, gives structural strength to the cell walls of fungi. The wall protects the cell from desiccation ('drying out') and predators.

Detailed Question Answer

Q1. Write down general characteristics of Protoctista and diversity among Protoctista?

Ans. The Kingdom Protista consists of eukaryotic protists. Members of this very diverse kingdom are typically unicellular and less complex in structure than other eukaryotes. In a superficial sense, these organisms are often described based on their similarities to the other groups of eukaryotes: animals, plants, and fungi.

Characteristics of Kingdom Protista:

The primary feature of all protists is that they are eukaryotic organisms. This means that they have a membrane-enclosed nucleus. Other characteristic features of Kingdom Protista are as follows:

1. These are usually aquatic, present in the soil or in areas with moisture.

2. Most protist species are unicellular organisms, however, there are a few multicellular protists such as kelp. Some species of kelp grow so large that they exceed over 100 feet in height. (Giant Kelp).

3. Just like any other eukaryote, the cells of these species have a nucleus and membrane-bound organelles.

4. They may be autotrophic or heterotrophic in nature. An autotrophic organism can create its own food and survive. A heterotrophic organism, on the other hand, has to derive nutrition from other organisms such as plants or animals to survive.

5. Symbiosis is observed in the members of this class. For instance, kelp (seaweed) is a multicellular protist that provides otters protection from predators amidst its thick kelp. In turn, the otters eat sea urchins that tend to feed on kelp.

6. Parasitism is also observed in protists. Species such as Trypanosoma protozoa can cause sleeping sickness in humans.

7. Protists exhibit locomotion through cilia and flagella. A few organisms belonging to the kingdom Protista have pseudopodia that help them to move.

8. Protista reproduces by asexual means. The sexual method of reproduction is extremely rare and occurs only during times of stress.

Q2. Describe structure and reproduction in Ulva?

Ans. It is a type genus of the family Ulvaceae; green seaweed having a thallus s cells thick: sea lettuce Ulva (Ulvales)is essentially a marine alga generally found on rocky shores where it occurs attached to stones, rocks, etc. Some species Ulva are also found in brackish water and polluted estuaries. It is associated with various other algal species such as Cladophora.

Asexual reproduction:

Asexual reproduction takes place by means of quadriflagellate zoospores. The zoospores are formed in ordinary Thallus Undulate- margin Holdlast usually grows ivegetative cell by the dividing up of protoplast. The divided parts of the protoplast metamorphose into zoospores, which liberate through an opening in the cell wall. The contents of any ordinary cell produce 4-8 zoospores. The zoospores are formed at first in the cells near the margin, later they are formed in other cells too which are always from the margin. The formation of zoospores continues until all the cells are used and nothing remains of the thallus but a filmy mass of empty cell wall. The liberation of zoospores takes place at the time when the thalli are reflooded by incoming tides and usually during morning tides. Sometimes the zoospores are liberated in large quantities and they color the water green. After swimming for an hour or so, a zoospore comes to rest on some substratum withdraws, its flagella and secretes a wall around it. Soon after, it divides by a transverse wall giving rise to two cells The lower cell develops into a rhizoidal holdfast and the upper into the blade.on of perennial holdfast.

Sexual reproduction:

The zoospores develop into sexual plants which produce gametes. The biflagellate gametes are produced at the margin of a thallus in a zone 5 to 15mm broad, of different colours from vegetative portion and a zone in which every cel forms gametes. The gametes are formed by repeated bipartition of the protoplast of a cell. The first cleavage is always parallel to the thallus surface and the second vertical to the first. Cleavage continues until 32 to 64 daughter protoplasts are formed. Each daughter protoplast metamorphoses into biflagellate gamete. Just before the cleavage of the protoplast each cell develops a beak-like outgrowth as its outer face and it expands to the thallus surface. They are piriform inshape with a single chloroplast and an eyespot. The gametophytes liberate gametes at the beginning of each series of offspring.

Q3. Give diagnostic features of four classes of fungi?

Ans. Fungi are usually classified in four divisions: the Chytridiomycota (chytrids), Zygomycota (bread molds), Ascomycota (yeasts and sac fungi), and the Basidiomycota (club fungi). Placement into a division is based on the way in which the fungus reproduces sexually.

Based on Mode of nutrition:

On the basis of nutrition, kingdom fungi can be classified into 3 groups.

Saprophytic - The fungi obtain their nutrition by feeding on dead organic substances. Examples: Rhizopus, Penicillium and Aspergillus.

Parasitic - The fungi obtain their nutrition by living on other living organisms (plants or animals) and absorb nutrients from their host. Examples: Taphrina and Parasitic Puccinia.

Symbiotic-These fungi live by having an interdependent relationship with other Lichens are the symbiotic association between algae and fungi. Here both algae species in which both are mutually benefited. Examples: Lichens and mycorrhiza and fungi are mutually beneficial as fungi provide shelter for algae and in reverse present between fungi and plants. Fungi improve nutrient uptake by plants, algae synthesis carbohydrates for fungi. Mycorrhiza is the symbiotic association whereas plants provide organic molecules like sugar to the fungus.

Based on Spore Formation:

Kingdom Fungi are classified into the following based on the formation of spores:

Zygomycetes - These are formed by the fusion of two different cells. The sexual spores are known as zygospores, while the asexual spores are known as sporangiospores. The hyphae are without the septa. Example - Mucor.

Ascomycetes - They are also called sac fungi. They can be coprophilous, decomposers, parasitic or saprophytic. The sexual spores are called ascospores. Asexual reproduction occurs by conidiospores. Example - Saccharomyces.

Basidiomycetes - Mushrooms are the most commonly found basidiomycetes and mostly live as parasites. Sexual reproduction occurs by basidiospores. Asexual reproduction occurs by conidia, budding or fragmentation. Example- Agaricus.

Q4. Write an essay on the economic importance of fungi?

Ans. **Importance in Human Life:**

Fungi are very important to humans at many levels. They are an important part the nutrient cycle in the ecosystem. They also act as pesticides.

Biological Insecticides:

Fungi are animal pathogens. Thus they help in controlling the population pests. These fungi do not infect plants and animals. They attack specifically some insects. The fungus Beauveria bassiana is a pesticide that is being teste to control the spread of emerald ash borer.

Reusing:

These microbes along with bacteria bring about recycling of matter decomposing dead matter of plants and excreta of animals in the soil, hence the reuse enriches the soil to make it fertile. The

absence of activities of fungi can have an adverse effect on this on-going process by continuous assembly and piling of debris.

Importance in Medicine:

- Metabolites of fungi are of great commercial importance.
- Antibiotics are the substances produced by fungi, useful for the treatment of diseases caused by pathogens. Antibiotics produced by actinomycetes and molds inhibits the growth of other microbes.
- Apart from curing diseases, antibiotics are also used on animals for speedy growth and to improve meat quality. Antibiotics are used to preserve freshly produced meat for longer durations.
- Penicillin is a widely used antibiotic, lethal for the survival of microbes. The reason it is extensively used is since it has no effect on human cells but kills gram-positive bacteria.

Chapter #08	*Diversity among plants*	*Botany*

INTRODUCTION OF DIVERSITY AMONG PLANTS:

All plants are multicellular eukaryotes that are photosynthetic autotrophs er, not all organisms with these characteristics are plants; such characteristics apply to son algae. Plant cells have walls made mostly of cellulose, and plants their surplus carbohydrate in the form of starch Plants share even more chloroplasts of both green algae and plants contain chlorophyll bas an accessory racteristics with their closest algal relatives, the green algae. For example, the photosynthetic pigment. (All photosynthetic eukaryotes, remember, use chlorophyll as the pigment directly involved in conversion of light energy to chemical energy!

So, how do we distinguish plants from multicellular algae? First, plants as we are defining them are nearly all terrestrial organisms, although some plants, such as water lilies, have returned secondarily to water during their evolution Living on land poses very different problems from living in water, and it is a set of ructural, chemical and reproductive adaptations for terrestrial living that distinguishes plants from algae.

In terrestrial habitats, the resources a photosynthetic organism needs are found in two very different places: Light and carbon dioxide are mainly available above the ground, while water and mineral nutrients are found mainly in the soil Thus the complex bodies of plants show varying degrees of structural specialization mto subterranean and aertal organs-roots and leaf-bearing shoots, respectively. In most plants, exchange of carbon dioxide and oxygen between the atmosphere and the photosynthetic interior of leaves occurs via stomata, microscopic pores through the surfaces of leaves.

Terrestrial adaptations of plant structure are complemented by chemical adaptations. For example, aerial parts of most plants, such as leaves, have a waxy coating called a cuticle, which helps to prevent excessive water loss, a major problem on land.

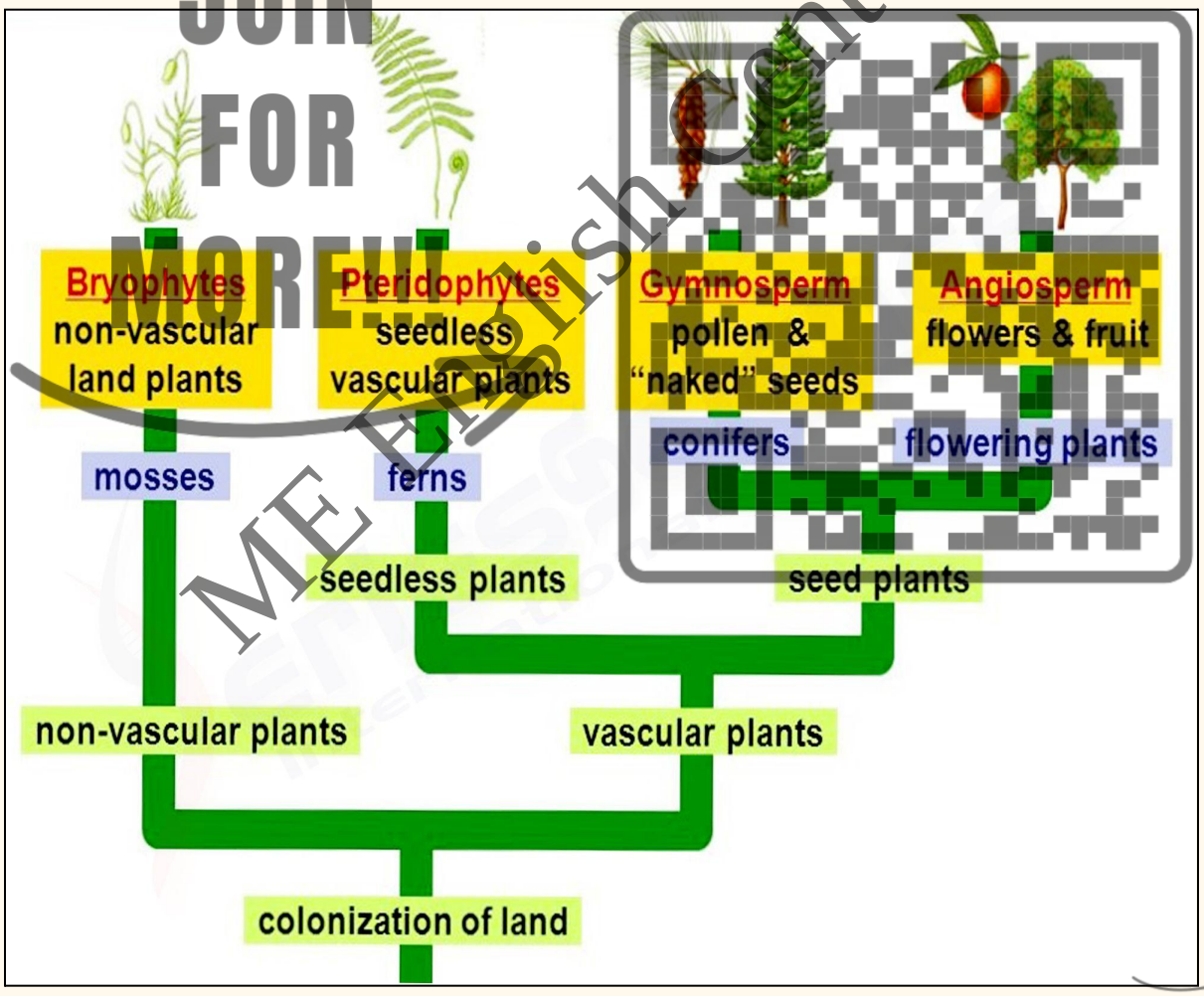
Plants are multicellular photosynthesizers that are adapted to living on land All plants protect their embryos from desiccation

The waxes of the cuticle are examples of secondary products, so named because they are not produced by the primary, mainstream metabolic pathways common to all plants.

Another example of secondary products as terrestrial adaptations is lignin the substance that hardens the cell walls of "woody tissues in many plants.

A secondary product particularly important in the evolutionary move of plants onto land was sporopollenin, a polymer that is resistant to almost all kinds of environmental damage. In fact, the fossil record of plants is due mainly to the durability of sporopollenin, lignin, and the materials of cuticles. The move onto land paralleled a new mode of reproduction. In contrast to p environment in which algae reproduce, gametes now had to be dispersed in a n aquatic

environment, and embryos, like mature body structures, had to be protected Chapter-8 179 against desiccation.



Encircle the correct choice

(i)) The rapid diversification of plants occurred in the period:

(a) Silurian
(b) Devonian ✓
(c) Carboniferous
(d) Paleozoic

(ii) Spores of land plants tough, flexible and resistant to biodegradation by :

(a) Lignin
(b) Chitin
(c) Waxes
(d) Sporopollenin ✓

(iii) Hepaticae, Anthocerotae and Moss are the classes of:

(a) Angiosperms
(b) Gymnosperms
(c) Tracheophytes
(d) Bryophytes ✓

(iv) The most successful kind of reproduction is:

(a) Heterogamy ✓
(b) Oogamy
(c) Anisogamy
(d) Isogamy

(v) The dominant generation of living vascular plants existing as free- living plants is:

(a) Sporophyte ✓
(b) Gametophyte
(c) Tracheophyte
(d) Pteridophyte

(vi) The most primitive living vascular plants is:

(a) Lycophyta
(b) Sphenophyta ✓

(c) Psilophyta
(d) Filicinophyta

(vii) The gametophyte of Fern is called:

(a) Archegonium
(b) Antheridium
(c) Cones
(d) Prothallus ✓

(viii) Double fertilization is the characteristic feature of:

(a) Bryophytes
(b) Gymnosperms
(c) Angiosperms ✓
(d) Ferns

(ix) Resins, turpentine and pine oil are obtained from:

(a) Rose
(b) Onion
(c) Pins ✓
(d) Banana

(x) In banana tree, flowers are covered over by one or many large brackets called:

(a) Spathes ✓
(b) Spadix
(c) Capitulum
(d) Palea

Short Question Answer

Q1. How does the life cycle of plants show alternation of generations?

Ans. Plants alternate between the diploid sporophyte and haploid gametophyte, and between asexual and sexual reproduction. Therefore, the life cycle is known as alternation of generations. The ability of the plants to reproduce sexually and asexually helps them to adapt to different environments.

02. Why are bryophytes called non vascular plants?

Ans. They lack true roots, stems, or leaves. They are called non-vascular plants because of the absence of vascular tissues (xylem and phloem) that function for the conduction of food, water, and minerals.

A. Non-vascular cryptogams:

Gymnosperms

B. Vascular cryptogams:

Pteridophytes

C. Phanerogams:

Algae, bryophytes

Q3.How do plants cope when they invade the land from the sea?

Ans. Plants evolved from living in water to habiting land because of genes they took up from bacteria, according to a new study which establishes how the first step of large organisms colonizing the land took place.

Q4. Why heterogamy is important for plants?

Ans. ***A Benefit of Heterogamy:***

Labeling Meiotically Produced Cells to Harness Variation While Enhancin Heterogeneity. Heterogametes in animals and plants generally display morphological differences, i.e., small sperm and large egg cells in comparison with their progenitor meiotic cells.

Q5. Why is a flower called a reproductive part of a plant?

Flowers are called reproductive structures of plants as they contain both male and female parts which reproduce to produce pollen grains and eggs. Each of them fertilizes a produced embryo which eventually produces a new plant.

Q6. Why is fertilization in angiosperms called double fertilization?

Ans: ***Double Fertilization in Angiosperms***

Pollination helps the pollen grains to reach stigma via style. The two sperm cells enter the ovule-synergid cell. This proceeds to fertilization. In angiosperms, fertilization results in two structures, namely, zygote and endosperm, hence the name "double fertilization."

Q7. How seeds evolved?

Ans: In seed plants the male gametophyte (microgametophyte) is hidden in the pollen grain ("Pollenkorn"), and the female gametophyte (megagametophyte) is hidden in the ovule ("Samenanlage"), after pollination and fertilization the ovule develops into the seed.

Q8.Why gymnosperms have naked seeds but not angiosperms?

Ans. Basically gymnosperms are in an evolutionary status where there is no development of fruits. So seeds remain naked.

Detailed Question Answer

Q1.Define plants. Discuss evolutionary relations in plants?

Ans. Plants are multicellular eukaryotes with Photosynthetic nutrition. Cells typically have cellulose walls, sap vacuole, plastid pigments which always Include chlorophyll a.

Evolution and Classification:

The organisms we call plants are assigned to a single clade; that is, a natural grouping based on the belief that they have all evolved from a common ancestor more recent than any shared with other organisms. Among the criteria for doing this are:

- Their shared use of the photosynthetic pigments chlorophyll a and chlorophyll b

- The similarities in the nucleotide sequences of the genes encoding both their small subunit (18S) and large subunit (25S) ribosomal RNA
- Their shared cellulose cell wall

Although the earliest vascular plants were relatively small an, probably, confined to swampy areas, after that a rapid diversification c lasts occurred gradually "Plants may be defined as multicellular eukaryotes that are photosynthetic autotrophs (chlorophyllous) with cell wall primarily made a cellulose, exhibiting heteromorphic alternation of generation and zygote develops into embryo".

Q2. Write down general characteristics of plants?

Ans. **General Characteristics of Plants:**

- Plants are multicellular eukaryotes.
- They are Photosynthetic autotrophs and contain photosynthetic pigments specially chlorophyll, which enable the plants to corn' light energy into food (chemical energy).
- Rigid cell wall of plant cells primarily made up of cellulose.
- Life cycle of show heteromorphic alternation of generation.
- Zygote retained and develops into embryo
- They are multicellular eukaryotes.
- They have a specialized reproductive organ.
- They produce food through photosynthesis.
- Life is not possible without plants.

Q3. Describe the life cycle of Moss with a diagram?

Ans. The female and male gametophyte produce haploid gametes, which fuse to form a zygote and give rise to the diploid sporophyte. The diploid sporophyte then produces haploid spores, germinating to the haploid gametophyte.

- ***Gametophyte***

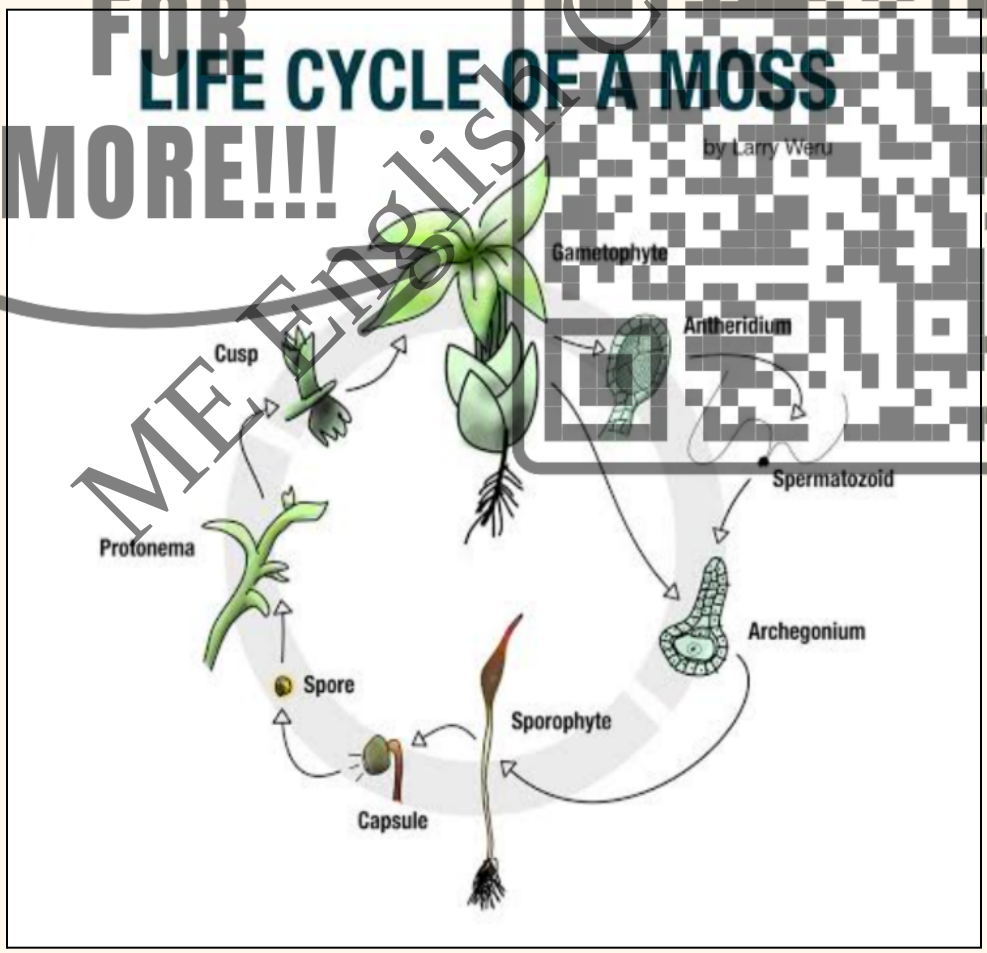
In structure, the gametophyte is distinguished into protonema and leafy stages, forming the male and female sex organs at their tips. The female sex organs are known as archegonia. It functions by producing the ovum or female gamete and is protected by perichaetium modified leaves. The archegonia resembles the shape of a bottle container. The male sex organ is known as antheridia. The antheridia are tiny, stalked and resemble a club-shaped structure. It functions by producing male gametes and is protected by modified leaves known as perigonium.

The antheridium mature to release antherozoids, which are biflagellate in structure. They swim in the water and fertilize with the egg of the archegonium.

The formation of the diploid zygote leads to the second life phase of mosses, the sporophyte. The archegonium divides to form calyptra, which acts as a protective structure for the capsule in the sporophyte.

- ***Sporophyte***

The diploid zygote develops into a diploid sporophyte. A sporophyte consists of, foot-long stalk called a seta, a capsule capped by the operculum. This parasite is dependent on food and water, which divides by mitosis. The capsule contains spore-producing cells which undergo meiosis to form haploid spores The capsule has teeth-like structures called peristomes, which prevent spores from falling off in wet conditions. When the conditions are favorable, the spores are ready to be dispersed, the operculum and peristome fall off, and the spores are scattered in the environment.



Q4. Why are vascular plants considered more successful land plants?

Ans. Vascular plants are successful due to better transportation for water, nutrients and reproduction. The xylem and phloem of the vascular bundles allow for distribution of water and food to all parts of the body. These structures allow vascular plants to colonize farther inland.

Vascular Plants as successful land Plants:

The vascular plants have evolved a number of adaptations to the terrestrial environment that have enabled them to invade all the most inhospitable land habitat. During this process they diverged sufficiently from one another. The four fundamental adaptations of vascular plants (with a few minor exceptions)make them more successful land plants.

1) A protective layer of sterile jacket cells around the gametangia.
2) Multicellular embryo retained within the archegonia.
3) Cuticles on the aerial parts to prevent evaporation of water.
4) Xylem for conduction of water and dissolved minerals as well as provides support.

Many other such adaptations, absent in the earliest vascular plants, appear in the most advanced members of the division.

Vascular Plants

Vascular plants are known as tracheophytes, which literally means "tube plants." The earliest vascular plants quickly came to dominate terrestrial ecosystems.

Vascular Tissues

The vascular tissues for which these plants are named are specialized to transport fluid. They consist of long, narrow cells arranged end-to-end, forming tubes. There are two different types of vascular tissues, called xylem and phloem.

Xylem is vascular tissue that transports water and dissolved minerals from roots to stems and leaves. This type of tissue consists of dead cells that lack end walls between adjacent cells. The side walls are thick and reinforced with lignin, which makes them stiff and waterproof.

Phloem is vascular tissue that transports food (sugar dissolved in water) from photosynthetic cells to other parts of the plant for growth or storage. This type of tissue consists of living cells that are separated by end walls with tiny perforations, or holes.

Q5. How do leaves evolve?

Ans. The leaf is the most important organ of a green plant because of its photosynthetic activity. There are two types of leaves in vascular plants.

(a) One veined leaf (microphyllous)

(b) Many veined leaf (megaphyllous)

It is very interesting to trace the origin of leaves in the green plants.

Evolution of One Veined Leaf:

Enation Theory: The evolution of one-veined leaf (microphyllous) can be explained by assuming that a thorn-like outgrowth (Enation) emerged on the surface of the naked stem. With an increase in size of the outgrowth, the vascular issues were also formed for the supply of water, food and support to the leaf.

Reduction Theory:

Another possibility is that a single veined leaf originated by a reduction in size of the part of the leafless branching system of the primitive vascular plant. This is how the leaf of lycopodium (club mosses) , an equisetum (horse tail) came into existence.

Webbed Theory: Many veined leaves (megaphyllous) originated much later. These forked branching system in the primitive of this isaf was the restriction of forked the next step at the evolution was filling the vascular issue.

Chapter #09	*Diversity among Animals*	*Zoology*

INTRODUCTION OF DIVERSITY AMONG ANIMALS:

In this chapter we trace the long evolutionary history of the animals, int and are several kinds of worms. These animals are important ecologically and we encounter the simplest members of this kingdom-sponges, jellyfish illustrate the advent of the major characteristics that are important in the advanced animal phyla. These characteristics include the development of tissues and organs, the use of internal digestion, the appearance of radial and then bilateral body organization and the appearance of internal body cavities.

Encircle the correct choice

(i) Choose the incorrect pair?

(a) Sponges → Spicules.
(b) Cnidaria → Nematocysts.
(c) Segmented worm → Pseudopodia. ✓
(d) Arthropoda → jointed legs.

(ii) Water movement through a sponge?

(a) Ostia → Spongocoel→ Osculum. ✓
(b) Spongocoel Osculum → Ostia.
(c) Ostia Osculum → Spongocoel.
(d) Osculum - Spongocoel → Ostia.

(iii) Choose the term which encompasses all other in the list

(a) Coelomate
(b) Protostome
(c) Bilateria
(d) Triploblastic ✓

(iv) Dry scaly skin, ectothermic, two pairs of legs, lungs, Internal Fertilization, eggs with amniotic shell, and a three chambered heart are all properties of which class?

(a) Amphibia
(b) Reptilia ✓
(c) Aves
(d) Mammals

(v) Pick the odd one out?

(a) Star fish.
(b) Brittle star. ✓
(c) Lamprey.
(d) Sea urchin.

(vi) Which of the following terms or structures is properly associated only with animals?

(a) Genes. ✓

(b) Cell wall.
(c) Autotrophy.
(d) Sexual reproduction.

(vii) An adult animal that possesses bilateral symmetry is most certainly also

(a) Triploblastic.
(b) Deuterostomes ✓
(c) Coelomate.
(d) Protostomes.

(viii) Protostome characteristics generally include which of the following?

(a) A Mouth that develops secondly and far away from the blastopore
(b) Radial body
(c) Radial cleavage. ✓
(d) Determinate cleavage

(ix) Sponges structural materials (spicules) are manufactured by the

(a) Pinacocytes.
(b) Choanocytes.
(c) Amoebocytes. ✓
(d) Porocytes

(x) Which of the following can be used to distinguish a nematode from annelids?

I. Type of body cavity

II. Number of muscle layers in the body wall

III. Presence of segmentation

IV. Number of embryonic tissue layers

(a) I only
(b) II only
(c) I and II
(d) I, II and III ✓

Short Question Answer

Q1. How are animals classified?

Ans. Animals are divided into two main groups. Animals that have a backbone are called vertebrates. Animals that don't have a backbone are invertebrates. Vertebrates and invertebrates are divided into smaller groups.

Q2. Why are sponges placed in the animal kingdom, when they lack tissue organization?

Ans. The sponges and the cnidarians represent the simplest of animals. Sponges appear to represent an early stage of multicellularity in the animal clade Although they have specialized cells for particular functions, they lack true tissues in which specialized cells are organized into functional groups

Q3. Why are flatworms named so?

Ans. Animals in the phylum Platyhelminthes are called flatworms because they are dorsoventrally flattened from head to tail.

Q4. Differentiate between invertebrate chordates and vertebrates?

Ans.

INVERTEBRATE CHORDATES	VERTEBRATES
• Chordates refer to an animal phylum that contains a notochord and a dorsally situated central nervous system • Consist of both primitive and advanced chordates • Possess a notochord at some point of their life • Invertebrate chordates do not have a vertebral column • Invertebrate chordates lack a cartilaginous or bony skeleton • Invertebrate chordates are limbless	• Vertebrates refer to a large group of animals which consist of a backbone • Consist of advanced chordates • Possess a notochord as well as a brain case • Have a vertebral column surrounding the nerve cord • Vertebrates possess a cartilaginous or bony skeleton • Vertebrate possess limbs or fins

Q5. Differentiate between cartilage fishes and bony fishes?

Ans:

CARTILAGINOUS FISHES	BONY FISHES
• Their endoskeleton is primarily made of cartilage. • Their exoskeleton is made of placoids. • The position of their tail is heterocercal. • They have 5 gills that are overly exposed (no operculum). • In them the fertilization is through internal mechanisms. • Eg- dogfish, electric ray torpedo and sharks.	• Their endoskeleton is entirely made of bone. • Their exoskeleton is made up of cycloids or thin bony plates. • Their tail fin is homocercal. • They have an operculum on either side of their gills. • They fertilize their eggs externally. • Eg-flying fish, globe fish and seahorses.

Q6. Why are protostomes named so?

Ans. The protostomes were so named because it used to be thought that in their embryos the dent formed the mouth while the anus was formed later, at the opening made by the other end of the gut.

Q7. Why are diploblastic animals different from triploblastic?

Ans. The key difference between diploblastic and triploblastic animals is that diploblastic animals produce two germ layers excluding mesoderm and triploblastic animals produce all three germ layers.

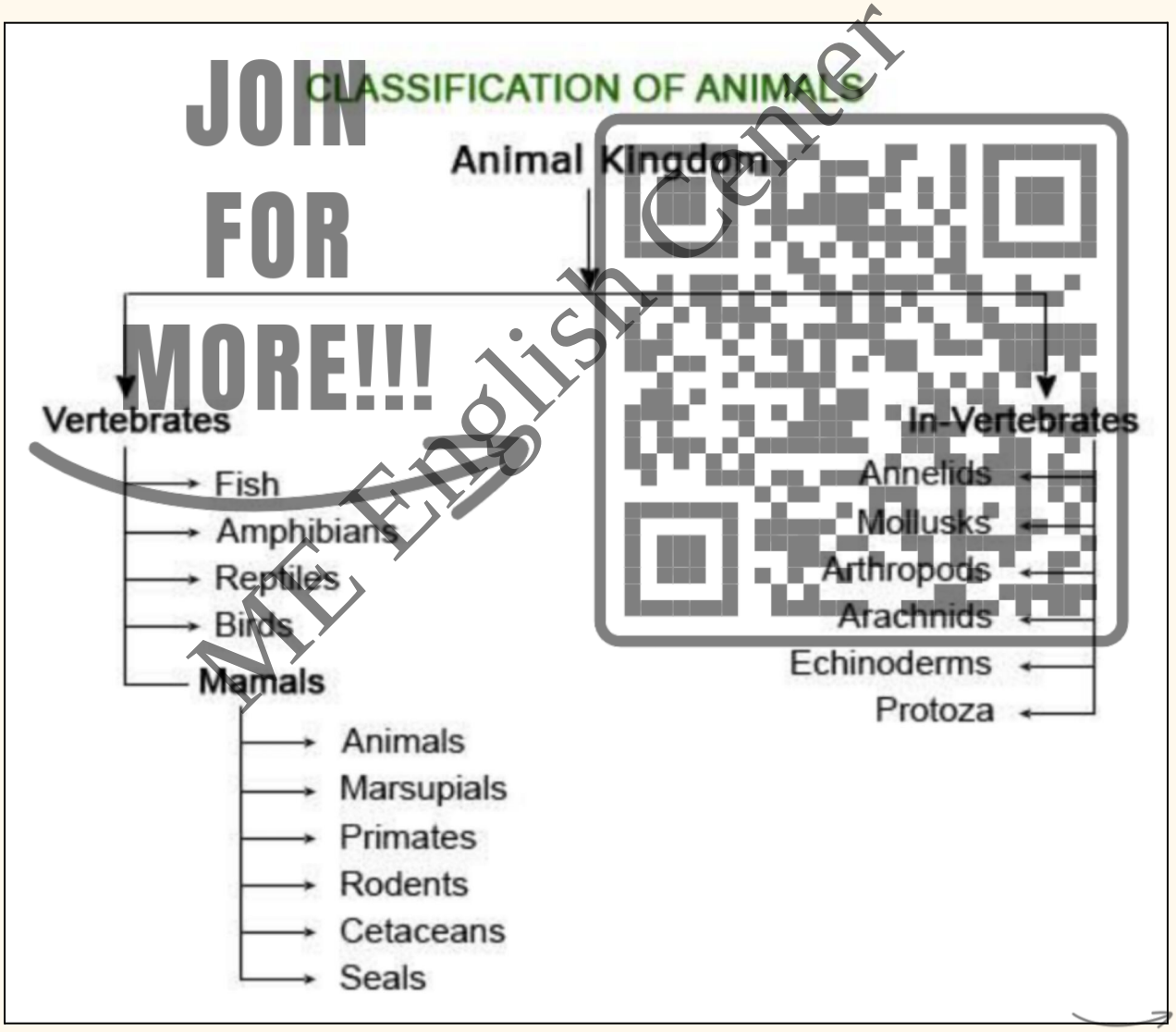
Q8. Why are echinoderms placed in bilateria When adults are symmetrical?

Ans. Echinoderms are a phylum of marine animals. There are 2 symmetries present in echinoderms. They have bilateral symmetry at the larval stage and in the adult stage they show radial symmetry. The adults in echinoderms are characterized by their radial symmetry like in starfish, sea urchins, sand dollars and sea cucumbers.

Long Questions Answer

Q1. Discuss the basic factors which help in classification of animals?

Ans. The kingdom animalia is divided into 33 groups called phyla. But we consider in depth only nine major phyla. These major phyla are porifera, Cnidaria, Platyhelminthes, Aschelminthes, Annelida, Mollusca, opodo, Echinodermata and chordata whereas rest of the groups are minor phyla. This classification or grouping of animals is called taxonomy or systematics. It is carried out primarily on the basis of their evolutionary relationships. Clues to these relationships are found in (1) Comparative morphology and (ii) internal architecture which includes presence and absence of tissues, number of tissue layers, symmetry and the embryological developmental pattern of their coelom and blastopore.



Q2.Write down evolutionary adaptations of phylum annelida?

Ans. These are supposed to have evolved from a primitive flat worm like ancestona the sea.

Digestion:

Tabular digestive system with both mouth and anus complete system.

Respiration:

Respiratory system is not found in diffusion is sufficient for gas exchange.

Transport:

Closed type circulatory system with blood confined to the heart and blood vessels.

Excretion:

Excretory organs are nephridia which are found in most system segments.

Nervous system:

Nervous system consists of a simple ganglionic brain in the head.

General characters of Phylum Annelida:

PHYLUM ANNELIDA (SEGMENTED WORMS)

Annelids are commonly called segmented worms, have the most complex body Structures among all the worms, they live on land, in moist soil, in freshwater or in sea. Many annelids are active free- swimming predators, some are equal filter feeder mud whereas leeches are ectoparasites, they are all triploblastic bilaterally symmetrical, coelomate and protostomes with an organ system level of body organization. Chitinous chaetae also called setae with or without parapodia are usually present in the most of annelids and help in locomotion Reproduction is usually sexually, most of annelids are hermaphrodite in few sexes an separate, development through trochophore larvae Common Annelids: Earthworm Neries,Leech

Q3. Write down the general characters of phylum arthropoda?

Ans. ***General characters of phylum Arthropoda:***

Arthropoda is the largest phylum of the animal kingdom, they are found everywhere on earth wherever the life is possible, even in the oil wells Arthropods are bilaterally symmetrical, triploblastic, coelomates and protostomes The diversity and success of arthropods are largely

related to heir segmentation hard exoskeleton, and jointed appendages. The body of arthropods is covered with an exoskeleton made up of protein and chitin.

The exoskeleton protects the animals and provides a point of attachment for the muscles that move the appendages. Sexes are usually separate and metamorphosis is a common occurrence. Common Arthropods: Scorpion, prawn, mosquito, honey bee and Housefly etc .

Q4.Describe the general characters of phylum Mollusca?

Ans. ***PHYLUM MOLLUSCA (SOFT BODIED)***

General characters of phylum Mollusca

1) Molluscs are soft bodied animals, but most are protected by hard shells made of calcium carbonate, slug, squids and octopus have reduced shell, most of which are internal, or they have lost their shell completely during evolution.
2) All the molluscs are triploblastic, bilaterally symmetrical, coelomates and protostomes with system grade of organ body organization.
3) All molluscs have a similar body plan with three main parts, Muscular foot usually used for movement, visceral mass containing most of the internal organs and a mantle, a fold of tissue that drapes over the visceral mass and secretes a shell.
4) Many molluscs feed by using a strap-like rasping organ called a radula to scrape food.
5) Reproduction is always sexual, some species have separate sexes and others are hermaphrodite
6) They all pass through a trochophore larvae stage.
7) Common Molluscs: Unio Octopus and pearl oyster.

Q5. What are mammals? Name its subclasses. Give the characters and examples of each subclass?

Ans. Animals belonging to class Mammalia are referred to as mammals. Mammals have vertebrae. They exhibit advanced characteristics which set them apart from all one of the most evolved species in the animal kingdom categorized under other animals. They are characterized by the presence of mammary glands through which they feed their younger ones.

Characteristics Of Mammals

Following are a list of distinct characteristics of mammals that separates them

from other classes:

1. Mammals are warm-blooded animals who give birth to their younger ones.

2. They are the most dominant form of animals found in almost all types of habitats

3. They have mammary glands that help them produce milk to feed their younger ones

4. Presence of region of the brain known as Neocortex

5. Their skin possesses oil glands (sebaceous glands) and sweat glands (sudoriferous glands).

6. The fur of hair throughout the body helps animals adapt to their environment.

Classification Of Mammals:

Mammalia has the largest class in the animal kingdom. Based on their reproduction, they are classified into three subclasses:

- Eutheria,
- Metatheria,
- Prototheria,

Eutheria:

Mammals under this subclass give birth to young ones. The young ones are developed inside the mother and derive nutrition through the placenta from the mother. Furthermore, it consists of 19 orders, few of which are:

Order	Examples
Proboscidea	Elephants
Rodentia	Rats
Artiodactyla	Cows

Metatheria:

Mammals belonging to this subclass give birth to immature young ones, hence they stay in their mother's pouch until they mature. For eg., Marsupials and Kangaroos. They are divided into seven different orders:

Order	Examples
Notoryctemorphia	Marsupial modes
Diprotodontia	Kangaroo
Microbiotheria	Colocolo
Didelphimorphia	New world opossum
Dasyuromorphia	Dasyurids
Peramelemorphia	Bandicoots
Paucituberculata	South American rat opossum

Prototheria:

Also known as Monotremes, the subclass Prototheria consists of egg-laying mammals. It has one order having 6 species

Order: Monotremata

Example: Duck Billed platypus, Echidna

General Classification of Mammals:

The scientists have also classified the mammals on a general basis which makes it easy to learn about the mammals and their distinguishing characteristics.

Classification	Examples
Animals	Lion, Tiger, Dog
Marsupials	Kangaroo, Koala, Womba
Primates	Chimpanzee, Gorilla, Monkey
Rodents	Squirrel. Mouse, Porcupine
Cetaceans	Dolphins, Whales
Other mammals	Seal, Walrus, Sea-lion
_____	_____

Chapter #10	*Forms and Functions In Plant*	*Botany*

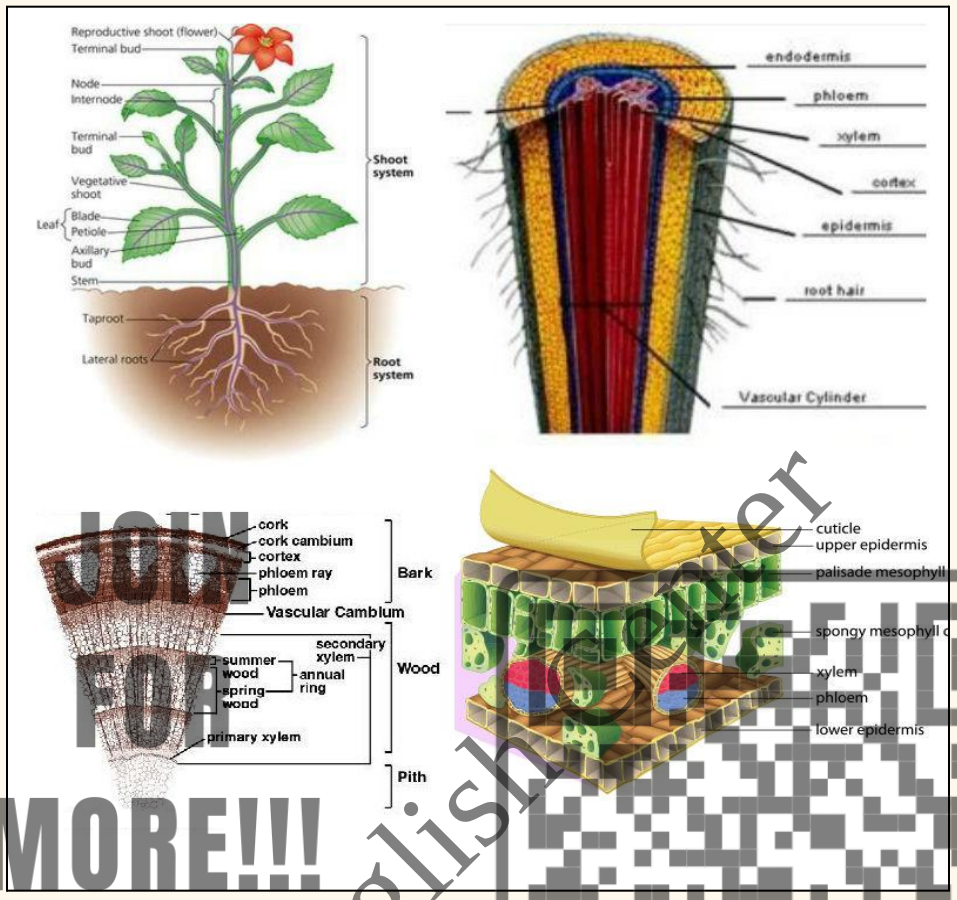
INTRODUCTION OF FORMS AND FUNCTIONS IN PLANT:

All Living organisms must obtain a variety of chemical substances from their surroundings. These substances are essential in order to bud their body. Living organisms also required energy to perform their function. Numtion is the process of acquiring energy and materials.

Plants are photosynthetic autotrophs They prepare their food by photosynthesis In addition to light, carbon dioxide and water, which are required for photosynthesis, plants use other raw materials to synthesize the organic compounds as a secondary products for growth. These elements are known as mineral nutrients. Plants use minerals like nitrates, sulfates and phosphates to make other secondary products like proteins, lipids that are needed for growth and other metabolic activities.

These nutrients are inorganic elements, 14 of which are essential especially nitrogen (N) phosphorus (P), potassium (K) and magnesium (Mg) etc.

All plants appear to have very similar nutritional requirements although the amounts required, vary between individual plants and between species in general macronutrients are required in large amounts, Nitrogen Phosphorus (P), Potassium (K), Sulphur (S), Sodium (Na), Chlorine (C Magnesium (Mg), and Calcium (Ca) are included in macronutrient Micronutrient (trace elements) are required in small amounts including Manganese (Mn), iron (Fe), Cobalt (Co), Copper (Cu), Zinc (Zn), Molybdenum (Mo), Boron (B), Fluorine (F) and lodine (I).



Encircle the correct choice

(i) From where Plants primarily obtain essential nutrients:

(a) Water
(b) Air
(c) Soil ✓
(d) Light

(ii) Identify a micro nutrient for plants amongst the following:

(a) Potassium
(b) Phosphorus
(c) Iron ✓

(d) Sulphur

(iii) In which mineral deficient soil carnivorous plant typically live:

(a) Nitrogen
(b) Calcium ✓
(c) Magnesium
(d) Potassium

(iv) The plants growing in salt marshes close to sea are termed as:

(a) Hydrophytes
(b) Xerophytes
(c) Mesophytes
(d) Halophytes ✓

(v) The cause of color of leaf turns in to dull or bluish green is the deficiency of:

(a) Nitrogen
(b) Phosphate ✓
(c) Potassium
(d) Magnesium

(vi) Which principle type of auxin of higher plants synthesized at the apices of stem and root:

(a) PAA
(b) 24-D
(c) IAA ✓
(d) NAA

(vii) Active transport of sucrose into sieve elements is a step commonly

called:

(a) Phloem loading ✓
(b) unloading
(c) Diffusion
(d) Osmosis

(viii) The capacity of a living system to lose water is:

(a) Osmotic pressure
(b) Water potential ✓
(c) Osmosis

(d) Plasma

(ix) The production of lateral appendages depends on the activity of:

(a) Lateral meristem ✓
(b) intercalary meristem
(c) Apical meristem
(d) none of these

(x) Which process involved in the promotion of flowering by cold treatment:

(a) Photoperiodism
(b) Vernalization ✓
(c) Secondary Growth
(d) Transpiration

Short Question Answer:

Q1.Why mineral nutrients are necessary for plants?

Ans: It is necessary for photosynthesis during the photolysis of water. The mineral is required for the synthesis of chlorophyll. It acts as an activator of nitrogen metabolism.

Q2.Why is N2 included in mineral nutrient although it is not mineral?

Ans. Nitrogen is included in minerals because it is the main constituent of plants b/c in plants it is converted into amino acids and then amino acids are used for different metabolic activities.

Q3. Why do desert plants reduce their leaf size?

Ans.In deserts, there is scarcity of water. So, in order to adapt to water scarce areas, desert plants have their leaves reduced to spines. Spines reduce water loss by transpiration significantly by reducing the surface area of leaves.

Q4. Why do carnivorous plants use insects as food?

Ans. Most plants absorb nutrients through their roots from nutrient-rich soil. Since carnivorous plants grow in nutrient-poor areas they eat insects to get the nutrients they need.

Q5. Why are phytochrome pigments important to photoperiodism?

Ans. Phytochrome allows plants to regulate many growth and development processes by detecting light and darkness. For example, some flowers bloom based on changes to day length over the course of their growing season in a phenomenon known as photoperiodism.

Q6.How annual rings are formed?

Ans. Annual rings and growth rings are formed due to fluctuation in the activity of cambium. Cambium is the meristematic layer responsible for cutting off vascular tissues - xylem and phloem. Initially, it is present in patches as a single layer between vascular bundles.

Q7. Why is cold treatment necessary for the germination of seed in some plants?

Ans. It is a survival mechanism so the seed does not prematurely germinate. Many plants require a period of cold temperatures to break their dormancy cycle with woody plants and herbaceous perennials being some of the more common species.

Q8. How is osmotic adjustment beneficial for plants?

Ans. Osmotic adjustment, defined as a lowering of osmotic potential (WTT) due to net solute accumulation in response to water stress, has been considered to be a beneficial drought tolerance mechanism in some crop species.

Detailed Question Answer:

Q1. Give an account of exchange of gasses in plants?

Ans.

Photosynthesis and Respiration: Photosynthesis occurs only during daytime since sunlight is an integral component of the same, Nevertheless, respiration, on the other hand, is a continuous process, day or night. Photosynthesis requires all plants to have a supply of carbon dioxide and hence the production of oxygen. While in the case of animals, it is the reverse as the supply of oxygen and disposal of carbon dioxide is a necessary component of cellular respiration.

But unlike animals, most often, disregarding the exceptions, plants do not possess a specialized organ to facilitate The process could be broken down into two parts:

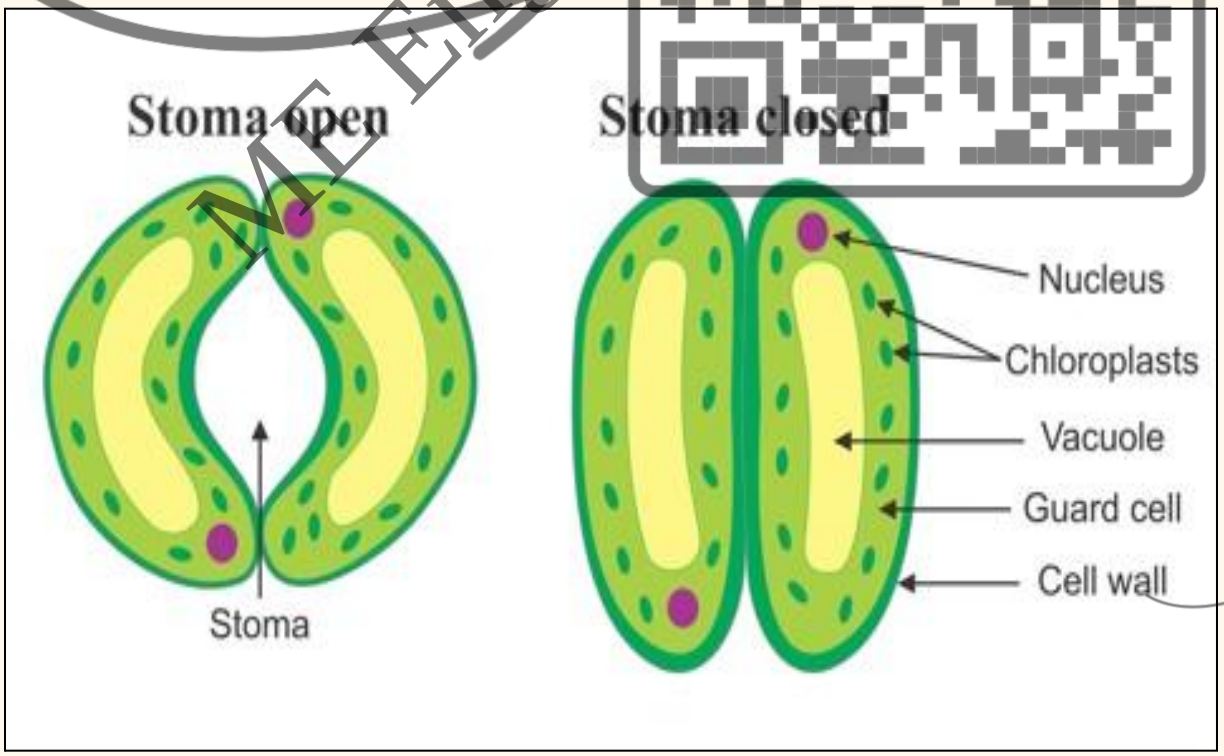
Firstly, photosynthesis where green plants produce oxygen.

6C02+6H2O ➡️ C6H12O6 +602

Secondly, respiration where this glucose in living cells is broken down to release energy.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$

The movement of gasses in green plants or the gaseous exchange in plants is called diffusion and it is regulated by the stomata exchange of gasses. Surface area in such organisms is greater than their volume so diffusion alone is sufficient for the transport of gasses from surface cells to inner ones. But in higher land plants gas exchange by the entire surface of cells present inside the leaves. Flowering plants gaseous exchange by diffusion through pores called stomata in their leaves and green stem. Each stoma is formed by two modified epidermal bean-shaped guard cells. Unlike other epidermal cells guard cells bear chloroplast with thicker inner and thinner outer walls. Stomata can be opened or closed depending upon the turgidity of guard cells which is regulated by concentration of sugar and potassium ions. Stomata regulate the passage of carbon dioxide, oxygen and water as well as concentration of sugar and potassium across the surface of the leaf. Leaves are the main sites of gaseous exchange. Gas exchange in plants is ***achieved by stomata and lenticels.*** The epidermis has tiny pores called stomata (singular, stoma) that control transpiration and gas exchange with the air. During the day when photosynthesis occurs, the oxygen released from the process is utilized for respiration. The exchange of oxygen and carbon dioxide in the leaf (as well as the loss of water vapor in transpiration) occurs through pores called stomata (singular = stoma). Normally stomata open when the light strikes the leaf in the morning and close during the night.



Q2. How does pressure flow theory explain the movement of sugar through the plants?

Ans. Plants need an energy source to grow. In growing plants, photosynthates (sugars produced by photosynthesis) are produced in leaves by photosynthesis, and are then transported to sites of active growth where sugars are needed to support new tissue growth. During the growing season, the mature leaves and stems produce excess sugars which are transported to storage locations including ground tissue in the roots or bulbs (a type of modified stem). Many plants lose leaves and stop photosynthesizing over the winter. At the start of the growing season, they rely on stored sugars to grow new leaves to begin photosynthesis again.

Locations that produce or release sugars for the growing plant are referred to as sources. Sugars produced in sources, such as leaves, need to be delivered to growing parts of the plant via the phloem in a process called translocation, or movement of sugar. The points of sugar delivery, such as roots, young shoots, and developing seeds, are called sinks. Sinks include areas of active growth (apical and lateral meristems, developing leaves, flowers, seeds, and fruits) or areas of sugar storage (roots, tubers, and bulbs). Storage locations can be either a source or a sink, depending on the plant's stage of development and the season.

The photosynthates from the source are usually translocated to the nearest sink through the phloem sieve tube elements. For example, the highest leaves will send sugars upward to the growing shoot tip, whereas lower leaves will direct sugars downward to the roots. Intermediate leaves will send products in both directions, unlike the flow in the xylem, which is always unidirectional (soil to leaf to atmosphere). Note that the fluid in a single sieve tube element can only flow in a single direction at a time, but fluid in adjacent sieve tube elements can move in different directions.

Q3. Describe the cohesion tension theory of water movement through ye How do these two interact to move water through a plant? What supplies the cohesion and what is the source of tension?

Ans. The tension created by transpiration "pulle water in the plant water upward in much the same way that you draw water upward on a saw Cohesion (water sticking to each other case molecules to the gap in the xylem as the top-most weler is pulled toward the stomata. In the Transport in the Xylem unit we will learn how plants are ate to move water and nutrients from the roots to the leaves Transpiration is the ong force Pal moves water through the plant Transpiration is the evaporation water from the of water from the surface of leaf cells in actively growing plans This water is replaced by additional absorption sol leading to a continu column of water in the plant's xylem Plants reduce waters by stomata, developing thick cuticles, or by possessing leaf hairs to increase the boundary layer Stomata are quick to respond to

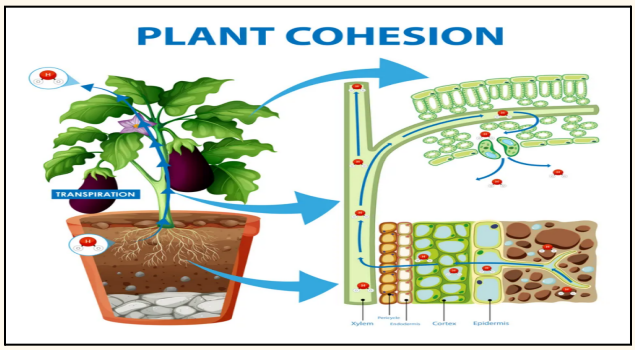
environmental cues to protect the plant from losing too much water, but still allowing in enough carbon dioxide to drive.

CO, needed for photosynthesis to take place in the leaves and O2 is released as a by-product of this process Gas exchange between these two gasses through the stomata. When the stomata are open and ges is exchanged, water is also lost through transpiration Guard cells regulate transcription by opening and dosing the stomata Stomata open and close depending on the turgor pressure In the surrounding guard cells When guard cats take in water, the turgor pressure increases, the cells swell causing them to bow outwards the opening the stoma. When the guard cells lose water, the turgor pressure decreases and the guard cells become flaccid, causing the storms to close There is also adhesion between water molecules and the inside of the xylem vessels Cohesion and adhesion both help maintain the water column all the way up from the root to the leaf.

Cohesion:

The force of attraction among the water molecules is called cohesion. It holds the water together and forms a solid chain-like column within the xylem tube. The cohesion is due to the hydrogen bonding between water molecules.

The cohesion is due to the hydrogen bonding between water molecules. The attractive force in between water molecules and the wall of the xylem vessel is called adhesion. The water molecules remain and form a column of water in the xylem tissue; it helps the water molecules to creep up. According to the ***cohesion-tension theory,*** the driving force for water movement in the xylem is provided by evaporation of water from the leaf and the tension or negative pressure that results. Water covers the surfaces of the mesophyll cells as a thin film, adhering to cellulose and other hydrophilic surfaces. As water evaporates from this film, the air-liquid interface retreats into the small spaces between cellulose microfibrils and the angular junctions between adjacent cells. Because the water column is continuous, this negative pressure, or tension, is transmitted through the column all the way to the soil. As a result, water is literally pulled up through the plant from the roots to the surface of the mesophyll cells in the leaf.



Q4. What essential inorganic nutrient does a plant require for growth, which of these nutrients are required in trace amounts? What are some of the general functions of inorganic nutrients?

Ans. In addition to macronutrients, organisms require various elements in small amounts. These micronutrients, or trace elements, are present in very small quantities. They include boron (B), chlorine (CI), manganese (Mn), iron (Fe), zinc (Zn), copper (Cu), molybdenum (Mo), nickel (Ni), silicon (Si), and sodium (Na).An inorganic nutrient refers to food-derived compounds lacking carbon. Unlike organic nutrients, inorganic nutrients are not derived from living organisms. However, inorganic compounds are still essential for the growth and repair of structural components in the human body.

For example, boron is an important mineral required in trace amounts that is considered essential for vascular plants and algae, but it is not considered essential for animal life, including human life. In contrast, iodine is essential for humans and other complex forms of animal life in that it is necessary for the production of the thyroxine group of thyroid hormones, which are involved in controlling the rate of metabolic processes in the body and also play a role in processes having to do with physical development

Q5. What are growth regulators? Name and discuss five in detail?

Ans. ***Plant hormones/growth regulators:***

Certain chemicals produced by plants have a profound effect on their subsequent growth and development. Such chemicals are called plant hormones or phytohormones. They are synthesized by plants in minute concentration and exert their effect either by altering gene expression, activating or inhibiting enzymes or changing properties of the membrane. They are produced in young embryonic tissues as there is no specific organ for their production in plants. There are five kinds of plant hormones.

These are:

- Auxins
- Gibberellins Cytokinins
- Abscisic acid
- Ethene

Auxins:

Are a powerful growth hormone produced naturally by plants. They are found in shoot and root tips and promote cell division, stem and root growth. They can also drastically affect plant

orientation by promoting cell division to one side of the plant in response to sunlight and gravity.

Gibberellins:

Are the plant growth regulators involved in regulating the growth and influencing different developmental processes which include stem elongation, germination, flowering, enzyme induction, etc. Gibberellins have different effects on plant growth and the stem elongation is the most dramatic amongst all.

Cytokinins:

Are one of the major plant hormones that regulate numerous aspects of growth and development. Although the role of cytokinins in various developmental processes has been well characterized, our knowledge on their effect on plant stress tolerance is still fragmentary.

Abscisic acid (ABA):

Is a key hormone involved in tuning responses to several abiotic stresses and also has remarkable impacts on plant defense against various pathogens. The roles of ABA in plant defense against bacteria and fungi are multifaceted, inducing or reducing defense responses depending on its time of action.

Ethylene:

Is regarded as a multifunctional phytohormone that regulates both growth, and senescence. It promotes or inhibits growth and senescence processes depending on its concentration, timing of application, and the plant species.

Q6.Discuss categorization of plants based on osmotic adjustment?

Ans:

Osmotic adjustment:

Depending upon the availability of water to flowering plants in their natural habitat they are grouped into four categories;

- Hydrophytes
- Halophytes
- Mesophytes
- Xerophytes

Hydrophytes:

Plants that live in water are known as hydrophytes. Hydrilla, Valisineria, and others remain completely submerged in the water, while trap, lotus, and others have most of their body parts submerged. Other important water plants include water lilies, sedges, and crowfoots.

Halophytes:

These are plants which naturally survive in salt-contaminated environments and can tolerate salinity concentrations as high as 1 M NaCl. About 1% of the total flora of the world (both dicots and monocots) are halophytic plants.

Mesophytes:

Mesophytes are terrestrial plants which are neither adapted to particularly dry nor particularly wet environments. An example of a mesophytic habitat would be a rural temperate meadow, which might contain goldenrod, clover, oxeye daisy, and Rosa multiflora.

Xerophytes:

Xerophyte, any plant adapted to life in a dry or physiologically dry habitat (salt marsh, saline soil, or acid bog) by means of mechanisms to prevent water loss or to store available water. Succulents (plants that store water) such as cacti and agaves have thick, fleshy stems.

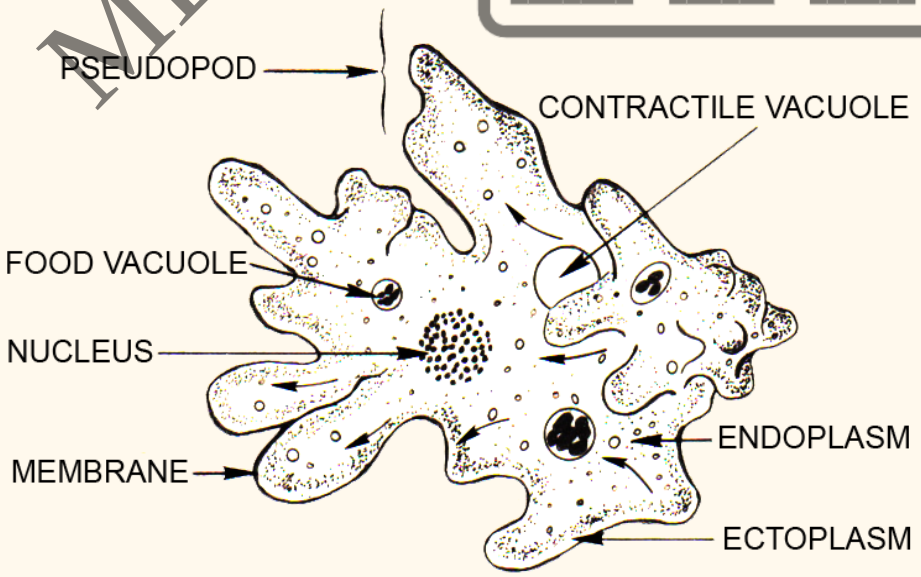
Chapter #11	*Holozoic Nutrition*	*Botany + Zoology*

INTRODUCTION OF HOLOZOIC NUTRITION:

Every living organism requires energy to perform its metabolic functions and molecules to build up its body. For this, they adopt the way familiarly known as sutrition So, nutrition is the process by which the organisms obtain energy to maintain the function of life, to build matter and maintain their structures.

Nutrients are food or any substance which supplies elements and energy to the living body for its metabolic activity. Both the synthesis of new protoplasm and the respiratory oxidation of high energy organic compounds demand the procurement of two main categories of molecules from the environment: (1) already synthesized high energy compounds or else the raw materials from which new protoplasm can be synthesized and (2) the oxygen used in cellular respiration

The main nutrients for living organisms are generally CO2, and H2O used directly or indirectly. On one hand, CO, and H2O are used directly by living organisms to produce high energy organic molecules with the help of light or chemical energy where CO,, is used as a source of carbon for organic molecules. On the other hand, C02, and HO are used indirectly in the living organisms, they use already found CO2, (organic molecules) as a source of carbon and energy for the synthesis of other biomolecules.



Encircle the correct choice.

(i) The process of nutrition does not include this:

(a) Taking in of food ✓
(b) Breaking down of food
(c) Absorption of nutrients
(d) Removal of undigested food

(ii) The chemicals playing the most important role in digestion of food are:

(a) Hormones
(b) Enzymes ✓
(c) HCI
(d) Both a & b
(e) None of these

(iii) The thecodont condition refers to:

(a) Presence of two sets of teeth during lifetime ✓
(b) all alike teeth
(c) Sharp, pointed teeth
(d) Embedded teeth ✓

(iv) The type of digestion in Planaria is:

(a) Intracellular
(b) Extracellular ✓
(c) Intercellular
(d) Both a & b

(v) Number of milk teeth is:

(a) 10
(b) 15
(c) 20 ✓
(d) 25

(vi) Teeth meant for cutting are:

(a) Incisors ✓
(b) Canines
(c) Premolars

(d) Molars

(vii) The part of gut also associated with respiratory system is:

(a) Stomach
(b) Esophagus
(c) Pharynx
(d) Both b & c ✓

(viii) The number of salivary glands in our oral cavity are:

(a) 3
(b) 4
(c) 5
(d) 6 ✓

(ix) The rugae are related to:

(a) Stomach ✓
(b) Duodenum
(c) Jejunum
(d) Ilium

(x) BMI over 30 kg/m2 is considered as:

(a) Normal
(b) Overweight
(c) under-weight
(d) Obesity ✓

Shorts Question Answer

Q1. List out the stages in holozoic nutrition?

Ans: This consists of 5 stages: ingestion, digestion, absorption, assimilation and egestion.

Q2. How is the stomach itself protected against the strong HCI?

Ans: The mucus covers the stomach wall with a protective coating. Together with the bicarbonate this ensures that the stomach wall itself is not damaged by the hydrochloric acid

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Q3. Point out the ways through which the internal surface area of the small intestine is increased?

Ans: The lining of the small intestinal mucosa is very highly specialized for maximizing digestion and absorption of nutrients. The lining is highly folded to form microscopic finger ke projections called villi which increase the surface area to help with absorption.

Q4. How bile helps in the digestion of fats?

Ans: Ble is a fluid that is made and released by the liver and stored in the gallbladder. Ble helps with digestion. It breaks down fats into fatty acids, which can be taken into the body by the digestive tract.

Q5. Enlist the role of the large intestine?

Ans: The large intestine has 3 primary functions: absorbing water and electrolytes. producing and absorbing vitamins, and forming and propelling feces toward the rectum for elimination

Q6: What accounts for the presence of bacteria in the large intestine?

Ans: Coliform is the name of the bacteria that is present in human intestines whose presence in water indicates contamination by disease-causing microorganisms Coliform bacteria are a commonly used indicator of sanitary quality of food and water.

Q7. What are the health risks involved in obesity?

Ans: ***Health Effects of Overweight and Obesity***

- ☐ All-causes of death (mortality).
- ☐ High blood pressure (hypertension).
- ☐ High LDL cholesterol, low HDL cholesterol, or high levels of triglycerides (dyslipidemia).
- ☐ Type 2 diabetes.
- ☐ Coronary heart disease.
- ☐ Stroke.
- ☐ Gallbladder disease.

Q8.List out some factors which may lead to obesity?

Ans: Many factors influence body weight-genes, though the effect is small, and heredity is not destiny; prenatal and early life influences; poor diets; too much television watching: too little physical activity and sleep; and our food and physical activity environment.

Q9.What is Anorexia nervosa?

Ans: Anorexia nervosa often simply called anorexia - is an eating disorder characterized by an abnormally low body weight, an intense fear of gaining weight and a distorted perception of weight.

Detailed Question Answer

Q1.State and explain the process of digestion in Amoeba?

Ans: The different processes involved in holozoic Digestion in amoeba are:

Ingestion:

Ingestion is the process of taking in the food into the body either by swallowing or absorbing it. Amoeba pushes out the pseudopodia to encircle the food and engulfs it forming a food vacuole. This process is known as phagocytosis.

Digestion:

Digestion is the process of breaking the insoluble and large food molecules into soluble and minute molecules. In amoeba, the food vacuoles are transported deeper into the cell and with the help of the digestive enzymes, the large insoluble particles are broken down to the simplest molecules.

Absorption:

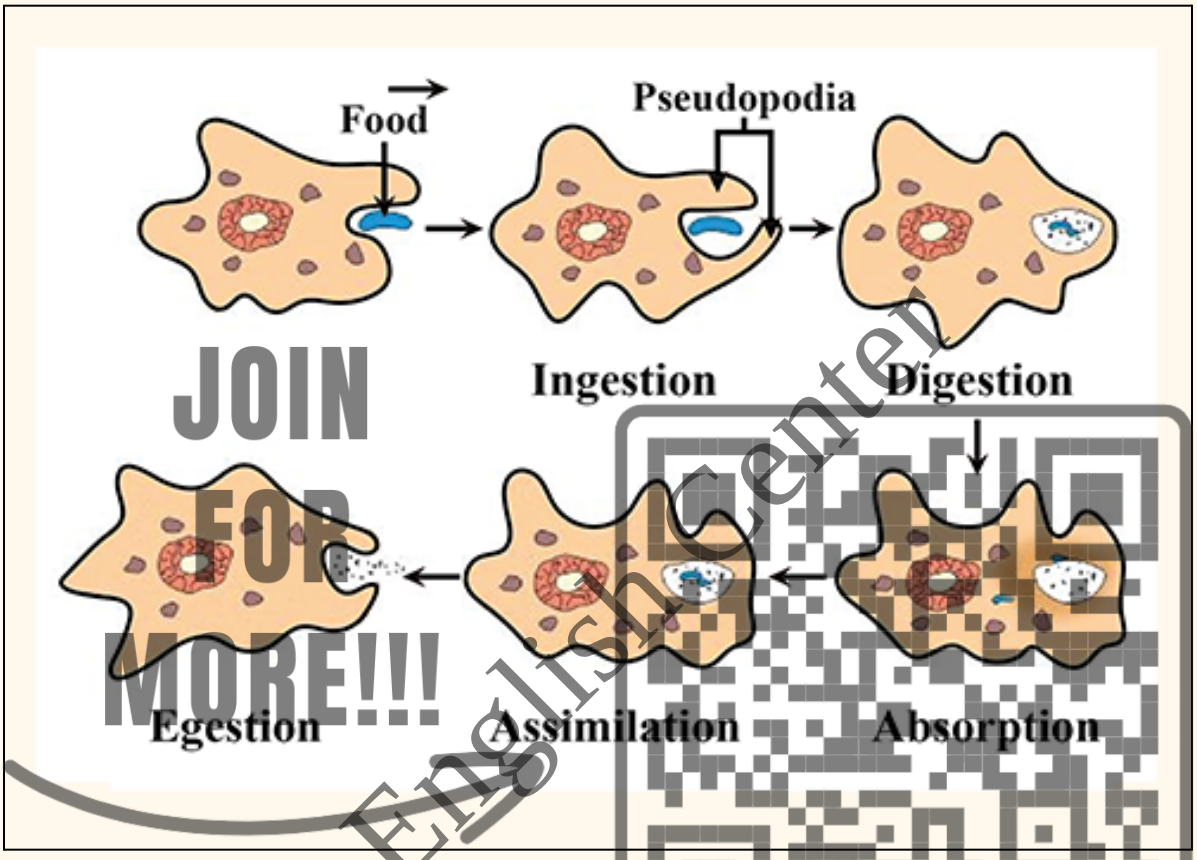
In this process of absorption, the nutrients from the digested food material are absorbed into the cell's cytoplasm by leaving behind the undigested particles. This process is called diffusion. The excess food is stored in the form of glycogen and lipids.

Assimilation:

Assimilation is the process of obtaining energy from the absorbed food molecules. In amoeba, absorbed food molecules are utilized for producing the energy required to carry out different life processes within the cell.

Egestion:

Egestion is the process of excretion of undigested food material. In amoeba, this process is carried out by rupturing the cell membrane to remove the undigested food material from its body.



Q2. Categorize the animals based upon their size of the food? Give examples of each group?

Ans:

Herbivores:

Some animals eat only plants, making them herbivores. Often, herbivores concentrate their munching on just the fruits or seeds of plants, ignoring stems, leaves, and roots. Herbivores have special digestive tracts that are designed to handle different types of plants they might eat. Herbivores usually have big front teeth, called incisors. These teeth are used to grasp and cut plants. Herbivores also have molars in the back, which they use to grind up the plants in their mouths. Herbivores are often very large animals, such as cows, deer, and elk. As you might imagine, it takes a lot of food to give a large herbivore the energy it needs. That is why herbivores may spend a large part of their day eating. Herbivores can also be medium-sized

animals such as sheep or goats. Examples of small herbivores include squirrels and chipmunks. Herbivores need a lot of food to satisfy their hunger.

Omnivores:

Animals that eat both animals and plants are called omnivores. This type of animal has the advantage of a wide selection of food to satisfy their hunger and dietary needs. Some scientists call omnivores "opportunistic eaters." This means that they can and will eat almost anything that is around when they are hungry.. Omnivores also have the benefit of being able to find food at any time of year because they will eat the food that is available. For example, an omnivore will eat fruits and nuts growing on plants during the summer, and it will also hunt for meat during other seasons of the year. Because omnivores eat almost any type of food, they have many different types of teeth. These animals have incisors in the front for cutting. They also have canines, which help them tear up meat. Omnivores have molars in the back of their mouths to grind up their food. Bears are an example of a big omnivore. These animals will eat plants such as berries and nuts when these foods are growing. They will also eat fish in the spring. Bears will hunt animals during any season when they need to eat. Raccoons and pigs are examples of medium-sized omnivores. Many birds eat both insects and berries, making them omnivores. Omnivores live in every type of environment, including deserts, forests, water, and even the arctic. The arctic ground squirrel will feast on insects and plants to survive.

Carnivores:

A mammal that eats only the meat from other animals is a carnivore. In the wild, a carnivore will hunt other animals for food. Carnivores usually have to eat a lot to give them the energy they need. Sometimes these animals have to spend most of their days hunting to make sure they get enough food. Because carnivores need to cut and tear up their food, they have big canine teeth and sharp molars. Carnivores usually have small incisors in the front of their mouths. Big carnivores include lions, tigers, and wolves. Some birds such as hawks and eagles are also carnivores. Snakes are usually carnivores as well. Small carnivores include frogs, birds such as robins, and spiders. Carnivores provide an important service in the wild because they help control the population of other animals. If carnivores were not hunting and removing these animals from environments, these animals would overpopulate an area.

Scavenger:

Decomposers and scavengers break down dead plants and animals. They also break down the waste (poop) of other organisms. Decomposers are very important for any ecosystem. If they weren't in the ecosystem, the plants would not get essential nutrients, and dead matter and waste would pile up.

Scavengers are animals that find dead animals or plants and eat them. While they eat them, they break them into small bits. Flies, wasps and cockroaches are scavengers. Earthworms are also scavengers, but they only break down plants. Once a scavenger is done, the decomposers take over, and finish the job and break down the materials into smaller organic compounds. Many kinds of decomposers are microscopic, meaning that they can't be seen without a microscope. Others, like fungi, can be seen.

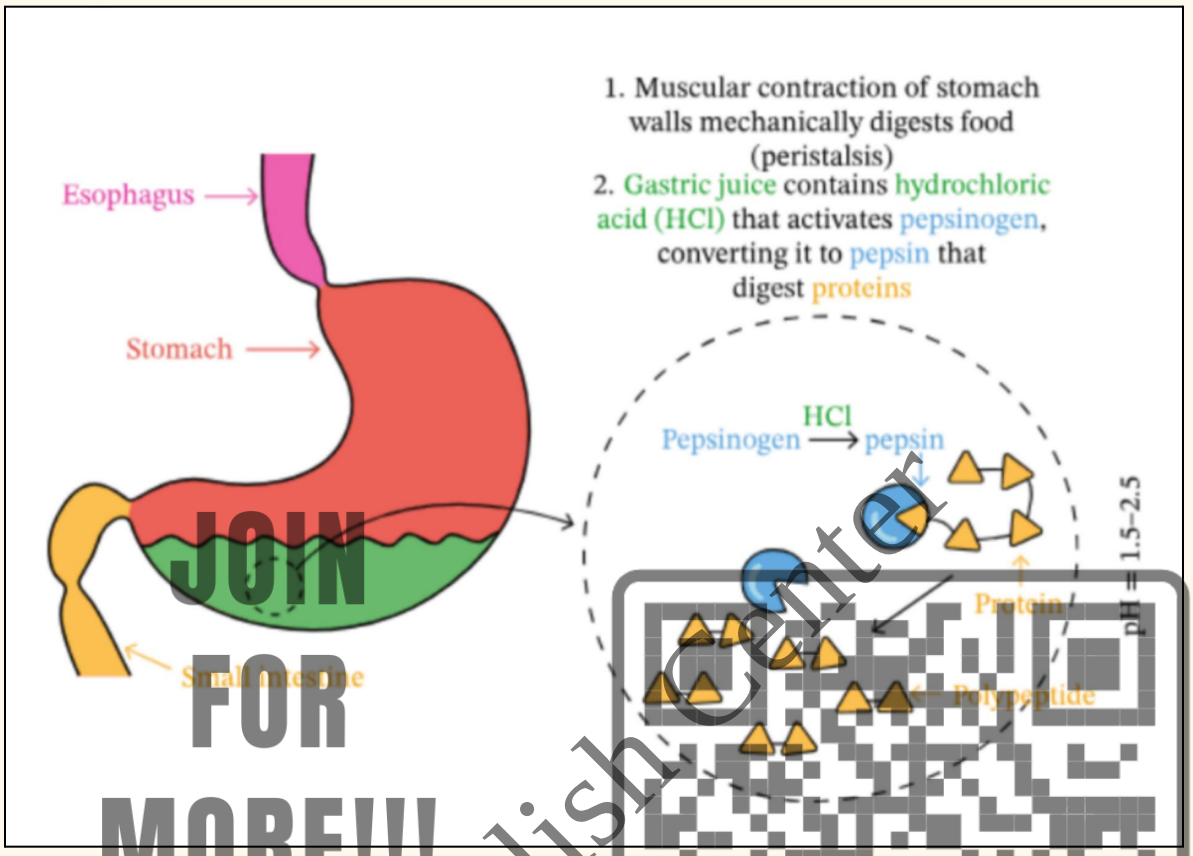
Different kinds of decomposers do different jobs in the ecosystem.

Q3. Discuss the process of digestion in the stomach?

Ans. As soon as the food enters the stomach, both mechanical and chemical digestions start simultaneously. As a consequence of food anticipation (smell, taste, sight, sound), the stimulation signals are released by the vagus nerve to the brain, or the distention of the stomach due to actual food input, especially proteins in the stomach, the gastrin hormone is released into the blood. The vagus nerve represents the main component of the parasympathetic nervous system, which oversees a vast array of crucial bodily functions, including control of digestion, immune response, heart rate etc. The gastrin via blood stimulates the gastric glands to release their gastric juice into the lumen of the stomach. The gastric juice, as already pointed out, contains HCL and pepsinogen. The HCI softens the food, kills the germs, and converts the inactive pepsinogen into active proteolytic enzymes, the pepsin. The pepsin breaks down proteins into peptones (short chain polypeptides). The stomach itself is protected against the action of HCL through its thick coating of mucous. The pH of the mucosal layer is raised up to 7 due to the release of bicarbonate ions while the pH towards the lumen of the stomach remains around 1.5 to 2.5. Therefore, the factors affecting the gastric juice secretion are neuronal, mechanical and hormonal. In infants, another proteolytic enzyme, rennin or chymosin is secreted that turns soluble milk protein, caseinogen into insoluble protein, casein which is then digested by pepsin.

<u>Digestion in stomach:</u>

- Stomach stores and mixes the food received from the esophagus with gastric juices.
- The main components of gastric juice are hydrochloric acid, mucus and pepsinogen.
- Hydrochloric acid dissolves bits of food and creates an acidic medium.
- In this medium, pepsinogen is converted to pepsin, which is a protein-digesting enzyme.
- Mucus protects the inner lining of the stomach from the action of HCI.



Q4. State and explain the role of accessory glands associated with our gut?

Ans:

Liver:

The liver is the largest gland in our body. It is situated in the upper part of the abdominal cavity just behind the diaphragm more towards the right side. The liver is enclosed in a thin inelastic capsule and incompletely covered by a layer of peritoneum. Folds of peritoneum form supporting ligaments attaching the liver to the inferior surface of the diaphragm. The aver has four lobes. The two most obvious are the large right lobe and the smaller, wedge-shaped, left lobe. The other two, the caudate and quadrate lobes, are areas on the posterior surface.

The lobes of the liver are made up of tiny lobules just visible to the naked eye. These lobules are hexagonal in outline and are formed by cubical-shaped cells. the hepatocytes, arranged in pairs of columns radiating from a central All the blood leaving the stomach and intestines passes through the liver.

Function of liver:

The liver processes this blood and breaks down, balances, and creates the nutrients and also metabolizes drugs into forms that are easier to use for the rest of the body or that are nontoxic.

Secretion of bile:

Bile is a physiological aqueous solution produced and secreted by the liver. It consists mainly of bile salts, phospholipids, cholesterol, conjugated bilirubin, electrolytes, and water

Metabolism and Homeostasis:

Homeostasis is quite crucial for the survival of organisms. It is often seen as a resistance to changes in the external environment. Furthermore, homeostasis is a self-regulating process that regulates internal variables necessary to sustain life. In other words, homeostasis is a mechanism that maintains a stable internal environment despite the changes present in the external environment.

The body maintains homeostasis by controlling a host of variables ranging from body temperature, blood pH, blood glucose levels to fluid balance, sodium, potassium and calcium ion concentrations. the common hepatic duct. Metabolism is the total amount of the biochemical reactions involved in maintaining the living condition of the cells in an organism. All living organisms require energy for different essential processes and for producing new organic substances. The metabolic processes help in growth and reproduction and help in maintaining the structures of living organisms. The organisms respond to the surrounding environment due to metabolic activities. All the chemical reactions occurring in the living organisms from digestion to transportation of substances from cell to cell require energy.

Synthesis:

It synthesizes plasma proteins and most of the blood clotting factors from the available amino acids occur in the liver. Breakdown: It is involved in breaking down worn out erythrocytes.

Defense:

This is carried out by phagocytic Kupffer cells (hepatic macrophages) in the sinusoids.

Detoxification:

It performs detoxification of drugs and noxious substances. These include ethanol (alcohol) and toxins produced by microbes. Inactivation of hormones:

These include insulin, glucagon, cortisol, aldosterone, thyroid, and sex hormones.

Production of heat:

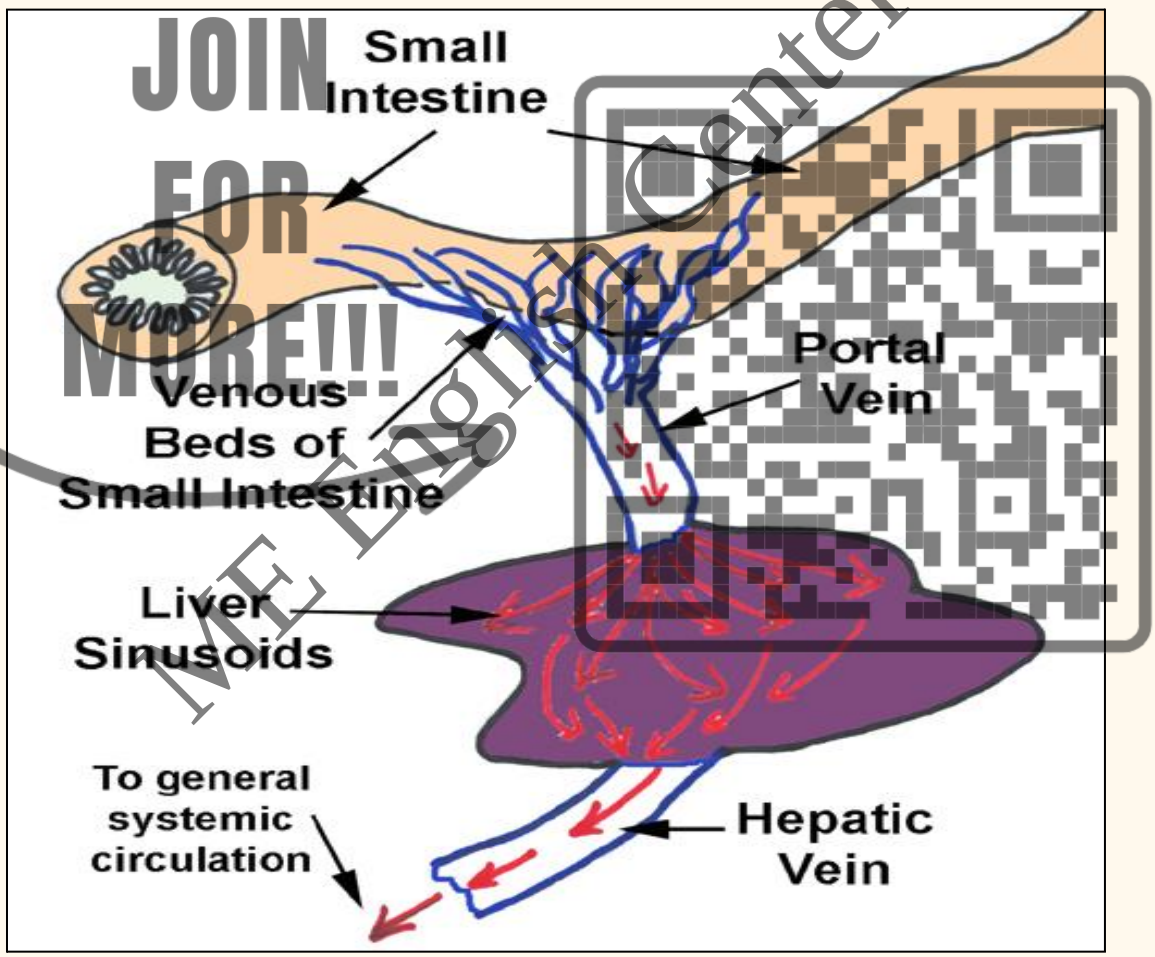
It uses a considerable amount of energy, has a high metabolic rate, and body. and produces a great deal of heat. It is the main heat-producing organ of the body.

Pancreas:

The pancreas is an organ and a gland. Glands are organs that produce and release substances in the body. The pancreas performs two main functions:

Exocrine function: Produces substances (enzymes) that help with digestion.

Endocrine function: Sends out hormones that control the amount of sugar in your bloodstream.



Q5. Explain the process of digestion and absorption of food in small intestine?

Ans.

Small intestine:

The small intestine has three parts: the duodenum, jejunum, and ileum. It helps to further digest food coming from the stomach. It absorbs nutrients (vitamins, minerals, carbohydrates, fats, proteins) and water from food so they can be used by the body. The small intestine is part of the digestive system.

Duodenum:

The duodenum continues the process of digestion of food that begins in the stomach. Its main function is to receive the chyme which is a combination of partially digested food and stomach acids. The chyme is released into the duodenum through pylorus, which is a small valve located between the stomach and the duodenum. The duodenum accepts the chyme from the stomach and continues the digestion. This is done with the help of digestive enzymes and intestinal juices secreted by the crypts in the intestinal wall. Also, the duodenum receives bile drained from the liver and gallbladder and pancreatic juice secreted by the pancreas. These secretions aid in digestion of food.

Apart from digesting foods, the duodenum regulates the rate of gastric emptying. Gastric emptying represents stomach emptying which is the process of food going from stomach to the duodenum. The duodenum also triggers the hunger signals. Both of these functions are performed with the help of hormones that are produced and released by the duodenal epithelium. Duodenal epithelium includes the cells that secrete two hormones known as secretin and cholecystokinin. When excess acid is present in small intestine or duodenum, hormone secretin is released. On the other hand, cholecystokinin is released in the presence of fatty acids and amino acids. Both secretin and cholecystokinin encourage secretion of bile and pancreatic juice.

Finally, duodenum absorbs the nutrients and it does it even more than the stomach. Because of that, in obese people, the duodenum is frequently bypassed in gastric bypass surgery to decrease the absorption of nutrients.

Jejunum:

The jejunum is one of three sections that make up the small intestine. The small intestine is part of the digestive system and is vital for breaking down and absorbing nutrients. It extends from the pyloric sphincter of the stomach to the ileocecal valve that connects the small intestine to the large intestine. The other two sections are called the duodenum and the ileum. The jejunum is located between the duodenum and the ileum.

Ileum:

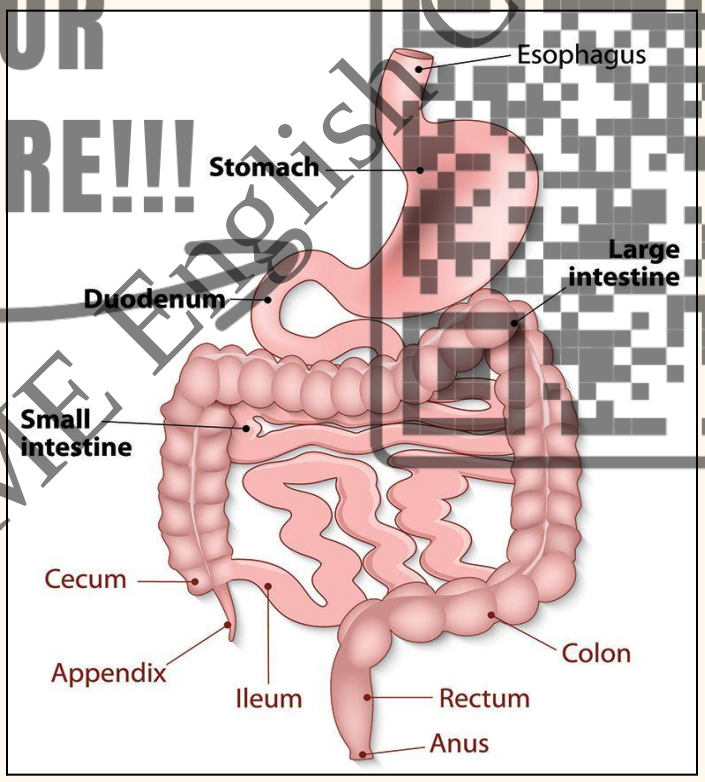
The last part of the small intestine. It connects to the cecum (first part of the large

intestine). The ileum helps to further digest food coming from the stomach and other parts of the small intestine.

Q6. State and explain the sac-like gut with suitable examples?

Ans. The stomach is a sac-like organ with strong muscular walls. In addition to holding food, it serves as the mixer and grinder of food. The stomach secretes acid and powerful enzymes that continue the process of breaking the food down and changing it to a consistency of liquid or paste. Rumen is a sac-like largest part of the stomach of the ruminants.

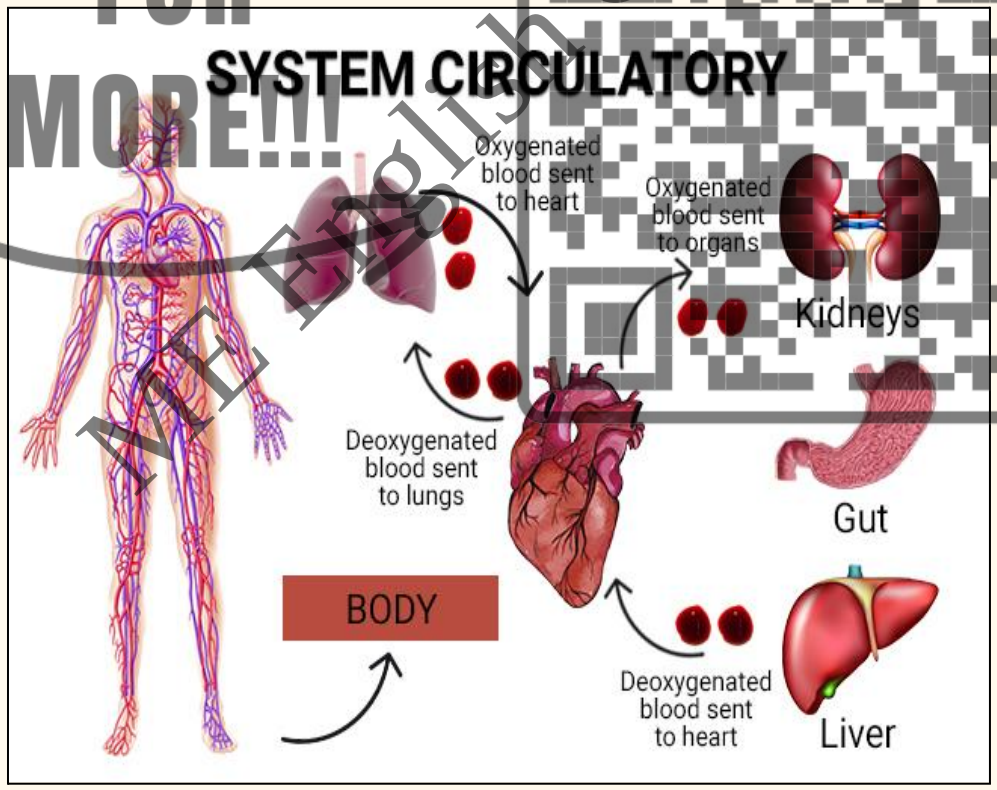
It acts as a storage or holding vat for feed. It is also a fermentation vat. Caecum is present in between the small intestine and large intestine. A sac-like digestive system has a single opening. Food travels into it through that, gets digested and excreta comes out of the same opening. For example, Platyhelminthes. This is also known as a digestive cavity.



Chapter #12	*Circulation*	*Zoology*

INTRODUCTION OF CIRCULATION:

Like plants, animals also have efficient means of transportation which are according to their complexity. In unicellular organisms, such as Amoeba and Paramecium, food is taken in by direct and simple mechanisms. Oxygen diffuses in through the body surface. The digested nutrients and the diffused oxygen are transported within the body by diffusion and cyclosis. The CO, and other metabolic wastes are also removed by simple diffusion through the body surface. This is possible because the distances between the external and internal environment and within the internal environment are much smaller and are covered by diffusion. However, in multicellular large sized animals due to increase in size and complexity. Some other means are adopted for transportation, Involving some kind of mass flow.



Encircle the correct choice.

(i) Lymph most closely resembles which of the following?

(a) Blood
(b) Urine
(c) Plasma
(d) Interstitial fluid ✓

(ii) What event initiates blood clotting?

(a) Contact with an irregular surface by platelets and other factors in plasma. ✓
(b) Production of the enzyme thrombin
(c) Conversion of fibrinogen into fibrin
(d) Excess flow of blood through a capillary

(iii) Damage to the S.A Node in humans

(a) Is a major contributor to heart attacks. ✓
(b) Would block conductance between the bundle branches and the purkinje fibers.
(c) Would have a negative effect on peripheral resistance
(d) Would disrupt the rate and timing of cardiac muscle contractions.

(iv) Which of the following is measured by an electrocardiogram?

(a) Impulses from the AV node
(b) Impulses of the parasympathetic nervous system that control heartbeat ✓
(c) The speed on impulses from the SA node
(d) Contraction of the two atria

(v) Where are semilunar valves to be found in the mammalian heart?

(a) Where blood goes from atria to ventricles
(b) On the right side of the heart only
(c) Where the pulmonary veins attach to the heart
(d) At the places where blood leaves via the aorta and pulmonary arteries ✓

(vi) Organisms in which a circulating body fluid is distinct from the fluid that directly surrounds the body's cells are likely to have which of the following?

(a) An open circulatory system

(b) A closed circulatory system ✓
(c) A gastrovascular cavity
(d) Branched tracheae

(vii) Average blood pressure is lowest in which structure (s)

(a) Aorta ✓
(b) Arterioles
(c) Capillaries
(d) Vena cava

(viii) Which of the following is/are a cause (s) of vasoconstriction?

(a) Lying down after standing
(b) Standing after lying down
(c) Stress or hormone concentration
(d) Histamine secretion ✓

(ix) Blood returning to the human heart in a pulmonary vein drains first into the?

(a) Left atrium ✓
(b) Right atrium
(c) Left ventricle
(d) Right ventricle

(x) Which of the following is NOT an important function of human circulation?

(a) Transport of nutrients and respiratory gasses
(b) Regulation of body temperature
(c) Protection of the body by circulating antibodies
(d) Removal of waste products for excretion from the body ✓

Short Question Answer

Q1.Why higher animals need a circulatory system?

And: In most animals, the circulatory system is used to transport blood through the body. Some primitive animals use diffusion for the exchange of water, nutrients, and gasses. However, complex organisms use the circulatory system to carry glasses, nutrients, and waste through the body.

Q2. Why is the SA node called the pacemaker of heart?

Ans: The SA (sinoatrial) node generates an electrical signal that causes the upper heart chambers (atria) to contract. The signal then passes through the AV (atrioventricular) node to the lower heart chambers (ventricles), causing them to contract, or pump. The SA node is considered the pacemaker of the heart.

Q3. Why do capillaries have a single layer of endothelium?

Ans. Capillaries have a single layer of flattened endothelial cells, as shown here in the diagram. There are no muscular or adventitial layers. The thinness of the capillaries helps efficient exchange between the lumen of the capillary and the surrounding tissue.

Q4. What are LUB and DUB?

Ans. Normal heart sounds come in pairs. The sounds are often described as a constant "lub-dub, lub-dub." The first "lub-dub" is the sound of the mitral and tricuspid valves closing. The second "lub-dub" is the sound of the aortic and pulmonary valves closing soon after.

Q5. Why is the circulatory system of arthropods called open type?

Ans. In contrast to a closed system, arthropods (including insects, crustaceans, and most mollusks) have an open circulatory system. In an open circulatory system, the blood is not enclosed in the blood vessels, but is pumped into a cavity called a hemocoel.

Q6. Why does blood flow faster in arteries?

Ans. Blood pressure varies within the different types of blood vessels. Blood pressure is highest within the large arteries (such as the aorta) because they are connected directly to the ventricle of the heart.

Q7. Distinguishing between single circuit circulation and double circuit circulation.

Single circulation	Double circulation
1) Blood flows through heart only once for completing one circulation. It is called single circulation. **Eg :** Fishes	1) If the blood flows through heart two times for completion of one circulation. It is called double circulation. **Eg :** Mammals, birds.
2) Pulmonary circulation is absent.	2) Pulmonary circulation is present.
3) Heart consists of two chambers.	3) Heart consists of three or four chambers.
4) Single circulation is seen in fishes.	4) Double circulation occurs in frogs, reptiles, birds and mammals.

Detailed Question Answer

Q1. Describe the structure of blood vessels in man?

Ans. Blood vessels are channels that carry blood throughout your body. They form a closed loop, like a circuit, that begins and ends at your heart. Together, the heart vessels and blood vessels form your circulatory system. Your body contains about 60,000 miles of blood vessels.

There are three types of blood vessels:

- Arteries carry blood away from your heart.
- Veins carry blood back toward your heart.
- Capillaries, the smallest blood vessels, connect arteries and veins.

The function of blood vessels is to deliver blood to the organs and tissues in your body. The blood supplies them with the oxygen and nutrients they need to function. Blood vessels also carry waste products and carbon dioxide away from your organs and tissues.

Each type of blood vessel serves a different function:

Arteries:

These strong, muscular blood vessels carry oxygen-rich blood from your heart to your body. They handle a large amount of force and pressure from your blood flow but don't carry a large volume of blood. At any given time, only about 10% to 15% of your body's blood is in your arteries.

Arterioles:

Arteries branch into smaller vessels called arterioles. Both arteries and arterioles are very flexible. They get bigger or smaller to help maintain your body's blood pressure.

Capillaries:

These tiny blood vessels have thin walls. Oxygen and nutrients from the blood can move through the walls and get into organs and tissues. The capillaries also take waste products away from your tissues. Capillaries are where oxygen and nutrients are exchanged for carbon dioxide and waste.

Venules:

Veins begin as tiny vessels called venules and get gradually larger as they near your heart. Venules receive blood from capillaries.

Veins:

Unlike arteries, veins don't have to carry highly pressurized blood, but they do have to carry large volumes of deoxygenated blood back to your heart. Thin, less elastic walls help them handle high volumes and low pressure. Most veins have valves that open and close. The valves control blood flow and keep your blood flowing in one direction. About 75% of your blood is in your veins.

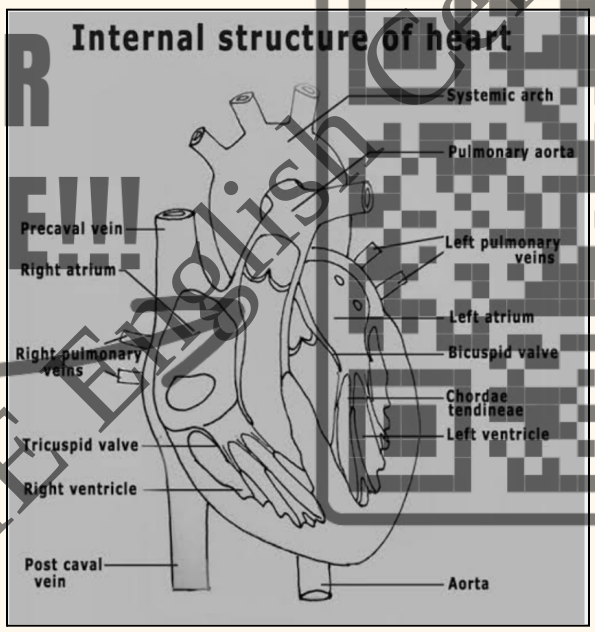
Q2. Describe the structure of the human heart?

Ans. ***Structure of heart***

Human heart consists of four chambers, two upper thin walled atria and two lower, thick walled ventricles. Two large veins, superior and inferior vena cava enter the right atrium and two pairs of pulmonary veins open into the left atrium. Similarly, two large arteries emerge, one from the right ventricle, the pulmonary aorta and other from the left ventricle the systemic aorta. The right and left atria are separated by a vertical membranous interatrial septum, the right atrium

and left ventricles are also separated by thick muscular interventricular septum. Four valves in the heart each consisting of connective tissue, prevent backward flow of blood. The right atrium opens into the right ventricle by an atrioventricular valve .The left atrium opens into the left ventricle by atrioventricular.

The AV valves are anchored by strong nets that prevent them from turning inside out. Semilunar valves are located at the two exit the heart, where the systemic aorta leaves the left ventricle and the leaves the right ventricle. The blood is pumped out into the arteries through the semilunar valves, which are forced open by pressure created by ventricular contraction when the ventricles relax blood starts to meted towards the heart, closing the semilunar valves, which prevents Cowed front flowing back into the ventricles. The cavity of the left ventricle is larger than the right ventricle because of more muscular walls. It is due to the fact that the right ventricle has to pump blood into the lungs only, pulmonary circulation. while the left ventricle pumps blood to the entire circulation.

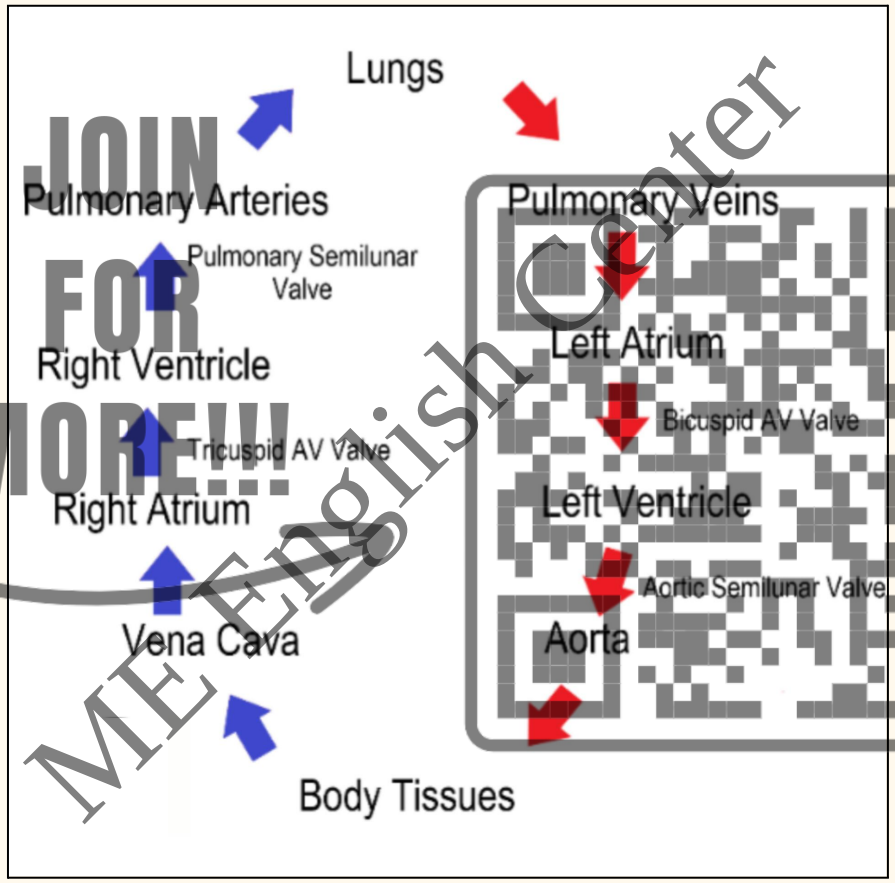


Q3. What is circulation? Explain needs of circulation?

Ans. The circulatory system carries oxygen, nutrients, and hormones to cells, and removes waste products, like carbon dioxide. These roadways travel in one direction only, to keep things going where they should.

Needs of circulation:

All cells in the body need to have oxygen and nutrients, and they need their wastes removed. These are the main roles of the circulatory system. The heart, blood and blood vessels work together to service the cells of the body. When we do not have circulatory system then anything was not transport one place to another in our body. For example if we do not have circulatory system. Then we do not have blood,blood vessels, excretory system, etc. Without blood the waste material of the body does not thrown out and many diseases obtained in our body. Another example was that we do not getting energy. Actually when we inhale oxygen lungs transport it to the heart by the help of blood. So, we need to circulatory system.



Q4. State the phases of heartbeat in man?

Ans. ***Cardiac Cycle Phases:***

Following are the different phases that occur in a cardiac cycle:

Atrial Diastole:

and pulmonary artery closes and atrioventricular valves open, thus causing In this stage, chambers of the heart are calmed. That is when the aortic valve chambers of the heart to relax.

Atrial Systole:

At this phase, blood cells flow from atrium to ventricle and at this period, atrium contracts.

Isovolumic Contraction:

At this stage, ventricles begin to contract. The atrioventricular valves, valve, and pulmonary artery valves close, but there won't be any transformation in volume.

Ventricular Ejection:

Here the ventricles contract and are empty. Pulmonary artery and aortic valve close.

Isovolumic Relaxation:

In this phase, no blood enters the ventricles and consequently, pressure decreases, ventricles stop contracting and begin to relax. Now due to the pressure in the aorta - pulmonary artery and aortic valve close.

Ventricular Filling Stage:

In this stage, blood flows from the atria into the ventricles. It is altogether known as one stage (first and second stage). After that, there are three phases that involve the flow of blood to the pulmonary artery from ventricles.

Q5. Describe the flow of blood through the human heart as regulated by the valves?

Ans. ***Heart valves:***

Heart valves control the flow of blood so that it moves in the right direction. The valves prevent blood from flowing backward.

The heart has four valves.

- The tricuspid valve separates the right atrium and right ventricle.
- The mitral valve separates the left atrium and left ventricle.
- The pulmonary valve separates the right ventricle and the pulmonary artery.
- The aortic valve separates the left ventricle and aorta.

The valves open and shut in time with the pumping action of your heart's chambers. The opening and closing involve a set of flaps called cusps or leaflets. The cusps open to allow blood to flow out of a chamber and close to allow the chamber to refill with blood. Heart valve diseases can cause backflow or slow the flow of blood through the heart.

Oxygen-poor blood from the body enters your heart through two large veins called the superior and inferior vena cava. The blood enters the heart's right atrium and is pumped to your right ventricle, which in turn pumps the blood to your lungs. The pulmonary artery then carries the oxygen-poor blood from your heart to the lungs. Your lungs add oxygen to your blood. The oxygen-rich blood returns to your heart through the pulmonary veins. Visit our How the Lungs Work page to learn more about what happens to the blood in the lungs.

The oxygen-rich blood from the lungs then enters the left atrium and is pumped to the left ventricle. The left ventricle generates the high pressure needed to pump the blood to your whole body through your blood vessels.

When blood leaves the heart to go to the rest of the body, it travels through a large artery called the aorta. A balloon-like bulge, called an aortic aneurysm, can sometimes occur in the aorta.

Q6. Describe the lymphatic system of man?

Ans: ***LYMPHATIC SYSTEM:***

The lymphatic system consists of a network of blind vessels (lymphatics) that drains lymph from all over the body back to the circulatory system. Numerous small lymph nodes, and two additional organs, thymus and spleen, although not strictly part of the circulatory system, the lymphatic system is closely associated with it.

The Composition and formation of intercellular:

All body tissues are bathed in a watery fluid derived from this intercellular or tissue fluid that is formed when blood passes through the capillaries. The capillary walls are permeable to all components of blood except RBCS and blood proteins.

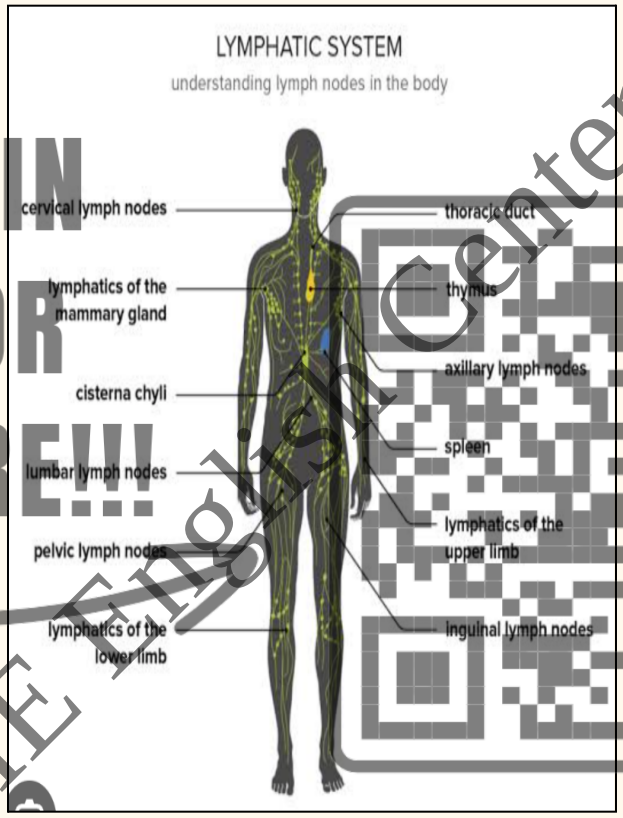
Comparison of the composition of intracellular fluid and lymph

The fluid passes from the capillary into the intercellular spaces as the intracellular or tissue fluid. About 85% fluid returns into the blood at the venous end of the capillary. The rest 15% of the tissue fluid drains into blindly ending lymphatic bacteria, are transported back to the heart through the lymphatic system. Thus lymph capillaries as lymph along with W.B.Cs, cell debris

and microorganisms like and fats. Lymph takes fluid substances from cells of tissues and intercellular can be defined as colorless body fluid that contains lymphocytes, small proteins spaces, which cannot penetrate the blood capillaries.

lymphatic vessels

Thin tube that carries lymph (lymphatic fluid) and white blood cells through the lymphatic system. Also called lymph vessels. Enlarge. Anatomy of the lymph system, showing the lymph vessels and lymph organs including lymph nodes, tonsils, thymus, spleen, and bone marrow.



Q7. Explain the electrocardiogram with the help of a diagram?

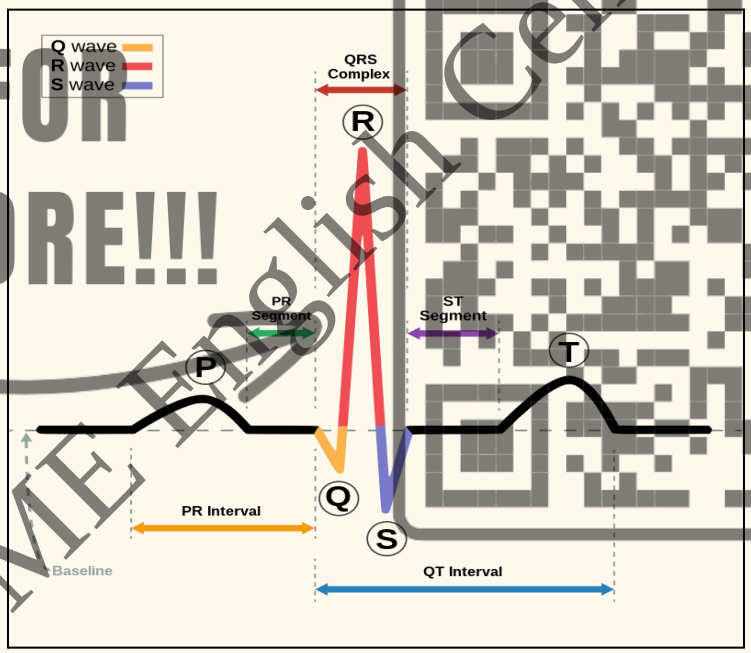
Ans. An electrocardiogram or ECG is a test used to measure the electrical activity of the heart. The test takes only about a few minutes and is devoid of any pain. The electrical activity of the heart causes the heart muscles to contract that results in the pumping of the heart. The ECG is in the form of spikes and dips known as waves. The wave pattern helps in assessing the rate and rhythm of our heartbeat. The human heart produces an electrical impulse by itself. As this electrical impulse passes through our heart, it generates an electrical current that spreads over our body and reaches the skin.

The patient is connected to the Electrocardiograph (ECG) machine with three electrical leads (one each to both wrists and the third to the left ankle of the patient), that is used to monitor the activity of the heart. This is standard ECG testing.

Process:

The process of electrocardiograph includes:

- Small sticky electrodes are attached to the arms, chest and legs.
- These electrodes are connected to the ECG machine through wires that help in detecting the electrical impulses occurring at each heartbeat.
- These electrodes usually detect the very minute form of changes in an electrical path on the skin which arises from the heart muscles and the electrophysiologic patterns of the depolarizing during every heartbeat.



Q8. Describe pulmonary circulation and symmetric circulation.

Ans: ***Pulmonary and systemic circulation:***

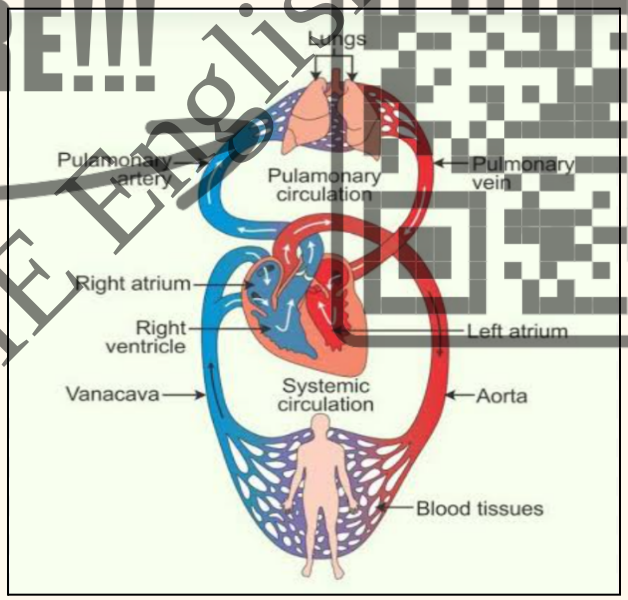
1. The circulation in animals is divided into two circuits, and blood is circulated twice through the heart, called double circulation.

2. The two forms of circulation that occur in a double circulation system are pulmonary and systemic circulation.

3. Systemic circulation transports oxygenated blood from the heart throughout the body.

4. pulmonary circulation brings deoxygenated blood back to the heart.

Pulmonary circulation	**Systemic circulation**
(i) This involves circulation of blood between the heart and the lungs.	(i) This involves circulation of blood between the heart and body organs (except lungs).
(ii) It is the function of the right side of the heart.	(ii) It is the function of the left side of the heart.
(iii) It carries deoxygenated blood to the lungs to receive oxygen.	(iii) It carries oxygenated blood to the body organs.
(iv) It begins on the rightventricle and ends on left auricle.	(iv) It starts at left ventricle and ends at the right auricle.
(v) It returns oxygenated blood back to the heart.	(v) It returns deoxygenated blood back to the heart.



Chapter #13	*Immunity*	*Zoology*

INTRODUCTION OF IMMUNITY:

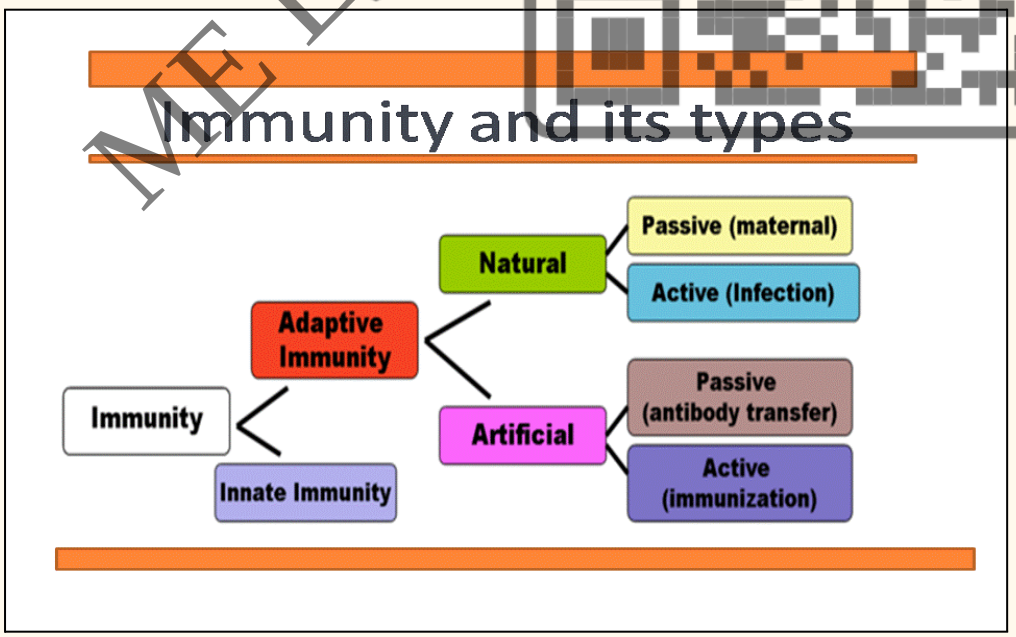
Immunity refers to the body's ability to prevent the invasion of pathogens. Pathogens are foreign disease-causing substances, such as bacteria and viruses, and people are exposed to them every day. Antigens are attached to the surface of pathogens and stimulate an immune response in the body. An immune response is the body's defense system to fight against antigens and protect the body.

There are several types of immunity, including innate immunity, passive immunity, and acquired/active immunity.

The immune system is a collection of organs, tissues, cells, and enzymes all united under one goal: protect the body.

The innate immune response is the non-specific, first response to foreign threats. Immune cells recognize a potential threat, ring the alarm, and the inflammatory response begins.

The acquired immune response is a specific attack on foreign threats. Key players in the acquired immune response include T cells, B cells, and antibodies.



Encircle the correct choice

(i) The study of functioning and disorders of immune system is termed as:

(a) Immunity
(b) Immune response
(c) Immunology ✓
(d) all of these

(ii) It is responsible for specific immune response:

(a) Innate Immune system
(b) First line of defense ✓
(c) Second line of defense
(d) Third line of defense

(iii) Following serves as physical barrier:

(a) Macrophage
(b) Mucous membrane ✓
(c) HCl
(d) Saliva

(iv) Our digestive tract consists of what kind of barriers?

(a) Physical barriers
(b) Biochemical barriers
(c) Both a & b ✓
(d) None of these

(v) Which of the following is involved in phagocytosis of bacteria?

(a) Neutrophil ✓
(b) Macrophage
(c) Both a & b
(d) None of these

(vi) It is not involved in antigen presentation:

(a) Macrophage
(b) Dendritic cell

(c) Neutrophil
(d) Both a & b ✓

(vii) The type of receptor exhibited by all nucleated cells other than

(a) MHC-I ✓
(b) MHC-II
(c) Both a & b
(d) TCR

(viii) Any foreign substance that can elicit immune response is called:

(a) Antibody
(b) Antigen ✓
(c) Both a & c
(d) Antihistamine

(ix) The type of immunity through the transfer of antibodies from mother to her fetus is:

(a) Artificial Active Immunity
(b) Artificial Passive Immunity
(c) Natural Active Immunity
(d) Natural Passive Immunity ✓

(x) Antibodies are secreted by:

(a) T cells
(b) B cells ✓
(c) Plasma cells
(d) Macrophages

Short Question Answer

Q1. List out any six biochemical barriers?

Ans: Natural barriers include the skin, mucous membranes, tears, earwax, mucus, and stomach acid.

Q2.How are tumor cells dealt with by our immune system?

Ans. In principle, tumor development can be controlled by cytotoxic innate and adaptive immune cells; however, as the tumor develops from neoplastic tissue to clinically detectable tumors, cancer cells evolve different mechanisms that mimic peripheral immune tolerance in order to avoid tumoricidal attack.

Q3.Differentiate between NK Cell and Tc cell?

Ans. NK cells are part of the innate immune system, as they effect rapid killing and cytokine responses without the need for extensive cell division or differentiation. By contrast, conventional T cells are, together with B cells, the prototypic cell types of adaptive immunity.

Q4. List out the ways of the second line of defense?

Ans. ***Neutrophils:***

These cells primarily attack bacteria. They are dispensable, rather like pawns on a chessboard. They rush to the site of incoming bacteria to fight them, but are easily killed.

T helper cells:

These cells are like the bosses. They give instructions to other cells by producing signals. Each T helper cell only looks out for one type of pathogen.

Cytotoxic (killer) T cells:

These are killer cells. They punch holes in the walls of the pathogen cell so that the contents ooze out.

Macrophages:

Macrophage means 'big eater'. These cells 'eat' (ingest) or clean up the mess of dead cells.

Dendritic cells: These cells are like the spies. They notice if there is an invader and then present evidence of the invader to T cells in the lymph nodes.

Q5. Even though the core proteins are the same, how do antibodies differ from each other?

Ans. Each antibody structure consists of two heavy chains and two light chains, which join to form a Y-shaped molecule. Each type of antibody has a different amino acid sequence at the tips of the "Y" which is why each antibody is shaped differently.

Q6. What is antipyretic therapy and why is it used?

Ans. An antipyretic from anti- 'against' and pyretic 'feverish') is a substance that reduces fever. Antipyretics cause the hypothalamus to override a prostaglandin- induced increase in temperature. The body then works to lower the temperature, which results in a reduction in fever.

Q7. List out four autoimmune disorders of man?

Ans. Common autoimmune disorders include:

- Addison disease.
- Celiac disease
- Dermatomyositis.
- Graves disease.
- Hashimoto thyroiditis.
- Multiple sclerosis.
- Myasthenia gravis.
- Pernicious anemia

Q8. What is phagocytosis? Name some WBCs acting as phagocytes?

Ans. Phagocytosis is the process by which a cell uses its plasma membrane to engulf a large particle, giving rise to an internal compartment called the phagosome. It is one type of endocytosis. A cell that performs phagocytosis is called a phagocyte. Monocytes, macrophages, and neutrophils are phagocytes. A phagocyte is a 4 type of white blood cell.

Q9. What is inflammation?

Ans. Inflammation is the response of a body tissue against any harmful pathogen, injury, irritation, or wound. The signs of inflammation are swelling, pain, redness, heat, etc. It is the first step of self-protection provided by the immune system.

Q10. Outline the harmful effects of fever?

Ans. However, high fevers that linger or worsen can cause significant health complications if left untreated, including febrile seizures, brain damage, and even death. If an illness is causing your fever, that illness may come with side effects and complications of its own.

Detailed Question Answer

Q1. State and explain how a bacterium is identified as non-self by our immune system?

Ans. The immune system must be able to distinguish what is nonself (foreign) from what is self. The immune system can make this distinction because all cells have identification molecules (antigens) on their surface. Microorganisms are recognized because the identification molecules on their surface are foreign.

For the adaptive immune response to work, it is first necessary to recognize the foreign organism as "non-self" by the immune cells. It is made possible by the identification of Antigens of invading organisms. The antigen could be any foreign macromolecule, especially proteins which can elicit Immune response. In response to the particular antigens, B-lymphocytes produce a small, soluble and specific protein called antibody which combines with specific antigen and helps to destroy the antigen displaying pathogenic organisms. The immune system of a vertebrate can produce billions of different antibodies. Not only the immune system destroys the pathogenic organism.

Q2.What is cytotoxicity? Compare and contrast the mechanisms of NK cell and Tc cell?

Ans. Cytotoxicity is defined as the toxicity caused due to the action of chemotherapeutic agents on living cells. Cytotoxicity tests are very important nanoparticles as they help in the determination of the proposed biomedical use.

Natural killer cells (Nk):

A type of immune cell that has granules (small particles) with enzymes that can kill tumor cells or cells infected with a virus. A natural killer cell is a type of white blood cell. Also called NK cell and NK-LGL.

Hence they were named as Natural Killer Cells. However, the mode of action in destroying the target cells is almost similar. Just like a policeman checking the national Identity card of a person for verification of his identity, the NK Cells do check on the cell surface, a conjugate. The

former forms pores in the plasma membrane of the target cells while the later enters the target cell and causes its lysis.

Cytotoxic T cells (Tc):

Cytotoxic T-cells are one of the main types of immune cells produced in your thymus. When you have an infection, your helper T-cells activate the cytotoxic T- cells. The cytotoxic T-cells fight the infection. These T-cells are an important part of your adaptive immunity.

Cytotoxic T-cells are a type of immune cell. They destroy cells infected with viruses. Another name for cytotoxic T-cells is killer T-cells.

Cytotoxic T-cells are one of the three main types of cells developed in your thymus. The thymus is a small gland in the front of your chest. The other types of T-cells include:

- Helper T-cells, which activate other immune cells to fight infections.
- Regulatory T-cells, which suppress other immune cells when needed.

T-cells begin to form first in your bone marrow. They move to your thymus while they're developing. Your thymus helps your T-cells mature and then circulates them throughout your body.

Q3. What is inflammation? Why is it developed and how is it controlled?

Ans: Inflammation is the response of a body tissue against any harmful pathogen, injury, irritation, or wound. The signs of inflammation are swelling, pain, redness, heat, etc. It is the first step of self-protection provided by the immune system.

- ☐ When your body encounters an offending agent (like viruses, bacteria or toxic chemicals) or suffers an injury, it activates your immune system. Your immune system sends out its first responders: inflammatory cells and cytokines (substances that stimulate more inflammatory cells).
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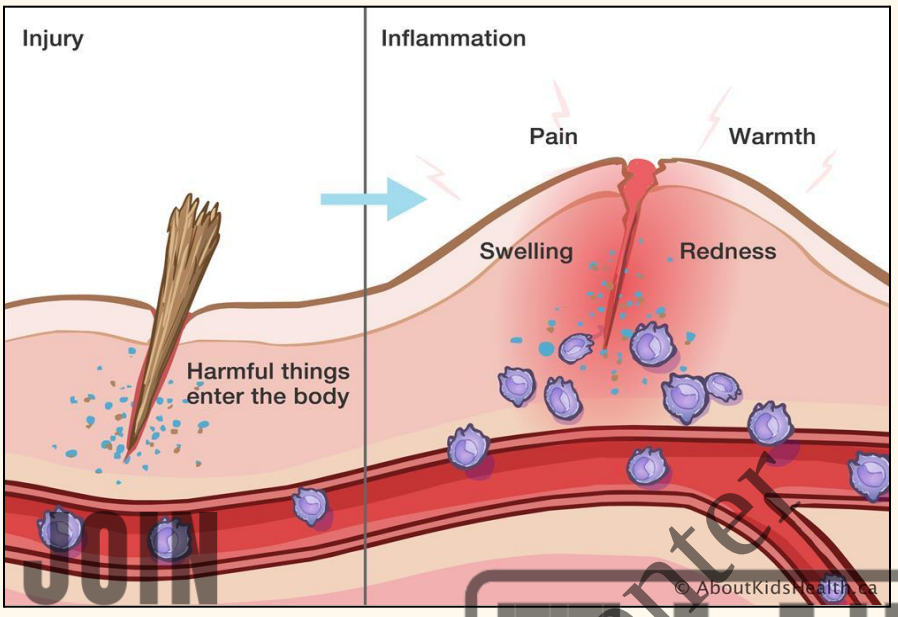


Q4. Explain the underlying mechanism of the fever. State and explain its protective role as well as harmful effects?

Ans. Whenever the body temperature rises above the normal, it is clinically termed as fever. It is a symptom rather than a disease. It is one of the non-specific types of our immune system which could be a sign of infection. It may also be caused by heat-stroke, brain tumors, toxins affecting the brain, some medicines, etc. Substances that induce fever are termed as Pyrogens. They may be endogenous (the body's own cell secretions) or exogenous (external source). The endogenous pyrogens are released by our immune cells in response to the presence of pathogenic organisms like bacteria, viruses, etc. They are released in the bloodstream from actively phagocytizing macrophages. The important pyrogens are Interleukin-1 (IL-1) and Interleukin-6 (IL-6), Tumor Necrosis Factor (TNF) and Interferons (IFN-alpha), respectively. Through the blood, the pyrogens are transported to the wain where they act upon hypothalamus, the thermostat of the brain. As the hypothalamus produces lipid-like signaling molecules, due to which the thermogenesis is increased and heat loss This causes rise in the body temperature or fever. Although fever in the above sense is beneficial to us, it also has harmful effects also.

i) A considerable amount of energy is lost as heat.

ii) It causes fatigue, dehydration, body ache and seizures also.

iii) Temperature higher than 105° F denature our enzymes and other proteins also. iv) It can denature our own cells. It can cause death also.

Q5. Discuss the structural features of antibodies? How is it helpful in getting rid of pathogenic organisms?

Ans. An antibody has a Y-shaped structure, made up of four polypeptide subunits. Each subunit has two identical light and heavy chains.

The N-terminus of each heavy chain forms an antigen-binding domain with a light chain. There are two antigen-binding domains forming the arms of the "Y" shape. They are known as fragment antigen-binding' (Fab) domains.

The C-terminus of the heavy chains forms a fragment crystallization (Fc) domain, which helps in the interaction with the effector cells.

All four polypeptide subunits are held together by disulfide and non-covalent bonds

The heavy chains of the antibodies contain a variable region and three constant regions. Each antibody has two identical antigen-binding sites and they differ in the antibodies.

Antibodies are proteins made by the body's natural defense system (immune system) to fight foreign substances, such as bacteria. Antibodies attach themselves to the foreign substance, allowing other immune system cells to attack and destroy the substance.

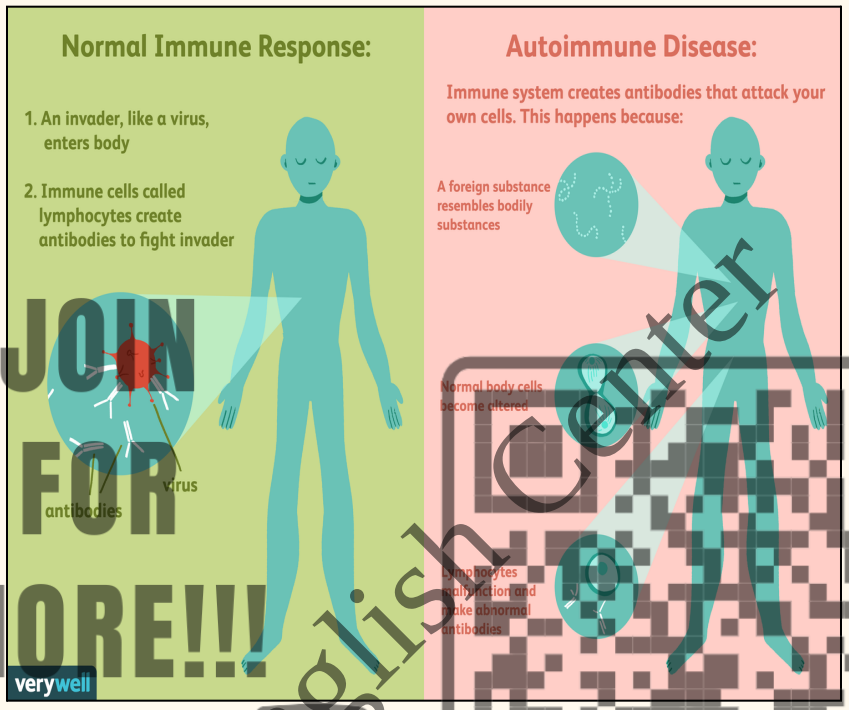
Q6 What do you understand about autoimmune disorder? Explain the role of T cells and B cells in transplant rejection?

Ans. Autoimmune disease happens when the body's natural defense system can't tell the difference between your own cells and foreign cells, causing the body to mistakenly attack normal cells. There are more than 80 types of autoimmune diseases that affect a wide range of body parts.

The role of T cells and B cells in transplant rejection.

- ☐ T cells are central to the process of transplant rejection through allorecognition of foreign antigens leading to their activation, and the orchestration of an effector response that results in organ damage.

- ☐ B cells contribute to allograft rejection after differentiating into antibody-secreting plasma cells (blue). Additionally, B cells shape the T-cell response through a combination of antigen presentation, cytokine production, and costimulation (green).



Chapter#14	*Gaseous Exchange*	*Zoology +Botany*

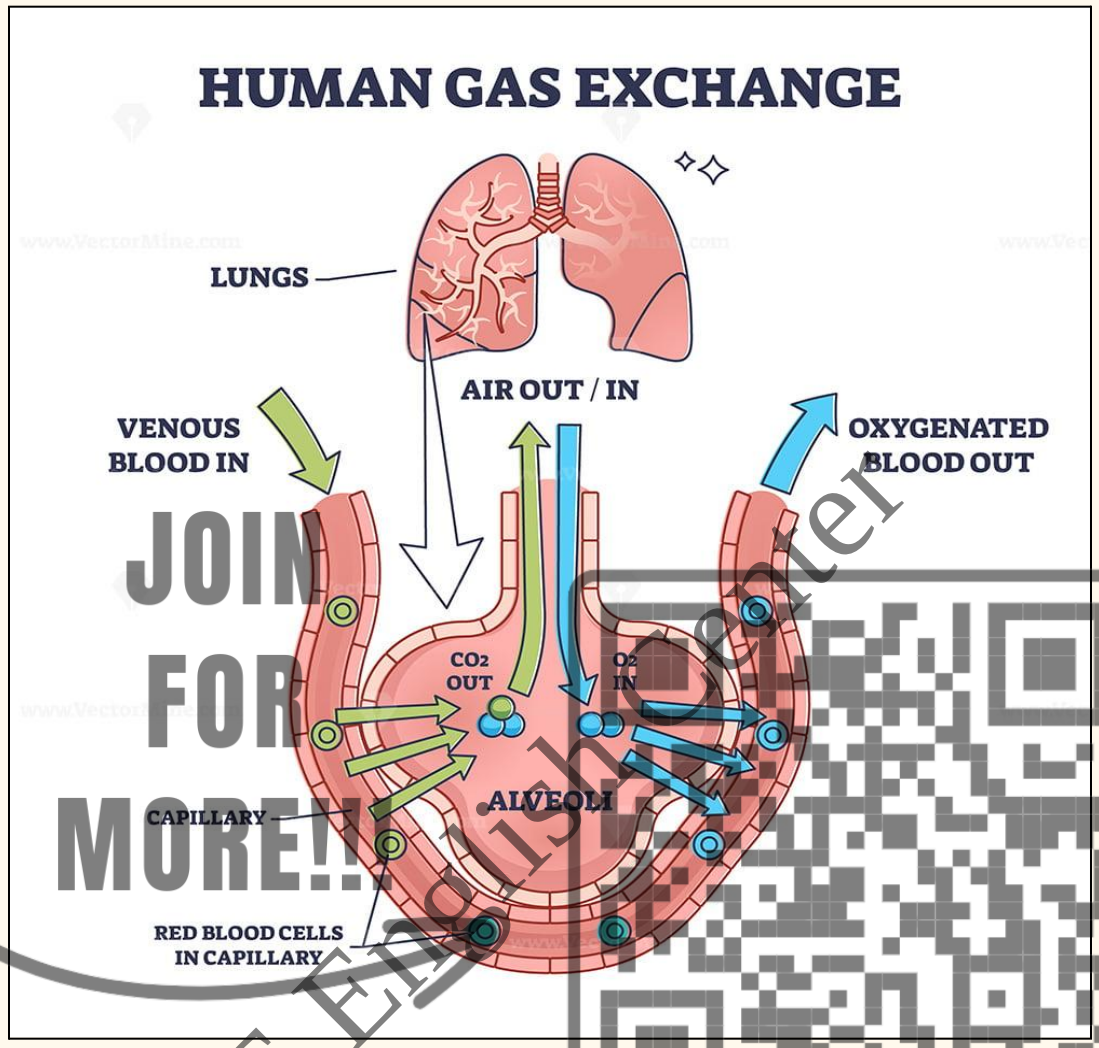
INTRODUCTION OF GASEOUS EXCHANGE:

All living organisms require energy to perform various activities in order to gain energy, they oxidize energy-rich molecules like ATP Adenosine.is-phosphate the continuous supply of ATP to living cello is made possible through the process of cantation. It is a complex process of oxidation-reduction in which food is oxidized and releases energy. An organism can generate a greater number of ATP using oxygen molecules, which can be obtained from its external environment. But during the chemical pathway, carbon dioxide is released as a by-product. Carbon dioxide must be given out of the organism, as it is harmful if it remains in the cell. Thus, living organisms are always in need of gaseous exchange (take in oxygen and give out carbon dioxide) with their In addition to the process of respiration, autotrophs like plants perform gaseous exchange for the process of photosynthesis. During this process, plants obtain carbon dioxide and release oxygen into their environment. But in the following discussion, we will consider the exchange of respiratory gasses only.

The gas exchange in organisms takes place by the process of diffusion.

Efficient gas exchange depends upon following factors:

- Maintenance of diffusion gradient.
- Large surface area in relation to the volume of organism, and Presence of moist membrane or respiratory surface for exchange of gasses.



Encircle the correct choice

(i) In which part of the respiratory system, gaseous exchange takes place?

(a) Alveoli ✓
(b) Pharynx
(c) Larynx
(d) Trachea

(ii) Which of the following statements is true about involuntary breathing?

(a) It is controlled by the bronchioles
(b) It is controlled by the pulmonary arterioles
(c) It is controlled by the alveolar-capillary network
(d) It is controlled by the neurons, located in the medulla and pons ✓

(iii) The tiny air sacs present in human lungs are called.

(a) Alveoli ✓
(b) Bronchus
(c) Bronchioles
(d) All of the above

(iv) The exchange of gasses between the external environment and the lungs.

(a) Respiration
(b) External respiration ✓
(c) Cellular respiration
(d) None of the above

(v) The maximum volume of air contained in the lung by a full forced inhalation is called.

(a) Tidal volume
(b) Vital capacity
(c) Ventilation rate
(d) Total lung capacity ✓

(vi) Which one of the following is correct regarding the larynx?

(a) It houses the vocal cords
(b) It prevents the invading pathogens into the trachea
(c) It is an organ made of cartilage and connects the pharynx to trachea ✓
(d) All of the above.

(vii) Which of the following is the function of the trachea?

(a) Gaseous Exchange ✓
(b) Filters the air we breathe
(c) Exhales the air from the body
(d) All of the above

(viii) Which of the following organs functions as an air conditioner?

(a) Larynx
(b) Pharynx
(c) Nasal chambers ✓
(d) All of the above

(ix) Which of the following statements is true about the entry of air into the lungs?

(a) Air enters the body and travels to the lungs through the mouth and the nose.
(b) Air enters the body and travels to the lungs through the esophagus and gullet.
(c) Air enters the body and travels to the lungs through the windpipe and the porse
(d) Air enters the body and travels to the lungs through the nose and the nervous system. ✓

Short Question Answer

Q1. When does the breathing process develop in animals?

Ans. Amphibians, mammals, and birds exchange gasses through special respiratory organs called lungs. Lungs are air-filled sac-like structures in the chest cavity. They are connected to the outside by a series of tubes and small openings.

Q2. What type of ventilation occurs in humans?

Ans. It is the process of air flowing into the lungs during inspiration (inhalation) and out of the lungs during expiration (exhalation). Air flows because of pressure differences between the atmosphere and the gasses inside the lungs.

Q3. Why does the rate of breathing increase in human beings?

Ans. When you exercise and your muscles work harder, your body uses more oxygen and produces more carbon dioxide. To cope with this extra demand, your breathing has to increase from about 15 times a minute (12 liters of air) when you are resting, up to about 40-60 times a minute (100 liters of air) during exercise.

Q4. Why is breathing of human beings called negative pressure breathing?

Ans. When you inhale, the diaphragm and muscles between your ribs contract, creating a negative pressure-or vacuum-inside your chest cavity. The negative pressure draws the air that you breathe into your lungs.

Q5. How CO2 from cell transport to lungs?

Ans. There are three means by which carbon dioxide is transported in the bloodstream from peripheral tissues and back to the lungs:

(1) Dissolved gas,
(2) Bicarbonate,
(3) Carbaminohemoglobin is bound to hemoglobin (and other proteins).

Q6. Which of the pigments is called respiratory pigment?

Ans. In vertebrates the respiratory pigment is hemoglobin. Hemoglobin has a molecular weight of about 68,000 and is composed of two pairs of polypeptide chains. Each chain carries an

iron-containing heme group. The hemoglobin molecule is capable of transporting four oxygen molecules.

Q7. Draw a flowchart for the passage of air from external nares to alveoli?

Ans.

Flow Chart:

Nostrils

↑↓

Nasal cavity

↑↓

Pharynx

↑↓

Larynx

↑↓

Trachea

↑↓

Bronchus

↑↓

Bronchioles

↑↓

Alveoli

↑↓

Blood

Q8. Why are hair and mucus glands present in nostrils and trachea?

Ans. The hairs present in nasal passage trap the dust particles present in the inhaled air thus allowing only the filtered air to enter into the body. Mucus moistens the air and traps dust particles and kills the bacteria. Q. Mucus lining in the nasal cavity helps in trapping microbes entering our body.

Q9. How exchange of gasses occurs at the alveolar level?

Ans. The walls of the alveoli share a membrane with the capillaries. That's how close they are. This lets oxygen and carbon dioxide diffuse, or move freely, between the respiratory system and the bloodstream. Oxygen molecules attach to red blood cells, which travel back to the heart.

Detailed Question Answer

Q1. What is respiration? Describe the human respiratory system?

Ans. The lungs and respiratory system allow us to breathe. They bring oxygen into our bodies (called inspiration, or inhalation) and send carbon dioxide out (called expiration, or exhalation). This exchange of oxygen and carbon dioxide is called respiration.

Features of the human respiratory system.

The respiratory system in human has the following important features:

- The energy is generated by the breakdown of glucose molecules in all living cells of the human body.
- Oxygen is inhaled and is transported to various parts and is used in the process of burning food particles (breaking down glucose molecules) at the cellular level in a series of chemical reactions.
- The obtained glucose molecules are used for discharging energy in the form of ATP-(adenosine triphosphate).

Respiratory Tract:

The respiratory tract in humans is made up of the following parts:

External nostrils - For the intake of air.

Nasal chamber - which is lined with hair and mucus to filter the air from dust and dirt.

Pharynx - It is a passage behind the nasal chamber and serves as the common passageway for both air and food.

Larynx - Known as the soundbox as it houses the vocal cords, which are paramount in the generation of sound.

Epiglottis - It is a flap-like structure that covers the glottis and prevents the entry of food into the windpipe.

Trachea - It is a long tube passing through the mid-thoracic cavity.

Bronchi - The trachea divides into left and right bronchi.

Bronchioles - Each bronchus is further divided into finer channels known as bronchioles.

Alveoli - The bronchioles terminate in balloon-like structures known as the alveoli.

Lungs - Humans have a pair of lungs, which are sac-like structures and covered by a double-layered membrane known as pleura.

Q2. What are the 5 main functions of the respiratory system?

Ans.

Nose:

Humans have exterior nostrils, which are divided by a framework of cartilaginous structure called the septum. This is the structure that separates the right nostril from the left nostril. Tiny hair follicles that cover the interior lining of nostrils act as the body's first line of defense against foreign pathogens. Furthermore, they provide additional humidity for inhaled air.

Larynx:

Two cartilaginous chords lay the framework for the larynx. It is found in front of the neck and is responsible for vocals as well as aiding respiration. Hence, it is also informally called the voice box. When food is swallowed, a flap called the epiglottis folds over the top of the windpipe and prevents food from entering into the larynx.

Pharynx:

The nasal chambers open up into a wide hollow space called the pharynx. It is a common passage for air as well as food. It functions by preventing the entry of food particles into the windpipe. The epiglottis is an elastic cartilage, which serves as a switch between the larynx and the esophagus by allowing the passage of air into the lungs, and food in the gastrointestinal tract.

Trachea:

The trachea or the windpipe rises below the larynx and moves down to the neck. The walls of the trachea comprise C-shaped cartilaginous rings which give hardness to the trachea and maintain it by completely expanding. The trachea extends further down into the breastbone and splits into two bronchi, one for each lung.

Bronchi:

The trachea splits into two tubes called the bronchi, which enter each lung individually. The bronchi divides into secondary and tertiary bronchioles, and it further branches out into small air-sacs called the alveoli. The alveoli are single- celled sacs of air with thin walls. It facilitates the exchange of oxygen and carbon dioxide molecules into or away from the bloodstream.

Lungs:

Lungs are the primary organs of respiration in humans and other vertebrates. They are located on either side of the heart, in the thoracic cavity of the chest. Anatomically, the lungs are spongy organs with an estimated total surface area between 50 to 75 sq meters. The primary function of the lungs is to facilitate the exchange of gasses between the blood and the air. Interestingly, the right lung is quite bigger and heavier than the left lung.

Q3. Draw labeled diagram of human respiratory system.

Q4. Describe the three regions of the pharynx and their functions?

Ans. Pharynx is a part of the throat that connects the mouth to the esophagus and nose to the larynx. It is a muscular tube that starts behind the nose, runs down the neck. Pharynx is a common passage in both the respiratory and digestive systems. Food and water from the oral cavity and air from both oral and nasal cavity comes to the pharynx. Pharynx is present in vertebrates and also in invertebrates such as annelids, arthropods, etc.

Pharynx Location:

Pharynx is located behind the oral and nasal cavity. It is a part of the throat and a common passage for both the digestive and respiratory system.

Pharynx opens into the esophagus in the digestive tract and opens into the larynx in the respiratory tract. Pharynx is also present in some of the invertebrates. The shape and size vary in different organisms. It may be thick and muscular, rotated or turned outward.

Pharynx Structure and Parts:

The pharynx can be divided into three main regions according to its location. They are:

Nasopharynx:

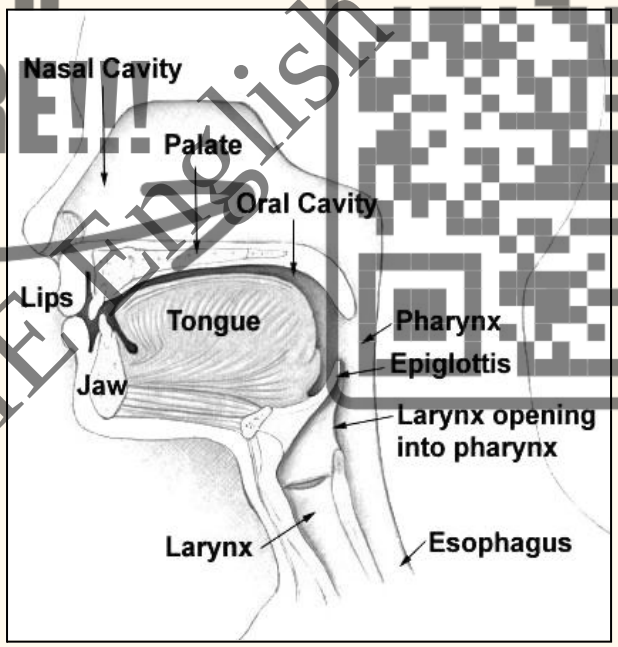
As the name suggests, it is the part of the pharynx that is present posterior to the nasal cavity.

Oropharynx:

It is the part behind the oral cavity and continues in the throat till hyoid bone.

Laryngeal pharynx

It is the lowermost part of the pharynx from epiglottis and continues to the esophagus.



Q5. What is the mechanism of inspiration and expiration?

Ans. ***Mechanism of Breathing:***

The air that we breathe in and out of the lungs varies in its pressure. So basically when there is a fall in air pressure the alveolar spaces fall and the air enters the lungs (inspiration) and as the

pressure of the alveoli exceeds the atmospheric pressure, the air is blown from the lungs (expiration). The flow rate of air is in proportion to the magnitude of the pressure difference

The breathing mechanism involves two processes:

- Inspiration
- Expiration

Inspiration:

In the process of inspiration, there would be a contraction of muscles attached to the ribs on the outer side which pulls out the ribs and results in the expansion of the chest cavity. Later, the diaphragm contracts, moves downwards and expands the chest cavity resulting in the contraction of the abdominal muscles. The expansion of the chest cavity produces a partial vacuum which sucks air into the lungs and fills the expanded alveoli.

Mechanism Of Inspiration:

- The process of intake of atmospheric air is known as inspiration. It is active. process.
- When the volume of the thoracic cavity increases and the air pressure decreases, inspiration takes place.
- Contraction of external intercostal muscles increases the volume of the thoracic cavity.
- Contraction of the diaphragm further increases the size of the thoracic activity. Simultaneously, the lungs expand.
- With the expansion of the lungs, the air pressure inside the lungs decreases. The pressure equalizes and the atmospheric air rushes inside the lungs.

Expiration:

The expiration process is considered once after the gaseous exchange occurs in the lungs and the air is expelled. This expulsion of air is called expiration.

During this process, muscles attached to the ribs contract, the muscles of the diaphragm and the abdomen relax which leads to a decrease in the volume of the chest cavity and increases the pressure of the lungs, causing the air in the lungs to be pushed out through the nose.

Mechanism Of Expiration:

- The process of exhaling carbon dioxide is called expiration. It is a passive process.
- It occurs when the size of the thoracic activity decreases and the air pressure outside increases.

- Now the external intercostal muscles relax and the internal intercostal muscles contract.
- As a result, the ribs are pulled inwards and the size of the thoracic cavity is reduced.
- The diaphragm is relaxed and the lungs get compressed.
- Consequently, the pressure increases and the air is forced outside.

Q6. Describe three ways in which carbon dioxide can be transported?

Ans. ***Transport of Carbon dioxide:***

Due to-the high concentration of CO2 it diffuses out from the tissues into the blood as a by-product. Now blood is deoxygenated and collected from all parts of the body cells and returned to the lungs. The color of deoxygenated blood is dark maroon. There are three ways to transport carbon dioxide into bloodstream:

1. As bicarbonate
2. As carbaminohemoglobin (bound to hemoglobin or other proteins),
3. As dissolved gas.

About 70% of carbon dioxide is transported by RBCs water in the presence of carbonic anhydrase enzymes. This enzyme reacts with carbon dioxide and forms carbonic acid (H2CO3). Later, carbonic acid dissociates into hydrogen (H+) and bicarbonate (H2CO3) ions. Bicarbonate ions combine with sodium and potassium ions to form sodium bicarbonate and potassium bicarbonate respectively.

$CO_2 + H_2O$____ H_2CO_3..... (1)

H_2CO_3_____$H^+ + HCO_3$ ..... (2)

Approximately, 20 percent carbon dioxide combines with hemoglobin in the red blood cell to form carbaminohemoglobin. This compound is dissociated into CO2 and Hb and CO2 moves into alveoli which is later brought into the lungs where its concentration is lower but partial pressure of oxygen is high in alveoli. So dissociated carbon dioxide is exhaled. The remaining 10% carbon dioxide dissolves in the plasma water of the blood and then transported to the lungs.