Paper- 5

Q. **1 (A) Answer in Short:** **(04)**

1. Identify Chitin and Cutin.
2. Which two enzymes are active in basic medium?
3. Write location and function of Pineal gland.
4. Give the names of Synthetic Auxins.

(B) Write short notes on: **(08)**

1. Volatile Plant Hormone.
2. Classification of Proteins.
3. Importance of sodium and potassium in the human body.
4. Nucleotides.

(C) Describe (Any Two): **(08)**

1. Biological improtance of enzymes.
2. Hormones of Pituitary gland.
3. Types of Lipids.

Q.2 (A) Answer in Short: **(04)**

1. What is Bract and Perianth?
2. Which light rays are responsible for maximum rate of photosynthesis?
3. Define Split Pericycle.
4. What is Phylloclade?

(B) Write Short notes on: **(08)**

1. Symbiotic roots.
2. Dead mechanical tissue.
3. Internal factors affecting the rate of photosynthesis.
4. Physical experiment to demonstrate Osmosis.

(C) Describe (Any Two): **(08)**

1. Theories of Ascent of sap.
2. Internal structure of Sunflower root.
3. Modifications of stipules in any four plants.

Q.3 (A) Write in Short: **(06)**

1. State the name of the smallest and largest leucocytes.
2. What is Cauda equina?
3. State the importance of Grey crescent.
4. What is Emulsfication?
5. Location and function of Gland of Swammerdam.
6. What is Membranous labyrinth?

(B) Write Short notes on: **(06)**

1. Pelvic girdle.
2. Transport of O_2 through blood.
3. Areolar connective tissue.

	(C)	**Describe in detial (any two):**	**(08)**
	1.	Functions of various parts of brain.	
	2.	Describe digestion of Proteins in digestive system.	
	3.	Describe process of Oogenesis.	
Q.4	**(A)**	**Answer in Short:**	**(04)**
	1.	State the function of Helicase and diformylase enzymes.	
	2.	What are Jumping genes?	
	3.	Give the source and function of Paramecin.	
	4.	Define Karyotype.	
	(B)	Describe the types of Chromosomes based on the position of centromere.	**(03)**
	(C)	**Describe (Any Two)**	**(08)**
	1.	Numerical Chromosomal abnormalities.	
	2.	Experiment of Bateson and Punnet on sweet pea plant.	
	3.	Explain 'Y' linked genes and sex influenced genes.	
	(D)	Draw neat, labelled, Diagram of following. (Any One)	(5)
	1.	Ventral view of Skull of frog.	
	2.	T. S. of stomach.	
Q.5	**(A)**	**Answer in Short:**	**(06)**
	1.	What is material cycle?	
	2.	Define Opsonisation.	
	3.	What is immunotherapy?	
	4.	State location and function of Memory Cells.	
	5.	What is Ecological Boomerang?	
	6.	What is Monoclonal antibody?	
	(B)	**Write Short notes on:**	**(08)**
	1.	Allergy and Inflammation.	
	2.	Noise pollution and its effects on health.	
	3.	Smoking .	
	4.	Types of cancer.	
	(C)	**Describe (any two):**	**(06)**
	1.	Recombinant DNA technique with diagram.	
	2.	Energy plantation.	
	3.	Development of Bio-technology in India.	

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ANSWER

A.1 (A) 1. **Chitin :** Structurally, it is a Polysaccharide. It is present in the exo-skeleton in animals of phylm Arthropoda.

Cutin : It is a simple lipid, a type of wax. It is present in the cuticle of aerial plant organs.

2. (i) Trypsin (ii) Alkaline phosphatase are the two enzymes active in basic medium.

3. **Location :** Pineal gland is situated on the dorsal side in a diencephalon region of the brain.

Function : Several alterations in the central nervous system occur due to this gland.

4. The Synthetic Auxins are :

(i) Indole Butyric Acid (IBA)

(ii) Indole Naphthalene Acetic Acid. (INAA).

(iii) 2, 4 - Dichlorophenoxy Acetic Acid. (2,4 - D).

(B) 1. **Volatile Plant Hormone :** Ethylene is a volatile hormone, which induces the process of leaf fall as well as senescence in plants. It prevents the growth of roots. Ethylene increases the production of fruits of cucumber by inducing the increase in the production of female flowers of this plant. The fruits such as banana, orange, mango, tomato etc. are initially green in colour when raw (unripe) but change their colour slowly under the influence of ethylene and become yellow, orange or red in colour and sweet and juicy on ripening. When the leaves of a plant have fallen and the fruits are to be reaped off the plant, the ethylene is required to be sprayed prior to the process of reaping .

2. **Classification of Proteins:** Proteins are classified on the basis of their form and structure into two types ;

(i) Simple Proteins : Proteins formed of one or more chains of amino acids only are called simple proteins. These proteins may be fibrous or globular. Simple fibrous proteins are found in silk, hair, skin etc. The serum albumen and serum globulins in the blood are the example of simple, globular proteins.

(ii) Complex Proteins : Some proteins contain a non-protein moiety in addition to their component amino acids. Such proteins are called complexd or conjugated proteins. e.g. haemoglobin, chlorophyll. mucin, casein, lipoprotein, nucleoprotein etc. Human blood contains haemoglobin wherein iron is the non-protein component. Similarly, Mg^{++} in chlorophyll, carbohydrate in mucin of saliva, phosphate in casein, lipid in lipoprotein and nucleic acid in nucleprotein are the non-protein components.

3. **Sodium :** The major source of sodium in our body is the table salt (NaCl) present in our daily diet. In the body, sodium salts are found in the bones, extracellular fluids, blood plasma and cytoplasm. The chloride and bicarbonate salts of sodium maintain the acid-base (pH) balance in the body. In addition, it plays an important role in the muscle contraction and conduction of nerve impulses; it also regulates the water balance.

Potassium : It is found in the composition of many enzymes. Muscle contraction and transport of carbon dioxide through blood require potassium compounds. The potassium maintains the ionic balance of cytoplasm as well as regulate the heart beats.

4. **Nucleotides :** When a nucleoside is linked to a phosphate it becomes phosphorylated and is called a nucleotide. When a ribonucleoside binds with a phosphate, it forms a ribonucleotide. Similarly, when a deoxyribonucleoside binds with a phosphate it forms a deoxyribonucleotide.

Ribonucleotide (Ribotide) Deoxyribonucleotide (Deoxyribotide)

Types of Nucleotides.

Adenosine is a type of nucleoside, formed by the binding of a pentose sugar (ribose) to a purine nitrogen base, adenine. If this ribonucleoside is linked to a phosphoric acid moiety, it forms adenosine monophosphate (AMP). When another phosphoric acid molecule gets linked with the phosphate moiety of AMP, a molecule of adenosine diphosphate (ADP) is formed. Similarly, when another phosphoric acid molecule gets linked with the second phosphate of ADP, a molecule of adenosine triphosphate (ATP) is formed. ATP is a energy-rich molecule.

(C) (1) **Biological importance of Enzymes :**

(1) Photosynthesis and respiration, occurs by enzymes where light energy is converted into chemical energy and chemical energy is converted into mechanical energy respectively.

(2) For conduction of impulses, a neurotransmitter, acetylcholine is produced which is harmful to the heart. Therefore, acetylcholine esterase associated with the nervous system hydrolyses it.

(3) Certain children are infected by ascaris. These worms produce secretions which inhibit the effect of pepsin and trypsin. But “fig” possesses “fissin” which destroys the secretions of these worms.

(4) Herbivorous animals eat grass. It is digested by enzyme cellulase, which is produced by the symbiotic bacteria residing int their digestive tract.

(5) Enzymes are necessary for ripening of fruits.

(6) As R.B.C. contain carbonic anhydrase, which accelerates the reaction between H_2O and CO_2 to form carbonic acid (H_2CO_3), the transport of CO_2 is done rapidly through R.B.C while it is slow in blood plasma due to the lack of enzyme.

(7) Food is digested and is converted into absorbable form by enzymes.

(8) Enzymes plays an important role in the coagulation of blood.

(9) Some enzymes in the pure form can be given orally or by injection to patients for curing certain ulcers. e.g. trypsin therapy.

(10) During anaerobic respiration, pyruvic acid is converted tito lactic acid or ethyl alcohol with the help of specific enzymes.

(11) For alcoholic fermentaion, an enzyme, carboxylase, is necessary.

(2) Hormones of Pituitary gland :

The hormones produced in the pituitary gland are proteinaceous in nature. The pituitary gland consists of three parts; (i) Anterior lobe (ii) Intermediate lobe and (iii) Posterior lobe.

Hormones of the Anterior Lobe :

(i) Growth Hormone is called GH or STH (somotropic hormone). It regulates the overall carbohydrate metabolism and growth. If this hormone is secreted in excess amount causes excesive growth and results in giantism.Optimum secretion leads to proportionate and normal growth, whereas a very low rate of secretion manifests dwarfism.

(ii) Adrenocorticotropic Hormone or ACTH: It influences the development and growth of the different parts of the adrenal cortex as well as medulla and regulates the production of chemicals in them.

(iii) Thyrotrophic hormone (TTH) or Thyroid Stimulating Hormone (TSH): It controls the activity and synthesis of the hormone of the thyroid gland.

(iv) Gonadotropic Hormones (GTH) : it influences the growth of ovarian follicles and corpus luteum, and regulate the secretion of hormones by the intersitial cells of the testis by the hormones such as LH, LTH, ICSH. The hormone responsible for growth of ovarian follicles is known as the Follicle Stimulating Hormone (FSH).

Hormone of Intermediate lobe :

The hormone knwon as MSH (Melanocyte Stimulating Hormone), Intermedin or MTH (Melanotropic hormone) is secreted from the intermediate lobe. It is responsible for altering the skin colour.

Hormones of Posterior lobe :

The posterior lobe of the pituitary gland secretes hormones of a polypeptide nature. The hormone oxytocin concerned with contraction of uterus and rapid secretion of milk from the lactating mammary gland of woman and the hormone vasopressin controls the viscosity of arterial blood and the constriction of arteries and osmo-regulation in body, are secreted from the posterior lobe. (The ADH (antiduretic hormone) responsible for the osmo-regulation in kidney is not the different hormone but the same vasopressin.)

(3) Types of Lipids:

Lipids are of three types : (1) Simple lipids, (2) Complex lipids and (3) Steroids.

(1) **Simple lipids:** Structurally they are formed of one molecule of alcohol and one to three molecules of fatty acids. Simple lipids are of two types : (1) Triglycerides and (2) waxes. One molecule of glycerol and three molecules of any faty acids when get linked by ester bonds (C-O-O-C) through the proces of dehydration from one molecule of triglyceride releasing three molecules of water.

Triglycerides are of two types : (1) Fats and (2) Oils.

The fats are solid at room temperature. All the fatty acids in its composition are saturated and mostly having long chain, e.g. Butter, ghee, animal fat, vegetable ghee etc.

The oils are liquid at room temparature. One, two or all the faty acids in its composition are short or long chain fatty acids of unsaturated nature, e.g. groundnut oil, til oil, coconut oil, fish-liver oil etc.

Fats and oils are highly energy-giving substances.

Waxes : In the structure of wax an alcohol molecule is not glycerol but some monohydroxyalcohol with which is linked a molecule of long chain saturated fatty acid. Structurally, suberin and cutin are also simple lipids (waxes). They have protective use in the structure of cell wall.

(2) **Complex lipids :** These lipids contain some non-lipid component in addition to fatty acids and alcohol. The non-lipid group in glycolipid is a carbohydrate, similarly phosphate is a non-lipid group in phospholipid.

(3) **Steroids :** Steroid molecule which contain hydroxyl (-OH) group but do not contain carboxyl (COOH) group or keto (>C=O) groups are called sterols, such as cholesterol, ergosterol etc, while cortisone, progesterone, etc. are steroid hormones found in animals which contain only carboxyl or ketogroup.

Cholesterol is a common structural material of the nervous tissue. It is also present in meat, liver, animal fat etc. If its amount increases in the blood, the wall of the blood vessels becomes stiff and the flow of blood through the vessels impaired. Ergosterol is found in the fungus such as yeast and Claviceps. It is converted into ergocalciferol (vit $D_{2)}$ under the influence of UV radiations while an alkaloid, namely, ergotamine obtained from ergot relaxes the smooth muscles and hence it is used to bring about easy parturition. Certain vitamins are fat-soluble steroids.

A.2 (A) 1. **Bract :** The leaf, from the axil of which a flower develops, is called bract.

Perianth : When the calyx and corolla of a flower are similar in shape and colour ane are indistinguishable, they are together called perianth.

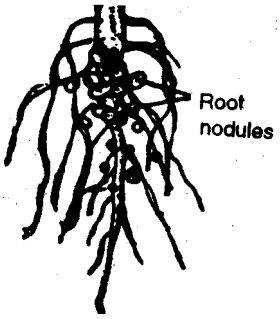
2. The rate of photosynthesis is maximum in red and dark orange light rays.

3. **Split pericyle:** In sunflower stem, the pericycle is made up of alternately arranged masses of parenchyma and sclerenchyma. Hence the pericycle is called split pericycle.

4. **Phylloclade :** A specialized stem that resembles and funcions like a leaf is called a phylloclade.

(B) 1. **Symbiotic roots:** Two different types of organisms when live together for mutual benefit and do not cause any harm unilaterally or bilaterally are called symbionts and their mode of life is called symbiosis. The roots of leguminous plants provide the best example of symbiosis. The soil bacteria of genus *Rhizobium* enter the root system of leguminous and plants and produce nodules of different sizes by multiplicatiion therein. These bacteria fix

up atmospheric nitrogen in the soil and convert it into NH_3, nitrites and nitrates. These are utilized by the plant for synthesis of proteins. Hence the leguminous plant organs are very rich in proteins. The bacteria get shelter, water and nutrients in return from the plants they inhabit.

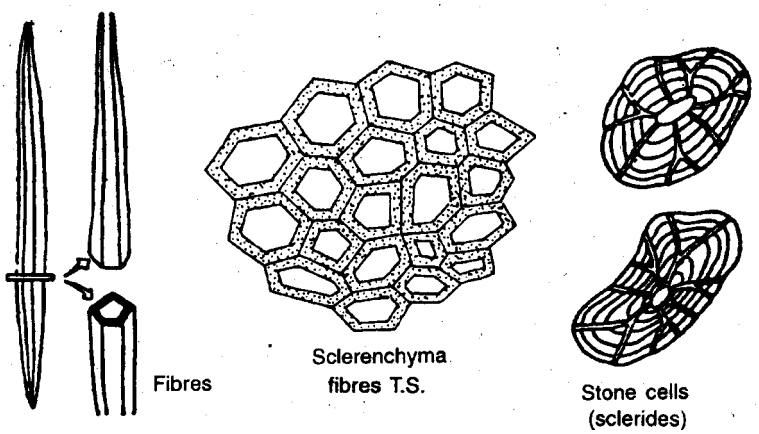


2. **Dead Mechanical tissue (Sclerenchyma):** The well differentiated cells of sclerenchyma become dead cells. During the formation of this tissue the cytoplasm and nuclei disintegrate and the primary wall made up of cellulose becomes thickened with lignin internally and form a secondary wall. as a result the cell wall becomes thick and the lumen of the cells gets reduced. Hence the sclerenchyma give mechanical strengtht and rigidity o the plant organs.

Sclerenchyma are of two types :

1. **Sclerenchyma fibres** are much longer than broad, fibre-like and arranged longitudinally. The cells are long and tapering at both ends. The intercellular spaces in the tissue are almost absent and hence the cells appeared to be polygonal in tranverse section.

2. **Sclerides (Stone cells)** are somewhat isodiametric or variously shaped. The are nicely observed in the outer seed coat of bean, pea and green gram seeds as well as in the pulp of chiku and pear. These cells provide mechanical strength.



3. **Internal factors affecting rate of photosynthesis.**

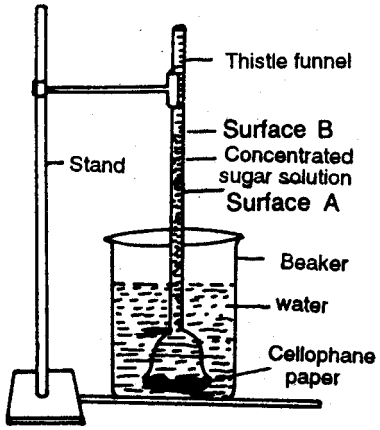
The internal factors include chlorophyll, structure of leaf and accumulation of photosynthetic products.

(1) **Chlorophyll:** Photosynthesis is not possible without chlorophyll as it is the only substance capable of absorbing solar light energy.

(2) **Structure of leaf:** The number of stomata on the leaf surface and the phenomena of opening and closing of stomata affect the rate of photosynthesis. There are much more numerous stomata on the leaf surface than on the stem surface. The tender young leaves show higher rate of photosynthesis which continues till they are fully grown up, after which the rate declines.

The chloroplasts as well as the amount and type of chlorophyll affect the rate of photosynthesis.

4. **Experiment to demonstrate osmosis :**



Take a thistle funnel and tie a parchment paper to close the wide mouth of the thistle funnel. Fill slowly concentrated sugar solution in this thistle funnel upto the mark-A. Dip the closed wide end of the funnel in a container filled with water and fix the funnel with the stand. Add 2-3 drops of oil on the surface of the sugar solution to prevent evaporation. It will be seen after sometime that the level of the solution in the thistle funnel has risen up to the mark -B due to endosmosis.

A. 2 (C) 1. Theories of Ascent of sap.

(1) Root-pressure theory: The water and minerals absorbed by the root hair and epidermal cells of the root pass from cell to cell and finally enter the xylem. This process being a continuous one, a continuous pressure is exertedon water in the xylem and sothe water rises up on the xylem. This model of upward flow of water cannot be considered as the main factor for ascent of sap. In certain plants the root pressure never occurs. Moreover, the water cannot rise togreat heights and the rate of ascents of sap cannot be increased by root pressure.

(2) Transpiration theory: The process of losing water in the form of water vapour, through the slomata and the remaining surface of the aerial plant organs, is called transpiration. Due to the loss of water the mesophyll cells of the leaf absorb water from the adjacent turgid cells. As a result the water flowing through the xylem experiences a suction force which causes the xylem vessels of the leaf to suck water from the xylem vessel in the stem. This sequence of events causes the rise or ascent of sap absorbed by the roots. Thus, a suction force is created due to transpirtation which causes the ascent of sap slowly and steadily.

(3) Theory of cohesive force: Dixon and Jolly put forth the theory of cohesive force to explain the phenomenon of ascent of sap. There exists a force of attraction or cohesion between the adjacent molecules of water. Also, an adverse force exists between the walls of xylem elements and the water molecules. A continuous column of water is formed in the entire plant due to the cohesive and adhesive forces of water molecules. This column rises upward through the xylem elements due to the suction force created by the process of transpiration. In this way the water column is pulled upward from root to leaves. Majority of plant physiologists agree with this theory of ascent of sap.

2. **Internal structure of Sunflower root.**

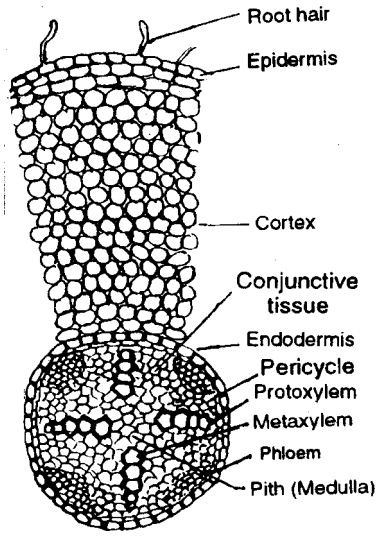
(1) Epidermal tisue system: Epidermis,also called piliferous layer, forms an outermost single layer of parenchymatous cells. Some of these cells get transformed towards the outer side into thin walled tubular outgrowth called root hair. These root hair perform the function of absorption of water and dissolved mineral salts from the soil. The outer surface of the epidermal cells is totally devoid of cuticle.

(2) Ground tissue system: The tissue beneath the epidermis that include parenchymatous cortex, endodermis, pericycle, conjunctive tissue and medulla form the ground tissue system.

The cortex is a wide region formed of several layers of parenchymatous cells having intercellular spaces. This region transmits the water and mineral salts absorbed by the epidermal tissue tothe conducting tissuing in the stele.

The endodermis is the innermost layer of cortex, which is single layered and parenchymatous. The radial walls of the barrel-shaped cells of the endodermis show thickening of wax-like suberin as well as lignin in the form of strips called Casparian strips. The name is so given after its discoverer Caspary.

The pericycle is a single layer of parenchymatous cells immediately beneath the endodermis and forms the outermost layer of stele. The laterl or secondary roots originate from the pericycle.



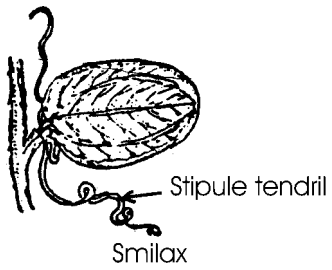
Sunflower root T.S.

The medulla (pith) forms the parenchymatous central core of the root. Its cells are round or isodiametric having intercellular spaces and merge with the conjunctive tissue. The latter is parenchymatous and connects the vascular bundles viz. xylem bundles and phloem bundles. The entire mass of centrally located tissues enclosed by the endodermis but excluding the latter forms the stele. The pericycle, conjunctive tissue and medulla in the stele form the part of ground tissue system while the xylem and phloem form the conducting tissue system.

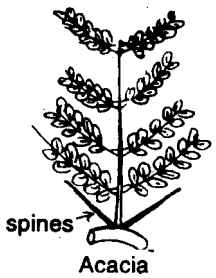
(3) Conducting tissue system: It consists of xylem and phloem which are located in stele. Generally, 4 and for sometimes 6 xylem bundles and an equal number of phloem bundles are found in this root, which are arranged alternatley. In the xylem bundles the protoxylem are found on the outer side and metaxylem towards the centre. The protoxylem develop first and hence have narrow lumen while the metaxylem develop later and hence have larger lumen. The sequence of development of the xylem is exarch in root. The xylem and phloem bundles being found on different radii, the arrangement of these bundles in the stele is called radial. Thus, the stele in the sunflower root is radial and tetrarch.

3. **Modifications of stipules:**

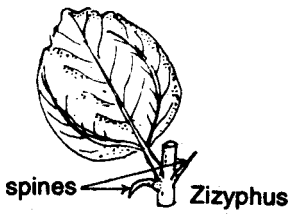
(i) Smilax: In *Similax* the two stipules arising from the leaf base are modified into long, spirally coiled and sensitive tendrils which twine around the support and help the plant in climbing. Thus, *Similax* is an example of stipule-tendril climber.



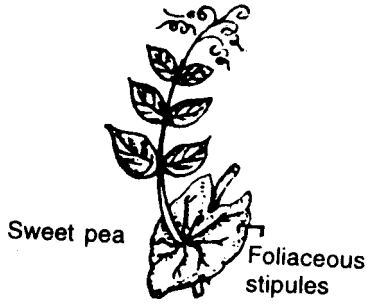
(ii) Acacia : In Acacia, there are pinnately compound leaves. The stipules arising from the leaf base get modified into twolong, strong, woody and sharply pointed structures called spines.



(iii) Zizyphus : In Zizyphus, one of the two stipules is modified into short straight and pointed spine, while the other stipule is modified into short and curved spine.



(iv) Sweet Pea : In sweet pea the stipules become modified into large, green and leaf-like to perform the funciton of photosynthesis. Such stipules are called foliaceous stipules.



A. 3 (A) 1. (i) Smallest leucocytes are lymphocytes.
(ii) Largest leucocytes are monocytes

2. **Cauda equina:** The last three pairs of ventral rami of spinal nerves along with the filum terminale of the spinal cord form a structure resembling a horse-tail, called cauda equina.

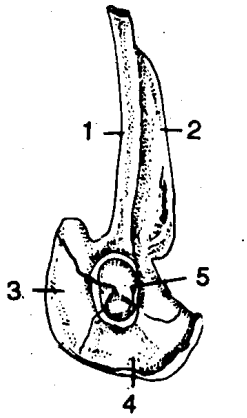
3. **Grey crescent:** It determines the future anterio-posterior axis and the axis of bi-lateral symmetry in the spherical zygote.

4. **Emulsification :** The organic bile salts combine with fat to reduce its surface tension and then convert it into fine droplets. This process is called emulsification.

5. In the neural canal, near the intervertebral foramen, there is a dorsally located gland of Swammerdam, which secretes white and bright calcareous material. This secretion hardens and renders tensile strength to the root of spinal nerve.

6. **Membranous labyrinth** are auditory sense organs which are protected by the pro-otic bones.

(B) 1. Pelvic girdle : It is "V' shaped. Its posterior ends join with each other to form a disc-like structure. It is formed of two equal halves, each being known as an innominate bone. The innominate bone is formed of an ilium, an ischium and a cartilagenous pubis. The latter is a calcified cartilage. The ilium and ischium are paired cartilage bones. The ilium is a long and laterally flattened bone having a dorsal iliac crest. Its anterior end has a cartilage which is attached tothe end of transverse process of the IX vertebra, while its posterior end is broad and forms the dorsolateral margin of the pelvic disc. The ischium is a more or less triangular and laterally flattened bone located on the dorsoposterior side of the pelvic disc. The pubis is a more or less triangular cartilage situated on the ventral side of pelvic disc. The ischia and pubis of both the innominate bones are fused firmly and inseparably forming the major part of the pelvic disc. On each lateral side of the pelvic disc there is a large concave facet - the acetabulum, in which fits in the head of femur bone forming a ball and socket joint. It maintains the shape of the body and protects the delicate organs.

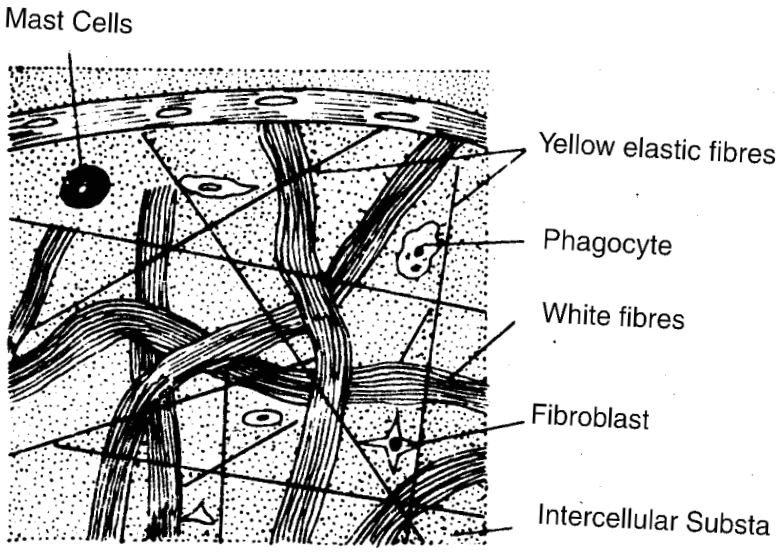


1. Ilium
2. Iliac crest
3. Ischium
4. Pubis
5. Acetabulum

2. **Transport of O_2 through blood :** The O_2 taken up into respiratory surface of respiratory organs during external respiration and CO_2 mixed up with blood from the cells does not flow upto respiratory surface through the blood in gaseous form. O_2 diffuses from the respiratory surface into the blood of the blood capillaries and ultimately reaches into RBX containg haemoglobin. Haemoglobin presents as in reduced form. Oxygen combines shiefly with HHb in RBC to form oxyhaemoglobinic acid ($HHbO_2$). The RBC reaching the respiratory surface also contain $KHCO_3$ which reacts with $HHbO_2$ to form $KHbO_2$ and H_2CO_3. O_{2i} is transported from the respiratory surface to the tissue cells chiefly as $KHbO_2$ which splits into KHB and O_2. The O_2 diffuses into tissue cells while KHB remains in the venous blood. A very small amount of O_2 dissolves in the blood plasma and is transported in this form.

3. **Areolor Connective Tissue:** This tissue is found as packing materal between the skin and muscles, between and areound the muscles, in peritoneum, mesentery and around the blood vessels and nerve fibres entering various organs. Its matrix is formed of thick, homoogeneous fluid collagen. The fibres therein are of two types : (1) White fibres which are unbranched and aranged in bundles having wavy outline> they are made up of collagen which is non-elastic and hence can withstand stress and strain. The collagen is converted into gelatin in boiling water and is soluble in dilute acetic acaid. (2) Yellow elastic fibres are branched, straight and arranged singly. They are made up of elastin which is elastic and hence cannot withstand much stress or strain. These fibres are insoluble in boiling water and dilute acetic acid.

   Cellular components of this tissue consist of fibroblasts, macrophage and mast cells. Fibroblasts are flat, irregular cell with branching processes. Their function is to produce white and yellow fibres as well as matrix. Macrophages are large, amoeboid cells which possess round or oval nucleus. Being phagocytic in nature, their function is to engulf and destroy the germs entering the body. Mast cells are round or oval in shape. They produce heparin and histamine. Heparin, being an anticoagulant, prevents intravascular clotting of blood while histamine acts as antiadrenaline and nullifies the effect of adrenaline.



A. 3 (C) (1) **Functions of brain's parts**: The brain as a whole controls and regu-lates as well as coordinates and correlates the activities of the different parts of the body. The brain possesses the controlling and coordinating centres for motor impulses and the analytic and correlating centres for thd sensory impulses. The functions of the different parts of the brain are as follows:

Olfactory lobes: The olfactory lobes possess centres for analysing and perceiving the sense of smell.

Cerebrum : The frog loses its spontaneous movements when the cerebrum is experimentally removed. In this condition it does not move of its own and does not make any attempts to capture and swollow the prey actively even if it is very hungry. It can, thus, be assumed that the cere-bral hemispheres possess the centres for initiating and regulating the voluntary and spontaneous movements.

Diencephalon: The diencephalon possesses the centres for sponta-neous movements as well as for perceiving the sense of touch (tactile sense). So, if the diencephalon is also removed along with cerebrum from the body of frog, it totally loses the ability of spontaneous movements and does not at all give any response to touch on the skin.. Moreover, since the optic nerves pass through the optic thalami they would also be cut when the diencephalon is removed.This would cause blindness in the animal.

Infundibulum: The infundibulum provides surface for the attachment of pituitary gland.

Optic lobes: The frog loses vision when the optic lobes are removed and its spinal cord is more rapidly stimulated. This shows that the optic lobes have centres for vision as well as inhibitory centres for inhibiting the spinal reflexes.

Crura cerebri : The crura cerebri form bridge for conducting the impulses between the cerebrum and the medulla obiongata.

Cerebellum: The cerebellum possesses the centres for controlling and regulating the voluntary movements and equilibrium of the body.

Medulla obiongata : The medulla obiongata possesses various centres for controlling and regulating the activities of involuntary organs as well as centres for several voluntary actions. Such actions include flinging the tongue swiftly to capture the prey, swaltowfng the prey, movements of organs during breathing process, croaking in breeding season as well as locomotion.The medulla obiongata possesses centres related to the processes of digestion, circulation and heart beats, respiration, excretion, reproduction etc. Hence, the animal dies almost instantly when the medulla obiongata is severely injured.

Choroid plexuses :The fluid that oozes out from the choroid plex-uses and enters the ventricles and central canal is known as cerebrospi-nal fluid which is a constantly changing fluid. The brain and spinal cord are supplied nutrients and oxygen through the cerebrospinal fluid which also helps in the removal of CO_2 and nitrogenous wastes.

A. 3 (C) (2) Digestion of protein starts in the stomach and gets completed in the ileum of small intestine.

(1) Digestion of proteins in the stomach : When the food enters the stomach, its wall gets stimulated and a hormone called gastrin is released in blood.

Gastrin stimulates the gastric glands to secrete gastric juice. Gastric juice contains an inactive pepsinogen, dil. HC1 and mucus. Dil. HC1 will convert inactive pepsinogen into active pepsin. Dil. HC1 provides acidic medium for the action of active pepsin. Mucus protects the wall of stomach from the effect of dil. HC1 and pepsin. Pepsin converts the proteins into peptones and proteoses. Thus the digestion of protein is initiated in the stomach and this incompletely digested food is called chyme. Then the pyloric valve opens and the chyme enters the duodenum.

(2) **Digestion of proteins in the duodenum :** Digestion of protein in the duodenum takes place with the help of the pancreatic juice. As soon as the acidic chyme enters the duodenum, its wall gets stimulated and it secretes hormones like cholecystokinin, pancreozymin, secretin. Secretin and pancreozymin stimulates pancreas to secrete pancreatic juice. Pancreatic juice contains inactive proteases trypsinogen, chymotrypsinogen and procarboxy peptidase. This inactive trypsinogen is transformed into active trypsin by a co-enzyme of intestinal juice called **enterokinase.** This trypsin converts chymotrypsinogen into chymotrypsin and procarboxy peptidase into carboxy peptidase. All these active proteases digest the peptones and proteoses of chyme and convert them into polypeptides, dipeptides and peptides. Thus the digestion of protein is not yet completed. The rest of the digestion of proteins takes place in the ileum part of the small intestine.

(3) Digestion of proteins in ileum : Enterocrinin and duocrinin stimulate intestinal glands to secrete intestinal juice. Here the digestion of proteins is carried out by intestinal juice produced by intestinal glands. The intestinal juice contains several proteases called erepsin. Erepsin digests the polypeptides, dipeptides and peptides and transforms them into amino acids. With the formation of amino acids, the digestion of proteins is completed.

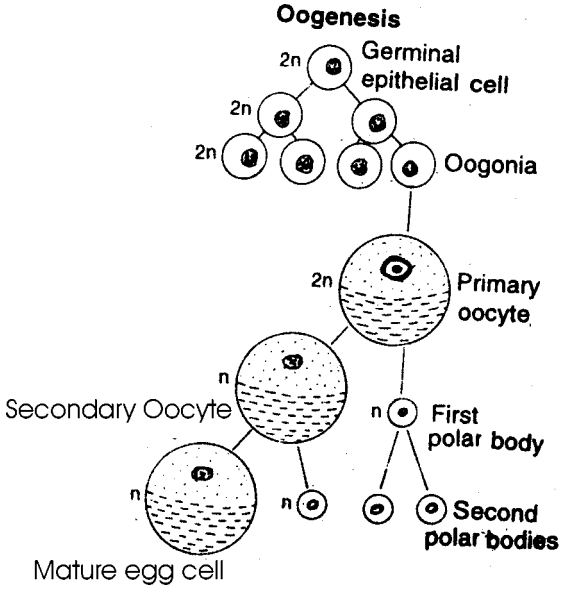
A. 3 (C) (3) The formation of the haploid ova from the diploid germinal cells of the ovary is called oogenesis. Each patch of germinal epithelium in the wall of the ovary is activated under the influence of gonadotropic hormones from the anterior pituitary lobe and produce an egg follicle. Unlike spermatogenesis, this process is not continuous, but can be divided into three phases, viz., (1) multiplication phase, (2) growth phase and (3) maturation phase.

(1) **Phase of multiplication** : The primordial germ cells of the ovarian germinal epithelium by repeated mitotic divisions produce diploid oogonia.

(2) **Phase of growth** : In this phase, the oogonia do not divide. One cell from each mass of oogonia enlarges and gets transformed into a **primary oocyte** (2n). The other cells remain small and get arranged around the primary oocyte to form the follicular epithelium. Primary oocyte and follicular epithelium together form an ovarian follicle. During the formation of primary oocyte, the mitochondria and large amount

of DNA and RNA accumulate at one place in the cell, which functions as the centre for the formation of yolk. The primary oocyte and the follicular cells are connected by plasmodesmata through which various organic nutrients and other useful substances enter the oocyte and synthesize yolk. At the same time, a black pigment called melanin, is also formed. The follicular epithelial cells secrete a tough, transparent, elastic egg membrane around the cell membrane to form the vitelline membrane. When the primary oocyte is fully grown up, the ovarian follicle ruptures and a primary oocyte is released in the coelom. This is called **ovulation.** The primary oocyte from the coelom enters the oviducal funnel due to the ciliary movement of the cells located at the margin of the oviducal funnel.

(3) **Phase of maturation** : The primary oocyte divides meiotically to form two unequal haploid cells. Of the two cells thus formed, the large one is called secondary oocyte and the smaller one is called first polar body. Further division is stopped until the sperm enters the secondary oocyte. As and when the sperm enters the secondary oocyte, the second mitotic maturation division takes place to form two unequal cells. The larger one containing nucleus and yolk is the mature egg and the smaller without yolk is the second polar body. The first polar body by second mitotic division forms two polar bodies. Thus, at the end of oogenesis, each primary oocyte produces one large mature egg and three small polar bodies. The polar bodies ultimately disintegrate. The mature egg is transformed into a zygote by fertilization.



A. 4. (A) **(1)** **(i)** **Helicase :** In the beginning of the process of DNA replication, the enzyme “Helicase” opens up the segments along he DNA double helix.

(ii) **Diformylase :** The first amino acid of any released polypeptide chain is methionine which is removed initially with the help of enzyme diformylase.

(2) **Jumping genes :** During recombination, a gene may change its location. Such genes are called jumping genes. They are described in Drosophila and Bacteria.

(3) **Source :** Kappa particles present in the killer strain of Paramoeciuum whose formation depends on a dominant gene.

Function : It is a toxic substance. Its presence in water is found to be responsible for the death of the sensitive varieties of paramoecium.

(4) Karyotype : The arrangements of chromosomes accroding to their size, shape and position of centromere is called karyotype.

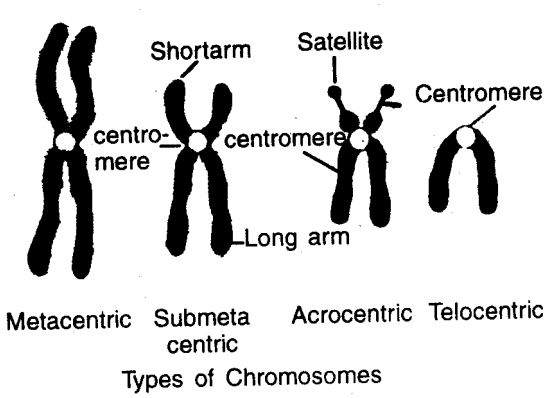
A. 4 (B) Depending upon the position of the centromere, the chromosome have been divided in four groups.

(1) Metacentric : In this type of chromosome, the centromere occurs in the centre and all the four chromatids are of equa length.

(2) Submetacentric: In this type of chromosome, the centromere, is a little away from the centre and therefore chromatida of one side are slightly longer than the other side..

(3) Acrocentric : In this type of chromosome, the centromere is located closer to one.end of the chromatid and therefore the chromatids on opposite side are, very long while on the side of the shorter chromatid, a small round structure can be observed, attached by a very thin thread. This is part of the chromatid and is termed as satellite. These thin strands at the satellite region are termed a Klucteolar organiser region.

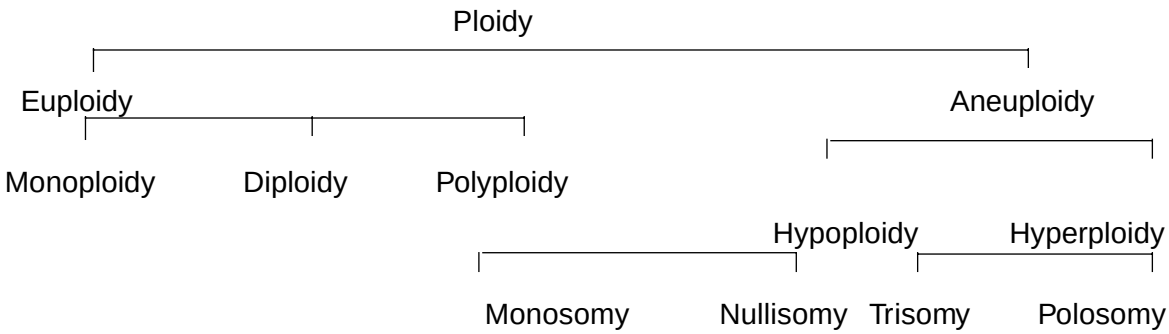
(4) Telocentric : In this type of chromosome, the centromere is placed at one end of the chromatids and hence they have only on arm. Such telocentric chromosomes are not. seen in human cells.



Types of Chromosomes

A. 4 (C) (1) Numerical chromosomal abnormalities

In any living cell if there is a variation in the number of chromosomes, then it is termed as Ploidy. Different types of ploidy have been shown in the chart :



Euploidy : In general, living organisms have either n or 2n number of chromosomes. The

changes in the number of chromosomes in the living cells could occur in multiples of odd number and such changes are termed as euploidy. Instead of the normal number of chromosomes in living organisms, the number could occur as a single set (Monoploidy) or in many multiples of the basic set of chromosomes.

Monoploidy : If, among diploid organisms, due to certain reasons irregularities occurring in chromosomal number result in individual having only a single basic set of chromosomes (haploid), the condition is termed as Monoploidy.

Diploidy : Generally, in living organisms, which are haploid like the lower groups of plants, if due to certain reasons the chromosomes occur as twice the haploid number, then such a condition is termed Diploidy. Higher living organisms normally have twice the basic number of chromosomes (2n) and hence they cannot be considered abnormal diploid.

Polyploidy (Multiple sets of chromosomes) : Euplodic organisms having multiple sets of chromosomes 3n, 4n, or 5n or more are termed as Polyploid and the phenomenon is termed as Polyploidy. This phenomenon is commonly observed among plants, whereas it occurs very rarely among animals. Experimentally, polyploidy has been induced in tomatoes, apples, chickoos, grapes, strawbery plants, all of which have been made polyploid. Besides these, crops such as wheat, jowar have also been made polyploid. Polyploidy is rare among human beings. Only cancer cell have been observed to be polyploid.

Aneuploidy: An increase or decrease of only one or many of the chromosomes in any group of homologous chromosomes has been termed as Aneuploidy. In the somatic cells of aneuploidic organisms, if the diploid number of chromosomes are less by only one or two chromosomes, the condition is termed hypoploidy and if it is more it is known as Hyperploidy. The condition in which organisms with hypoploidy lack only one chromosome of a homologous pair (2n - 1) is known as Monosomy and when two chromosomes of a homologous pair are missing (2n - 2), this event is called Nullisomy. In Hyperploid organisms having (2n + 1) an extra chromosome in any one of the homologous pair of any group of chromosomes, the condition is termed Trisomy and an increase in more than one chromosome in a pair is termed as ploysomy. A condition of trisomy, similar to that described above, if instead of a single pair it occurs in two or three pairs of chromosomes, then it is described as Double or Triple Monosomy or Trisomy.

If the above-mentioned chromosomal irregularities occur in autosomes, the condition is termed autosomal aneuploidy, and if it occurs in the sex chromosome, it is known as sex chromosomal aneuploidy.

A.4 (C) (2)

Bateson and Punnet (1906) carried out experiments on the sweet pea plant *(Lathyrus odoratus)* The plants of a variety of sweet pea having purple flowers and long pollen (PPLL) were crossed with a variety having red flowers and round pollen *(ppll)* . The plant with purple flowers and long pollen has obtained in F, generation.

P Generation	PPLL Purple flowers with long pollen	X	ppll Red flowers with round pollen	
		↓		
F_1 generation		PpLl Purple flowers &	X	PpLl

When the F_1 individuals are self-crossed, the following results of the F_2 generation are obtained.

Results of F_2 Generation :

Number	Purple flowers Long pollen	Purple flower Round pollen	Red flower long pollen	Red flower round pollen
Experimental Ratio	11	1	1	3
Expected Ratio	9	3	3	1

Such a cross of F, individual with either of the two parents is Known as a backcross. [Only the cross with the recessive parent is known as a test cross. It is called a test cross, because it is used to test whether a genotype of an individual is homozygous (pure) or heterozygous (hybrid).] When the F, plants with purple flowers and long pollen are test crossed with the plants having homozygous recessive for both characters, the plants produced in the forthcoming F_2 generation, are obtained in following manner instead of expected test crossed ratio 1:1:1:1.

F_1 generation **P*pL/*** × ***ppll***

↓ **back cross (test cross)**

F_2 generation

Purple flower : Red flower : Purple flower : Red flower
Long pollen Long pollen round Pollen round pollen
7 : 1 : 1 : 7

A4 (C) (3)

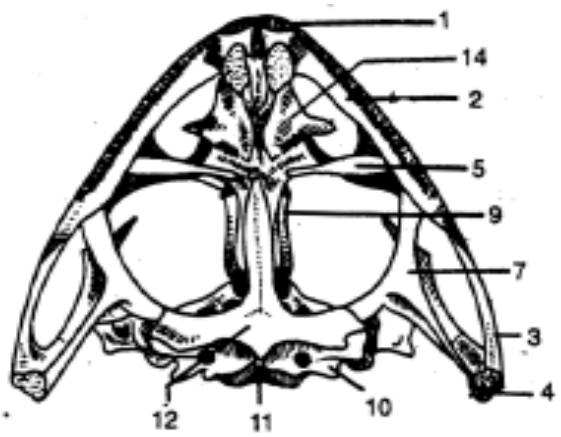
Inheritance of Y-linked genes: Certain genes are located only on the Y-chromosome, of which many are involved in the mechanisms of sex determination and differentiation.

In man, the growth of hair on the ears rims and beard and development of testis, are controlled by genes located on the Y-chromosomes and hence they are expressed only in the male. Such genes are termed as holandric genes. Such characters are transmitted from the father to the son.

Genes for sex-influenced traits: Certain genes are present on the autosome in both mates and females and are not linked with the sex-chromosomes, still these genes are expressed under the influence of the sex of the organism. Hence, the same genes are expressed differently in the male and female.

In man gene controlling baldness are an appropriate example for such sex influenced traits. These genes are located on autosomes and are in the heterozygous condition, expressing differently in males and females. In males, under the influence of male sex hormones, these genes express themselves and the man expresses baldness while, in the female, the female sex hormones will suppress the expression of these genes and hence in normal circumstances females do not express baldness.

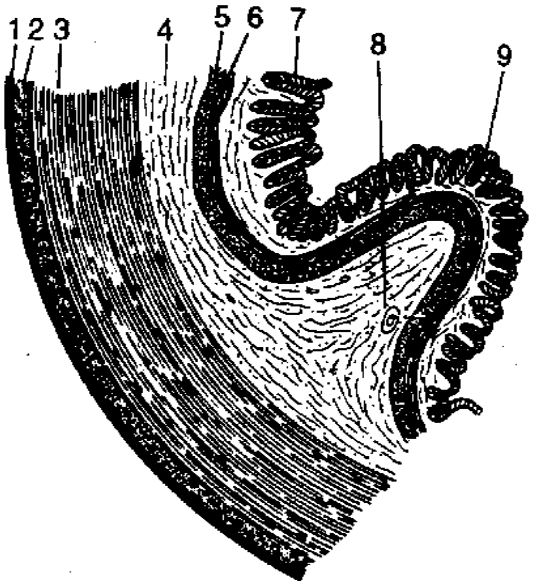
A. 4. (D) (1)



1. Premaxilla 2. Maxilla 3. Quadratojugal 4. Quadrate cartilage
5. Palatine 6. Squamosal 7. Pteyrgoid 8. Sphenethmoid
9. Frontoparietal 10. Exoccipital–pro-otic 11. Foramen magnum
12. Parasphenoid 13. Nasal 14. Vomer

Skull (Ventral view)

A.4. (D) (2)



1. Serosa
2. Longitudinal muscle layer
3. Circular muscle layer
4. Submucosa
5. Longi. muscle layer of muscularis mucosa
6. Circular muscle layer of muscularis mucosa
7. Glandular epithelium of mucosa
8. Blood vessel
9. Gastric gland

A. 5 (A) (1) Material Cycle : The interrelationship between living organisms and non-living components of the ecosystem constitutes the material cycles.

(2) Opsonisation : It is a process in which the phagocytes recognize and digest the antigen molecules. Immunoglobulin molecules of 'G' type (IgG) cover the surface of the antigen with which, phagocytes can recognize the antigen molecules.

(3) Immunotherapy is amethod where antibodies are used for the treatment of cancer.

(4) Memory Cells

Location : There are sotred in spleen and other lymph glands.

Function : Memory cells remember the antigen that had entered at the time of first attack and produce cells which can fight more effectively against the same type of antigen, if the attack is repeated.

(5) Ecological Boomrangs : When man causes variation in environment, the environment reacts naturally against these changes. This reaction of the environment against any change is known as ecological boomerangs e.g. Green House Effect, acid rain, pollution etc.

(6) The hybridoma cell can produce specific type of antibody, which is known as monoclonal antibody.

A5 (B) (1) **Allergy and inflammation** : Allergy is a specific type of antigen-' antibody reaction occurring in the body, in which the body shows high and unusual physiological response against certain substances. These substances which are causative for producing such unusual response, i.e. allergy, are called allergens. An allergen is a kind of antigen. The antibody binds with the allergen on the receptor surface of the Mast cells found in the connective tissue in our body. All people are not sensitive to all types of allergens. The allergic reaction does not occur when a person comes in contact with a particular allergen for the first time, because the antibody is not yet produced against the allergen. Once the antibodies are produced against a particular allergen, the subsequent exposure to the allergen would enhance the antibody production. At this stage the antibody binds with the allergen on the surface of Mast cells causing them to burst and release histamine. The release of histamine causes skin irritation and inflammation in that part of the body. This phenomenon is known as allergy which occurs quite fast. As a result of this reaction there is irritation in the mucous membrane, excessive secretion of nasal and opthalmic fluids, increased sensitivity and softness of the skin, urticaria, asphyxia etc. In some cases the patient is required to be given oxygen. Sometime we hear the cases of death caused by a single penicillin injection or by the sting of honeybee or scorpion. Such cases of death are due to anaphylactic shock. Antihistamine druns are given to nullify the allergic effect of histamine.

(2) **Noise pollution and its effect on health :** Noise is any unwanted, discordant loud sound, which has adverse effects on the health. Such unwanted noise when its intensity increases and it remains for a long time in the environment disturbs man's mental peace and create* annoyance and irritation. Disturbed rest, mental peace and tranquility in turn has drastic effects on the health, and can cause deafness.

It has been reported that noise can cause constriction of the small blood vessels, due to which the organ being supplied, does not receive an adequate quantity of blood. This consequently results in fatigue and restlessness.

Noise creates tension which in turn cause several disturbances in the physiology, such as dilation of eye pupil, increase in blood pressure, increase in blood adrenalin levels which causes rest-lessness and irritation.

Noise also causes heart ailments, headaches, increased blood pressure, weakness. As a result concentration and memory may also be decreased.

(3) **Smoking** : Nicotine present in tobacco is an addicting agent, causes person to be addict. It lures people as its consumption gives a 'kick' that is enjoyable. However, nicotine is a highly toxic substance. Nicotine contents of a cigar, if injected in blood can cause death. Long term ill effects* of inhaling cigarette smoke are observable.

Nicotine excites nerves, relaxes muscles and releases adrenaline. Blood pressure increases and palpitation sets in, and chances of heart disease increases. Smoking by a pregnant woman affects the growth of the foetus. Worst of all nicotine is habit forming.

Inhaling tobacco smoke causes respiratory diseases and chances of cancer increase. This is also a reason for causing cancer of lungs. Smoking also makes one susceptible to oral cancer. During past few years a large number of reports have been published to show ill effects of consumption of tobacco in any form. The Govt. made it compulsory to print a legal warning of health hazards of tobacco on cigarette packs and tobacco pan masala, so that people remain away from the uses of tobacco. Yet public awareness in the matter is not insignificant.

(4) There are chiefly three types of cancers : (1) Carcinoma, (2) Sarcoma, (3) Leukaemia.

(1) Carcinoma : When the cells of epithelial tissue of the body grow abnormally and forms malignant growth, it is known as a carcinoma. This includes breast cancers, lung cancer, pancreatic cancer and stomach and intestinal cancers.

(2) Sarcoma : When tissues of mesodermal origin grow abnormally to form a malignancy,

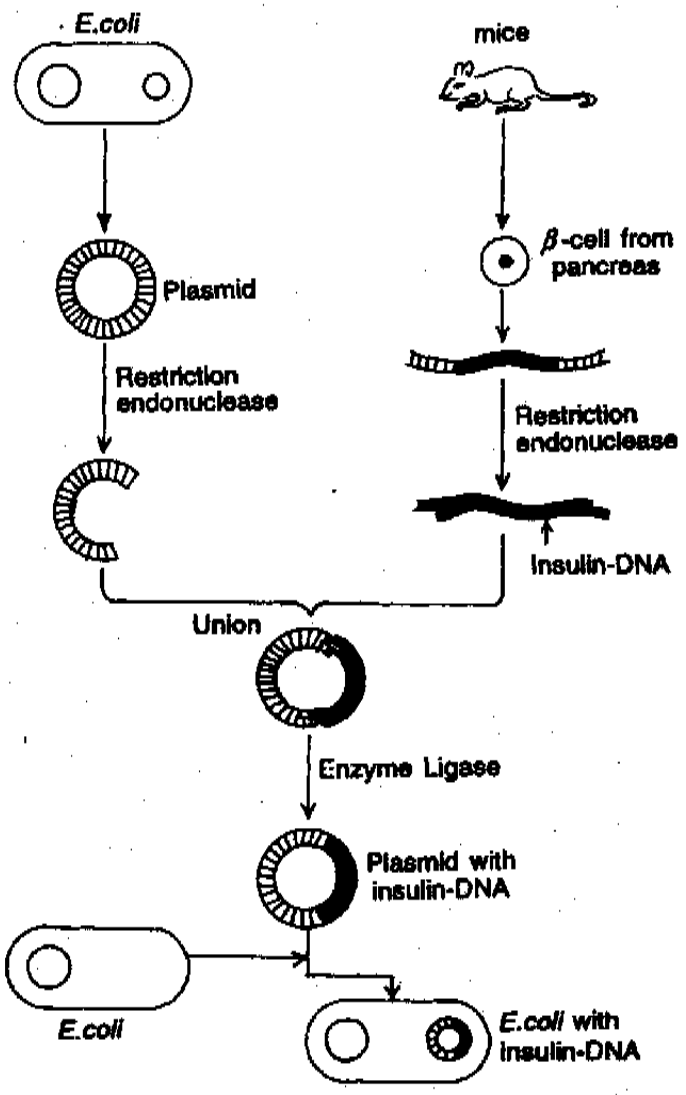
it is known as a Sarcoma. This includes bone cancer, muscular tissue cancer, and lymphatic cancers.

(3) Leukaemia : Leukaemia is that form of cancer which affects the blood cells and bone marrow. The number of white blood cells (leukocytes) increases in a patient with leukaemia. Besides these new-bom and infants are often affected by cancers, which develop in certain tissues like kidneys, eyes and brain, during embryonic development. Such cancers are often malignant.

A5 (C) (1)

Recombinant DNA

In the Recombinant DNA technology the desired DNA fragment is isolated from the suitable cell of an organism and is joined with a DNA fragment of some other organism. In this technique the enzyme restriction endonuclease obtained from *E.coli* is used for cutting the DNA strands in both the organisms and the enzyme ligase from *E.coli* is used for joining these DNA fragments with each other. Such DNA fragments can be obtained from two individuals of the same or different species. The new DNA fragment, so obtained by recombinant DNA technique, is known as hybrid ONA or recombinant DNA or gene. Such a hybrid gene can be introduced in the *E.coli.* A large number of copies of such DNA are formed as a result of the growth and multiplication of the host bacteria. Such bacteria having hybrid gene can be utilized to obtain specific types of genetical products (proteins). The artificial production of insulin is now possible by this technique. Thus, the recombinant DNA technology is a boon for the production of somatostatin and other hormones, interferon, vaccines etc.



Technic of introducing insulin-gene of mice in *E.coli*

(2) **Energy plantation** : To maintain a continuous supply of firewood for fuel, energy forest plantation is essential in large scale. The advantage of energy forests are mentioned below :

(1) Solar energy can be stored continuously by energy plantations.
(2) If the energy is used precisely, it can be used again and again as it is a renewable resource.
(3) Energy plantation can be easily carried out and does not require any sophisticated technology.
(4) We have all the necessary man-power for energy plantation.
(5) It is economical to carry out such plantation.
(6) Plantation of energy forest is also part of the environmental protection.

It is necessary to consider the following important steps for energy plantations :

(1) Obtaining land for energy plantation : Land is the main necessity for energy plantation. Agricultural land should not be used for this purpose, but non-agricultural, farm wastelands, any land used for general purposes in the village, land on either side of roads, railway lines and canal, infertile forest lands, wasteland may also be used for energy plantation.

(2) Selection of proper trees for plantation : Success of energy plantation depends upon which trees are planted for the purpose of deriving energy. To choose the correct trees, the following criteria should be considered. The trees should be selected in such, a *way* that it has many uses/Besides fuel, these trees should also provide fruit, seeds, fodder, gum, medicine etc., by keeping this point in mind. The energy plantation is for the people, so the people themselves should start such plantations and use their products. This has been termed as social forestry.

(3) Development of Agrotechnology in energy plantation : Techniques should be developed to cultivated trees in such a region where the maximum production could be made of its products. Along with energy, forestation, plantation is earned out such that we utilize the land at it maximum to get grass, fodder etc.

(3) Development of Biotechnology In India : U.S.A., Japan and European countries have made tremendous progress in- the field of Biotechnology. National Biotechnology Board (NBTB) has been established in India for the development of Biotechnology. After this, the International Centre for Genetic Engineering and Biotechnology (ICGEB) was established in New Delhi. This centre, as its name suggests, is linked with other national and international Biotechnological institutes. Some of the institutions located in India and working in this field are Indian Agriculture Research Institute (IARI), New Delhi; National Dairy Research Institute (NDRI), Kamal; Indian Veterinary Research Institute (IVRI), Izzatnagar (U.P); Bhabha Atomic Research Centre (BARC), Mumbai; Bharat Immunological and Biological Corporation Ltd. (BIBCOL) for polio vaccine; Centre for Cellular and Molecular Biology (CCMB), Hyderabad which is famous for DNA finger-printing; Institute of Microbial Technology (IMTEC), Chandigadh for the manufacture of various alcoholic beverages with the help of yeast culture, etc.

Many other institutions, in addition to those mentioned above, have developed technics to produce vaccines against different diseases, diagnostic kit for filaria, various vegetable plants, home decorative plants and some other plants such as date, palm, banana plant, sugar-cane, clove etc., by different tissue culture technics. The discovery of biopesticides and biofertilizers has been proved to be very

useful. Similarly, Biotechnology has contributed signficantly in the field of prawn culture, pearl culture, sericulture etc.

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