Telangana State Board of
INTERMEDIATE Education

ZOOLOGY-II

BASIC LEARNING MATERIAL

For The Academic Year : 2020-2021

TELANGANA STATE BOARD OF INTERMEDIATE EDUCATION

ZOOLOGY 2nd YEAR (E/M)

BASIC LEARING MATERIAL

For Academic Year

2020-2021

PREFACE

The ongoing Global Pandemic Covid-19 that has engulfed the entire world has changed every sphere of our life. Education, of course is not an exception. In the absence of Physical Classroom Teaching, Department of Intermediate Education Telangana has successfully engaged the students and imparted education through TV lessons. The actual class room teaching through physical classes was made possible only from 1st February 2021. In the back drop of the unprecedented situation due to the pandemic TSBIE has reduced the burden of curriculum load by considering only 70% syllabus for class room instruction as well as for the forthcoming Intermediate Public Examinations May 2021. It has also increased the choice of questions in the examination pattern for the convenience of the students.

To cope up with exam fear and stress and to prepare the students for annual exams in such a short span of time , TSBIE has prepared "Basic Learning Material" that serves as a primer for the students to face the examinations confidently. It must be noted here that, the Learning Material is not comprehensive and can never substitute the Textbook. At most it gives guidance as to how the students should include the essential steps in their answers and build upon them. I wish you to utilize the Basic Learning Material after you have thoroughly gone through the Text Book so that it may enable you to reinforce the concepts that you have learnt from the Textbook and Teachers. I appreciate ERTW Team, Subject Experts, Medha Charitable Trust who have involved day in and out to come out with the, Basic Learning Material in such a short span of life.

I would appreciate the feedback from all the stake holders for making it enriching and cent percent error free in all aspects.

The material can be accessed through our website www.tsbie.cgg.gov.in which is exclusively devoted to uploading the additional study material from time to time.

Commissioner &Secretary
Intermediate Education, Telangana.

Contents

UNIT-IB

BREATHING AND EXCHANGE OF GASES

Very Short Answer type Questions

1. Define vital capacity. What is its significance ?

Ans:- **Vital Capacity (V.C):-** The maximum volume of air a person can breath in after forced expiration this includes ERV, TV and IRV

V.C.=TV+1RV+ERV

2. What is the volume of air remaining in Lungs after a normal expiration ?

Ans:- The volume of air that remains in the lungs after normal expiration is "Functional Residual capacity (FRC)

3. Diffusion of oxygen occurs in the alveolar region only and not in the other parts of respiratory system. How do you justify the statement ?

Ans:- The diffusion membrane is made up of three major layers namely (1) The thin sqlamous epithelium of the alveolar wall (2) the endothelium of the alveolar capillaries and (3) the basement material inbetween them. As if is a very thin border. It is favourable for diffusion of gases.

4. What is the effect of PCo_2 on oxygen transport ?

Ans:- The effect of PCo_2 on oxygen transport is called "Bohr Effect"

5. What happens to the respiratory process in a men going up a hill ?

Ans:- At a height of about 6000m the Po_2 becomes almost half of what it is at the mean sea level hence the "mountain sickness" in people ascending hills. The ribcage and the diaphragm help mammals breath in air more effectively.

6. What is tidal volume ? Find out the tidal volume (Approximate Value) in a healthy human in an hour ?

Ans:- **Tidal Volume (T.V.) :-** Volume of air inspired or expired during normal inspiration or expiration. It is apprximately 500ml i.e., a healthy man can inhale or exhale approximately 6000 to 8000ml of air per minute. So in an hour T.V. is 500x60=30000ml (or) 30L

7. Define oxyhaemoglobin dissociation curve ? Can you suggest any reason for its sigmoidal pattern ?

Ans:- A sigmoid curve is obtained when percentage saturation of haemoglobin with O_2 is plotted against the Po_2. This curve is called oxyhaemoglobin

dissociation curve.

8. What are Conchae ?

Ans:- In Nasal chambers respiratory part has three thin twisted bony plates called conchae.

9. What is meant by chloride shift ?

Ans:- **Chloride shift :-** Exchang of chloride and bicarbonate ions between erythrocytes and plasma. It is also called Hamburger's Phenomenon.

10. Mention any two occupational respiratory disorders and their causes in human beings ?

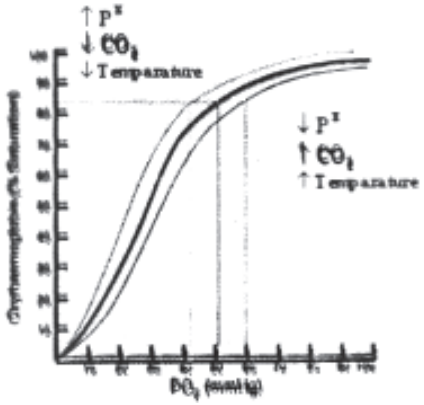
Ans:- **1. Asbestosis:-** It occurs due to charonic exposure to asbestos dust in the people working in asbestos industry.

2. Silicosis :- It occurs because of long term exposure to silica dust in the people working in mining industries, quarries e.t.c.

11. Name the muscles that help in normal breathing movements ?

Ans:- The muscular diaphragm and a specialized set of muscles, the external and internal inter-costal muscles help in normal breathing movements.

12. Draw a diagram of oxyhaemoglobin dissociation curve ?



Short Answer type Questions

1. Explain the process of inspiration and expiration under normal conditions?

Ans:- **1. Inspiration :-** In take of atmospheric air into the Lungs is called inspiration. It is an active process as it takes place by the contraction of the muscles of the diaphragm and the external inter costal muscles. which extend in between the ribs.

2. Expiration :- Release of alveolar air to the exterior is called expiration. It is a passive process. Relaxation of the diaphragm and the external inter costal muscles returns diapharagm and sternum to their normal position.

2. What are the major transport mechanisum for Co_2 Explain ?

Ans:- **As bicarbonates :-** About 70 percent of Co_2 is transported as bicarbonates with the help of carbonic an hydrase enzyme. This enzyme facilitate the following reaction in both the directions.

$$Co_2 + H_2o \xrightarrow{\text{Carbonic anhydrase}} H_2Co_2 \xrightarrow{\text{Carbonic anhydrase}} Hco_3^+ + H^+$$

At the tissues where partial pressure of Co_2 is high due to catabolism. Co_2 diffuses into the blood (RBC & Plasma) and forms carbonic acid which dissociates into and H^+. At the alveolar site where PCo_2 is low, the reaction proceeds in the opposite direction leading to the formation of Co2 and water. Thus Co_2 is mostly trapped as bicorbonate at the tissues and transported to the alveoli where it is relesed out as Co_2.

Chloride Shift :- Exchange of chloride and bicorbonate ions between erythrocytes and plasma is also called Hamburger's Phenomenon.

3. How is respiratory movements regulated in man ?

Ans:- (1) A special centre present in the medulla region of brain Called respiratory rhythm centre is primary responsible for regulation.

(2) Another centre present in the pons of the brain stem called Pneumotoxic centre can moderate the functions of the respiratory rhythm centre.

Hco_3^-

(3) A chemo-sensitive area is situated adjacent to the respiratory rhythm centre which is highly sensitive to Co_2 and H^+ ions

(4) Receptors associated with aortic arch and carotid artery also recognize changes in Co_2 and H^+ concentration and send necessary signals to the respiratory rhythm centre for necessary actions.

4. **Describe the disorders of Respiratory System ?**

Asthama :- is a difficulty in breathing caused due to inflammation of bronchi and bronchioles symptoms include coughing difficulty in breathing and wheezing.

Emphysema:- is a chronic disorder in which alveolar walls are damaged and their walls coalesce due to which respiratory surface are of exchange of gases is decreased one of the major causes of this smoking of tobacco.

Bronchitis:- is the inflammation of the bronchi resulting in the swelling of mucous lining of bronchi increased mucus production and decreases in the diameter of bronchi

Pneumonia :- is infection of lungs caused by bacteria such as streptococcus pneumoniae and also by certain viruses, fungi, protozovans and mycoplasmas.

Occupational Respiratory disorders:- "Asbestosis", "Silicosis" "Siderosis", "Black-lung disease" are caused by exposure of the body to the harmful substances from certain industries, especially those involving grinding or stone breaking.

Long Answer type Questions

1. Describe the respiratory system in man ?

Ans:- Respiratory system of man includes the following :

I. External nostrils (External Nares)

A pair of external nostrils opens out above the upper lip/They lead into nasal chambers through the nasal passages.

II. Nasal Chambers

They lie above the palate and are separated from each other by a nasal septum. Each nasal chamber can be differentiated into three parts namely; i. vestibular part (which has hair and sebaceous glands to prevent the entry of dust particles), ii. respiratory part (which is involved in the conditioning the temperature of inhaled air, it has three thin, twisted bony plates called turbinals /conchae) and iii.olfactory part (which is lined by an olfactory epithelium).

III. Naso-pharynx

Nasal chambers lead into nasopharynx through a pair of internal-nostrils. located above the soft palate. Nasopharynx is a portion of the pharynx, the common chamber for the passage of food and air. Nasopharynx leads into oropharynx and opens through glottis of larynx into the trachea,

IV. Larynx

Larynx is a cartilaginous box which helps in sound production, hence called the voice box- Wall of larynx is supported by nine cartilages. Thyroid, cricoid and epiglottis are the unpaired cartilages, whereas corniculate cartilages (cartilages of Santorini - two small conical nodules of elastic cartilage articulating with the arytenoid cartilages), arytenoids, and cuneiform cartilages are the paired cartilages. Epiglottis is a thin leaf like elastic *cartilaginous jlap* attached to the thyroid cartilage to prevent the entry of food into the larynx through the glottis. The *yellow elastic fibres* which connect the thyroid and arytenoid cartilages are called vocal cords/vocal folds- The space between the *true vocal cords* and the *arytenoids cartilage/* is called rima glottidis.

The mid ventral part of the thyroid cartilage forms the laryngeal prominence called Adam's apple

In males, the vocal cords are thicker, longer, and produce low pitch voice, where as in women and children the vocal cords are usually short and produce high pitch voice.

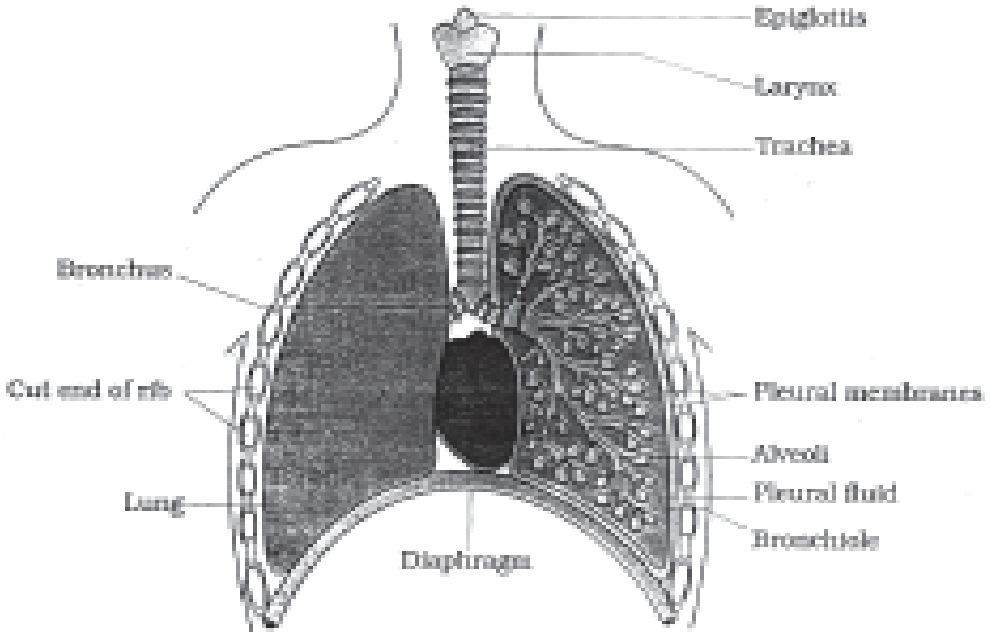
V. Trachea

Trachea, the wind pipe is a straight tube extending up to the mid-thoracic cavity. The wall of the trachea is supported by 'C' shaped rings of hyaline cartilage. These rings are incomplete dorsally and keep the trachea always open preventing collapse, Internally the trachea is lined by *pseudostratified ciliated epithelium.*

VI. Bronchi and Bronchioles

On entering the mid thoracic cavity, trachea divides at tlie level of the fifth thoracic vertebra in to right and left primary bronchi. Each primary bronchus enters the corresponding lung and divides into secondary bronchi that further divide into tertiary bronchi. Each tertiary bronchus divides and re-divides to form primary, secondary, tertiary, terminal and respiratory bronchioles sequentially. Each respiratory bronchiole terminates in a cluster of alveolar ducts which end in alveolar sacs. Bronchi and initial bronchioles are supported by incomplete cartilaginous rings. The branching network of trachea, bronchi and bronchioles constitute the `pulmonary tree' (an upside down tree).

VH. Lungs



Diagrammatic view of human respiratory system
(Sectional view of the left lung is also shown)

Lungs occupy the greater part of the thoracic cavity. Lungs are covered by a double layered pleura, with pleural fluid between them. It reduces friction on the lung surface. The outer pleural membrane is in close contact with the thoracic lining whereas the inner pleural membrane is in contact with lung's surface. *The part starting with external* nostrils up to the terminal bronchioles constitute *the conducting part, whereas the alveoli* and `their *ducts form the respiratory or exchange part of the respiratory system.* The conducting part transports the atmospheric air to the alveoli, dears it from foreign particles, humidifies and also brings the inhaled air to the body temperature. Exchange part is the site of actual diffusion of and between blood and atmospheric air.

The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber, it is formed dorsally by the vertebral column, ventrally the sternum, laterally by ribs and on the lower side by the dome-shaped diaphragm. The anatomical setup of lungs in the thorax is such that any change in the volume of thoracic cavity will be reflected in the lung cavity. Such an arrangement is essential for breathing, as the pulmonary volume cannot be directly altered.

UNIT-IIA

HUMAN ANATOMY AND PHYSIOLOGY-II

Very Short Answer type Questions

1. Write the difference between open and closed system of circulation ?

Ans:-

open type	Closed type
In this type blood flows freely in the body space, comes out of the blood vessels.	In this type blood flows through blood vessels
Ex:- Arthopods, molluscs, echinoderms and ascidiams	Ex:- Annelids, Cephalopods and vertebrates

2. Sino-atrial node is called the pacemaker of our heart why ?

Ans:- Sino-atrial node(SAN) consists of specialized cardio myocytes. It has the ability to generate action potentials without any external stimull hence called pace maker.

3. What is the significance of artrio ventricular node and atrio ventricular bundle in the functioning of the heart ?

Ans:- Artioventricular node (AVN) is seen in the lower left corner of the right atrium close to the atrio ventricular septum. This is a relay point that relays the action potentials received from the SA node to the ventricular musculature.

A bindle of nodal fibers called atrioventricular bundle(His bundle) continues from the AVN into the inter-ventricular septum.

4. Name the valves that guard the left and right atrioventricular aperatures in man ?

Ans:- The left and right apertures are guarded by bicuspid (mitral valve) and tricuspid valves respectively.

5. Where is the valve of the besius in the heart of man ?

Ans:- Coronary sinus is opening into the right artium is guarded by the valve of the besius.

6. Name the aortic arches arising from the ventricles of the heart of man ?

Ans:- 1. The pylmonary arch arises from the left anteriar angle of the right ventricle

2. Systemic arch(left) arises from the left ventricle and transported blood to different parts of the body.

7. Name the heart sounds when are they produced ?

Ans:- Lub and Dub are the heart sounds.

⇨ At the time of ventricular systole the production of the first heart sound known as LUB

⇨ The ventricles now relax the production of the second heart sound known as DUB

8. Define Cardiac cycle and Cardiac out put ?

Ans:- **Cardiac cycle :-** The Cardiac events that occur from the begining of one heart beat to the begining of the next constitute a cardiac cycle.

Cardiac out put :- The volume of blood pumped out by the heart from each ventricle per minute is termed cardiac output.

Cardia out put=Stroke volume x No. of beats per minute.

9. What is meant by double circulation ? What is its significance ?

Ans:- Blood has circulated two times through the heart in a complete circulation one is systemic circulation another is pulmonary circulation that is called double circulation.

In systemic circulation, deoxygeneted blood collected from body parts (except Lungs)

In pulmonary circulation heart receive the oxygenated blood from lungs.

10. Why the arteries are more elastic than the veins ?

Ans:- Arteries are thick-walled as the tunica media is relatively thick with elastin and smooth muscles but veins are thin walled and sightly muscular so arteries are more elastic than veins.

Short Answer type Questions

1. Write the difference between open and closed system of circulation ?

Ans:- 1. Fishes have a 2-chambered heart with an atrium and ventricle.

2. Amphibians have a 3-chambered heart with two atria and one ventricle.

3. Reptails have two atria and an incompletly divided ventricle (except in

the crocodiles)

4. Birds and mammals possess a 4-chambered heart with two atria and two ventricles this is evolutionary development of the heart in vertibrates.

2. Describe the atria of the heart of man ?

Ans:- Atria are thin waled receiving and upper chambers. The right one is larger than the left. The two atria are separated by thin inter-atrial septum.

- ⇨ In the fetal heart the atrial septum has a small pore called foramen ovale. Normally It is closed at birth, when Lungs become functional. If does not close properly it is called a patent foramen ovale.
- ⇨ The right atriumr eceives deoxygenated blood from different parts of the body (except the Lungs) through three caval veins the two precavals and a post cavel vein.
- ⇨ It also receives blood from the myocardium through the coronary sinus, whose opening into the right atrium is guarded by the valve of thebesius opening of the postcaval vein is guarded by the Eustachian valve.
- ⇨ Atria and ventricles are seperated by a membranous atrio-ventricular septum. The left and the right apertures are guarded by bicuspid (mitral valve) and tricuspid valves respectively.

3. Describe the ventricles of the heart of man ?

Ans:- 1. Ventricles are the thick walled blood pumping lower chambers separated by an interventricular septum.

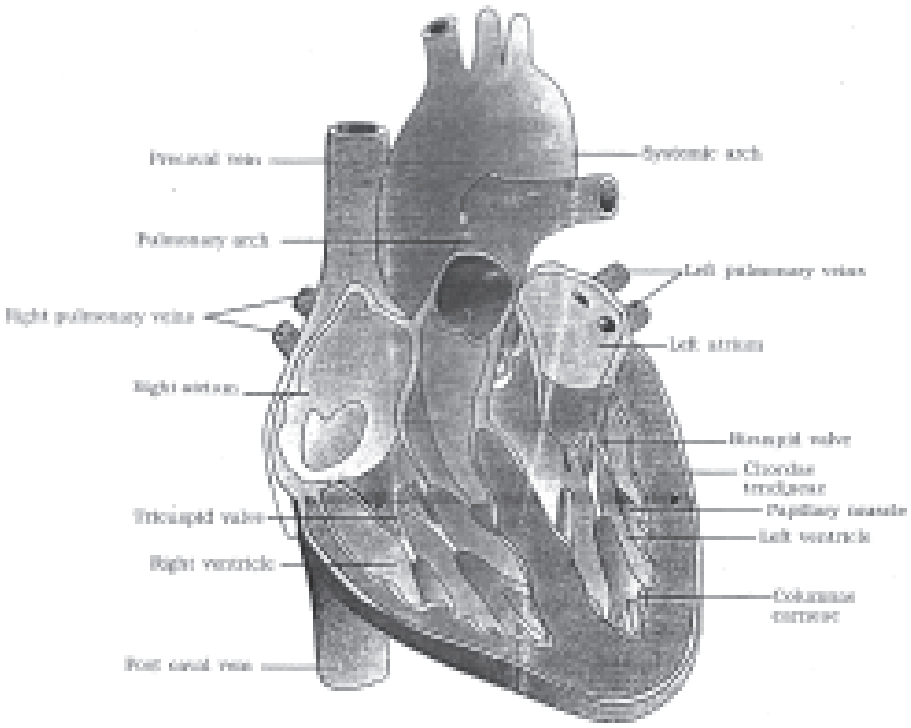
2. The wall of the left ventricles is thicker than that of the right ventricle.

3. The inner surface of the ventricles is raised into muscular ridges or columns called columnae carneae projecting from the inner walls of the ventricles.

4. Some of ridges are large and conical are called papillary muscules whose apices are connected to the chordae tendineae (or) heart strings

5. They are card-like collagenous processes that connect the papillary muscles to the tricuspid valve and the mitral valve in the heart.

4. Draw a labelaled diagram of the L.S. of the heart of man ?



Internal structure of the Heart

5. Describe the events in a cardiac cycle briefly ?

Ans:- Cardiac cycle consists of three phases namely (1) atrial systole (2) ventricular systole and cardiac diastole.

Atrial systole :- The SAN now generates an action potential which stimulates both the atria to contract simultaneously causing the atrial systole. It lasts about 0.1sec

Ventricular systole :- The action potentials from the SAN reach the AVN from where they are conducted through the bundle of his. Its branches and the purkinje fibres to the entire ventricular musculature. This causes the simuntaneous ventricular systole. It lasts for about 0.3 sec. In this stage first heart sound LUB is produced.

Cardiac diastole:- The ventricles now relax and the ventricular pressure falls causing the closure of the semilunar valves which prevents the back flow of blood. This results in the production of the second heart sound known as DUB.

6. Explain the mechanism of clotting of blood ?

Ans:- Cloting takes place in three essential steps:-

Step-I :- It involving the formation of a complex of activated substances collectively called prothrombin activator. It is formed by a complex cas-

cade of chemical reactions that occur in the blood by the involvement of clotting factors in two pathways (a) intrinsic pathway (b) Extrinsic pathway.

Step-II:- The prothrombin activator in the presence of sufficiant amount of ionic ca^{++} causes the conversion of inactive protrombin to active thrombin.

Step-III :- Thrombin converts the soluble protein fibrinogen into soluble fibrin monomers, which are held together by weak hydrogen bonds. The fibrin stabilizing factor replaces hydrogen bonds with covalent bonds and crase links the fibres to form a megh work. The insoluble mogh work of fibrin fibers spreading in all directions adhere to the damaged surface and trai the blood cells and platelets.

within a few minutes after the cloat is formed. It begins to contract so that the fluid is expelled out. This is called clot retaction and the fluid thus formed is the serum.

7. Distinguish between SAN and AVN ?

Ans: SAN	AVN
1. SAN sinoatrial node.	1. Atrioventricular Node.
2. It is consists of specialized cardio myocytes. Present in the right upper corner of the right atrium near the openings of the superior vena cavae.	2. It is Seen in the lower left corner of the right atrium close to the atrio ventricular septum.
3. It has the ability to generate action potentials without any external stimuli hence called pace maker.	3. It is a relay point that relays the action potentials received from the SAN mode to the ventricular musculature.

8. Distinguish between arteries and veins ?

Ans: Arteries	Veins
1. Arteries carry oxygenated blood away from the heart (Excell the pulmonary arters).	1. veins carry deoxygenated blood towards the heart (Excell the pulmonary veins).
2. These are bright red in colour.	2. These are dark red in colour.
3. These are mostly deep seated in the body.	3. veins are generally superficial.
4. Arteries are thick-walled as the tunica. cular.	4. Veins are thin walled and flightly mus-
5. Lumen is narrow.	5. Lumen is wide.
6. Non-Valvular .	6. Valvular.
7. Blood in the arteries flows with more pressure and by jerks.	7. Blood in the veing flows steadily with relatively low pressure.
8. Arteries end in Capillaries.	8. Veins start with Calillaries.

Long Answer type Questions

1. Describe the structure of the heart of man with the help of neat labelled diagram ?

Ans:- **Structure of the heart:-** The heart is mesodermal in origin. It is a thick walled muscular and pulsating organ situated in the media sternum. It is covered by a doublewalled pericardium which consists of the outer fibrous pericardium and the inner serous pericardium. The serous pericardium is double layered formed of an outer parietal layer and an inner visceral layer. The two layers are separated by a narrow pericardial space, which is filled with the pericardial fluid. This fluid reduces friction between the two membranes and allows free movement of the heart.

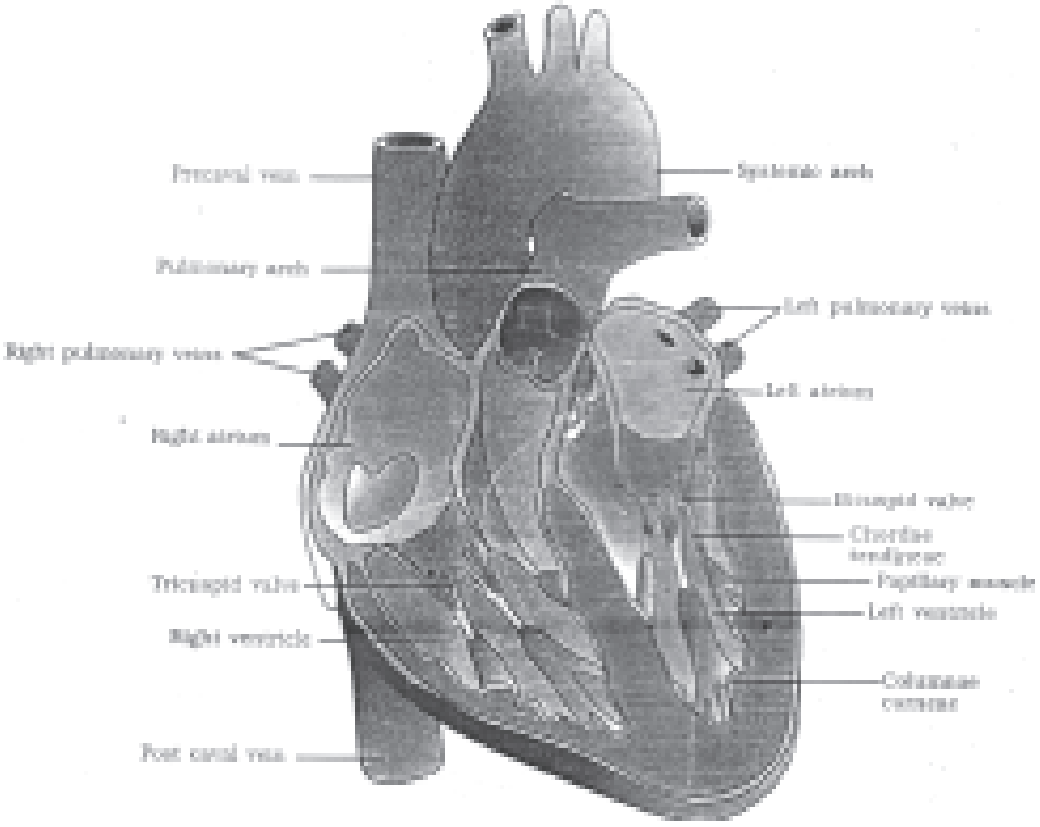
The wall of the heart consists of three layers. They are the outer epicardium, the middle myocardium (a thin layer of cardiac muscles), and the inner most endocardium (a thin layer of endothelium). The endothelium covers the heart valves also and is continuous with the endothelial lining of the large blood vessels connected to the heart.

External *structure*

Human heart has four chambers, with two relatively smaller upper chambers, called atria and two larger lower chambers called ventricles. Atria and ventricles are separated by a deep transverse groove called coronary sulcus (atrio-ventricular groove). The muscular pouch like projection from each atrium is called auricular appendix (auricular appendage). The ventricles are separated by two inter ventricular grooves (anterior and posterior), in which the coronary arteries and their branches are lodged.

Internal structure

i) **Atria:** Atria are thin walled `receiving chambers' (upper chambers). The right one is larger than the left. The two atria are separated by thin inter-atrial septum. In the fetal heart, the atrial septum has a small pore called foramen ovale. Normally the foramen ovale closes at birth, when lungs become functional. It is represented by a depression in the septum between the right and left atria, called fossa©valis (that marks the position of the foramen ovale in the fetus). If, the foramen ovale does not close properly, it is called a patent foramen ovale.



Internal structure of the Heart

The right atrium receives deoxygenated blood from different parts of the body (except the lungs) through three caval veins viz. the two precavals (right and left) and a post caval vein. It also receives blood from the myocardium (wall of the heart) through the coronary sinus, whose opening into the right atrium is guarded by the valve of Thebesiious. Opening of the postcaval vein is guarded by the valve of the inferior vena cava or Eustachian valve. It directs the blood to the left atrium through the foramen ovale, in the foetal stage, but in the adult it becomes rudimentary and non-functional. The openings of the precaval veins into the right atrium have no valves. The left atrium receives blood from each lung through two pulmonary veins, which open into the left atrium. The two left pulmonary veins open by a common aperture in some. Atria and ventricles are separated by a membranous atrio-ventrlcular septum, which possesses left and right atrioventricular apertures. The left and right apertures are guarded by bicuspid (mitral valve) and tricuspid valves respectively.

ii) **Ventricles:** These are the thick walled blood pumping chambers (lower chambers), separated by an interventricular septum. The wall of the left

ventricle is thicker than that of the right ventricle. The inner surface of the ventricles is raised into muscular ridges or columns called colomnae carneae/ trabeeulae carneae projecting from the inner walls of the ventricles. Some of these ridges are large and conical, and are called papillary muscles, whose apices are connected to the chordae tendinae, or `heart strings'. They are cord-like collagenous processes that connect the papillary muscles to the tricuspid valve and the mitral valve in the heart. They prevent the cusps of the atrioventricular valves from bulging too far into atria during ventricular systole.

Nodal tissue

A specialized cardiac musculature called the nodal tissue is also distributed in the heart. A patch of this tissue called the sinoatrial node (SAN) is present in the right upper corner of the right atrium near the openings of the superior vena cavae. Another mass of this tissue, called the atrioventricular node (AVN), is seen in the lower left corner of the right atrium close to the atrioventricular septum. A bundle of nodal fibres called atrioventricular bundle (AV bundle/`His' bundle) continues from the AVN into the inter-ventricular septum. It divides into right and left *bundle* branches. These branches give rise to minute fibres called Purkinje firbres that extend throughout the ventricular musculature / walls of the respective sides.

iii) **Aortic arches:** The pulmonary arch arises from the left anterior angle of the right ventricle. Its opening is guarded by the pulmonary valve and it carries deoxygenated blood to the lungs. The systemic arch (left) arises from the left ventricle and transports oxygenated blood to different parts of the body through its branches. Its opening is guarded by the `aortic valve'. The pulmonary and aortic valves are madeup of three semilunar flaps, each. A fibrous stand, known as ligamentum arteriosam is present at the point of contact of the systemic and pulmonary arches. It is the remnant of the ductus arteriosus, which connects the systemic arid pulmonary arches in the embryonic stage.

2. Write notes on the working of the heart of man ?

Ans:- **Cardiac cycle :-** The cardiac events that occur from the begining of one heart beat, to the beginning of the next constitute a cardiac cycfe. This cardiac cycle consists of three phases, namely atrial systole, ventricular systole and cardiac diastole

To begin with, all the four chambers of the heart are in a relaxed state/joint diastole stage- Blood from the pulmonary veins and venae

cavae flows into the respective atria. As the A-V valves are in open condition, blood flows into the left and right ventricles, through, the left and right atrioventricular apertues. The semilunar valves of the pulmonary and aortic arches are closed at this stage.

Atrial systole :- The SAN now generates an action potential which stimulates both the atria to contract simultaneously causing the `atrial systole'. It lasts about 0.1 sec. This increases the flow of blood into the ventricles by about 30% (Ref: NCERT Text Book). It means atrial systole accounts for about 30% of the filling of the ventricles, the remaining blood flows into the ventricles before the atrial systole.

Ventricular systole

The action potentials from the SAN reach the AVN from where they are conducted through the bundle of His, its branches and the Purkinje fibres to the entire ventricular musculature. This causes the simultaneous *ventricular systole.* It lasts for about o.3 sec. The atria undergo relaxation coinciding with the ventricular systole. Ventricular systole increases the pressure causing the closure of the AV valves preventing the `backflow' of blood. It results in the production of the first heart sound known as `Liib'- As the ventricular pressure increases further, the semilunar valves guarding the pulmonary artery and the aorta are forced open. This allows the blood in the ventricles to flow into the aortic *arches and* enter the circulatory pathway.

Cardiac diastole

The ventricles now relax and the ventricular, pressure falls causing the closure of the semilunar valves which prevents the back flow of blood. This results in the production of the second heart sound known as `DuP'. As the ventricular pressure declines further, the AV valves are pushed open by the pressure in the atria exerted by the blood, which flowed into them through the larger veins. The blood now once again flows freely into the ventricles. All the heart Chambers are now again in a relaxed state (Joint diastolic phase). Soon, another cardiac cycle sets in.

Cardiac output

The volume of blood pumped out by each ventricle, for each heart beat, is known as the *stroke volume.* The volume of blood pumped out by the heart from each ventricle per minute is termed *cardiac output.*

Cardiac output = stroke volume x No. of beats per minute = 70ml/ beat x 72 beats/minute = 5040 rnl/min. or approximately 5 liters

Double circulation :-

The blood pumped by the right ventricle enters the pulmonary artery, whereas the left ventricle pumps blood into the aorta. The deoxygenated blood pumped into the pulmonary arch is passed on to the lungs from where the oxygenated blood is carried by the pulmonary veins into the left atrium. This pathway constitutes the pulmonary circulation *(lesser circulation).* The oxygenated blood entering the aorta is carried by a network of arteries, arterioles and capillaries to the tissues from where the deoxygenated blood is collected by a system of venules, veins and vena cavae and emptied into the right atrium. This is the systemic circulation *(greater circulation).* The systemic circulation provides nutrients, O_2 and other essential substances to the tissues and collects CO_2 and other harmful substances away, for their elimination.

UNIT - II B

Excretory Products and their Elimination

Very Short Answer type Questions

1. Name the blood vessels that enter and exit the kidney ?

Ans:- Renal artery enter in the kidney and Renal vein exit from the kidney.

2. What are renal pyramids and renal papillae ?

Ans:- In the human kidney. The medulla is devided into multiple cone shaped masses of tissue called renal pyramids.

3. What are the columns of Bertin ?

Ans:- In the human kidney. The renal pyramids are separated by the projections of the cortex called columns of bertin.

4. Name the structural and functional unit of kidney ? What are the two main types of structural units in it ?

Ans:- Nephrons are the structural and functional unit of the kidney. Each nefron has two parts the Bowman's capsule and the renal tabule.

Nefrons are two types (1) Cortical nephrons

(2) Juxtamedullary nephrons

5. Distinguish between cortical and juxtra medullary nephrons ?

Ans:- The loop of Henle is too short and extends only very little into the medulla in cortical nephrons.

The loop of Henle are very long and run deep into the medulla in Juxtamedullary nephrons.

6. Define glomerular filtration ?

Ans:- The first step in the formation of urine is the filtration of the blood from the glomerulus into the Lumen of the Bowman's capsule and this passive process is called glomerular filtration.

7. Define Glomerular Filtration Rate (GFR) ?

Ans:- **Glomerular Filtration Rate:-** It is the volume of fluid filtered from the renal glomerular capillaries into the bowman's capsule per unit time.

8. What is Juxta glomerular apparatus ?

Ans:- macula densa together with juxtaglomerular cells form the juxtaglomerular apparatus.

9. Distinguish between Juxtaglomerular cells and maculadensa ?

Ans:- The wall of the afferent enal arteriole has juxtra glomerular cells. They are modified smooth muscle cells of the afferent arteriole.

A Group of modified epithelial cells of the distal convoluted table are crowded in this region constituting the macula densa.

10. Distinguish between the enzymes renin and rennin ?

Ans:- **Renin:-** It is an enzyme secreted by juxtaglomerular cells of nefron (kidney). This enzyme catalyzes the conversion of angiotensinogen into angiotensin.

Rennin :- is a proteolytic enzyme found in the gastric juice of infants

Casein Calcium osracseinate

11. What is meant by the term osmoregulation ?

Ans:- The p[rocess of maintaining the quantity of water and dissolved solutes in balance is refferred to as gemoregulation.

Short Answer type Questions

1. Terrestrial animals are generally either ureotelic (or) uricotelic and not ammonotelic why ?

Ans:- 1. Ammonia is highly toxic and readily soluble in water hence it should be eliminated from the body quickly and in a very dilute solution. Therefore excretion of ammonia is most common in aquatic species.

2. Uria is 100000 times less toxic than ammonia. Urea excreting animals require much less water.

3. Uric acid is less toxic than urea and being insoluble in water can be excreted as semisolid paste or pellets with very little water loss.

4. This is a great advantage for animals with litttle access to water so Terrestrial animals are generally either ureotelic (or) Uricotelic.

2. Differentiate vertebrates on the basis of the nitrogenous waste products they excrete giving example ?

Ans:- **Ammonotelism :-** The elimination of ammonia as the chief nitrogenous waste material is turned ammonotelism

Ex:- Aquatic animals like fishes

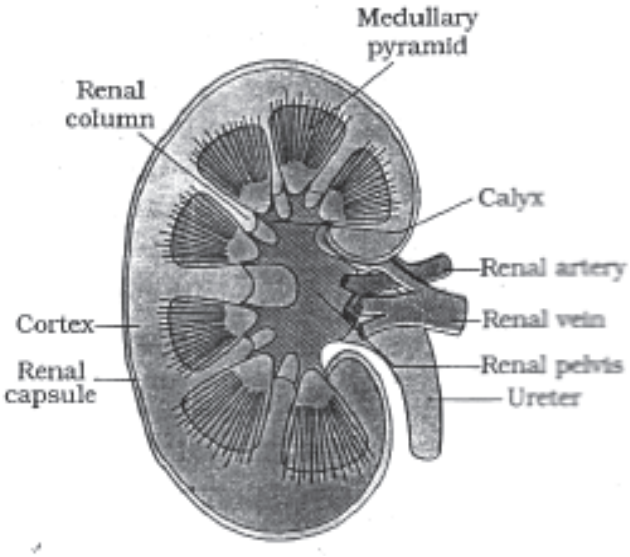
Ureotelism :- The elimination of urea of the principal nitrogenous waste material is temned ureotelism

Ex:- Earth worms Amphibiens and mammals

Uricotelism :- The elimination of uric acid as the chief nitrogenous wasxte material is called uroicotelism

Ex:- Arthropods reptals and birds

3. Draw a labeled diagram of the L.S. of kidney ?



L.S of Kidney

4. Describe the internal structure of kidney of man ?

Ans:- 1. A longtitudinal section of the human kidney shows two distinct regions the outer cortex and the innear medulla

2. The medulla is divided into multiple cone shaped masses of tissue called renal pyramids

3. The renal pyramids are separated by the projections of the cortex called "columns of Bertin".

4. The both of each pyramid originates at the border between the cortex and the medulla and terminates in the renal papilla

5. Renal papillae project into cup like calyces, formed by the funnel shaped pelvis, which continues out as the ureter.

5. Explain micturition ?

Ans:- Urine formed by the nephrons is ultimately carried to the urinary bladder where it is stored till a voluntary signal is given by the "Central Nervous System"(CNS)

2. This signal is initiated by the stretching of the urinary bladder as it gets filled with urine.

3. In response the stretch receptors on the walls of the bladder send signates to the central nervous system (CNS)

4. The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sp[hincter, causing the release of urine.

5. The process of passing out urine is called mixturition and the neural mechanism involved is called micturition reflex.

6. Give a brief account of the counter current mechanism ?

Ans:- 1. Mammals have the ability to produce concentrated urine.

2. The henle's loop and vasa recta play a significant role ion this

3. The flow of the renal filtrate in the two limbs of Henle's loop is in opposite directions and thus forms a counter current.

4. The flow of blood through the two limbs of vasa recta is also in a counter current pattern.

5. The Proximits between the Henle's loop and vasa recta as well as the counter current of renal fluid and blood in them help in maintaining an increasing as molarity towards the medullary interstitium.

6. Transport of substances facilitated by the special arrangement of Henles loop and vasa recta is called the counter current mechanism

7. This mechanis=m helps to maintain a concentration gradient in the medullary interstitium

9. Describe the role of liver, lungs and skin in excretion ?

Ans:- **Liver:-** It is the largest gland in our body. It changes the decomposed haemoglobin of the worm-out RBCs into bile pigments namely bilirubin and biliverdin. These pigments pass into the alimentary canal along with the bile for elimination. The liver also excretes cholesterol steroid harmones. certain vitamins and drugs via bile.

Lungs:- Lungs regularly eliminate about IPL of Co_2 and also significant amount of water per day in the form of water vapor in normal resting condition. The quantity of water loss increases in dry climates various voltile materials are also eliminated through the lungs

Skin:- Human skin possesses two types of glands for the elimination of certain substances through their secretion.

Sweat glands:- Secrete a watery fluid called weat primary function of

sweat is to facilitate a cooling effect on the body surface. It also helps in the removal of some of the wastes like Nacl small amount of urea, lactic acid e.t.c.,

Sebaceous glands:- eliminate the sterols hydrocarbons waxes through sebum this secretion provides a protective "oily covering" to the skin.

Long Answer type Questions

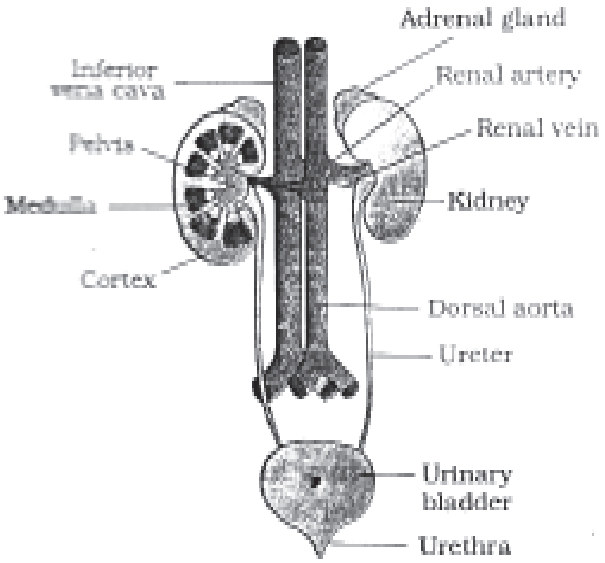
1. Describe the excretory system of man giving the structure of a nephron ?

Ans:- **Human Excretory System**

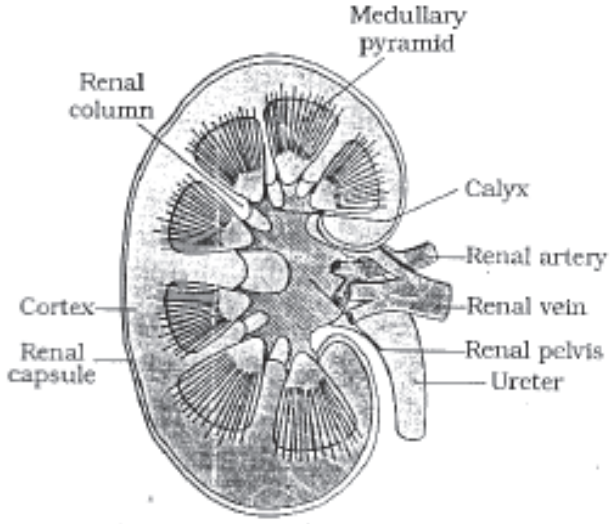
In humans, the excretory system consists of a pair of ureters, a urinary bladder and urethra.

Kidneys

Kidneys are reddish brown, bean shaped structures, situated on either side of the vertebral column between the levels of the last thoracic and third lumbar vertebrae, in a `retroperitoneal position'. The right kidney is slightly lower than the left one due to the presence of liver.



The outer surface of the kidney is convex and the inner surface has a deep notch called hilum, the point at which the renal artery and nerves enter and the renal vein and ureter leave. Each kidney is surrounded by a tough, fibrous capsule that protects its delicate inner surface.



Internal structure :- *A* longitudinal section of the human kidney shows two distinct regions, the outer cortex and the inner medulla. The me-

dulla is divided into multiple cone shaped masses of tissue called renal pyramids. The renal pyramids are separated by the projections of the cortex called columns of Bertin (renal column). The base of each pyramid originates at the border between the cortex and the medulla and terminates in the renal papilla. Renal papillae project into cup like calyces, formed by the funnel shaped pelvis, *which* continues out as the ureter.

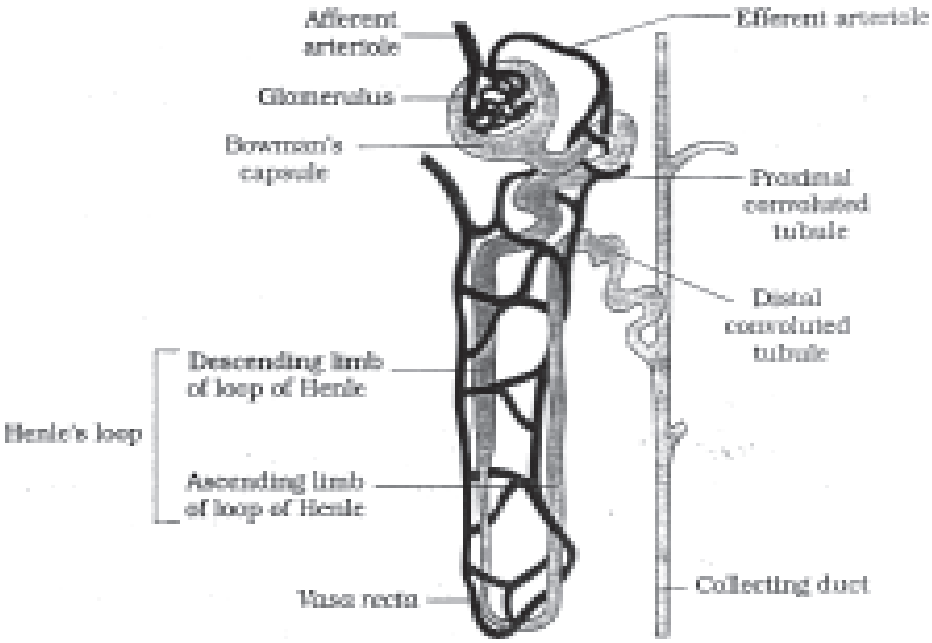
Ureters :- These are slender whitish tubes which emerge from the pelvis of the kidneys. Their walls are lined by transitional `epithelium'. The ureters run downwards and open into the urinary bladder.

Urinary bladder :-

It is a median storage sac, situated in the lower abdominal cavity. It has thick, muscular, distensible wall lined by `transitional epithelium'. The neck of the bladder leads into the urethra, which has an internal urethral sphincter (made of smooth muscles) and external urethral sphincter (made of striped muscles). Urethra opens near the vaginal orifice in the females and through penis in the males.

Structure of a Nephron

Each kidney has nearly one million nephrons which are the `structural' and `functional' units. Each nephron has two parts - the Bowman's capsule' and the renal tubule. The Bowman's capsule encloses a tuft of capillaries called glomerulus, formed by the afferent renal arteriole - a fine branch of the renal artery. Blood from the glomerulus is carried away by an efferent renal arteriole of a lesser diameter. The blind end of the tubule forms a double walled cup called Bowman's capsule, which surrounds the glomerulus. The inner wall of the Bowman's capsule has certain unique cells called podocytes which wrap around each capillary. The podocytes are arranged in an intricate manner so as to leave some minute spaces called *`filtration slits*' or `slit *pores*'. The endothelial cells of the capillaries have numerous pores or `Finestrations'. The glomerulus along with the Bowman's capsule constitutes the Malpighian body or renal corpuscle.



A diagrammatic representation of a nephron showing blood vessels, collecting duct and tubule

The tubule continues further and forms a highly coiled proximal convoluted tubule (PCT). A hairpin shaped Henle's loop, which has descending and ascending limbs, is the next part of the tubule. The proximal part of the ascending limb is thin and the distal part is thick. The thick ascending limb continues into the distal convoluted tubule (DCT). The DCT continues as the initial collecting duct' in the Cortex. Some initial collecting ducts unite to form a straight collecting duct, which passes through the medullary pyramid. In the medulla, the tubes of each pyramid join and form the duct of Bellini which finally opens on the tip of the renal papilla. The contents of the duct of Bellini are discharged into the renal *pelvis* through the renal *calyx*.

The Malpighian corpuscle, PCT and DCT of a nephron are situated in the cortical region of the kidney, whereas the loop of Henle is in the medulla. In a majority of nephrons, the loop of Henle is too short and extends only very little into the medulla. Such nephrons are called cortical nephrons. In some of the nephrons, the loops of Henle are very long and run deep into the medulla. These nephrons are called juxtamedullary nephrons.

The efferent arteriole emerging from the glomerulus forms a fine capil-

lary network called the peritubular capillaries, around the renal tubule. The portion of the peritubular capillaries thai surrounds the loop of Henle is called the recta. The vasa recta is absent or highly reduced in the cortical nephrons. The juxtamedullary nephrons possess well developed vasa recta.

2. Explain the physiology of urine formation

Ans:- The formation of urine involves three main *processes* namely, glomerular filtration, selective reabsorption and tubular secretion.

a) **Glomerular filtration:** The first step in the formation of urine is the `filtration' of the blood from the glomerulus into the lumen of the Bowman's capsule and this `passive' (non-energy consuming process) process is called glomerular filtration. The hydrostatic pressure of the blood while flowing in the glomerulus is 60 mmHg. It is opposed by glomerular colloidal osmotic pressure of 32 mmHg (which is exerted by the non-filtered plasma proteins of the blood in the glomerular capillaries) and Bowman's capsular hydrostatic pressure of 18mmHg. The net filtration pressure is 10mm Hg (6O-32+18=10). This causes the filtration of blood through the 3 layered *filtrate membrane* formed by the endothelial cells of glomerular capillary together with the basement membrane and podocytes of the Bowman's cup. Blood is filtered through the fine slit pores and fenestrations due to the NFP. Therefore, this process is called `ultrafiltration'. The filtrate contains almost all the constituents of the plasma, except the proteins. The filtrate thus formed is called ultra-filtrate or `glomerular filtrate' or *`primary urine',* which is hypotonic to the cortical fluid. It passes into the next part of the renal tubule.

b) **Selective reabsorption and secretion:** The tubular epithelial cells in different segments of a nephron reabsorb certain substances of the glomerular filtrate either by active or passive mechanisms. About 85% of the filtrate formed is reabsorbed In a constant, unregulated fashion by the PCT and descending limb of Henle's loop (obligatory or mandatory reabsorption) and the reabsorption of the rest of the fluid is `regulated'. Based on the necessity of re-absorption, the substances of glomerular filtrate can be categorized into `high threshold substances (essential and are efficiently reabsorbed e.g. glucose, amino acids, vitamins, some salts etc.), `low threshold substances (absorbed in very little amounts e.g. urea, uric acid etc.) or `athreshold substances' (actual excretory products and are not reabsorbed at all e.g. creatinine).

During the formation of urine, the tubular cells secrete substances such

as H^+. K^+ and NH_3 into the filtrate. Tubular secretion is also an important step in the formation of urine, as it helps in the maintenance of ionic and acid-base balance of the body fluids. Mechanism of selective reabsorption and secretion in different parts of a nephron takes place as follows:

i) **in the proximal convoluted tubule:** PCT is lined by simple cuboidal epithelium with `brush border', which increases the surface area of absorption. Nearly all the essential nutrients and 70-80% of electrolytes and,water are reabsorbed by this segment. $Na^+$is actively transported into the cortical interstitial fluid. This transfer of positive charge drives the passive transport of Cl^-. Glucose, amino acids, and other essential substances are also `actively' transported. Movement of water occurs by. `osmosis'.

PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions, and ammonia into the filtrate and by the absorption of from it.

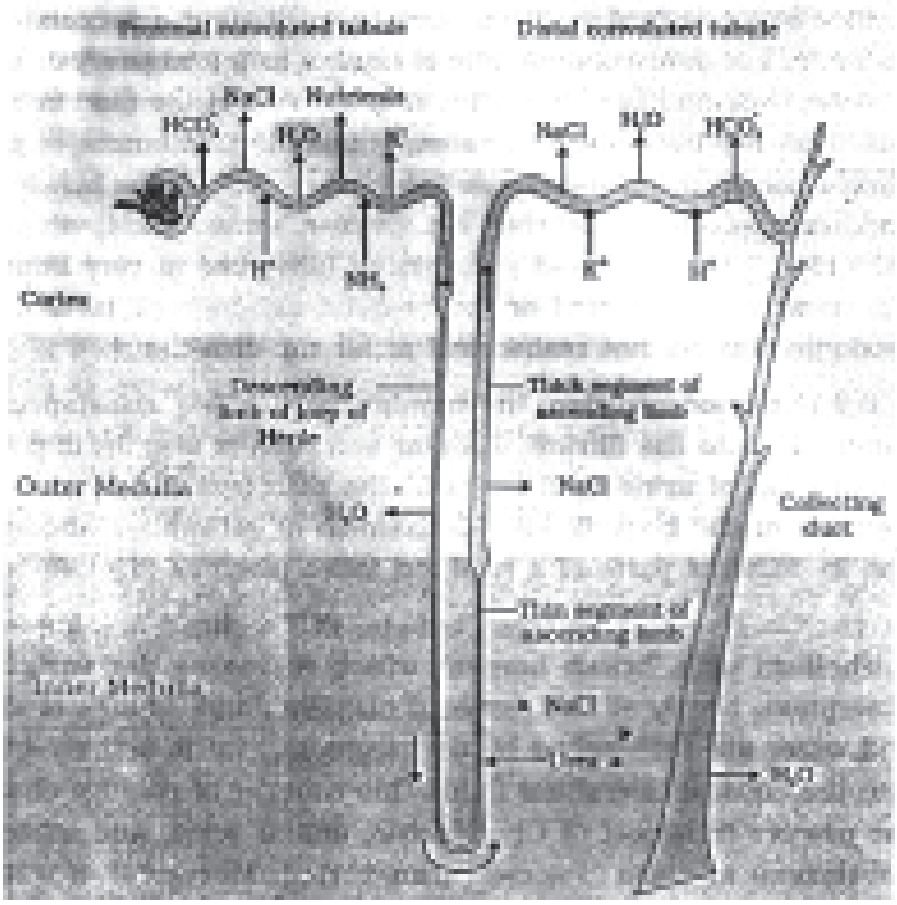
ii) **In the Henle's loop:** Reabsorption in this segment is minimum. However, this region plays a significant role in the maintenance of high osmolarity of the medullary interstitial fluid.

HCo_3^-

The descending limb of loop of Henle is permeable to water and almost impermeable to electrolytes, hence reabsorption of water continues as the filtrate moves along the descending limb (passive transport). As a result, the filtrate concentration gradually increases as it moves towards the inner medulla. The ascending limb has two specialized regions, aproximal thin segment, in which NaCl diffuses out into the interstitial fluid *passively,* and a distal thick segment in which NaCl is *actively* pumped out. The ascending limb is impermeable to water. Thus the filtrate becomes progressively more dilute as it moves up to the cortex (towards the DCT).

iii) **In the distal convoluted tubule (DCT)**

The cells here are shorter than those In the proximal tubule and lack `microvilli, indicating that they are not involved much in reabsorption. `Conditional *reabsorption'/ `facultative reabsorption'* of Na+ and water takes place in this segment. The reabsorption of water is *variable* depending on several conditions and is regulated by ADH. DCT is also capable of reabsorption of and selective secretion of H^+ and K^+ ions and NH_3 into the DCT from the peritubular network, to maintain the pH and sodium-potassium balance in the blood.



Reabsorption and secretion of major substances at different pairs of the nephron(arrows indicate direction of movement of materials)

iv) In the collecting duct (CD)

This long duct carries the filtrate through the medulla to the renal pelvis. Considerable amount of water could be reabsorbed from this region to produce concentrated urine. This segment allows passage of small amount of urea to the medullary interstitum to keep up its osmolarity. It also plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+ ions. The renal fluid after the process of facultative reabsorption in the C.D. influenced by ADH, constitutes the `Urine'. That is sent out. Urine in the C.D is hypertonic to the plasma of blood.

UNIT-III A
Musculo-Skeletal System

The Muscle

Very Short Answer type Questions

1. What is a "motor unit" with reference to muscle and nerve ?

Ans:- A motor neuron and the set of muscle fibres innervated by all the telodendrites constitute a "motor unit"

2. What is triad system ?

Ans:- "T tubule" and the two terminal cisternae of sarcoplasmic reticulum at its sides form "triad system.

3. Write the difference between actin and myosin ?

Ans:-	**Actin**	**Myosin**
	1. Actin filament is made of two Factin molecules	1. Many meromyosins together form myosin filament
	2. Actin filament is thin	2. Myosin filament is thick
	3. It is present in "I" band	3. It is presentin "A" band
	4. They are attached to "Z" line	4. attached to "M" line

4. Distringuish between red muscle fibers and white muscle fibers ?

Ans:-		
	1. Myoglobin contentis more	1. Myoglobin content is less
	2. Contain more number of mitochordria	2. Contain less number of mitochondria
	3. They use oxygen for the production of ATP so they are called as aerobicmuscles	3. They depend on anaer bic process for the release of energy.

Short Answer type Questions

1. Write a short note on sliding filament theory of muscle contraction ?

Ans:- Sliding filament theory of muscle contraction was proposed by Jean Hanson and Hugh Haxley. The series of events that can be studies in muscle contraction are.

1) Excitation of Muscle :- Central nervous system sent a signal through motor nerve. It releases neuro transmitter (acety choline) at neuron

muscular junction, which generates anaction potential in the sarcolemma. This action potential spreads to the triad system. Triad system releases calcium into the sarcoplasm.

2) **Formation of Cross bridges :-** The releated cattions bind with Tn-c subunit of the troponin of the action filament. This makes troponin and troponin and tropomyosin complex move away from the active sites of Actin filaments. Now the active sites are exposed to the myosin heads. Hydrolysis of ATP provides energy for myolin heads to bind with active sites on the actin molecules to form a cross bridge and P is released.

3) **Power Stroke :-** The cross bridge pulls the attached actin filaments towards the centre of the "A" band. The "Z" lines attached to these actin filaments are also pulled inwards from both the sides there by causing shortening of the sarcomere i.eid contraction.

During the shortening of the muscle, the "I" bands get reduced in size length where as the "A" bands retain their size. Myofilaments donot actually shorten.

4) **Recovery Stroke :-** The myosin releases ADP and goess back to its relaxed state. A new ATP molecule binds to the head of myosin and the cross bridge is broken. The new ATP is hydrolysed by the ATP are of the myosin head and the cycle of cross bridge formation and break age is repeated.

5) **Relaxation of muscle :-** When motor impulses stop the cations are pumped backto sarcopla smic cisternac. Active site of Actin are marked, myosin fails to bind with Actin filaments. So the 'Z'lines return to their original position.

2. Describe the important steps in muscle contraction.

Answer given for the 1st short Answer question.

3. Describe the structure Skeletal muscle ?

Ans:- Skeletal muscle in our body is made of a number of "muscle bundles" or "fascicles". Each fasicle contains a number of cylindrical muscle fibres. The fascicles are held together by a connective tissue called "fascia"

Ultra Structure of Skeletal muscle fibre

Each muscle fibre is lined by the plasma membrance called sarcolemma enclosing sarcoplasm. Skeletal muscle cells are multinucleate(Syncytium). The endoplasmic reticulum is also called sarco plasmic reticulum of the muscle fibres is thee store house of calcium ions. Muscle fibre possess a large number of parallel filaments called

myofilaments or myofibrils in the sarcoplasm.

Structure of myofibril

Each myofril has alternate dark and light bands in it. Straited appearance is due to the distribution of two important proteins actin and myosin. The lightband contains actin and two regulatory proteins called troponin and tropomyosin. The light band is called I-band or Isotropic band. The dark band or Anisotropic band contains myosin filaments.

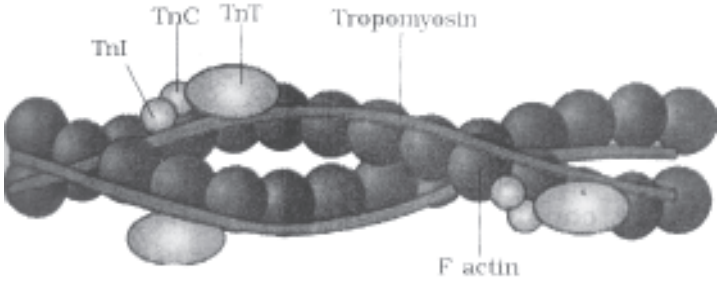
In the middle of the I band is anelastic fiber called "Z"line. Actin filaments or thin filaments attached to it. Thick filaments or myosin filaments are held together in the middle of A band by a membrance called "M" line the bands A and I are arranged alter nately giving striatedappearance.

Sarcomere :- The portion of the myofibril between two successive "Z" lines is called "Sarcomere" It is the functional unit of contraction. The central part of "A" band without the thin filaments is called "H" zone / "H" band / Hensens disc.

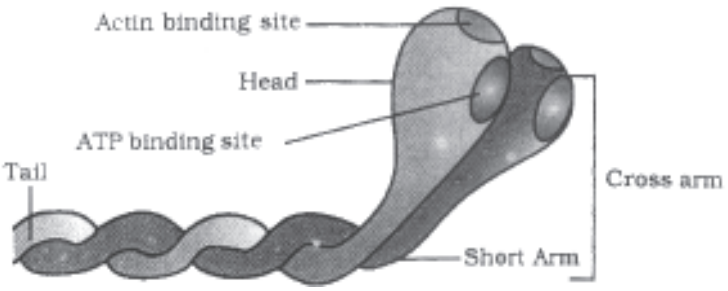
4. Write Short notes on contractile Proteins ?

Ans:- Each actin (thin) filament is made of two 'F' (filamentous) actin molecules helically wound around each other. Each 'F' actin is a polymer of monomeric 'G' (globular) actin molecules. Two filaments of another protein, called tropomyosin also run close to the 'F' actin molecules, throughout their length. A complex protein called 'troponin' is distributed at regular intervals on the tropomyosin.

Troponin is made of three polypeptide units named Tn-T, Tn-I, and Tn-c. Tn-T binds to tropomyosin. Troponin-I (Tn-I), inhibits the myosin binding site on the actin. Tn-c can bind to Ca^{2+}. When calcium ions are not bound to troponin (Tn-C), it stabilizes tropomyosin in its blocking position over the active sites of actin. When Calcium ions attach to the Tn-C of the troponin, the tropomyosin moves away/is pulled away from the active sites allowing the myosin heads to bind to the active sites of actin. Troponin and tropomyosin are often called regulatory proteins, because of their role in masking and unmasking the active sites.



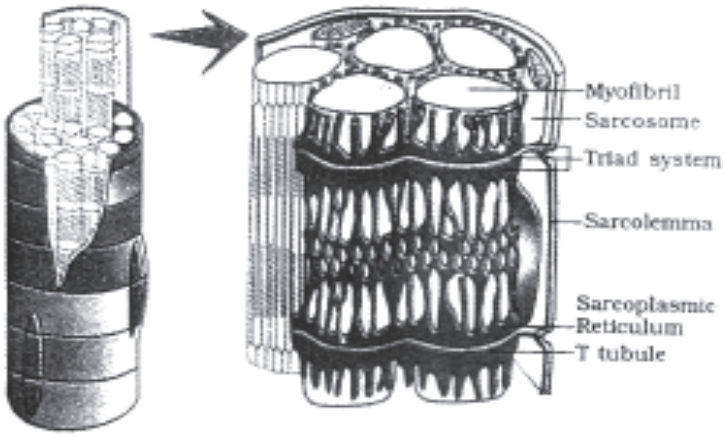
Thin filament



Thick filament

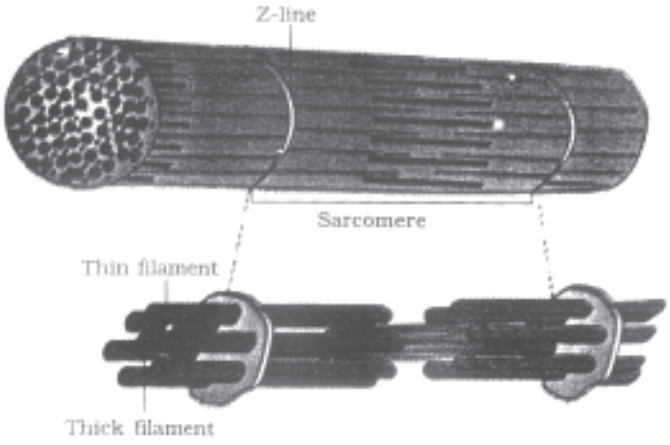
Myosin is a motor protein that is able to convert chemical energy in the ATP molecules into mechanical energy. Each myosin (thick) filament is a polymerized protein. Many monomeric proteins called meromyosins constitute one thick filament. Each meromyosin has two important parts, a globular head with a short arm(neck) and a tail. The globular head with short arm is composed of heavy meromyosin (HMM) and the tail is made of light meromyosin (LMM). The short arm / neck serves as a 'flexible link' between the head and tail regions. There are about 200-300 molecules of myosin per thick filament. Half of themyosin molecules have their 'heads' oriented towards one 'Z' membrance and the other half towards the other 'Z' membrance of the same sarcomere, so as to pull actin molecules/ thin filaments from either side. It means the 'tails' of all myosin molecules in an 'A' band are directed towards the 'M' line. The head and short arm project outwards at regular distances and angles from each other from the surface of a polymerized myosin filament and is known as cross arm. Each head has two binding sites, one for ATP and the other for an active site on the actin molecule. The heads on the two ends of the thick filaments are oriented in opposite directions to pull in actin filaments of both the sides.

5. Draw neat labeled diagram of the ultra structure of muscle fibre.



Ultra structure of a Skeletal Muscle Fibre

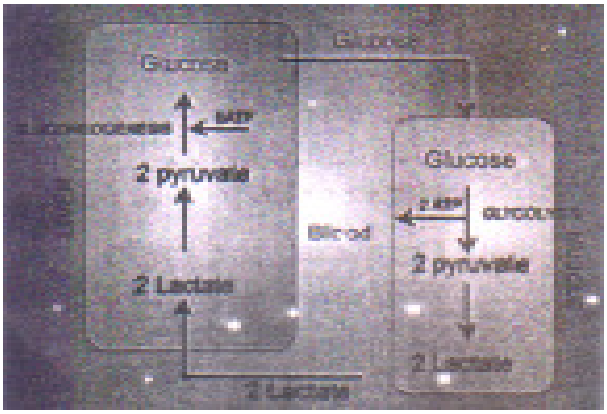
6. Draw the diagram of a sarcomere of skeletal muscle showing different regions.



Sarcomere

7. What is cori's cycle explain the process.

Ans:- The lactic acid produced during rapid contractions of skeletal muscles under low availability of oxygen is partly oxidized and a major part of it is carried to the liver by the blood, where it is converted into pyruvic acid(pyruvate) and then to glucose through gluconeogenesis. The glucose can enter the blood and be carried to muscles and immediately used. If, by this time the muscles have stopped contraction, the glucose can be used to rebuild reserve of glycogen through glycogenesis. This two way traffic between skeletal muscle and liver is called the Cori cycle.

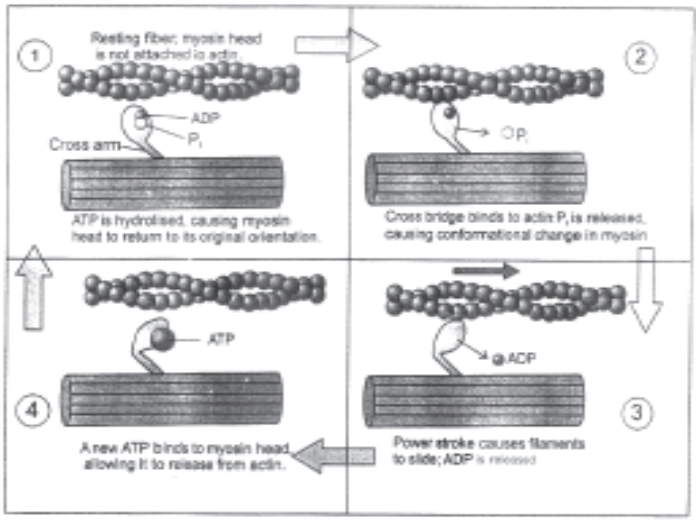


Long Answer type Questions

1. Explain the Menchanism of Muscle Contraction ?

Ans:- Mechanism of muscle contraction is best explained by the 'Sliding Filament *Theory'*. It states that contraction of a muscle fibre takes place by the sliding of the thin filaments over / in between the thick filaments. It was proposed by Jean Hanson and Hugh Huxley. The process of muscle contraction can be studied under the following heads:

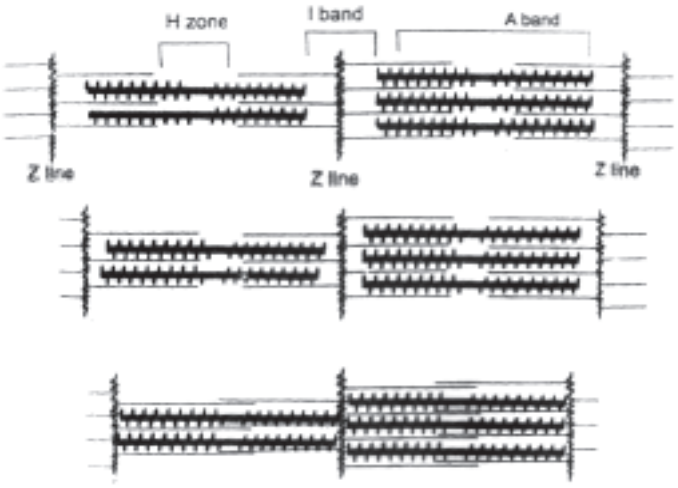
i) **Excitation of musle:** Muscle contraction is initiated by a signal sent by the central nervous system (CNS) via a motor neuron. A neural signal reaching the neuromuscular junction releases a neurotransmitter (acetylcholine) which generates an 'action potential' in the sarcolemma. When the action potential spreads to the triad system through the T tubules, the cisternae of the sarcoplasmic reticulum release calcium ions into the sarcoplasm.



Mechanism of Muscle Contraction

ii) **Formation of Cross bridges :** Increase in the Ca^{2+} level leads to the binding of calcium ions to the subunit Tn-C of the troponin of the thin filaments. This makes troponin and tropomyosin complex to move away from the active sites of actin molecules. Now, the active sites are exposed to the heads of the myosin. Utilizing the energy released from hydrolysis of ATP, the myosin head now binds to the exposed 'active sites' on the actin molecules to form a cross *bridge* and P_1 is released

iii) **Power Stroke:** The cross bridge pulls the attached actin filaments towards the centre of the 'A' band. The 'Z' lines attached to these actin filaments are also pulled inwards from both the sides, thereby causing shortening of the sarcomere, i.e., contraction. During the shortening of the muscle, the 'I' bands get reduced in



Sliding Filaments

size/length *(Z* membranes of the sarcomere are brought closer)**,** whereas the 'A' bands retain their size/length. It is important to note that myofilaments do not actually shorten. As the thin filaments are pulled deep in to the A bands making the H bands narrow, the muscle shows the effect-**contraction.**

iv) **Recovery Stroke:** The myosin, goes back to its relaxed state and releases ADP. A new ATP molecule binds to the head of myosin and the cross-bridge is broken. The new ATP is again hydrolysed by the ATPase of the myosin head and the cycle of cross bridge formation, and breakage is repeated causing further sliding.

v) **Relaxation of Muscle:** When motor impulses stop the Ca^{2+} ions are pumped back into the sarcoplasmic cisternae. It results in the masking of the active sites of the actin filaments. The myosin heads fail to bind with the active sites of actin. These changes cause the return of 'Z' lines back to their original position, i.e., ***relaxation.***

UNIT-III B
Nevral Control and Co-ordination

Very Short Answer type Questions

1. Name the cranial meninges covering the brain of man ?

Ans:- 1. Duramater 2. arachnoid mater and 3. Piamater

2. What is corpus callosum ?

Ans:- Two cerebral hemispheres are internally connected by transverse, wide and flat bundle of myelinated fibres beneath the cortex called corpus callosam.

3. What do you know about arbor white ?

Ans:- Cerebellum has a branching tree-like core of white matter called arbor white

4. Why the sympathetic division is called thoraco-lumbar division ?

Ans:- In the sympathetic division the preganglianic neurons arise from the thoracic and lumbar regions of the spinal cord hence called thoracolumbar division.

5. Why the parasympathetic division is called cranio sacral division ?

Ans:- The cell bodies of preganglionic neurons of the parasympathetic division are located in the brain and in the brain and in the sacral region of the spinal cord. So it is called as Cranio-Sacral division.

6. Ditinguish between the absolute and relative refractory periods.

Ans:- Absolute refactory period	Relative refractory period
1. During the absolute refractory period, even a very strong stimulus cannot initiate a second action potential	1. The relative refractory period is the time during which a second action potential can be initiated by a larger than normal stimulus
2. This period coincides with the periods a of depolarization and repolarization	2. It coincides with the period of hyperpo larization

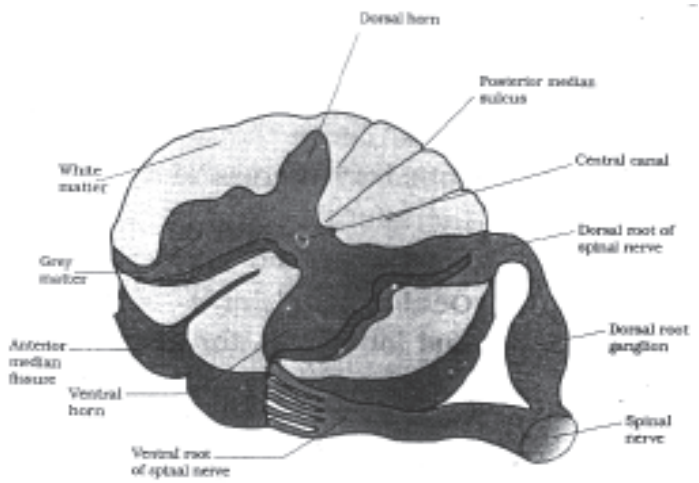
7. What is all-or-none principle ?

Ans:- The action potential occurs in response to a threshold stimulus or suprathreshold stimuli, but does not occur at subthreshold stimuli. It means the nerve impulse is either conducted totally or not conducted at all. This is called all or none principle.

Short Answer type Questions

1. Draw a labelled diagram of the T.S of the spinal cord of man

Ans:-



T.S. of spinal cord

2. Distinguish between somatic and autonomic neural systems.

Ans:-	Somatic neural system	Autonomic neural system
	1. Sensations normally or consciously perceived	1. The ANS operates without conscious control
	2. Somatic motor neurons innervate the skeletal muscles and produce voluntary movements	2. Autonomic motor neurons regulate the involuntary activities of cardiac muscle, smooth muscle and glands.
	3. The axon of a single myelinated somatic motor neuron extends from CNC to skeletal muscle	3. Two neuron pathway
	4. The effect of somatic motor neuron always is excitation	4. The effect of ANS is excitation and inhibition
	5. Acetyl Choline is neuro transmitter	5. Acetyl choline or nor Apinephrine

3. Give an account of synaptic transmission ?

Ans:- A nerve impulse is transmitted from one neuron to another through junctions called synapses. A synapse is formed by the membrance of a pre-synaptice neuron and polt synaptic neuron, which may or maynot be seperated by a gap called synaptic cleft. There are two types of syn-

apses (1) electrical synapses and chemical synapses. At electrical synapses, the membrance of pre-and post synaptic neurons are in very close proximity compared to chemical synapses. These synapses are electrically conductive links between two neurons and are also called "gap junctions". Impulse transmission is always faster in these synapses when compare with chemical synapse.

At a chemical synapse, the membranes of the pre- and post-synaptic neurons are separated by *a.* fluid-filled space called synaptic cleft (a structural gap and a functional bridge). Chemicals called neurotransmitters are involved in the transmission of impulses at these synapses. The axon terminals contain vesicles (boutons) filled with these neurotransmitters. When an impulse (action potential) arrives at the axon terminal, it depolarizes the membrane opening voltage gated calcium channels. Calcium ions stimulate the movement of the synaptic vesicles towards the membrane where they fuse with the plasma membrane and release their
neurotransmitters in the synaptic cleft by exocytosis. The released neurotransmitters bind to their *specific receptors,* present on the post-synaptic membrane. **Acetyl choline** is the most common neurotransmitter. Epinephrine, norepinephrine, dopamine, serotonin etc. are either excitatory or inhibitory neurotransmitters. Glycine, GABA (Gamma Amino Butyric Acid) are inhibitory neurotransmitters. The post synaptic membrane has *ligand gated channels.* (They are ion channels which respond to chemical signals (ligands), rather [than to changes in the membrane potential). The entry of ions can generate a new potential in the post-synaptic neuron. The new potential developed may be either excitatory or inhibitory. Excitatory post synaptic potentials (EPSPs) cause depolarization, whereas inhibitory post synaptic potentials **(IPSPs)** cause hyperpolarisation of post synaptic membrane. Post synaptic potentials are graded potentials and 'summation' of these potentials occurs it the 'axon hillocks'. Summation of inputs from many presynaptic membranes is called 'spatial summation', whereas summation of successive inputs from a single presynaptic membrane is called 'temporal summation'. development of action potential depends on which is more? - *The sum of* excitatory post synaptic potentials *or the sum of inhibitory postsynaptic potentials.*

4. List out the differences between sympathetic and para sympathetic neural systems in man.

Ans:- Sympathetic neural system (SNS)	Para sympathetic neural system (PNS)
1. It orginates in the thoracic and lumber regions of the spinal cord nal	1. It originates in the cranial region of the brain and the sacral region of the spi-cord
2. Its ganglia are linked up toform a chain	2. Gangliaremain isolated
3. Preganglionic fibres are shortand the post ganglionic fibres are long	3. Preganglionic fibres are long and the post ganglionic fibres are short
4. Nor epinephrine is produced at the synapes. synapses. Hence the system is called adrenogenis usually	4. Acetyl Choline is produced at the Hence the system is called "Cholin-ergic" usually
5. Active during stress ful conditions. Preparing the body to fare them	5. Active during relaxing times, restoring normal activity after stress.
6. The over all effective excitory and stimulating	6. The over all effect is inhibitory

Long Answer type Questions

1. Give a brief account of the structure and functions of the brain of man.

Ans:- It is the site of information processing and control (the living super computer). It is protected inthe cranial cavity and covered by three cranial meninges namely duramater arachnoid mater and piamater Duramater is outer most double layered membrance. Arachnoid mater is athin middle layer. The space between dura mater and arachnoid membrane is called sub dural space. Piamater is innermost layer, it is separated from archnoidmembrane by the subarchnoid space. The brain can be divided into three major parts.

1. Fore brain (Prosenuphalon)
2. Mid brain (Mesencephalon)
3. Hind brain (Rhombencephalon)

I. Fore brain (Prosencephalon) :- The fore brain consists of 1) Olfactory bulb 2) Cerebrum 3) Diencephalon

Olfactory bulb :- Olfactory bulbs receive impulses pertaining to smell from the olfactory epithelium.

Cerebrum :- Cerebrum forms the major part of the brain. It is divided into the left and the right cerebral hemispheres by longitudinal fissure. The two hemispheres are internally connected by a transverse, wide mye linated fibres beneath the cortex called corpus callosum. It brings coordination between these two hemispheres. The surface of the cerebrum has grey matter with more neuronal cello bodies and is called cerebral cortex.

The surface of the cerebral cortex has many folds and groovel. The folds are called guri, the groove are called fissures or sulcigri and sulci increase the surface are of the cerebral cortex.

Cerebral cortex has three functional areas called **a)sensory areas,** that receive and interpret the sensory impulses **b) motor areas,** which control voluntary muscular movements **c) association areas,** which are neither clearly sensory nor motor in function and they deal with more complex 'integrative functions' such as memory and communications. The **cerebral medulla** consists of mostly myelinated axons (white matter). Each cerebral hemisphere of the cerebrum is divided into four lobes namely **frontal, parietal, temporal and occipital lobes.**

iii. ***Diencephalon (Thalamencephalon):*** The main parts of the diencephalon are the epithalamus, thalamus and hypothalamus.

i) Epithalamus: It is the roof of the diencephalon. It is a non-nervous part which is fused with the pia mater to form the **anterior choroid plexus.** Just behind the anterior choroid plexus, the epithelium of the epithalamus forms a pineal stalk, which ends in a rounded structure called **pineal body.**

ii) Thalamus: It lies superior to the mid brain. It is the major coordinating centre for sensory and motor signalling.

iii) Hypothalamus (the thermostat of the body): It lies at the base of the thalamus. The hypothalamus forms a funnel-shaped downward extension called 'infundibulum', connecting the hypothalamus with the pituitary gland. It also contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones. Hypothalamus controls and integrates the activities of the autonomous nervous system (ANS) and it has osmoregulatory, thermoregulatory, thirst, feeding (hunger) and satiety centres.

Limbic system

The inner parts of the cerebral hemispheres and a group of associated deep structures like amygdala or amygdale, hippocampus

etc. form the limbic system. The limbic system along with hypothalamus is involved in the regulation of sexual behaviour and expression of emotional reactions.

II. Midbrain (Mesencephalon)

The midbrain is located between the thalamus/hypothalamus of the forebrain and the pons Varolii of the hindbrain. The ventral portion of the midbrain consists of a pair of longitudinal bands of nervous tissue called cerebral peduncles or crura cerebri (sing: crus cerebrum) *(which connect the cerebral hemispheres with the pons).* The dorsal portion of the midbrain consists of four rounded lobes called corpora quadrigemina (Four optic lobes). The two larger anterior optic lobes are called superior colliculi and the smaller posterior lobes are called inferior colliculi. The superior colliculi and the inferior colliculi are concerned with visual and auditory functions, respectively.

III. Hindbrain (Rhombencephalon)

The hind brain comprises cerebellum, pons Varolii and medulla oblongata.

Cerebellum ('the little brain'): It is the second largest part of the brain. It consists of two cerebellar hemispheres and a central vermis. Each cerebellar hemisphere consists of three lobes namely anterior, posterior and floccular lobes. It has a branching tree - like core of white mater called arbor vitae (the *tree of life)* surrounded by a sheath of grey matter (cerebellar cortex).

Cerebellum is responsible for the control and coordination of locomotor movements. The cerebellum is called the 'gyroscope of the body' because it maintains equilibrium. Damage to cerebellum often results in ataxia (uncoordinated voluntary muscle movements).

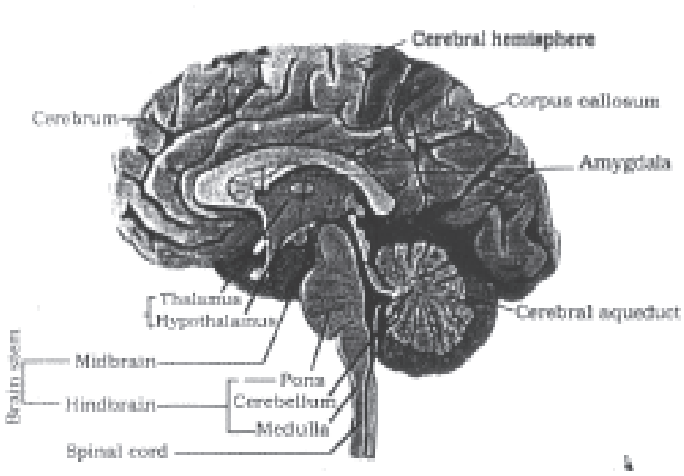
Pons Varolii

It lies in front of the cerebellum below the mid brain and above the medulla oblongata. It consists of nerve fibres which form a bridge between the two cerebellar hemispheres. It is a relay station between the cerebellum, spinal cord and the rest of the brain. Pons has the pneumotaxic centre (involved in the control of the respiratory muscles as it regulates the amount of air a person can take in each time).

Medulla oblongata

It is the posterior most part of the brain. It extends from the pons Varolii above and continuous with the spinal cord below. It has a very thin, vascular folded structure called posterior choroid plexus. Medulla includes cardiovascular and respiratory centers, the centers for swal-

lowing, vomiting, coughing, sneezing and hiccupping. The midbrain, pons and the medulla oblongata are together referred to as the 'brain stem'.The medulla oblongata passes out of the 'cranium through the foramen magnum and joins the spinal cord.



Sagittal section of human brain

Ventricels of the human brain

Human brain consists of four ventricles. The first and second ventricles (lateral ventricles or paracoels) are present in the right and left cerebral hemispheres respectively. The third ventricle (diocoel) occurs in the diencephalon. The two paracoels are connected to the median diocoel individually by the two 'foramina of Monro' (interventricular fo ramina). The fourth ventricle (myelocoel) is present in the medulla. The myelocoel and the diocoel are connected by a narrow canal called iter or aqueduct of Sylvius/ cerebral **aqueduct.** The metacoel is continuous with the central canal of the spinal cord.

The ventricles of the brain, and the subarachnoid space are filled with Cerebro-spinal fluid (CSF). CSF is an alkaline, colourless fluid which is filtered from the choroid plexuses into the ventricles of the brain.

2. Explain the transmission of nerve impulse through a nerve fibre with the help of suitable diagrams.

Ans:- Nerve cells exhibit a special property called electrical excitability. The signal that travels along the length of a nerve fiber and ends in the release of neurotransmitters is called *a nerve impulse.* Neurons can respond to external and internal stimuli and conduct nerve impulses *(action potentials)* because in a neuron a membrane potential is established across the neuronal membrane. It means there is an "unequal distribution of ions" (charged atoms) on the two sides of a nerve cell membrane with the cell's interior more negative with respect to that of the exterior. Ions keep moving in and out of an axon through several *'ion channels'.* The axolemma of a neuron has the following three different types of ion

channels.

1) **Leakage channels:** They are k^+ and Na^+ leakage channels. K^+ leakage channels are more than those of Na^+ leakage channels. Hence axolemma has greater permeability to K^+ ions than Na^+ ions.

2) **Ligand-gated channels:** They are located in the post synaptic membrane (dendrites and cell bodies) and **open** or **close in** response to ***chemical stimuli.***

3) **Voltage gated channels:** These channels open in response to a change in membrane potential. There are **sodium voltage gated and potassium voltagegated channels** across the axolemma. Sodium voltage gated channels are of two types. They are **sodium activation and inactivation** voltage gated channels. For K^+ only potassium **activation voltage gated channel** is present.

Resting membrane potential

The resting membrane potential exists because of a small buildup of negative ions in the axoplasm along the inside of the membrane, and an equal buildup of positive ions in the extra cellular fluid along the outer surface of the membrane. Such a separation of positive and negative electrical charges is a form of **potential energy.** In neurons, the resting membrane potential ranges from **-40** to **-90** mV. A typical value is **-70 mV.** The minus sign indicates that the inside of the cell is negative relative to the outside.

At **resting phase,** the axolemma is polarized. The membrane potential can change from its resting value when the membrane's permeability to particular ions changes. If the inner side becomes less negative, it is said to be **depolarized.** If the inner side becomes more negative, it is said to be, **hyperpolarized.** *During the resting phase the activation gates of sodium are losed, the inactivation gates of sodium are open and the activation gates of potassium are closed.*

Sodium - potassium pump

Sodium and potassium ions diffuse inwards and outwards , respectively, down their concentration gradients through leakage channels. Such a movement of ions, if unchecked, would eventually disturb the resting membrane potential. These flows of ions are offset by ***sodium - potassium, pumps*** (Na^+ **/ K^+ATPases)** present in the axonal walls. These pumps expel **three** Na^+ **ions** for each **two K* ions** imported. As these pumps remove more positive charges from the axoplasm than they bring into it, they contribute to the negativity of the resting membrane potential **i.e., -70mv.**

Depolarization (Rising phase)

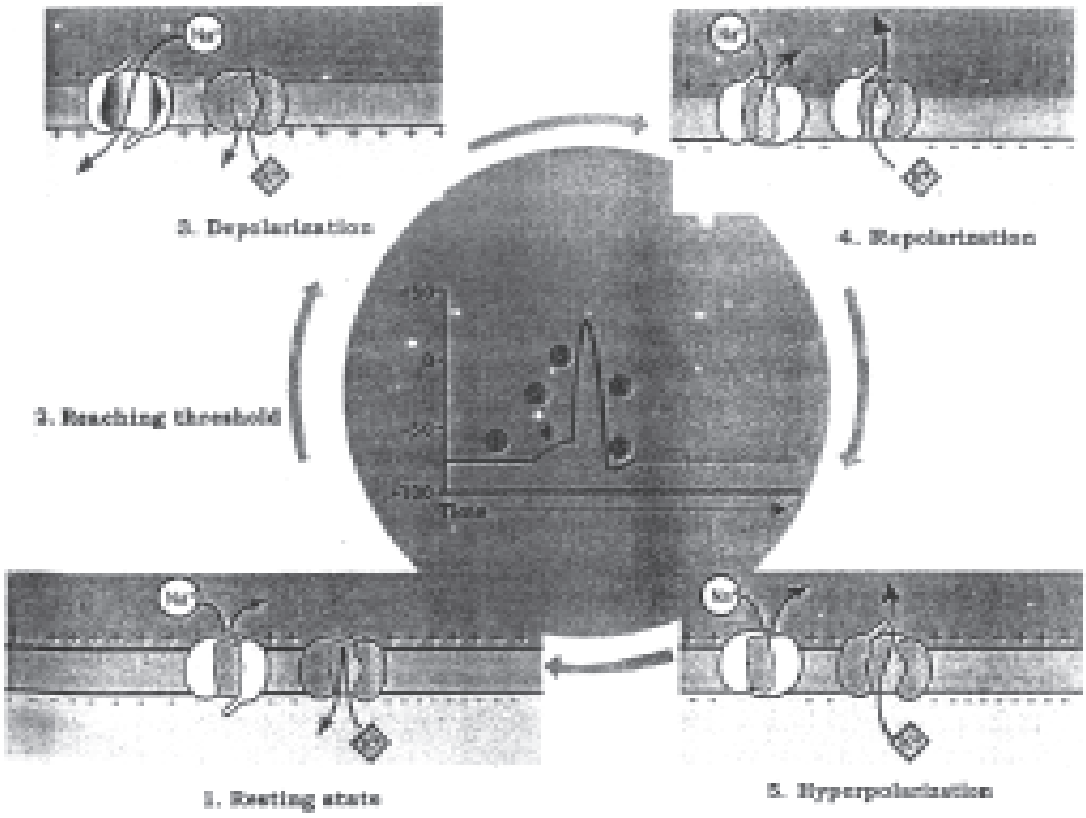
When a nerve fibre is stimulated, the plasma membrane becomes more permeable to Na^+ ions than to K^+ ions as the activation and inactivation voltage gates of sodium open and activation voltage gates of potassium close. As a result the rate of flow of Na^+ into the axoplasm exceeds the rate of flow of K^+ to the **ECF.** Hence, the axolemma is positively charged inside and negatively charged outside. This reversal of electrical charge is called] **"depolarization"**

Outer face of the point which is adjacent to the site of depolarization remains positively charged. The electrical potential difference between these two areas is called **"action potential".** An action potential occurs in the membrane of the axon of a neuron when depolarization reaches a certain level called **'threshold potential'** (-55 **mV).** The particular stimulus which is able to I bring the membrane potential to threshold is called **'threshold stimulus'.** The action potential occurs in response to a threshold stimulus or supraj threshold stimulus but .does not occur at subthreshold stimuli. It means the nerve impulse is either conducted totally or not conducted at all and this is called **'all- or - none principle'.** Due to the rapid influx of Na+ **ions,** the membrane potential shoots rapidly up to +45 **mV (spike potential).**

The initial entry of sodium ions causes charge reversal from negative to positive Inside. It results in the opening of more and more sodium channels leading to a larger **influx of sodium ions** (called **POSITIVE FEED BACK REGULATION).**

Repolarization (Falling phase)

As the wave of depolarization passes away from its site of origin to the adjacent point, the activation gates of sodium remain open, inactivation gates of sodium close and activation gates of potassium open at the site of origin of depolarization. As a result the influx of Na^+ **ions** into the axoplasm from the ECF is checked and **'efflux'** of **K^+ions** occurs, which leads to the returning of axolemma to the resting state ***(exit ofpotassium ions causes a reversal of membrane potential to negative inside).*** This is called **'repolarization'.**



Hyperpolarization (Undershoot)

The repolarization typically goes more negative than the resting potential to about **-90 mV.** This is called '**hyperpolarization'.** This occurs because of the increased K^+ permeability that exists while voltage-gated K^+ channels are open (however they close 'rather **slowly as K voltage gates are said to be 'lazy' gates),** activation and inactivation gates of Na^+ channels remain **closed.** The membrane potential returns to its original resting state as the K^+ channels close completely. As the voltage falls below the **-70mV** level of the resting state, it is called '**undershoot**'

The Refractory Periods

The period of time after an action potential begins during which the neuron cannot generate another action potential in response to a normal threshold stimulus is called the '**refractory period'.** There are two kinds of refractory periods, namely **absolute refractory period** and **relative refractory period.**

During the absolute refractory period, even a very strong stimulus cannot initiate a second action potential. This period coincides with

the periods of **depolarization** and **repolarization.** The relative refractory period is the time during which a second action potential can be initiated by a larger- than -normal stimulus. It *coincides* with the period of **hyperpolarization.**

Conduction speed

The conduction speed of a nerve impulse depends on the diameter of the axon: the greater the axon's diameter, the faster is the conduction. In a myelinated axon, the voltage-gated Na^+ and K^+ channels are concentrated at the **nodes of Ranvier.** As a result the impulse 'jumps' from one Ranvier's node to the next, rather than traveling the entire length of the nerve fibre. This mechanism of conduction is called **Saltatory conduction.** Saltatory, conduction is faster (in myelinated fibres) than the continuous conduction (in nonmyelinated fibres).

UNIT-IV

HUMAN ANATOMY AND PHYSIOLOGY

UNIT-IV (A)

Endocrine System and Chemical Coordination

Very Short Answer Questions

1. What is acromegaly ? Name the hormone responsible for this disorder.

Ans:- Acromegaly is characterised by enlargement of the bones of the jaw, hand and feet, thickened nose, lips, eyelids and wide fingertips and "gorilla like appearance" of the person affected. Growth hormone (Somatotropin).

2. Which hormone is called antidivertic hormone ? Write the name of the gland that secretes it.

Ans:- Vasopressin

Pituitory gland.

3. Name the gland that increases in size during childhood and decreases in size during adulthood what important role does it play in case of infection.

Ans:- Thymus gland

Thymus gland secretes thymosins which play an important role in the differentiation of "T" lymphocytes, which provide cell mediated immunity and also promote the production of antibodies to provide humoral immunity.

4. Distinguish between diabetes insipidus and diabetes mellitis

Ans:- Diabetes insipidus	Diabetes mellitus
1. Deficiency of vasopressin causes diabetes insipidus	1. Deficiency of insulin causes diabetes mellitus
2. Increased excretion of the urine	2. Loss of glucose through urine (glyco & uria)

5. What are Islets of langer hans ?

Ans:- Endocrine portion of the pancreas is called Islets of Langerhans. It has two types of cells - cells and - cells. -cells produce glucogon, - cells produce insulin.

6. What is insulin Shock ?

Ans:- Hyperseretion of insulin leads to decreased level of glucose in the blood resulting in insulin shock.

7. Which hormone is commonly known as fight and flight hormone ?

Ans:- Adrenoline or epinephrine

8. What are androgens ? Which cells secrete them ?

Ans:- Androgens are male sex harmonel required for the development, maturation and functioning of the male accessory sex organs.

The Leyadig cells or interstial cells of Leydig lie in the inter-seminiferous tubular spaus produce androgens.

9. What is erythropoietin ? What is its function ?

Ans:- It is a hormone produced by kidney. It regulates the formation of red blood cells by regulating the differentiation and proliferation of erythroid progeniter cells in the bone marrow.

Short Answer Questions (4 Marks)

1. List out the names of endcrine glands present in human beings and mention the hormones they secrete.

Ans:- Human body has no. of endocrine glands among them pituitory is one of the important gland. Pituatory gland is divided into anterior pitutory or adenohypophysis and posterior pituitory or neuro hyphophysis. Between these two is a small zone called the pars intermedia.

I a) Anterior pituitory/Adenohypophysis :- Six hormones are produced by Anterior pituitory

1) Growth hormone 2) Pralactin 3) Thyroid stimulating hormone TSH 4) Adreno cortico tropic hormone (ACTH) 5) Follicle stimulating hormone FSH 6) Luteinizing hormone

b) Pars intermedia produces melanocyte stimulating hormone

c) Posterior pituitory secretes two hormones oxytocin and vasopressin

II. Pineat gland secretes melatonin

III. Thyroid gland :- Secreter thyroxine, calcitonin

IV. Parathyroid glands :- Parathormone

V. Thymus gland :- Thymosins

VI. Adrenal gland :- Corticoids, adrenaline, noradrenaline

VII. Pancreas:- Insulin, glucogon

VIII. Testes :- Androgens testosterone.

IX. Ovaries :- estrogen, progesterone. Inaddition to these non endocrine tissues organs the kidney, heart and gastro intestinal tract produce hormones.

Heart - Atrial natriuretic factor (ANF)
Kidney - erythropoietien
gastrointestinal tract - gastrin, secretin cholecytokinin, GIP

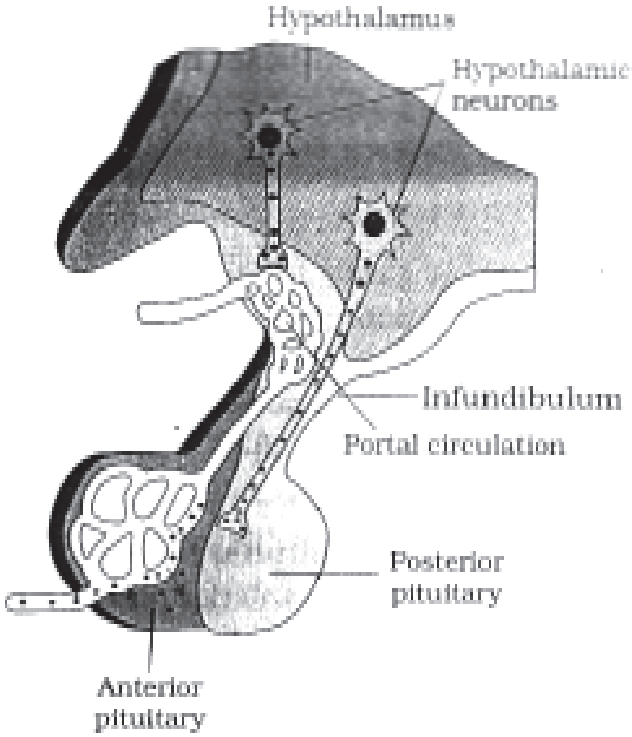
2. Describe the role of hypothalamus as a neuro endocrine organ.

Ans:- **Hypothalamus**

(Greek: Hypo = under; Thalamus = chamber)

The hypothalamus is located below the thalamus. constituting the floor of the diencephalon. a part of the fore brain. It connects the neural and endocrine systems as it is closely tied to the pituitary gland. It responds to the sensory impulses received from different receptors by sending out appropriate neural or endocrine signals.

It regulates a wide range of body functions. It contains several groups of neurosecretory cells called `nuclei' which produce hormones called neuro-hormones. They are transported to the neurohypophysis through the axons of the hypothalamo-hypophysical tract. The two types of hormones produced by the hypothalamus are 1) the releasing hormones (which stimulate secretion of pituitary hormones), and 2) the inhibiting hormones (which inhibit secretions of pituitary hormones).



Pituitary gland and hypothalamus

The hypothalamus is the `Master Control Centre' of the endocrine system, as its secretions directly control the pituitary gland which in turn secretes hormones that regulate the growth and functioning of other endocrine glands.

For example, a hypothalamic hormone called growth hormone releasing hormone (GHRH/Somatocrinin) stimulates the synthesis and

release of Somatotropin (growth hormone) by the pituitary. On the contrary the growth hormone-inhibiting hormone (GHIH) or somatostatin from the hypothalamus inhibits the release of growth hormone from the pituitary. These hormones originating in the hypothalamic neurons pass through axons and are released from their nerve endings. They reach the anterior pituitary through a portal circulatory systeim called **hypophysial** portal system and regulate the functions of the anterior pituitary. The posterior pituitary is under the direct neural regulation of the hypothalamus.

3. Give an account of the secretions of pituitory gland.

Ans:- The pituitory gland also called hypophysis located beneath the hypothalamus. It is divided into anterior pituitory or adenohypophysis and post erior pituitary or neurohypophysis. Between these two is a small zone called the pars intermedia.

I. Anterior pituitory/Adenohypophysis

It produces 6 hormones. They play major role in the control of metabolic functions throughout the body.

a) Growth hormone :- (Somatotropin) This hormone stimulates cell division in the epiphyseal plates leading to elongation of bones. They also promote growth of the entire body by accelerating protein synthesis, cell division and cell differentiation.

b) Prolactine:- It is also called lactogenic hormone/luteotrophic hormone (LTH). It causes enlargement of the mammary glands of the breasts and prepare them for the production of milk. In women it initiates and sustain lactation. It also maintain corpus luteum of the ovary, which produces progesterone that helps to sustain pregnancy.

C) Thyroid Stimulating Hormone :- TSH(Thyrotropin) stimulates the synthesis and secretions of thyroid hormones from the thyroid gland.

d) Adreno corticotropic Harmone :- (ACTH) controls the synthesis and secretion of steroid hormones called glucocorticids, by the adrenal cortex

e) Follicle stimulating hormone (FSH) :- It stimulates growth and development of the ovarian follicles in females in males FSH along with the androgens, regulates spermatogenesis

f) Luteinizing hormone:- (LH) Stimulates the synthesis and secretion of androgens (testosterone) In female it stimulates ovulation and also stimulates ovary to produce estrogens and progesterone.

II. Pars interonedia:- It secretes only one hormone called melanocyte stimu-

lating hormone (MSH). The role of MSH is not significant in man.

III. Posterior pituitory :- Neurohypophysis it produces two hormones. There are called as neuro hormones.

a) Oxytocin

b) Vassopression

a) Oxytocin:- In a female it stimulates powerful contractions of the uterus during child birth and ejection of milk from the mammary glands.

b) Vasopression :- It stimulates reabsorption of water and electrolytel by DCT and the collecting duct from nephric filtrate. Thus urine becomes hypertonic and diuresis is prevented. Hence is also called anti-diuretic hormone (ADH)

4. Compare a "pituitory dwarf" and a "thyroid dwarf" in respect of similaritie s and disimilarities they posess.

Ans:-

Pituitory dwarf	Thyroid dwarf
dissimilarities	
1. Hypo secretion of growth hormone during the growth years slows down bone growth	1. Hypo secretion of thyrox ine during pregnancy leads a disorder called cretinism i.e., (thyroid dwarf)
2. The epiphysic plates close before normal height is reached	2. Physical and mental growth gets securely stunted due to untreated congenital hypothyroidism.
3. Other organs also fail to grow	3. Abnormal skin, deafness, mutism appear
4. The pituitory dwarfic sexually and intellectually a normal individual	4. Thyroid dwarf is physically mentally retarded, low intelligence quotient and they are sterile growth is stunted
Similarities	
1. growth is stunted	1. growth is stunted

5. Explain how hypothyroidism and hyperthyroidism can affect the body ?

Ans:- **Effects of Hypothyroidism :-** During pregnancy, due to hypothyroidism, defective development of the growing baby leads to a disorder called cretinism. Physical and mental growth gets severel stunted (thyroid *dwarf)* due to untreated *`congenital hypothyroidism'* (deficiency of thyroid hor-

mones *by birth).* Stunted growth, mental retardation, low intelligence quotient, abnormal skin, deafness and mutism are some of the characteristic features of this disease. In adult women, hypothyroidism may cause irregular menstrual cycles. In adults the hypothyroidism results in a condition called myxedema. Lethargy, mental impairment, intolerance to cold, puffiness of face and dry skin are some of the symptoms *of myxedema.*

Effects of Hyper thyroidism :- Over activity of the thyroid, cancer of the gland or development of nodules of thyroid lead to hyperthyroidism. In adults abnormal growth causes a disease called *exophthalmic goiter,* with characteristically protruded eyeballs Hyperthyroidism also affects the physiology of the body (increased metabolic rate). Inadequate supply of iodine in the diet results in hypothyroidism and enlargement of the thyroid gland. This condition is called simple *goiter.*

6. Write a note on addison's disease and cushing's syndrome ?

Ans:- Addison's disease is caused due to hyposecretion of glucocorticoids by the adrenal cortex. This disease is characterised by loss of weight, muscle weakness, fatigue and reduced blood pressure. Sometimes darkening of the skin in both exposed and nonexposed parts of the body occurs in this disorder. This disorder does not allow an individual to respond to stress.

Cushing's syndrome : It results due to over production of glucocorticoids. This condition is characterized by breakdown of muscle proteins and redistribution of body fat resulting in spindly arms and legs accompanied by a round moon face, buffalo hump on the back an pendulous abdomen. Wound healing is poor. The elevated level of cortisols causes hyperglycemia, over deposition of glycogen in liver and rapid gain of weight.

7. Why does sugar appear in the urine of a diabetic ?

Ans:- Insulin which is secreted by the cells of Islets of Langerhans of the pancreas, regulates the normal glucose level in the blood. It mainly acts on the liver cells and adipocytes and increases the uptake and utilization of glucose by the body cells. Glucose is taken up by the hepatocytes, Skeletal muscles and adipocytes thus reducing the level of glucose in the blood (hypoglycemia). Insulin promotes conversion of glucose into glucogen (glycogenesis) in the target cells (hypoglycemic hormone).

Under secretion of insulin by the pancreatic gland increases the

level of glucose in blood hyperglycemia. Prolonged hyper glucemia leads to a complexdisorder called diabetes mellitus, associated with loss of glucose through urine "glycouria" and formation of harmful compounds called ketone bodies.

8. Describe the male and female sex harmone and their actions.

Ans:- Androgens are secreted by Leydig cells of Tests. Testosterone is one of the important androgens. Male sexharmones are required for the development, matuation and functioning of the male accesory sex organs such as epididymis, vas deferens, seminal vesicles, prostrate gland urethra exc. These hormones control muscular growth, growth of factual and axillary hair, aggressiveness, low pitch voice (masculine voice) etc. Androgens stimulate the process of spermatogenesis. Androgens affect the central neural system, controlling the male sexual behaviour (libido/sex drive sexual urge) and also have an effect on protein and carbohydrate anabolism.

Ovaries are the female gonadal organs present in the abdominal cavity. These are cytogenic organs and produce one ovum during each menstrual cycle. Besides this, ovaries act as endocrine glands too producing the female hormones chiefly: *estrogen* and *progesterone.* Ovarian follicles and stromal tissues are present in the ovary. The hormone estrogen is produced by the growing follicles of the ovary. After ovulation, the ruptured follicle becomes a `yellow body' called corpus *luteum (which acts as a temporary endocrine gland)* and secretes progesterone. After a few days, in the absence of pregnancy, the corpus luteum stops functioning and becomes the corpus albicans

Estrogen is responsible for the development and the activity of the female secondary sex organs, development of the growing ovarian follicles, high pitch of voice etc. and the development of the mammary glands. Estrogen also controls the female sexual behaviour.

Progesterone has an important role in preparing the uterus for the implantation of the blastocyst in the wall of the uterus. It inhibits contraction of the uterus. Thus it supports pregnancy. In case of deficiency of this hormone, pregnancy fails to maintain. It stimulates the

formation of alveoli (sac like structures which store milk) in the mammary glands and secretion of milk.

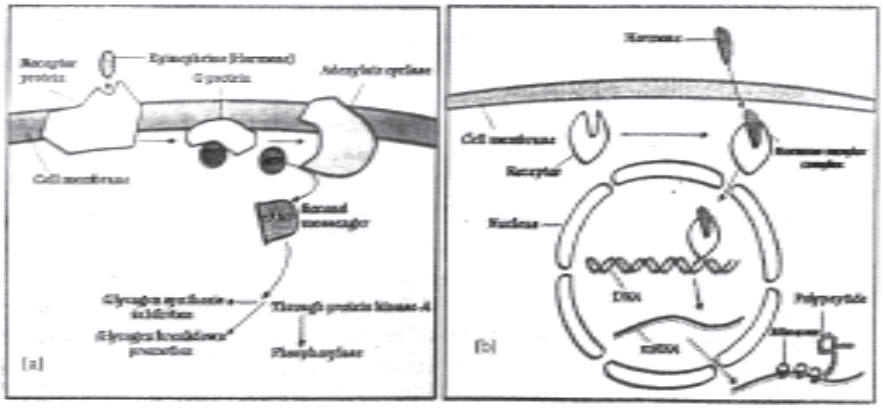
9. Write a note on the mechanism of action of hormones ?

Ans:- Hormones stimulate or inhibit the target cells' activities. Hence they are called regulators. Hormones play a vital role in regulating the functions of the body.

Hormones produce their effects on target tissue by binding to specific proteins called hormone receptors located in the target tissues only. Hormone receptors present on the cell membranes of the target cells are called membrane bound- receptors and the hormone receptors present inside the target cells are called intracellular receptors. Intracellular receptors mostly nuclear receptors (present in the nucleus). Hormone receptors are specific, as each receptor is specific to a certain hormone only. A Haraone and its receptor protein together form a hormone-receptor complex. This hormone-receptor complex generates biochemical changes in the target cells.

Hormones interacting with membrane bound receptors do not enter the target cell, but they generate `second messengers' (e.g. Cyclic AMP produced from ATP by the action of the enzyme adenylate cyclase/ Adenylyl cyclase, IP_3, Ca^{++} etc). These second *messengers* regulate cellular metabolism in the target cells in a cascading action amplifying the final effect. In this way even a very small quantity of the hormone can cause a series of enzymatic actions, each step having a muluplicating effect, bringing a powerful cascading effect.

We can take an example to understand the action of hydrophilic hormone, such as Epinephrine, which cannot enter a cell. In the *liver cells 1)* Epinephrine attaches to cell membrane receptor 2) G protein of cell membrane binds to GTP and activates adenylate cyclase, a membrane enzyme 3) Activated Adenylate cyclase forms cAMP from ATP 4) cAMP activates Protein Kinase-A, which activates the enzyme `phosphorylase' 5) Phosphorylase `phosphorylates' Glycogen to Glucose-6 -phosphate- and it, in turn produces glucose. Thus the liver cell is able to produce several molecules of glucose needed to the cell under the action of epnephrine (one *of the fight and flight responses of the body).*
The cyclic-AMP (cAMP) is a `signalling molecule'. A single hormone molecule activates hundreds of phosphorylations by causing a series of `cascading actions' initiating With cAMP.



Mechanism of hormonal action (a) Membrane bound–receptor mechanism (b) Intracellular receptor mechanism

Hormones which interact with *intracellular receptors* (e.g. steroid hormones, iodothyronines, etc.) are lipid soluble and they diffuse through the plasma membrane into the cytoplasm. They bind to certain internal receptors, enter the nucleus and *regulate gene expression.* The hormonal mechanism of steriod hormones is called mobile receptor mechanism

UNIT-IV (B)

Immune System

Very Short Answer Questions

1. Define the terms immunity and immune system ?

Ans:- Abiity of an individual to fight against the disease causing organisms is called immunity. The network of organs, cells and proteins that protect the body from harmful, infectious agents such as bacteria, viruses, animal parasites, fungi etc., is called the Immune system.

2. Define the non-specific lines of defence in the body ?

Ans:- Whenever bacteria, viruses, fungi and parasites try to enter the body of an organism, skin mucus membranes and the enzyme lysozyme of saliva tears prevent their entry. This is called the first line of defence.

If micro organisms cross the first line of defence and enter the body the phagocytes natural killer cells, antimicrobial substances. inflammation fever etc., destroy them. This called the second line of dence. These two lines of defence are very fast reacting responses but they are not specific.

3. Differentiate between mature -cells and functional -cells.

Ans:- Mature cells synthesize various types of antibodies which are displayed on their membrane surfaces. The antibodies on the mature cells can take antigens so these are called as immuno-completent -cells. These mature immuno-competent -cells reach the secondary lymphoid. Organs and develop into functional immune cells.

4. Write the names of any four mononuclear phagocytes.

Ans:- 1) Kupffer cells
2) Microglia cells
3) Osteoclasts
4) Synomial cells

5. What are complement proteins ?

Ans:- These are group of inactive plasma proteins and cell surface proteins. When activated, they form a membrane attack complex (MAC) that forms a pore in the plasma membrane, allowing ECF toenter the cell and make it swell & burst.

6. "Colostrum is very much essential for the new born infants" justify.

Ans:- The colostrum secreted by the mother during the initial days of lactation has abundant Iq A antibodies, to protect the infant.

7. Differentiate between perforins and granzymes.

Ans:- Perforins Granzymes

Perforins form pores in the cell membrane of the infected cells Granzymes enter the infected cells through these perforations and activate certain proteins which helpin the destrution of infected cell (apoptosis)

8. Explain the mechanism of vaccination or immunization.

Ans:- The principle of vaccination or immunization is based on the property of the memory of the immune system. During the proces of vaccination, inactivated or weakened pathogens (vaccines) or antigenic proteins of the pathogen are introduced into the body of the host. They initiate the production of appropriate antibodies in the host and also generate memory-B cells and memory T cells. On subsequent exposures, the memory cells recognise that pathogen quickly and overcome the invader with a rapid and massive production of antibodies.

9. Mention various types of immunological disorders

Ans:- a) Immuno deficiency disorders
b) Hypersensity disorders
c) Auto-immune disorders

10. More and more people in metrocities of india are prone to allergies justify.

Ans:- Exposure to various types of pollutants in the urban atmosphere leads to allergies. High percentage of pollutants in the air in metro cities of india cause allergy in more and more people.

11. What are auto immune disorders ? Give any two examples ?

Ans:- Generally our immune system can recognise our own proteins and does not attack our own tissues. Unfortunately, in some cases our immune system fails to recognise some of our own body proteins and treats them as foeign antigens that results inattack on our own tissue. This leads to auto immune diseases.
Ex:- "Graves disease", "Rheumatiod arthritis"

12. How can the graft rejections be avoided in patients ?

Ans:- Tissue matching and blood group matching are essential before undertaking any graft or transplant. Even after this, the patient has to take immuno suppressant drugs throughout their life.

Short Answer Questions

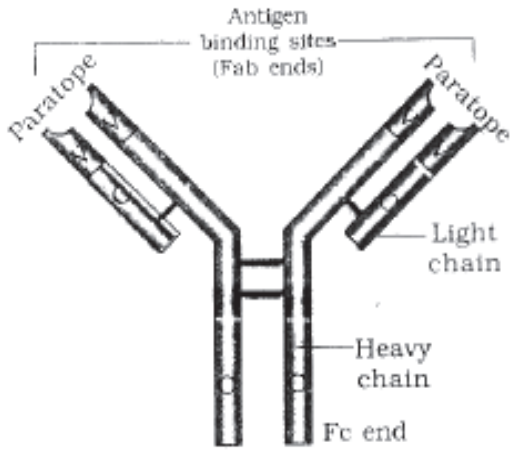
1. Write short notes on B-cells.

Ans:- Based on the size, lymphocytes can be divided into small lymphocytes and large lymphocytes. Small lymphocytes include B-cells and T-cells, wheres the large lymphocytes include large granular lymphocytes that consist of Natural killer cells (NK-cells)

B-cells (B-Lymphocytes): The lymphocytes capable of producing antibodies and can capture circulating antigens are called B-cells, They are produced from the `stem cells' in the bone marrow of adult mammals, liver of foetus and *bursa of Fabricius* in birds. Mature B-cells synthesize various types of antibodies which are displayed on their membrane surfaces. As these antibodies can take antigens, the mature B-cells are also called *immuno-competent B-cells.* These mature immuno-competent B-cells reach the secondary lymphoid organs and develop into functional immune cells which later differentiate into `long lived' memory cells and `effector' plasma cells. The plasma cells produce antibodies specific to the antigen to which they are exposed. Memory cells store information about the specific antigens and show quick response, when the same type of antigen invades the body later.

2. Write short notes on immunoglobulins.

Ans:- **Antibodies (immunoglobulins):** Whenever pathogens enter our body, the B-lymphocytes produce an army of proteins called antibodies to fight with them. They are highly specialized for binding with specific antigens. The part of an antibody that recognizes an antigen is called the paratope (antigen binding site)- Based on their mobility, antibodies are of two types, namely *circulating or free antibodies* and *surface antibodies.* The circulating or free antibodies are present in the body fluids whereas the surface antibodies are present on the surface of the mature B-cells as well as the memory cells.



Structure of Antibody

Structure: The basic structure of an antibody was proposedby Rodney Porter. It is a Y shaped molecule with four polypeptide chains of which two are long, identical (H) and two are small, identical light chains (L). Hence, an antibody is represented as H_2L_2. The two chains are linked by disulphide

bonds. One end of the antibody molecule is called F_{ab} end *(Fragment-antigen binding)* and the other end is called F_C end *(Fragment-crystallizable or Fragment-cell binding).* Based on the structure, the antibodies are of five types, namely IgD, IgE, IgG, IgA and IgM.

IgD, IgE and IgG are monomeric units, whereas IgA is dimeric and IgM is a pentameric form of antibody.

3. Describe various types of barriers of innate immunity.

Ans:- The inborn resistance to diseases, possessed by all the living organisms is called innate immunity different types of barriers of innate immunity

a) **Physical barriers :-** Skinand mucous membranes are the main physical barriers. Skin prevents the entry of micro organisms. Where as mucous membranes help in trapping the microbes entering our body.

b) **Physiological barriers :-** Secretions of the body like Hcl in the stomach, saliva in the mouth, tears from the eyes are the physiological barriers against microbes.

Saliva, tears, sweat contain "lysozyme" which can digest the bacterial cell walls. Oil(sebum) sweat of skin hane a pH range of 3-5 making the skin an effecting inhibitor of microbial growth.

c) **Cellular barriers :-** Poly morpho nuclear leukocytes (PMN-neutrophils), monocytes and natural killer cells in the blood as well as macrophages in the tissue are the main cellular barriers. They phagocytose and destroy the microbes.

d) **Cytokine barriers :-** The cytokines secreted by the immune cells are involved in differentiation of the cells of immune system and protect the non-infected cells from further infection.

4. Explain the mechanism of humoral immunity.

Ans:- ***Mechanism of Humoral immunity (HI)***

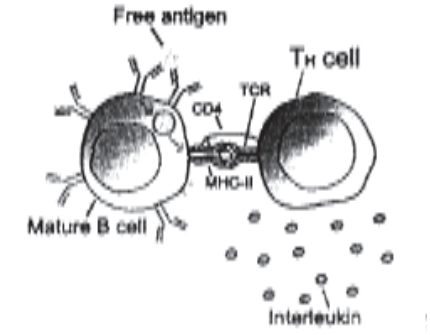
In the secondary lymphoid organs, the free antigens bind to the F_{ab} end of the antibodies that are present on the surface of mature B-cells. *They* engulf and process the antigens. Then they display the antigenic fragments on their membrane with the help of Class-II MHC molecules. Then appropriate T_H cells *recognize* them and interact with the antigen-MHC-II complex and release a type of interleukin which stimulates the B-cells to proliferate and differentiate into memory cells and plasma cells. The plasma cells release specific antibodies into the plasma *or* extra cellular fluids. These antibodies help in opsonising and immobolising the bacteria, neutralising and cross linking of antigens

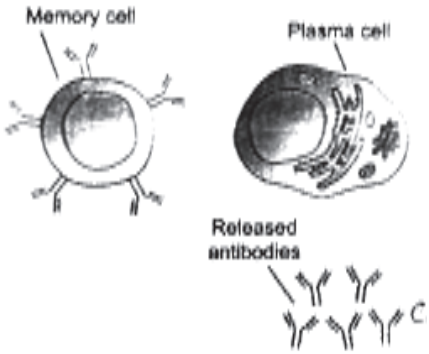
leading to agglutination of *insoluble* antigens and precipitation of *soluble* antigens. They also activate the phagocytes and complement systems.

The products of antigen, antibody reactions are called `antigen- antibody complexes' or immunocomplexes, which are removed by eosinophils and monocytes.

5. Explain the mechanism of cell mediated immunity.

Ans:- **Cell Mediated Immunity (CMI):** The immunity mediated by the activated T-cells, natural killer cells, etc., is known as cell mediated immunity. It is effective against both exogenous and endogenous antigens. It does not involve antibodies.

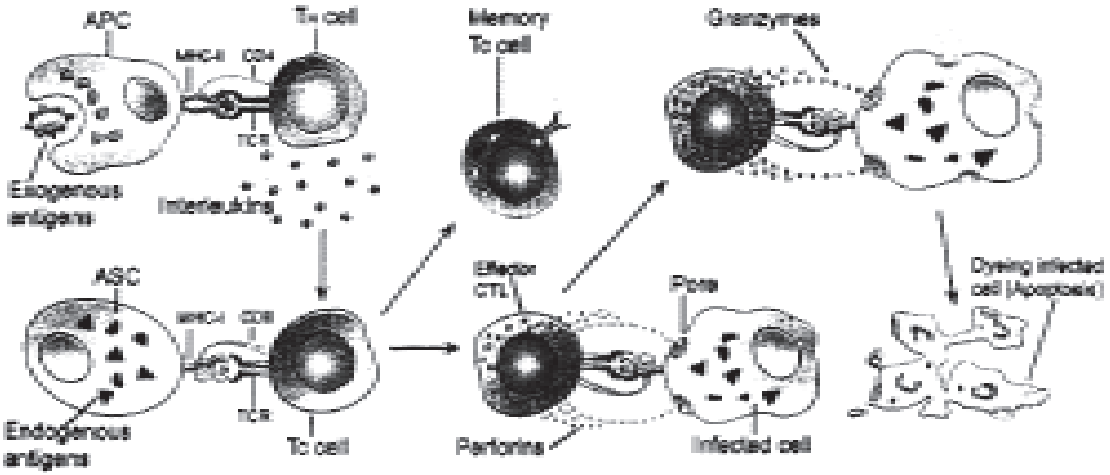




Mechanism of humoral immunity

Mechanism of Cell mediated immunity (CMI)

Antigen presenting cells process the exogenous antigens whereas the altered self-cells process endogenous antigens. Then, the processed antigenic fragments are displayed on their (APCs or ASCs) membranes. They are recognised by T-cells. Binding of T-cells to the APCs or ASCs causes the production of activated T cells and memory T cells. The activated T_H cells secrete various types of interleukins which transform activated Tc cells into effector Cytotoxic T-Lymphocytes (CTLs / Killer cells). They attach to the infected cells and release certain enzymes called perforins and granzymes perforins form pores in the cell membrane of the infected cells. Then granzymes enter the infected cells through these perforations and activate certain proteins (e.g. ca-pases) which help in the destruction of the infected cell apoptosis). The NK cells are similar in their action to CTLs. However NK cells distroy the infected cells in an antibody independent manner where as the CTLs destroy the infected cells in an antibody dependent manner.



Mechanism of cell mediated immunity

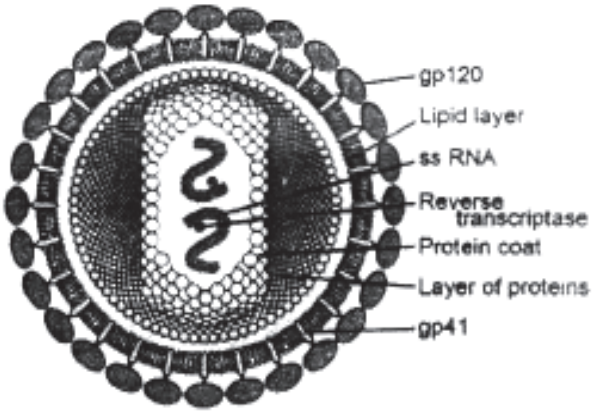
6. Explain the mechanism by which HIV multiplies and leads to "AIDS"

Ans:- HIV after getting into the body of a person it enters the T_H cells, macrophages or dendritic cells. In these cells the ss RNA of HIV synthesizes a DNA strand "complementary" to the viral RNA using the enzyme reverse transcriptase. It also catalyses the formation of the second DNA strand complementary to the first stand forming the double stranded viral DNA.

This viral dNA gets incorporated in the DNA of the host cells DNA by a viral enzyme (integrate) and it is in the form of a "provirus". Transcription of DNA results in the production of RNA which can act as the genome for the new viruses or it can translated into viral proteins. The various components of the viral particles areassembled and the HIV are produced. The infected human cells continue to produce virus particules and in this way they act like HIV generation factories.

New viruses bud off from the host cells they attack T_H cells of the infected person leading to immuno deficiency in him.

Even though HIV attacks cells with CD4 marker, only T_H cells are destroyed and not the "macro phages". The gp 120 molecules on the surface of HIV attach to CD4 receptors of human cells, mostly the T_H cells. Attack on certain types of cell / tissues only by viruses such on HIV is referred to as "tissue tropism".



Structure of HIV

There is time lag between the first infection and appearance of symptoms. This period may vary from few months to many years. As the no. of T_H cells decreases the person develops immuno deficiency. Gradually the person starts suffering from infections due to bacteria, viruses, fungi. The person also suffers from bouts of fever, diarrhoea & loss of weight. Now the AIDS patient become so immuno deficient that they are unable to protect themselves against these minor infections, which normal healthy people can easily overcome.

UNIT-V

HUMAN REPRODUCTION

UNIT-V (A)

HUMAN REPRODUCTIVE SYSTEM

Synopsis

Human reproduction is a form of sexual reproduction resulting in the conception of a child, typically involving sexual intercourse between a man and a woman, the reproductive events in humans include formation of gametes (gametogenesis), i.e. sperms in males and ova in females, transfer of sperms into the female genital tract (insemination) and fusion of male and female (fertilization) leading to the formation of zygote, this is followed by the formation and development of blastocyst and its attachment to the uterine wall (implantation), embryonic development (gestation) and delivery of the baby (parturition). All these reproductive events occur in puberty (sexual maturity: the first occurrence menstruation in girls). There are remarkable differences between the reproductive events in male and female.

Very Short Answer Questions

1. Where are the testes located in man? Name the protective coverings of each testis?

Ans:- Testes are suspended outside the abdominal cavity within a pouch called scrotum. Testes are enclosed with two coverings 1. Tunica albuginea 2. Tunica vaginalis.

2. Name the canals that connect the cavities of scrotal sac and abdominal cavity. Name the structures that keep the testes in their position.

Ans:- The cavity of the scrotal sac is connected to the abdominal cavity through the inguinal canal. Testis is held in position in the scrotum by the gubernaculum.

3. What are the functions of cells of the seminiferous tubules and the Leydig cells in man?

Ans:- Seminiferous tubule is lined by undifferentiated male germ cells called spermatogonial mother cells and also nourishing cells called sertoli cells. Leydig cells produce androgens the most important of which is testosterone.

4. Name the copulatory structure of man. What are the three columns of tissues in it?

Ans:- Penis is the copulatory structure of man. It is made up of two upper corpora cavernosa on the dorsal side and one corpus spongiosum on the ventral side.

5. Define spermiogenesis and spermiation.

Ans:- **Spermiogenesis:** The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis.

Spermiation: After spermiogenesis, sperm heads become embedded in the serotli cells, and are finally released from the seminiferous tubules by the process called spermiation.

6. Name the yellow mass of cells accumulated in the empty follicle after ovulation. Name the hormone secreted by it and what is its function?

Ans:- After ovulation the granulose cells in the follicle proliferate and are transformed into a yellowish glandular mass called corpus luteum. Corpus luteum secretes the hormone progesterone.

7. Define gestation period. What is the duration of gestation period in the human beings?

Ans:- Intra uterine development of the embryo or foetus is called gestation period. Human pregnancy averages 266 days (38 weeks).

8. What is implantation, with reference to embryo?

Ans:- The zona pellucida present around the blastocyst gradually disappears and the cells of the trophoblast stick to the uterine endometrium. The trophoblast invades the endometrium of the uterus. This is called implantation.

9. Distinguish between epiblast and hypoblast.

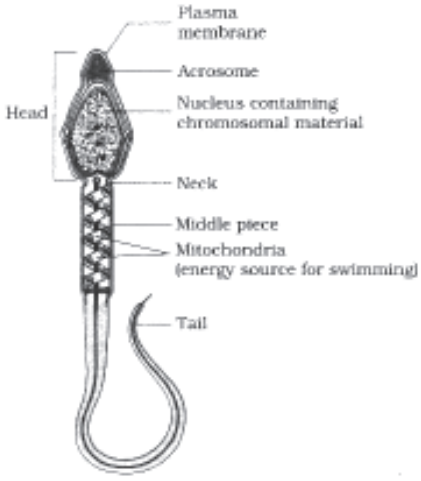
Ans:- Some cells from embryonic disc, separated by delamination and eventually form a layer on the inner surface of the the embryonic disc. This layer develops into the hypoblast. The remaining part of the disc is called epiblast.

10. Write two major functions, each of testis and ovary.

Ans:- Testes: Produces the sperms, and the hormone testosterone which controls the development of secondary sexual characters.

Ovary: Produces ovum and the hormones progesterone and relaxin. These hormones bring changes in body of females.

11. Draw a labelled diagram of a sperm.



Structure of a Sperm

12. What are the major components of the seminal fluid?

Ans:- The seminal fluid contains fructose, proteins, citric acid, inorganic phosphorus, potassium and prostaglandins along with the secretions of prostate gland and bulbourethral glands.

13. What is menstrual cycle? Which hormones regulate menstrual cycle?

Ans:- The reproductive cycle in the female primates (e.g. monkeys, apes and human beings) is called menstrual cycle. The secretion of gonadotropins (Leutinizing Hormone and Follicle Stimulationg Hormone) regulates the menstrual cycle.

14. What is parturition? Which hormones are involved in inducing parturition?

Ans:- The process of delivery of the child is called parturition. Maternal pituitary hormone oxytocin acts on the uterine muscles and causes stronger uterine contractions. This leads to expulsion of the baby out of the uterus through the birth canal.

15. How many eggs do you think were released by the ovary of a female dog which gave birth to six puppies?

Ans:- Dogs and rodents are polyovulatory species. In these species, more than one ovum is released from the ovary at the time of ovulation. Hence, six eggs were released by the ovary of a female dog to produce six puppies.

16. What is neurulation?

Ans:- Along the longitudinal axis of the embryo, the neural plate invaginates towards the notochord to form a neural groove, which deepens progressively to form a tube by fusion of the lateral neural folds. The process of formation of neural tube is referred to as neurulation.

17. What is capaciation of sperms?

Ans:- After copulation in the female reproductive tract, cholesterol, glycoproteins and some proteins are removed from plasma membrane of the sprem. Hence, the tail of sprem begins to beat rapidly and the plasma membrane of sperm is ready to fuse with plasma membrane of ovum. These changes are referred to as capacitation.

18. What is compaction in the human development?

Ans:- After the 8-cell stage, embryos undergo what is called compaction, where the cells bind tightly to each other, forming a compact sphere. Now the embryo has a superficial flat cell layer tropoblast and inner cell mass embryoblast.

19. Distinguish between involution and ingression in the human development.

Ans:- **Ingression:** The process by which the epiblast cells in embryonic disc center and replace the hypoblast to form endoderm of embryo is known as ingression.

Involution: The future mesodermal cells of embryonic disc are converged towards primitive folds,involute through primitive groove and reach between epiblast and hypoblast to form mesoderm.

20. What are the four extra embryonic membranes?

Ans:- The 4 extra-embryonic membranes are 1.Chorion (outermost layer),
2. Yolk sac,
3. Allantois
4. Amnion (innermost layer)

Short Answer Questions

1. Describe the structure of seminiferous tubule.

Ans:- There are about 250 testicular lobules in each testis. Each lobule contains 1-3 highly coiled seminiferous tubules.

- ⇨ A pouch of serous membrane (peritoneal layer) called tunica vaginalis covers the testis.
- ⇨ Each seminiferous tubule is lined by the germinal epithelium which consists of undifferentiated male germ cells called spermatogonial mother cells and it also bears nourishing cells called sertoli cells.
- ⇨ The spermatogonia produce the primary spermatocytes whicdh undergo meiotic division, finally leading to the formation of spermatozoa or sperms (spermatogenesis).
- ⇨ Sertoli cells provide nutrition to the spermatozoa and also produce a hormone called Inhibin, which inhibits the secretion of FSH.

- ⇨ The regions outside the seminiferous tubules contain interstitial cells of leydig or leygdig cells. Leydig cells produce androgens the most important of which is testosterone,.
- ⇨ Testosterone controls the development of secondary sexual characters and spermatogenesis.

2. What is spermatogenesis? Briefly describe the process of spermatogenesis in man.

Ans: In the testis, the immature male germ cells, spermatogonia produce sperms by spermatogenesis that begins at puberty.

- ⇨ The spermatogonial stem cells present in the seminiferous tubules, multiply by mitotic divisions and increase in numbers. Each spermatogonial cell is diploid and contains 46 chromosomes. Some of the spermatogonial stem cells develop into primary spermatocytes which undergo meiosis periodically.
- ⇨ A primary spermatocyte completes the first meiotic division (Meiosis-I) leading to formation of two equal sized, haploid cells called secondary spermatocytr5s, which have only 23 chromosomes each.
- ⇨ The secondary spermatocyte undergo the second meiotic division (Meiosis-II) to produce four equal sized haploid spermatids.
- ⇨ The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis.
- ⇨ After spermiogenesis, sperms heads become embedded in the sertoli cells, and are finally released from the sminiferous tubules by the process called spermiation.

3. What is oogenesis? Give a brief account of oogenesis in a woman.

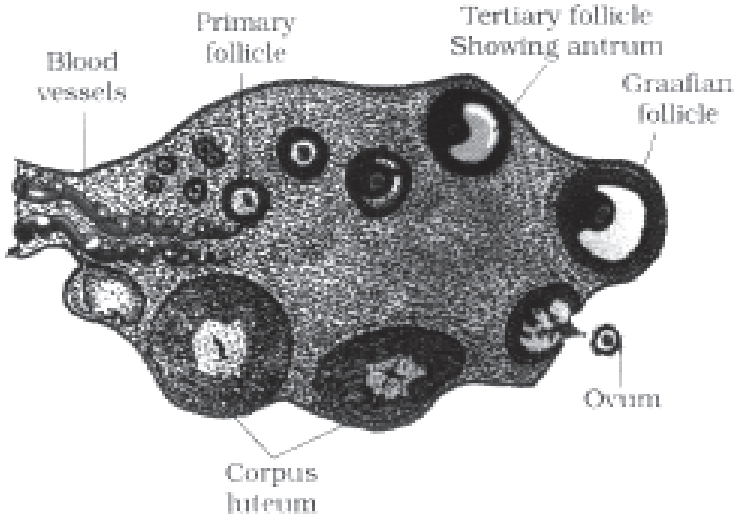
Ans: The process of formation of a mature female gamete is called oogenesis.

- ⇨ At puberty 60000-80000 primordial follicles are present in each ovary. Later the flattened follicular cells become cuboidal and proliferate to produce a stratified epithelium which constitutes the membrana granulosa. The cells are called granulosa cells.
- ⇨ Follicles at this stage of development are called primary follicles.
- ⇨ A homogenous membrane, the zona pellucida, appears between the primary oocyte and granulose cells.
- ⇨ The innermost layer of granulosa cells are firmly attached to zona pellucida forming the corona radiata.
- ⇨ A cavity (antrum) appears within the membrana granulosa. The follicular cavity increases in size. As the result, the wall of the follicle becomes relatively thin. The oocyte now lies eccentrically in the follicle surrounded

by some granulosa cells. It is called cumulus oophorus.

- ⇨ As the follicle expands the stromal cells surrounding the membrane granulose become condensed to form a covering called the theca interna,
- ⇨ Outside the theca interna some fibrous tissue becomes condensed to form another covering called theca externa. Now these follicles are called secondary follicles.
- ⇨ The celles of theca interna later secrete a hormone called oestrogen. At this stage, the primary oocyte within the secondary follicle grows in size and completes meiosis-I resulting the formation of large haploid secondary oocyte and a tiny first polar body (haploid). The secondary follicle further changes into the mature follicle called graafian follicle.

4. Draw a labelled diagram of a graafian follicle.



Diagrammatic Sectional view of ovary

5. In our society women are often blamed for giving birth to daughters. Can you explain why this is not correct?

Ans:- The chromosome pattern in the human female is XX and that in the male is XY. Therefore, all the haploid gametes produced by the female (ova) have the sex chromosome X whereas in the male gametes (sperms) the sex chromosome could be either X or Y, hence, 50 per cent of sperms carry the X chromosome while the other 50 per cent carry the Y. After fusion of the male and female gametes the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilised the ovum. The zygote carrying XX would develop into a female baby and XY would form a male. That is why, scientifically it is correct to say that the sex of the baby is determined by the father and not by the mother!

6. Describe the placenta in a woman.

- ⇨ The placenta consists of two essential portions: The maternal part of the placenta derived from the endometrium of the uterus and contains uterine epithelium, uterine capillary tissue and uterine capillary endothelium.
- ⇨ The foetal membranes are foetal capillary endothelium, foetal connective tissue and foetal chorionic epithelium.
- ⇨ The placenta of human is called chorioallantoic placenta as allantois also fuses with the chorion in the process of vascularisation.
- ⇨ Placenta is discoidal as the villi are restricted to the dorsal surface of the blastodisc.
- ⇨ Placenta is haemochorial as the maternal blood comes into direct contact with the foetal chorion
- ⇨ During the parturition the placenta is cast off with loss of embryonic membranes. So it's is calles as deciduate placenta.

Long Answer Questions

1. Describe female reproductive system of a woman with the help of a labeled diagram.

Ans:- The female reproductive system consists of a pair of ovaries along with a pair of oviducts, uterus, vagina and the external genitalia along with a pair of mammary glands.

Ovaries:

A pair of ovaries is located on one each side of the lower abdomen connecting with mesovarium. The ovaries are covered on the outside with germinal epithelium. Underneath these layers, there is a dense connective tissue the tunica albuginea. The ovarian stroma is distinctly divided into an outer cortex and an inner medulla. The cortex appears more dense and granular due to the presence of numerous ovarian follicles in various stages of development. The medulla is a loose connective tissue with abundant blood vessels, lymphatic vessels, and nerve fibers.

Fallopian tubes (oviducts): Each fallopian tube extends from the periphery of each ovary to the uterus, and it bears a funnel shaped infundibulum. The edges of the infundibulum possess finger like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus. Fallopian tube is the site of fertilization; it conducts

the ovum or zygote towards the uterus by peristalsis. The fallopian tube is attached to the abdominal wall by a peritoneal fold called mesosalphinx.

Uterus: Uterus is a large, muscular, highly vascular structure present in the pelvis between bladder and the rectum. It is connected to the abdominal wall with peritoneal fold called mesometrium.the uterus opens into the vagina through cervix. The cavity of the cervix is called cervical canal.

Vagina: The vagina is a muscular tube that extends from the cervix to the vestibule. It is lined by non-keratinised stratified squamous epithelium. Its highly vascular and opens into the vestibule by the vaginal orifice.

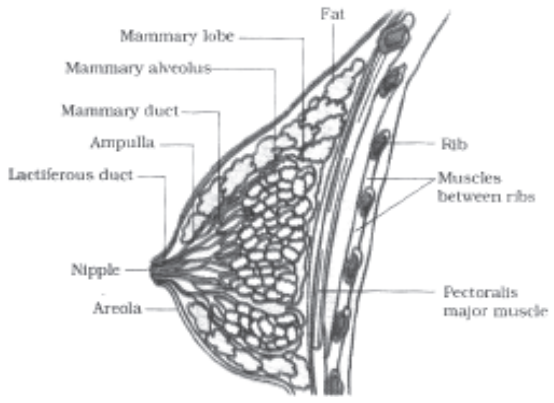
Vulva: The term refers to external genitals of the female. The vestibule has two apertures- the upper external urethral orifice, lower vaginal orifice. Vestibule is bound by two pairs of fleshy folds of tissue called inner labia minora and larger outer labia majora. Clitoris is a sensitive erectile structure homologous to penis of a male as both are supported by corpora cavernosa internally.

Accessory reproductive glands of female:

Bartholins's glands: two glands located slightly posterior and to the left and right of the opening of the vagina. They secrete mucus to lubricate the vagina.

Skene's glands: located on the anterior wall of the vagina, secrete a lubricating fluid when stimulated. Homologous to prostate gland in male.

Mammary glands: the glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The cells of alveoli secrete milk which is stored in the cavities of the alveoli. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form mammary ampulla which is connected to lactiferous duct through which milk is sucked out by the baby.



A diagrammatic sectional view of Mammary gland

2. Describe male reproductive system of a man. Draw a labelled diagram of it.

Ans:- **Testes:-** The testes (testicles) are a pair of oval pinkish male primary sex organs suspended outside the abdominal cavity within a pouch called scrotum. The cavity of the scrotal sac is connected to the abdominal cavity through the inguinal canal. Testes is held in position in the scrotum by the gubernaculum, a fibrous cord that connects the testis with the bottom of the scrotum and spermatic cord, formed by vas deferens, nerves, blood vessels and other tissues that run from the abdomen down to each testicle, through the inguinal canal. Each testis is enclosed in a fibrous envelope, the tunica albuginea, which extends inward to form septa that partition the testis into lobule.

There are about 250 testicular lobules in each testis. Each lobule contains 1-3 highly coiled seminiferous tubules. A pouch of serous membrane (peritoneal layer) called tunica vaginalis covers the testis. Each seminiferous tubule is lined by the germinal epithelium which consists of undifferentiated male germ cells called spermatogonial mother cells and it also bears nourishing scells called sertoli cells. The spermatogonia produce the primary spermatocytes whicdh undergo meiotic division, finally leading to the formation of spermatozoa or sperms (spermatogenesis). Sertoli cells provide nutrition to the spermatozoa and also produce a hormone called inhibin, which inhibits the secretion of FSH. The regions outside the seminiferous tubules contain interstitial cells of leydig or leydig cells. Leydig cells produce androgens the most important of which is testosterone. Testosterone controls the development of secondary sexual characters and spermatogenesis.

The seminifeorous tubules open into the vasa efferentia through the rete testis.

Epididymis: the vasa efferentia leave the testis and open tinto a narrow, tightly coiled tube called epididymis located along the posterior surface of each testis. The epididymis provides a storage space for the sperms and gives the sperms time to mature. It is differentiated into three regions: caput epididymis (receives the spermatozoa via the vasa efferentia of the mediastinum testis), corpus epididymis and cauda epididymis.

Vasa deferentia: is a long narrow, muscular tube. It starts from the tail of the epididymis, passes through the inguinal canal into the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle. Both the ducts unite to form an ejaculatory duct. The ejaculatory ducts

converge in the centre and open into urethra.

Urethra: in males urethra is the shared terminal duct of the reproductive and urinary systems. The urethra originates from the urinary bladder and provides an exit for urine as well as semen during ejaculation.

Penis: the penis serves as a urinal duct and also intromittent organ that transfers spermatozoa to the vagina of a female. The human penis is made up of three columns of tissue; two upper corpora cavernosa on the dorsal and one corpus spongiosum n the ventral side. The enlarged bulbous end of penis called glans penis is covered by a loose fold of skin called prepuce.

The male accessory glands: include paired seminal vesicles, a prostate and bulbo urethral glands.

Seminal vesicles:

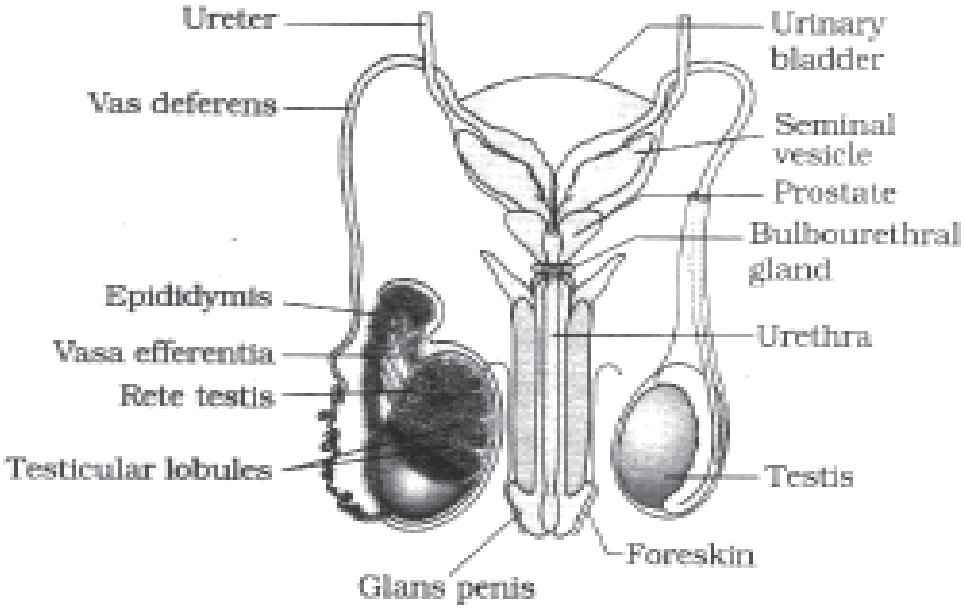
- The secretion of seminal vesicles constitutes 60% of the volume of seminal fluid.
- It is an alkaline, viscous fluid that contains fructose, proteins, citric acid, inorganic phosphorus, potassium, and prostaglandins.
- Fructose is the main energy source for the sperm outside of the body.
- Prostaglandins are believed to aid fertilization by causing the mucus lining of the cervix to the sperm towards the ovum with peristaltic contractions of the uterus and fallopian tubes.

Prostate glands:

- This gland is located beneath the urinary bladder and surrounds the prostatic urethra.
- The prostate contributes 15-30 percent of the semen.
- The fluid from the prostate is clear and slightly acidic. The prostatic secretion activates the spermatozoa and provides nutrition

Bulbo urethral glands:

- Also called as cowper's glands, are located beneath the prostate gland at the beginning of the internal portion of the penis.
- The alkaline fluid secreted by these glands lubricates the urethra, and thought to be flush out the acidic urinary residues that remain in the urethra, before the semen is ejaculated.



Diagrammatic view of male reproductive system

UNIT- V (B)

REPRODUCTIVE HEALTH

Very Short Answer Questions

1. What in your view are the reasons for population explosion, especially in India?

Ans:- Increased healthcare facilities along with better living conditions had an explosive impact on the population growth. Probable reasons for this growth rate are decline in death rate, maternal mortality rate and infant mortality rate.

2. It is true that 'MTP is not meant for population control'. Then why did the government of India legalize MTP?

Ans:- It is considered to be the only available choice to get rid of unwanted pregnancies resulted due to casual unprotected intercourse, failure of the contraceptive used during coitus or in case of rapes or in the case of confirmed incurable genetic disorders in the foetus, in cases where continuation of pregnancy could be harmful or even fatal either to the mother, or to the foetus or for both, MTP is the inevitable solution.

3. What is 'amniocenteses'? Name any two disorders that can be detected by amniocentesis.

Ans:- Amniocenteses is a diagnostic procedure to detect genetic defects in the unborn baby. In this procedure, usually a needle is inserted through the mother's abdominal wall into amniotic sac by the expert physician. The chromosomes of the stained foetal cells are examined under a microscope for abnormalities like Down syndrome, Edward's syndrome and Turner's syndrome.

4. Mention the advantages of 'lactational amenorrhea method'.

Ans:- Ovulation generally will not occur during the period of intense lactation by the mother following parturition, this is known as lactational amenorrhea. Some couples utilize the contraceptive benefit of these methods.

Short Answer Questions

1. Briefly describe the common sexually transmitted diseases in human beings.

Ans:-

S.No.	Name of the disease	Causative organism
1	Gonorrhea	Neisseria gonorrhoeae (bacteria)
2	Syphilis	Treponema pallidum (spirochete bacterium)
3	Genital herpes	Herpes simplex virus(HSV)
4	Genital warts, cervical cancer	Human papilloma virus (HPV)
5	Trichomoniasis	Trichomonas vaginalis (a protozoan parasite)
6	Chlamydiasis	Chlamydia trachomatis (bacteria)
7	Hepatitis-B	HBV
8	HIV infection/AIDS	HIV (human immune deficiency virus)

Un treated STDs in woman may lead to pelvic inflammatory diseases, abortions, still births, ectopic pregnancies, infertility or even cancer.

Simple principles to be followed to prevent STDs:

⇨ Avoiding sex with unknown partjners/multiple partners

⇨ Using condoms compulsorily during coitus

⇨ Consulting qualified doctor for early detection of STDs and getting complete treatment in case of infections.

2. Describe the surgical methods of contraception.

Ans:- Surgical procedure to prevent pregnancy is also known as sterilization. Sterilization procedure in the male is called vasectomy and that in the female tubectomy.

Vasectomy: A small part of the vas deferens on either side is removed or tied up through a small incision on the scrotum. Thus the sperms are prevented from reaching seminal vesicle and so the semen in vasectomised males do not contain sperms.

Tubectomy: A small part of the fallopian tube on both sides is removed or tied up through a small incision made in the abdomen or through vagina. This will block the entry of ova into the fallopian tubes and thus

pregnancy is prevented.

3. Write short notes on any two of the following.

a) IVF b) ICSI c) IUDs

Ans:- ***In Vitro* Fertilization and Embryo Transfer (IVF-ET):** fertilization of ovum by sperm done outside the body of a woman is called *invitro* fertilization. The resultant early embryonic stage is transferred into the mother's uterus for further development.

Intra Uterine Devices (IUDs): These devices are inserted by doctors or expert nurses in the uterus through vagina. These Intra Uterine Devices are presently available as the non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (CuT, Cu7, Multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20). IUDs increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilising capacity of sperms. The hormone releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms. IUDs are ideal contraceptives for the females who want to delay pregnancy and/or space children. It is one of most widely accepted methods of contraception in India.

4. Suggest some methods to assist infertile couples to have children.

Ans:- ***In Vitro* Fertilization and Embryo Transfer (IVF-ET):** fertilization of ovum by sperm done outside the body of a woman is called invitro fertilization. The resultant early embryonic stage is transferred into the mother's uterus for further development.

Zygote intrafallopian transfer (ZIFT): The ovum is extracted and fertilized outside the body (in vitro) and the zygote is transferred into the woman's fallopian tube to complete its further course of development.

Gamete Intrafallopian Transfer (GIFT): in this method an ovum is collected from a donor is transferred to the fallopian tube of the recipient woman for fertilization. This is practiced in woman who cannot produce ova.

Intracytoplasmic Sperm Injection (ICSI): The sperm is directly injected into the ovum with the help of a microscopic needle to form an embryo in the laboratory. Later the embryo is transferred to the uterus or fallopian tube for further development.

Artificial Insemination (AI): In this technique, semen is collected from the husband/healthy donor and is introduced in to the uterus for achieving fertilization.

5. Is sex education necessary in schools? Why?

Ans:- Human sexuality has biological, physical, emotional and spiritual as-

pects. The biological aspect of sexuality refers to the reproductive mechanism as well as the basic biological drive, libido that exists in all species, which is strongly influenced by hormonal levels. The emotional or physical aspect of sexuality refers to the bond that arises between individuals, and is manifested physically or through emotions such as love, trust and caring. There is also a spiritual aspect of sexuality of an individual or as a connection with others. Experience has shown that adolescents are curious about aspects of their sexuality as well as the nature of sexuality in general, and that many will seek to experience their sexuality in some way. Traditionally, adolescents were not given any information on sexual matters, with discussion of these issues being considered taboo. Such instruction as was given was traditionally left to a child's parents, and often this was put off until just before a child's marriage. Most of the information on sexual matters was obtained informally from friends and the media, and much of this information was of doubtful value. Much of such information was usually known to be deficient, especially during the period following puberty when curiosity of sexual matters was the most acute. This deficiency became increasingly evident by the increasing incidence of teenage pregnancies. As part of each country's efforts to reduce such pregnancies, programs of sex education were instituted, initially over strong opposition from parent and religious groups. The outbreak of AIDS has given a new sense of urgency to sex education. In many parts of the world, where AIDS is at epidemic levels, sex education is seen by most scientists as a vital public health strategy. Some international organizations such as Planned Parenthood consider that broad sex education programs have global benefits, such as controlling the risk of overpopulation and the advancement of women's rights.

UNIT-VI

Genetics

Very Short Answer Questions

1. What is pleiotrophy?

Ans:- A single gene often influences more than one phenotypic trait. This phenomenon of multiple effects of a single gene is called pleiotropy.

2. What are the antigens causing 'ABO' blood grouping? Where are they present?

Ans:- Blood group-A persons have antigen A, blood group-B persons have antigen-B, blood group-AB persons have antigen A&B on their RBCs. Blood group-O persons have no antigens.

3. What are the antibodies of 'ABO' blood grouping? Where are they present?

Ans:- Blood group-A persons have anti-B antibodies, blood group-B person have anti-A antibodies and blood group-O person have anti-A & anti-B antibodies in the plasma. Blood group-AB persons have no anti bodies in the plasma.

4. What are multiple alleles?

Ans:- Sometimes a gene may have more than two alleles. When more than two allelic forms occur at the same locus on the homologous chromosomes of an organism, they are called multiple alleles.

5. What is erythroblastosis foetalis?

Ans:- A severe hemolytic disease of a foetus or newborn infant caused by the production of maternal antibodies against the foetal red blood cells, usually involving Rh incompatibility between the mother and foetus.

6. A child has blood group 'O'. If the father has blood group 'A' and mother blood group 'B', work out the genotypes of the parents and the possible genotypes of the other offspring.

Ans:-

Childs genotype is	I^OI^O
Father's possible genotype	I^AI^O
Mother's possible genotype	I^BI^O
Possible genotypes of the other offspring are	I^AI^B, I^AI^O and I^BI^O.

7. What is polygenic inheritance?

Ans:- Polygenic inheritance occurs when one characteristic is controlled by two or more genes. Examples of human polygenic inheritance are height,

skin color and weight.

8. Compare the importance of Y-chromosome in human being and Drosophila.

Ans:- In Human beings, Y chromosome determines maleness. But in *Drosophila,* Y chromosome lacks male determining factors, but contains only genetic information essential to male fertility. This concept was explained by Calvin Bridges.

9. Distinguish between heterogametic and homogametic sex determination systems.

Hetero gametic	Homo gametic
1. It is the condition in which there are two different types of gametes are formed	1. It is the condition in which similar types of gametes are formed
2. In human males XY chromosomes are are present, it produces sperms with X-chromosomes, and with of egg Y-chromosomes.	2. In human females XX chromosomes present, it produces only one type i.e. with X-chromosome.

10. What is haplo-diploidy?

Ans:- Haplo-diplodidy is a mechanism of sex determination that is common in the hymenopteran insects such as honey bees, ants and wasps. In this system, the sex of the offspring is determined by the number of sets of chromosomes it receives.

11. What are Barr bodies?

Ans:- In female mammals, the extra X-chromosome undergoes heterochromatinisation and becomes inactive during early embryonic development. This appears as a darkly-staining body attached to the nuclear membrane. These are called Barr Bodies.

12. What is Klienfelter's syndrome?

Ans:- Klinefelter's syndrome is a genetic disorder caused by trisomy of 23rd pair (karyotype is 47, XXY). The principal effects are hypogonadism and reduced fertility, slight enlargement in breasts (gynecomastia).

13. What is Turner's syndrome?

Ans:- Monosomy of 23rd pair (karyotype 45, X) is called Turner's syndrome. The symptoms of a Turner female are short stature, gonadal dysgenesis, webbed neck and broad shield like chest with widely spaced nipples.

14. What is Down syndrome?

Ans:- Trisomy of 21st set (Karyotype is 47, XX, +21) is called as Down syn-

drome. The affected individual is short statured with small round head, furrowed tongue and partially open mouth. Physical, psychomotor and mental development is retarded.

15. What is Lyonisation?

Ans:- The inactivation of an X-chromosome is called as Lyonisation, one of the two copies of the X-chromosomes present in the body cells of female mammals is inactivated.

16. What is sex-linked inheritance?

Ans:- The sex chromosomes carry sex-linked genes for some traits that are unrelated to sex characteristics and the inheritance is called sex linked inheritance.

17. Define hemizygous condition?

Ans:- Hemizygous describes a diploid individual who has only one allele of a gene or chromosome segment rather than the usual two. A hemizygote refers to a cell or organism whose genome includes only one allele at a given locus. E.g. In mammals, males are hemizygous for genes on the Y chromosome.

18. What is crisscross inheritance?

Ans:- The transmission of a character from father to grandson through his daughter is called crisscross inheritance. In crisscross inheritance, the character appears in alternate generation only. The sex linked characters exhibit crisscross inheritance.
E.g. Haemophilia.

19. Why are sex-linked recessive characters more common in the male human beings?

Ans:- X-linked diseases are mostly recessive and restricted to the males who carry the mutant allele. This is because males have only one X- chromosome, where as females have two. Thus, females who carry a single mutant allele are generally unaffected.

20. Why are sex-linked dominant characters more common in the female human beings?

Ans:- Females are more likely to be affected by sex linked dominant characters as the females have 2 X-chromosomes, they have double chance to inherit the mutated allele.

21. What are sex limited characters?

Ans:- The genes for sex limited characters are present on autosomes in both

males and females and their phenotypic expression is limited to one sex only due to internal hormonal environment. e.g., Secondary sexual characters in male and females.

22. What are the sex influenced characters?

Ans:- The genes for sex influenced characters are autosomal genes in both male and female. They express in both males and females but with different way i.e., dominat in one sex and recessive in another sex.
e.g., pattern baldness, one form of white forelock and absence of Upper lateral incisor teeth

23. What is 'junk DNA'?

Ans:- Some DNA is involved in regulating the expression of the genes that code for specific proteins, the remaining nonfunctional DNA is called Junk DNA.

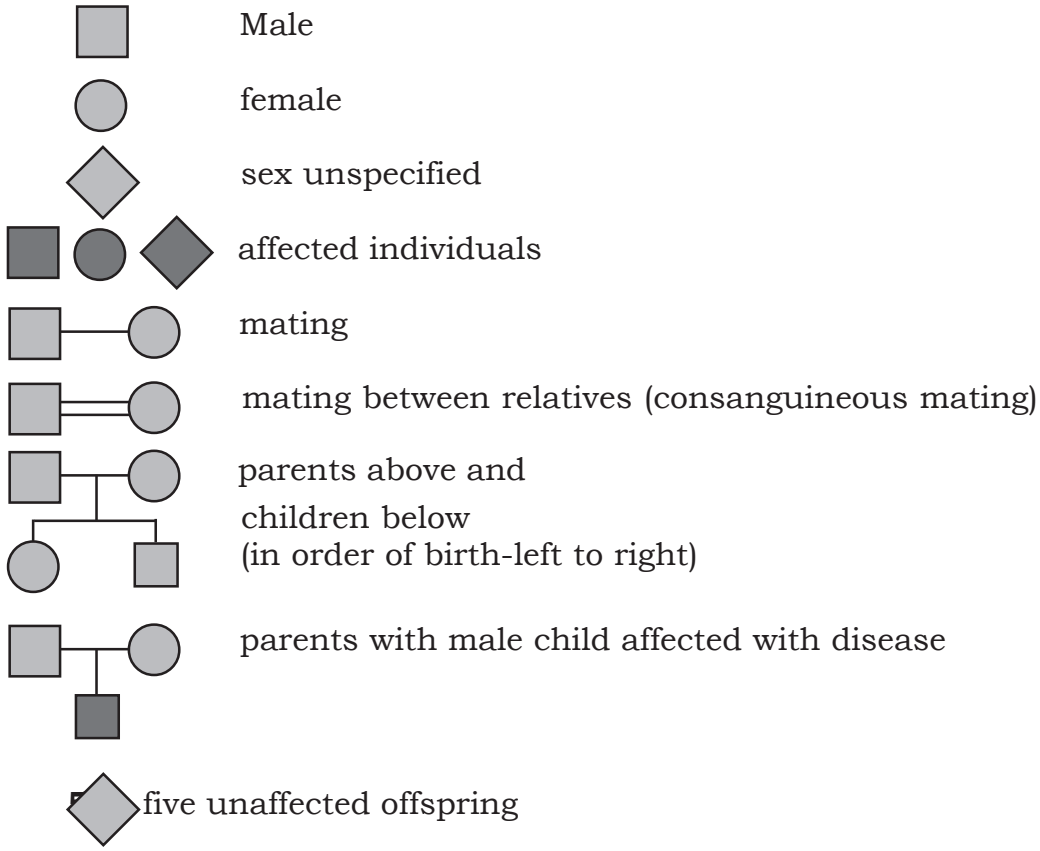
24. What are the VNTRs?

Ans:- No two people (other than identical twins) have exactly the same sequence of bases in their DNA. Restriction Fragment Length Polymorphisms (RFLPs) are characteristic to every person's DNA. They are called Variable Number Tandem Repeats (VNTRs) and are useful as genetic markers.

Short Answer Questions

1. What is pedigree analysis? Suggest how such an analysis, can be useful.

Ans:- Scientists have devised an approach called pedigree analysis, to study the inheritance of a specified trait, abnormality or disease. Pedigree is a chart showing the record of inheritance of certain traits over two or more ancestral generations of a person in the form of a diagram of family tree (pedigree chart). Pedigree analysis is useful in many ways like it helps to work out the possible genotypes from the knowledge of the respective phenotypes. It helps to study the pattern of inheritance of a dominant or a recessive trait. The possible genetic makeup of a person for a trait can also be known with the help of the pedigree chart. Some of the important standard symbols used in the pedigree analysis are shown in the figure.



2. Describe erythroblastosis foetalis.

Ans- Rh antigens and anti-Rh antibodies are involved in the disorder Erythroblastosis foetalis or Haemolytic disorder of the new born (HDNB). It occurs in an Rh-foetus whose father is Rh-positive and mother is Rh-negative.

An Rh positive person has Rh antigen and no antibodies. An Rh negative person has no antigen or antibody. But antibodies may develop in Rh-negative person when the blood from Rh-positive person enters into him. When the mother is Rh +ve and father is Rh +ve (homozygous), the developing embryo is also Rh +ve. The Rh +ve contain the antigens. These antigens enter the mother blood passing through the placenta and sensitize the mother. So the mother starts to develop antibodies against Rh antigen. By the time these antibodies are fully developed the first baby is born safely. For the second pregnancy, the mother now has fully developed antibodies against Rh antigen. Now the second child is also Rh +ve. With Rh antigens, the Rh antibodies (Ig G) developed in the mother then enter the developing foetus and causes Haemolysis and leads to the death of the foetus immediately after birth.

This is due to incompatible blood group. This condition of death of foetus is known as Erythroblastosis foetalis. It can be prevented by injecting the Rh-antibodies to the mother immediately after the first delivery. They destroy the foetal RBC. Thus thsensitization or activation of memory cells will be prevented in the mother.

3. Describe the Genic Balance Theory of sex determination.

Ans:- According to Bridges, in Drosophila the sex of an individual is determined by the balance between the genes for femaleness located on the X-chromosome and those for maleness located on the autosomes. Hence the sex of an individual is determined by the ratio of number of its X-chromosomes and that of its autosomal sets, the Y-chromosome taking no part it the determination of the sex. The ratio is termed as sex index and is expressed as follows.

Sex index = Number of X chromosomes / Number of sets of autosomes (X/A)

Bridges studied the **o**ffspring resulting from the non-disjunctin of X-chromosome during the meiosis in females. There were various types of gametes such as the ones which contained one exra X-chromosome (AXX) and some others contained one chromosome less (AO). Syngamy of such aberrant gametes and normal gametes produces zygotes with aneuploid karyotypoes such as 2n+1, 2n-1 etc. AAXO male is produced when an usual ovum (AO) in the female is fertilized by a sperm with AX chromosome complement. An AAXXY female is produced when an unusual ovum with AXX and a sperm with AY fuse. Bridges found that the AAXXY flies were fertile females and AAXO flies were sterile males. It is important to note that the presence of Y-chromosome in the AAXXY flies did not cause maleness, and its absence in the AAXCO flies did not produce femaleness.

When bridges crossed triploid females (AAXXX) with normal dilploid males (AAXY), he obtained normal diploid females, males, triploid females, intersexes, super females and super males. The occurrence of triploid intersexes from such a cross clearly established that autosomes also carry genes for sex determination.

Bridges realized that the critical factor in determining sex is the ratio of X chromosomes to the number of haploid sets of autosomes (A) present. He concluded that Y-chromosome in drosophila lacks male determining factor.

Sex Chromosome Complement	Haploid Steps Of Complements	X:A Ratio	Sexual Phenotype
XX	AA	1.5	Female
XY	AA	0.5	Male
XO	AA	0.5	Male
XXY	AA	1.0	Female
XXX	AA	1.5	Meta female
XXXY	AA	1.5	Meta female
XX	AAA	0.67	Intersex
XO	AAA	0.33	Meta male
XXXX	AAA	1.3	Meta female

4. Mention any two autosomal genetic disorders with their symptoms.

Ans:- **Down syndrome:** Trisomy of 21st set (Karyotype is 47, XX, +21) is called as Down syndrome. The affected individual is short statured with small round head, furrowed tongue and partially open mouth. Physical, psychomotor and mental development is retarded.

Edward syndrome: Trisomy of 18th set (Karyotype is 47, XX, +18) **is** called as Edward syndrome. Edward syndrome occurs in all human populations but is more prevalent in the female offspring. The majority of people with the syndrome die during the foetal stage: infants who survive experience serious defects (cardiac abnormalities and kidney malfunction) and commonly for short periods of time.

5. Explain the inheritance of sex influenced characters in human beings.

Ans:- Sex influenced genes are the autosomal genes present in both males and females. In sex-influencded inheritance, the genes behave differently in two sexes. The heterozygous genotype may exhibit one phenotype in males and the contrasting one in females.

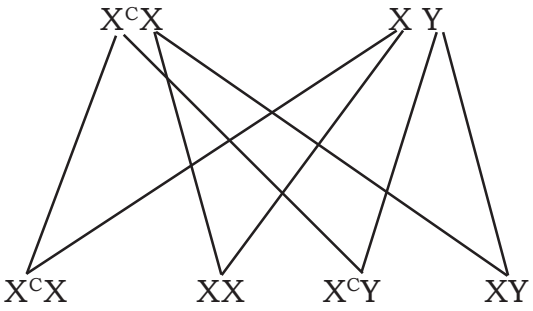
Pattern baldness:- The allele for baldness behaves dominant (B) in males but recessive (b) in females. The amount of thinning of the hair or balding that is observed depends both on genotype and the amount of testosterone exposure.

A male who is `BB' will show severe balding. A female who is `BB' will also be affected, and usually less severely, with thinning of the hair, rather than total loss. A male who is heterozygous (Bb) will not be affected. Individuals of either sex who are fully recessive (bb) will not affected. If a heterozygous non-bald woman (Bb), in the offspring the ratio of bald to non-bald in the male progeny is 3:1, while in females it is 1:3.

6. A man and a woman of normal vision have one son and one daughter. Son is color-blind and his son is with normal vision. Daughter is with normal vision, but one of her sons is color-blind and the other is normal. What are the genotypes of the father, mother, son and daughter?

Ans:- Man and woman are normal vision having color blind son and normal vision daughter. So the genotypes of man and woman are woman is carrier, man normal.

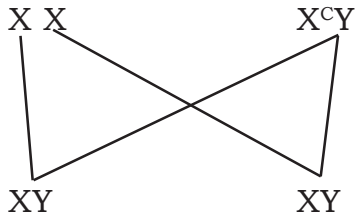
(Carrier mother) (Normal father)



(Carrier daughter) (Normal daughter) (Wlor blind son) (Normal son)

In the above cross color blind son X^CY, if he marries a normal woman his son will be normal.

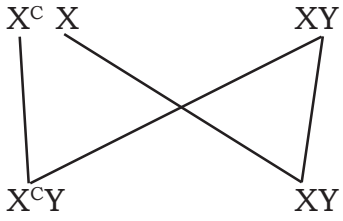
(Narmal woman) (Colourblind son)



(Normal male) (Normal male)

And in second case daughter is with normal vision and one of her son is color blind (X^CY sand XY). So the genotypes of parents might be:

(Carrier woman) (Normal man)



(Color blind son) (Normal son)

Sons get y chromosome from their father, so if mother is carrier there is chance to get half of their sons colorblindness.

From these genotypes:

Man is XY - Normal

Woman X^CX - Carrier

Daughter of the above pair X^CX - Carrier

Sons of the above daughter - 50% normal and 50% colorblind

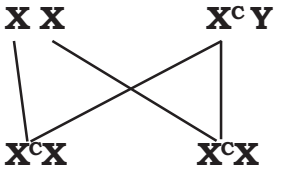
7. A colour-blind man married a woman who is the daughter of a colour-blind father and mother homozygous normal vision. What is the probability of their daughters being colour-blind?

Ans:- color blind fathers's genotype: X^CY

Normal homozygous mother's genotype: XX

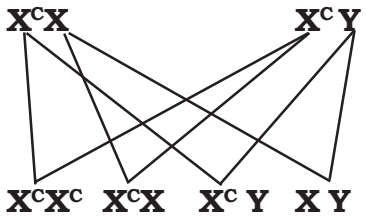
(Normal woman) (Color blind man)

Daughters of the above parents:



In above case daughters get X chromosome from their father, so all the daughters of normal mother and color blind father are carriers. If carrier woman marry color blind man:

(Carrier woman) (Color blind man)



50 % if daughters are colorblind.

50% of daughters are carriers.

50% of sons are colorblind.

50% of sons are normal.

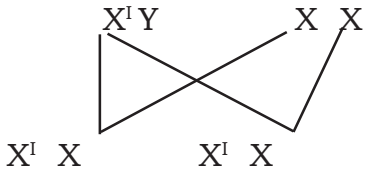
8. A woman's father shows 'IP' but her mother and husband are normally pigmented. What will be the phenotype ratio of her children?

Ans:- Incontinentia Pigmenti (IP) is inherited in an X-Linked dominant manner.

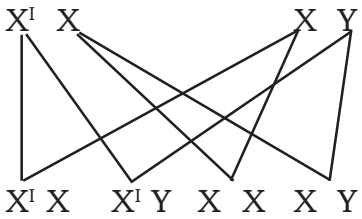
The father's genotype is - $X^I Y$

Mother's genotype is -X X

Then daughter's possible genotype is -



Daughter of IP father and normal mother show IP. If she marries normal man:



In their children 50% of male and 50% of female shows IP.

Long Answer Questions

1. What are multiple alleles? Describe multiple alleles with the help of ABO blood groups in man.

Ans:- Generally a gene has two alternative alleles. But sometimes a gene may have more than two forms. These are referred to as Multiple alleles. Multiple alleles cannot be observed in a person, but can be observed in a family or population. The inheritance of multiple alleles is called multiple allelism. Number of genotypes from multiple alleles is given by the expression (n +1)/2, where `n' is the number of alleles. ABO blood groups are the best example for multiple alleles.

ABO Blood Groups: Karl Land Steiner observed the ABO blood grouping in human beings. The phenotypes A, B and AB are characterized by the presence of antigens on the surface of red blood cells. The phenotypes O are without antigens on the surface of RBCs. These are under the control of a gene located on chromosome nine (9). The four phenotypes of blood groups are due to the antigens A and B. Blood group A has antigen A on the R.B.C and anti B antibody in plasma. Blood group

B has antigens B on R.B.C. and anti A antibody in the plasma. Blood group AB has both anti A and anti B on RBCs but no antibodies in the plasma. Blood group O is without any antigens on RBCs but with both anti A antibody and anti B antibody in plasma.

Character	Group- A	Group- B	Group- AB	Group- O
Antigen on RBC	Antigen `A'	Antigen `B'	`A' & `B'	Antigen absent
Antibodies in Plasma	Antibody `b'	Antibody `a'	Absent	Antibodies `a' & `b'

The ABO phenotype of any individual is ascertained by mixing a blood sample with Anti serum containing anti-A or anti-B; If a clump is formed with anti-A the blood is of `A' type. If the clump is formed with anti-B, the blood is of `B' type. If the clump is formed with both anti A and anti-B antibodies, the blood is `AB' type. If no clump is produced with either of the antibodies, the blood is of `O'type.

GENETIC BASIS:

Bernstein proposed the genetic basis of ABO blood grouping. The genetic basis of ABO blood grouping is mainly dependent on the three Alleles I^A, I^B, I^O of the gene I. The antigens which are present on RBC are known as isoagglutinogens and antibodies in plasma are known as isoagglutinins. Isoagglutininis are the antibodies of an individual of a species causing agglutination reactions with antigen of another individual of the same species.The alleles I^A, I^B are mainly responsible for the production of isoagglutinogens.

Out of the three alleles I^A, I^B, I^O, the alleles I^A and I^B are dominant and I^O is recessive, when I^A,I^B are present co-dominance occurs.

$$\mathbf{I^A = I^B > I^O}$$

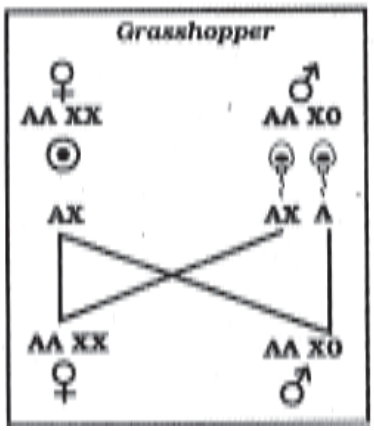
I^A & I^B alleles dominant to allele I^O but both are codominant to each other. 6 genotypes are possible with 3 alleles I^A, I^B and I^O, they are I^AI^A, I^AI^O, I^BI^B, I^BI^O, I^AI^B, I^OI^O.

phenotype	Genotype
A	I^AI^A, I^AI^O
B	I^BI^B, I^BI^O
AB	I^AI^B
O	I^OI^O

2. Describe chromosomal theory of sex determination.

Ans:- The process of sex determination by allosomes is called chromosomal

sex determination. If two sex chromosomes are similar (XX), the individual is described as homogametic. Gametes produced from it are similar. If the two sex chromosomes are different (XY) or contains only one sex chromosome (XO), the individual is described as heterogametic.

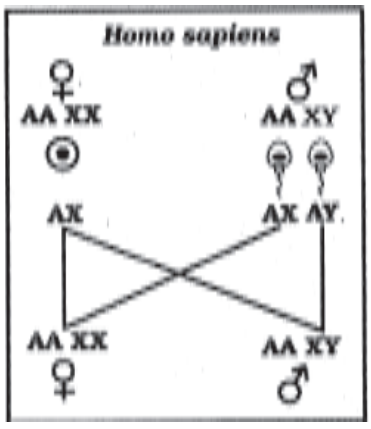


Sex determination in grass hopper

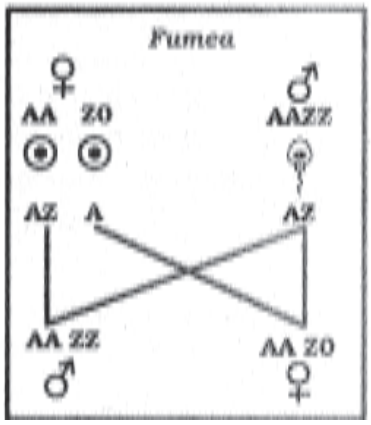
Male heterogamety:- in this method males produce dissimilar gametes while females produce similar gametes.

XX-XO type:- In some insects such as bugs, grasshoppers and cockroaches, females are with two X-chromosomes and males are with one X-chromosome in each somatic cell. McClung discovered this type in grass hoppers, the unpaired X-chromosome determines the male sex. The karyotype of the female is AAXX and that of the male is AAXO. All the ova contains AX type of chromosomes and the sperms are of two types. One half of the sperms have AX complement and the other half have `A' complement of chromosomes. The sex of the offspring depends on the type of sperm that fertilizes the ovum.

XX-XY type: Human beings and some insects such as drosophila, both females and males have the same number of chromosomes. The karyotype of the female is AAXX and that of the male is AAXY. Females are hmogametic with `XX' chromosomes. They produce similar ova having one X-chromosome each. Males are `heterogametic' with X and Y-chromosomes. They produce two kinds of sperms: one half of them



Sex determination in grass hopper

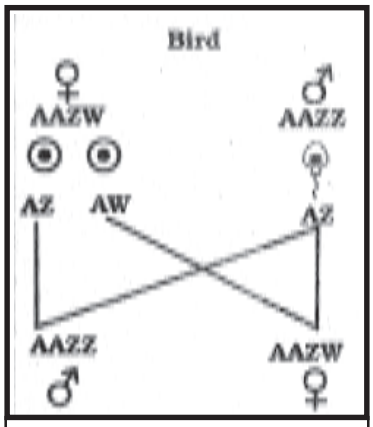


Sex determination in Fumea

with X-chromosome and the other half with Y-chromosome. The sex of the offspring depends on the fertilizing sperm.

Female heterogamety: In this method of sex determination, the males produce `similar gametes' while females produce `dissimilar gametes'.

ZO-ZZ type: In moths and some butterflies, female is heterogametic with one Z-chromosome (ZO) and male is homogametic with two Z-chromosomes (ZZ). The karyotype of female is AAZO and male is AAZZ. Females produce two kinds of ova, half of them with a Z-chromosome and the other half with no sex chromosome. Males produce similar type of sperms. The sex of the offspring depends on the type of ovum that is fertilized.



Sex determination in Fowl

ZW-ZZ type: In birds, reptiles, some fishes, etc, the females are heterogametic with ZW - allosomes and males are homogametic with ZZ-allosomes. The karyotype of female is AAZW and that of the male is AAZZ. All sperms are similar with the allosome - Z. ova are of two different kinds; one half of the ova are with the allosome-Z and the other half with the allosome -W. The sex of the offspring depends on the type of ovum that is fertilized.

Sex determination in humans (XX-XY method of Sex Determination): In human beings, both females and males have the same number of chromosomes. Females are homogametic with XX chromosomes. They produce ova having X-chromosomes. All ova are similar. Males are heterogametic with X and Y-chromosomes. They produce two kinds of sperms, half of them with X-chromosome. On fertilization the zygotes may have either the XX or XY. The zygote with XX becomes the female and the zygote with XY becomes the male. In human beings females are homogametic with 44 autosomes and XX-allosomes. Males are heterogametic with 44 autosomes and XY-allosomes. All the ova are similar in their karyotype having 23 chromosomes, (22 + X). Sperms also have 23 chromosomes but are of two types. Half of them are with allosome Y (22 + Y). The sex of the off spring depends on the fertilizing sperm. Thus, in each pregnancy there is always 50 percent probability of giving birth to either a male or a female child.

3. What is crisscross inheritance? Explain the inheritance of one sex linked recessive character in human beings.

Ans:- **Crisscross inheritance:** The transmission of a character from father to grandson through his daughter is called crisscross inheritance. In crisscross inheritance, the character appears in alternate generation only. The sex linked characters exhibit crisscross inheritance. Crisscross inheritance is also known as skip generation inheritance.

Sex linked inheritance: The sex chromosomes carry sex linked genes for some traits that are unrelated to sex characteristics and the inheritance is called sex linked inheritance. While most Y-linked genes help determine sex, the X chromosomes have genes for many characters unrelated to sex.

X-linked inheritance: X-linked diseases are mostly recessive and restricted to the males who carry the mutant allele. This is because males have only one x-chromosome, where as females have two.

Characters of X-linked Traits:

- ⇨ X-linked genes are never passed from father to son. The Y-chromosome is the only sex chromosome that passes from father to son.
- ⇨ Males are never carriers-if they have a single mutated gene on the X-chromosome, it will be definitely expressed.
- ⇨ Males are termed hemizygous for genes on X-chromosome, females are either homozygous or heterozygous.

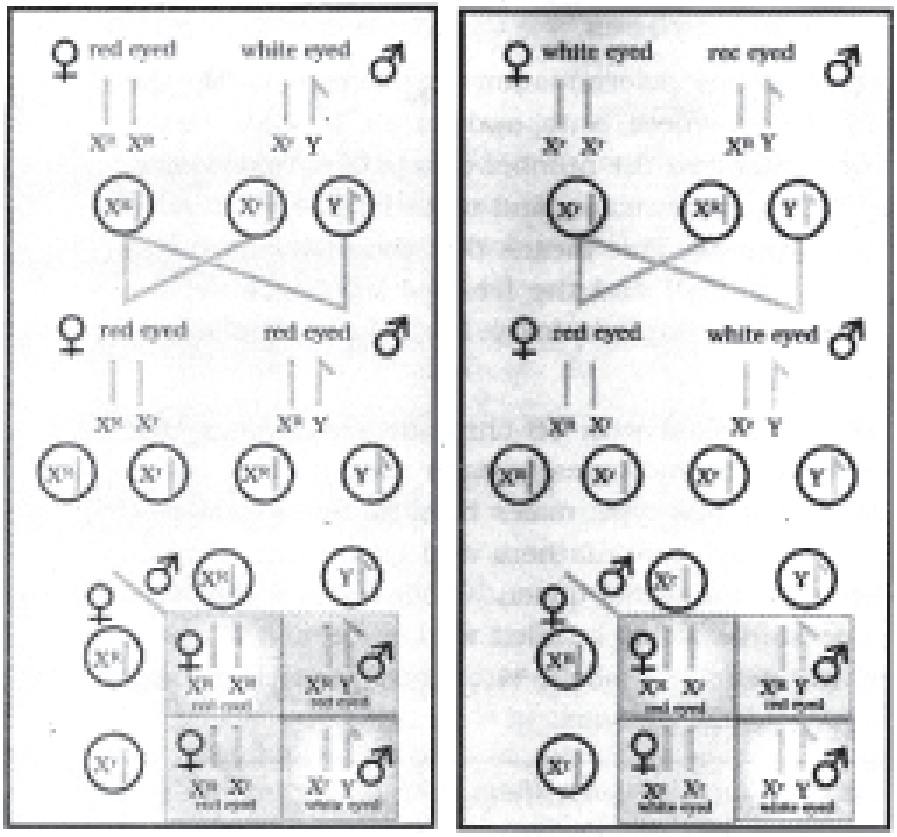
X-linked recessive inheritance: X-linked recessive inheritance is a mode of inheritance in which a mutation in a gene on the X-chromosome because the phenotype to be expressed in males and in the females who are homozygous for the allele. All affected females have an affected father and a carrier or affected mother.

Characters of X-linked recessive Traits:

- ⇨ Males are much more likely to be affected because they need only one copy of the mutant allele to express the phenotype.
- ⇨ Affected males get the disease from their mothers.
- ⇨ If a female is homozygous affected, all her sons are affected.
- ⇨ Daughters of affected male are either carriers or affected,
- ⇨ Affected male pass his X- chromosome to his daughters.
- ⇨ X-linked recessive disorders are typically passed on from an affected father to 50% of his grand sons through carrier daughters.
- ⇨ The X-linked recessive traits follow crisscross pattern of inheritance.
- ⇨ The most common X-linked recessive disorders are Hemophilia, Color

blindness (protanopia and deuteranopia), Duchenne muscular dystrophy etc.

Colour blindness: it is a sex linked recessive disorder. Retina of the eye in man contains the cell sensitive to red and green colours. This called dystrophin.



Sex linkage in Drosophila melanogaster

4. Why is the 'Human Genome Project' called a mega project?

Ans:- Human Genome Project (HGP) was called a mega project. It was an international effort formally begun in October, 1990.

Goals of HGP:- Some important goals of HGP were as follows:

i. Identify all the approximately 20,000-30,000 genes in human DNA.

ii. Determine the sequences of the 3 billion chemical base pairs that make up human DNA.

iii. Improve tools for data analysis.

iv. Address the ethical, legal, and social issues (ELSI) that may arise from the project.

Salient Feature of Human Genome: Some of the salient observations drawn from human genome project are as follows:

i. The human genome contains 3164.7 million nucleotide bases.
ii. The average gene consists of 3000 bases, but sizes vary greatly, with the largest known human gene being the one that codes for the protein called dystrophin.
iii. The total number of genes is estimate at 30,000. Almost all (99.9%) nucleotide bases are exactly the same in all people.
iv. The functions are unknown for over 50% of the genes discovered.
v. Less than 2% of the genome codes for proteins.
vi. Repeated sequences make up very large portion of the human genome.
vii. Repetitive sequences are stretches of DNA sequences that are repeated many times. They are thought to have no direct coding functions, but they shed light on chromosome structure, dynamics and evolution.
viii. Chromosome 1 has the highest number of genes (2,968), and the Y-chromosome has the fewest genes (231).
ix. Scientists have identified about 1.4 million locations where single base DNA differences (SNPs- single nucleotide polymorphism pronounced as snips) occur in humans. This information promises to revolutionize the processes of finding chromosomal locations for disease - associated sequences and tracing human history.

Advantages of HGP:

1. In the area of health care, identification and mapping of the genes responsible for genetic diseases helps in diagnosis, treatment and prevention of these diseases.
2. Detailed knowledge of the genomes of humans and other species will give a clear picture of gene expression, cellular growth and differentiation and evolutionary biology.
3. Earlier detection of genetic predispositions to disease, rational drug design, gene therapy is going to be easy with more knowledge on human genome.
4. A new era of molecular medicine, characterized by looking into the most fundamental causes of disease than treating the symptoms will be an important advantage.

5. What is DNA fingerprinting? Mention its applications.

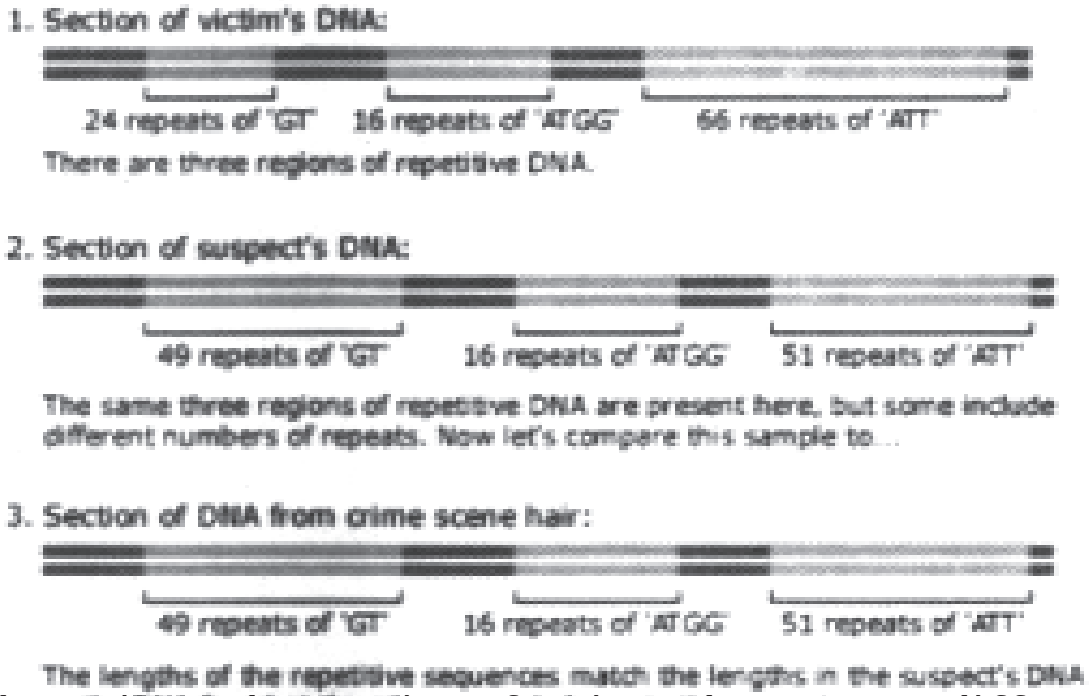
Ans:- No two people (other than identical twins) have exactly the same sequence of bases in their DNA. Restriction Fragment Length Polymorphisms (RFLPs/riflips) are characteristic to every person's DNA. They are called Variable Number Tandem Repeats (VNTRs) and are useful as

Genetic markers. The VNTRs of two persons generally show variations. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called repetitive DNA, because in these sequences, a small stretch of DNA is repeated many times. These sequences show high degree of polymorphism and form the basis of DNA fingerprinting.

In 1984 Alec Jeffrys discovered the fundamental techniques involved in fingerprints while studying the gene for myoglobin.

DNA Fingerprinting-Protocol

1. **Obtaining DNA:** the DNA is obtained from blood, saliva, hair roots, semen etc.
2. **Fragmenting DNA:** with help of restriction endonucleases cut the DNA into smaller fragments at specific sites.
3. **Separation of DNA fragments by electrophoresis:** DNA fragments are separated by their size by gel electrophoresis method.
4. **Denaturing DNA:** the DNA on the gel is separated into single strands by breaking of hydrogen bonds.
5. **Blotting:** By the southern blotting process the DNA strands are transferred on to the nylon membrane by capillary action.
6. **Using probes to identify specific DNA:** A radioactive probe is added to the DNA bands. The probe is a single stranded DNA molecule that is complementary to the gene of interest in the sample under study.
7. **Hybridization with probe**: After the probe hybridizes and the excess probe washed off, a photographic film is placed on the membrane containing `DNA hybrids'.
8. **Exposure on film to make a Genetic/ DNA Finger Print:** The radioactive label exposes to film to form an image (image bonds) corresponding to specific DNA bands. The thick and thin dark bands form a pattern of bars which constitute a genetic fingerprint.



Reabsorption and secretion of major substances at different pairs of the nephron(arrows indicate direction of movement of materials)

Applications of DNA fingerprinting:

- ⇨ Conservation of wild life- protection of endangered species: by maintaining their DNA records for identification of tissues of the dead endangered organisms
- ⇨ Taxonomical applications- study of phylogeny
- ⇨ Pedigree analysis- inheritance pattern of gene through generations
- ⇨ Anthropological studies- charting of origin and migration of human population
- ⇨ Medico-legal cases- establishing paternity and / or maternity more accurately
- ⇨ Forensic analysis- positive identification of a suspect in a crime

UNIT-VIII
APPLIED BIOLOGY

Very Short Answer type Questions

1. What factors constitute dairying ?

Ans:- Breeding, feeding and management of milch animals, production, processing and marketing of their milk and milk products on economic basis constitute dairying.

2. Mention any two advantages of inbreeding ?

Ans:- 1. Inbreeding increases homozygosity. Thus inbreeding is necessary if we want to evolve a pure line animal.

2. It helps in the accumulation of superior genes and elimination of less dessirable genes.

3. Distinguish between out-cross and cross-breed.

Ans:- **Out-cross :-** It is the practice of mating of animals within the same breed, but having no common ancestors an either side of the pedigree for u-6 generations. The off spring of such a mating is known as an out-cross.

Cross-breed:- In this method superior males of one breed are mated with superior females of another breed. The off spring of such a mating is said to be a cross-breed.

4. Define the terms layer and broiler ?

Ans:- **Layer:-** The birds which are raised exclusively for the production of eggs are called layers.

Broilers:- The birds which are raised only for their meat are called broilers.

5. What is epiculture ?

Ans:- The maintenance of lives of honey bees for the production of honey and wax is called epiculture.

6. Distinguish between a drone and worker in a honey bee colony ?

Ans:- **Drone :-** These are robust, large winged, small numbered short lived and fed with bee bread by nurse workers. They are developed from the unfertilized ova by arrhenotoky.

Worker :- They are multifaceted sterile females which develop from the

fertilised eggs and perform diverse functiions.

7. Define the term fishery.

Ans:- Fishery is an industry or occupation devoted to the catcling, procesing for storage in freezers and selling of fish shell fish or any other aquatic animals for human consumption.

8. Differentiate aqua culture and pisciculture.

Ans:- **Aquaculture :-** It means rearing and management of selected aquatic organisms under regulated conditions and their subsequent harvesting after the stipulated time.

Pisciculture : rearing of fish.

9. Explain the term hypophysation.

Ans:- Hypophysation is followed in artificial breeding. Pituitary extracts containing gonadotropins are injected into brood fish to induce release of spawn for seed production.

10. List out any two Indian carps and two exotic carps.

Ans:- **Indian Carps:-**

1) Catla catla 2) Labeo rohita

Exotic carps:-

1) Grass carp 2) Silver carp

11. Mention any four fish by products?

Ans:- 1) Shark liver oil 2) Fish guano 3) Shagreen 4) Isinglass

12. How many amino acids and polypeptide chains are present in insulin ?

Ans:- Human insulin is made up of 51 amino acids and two polypeptide chains.

13. Define the term `Vaccine'

Ans:- A vaccine is a biological preparation that improves immunity to a particular disease. A vaccine typically contains the disease causing micro organism and is often made from weakened or killed forms of the microbe.

14. Mention any two features of PCR ?

Ans:- 1) PCR helps to detect very low amounts of DNA by amplification of the small DNA fragment.

2) PCR is now routinely used to detect HIV in suspected cases.

15. What does ADA stand for ? Deficiency of ADA causes which disease ?

Ans:- ADA is stand for the immune system to function. Deficiency of ADA causes severe combined immunodeficiency (SCID)

16. Define the term transgenic animal ?

Ans:- Animals that have their own genome and had their DNA manipulated to possess and express n extra gene are known as transgenic animals

17. What is popularly called `Guardian Angel of Cells Genome?

Ans:- Gene is popularly called as Guardian Angel of cells genome.

18. List out any four features of cance rcells ?

Ans:- 1) Cancer cells actively divide and grow they starve the normal cells by competing for vital nutrients.

2) Cancer cells have abnormal changes on their cell surface

3) There is increased growth of blood vessels towards the tumors.

Short Answer type Questions

1. What are the various methods employed in animal breeding to improve livestock ?

Ans:- Animal breeding is an important aspect of animal husbandry which aims at increasing the yield of animals and improving the desirable qualities of the produce

Methods of animal breeding:-

There are two methods of breeding

1) inbreeding 2) outbreeding

I **Inbreeding :-** When crosing is done between animals of the samebreed it is called inbreeding. It refers to mating of more closely related individuals within the same breed of individuals in a lineage. Inbreeding is of two types

1) close breeding :- Close breeding is mating between male parent and female offspring or female with male offspring.

2) Line breeding :- Line breeding is the selective breeding of animals for a desired feature by mating them within a closely related line.

II. **Out breeding:-** out breeding is the breeding of the unreated animals out-breeding is of 3 types 1) Out-crossing 2) Cross-breeding 3) Interspecific hybridisation

Out-Crossing:- It is the practice of mating of animals within the same breed but having no common ancestors on either side of the pedigree for 4-6 generations. The offspring of such a mating is known as an out-cross.

Cross-breeding:- In this method superior males of one breed are mated with superior females of another breed. The offspring of such a mating is known as cross-breed.

Interspecific hybridisation:-

In this method male and female animals of two different related species are mated. The progeny may combine desirable features of both the parents and is different from both the parents.

2. Define the term `breed'. What are the objectives of animal breeding ?

Ans:- A bread is a group of animals related by descent and similar in most characters like appearance, features, size, configuration etc.

Objectives of animal breeding:-

1) Disease resistance
2) Increase in the quality and quantity of milk, meat, wool e.t.c.,
3) Fast growth rate
4) Enhanced productive life by improving the genetic merit of livestock.
5) Early maturity
6) Economy of feed.

3. List out the various steps involved in MOET ?

Ans:- The following are the steps involvedin MoET

1) A cow is administered hormones, with FSH-like ctivity.
2) This includes follicular maturation and super ovulation.
3) The animal (cow) is either mated with an elite bull or artificially inseminated
4) The embryos are at 8-32 called stages are recovered non-surgically and transferred to surrogate mother.

4. Write short notes on controlled breeding experiments.

Ans:- Controlled breeding experiments are carried out using artificial insemination and multiple ovulation and embryo transfer technology.

Artificial insemination:- is the technique in which seman is collected from superior bulls and introduced into the femal reproductive tract when the female is in `heat'. This semen can be used immediately or can be frozen and used at a later period. It can be transported in a frozen form to the place where a female is housed. In this way desirable crosses can be made.

MOET :- The following are the steps involvedin MoET

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5. Explain the important components of poultry management ?

Ans:- Selection of disease free and suitable breeds :- The selected breed should get avickmash to a wide range of climatic conditions.

Feed management :- Balanced diet is a must to maximize the yield. Brooder/Clickmash, grower mash, prelayer mash and layer mash arefed to layers at different ages. Likewise prestarter mash, starter mash and finish mash are the feed to broilers. Safe waters should be supplied.

Health care:- Vaccination against viral diseares and using antibiotics to treat bacterial diseases make the pultry birds disease free.

In adition to the above, hygiene, proper and safe farm condition ensure better produce.

6. Discuss in brief about `Avian Flu'

Ans:- is an important disease affecting poultry birds and man has to be very watchful about this disease as it is very dangerous to man.

Causative organism:- Bird flu is caused by an `avian flu virus'. The H5N1. The virus that causes the bird infection infects humans too. It can start a worldwide epidemic.

Made of infection:- Infection may be spread simply by touching contaminated surfaces. Birds infected by this type of influenza continue to release the virus as in their faces and saliva for as long as 10 days.

Symptoms:- Infection by the avian influenza virus H5N1 in humans causes typical flu-like symptoms, which might include: cough, diarrhoea difficulty in breathing, fever, headache, malaise, muscle aches and sore throat.

Prevention:-

1) Avoiding consumption of underooked chicken meat reduces the risk o fexposure to avian flu.

2) People who work with birds should use protective clothing and special breathing masks.

3) Complete culling of infected flock by burying them.

7. Explain in brief about queen bee ?

Ans:- **Queen bee:-**

- ⇨ It is the largest individual in the colony.
- ⇨ It is a fertile, diploid female, one per bee live and the egg layer of the colony.
- ⇨ She lives for about five years and her only function is to lay eggs.
- ⇨ The queen bee during its nuptial flight receives sperms from a drone and stores in the spermathecae and lays two types of eggs, the fertilised and unfertilised.
- ⇨ All fertilised eggs develop into females
- ⇨ All the larvae developing from the fertilised eggs are fed with the royal jelly for the first 4 days only.
- ⇨ Afterwards royal jelly is fed only to the bee that is bound to develop into next queen, where as the other larvae fed on bee bread become workers.

8. Honey bees are economically important - Justify.

Ans:- Economic importance of Honey bees :-

The bee productis like Honey, wax, propolis and bee venom are used in various ways.

1) Honey is a rich source of fructose, water, glucose, minerals and vitamins.
2) Bee's was is used in the preparation of cosmotics, polishes of various kinds and candles.
3) propolis is used in the treatment of inflammation and superfical burns
4) Bee's venom, which is extracted from the ting of worker bees is used in the treatment of rheumatoid arthritis.
5) **Pollination:-** Bees are the pollinators of our crop plants such as sunflower, brassica, apple and pear.

9. What are the various factors required for be keeping ?

Ans:- **Factors for successful Bee Keeping :-**

1) Knowledge of nature and habits of honey bees
2) selection of suitable location for keeping the beelives,
3) Raising a live with the help of a queen and small group of worker bels.
4) Management of beehives during different seasons
5) Handling and collection of honey and bee wax.

10 Explain in brief structue of Insulin.

Ans:- **Structure of insulin:-** Human insulin is made up of 51 amino acids arranged in two polypeptide chains. Chain-A-contains 21 aminoacieds

and chain-B contains 30 amino acids, which are linked together by disulphide linkages. In mammals, including humans insulin is synthesised as a pro-hormoue which contains an extra stretch called the `c'-peptide. This `c'-peptide is not present in the nature insulin and is removed during maturation into insulin.

11. Define vaccine and discuss about types of vaccines.

Ans:- **Vaccine:-** A vaccine is a biological preparation that improves immunity to a particular disease a vaccine typically contains the disease causing micro organism and is often made from weakened or killed forms of the microbe.

Types of vaccines:-

Attenuated whole agent vaccines:- They contain disabled live micro organisms. mostly they are antiviral.

Examples:- Vaccines against yellow fever, measles, ubella and mumps and the bacterial disease such as typhoid.

Inactivated whole agen tvaccines:- They contain killed microbes

Ex:- vaccines against influenza, cholera, bubonic plague, polia, hepatitis-A, rabies and sabin's oral polio vaccine

Toxoids:- They contain `toxoids' which are inactivated `exotoxins' of certain microbes. Ex:- the vaccines against Dipththeria and Tetanus.

12. Write in brief the types of gene therapy.

Ans:- Types of Gene therapy:- Two basic types of gene therapy can be applied to humans, germline and somatic line.

1) Germ line gene theraphy:- In this type of therapy functional genes are introduced into sperms or ova and are thus integrated in to their genomes. Therefore the change or modification becomes heritable. Due to various technical and ethical reasons, the germ line gene therapy remained at the `infant stage' for the time being

2) Somatic line therapy:- In this type of therapy, functional genes are introduced into somatic cells of a patient. The approach is to correct a disease phenotype by treating some somatic cells in the affected person. The changes effected in this type of gene therapy are non-heritable. Somatic line therapy is of two types. (1) ex-vivo cells are modified outside the body and then transplanted back. (2) in-vivo-genes are changed in cells, while they are stil inside the body.

13. Explain the different types of Cancers ?

Ans:- Types of Cancers:

I. **Familial Cancers :-** genetic based Cancers

Carcinomas:- Cancers of epithelial cells which are most common.

Sarcomas:- Cancers of connective tissues

Leukemias :- Cancers of bone marrow cells resulting in unrestrained production of WBC

Lymphomas:- Cancers of the lymphatic system