



Thermometer

[Experiment 01]

Aim :- (उद्देश्य)

To record the body temperature using thermometer

Requirement :- (आवश्यकताये)
Thermometer.

Reference :- संदर्भ Sharma Shailesh & Gupta G.D
Practical of Human anatomy Physiology
by Nirali Prakashan (73-75)

Theory :- सिद्धान्त i) Human are Homoithermis of warm blooded Chemical

ii) the body temperature is maintained between
* 97°F to 99°F

iii) Heat is lost from body by various ways of
Conduction, Convection radiation and evaporation
C Skin, lungs, & excretion

iv) Thalamus Plays an important role in Conservation (absorb) and loss of heat from body, there are Shivering and antoise centers are there in brain that Sweating, Vasodilation etc. to Increase heat loss

v) The rise in body temperature (pyrexia and fever) occurs due to derangement of heat regulating mechanisms.

vi) Toxins : Poison or harmful substance. Infections, dehydration, tissue etc. also cause rise in body

vii) Temperature in the form of various activities like increased metabolism, blood pressure, pulse, Cardiac output and rate of respiration.

* A Clinical thermometer is used to measure the body temperature.

* It consists of a main bulb and the capillary tube. Because of this device, small portions of mercury rise above the twist and separate it self from the main bulk in the ~~water~~ bulb.

* Clinical thermometer contains a flattened back with white coating that helps in reading the index of temperature in Centigrade as well as in Fahrenheit.

OBSERVATION TABLE

S.R	TEMPERATURE FROM BUCCAL CAVITY °F
1.	99 Temperature measure in °F
2.	98.5
3.	97

Calculate the average $\frac{99 + 98 + 97}{3} = \frac{294}{3} = 98$ °F

Procedure:-

- 1) Bring the mercury down to about 95°F by quick motion downwards.
- 2) Place it in Such a Position that tissue of the body Completely Surround the bulb.
Such position are available at axilla, mouth, Vagina and rectum.
Usually, the thermometers are placed into the mouth under the tongue in adults and in axilla of children.
- 3) While taking the temperature under the axilla. It should be dry clean and unexpected to the surrounding. No fold of clothing should interfere the contact of thermometer with skin.
- 4) While taking the temperature in mouth.
It should be noted that the patient has not taken any hot or cold drink prior to the recording.
The temperature recorded from mouth is always a half degree higher than axillary temperature.

Result:- The body Temperature is found 98.6°F

Sakshi

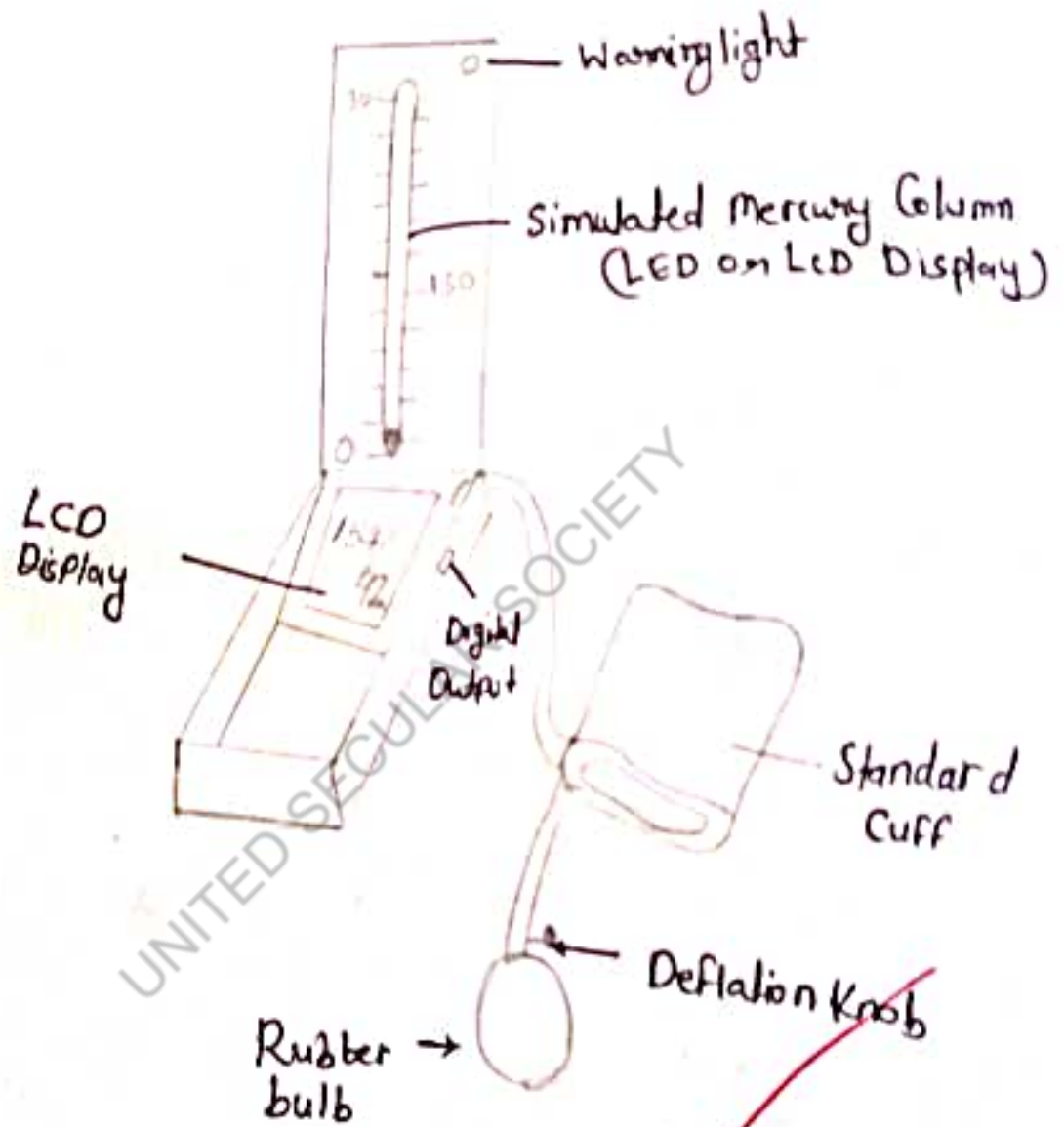
Aim :- To Record the blood pressure of a Subject.

Reference :- Sharma Shailesh & Gupta G.D
"Practical of Human anatomy Physiology"

Requirement :- STETHOSCOPE, and a mercury
SPHYGMOMANOMETER.

Theory :- Blood Pressure (B.P) is Defined as the lateral pressure exerted on the walls of the vessels by the contained blood.

This is due to the muscularity and elasticity of the walls of blood vessels. The blood pressure also depends upon the force exerted by the heart when it pumps the blood. The maximum pressure during systole is defined as systolic blood pressure. Whereas the minimum pressure during diastole is defined as the diastolic blood pressure. The difference between the systolic and diastolic blood pressure is described as Pulse pressure. The average systolic blood pressure in healthy adult is 100-140 mm Hg.



SPHYGMOMANOMETER

The average diastolic blood pressure is 80-100 mmHg.
The average pulse pressure is about 30-50 mmHg.

* There are two methods which are used to measure blood pressure using Sphygmomanometer, which are :-
(A) Palpatory method (Feeling Pulse)
(B) Auscultatory method (Hearing Pulse)

* Procedure :-

- 1) ASK the Subject to sit Down or lie down at ease On the Couch in the Supine Position, Remove the garments round the armpit, Place the arm On a table and adjust position such that it is level of the heart.
- 2) Tie the Cuff of Sphygmomanometer around the arm. It should be neither too tight to cause any discomfort to the Subject, nor too loose to allow its movement round the arm.
- 3) Feel the artery and mark its Course in the Cubital fossa. Also feel and mark the radial pulse at the place where it is felt well.

S.NO.	SYSTOLIC BLOOD P.
1.	117
2.	8p (mmHg)
3.	

UNITED SECULAR SOCIETY

- 4) Place the manometer by the Side of the Subject, between his arm and the body. Tight the screws of the rubber Pump and press the pump to inflate the bag.
 It inflates to raise the mercury to 200 mm level or 20-25 mmHg Higher after the Disappearance of Pulse.
- 5) Keep the eyes Fixed at mercury level and the fingers at the pulse (which is disappeared) slowly released pressure by unscrewing the Valve of the rubber Pump. The reading of the level of the mercury When the Pulse Reappears gives the Systolic Pressure. This is palpatory method. This method does not give any idea about diastolic pressure.

Result:- The blood Pressure is found 117 mmHg.

Satish

EXPR. 3

Aim: - To Study the gross anatomy and Physiology of Digestive System

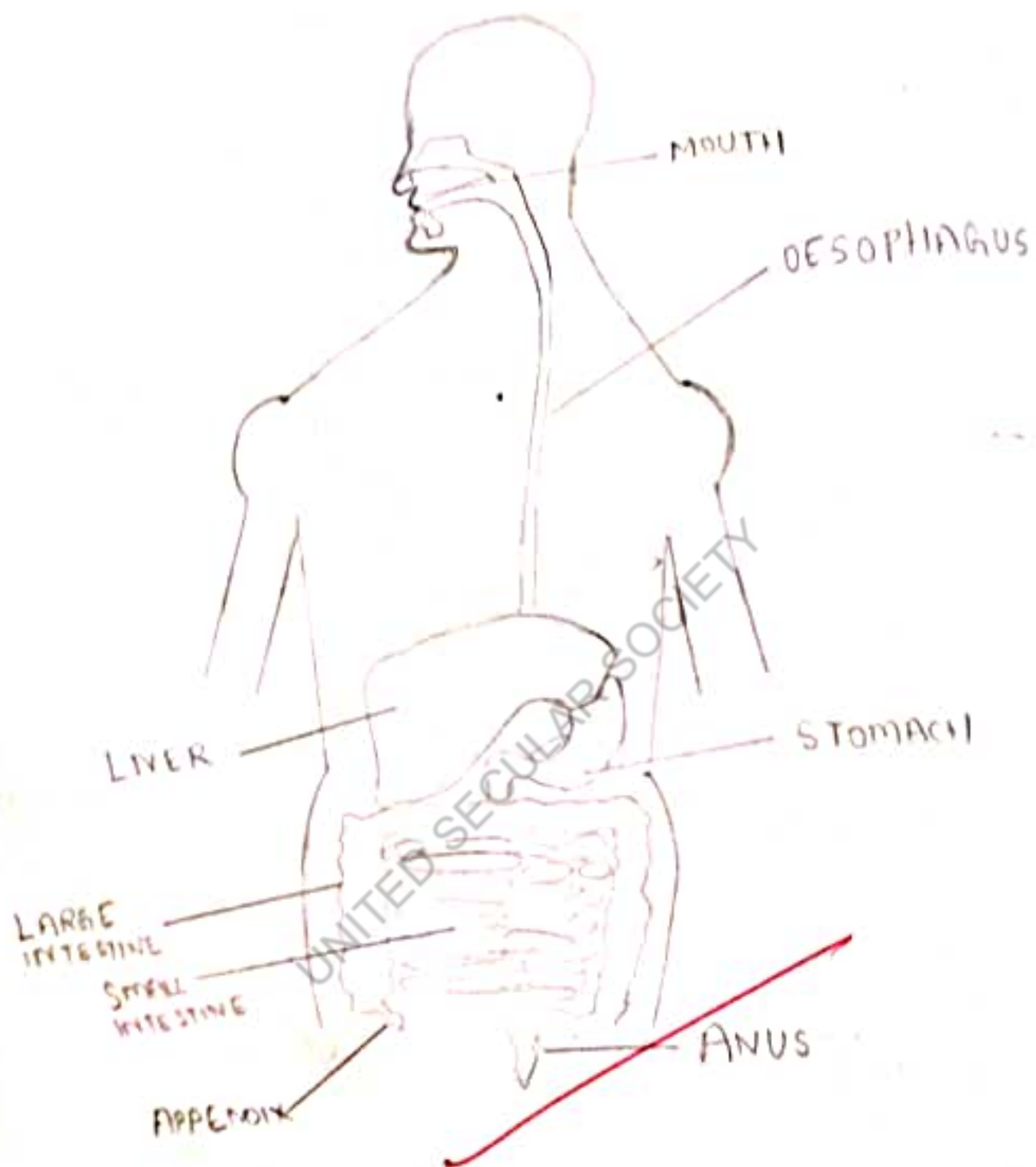
Reference: -

Sharma Shailesh Dr. Gupta G.D
Practical of Human anatomy Physiology
by Nirali Prakashan (78.80)

Theory: - The Digestive System is a System of body which breakdown food into forms that can be absorbed and used by body cells. It also absorbs water vitamin and minerals, and eliminates wastes from the body. It breakdowns the larger molecules present in food into molecules that are small enough to enter body cells by a process known as Digestion. The organs which are involved in the breakdown of food are collectively called the Digestive System. The digestive system is a tubular system which extends from the mouth to the anus.

• Mouth and Oral Cavity:

(a) Lips: They are partly surrounded by skin and consists of striated muscles and mucous glands. The main function of lips is to provide a gateway to the digestive system.



HUMAN DIGESTIVE SYSTEM

- (b) Teeth: There are total 32 teeth in a normal adult. They are further classified as Incisor (2), Canine (1), Premolar (2) and molars (3) on the each side of jaw, and same number of teeth are there in lower jaw. Major functions of teeth are cutting, gripping and tearing, crushing and grinding.
- (c) Salivary glands: Salivary glands are present in our mouth which secrete saliva to moisten, lubricate and digest the food we engulf. They are of three types: parotid, sublingual, and submandibular glands.
- (d) Tongue: Tongue is an accessory digestive system organ composed of skeletal muscle covered with mucous membrane. It helps to taste the food, swallow food and to speak. Tongue and its associated muscles form floor of mouth.
- (e) Pharynx: It is the junction between the oral and nasal cavity and inferiorly, it is attached to larynx and oesophagus. It provides its attachment with digestive system. The major functions of pharynx are to transport air to the respiratory system and food to the digestive system.

(E) Stomach: Stomach is a 'J' Shaped enlargement of GI Tract which lies directly inferior to diaphragm. It connects oesophagus to duodenum (first part of Small Intestine). Stomach serves as mixing chamber and holding reservoir for food. When food is ingested, Stomach pushes a small quantity of food into duodenum periodically. As the size of Stomach can vary, it can store large amount of food. It is divided into four parts: ~~Cardia fundus~~, Body and Pylorus. The pylorus communicates with the duodenum of the Small Intestine via smooth muscle sphincter called the ~~pyloric~~ Pyloric sphincter. In Stomach, semi-solid bolus is converted into liquid, digestion of starch continues, digestion of triglycerides and protein starts, and absorption of several substances takes place.

(F) Small Intestine: Small Intestine starts from pyloric sphincter of Stomach, coils through central and inferior part of abdominal cavity and at large Intestine. It has major role in digestion and absorption of nutrients.

Anatomy: It has three major parts:

(1) Duodenum: This is first part of Small intestine. It starts from pyloric sphincter, extends up to 25 cm and merges into jejunum. It secretes proteolytic enzymes (trypsinogen,

chymotrypsin, procarboxy, peptidase, nuclease, collagenase and elastinase to digest proteins. It also secretes amylase which digests carbohydrates and lipase for digestion of lipids.

(ii) Jejunum: It is middle part and extends up to ileum. It secretes intestinal juice which consists of various proteolytic enzymes like trypsin, amylase, nuclease etc., carbohydrates splitting enzymes like amylase, maltase, lactase etc., and lipid digesting enzymes like lipase.

(iii) Ileum: It is last part of small intestine and ends at ileocecal junction of large intestine. It involves in absorption of digested food material.

• Large Intestine: The large intestine is the terminal portion of the GI tract. The overall functions of the large intestine are the completion of absorption, the production of certain vitamins, the formation of feces and the expulsion of feces from the body. Large intestine is about 1.5 m long and extends from ileum to anus. The joining of small and large intestine occurs at ileocecal sphincter which controls movement of material from small intestine to large intestine. Large intestine consists of four major regions: cecum, colon, rectum and anal canal.

(a) Cecum is a small pouch like organ, which is present next to the ileocecal sphincter. Attached to Cecum is a coiled and twisted tube called appendix or Vermiform appendix.

(b) Colon is a long tube which is present next to Cecum. The open end of Cecum attaches with Colon. Colon is divided into four parts i.e. ascending Colon, transverse colon, descending Colon and Sigmoid Colon.

(c) Rectum is approximately last 20 cm of GI tract. Terminal 2-3 cm of rectum is called anal canal. Opening of anal canal to exterior is called anus which is guarded by internal sphincter of smooth muscles and external sphincter of skeletal muscles.

* The Accessory Digestive Organs: These are the organs which assist in digestion of food. These include the teeth, tongue, Salivary glands, liver, gall bladder and pancreas.

(a) Pancreas (pan - all, creas - flesh) is a retroperitoneal (behind peritoneum) gland, which lies posterior to greater curvature of Stomach. It is 12-15 cm long and 2-3 cm thick. Anatomically, it is divided into three parts;

1. Head: It is expanded portion and lies near to Curve of duodenum.
 2. Body: It is central part and is left and superior to head.
 3. Tail: It is last tapering portion of pancreas.
- * These pancreatic islets secrete four types of hormones:
- (1) Glucagon: It increases blood sugar level.
 - (2) Insulin: It decreases blood sugar level.
 - (3) Somatostatin: It maintains Glucagon and Insulin level in body.
 - (4) Pancreatic Polypeptide: - It controls Somatostatin secretion.

(b) Liver and gall bladder:

Liver is the second largest organ in body, located inferior to diaphragm. Gall bladder is pear shaped sac located inferiorly and posteriorly to liver. Liver is divided into two lobes: Right lobe (larger) and left lobe (smaller). The inferior broad portion is called fundus, the middle portion is called body and the upper taper portion is called neck. Liver produces the bile and the gall bladder stores the bile secreted by liver and send it to the small intestine where it aids in the digestive process.

Result: the human digestive system is studied

Sakshi

EXPERIMENT NO. 4

Aim: To Study the anatomy and Physiology of epithelial tissues.

Reference: - Sharma Shailesh ch. Gupta G.D
Practical of Human anatomy Physiology
by Nirali Prakashan

Theory:

Epithelial Tissue: (Epithelial - Covering) lay on. Epithelial tissue consists of cells arranged in continuous sheets in single or multiple layers. It is lining covering and glandular tissue of body.

Epithelial tissue play different roles in body like protection, filtration, secretion, absorption and excretion. there are the following three types of epithelial tissue.

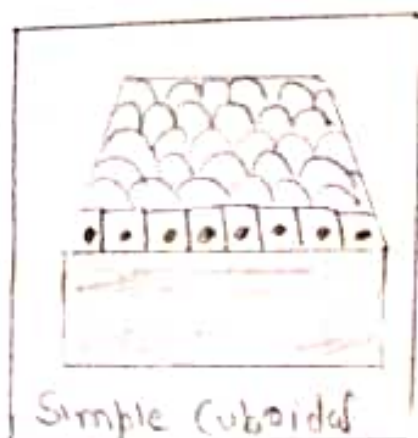
1. **Simple Epithelium:** It contains single layer of cells and is of four type:

(a) **Simple Epithelium Squamous epithelium:** the tissue consists of a single layer of flat cells that resembles a tiled floor when viewed from the apical surface. Simple

Squamous epithelium is present at sites where the process of filtration or diffusion occur.



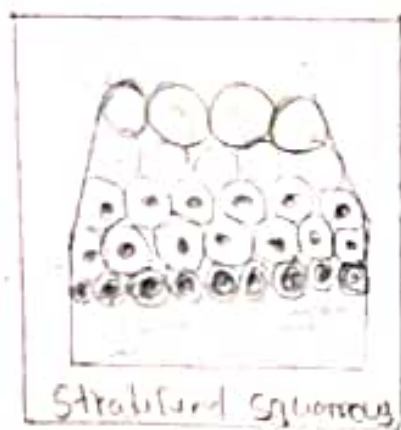
Simple Squamous



Simple Cuboidal



Simple Columnar



Stratified Squamous



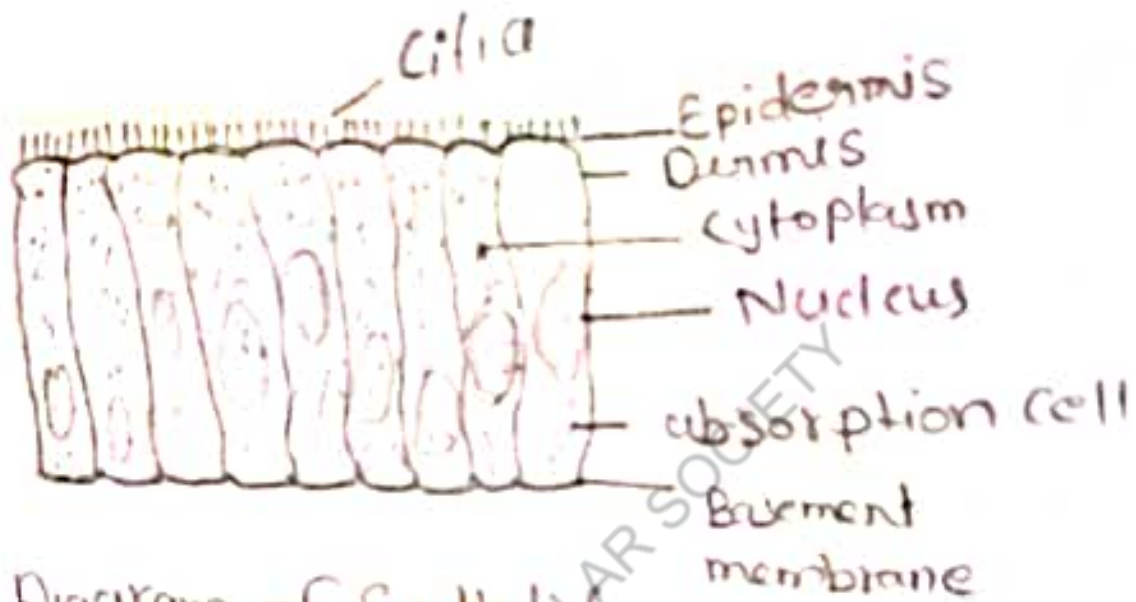
Transitional



Pseudostratified Columnar

Different Human Epithelial Tissues

- (b) Simple Cuboidal epithelium: -
It consists of single layer of cube shaped cells having round and centrally located nucleus. This epithelium is found in organs such as the thyroid gland and kidney. It performs the functions of secretion and absorption.
- (c) Simple Columnar epithelium: - The cells of simple columnar epithelium appear like columns, with oval nuclei near the base. These play a role in absorption and secretion. Simple columnar epithelium cells can be ciliated (containing hair on surface).
- (d) Pseudo-stratified Columnar epithelium:
Pseudo-stratified columnar epithelium appears to have several layers because the nuclei of the cells are at various depths. Even though all the cells are attached to the basement membrane in a single layer, some cells do not extend to the upper surface. In pseudo-stratified ciliated columnar epithelium, the cells secrete mucus or bear cilia. Pseudo-stratified non-ciliated columnar epithelium contains cells without cilia and lacks mucous cells.



[Diagram of Epithelial cell]

They are found in on your skin
blood vessels, urinary tract Org.

2. Stratified Epithelium:

It contains multiple layer of cells. It is more durable and can better protect underlying tissues and is of four types:

(a) Stratified Squamous epithelium:

Upper layers of this epithelium are squamous deep are cuboidal and deeper may be columnar. This type of epithelium is found at sites which receive good deal of abrasion, wear and tear. Its major functions are protection, prevention of water loss and foreign invasion. This type of epithelium is generally present in skin, wet lining of mouth, oesophagus and tongue.

Date _____
Page _____

Stratified Cuboidal epithelium:

This is a fairly rare type of epithelium in which cells in the upper layer are cuboidal. Stratified cuboidal epithelium serves a role in protection, secretion and absorption.

Stratified Columnar epithelium:

This is also an uncommon type of epithelium. The basal layer consists of shortened, irregularly shaped cells; only the upper layer has cells in columnar shape. This type of epithelium functions in protection and secretion.

Present in ducts of glands and conjunctiva of eye.

Transitional epithelium:

Transitional epithelium is present only in the urinary system. In its relaxed or up-stretched state, transitional epithelium looks like stratified cuboidal epithelium. As the tissue is stretched, its cells become flatter, giving the appearance of stratified squamous epithelium. It allows the urinary bladder to stretch to hold a variable amount of fluid without rupturing.

(c) Glandular epithelium:

The function of glandular epithelium is secretion. Glandular cells often lie in clusters deep to the covering and lining epithelium. A gland consists of a single cell or a group of cells that secrete substances into ducts (tubes), onto a surface, or into the blood. All glands of the body are classified as either endocrine or exocrine.

- **Endocrine glands:** (Endo - inside; Crine - secretion)
These are the glands whose secretions (hormones) enter the interstitial fluid and then diffuse directly into the blood stream without flowing through a duct. The pituitary, thyroid, and adrenal glands are examples of endocrine glands.
 - **Exocrine glands:** (Exo - Outside; Crine - secretion)
These are the glands whose secretions (hormones) enter the interstitial fluid. They secrete their products into ducts that empty onto the skin surface or the lumen of a hollow organ. The secretions of exocrine glands include mucus, sweat, oil, ear wax, saliva and digestive enzymes. Examples of exocrine glands include sudoriferous (sweat) glands which produce sweat to help lower body temperature and salivary glands, which secrete saliva.
- Result:** ~~the~~ the human epithelial cells are studied.

[EXPERIMENT-05]

Aim : - To Study the anatomy and physiology of muscular Tissues.

Reference : - Sharma Shailesh dr. Gupta G.D.
Practical of Human Anatomy Physiology by
Nirali Prakashan

Theory:- Muscular tissue Consists of elongated cells called muscle fibres or myocytes that can use ATP to generate force. Muscular tissue produces body movements, maintains posture and generates heat. It also provides protection. Muscular tissue is classified into three types: Skeletal, Cardiac, and smooth.

(a) Skeletal muscle tissue: It is named for its location as it is usually attached to the bones of the skeleton. It contains striations, alternating light and dark bands within the fibres that are visible under a light microscope. Skeletal muscle is considered voluntary because it can be made to contract or relax by conscious control. A muscle fibre is roughly cylindrical in shape and has many nuclei located at the periphery.



SKELETAL MUSCLE



SMOOTH MUSCLE



CARDIAC MUSCLE

Diagram of Muscular Tissue

(b) Smooth muscle tissue:

It is located in the walls of hollow internal structures such as blood vessels, airways to the lungs, the stomach, intestines, gall bladder and urinary bladder. Its contraction helps in constriction of blood vessels, physically break down and movement of food along the gastrointestinal tract, movement of fluids through the body and eliminates wastes. Smooth muscle fibres are usually involuntary and they are non-striated (lack striations), hence named smooth. A smooth muscle fibre is small, thickest in the middle and tapering at each end. It contains a single, centrally located nucleus.

(c) Cardiac muscle tissue:

It forms most of the wall of the heart. It is also striated. It is involuntary to control as its contraction is not consciously controlled. Cardiac muscle fibres are branched and usually have only one centrally located nucleus; an occasional cell has two nuclei. They are attached at end to end by intercalated discs. Intercalated discs hold the fibres together during their vigorous contraction and provide a route for quick conduction of muscle action potentials throughout the heart.

Result:- The human muscular tissues are studied.

[EXPERIMENT - 07]

Aim: - To Study the anatomy and Physiology of Nervous Tissues.

Reference: - Sharma Shailesh Dr. Gupta G.D * Practical of Human anatomy Physiology by Nikali prakashan Page - 53

Theory: Nervous tissue Detects changes in Conditions Inside and Outside the body and respond by generative action potential (Nerve Impulse) that activate muscular Contraction and glandular Secretion. Nervous tissue is Consist of

- two types of Cell. Neurons and Neuroglia.

1. Neurons: Neurons are the Cells which are Sensitive to various Stimuli. These Convert Various Stimuli into electrical Signals, called action Potentials (nerve impulses) and Conduct these action potentials to other neurons, muscle tissue or glands. Neurons Consist of three parts.

(a) Cell Body: It Contains the nucleus and Other Organelles.

(b) Dendrites (dendr - tree): These are tapering, branched and short processes and are the receiving portion of a neuron.

(c) **Axon:** Single, thin, cylindrical and long process. It is the output portion of a neuron which conducts nerve impulses toward another neuron or to some other tissues.

2. **Neuroglia:** - These cells do not generate or conduct nerve impulses but provide protection and support to neurons. Neuroglia cells are of six types: astrocytes, oligodendrocytes, microglia, ependymal cells, Schwann cells and satellite cells.

Result:- The human nervous tissue are studied

Exp. No - 7

Aim :- To determine the bleeding time of one's own blood

Reference :-

Requirements :- Sterile needle, spirit, ~~staple~~ stop watch.

Theory :- Bleeding time depends on the effectiveness of vasoconstriction and platelet plug formation.

It is defined as the time from onset of Bleeding till the ~~storage~~ stoppage of bleeding. Length of time needed for bleeding to cease is noted after deep skin puncture. It determines the function of platelets & integrity of the capillaries.

Procedure :-

- 1) Clean the finger tip with spirit or alcohol and make a deep puncture with the help of sterile needle.
- 2) Start stop watch immediately and count the time.
- 3) Place a drop of blood on the filter paper after every 30 seconds.
- 4) Note the time of stoppage of blood.
- 5) This gives the bleeding time.

Result :- The bleeding time of my own blood was found to be 3 minute and 20 seconds.

Aim:- To determine the clotting time of one's own blood.

Reference:-

Requirements:- Sterile needle, spirit, stopwatch, glass capillary tubes, filter paper.

Theory:- Clotting time is the length of time it takes for the blood to clot and is detected by the appearance of fibrin string.

Procedure:-

- 1) Clean the finger tip with spirit or alcohol and make a deep puncture with the help of sterile needle.
- 2) Start stop watch immediately and count the time.
- 3) Wipe off the first drop of blood and allow the next drop of blood to flow into the capillary tube by introducing one end of the tube into the drop and holding the other end at lower level.
- 4) Hold the capillary tube between the palms.
- 5) Wait for 2 min, and then break off the capillary tube 1-2 cm from one side every 30 sec and observe the formation of fibrin thread.
- 6) Note the time at which fibrin is formed that indicates the clotting of blood.

Result:- The ~~normal~~ clotting time of my own blood was found to be 6 minutes.

Teacher's Signature _____

Experiment No - 9

Aim:- To study of ^{compound} microscope.

Reference:- Thakare N. Vishnu, Practical book of Human Anatomy and physiology, Nirali Prakashan, Second edition, Page No- 1-4.

Requirements:- Microscope

Theory:-

Microscope is an optical instrument which uses visible light and a system of lenses to view magnified images of very small objects. This microscope also called light microscope.

Types:-

- 1) compound microscope
- 2) ~~co~~ simple microscope.
- 3) Electron microscope.

compound microscope:- It is an arrangement of objective and eyepiece use to magnify an object to the point where it can be seen with the human eye.

Part of a compound microscope:-

① **The support system:-** The support system consist of various parts which are described below:-

a) Base of microscope

b) Pillars

c) Handle (Arm)

d) Body Tube

e) Stage

Date _____

Page No. _____



2) The illuminating system:- There are six types of illuminating systems based on which the microscope function.

a) Bright field microscope.

b) Dark field microscope.

c) Fluorescent microscope.

d) Condenser.

3) Magnification system:- As the name indicates, it directly implies magnifying the image of the object under observation & comprises of the eyepiece & objectives.

a) eye piece:- The eyepiece is a lens that fits into the top of the body. Generally 5x and 10x eyepieces are used.

b) objectives:- Generally these objectives are screwed into the revolving nosepiece in a compound microscope.

4) Immersion objective:-

4) Adjusting system:- Two adjusting system are used:-

a) Coarse adjustment:- Two coarse adjustment screws are employed for coarse adjustment. These screws are mounted at the top of the handle by a double side micrometer mechanism, one on each side.



b) Fine adjustment:- Two fine adjustment screws are mounted on the handle below the coarse adjustment & screws by double side mounter mechanism, one on each side.

Result:- The compound microscope studied successfully.
Draw compound microscope (Plane paper):

Experiment No- 10

Aim:- To record own pulse rate.

Reference → (see same as experiment No-9)
(experiment 9 at CH ET) Page No-55

Requirements:- Stop watch.

Theory:- The alternating expansion and recoil of elastic arteries during each cardiac cycle creates a pressure wave called a pulse. Thus, the generation of aortic pressure wave that expands the arterial wall is recorded as pulse. Pulse can be felt at various arteries viz, superficial temporal, facial, common carotid, brachial, femoral, posterior, radial etc.

Procedure:-

- 1) Palpate the superficial arteries by pressing them against the underlying bones.
- 2) usually the radial artery at the wrist position is used for pulse recording.
- 3) Record the pulse rate for 1 min which is expressed as beats/min.

Result:- My own pulse rate was found to be 79 beats/min.

Experiment No-11

Aim:- To determine the no. of WBCs in own's blood sample.

Reference:- Same as exp. No-9 (Page No - 21-23)

Requirements:- Hemocytometer containing Neubauer's counting chamber, WBC pipette, sterile needle, microscope, coverslip, WBC diluting fluid, spirit.

Principle:- The use of acetic acid solⁿ with blood cause hemolysis of RBCs and accentuates nuclei of white cells. The WBC's can then easily be counted. Normal range of WBCs is $4500 - 10000/\text{mm}^3$ of blood.



Theory:-

The white blood cells (WBCs) are also called as leukocytes. They are nucleated, actively amoeboid and do not contain haemoglobin and originate purely from extra vascular tissue. They contain proteins and various enzymes. Life span of WBCs is less than that of RBCs.

The types and subtypes of WBCs:-

1) Granulocytes

- a) Eosinophils
- b) Basophils
- c) Neutrophils

2) Agranulocytes

- a) Lymphocytes
- b) Monocytes

Procedure:-

- 1) Take clean and dry apparatus. Use sterilised needle either having 22 or 24 gauge number. Prick the finger and allow blood drop to form on the fingertip spontaneously.
- 2) Take the pipette and suck the blood into the WBC pipette up to the 0.5 mark only.
- 3) Wipe the tip of the pipette and maintain the blood level at the 0.5 mark by holding the pipette in a horizontal position.
- 4) Dip the pipette into the diluting fluid below the surface of the liquid.
- 5) Suck the WBC diluting fluid upto 11 marks. While the bulb is being filled, tap the pipette



- with a finger to knock the bead below the surface of fluid in the bulb to prevent any bubble formation.
- 6) Maintain the level of the mixture at 11 marks by closing the tip of pipette with the index finger during removal of pipette from diluting fluid.
 - 7) Hold the pipette horizontally and close the both ends of the WBC pipette, then gently mix the contents of the bulb.
 - 8) After mixing, put the pipette in the horizontal position to prevent any loss of its content until the cell count is completed.
 - 9) Discard the first 2 drops of fluid from the pipette as it does not contain the cells.
 - 10) Charge the ruled area of the counting chamber taking care to prevent flooding.
 - 11) Focus the microscope carefully and place the Neubauer's chamber on the stage of the microscope.
 - 12) Look at the counting chamber from the side and by turning the ~~coarse~~ coarse knob, lower the power objective (10mm x 10mm) until it is almost touching the cover glass.
 - 13) Now while continuously looking through the eyepiece, slowly rotate the coarse adjustment towards yourself until you observe a faint line in the eyepiece. Adjust light with a mirror and diaphragm and use coarse adjustment back and forth until you get cells in good focus.

Date _____

Page No. _____



Calculation 6 (जो बिना लॉइन वाले पैपर पर करनी है)

Area of 4 WBC squares = $4 \times 1 = 4 \text{ mm}^2$.

Volume of WBC squares = $4/10 \text{ mm}^3$

($1/10$ - 10 volumes of diluted blood in bulb contains 0.5 volume of blood and 9.5 volume of diluting fluid)

hence, dilution is 1 in 20 ($1:20$)

cells in $4/10 \text{ mm}^3$ volume of diluted blood = 120

cells in 1 mm^3 volume of diluted fluid = $\frac{10 \times 120 \times 20}{4}$

= 60×120

= $6000/\text{mm}^3$

Result:- The total WBCs count of my own blood sample was found to be $6000/\text{mm}^3$ of blood

was found to be 6000/mm³ →

Experiment - 12

Aim: To determine the no. of RBCs

Refrain: Same as (Page No. 11-15).

Requirement: Microscope, hemocytometer containing Neubauer's counting chamber, RBC pipette, sterile needle (22-24 gauge), coverslip, RBC diluting fluid.

Theory: The red blood cells also called as erythrocytes, have circular, biconcave shape. They are non-nucleated cells and



are red in colour. Their lifespan is of 120 days. Formation of RBCs in bone marrow is known as erythropoiesis. The main function of RBCs is to carry oxygen from the lungs to cells/tissues of the body and carbon dioxide from cells/tissues to lungs.

→ The Normal range of RBCs are 4.5-6 millions/ mm^3 of blood.

Procedure :-

- 1) Take freshly prepared RBC diluting fluid in a watch glass.
- 2) Sterilise the skin on the finger with a cotton swab dipped in spirit and prick with sterilised needle.
- 3) Suck blood into the pipette up to 0.5 mark on the pipette.
- 4) Hold the pipette in horizontal position and by placing tip of pipette against index finger and blowing gently on the rubber tube, adjust the blood column, so that it is exactly on the 0.5 mark and suck the diluting fluid immediately up to 101 mark of the pipette.
- 5) Rotate the pipette for 2-3 minutes with its tip pressing against the left hand palm for mixing of the contents of the tube. The red bead in the bulb of the pipette should move from the one side to other during the mixing of blood cells.
- 6) Discard the first two drops of fluid from the pipette, which probably does not contain cells.
- 7) Place tip of the pipette on the edge of a suited



area and below one-two drops of diluting blood

8) Place the charged chamber on the stage of microscope and adjust the microscope for observation under low power (10x).

9) Focus the central square of the Neubauer's chamber and check the uniform distribution of RBCs.

(a) Then focus the RBC square under high power objective (45x). Count in the medium RBC square.

1) Counting of RBCs should start from small square at upper left hand corner.

2) A cell that touches any of the triple lines that border the right side of RBC section should not be counted.

3) Count the cell.

Calculation: (in blank paper for self E1)

RBC count has performed by mixing of blood with diluting fluid. Therefore, dilution correction factor to be calculated first.

Therefore dilution correction factor,

$$\begin{aligned} \text{RBCs count} &= \text{Total no. cells in 5 RBC sections} \times \\ &\quad 10,000 \text{ correction factor (200} \times 50) \\ &= \quad \quad \quad \times 10,000 \\ &\quad \quad \quad = 5 \text{ millions / mm}^3 \text{ of blood.} \end{aligned}$$

Result — The total RBC count of own blood was found to be 5 million / mm³ of blood.

found to be 5 million/mm³ of blood.

Experiment No-13

Aim :- To determine the blood group of one's own blood sample.

Reference :- Same as (Page No - 43-45).

Requirement :- Glass slide or slide with 3-4 cavities, Sterile needle, spirit, antiserum A (Blue), B (yellow), C (colourless).

Theory :-

ABO Blood group is based on two glycolipids namely antigen A and Antigen B. Person with Antigen A on their RBCs fall under blood group A, those with B antigen on their RBCs have blood group B and those who have Both A and B antigens on their RBCs fall under blood



group AB. and Individuals who possess neither A or B antigens fall under blood group O and is known as universal donor, who can donate blood to any person.

Procedure:-

- 1) Clean and dry the cavity slide.
- 2) Mark the cavities of the slide as A, B, D.
- 3) Place a drop of anti A, Anti B, and anti D respectively in the cavity.
- 4) Sterilise finger tip with a cotton swab dipped in spirit and prick the finger using a sterilised needle.
- 5) Add 1-2 drops of blood in each depression and mix it immediately with the help of a sealed glass capillary or by gently shaking of cavity slide on plain horizontal surface.
- 6) observe agglutination formation in each depression.

Result:- The Blood group of my own's blood sample was found to AB.



Experiment No-14

Aim:- To study the cardiovascular system (CVS).

Reference:- same as (Page :- 87-93)

Theory:- Cardiovascular (CVS) consist of heart, blood and blood vessels.

Blood is a connective tissue composed of a liquid extracellular matrix called blood plasma that contains dissolved substances and contains various cells fragments suspended in it. Blood transport O_2 & nutrients.

Blood flows from heart towards blood vessels or from blood vessels to heart. This function is carried out by its pumping action & therefore heart acts as a pump.

Anatomy of heart:-

(A) Location of the heart:- The heart lies below vertebral column and lung.

(B) Size and shape of heart:- It is 12 cm long, 9 cm wide, 6 cm thick with about 250-300 gm weight.

(C) Layers of heart:-

- * Pericardium
- * epicardium.
- * myocardium.
- * Endocardium.



D) Heart chambers:- It is composed of 4 chambers, two atria superiorly and two ventricles inferiorly.

- * Right atrium
- * Right ventricle
- * Left atrium
- * Left ventricle

Systemic and pulmonary circulation:-

Systemic circulation:- This involves flow of oxygenated blood from left ventricle into aorta through the SL valves, then into arteries, arterioles and finally into the systemic capillaries in which exchange of gases and nutrients take place. Blood unloads O_2 and takes up CO_2 through capillaries and venules and the same travel towards right atrium of heart from veins and the process continues.

Pulmonary circulation:- During ventricular diastole deoxygenated blood from the right ventricle flows into the pulmonary trunk, which branches into pulmonary arteries that carry blood towards the lungs.

Conduction system:-

Heart beats due to its inherent and rhythmic electrical activity. Autorhythmic ~~fibres~~ fibres are responsible for such activity, they repeatedly



generate an action potential due to which the heart muscle.

Autorhythmic fibers: These act as pacemaker and form the conduction system - a specialised network of cardiac muscle fibres, gives direction for each cycle of cardiac excitation to progress through the heart consisting of the following sequence:

- a) SA Node
- b) AV Node
- c) Bundle of His
- d) Bundle of Branches
- e) Purkinje fibres.

Cardiac cycle:-

Events occurring during each beat of heart is called as cardiac cycle. Normal Rate 72 beats/min. Following are the events that occur during each cardiac cycle.

- * Atrial Systole
- * Ventricular Systole
- * Ventricular Diastole

Blood vessels:- Blood vessels are of five types consisting of arteries, arterioles, capillaries, venules and veins.

Result:- The CVS was studied successfully.

➤ Aim

To study the human respiratory system.

➤ Theory

Reference same as Page No (103-106)

The functioning of the respiratory system along with the circulatory system is essential for the exchange of oxygen and carbon dioxide (gases). Respiration is the chemical process in the biological system where in exchange of these gases take place (cellular respiration is the constant supply of oxygen to cells for energy-conversion process that occur in the mitochondria of the cells). The exchange of gases between blood and the lungs is called external respiration, while the exchange between blood and the cells is called internal respiration.

Anatomically, the respiratory system has two parts viz. upper respiratory tract (nose, nasopharynx, oropharynx, laryngopharynx and larynx); lower respiratory tract (trachea, bronchial tree including, bronchioles, alveolar ducts, alveolar sac and alveoli) (figure 26.1)

Physiologically, respiratory system includes various accessory parts, oral cavity, rib cage and respiratory muscles (diaphragm).

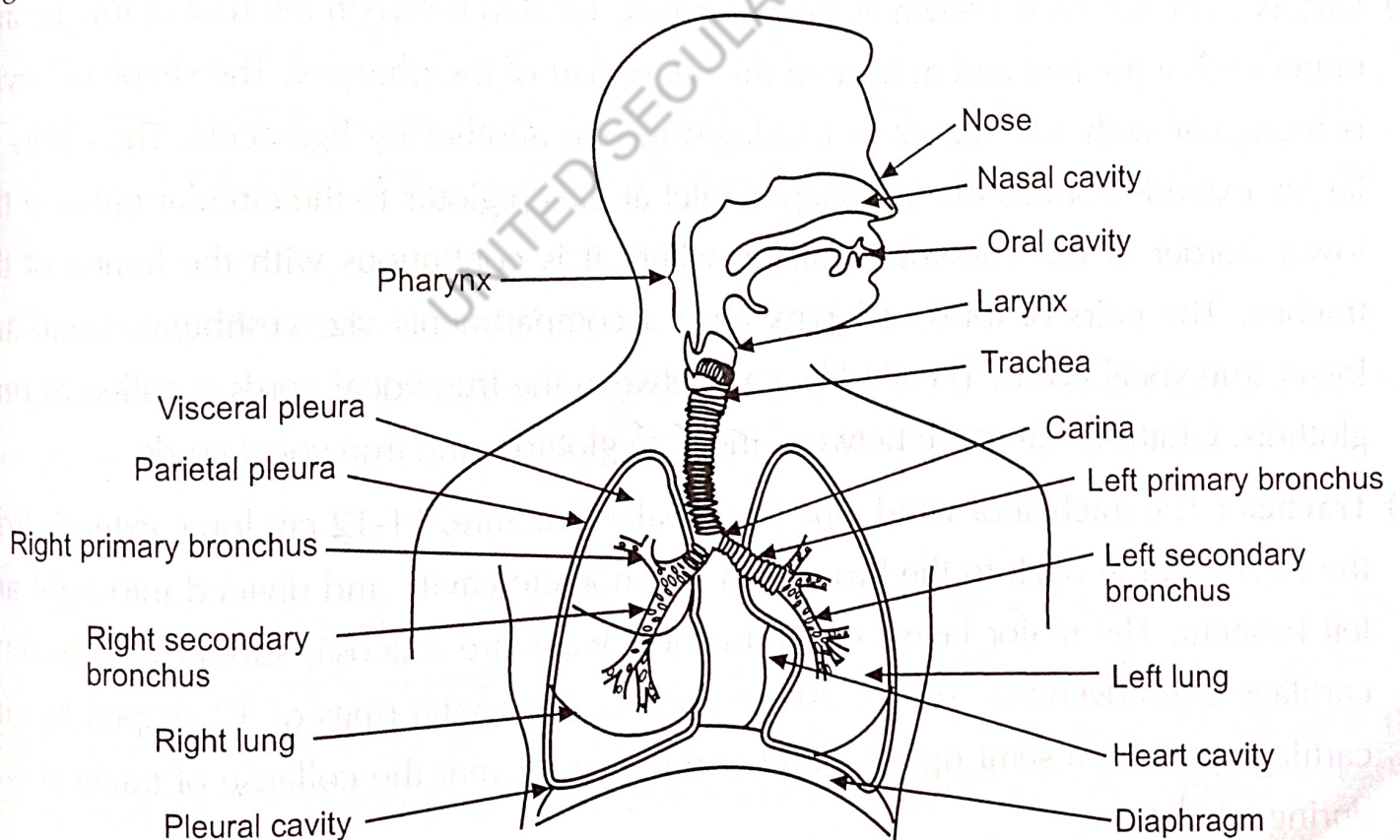


Figure 26.1 : Respiratory tract

➤ Upper respiratory tract

- (a) **Nose** : It is divided into external and internal structures. External structure consists of supporting framework of bone and hyaline cartilage which surrounds the muscle and skin. The nose is surrounded by maxilla laterally and inferiorly at its base. The flaring cartilaginous expansion forming and supporting the outer side of each oval nostril opening is called as the ala. The nasal passage of internal nose lies on the roof of the mouth. The nasal passage is separated into right and left cavity by a middle portion called as the septum. In side the nasal cavity, the frontal region is known as vestibule. The nasal passage consists of pseudo stratified ciliated columnar epithelium cells. The olfactory receptors (for smell sensation) are situated on lining of the superior nasal conchae and near the septum. The functions of the nose include-warming of inhaled air and entrapment of particulate matter and bacteria in the sticky mucous.
- (b) **Pharynx** : It is also known as throat. It is funnel shaped, up to 13-14 cm long and lined by mucus membrane. Fibrous and mucus tissues begin at the internal half and extend to the cricoids and inferior cartilage of the larynx. The pharynx lies posterior to the nasal and oral cavities, superior to the larynx and just anterior to the cervical vertebrae and forms the common passage for food and air, and provides a resonating chamber for voice production. It is divided into nasopharynx, oropharynx and laryngopharynx.
- (c) **Larynx** : The larynx is known as the voice box, located between the root of tongue and upper end of trachea and in front of the lower part of the pharynx. The shape of larynx is triangular with attachment of cartilages to one another by ligaments. The cavity of larynx extends from its triangle shaped inlet at the epiglottis to the circular outlet at the lower border of the cricoids cartilage, where it is continuous with the lumen of the trachea. The pairs of folds of larynx form 3 compartments viz. vestibular, vocal and lower true vocal cords. The slit like gap between the true vocal cords is called as rima glottidis. Glottis is the space between the rima glottidis and true vocal cords.
- (d) **Trachea** : The trachea or wind pipe is a tubular structure, 11-12 cm long, extends from the larynx in the neck to the bronchi in the thoracic cavity and divided into right and left bronchi. The major layers of the tracheal walls are mucosa, submucosa, hyaline, cartilage and adventitia. The 16-20 incomplete, horizontal rings of 'C' shaped hyaline cartilage provide a semi rigid support and hence prevent the collapse of tracheal wall during inhalation.

- (e) **The bronchi :** The right and left bronchi begin at the level of the 5th thoracic vertebra. The right bronchus is vertical, shorter and wider than the left one. Carina is the internal ring, from where trachea divides into right and left bronchus. The mucus membrane of the carina is the susceptible part of the larynx and trachea involved in cough reflex. After entering into the right lung, the right divides into 3 branches while the left bronchus after entering into the left lung, divides into two branches, one goes to each lobe of the lung. Each branch then divides into bronchioles and subdivides into smaller bronchioles. Bronchi are lined with ciliated columnar epithelial cells and the terminally bronchi are lined with simple cuboidal epithelium. The bronchioles are divided into alveolar ducts, and these ducts result in the formation of bag like structures known as alveoli which are responsible for the exchange of gases. The main functions of bronchi are adhering to foreign particulates and bacteria due to their sticky nature and the movement of mucus towards the throat.
- (f) **The lung :** The lung is a cone shaped organ located in the thoracic cavity, that extends from the diaphragm to a point slightly above the clavicles. Heart and other adjacent organs in the mediastinum, separates the thoracic cavity into structurally different chambers. Pleural membranes protect the lungs from any damage. The superficial layer called the parietal pleura, lines the wall of the thoracic cavity, deeper layer known as visceral pleura, covers the lungs. Pleural cavity is the space between the parietal and visceral pleurae which contains a lubricating fluid, which aids in reduction of friction between membranes. Due to the space occupied by the heart, the left lung is about 10 % smaller than right lung. The main and important function of lungs is the exchange of gases.

➤ **Physiology of respiratory system**

Respiration is a process by which the lungs inhale the air in and thereby expand the size and contract to exhale air.

➤ **Phases of respiration**

When the capacity of the thoracic cavity is increased by contraction of intercostal muscles and diaphragm, pressure in the thoracic cavity decreases as compared to the atmospheric pressure. This results in air being drawn into the lungs to equalise the alveolar and atmospheric pressure in the process called inspiration or inhalation.

When the diaphragm and intercostal muscles relax, the ribs regain their original position, the diaphragm ascends, and the lungs recoil and this results in expiration or exhalation. There is a brief pause (stoppage of breathing) and another cycle begins.

➤ **Pathological significance**

Pharyngitis : It is the inflammation of pharynx.

Laryngitis : It is the inflammation of larynx.

Asthma : It is a disorder characterised by obstruction in airway, inflammation, hypersensitivity which causes difficulties in breathing. These symptoms may be due to release of chemical substances, histamine, bradykinin and leukotrienes (inflammatory mediators) in response to antigenic stimuli.

Chronic obstructive pulmonary diseases (COPD) : These diseases are characterised by persistent airway obstruction due to emphysema or bronchitis.

Chronic bronchitis : Chronic bronchitis presents itself as cough with or without expectoration for at least 3-4 months of a year for 2 consecutive years.

Emphysema : It is the enlargement of alveoli with destruction of alveolar septa.

Pneumonia : It is an infectious disease characterised by alveolar inflammation, fever, chills, productive or dry cough, malaise (pain throughout body) and chest pain. *Streptococcus pneumonia* is the common causative microorganism responsible for the pneumonia but it can also be caused by viruses, fungi and parasites.

Tuberculosis : It is an infectious and communicable disease caused due to *Mycobacterium tuberculosis* affecting lungs and pleurae of bronchi, and it is characterised by symptoms mainly fatigue, loss of weight and appetite, cough, chest pain etc.

Result : Study of Respiratory System Studied successfully.

EXERCISE

1. What is respiration? Differentiate between external and internal respiration.
2. Enlists the organs of upper and lower respiratory tracts.
3. Give the anatomy of bronchi.

Experiment - 15

Aim → To study urinary system with the help of model and charts.

Reference → Waugh Anne and Grant Wilson Ross and Wilson, Anatomy and Physiology, 11th edition; Churchill Living stone Publication. Page no. - 332-344.

→ Requirement → charts and models.

→ Theory →

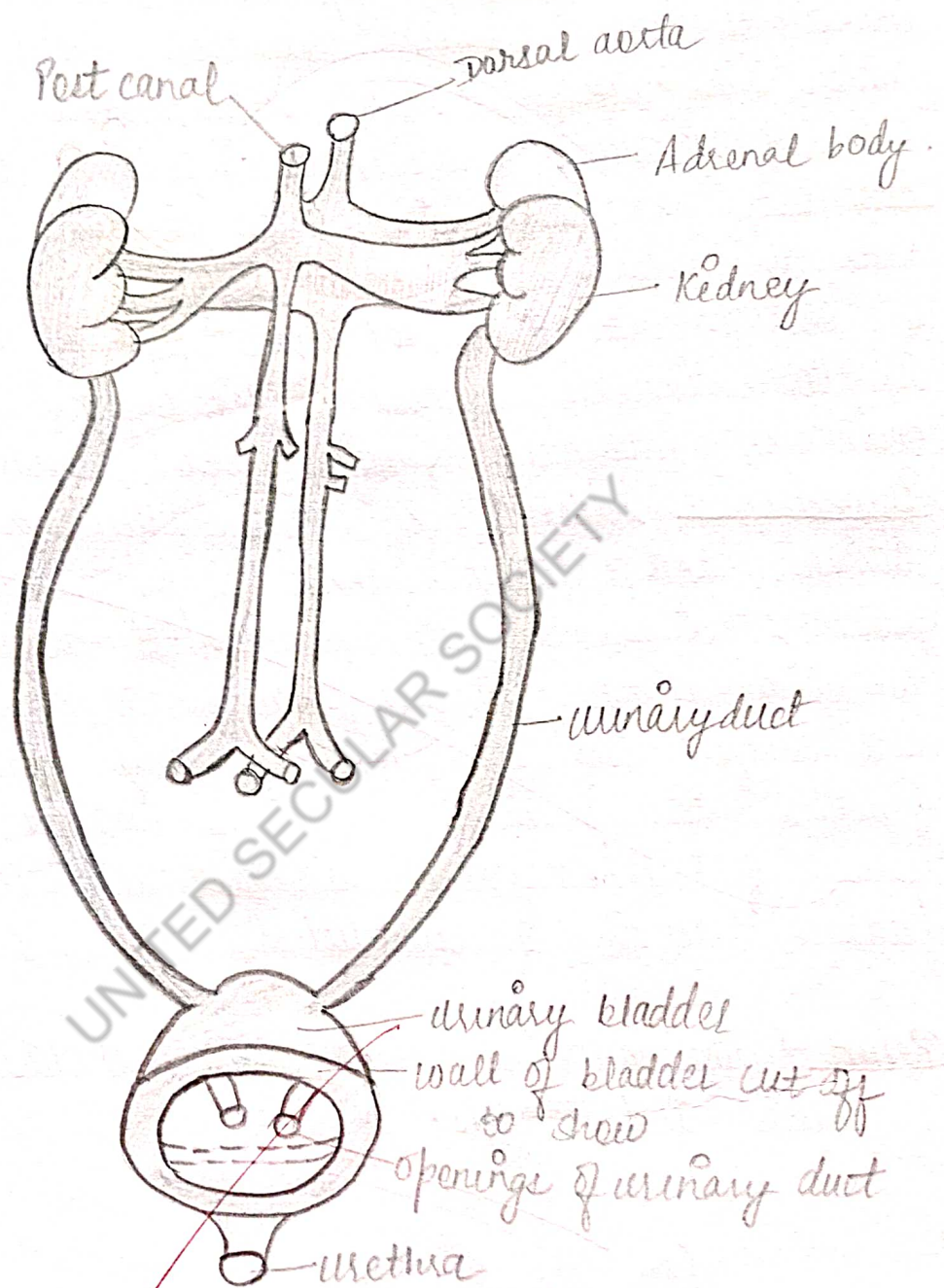
→ The urinary system is the main excretory system and consist of :-

- ① 2 kidney which secrete urine.
- ② 2 ureters which convey urine from kidney → urinary bladder.
- ③ The urinary bladder, where urine collects and is temporarily stored.
- ④ The urethra through which urine passes from urinary bladder to the exterior.

→ Function →

- ① Detoxification → It helps in removal of toxins from the body.
- ② Homeostasis → It helps to maintain homeostasis by secreting

Teacher's Signature



Excretory Organs

er removing selective amount of water or electrolyte.

→ Kidney → It is bean shaped, 10-12 cm long and weight around 150 gm. It is located b/w the parietal peritoneum and posterior part wall of the abdomen partially protected by 11th and 12th pair of ribs. The layers of tissue that surrounds each kidney are :-

- ① Inner layer - Renal capsule.
- ② Middle layer - Adipose capsule.
- ③ Outer layer - Renal fascia.

→ Frontal section of kidney reveals an outer reddish area → cortex and inner reddish brown area → medulla. Medulla consist of conical shaped structures, the renal pyramids.

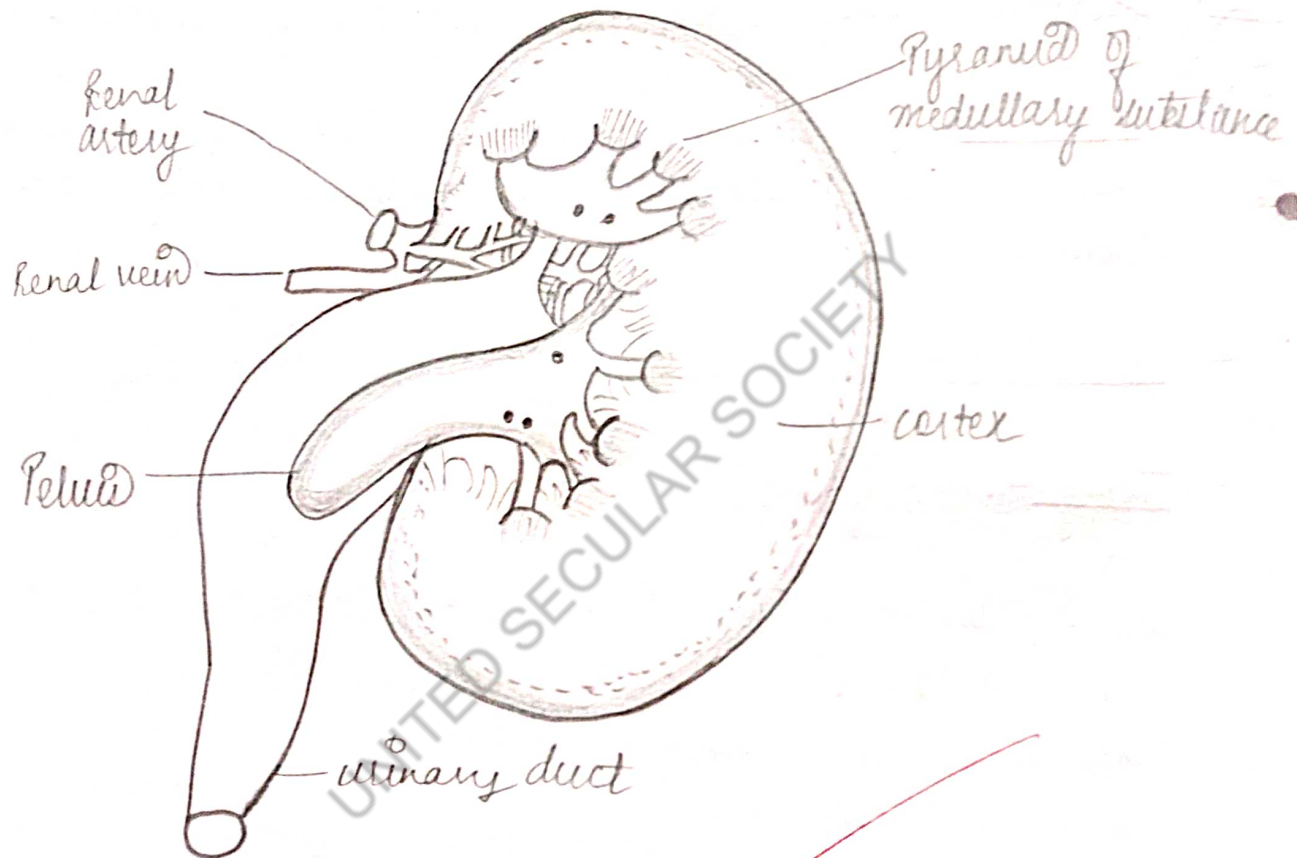
→ Nephron → It is the smallest functional and structural unit of kidney.

→ It consists of two portions -

- ① Renal capsule.
- ② Renal tubule.

① Renal capsule → It is composed of two components → glomerulus and the glomerulus capsule.

② Renal tubule → It consist of - proximal convoluted tubule, loop of Henle and distal convoluted tubule.



L.S of Kidney

→ Function of nephron →

- ① Reabsorption.
- ② Filtration.

→ The upper part of the nephron is → renal cortex and the lower part (loop of Henle) is the → renal medulla.

→ Functions of kidney →

- ① Formation and secretion of urine.
- ② Production and secretion of erythropoietin.
- ③ Production and secretion of renin.

A. → Renal Tubule →

→ The distal convoluted tubule leading into a collecting duct which unite forming papillary duct that empty into the ^{min} calyx.

→ The cells of proximal convoluted tubule are cuboidal epithelial cells and have a prominent bridge border of micro-villi - it increases the surface area for reabsorption and secretion.

→ In ascending limb and distal part of ascending limb of Henle, the cells are simple, squamous

epithelial cells. The thick ascending limb of Henle is composed of simple cuboidal to columnar epithelial cells.

- Function → Involved in reabsorption and secretion.
- Juxta glomerular apparatus → The macula densa cells along with juxta glomerular cells form juxta glomerular apparatus.

→ Formation of urine → It takes three steps for urine formation →

- ① Filtration - Bowman's capsule, glomerulus.
- ② Selective reabsorption - tubular part.
- ③ Secretion - collecting duct, distal tubule.

B. → Renal capsule → one close end with the renal tubule form the cup shaped Bowman's capsule which almost completely encloses a network of arterial capillaries called glomerulus.

→ Bowman's capsule is a double layered structure consisting of visceral layer and parietal layer.

→ Function → Involved in the filtration of urine.

→ Ureter → 25-30 cm long, 3mm in diameter.

consist of three layers →
outer layer consisting of areolar connective tissue continuous with fibrous capsule of the kidney.

Middle layer is a vascular layer composed of inner longitudinal and outer circular layer of muscle fibre.

Inner layer is a mucous membrane with transitional epithelial and areolar connective tissue with considerable amount of collagen and elastic fibre and lymphatic tissue.

The ureter is continuous with funnel shaped renal pelvis.

Function → They are the tubes that carry urine from the kidney to the urinary bladder.

Urethra → The urethra is a canal extending from the neck of the bladder to the exterior at the external urethral orifice. It is longer in the male than in the female.

The male urethra is associated with the urinary and the reproductive system.

The female urethra is approximately 4cm long and 6mm in diameter. It runs downwards and forward behind the symphysis pubis and open at the external urethral orifice just in front of vagina.

→ The external urethral orifice is guarded by the external urethral sphincter which is under voluntary control.

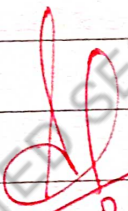
→ Urinary Bladder → Distensible muscular organ situated in pelvic cavity. It can expand to hold about 700-800 ml of urine. The bladder wall is composed of three layers -

- ① Outer layer → of loose connective tissue containing blood, blood vessels, nerves and lymphatic vessels.
- ② Middle layer → consist of three layers of smooth muscle fibre - inner longitudinal, middle circular and outer longitudinal muscle layer. This is called detrusor muscle.
- ③ Inner layer → of transitional epithelium. The three orifices in the bladder form a bladder wall triangle. The upper two are the opening of ureters, lower is the point of origin of urethra. Smooth muscles of bladder wall runs down into urethra where the urethra originate the circular fibre form an internal sphincter (gate like structure) that controls the passage of urine from the bladder. Below the internal sphincter is the external sphincter which is composed of skeletal muscle. The internal sphincter is under autonomic nervous system (ANS).

→ Functions of kidney →

- Regulation of blood volume and ionic composition (electrolyte balance).
- Maintenance of blood osmolality.
- Regulation of blood pressure.
- Regulation of blood pH.
- Release of Hormones.
- Regulation of blood glucose level.
- Excretion of waste and foreign substance.

1. Result → The excretory system was studied with the help of models and charts.


12/21/19

EXPERIMENT NO. 39

20

STUDY OF THE HUMAN SKIN

Exp:- 17.

> Aim

To study the human skin

Reference - same as:-

> Theory

Skin is part of the integumentary system which helps in protection and temperature regulation. It is also known as cutaneous membrane, an outer covering of body with surface area of about $1.5-2 \text{ m}^2$ and consists of glands, hairs and various cells. Skin has two important layers i.e. epidermis and dermis (Figure 39.1).

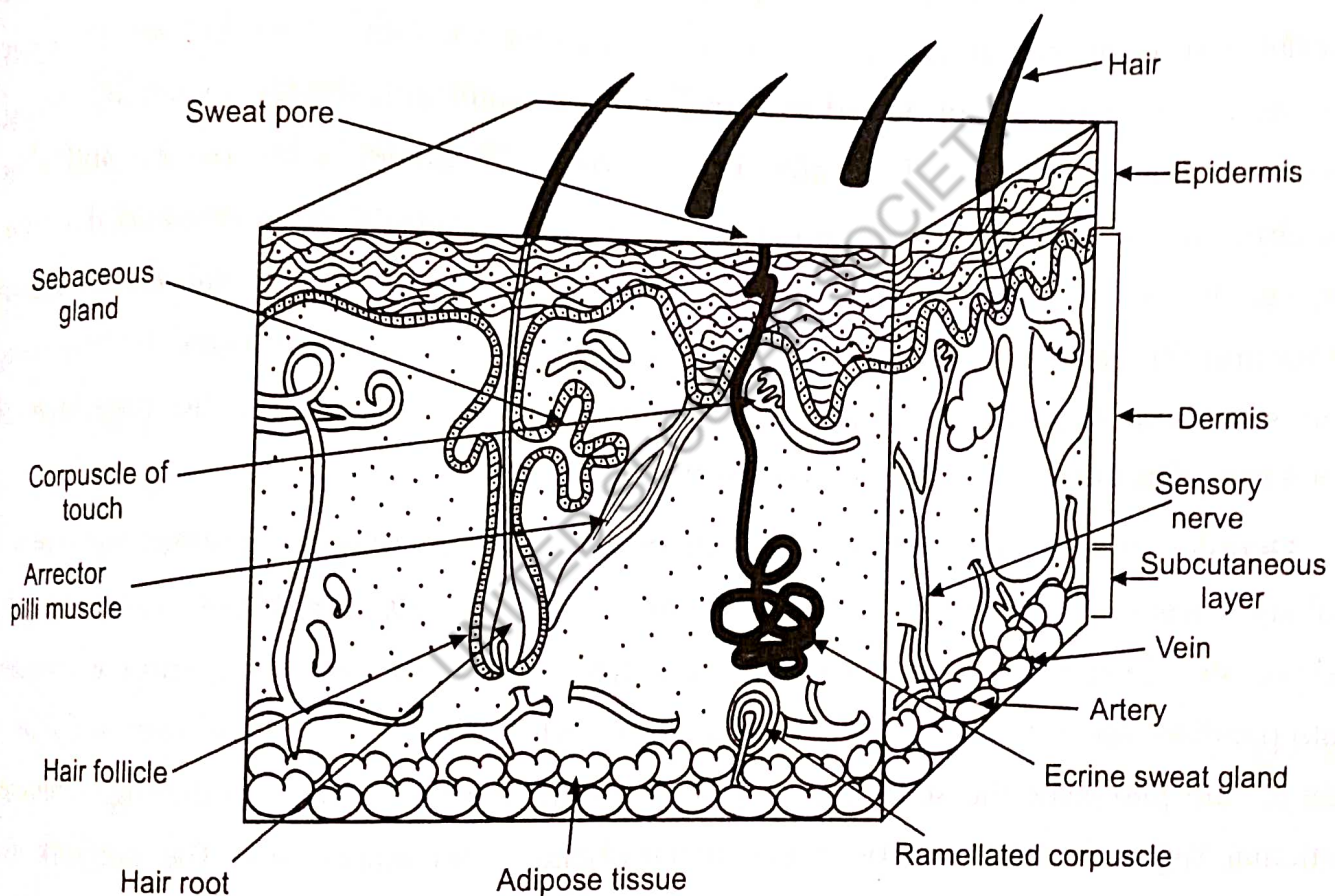


Figure 39.1 : The Human Skin

Epidermis : It is the superficial layer of the skin, made up of stratified keratinized squamous epithelium which varies in thickness in different parts of the body. Blood vessels and nerve endings are absent in the epidermis, although for supply of oxygen and nutrients, deeper layer are bathed in the interstitial fluid of the dermis.

The keratinocytes, melanocytes, Langerhans and Merkel cells are the important cells found in the epidermis. Keratinocytes produce a protein called as keratin which helps in protection from heat, chemicals and microorganism. Melanocytes are cells which produce a pigment known as melanin which gives a characteristic colour to the skin and protect skin from UV light. Langerhans cells originate from the bone marrow, migrate towards the epidermis and prevent the entry of microorganisms into the skin. Merkel cells formed deep in the epidermis detect touch sensation. Epidermis is made up of stratum basale, stratum lucidum, stratum spinosum, stratum corneum, stratum granulosum.

Stratum basale is made up of cuboidal columnar keratinocytes, which form a tough protein keratin which helps in protection from injury to deeper layer. Stratum spinosum superficial to stratum basale gives strength and flexibility to the skin. Stratum granulosum, a middle portion of epidermis is made up of 3-5 flattened keratinocytes, the keratinocytes acts water repellent sealant, retard loss and entry of water and foreign materials. During apoptosis (programmed cell death), break down of nuclei take place, and thus keratinocytes of stratum granulosum do not carry out metabolic reactions and they die. Hence, stratum granulosum marks the transition between the deeper, metabolically active strata and the dead cells of the superficial strata. Stratum lucidum found in fingertips, palms of hands and sole of feet provides toughness. Stratum corneum is the outer layer of epidermis offers protection to microorganisms and injury.

Dermis : It is a tough, elastic layer made up of dense irregular connective tissue - collagen fibre. The different cells found in the dermis are fibroblasts, macrophages, adipocytes along with blood vessels, nerves, glands and hair follicles. Dermis is divided into papillary and reticular region. The papillary region is made up of collagen and elastic fibres, and perceives the sensation of pain, warmth, cold, tickling and itching, whereas reticular region consists of fibroblasts, macrophages, and adipocytes. The network like arrangement of collagen fibers helps the skin resist stretching. Collagen and elastic fibers provides the skin with strength, flexibility and ability to stretch.

Sweat glands : These are distributed throughout the skin, predominantly found in the palms of hands, soles of feet, axillary and groin regions. Tiny pores of sweat gland secrete clear, watery fluid; due to decomposition of bacteria it has unpleasant smell.

Hair : These are present on skin surface except on the palms and soles of feet. Hair is divided into shaft (above the skin) and root (portion that penetrates into the dermis and up

to the subcutaneous layer). Hair follicles are the part surrounding the root and made up of epithelial root sheath. The onion shaped structure at the base of each hair follicle is known as bulb, which contains a nipple shaped serration called papilla, made up of areolar connective tissue and blood vessels responsible for nourishment for hair follicles.

Sebaceous glands : These are found in the skin of the scalp, face, axillae and groin region. They secrete sebum into hair follicles and thus keep the hair soft with shiny appearance and prevent infection against bacteria and fungi. Sebum also prevents drying and cracking of the skin. During puberty, there is excessive secretion of sebaceous glands rendering the skin prone to the effects of excessive moisture.

➤ Functions of skin

1. Provides protection against microorganisms and UV light.
2. Regulates body temperature by maintaining homeostasis
3. Synthesis of vitamin D through exposure to UV light;
4. Prevent dehydration due to moisturizing action.

Result to human skin was studied,

EXERCISE

1. Enlist the layers of skin.
2. Discuss in short the structure of skin.

exp:- 18

➤ Aim

To study the human pectoral girdle and bones of the upper limb

Reference: same as

➤ Theory

Pectoral Girdle:

The pectoral girdle or shoulder attaches the bones of the upper limbs to the skeleton. There are two pectoral girdles consisting of clavicle and scapula.

Clavicle : It is an 'S' shaped bone, also known as collar bone. It is positioned horizontally across the frontal part of the thorax, superior to the first rib (figure 29.1). It has convex and concave curves, and the junction between these form the delicate region of the clavicle most likely to fracture. It articulates with manubrium of the sternum and forms the sternoclavicular joint. Clavicle articulates with scapula at acromioclavicular joint and with humerus at the shoulder joint. The clavicle transmits force from the upper limb to axial skeleton and also provides attachments for the muscles.

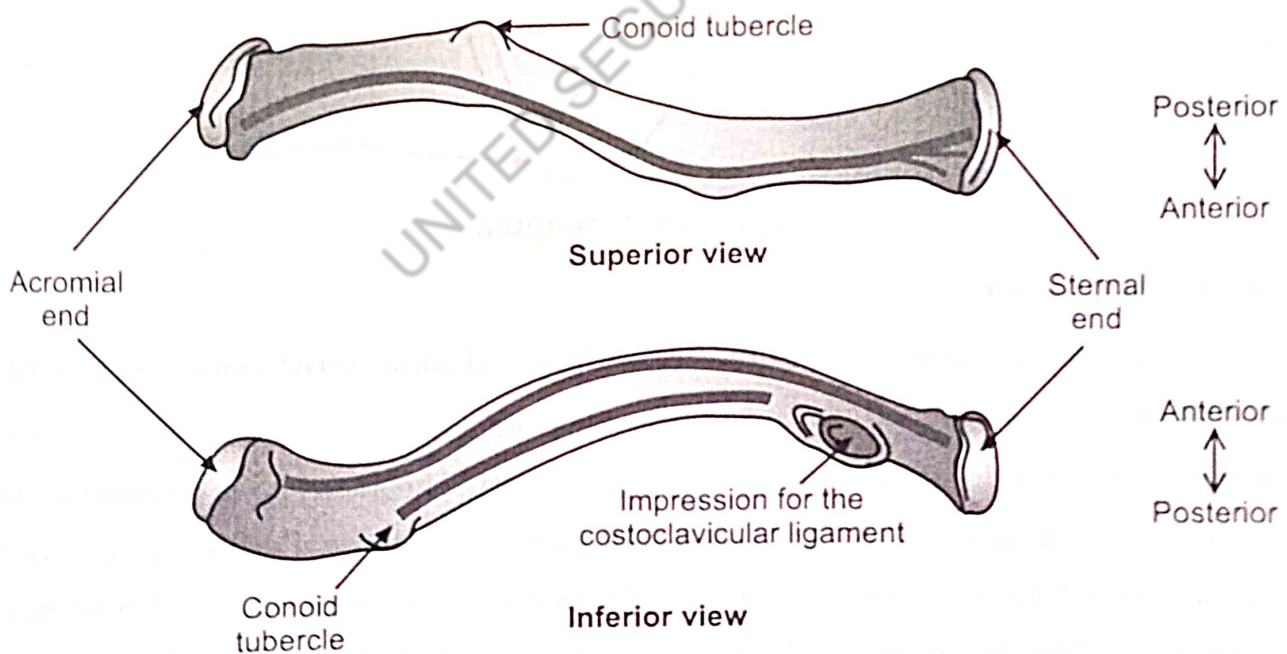


Figure 29.1 : Clavicle bone or Collar bone

Scapula (shoulder blade) : It is flat and triangular shaped, located on the back surface of the chest wall and is superficial to the ribs (figure 29.2). From the lateral side, it has shallow surface known as glenoid cavity which is involved in the formation of shoulder joint with the head of the humerus. Spine is a rough ridge on the posterior part of the body, which extends beyond the lateral border of the scapula and overhangs the glenoid cavity. The acromion process with clavicle forms the joint called as acromioclavicular joint, a slightly movable synovial joint responsible for the movement of shoulder girdle. The coracoid process, is a projection from upper boarder portion of the scapula that provides attachment to muscle and gives movements to shoulder joint.

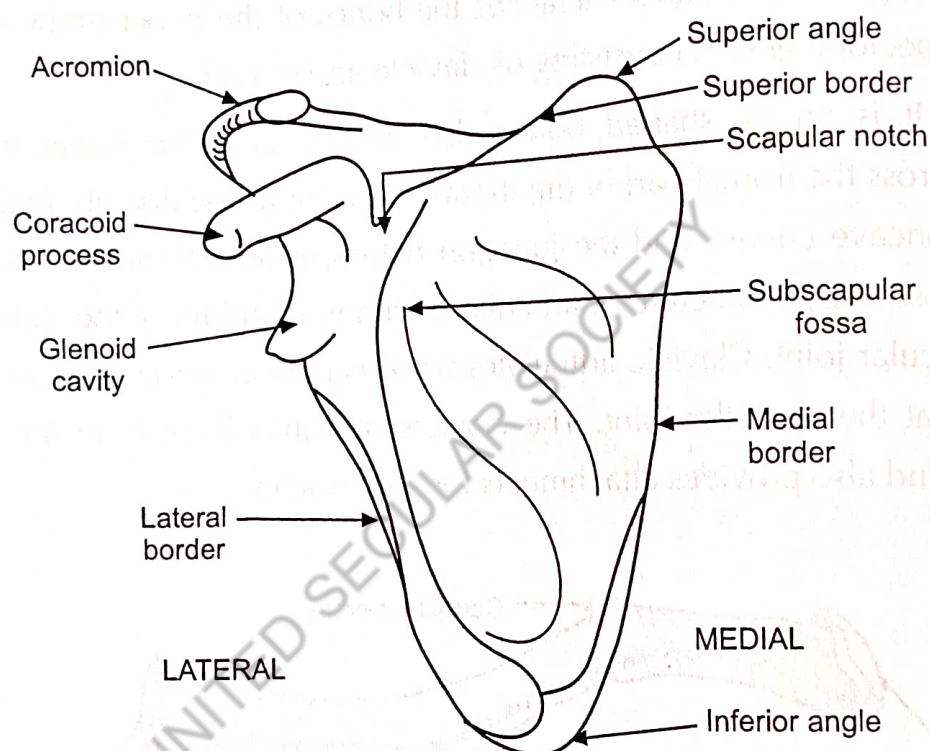


Figure 29.2: Scapula

Bones of the upper limb

Bones of upper limb consist of humerus, radius and ulna, wrist bones, bones of hand, finger bones etc.

Humerus : It is the longest bone of the upper limb. The head of the humerus fits into the glenoid cavity of scapula, forming the shoulder joint also called as socket joint. The greater and lesser tubercles are the two rough projections of humerus. There is a deep groove present between these two tubercles known as bicipital groove (figure 29.3). The distal end of the humerus presents two surfaces that articulate with the radius and ulna to form the elbow joint.

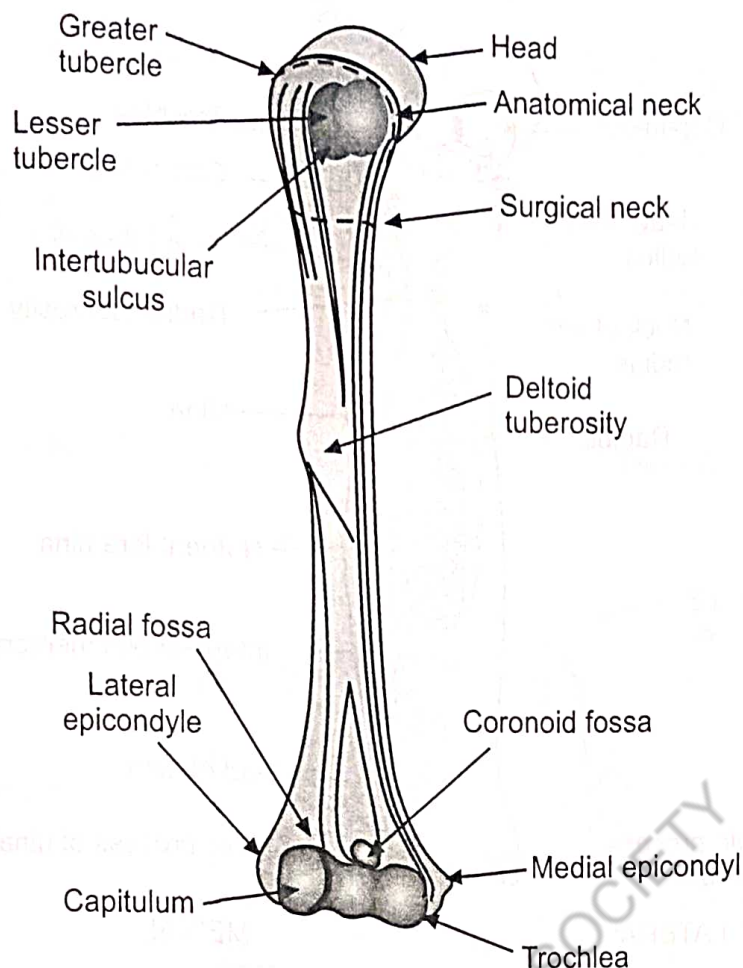


Figure 29.3: Humerus

Radius and ulna : The radius is the smaller bone and situated on the lateral side of the forearm. Its proximal end is narrow, having disc shaped head which articulates with capitulum of the humerus and the radial notch of the ulna, where as the distal end is wider (figure 29.4). Adjacent to the head of the radius is the neck, and roughened area inferior to neck is the radial tuberosity, which is a point of attachment of tendons of biceps muscle. At the distal part of the radius, there is wider shaft forming a styloid process on the lateral side which gives attachment to brachioradialis muscle and radial collateral ligament to wrist part of the hand.

The ulna is located on the medial part of the forearm and is larger than the radius. The olecranon, the proximal end, forms the prominence of the elbow. An anterior projection to the olecranon is the coronoid process which attaches with trochlea of the humerus. The distal end of the ulna consists of head which is separated from the wrist by disc of fibrocartilage. Posterior to ulna's distal end there is styloid process, which gives attachment for the ulnar collateral ligament to the wrist. Both the radius and ulna form the elbow joint with the humerus.

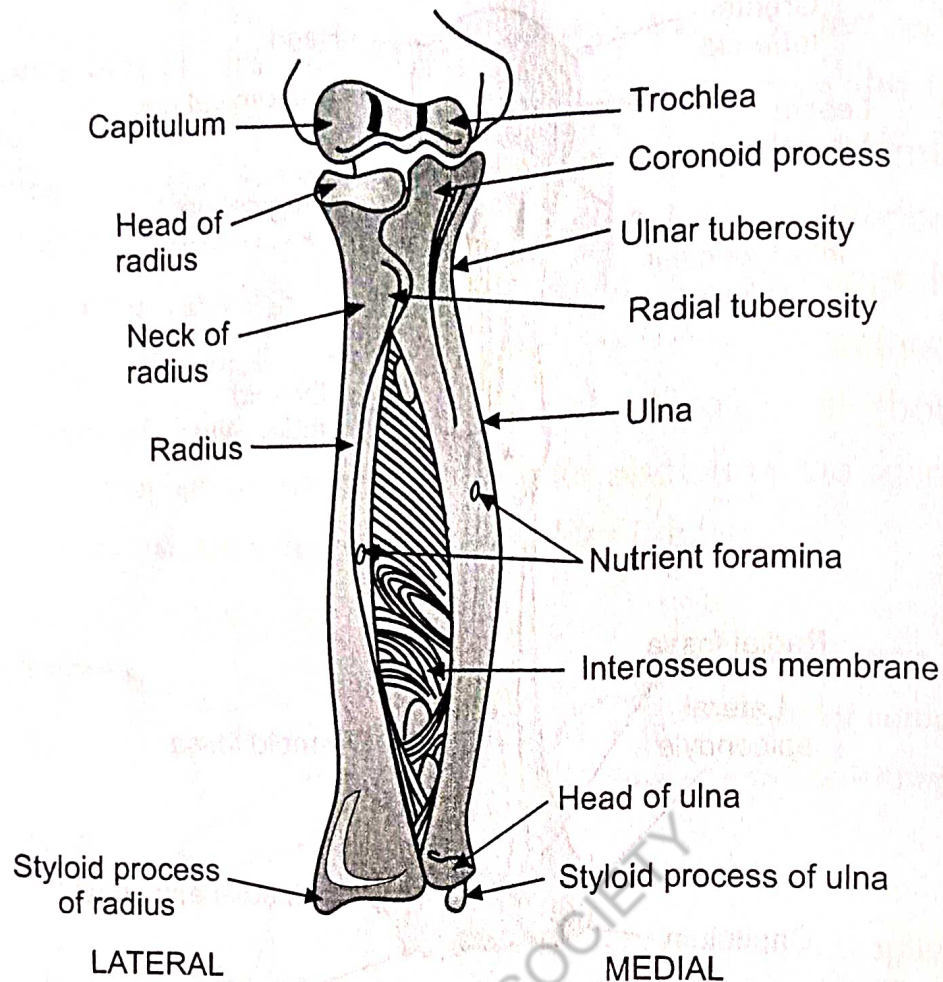


Figure 29.4: Radius and ulna

Wrist (carpal) bones : The eight carpal bones, closely fitted and arranged into two rows i.e. proximal (scaphoid, lunate, triquetrum, pisiform) and distal rows (trapezium, trapezoid, trapezoid, trapezoid, trapezoid, trapezoid, trapezoid, trapezoid). The proximal bones of carpal are associated with the wrist joint whereas distal bones form the joints with metacarpal bones.

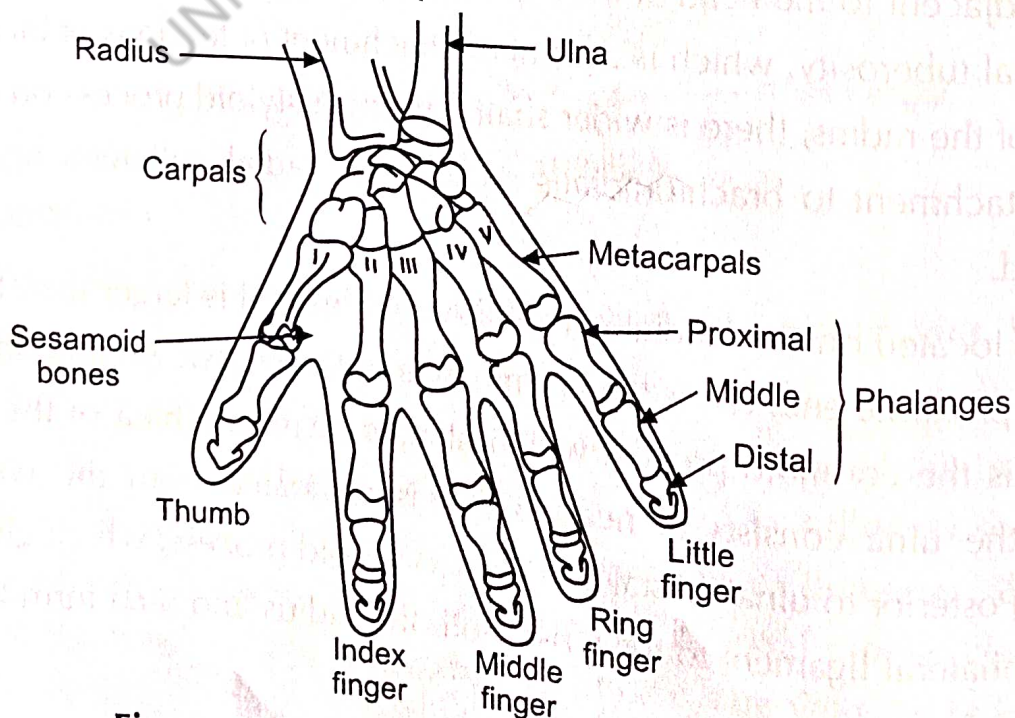


Figure 29.5 : Carpal, metacarpal and phalanges

Metacarpal bones : The five bones of the palm of the hand are called as metacarpal bones. The proximal ends articulate with carpal bones and distal ends with phalanges.

Phalanges : There are 14 phalanges, 3 in each finger, and 2 in thumb. Phalanges articulate to metacarpal bone and with each other by hinge joint (figure 29.5).

➤ Thoracic cage

Thoracic cage consists of bones of a sternum, 12 pairs of ribs and 12 thoracic vertebrae

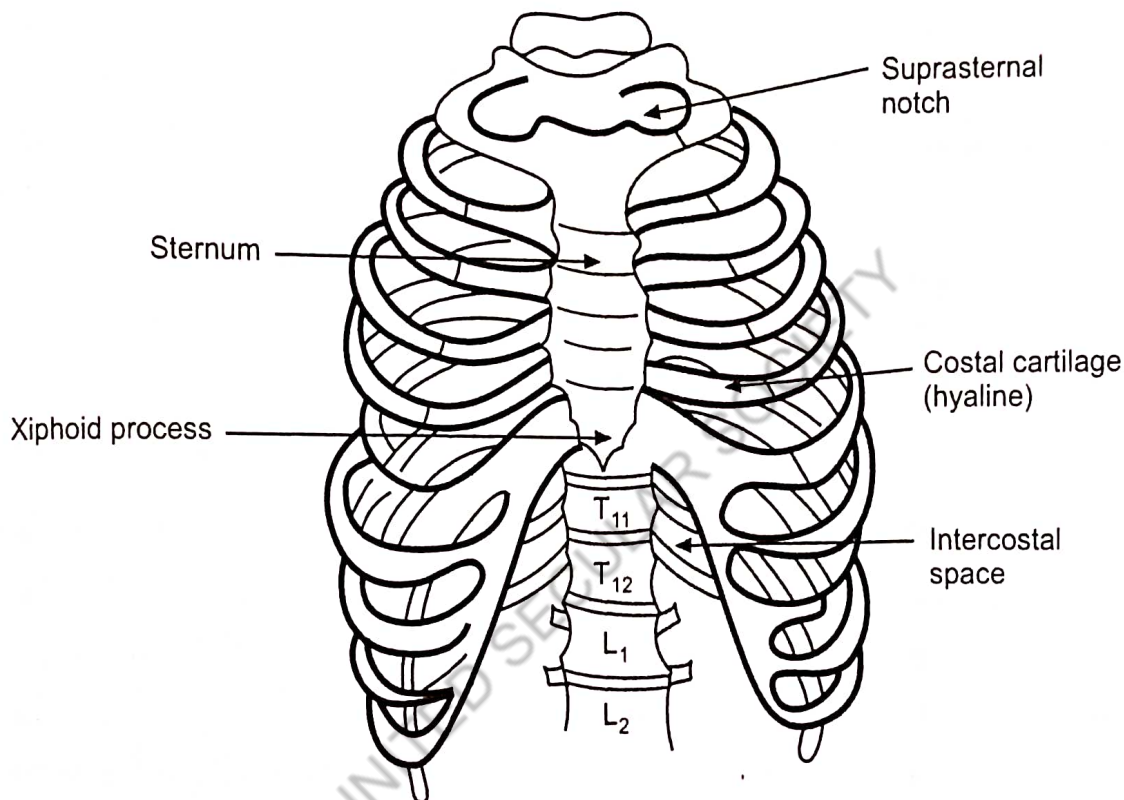


Figure 29.6: Thoracic cage

Sternum : It is also known as breastbone. It is flat, narrow, 'T' shaped, lies in the middle of the anterior thoracic wall and has 3 parts; manubrium, gladiolus and xiphoid process (figure 29.6). It connects to the rib bones through cartilage, forming the anterior section of the rib cage with them, and thus helps to protect the lungs, heart and from physical trauma.

Result:- The human pectoral girdle and bones of the upper limb was studied.

EXPERIMENT NO. 30

STUDY OF BONES OF THE VERTEBRAL COLUMN

Aim

To study the bones of the vertebral column

Theory

The vertebral column is known as backbone or spinal column and with the thoracic cage it forms the skeleton of the trunk of the body. The major functions of the vertebral column are to facilitate the forward, backward and sideways movements. It serves as a point of attachment to the thoracic cage and muscle, protects the spinal cord and provides support to the head.

There are a total 26 vertebrae which include 7 cervical vertebrae at the neck region; 12 thoracic vertebrae posterior to thoracic cavity; 5 lumbar, 1 sacrum and 1 coccyx. The sacrum and coccyx are the immovable bones while others are movable.

Cervical vertebrae

A total of 7 cervical vertebrae smaller than thoracic vertebrae make up 3 foramina i.e. 2 transverse and 1 vertebral foramina having vein and nerve fibers passing through.

Atlas : It is the first and topmost cervical vertebra, and along with the axis, it forms the joint connecting the skull and spine. Atlas is a large ring like structure without body, consisting of an anterior and a posterior arch and two lateral masses.

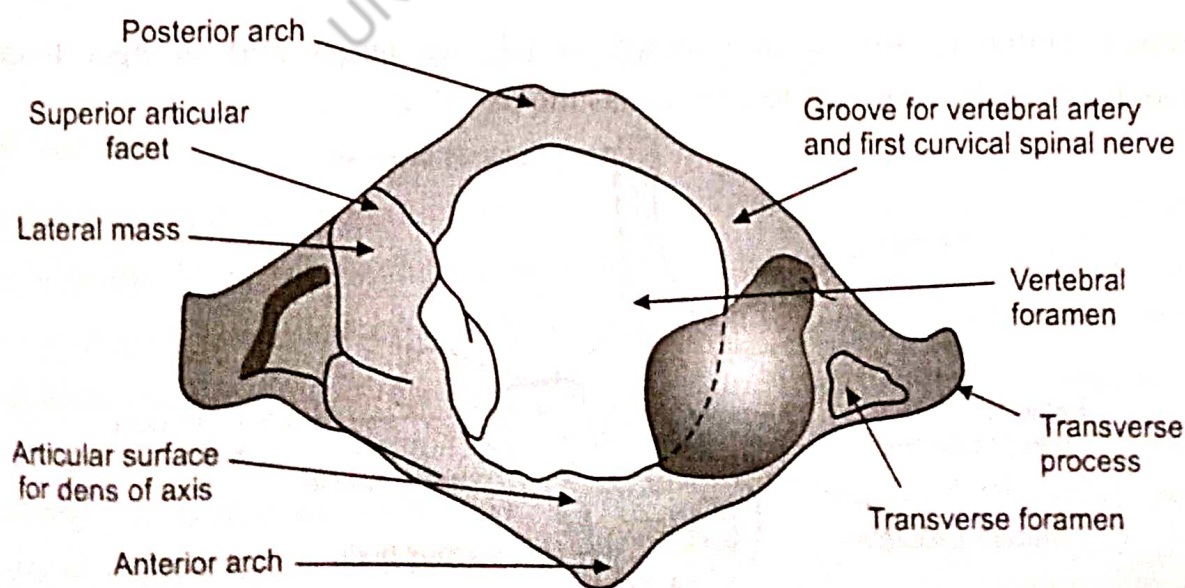


Figure 30.1: Atlas Vertebra

The superior articular facets of atlas articulate with occipital condyles of the occipital bone (figure 30.1) to form the atlanto-occipital joint which gives the 'YES' saying movement (up and down movements) of skull. The inferior articular facets articulate with axis.

Axis : It is the second cervical vertebra, and has a strong odontoid process which rises perpendicularly from the upper surface of the body (figure 30.2). It forms the pivot joint by articulating with atlas which helps during the rotating of head side to side.

The other 4 cervical vertebrae consist of bifid spinous processes and 7th is non bifid spinous and serve as essential anatomical landmark.

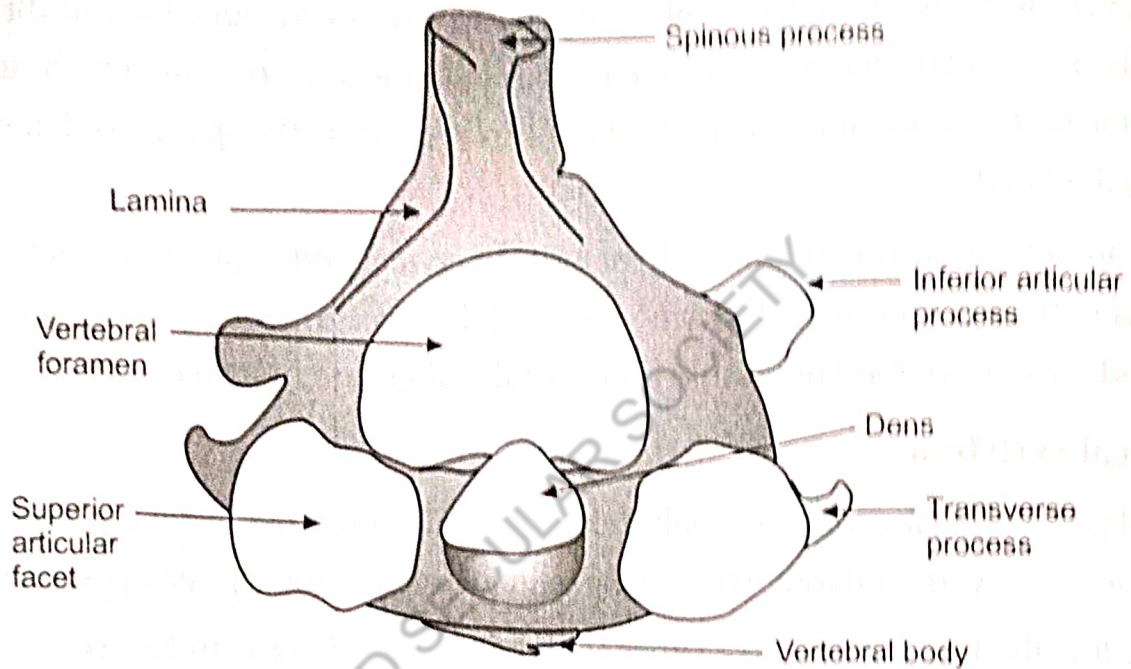


Figure 30.2 : Axis

➤ Thoracic vertebrae

Thoracic vertebrae are 12 in numbers which are larger and stronger than other vertebrae. It articulates with ribs to form facets (figure 30.3).

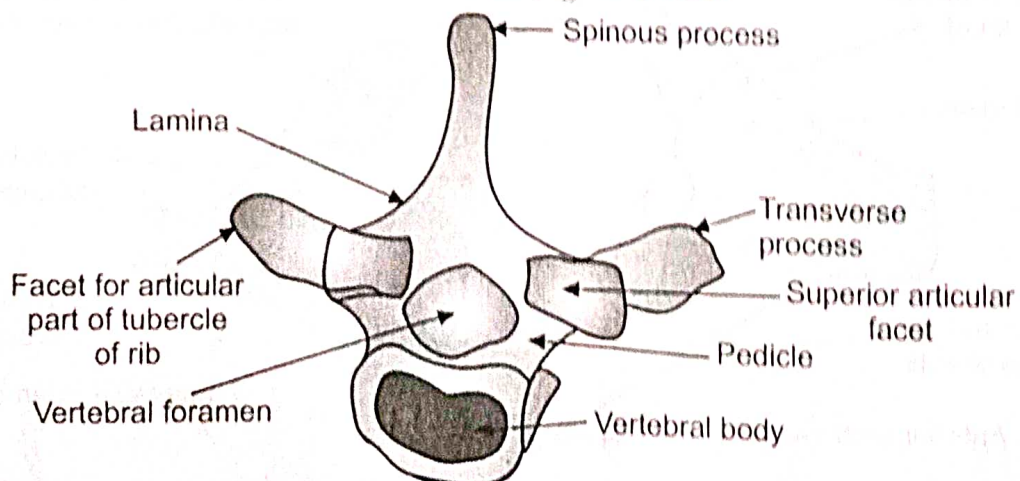


Figure 30.3 : Thoracic vertebra

It consists of heart shaped body, downward pointed spinous processes, two facets present, on either side, two costal semi-facets, one above, near the root of the pedicle, the other below in front of the inferior vertebral notch . A small facet at the tips of the transverse process articulates with tubercles of the ribs.

➤ The lumbar vertebrae

They are 5 in number and is the largest vertebrae of the column. The body is kidney shaped and does not articulate with ribs (figure 30.4). The spinous processes of this vertebra are flat and stout and have backward projection and provide attachment for the back muscles.

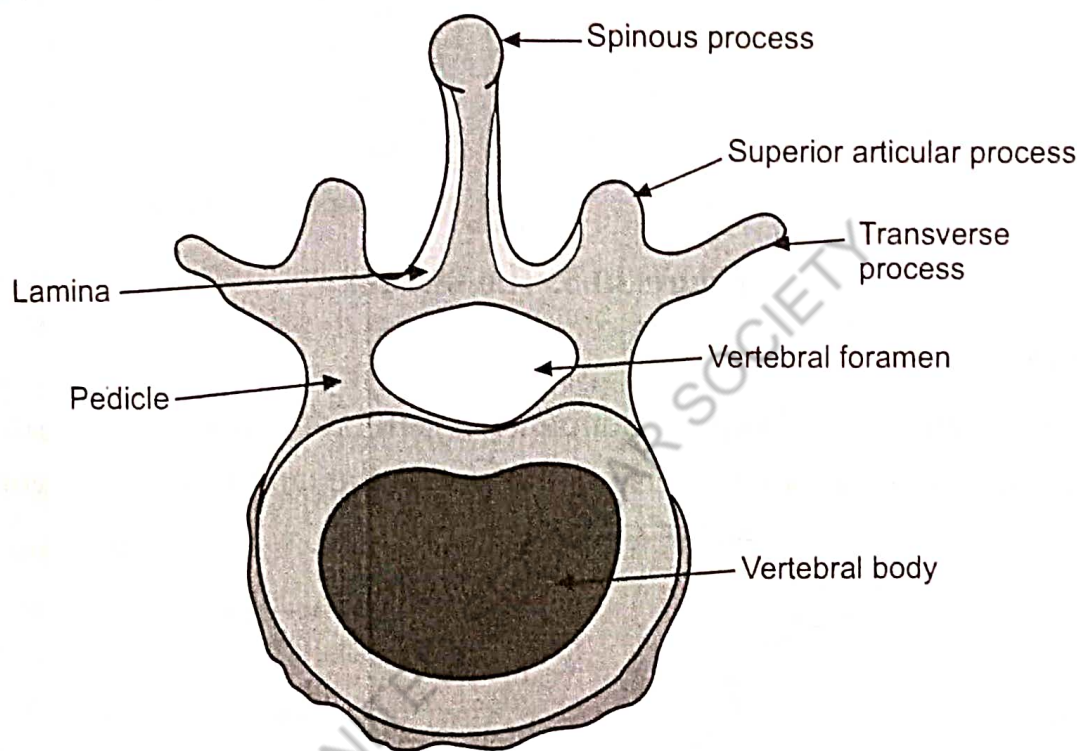


Figure 30.4 : Lumbar vertebra

➤ The sacrum

The sacrum is a triangular bone formed by the collection of five sacral vertebrae which articulates to the 5th lumbar vertebrae and forms the lumbo-sacral angle and below with the coccyx (figure 30.5). The body is large and much wider from side to side than from backwards. Its anterior projecting edge is named the sacral promontory. Transverse process and the costal element are fused to each other to form the upper surface of the lateral mass of the sacrum on both sides. Its base projects forward and upward forming the prominent sacrovertebral angle when articulated with the last lumbar vertebra. Its central part is projected backward, so as to give increased capacity to the pelvic cavity. In between the

body and lateral masses contain anterior sacral foramina which offer gap for passage of nerves. The inferior surface of the sacrum articulates with coccyx.

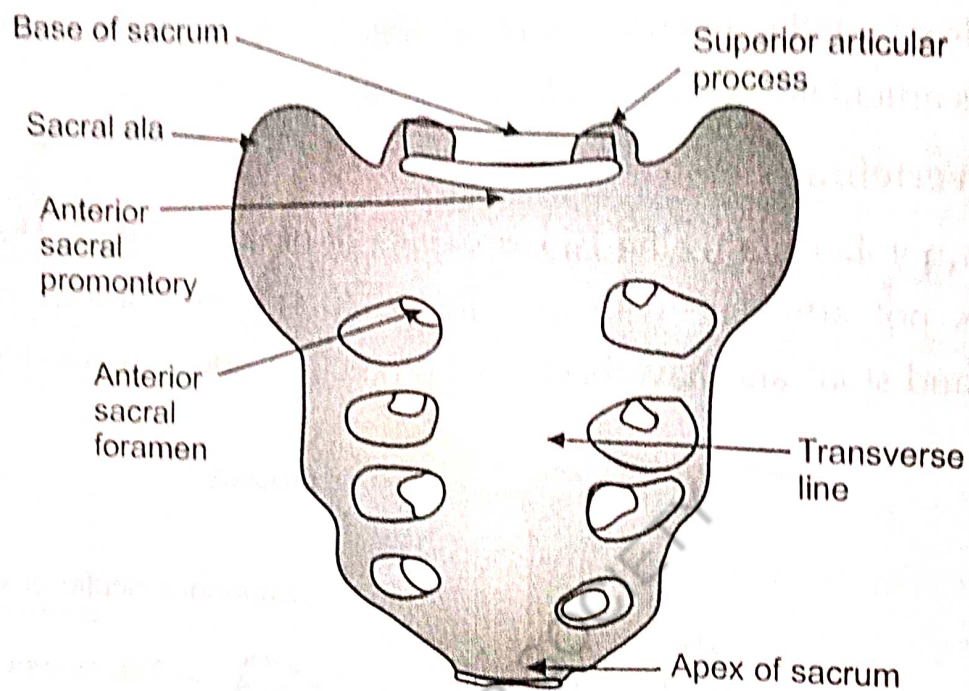


Figure 30.5: The sacrum

➤ The coccyx

It is triangular, single, fused with 4 rudimentary vertebrae. Superiorly, it articulates with sacrum and contains a series of transverse processes on the lateral surface (figure 30.6).

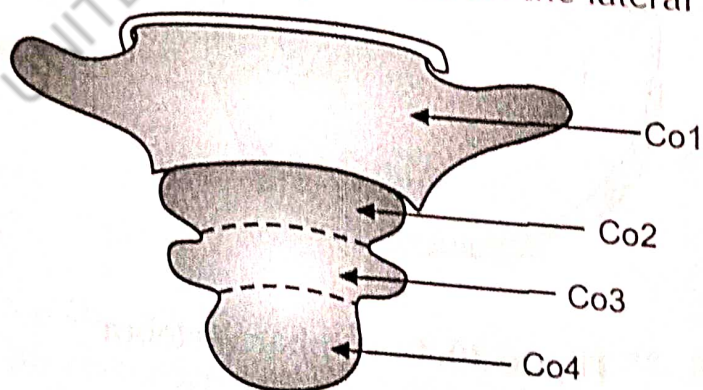


Figure 30.6: The coccyx

result :- Bones of Vertebral column over studied

EXERCISE

1. Enlist the bones of the vertebral column
2. Give the locations of the thoracic vertebrae.
3. What are the functions of the cervical vertebrae?
4. Give the total number of vertebrae.

STUDY OF VARIOUS JOINTS

Exp - 20.

> Aim

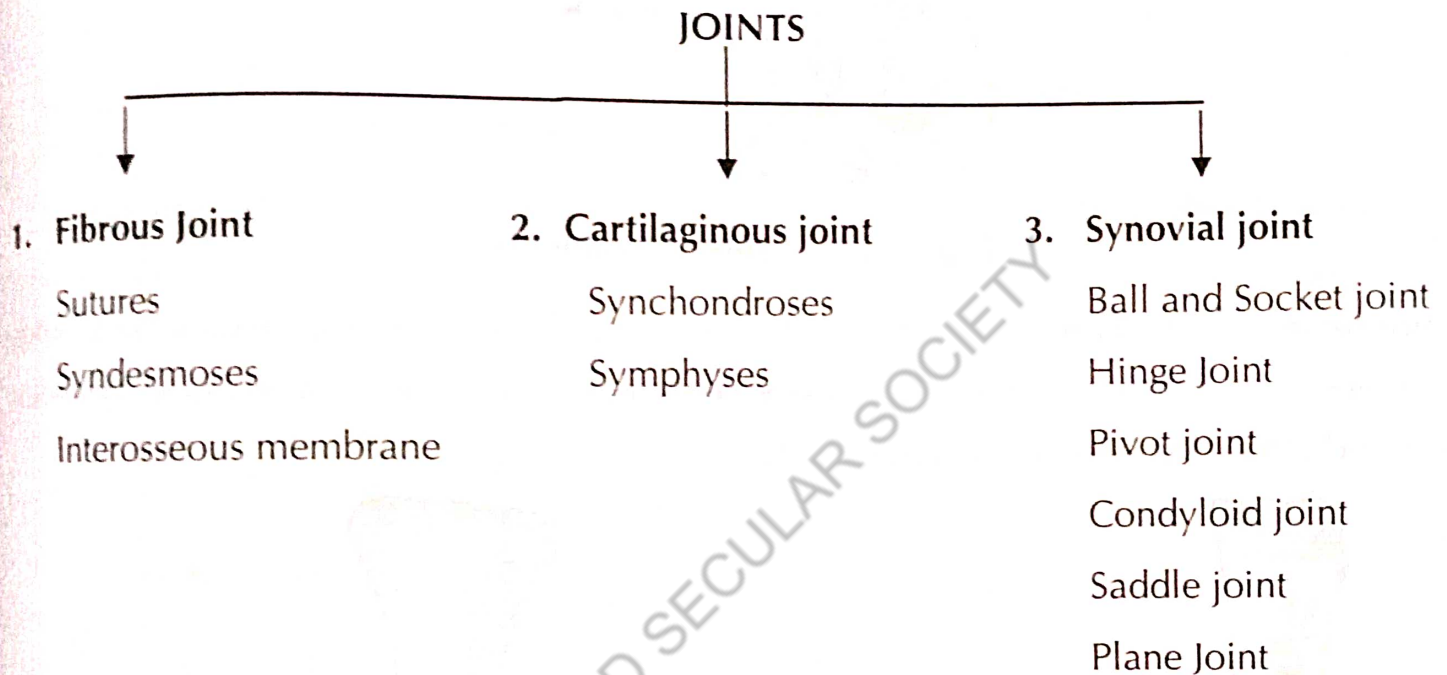
To study the various human joints

> Theory

Reference

Joint is a point of attachment or contact between two bones or between bones and cartilages, or teeth. Joint is also called as articulation.

Joints are classified into



1. Fibrous joints

Fibrous joint holds the other articulating bones closely together by dense irregular connective tissue and is without synovial cavity; thus these joints do not move or show little movements.

Sutures : It consists of thin irregular connective tissue that join the bones of the skull together by its interlocking edges (figure 32.1). The interlocking edges offer strength, and reduces chances of fracture and also acts as shock absorbent.

Syndesmoses : These are fibrous joints, articulate two bones and are arranged as ligaments which permit limited movements of bones (figure 32.2).

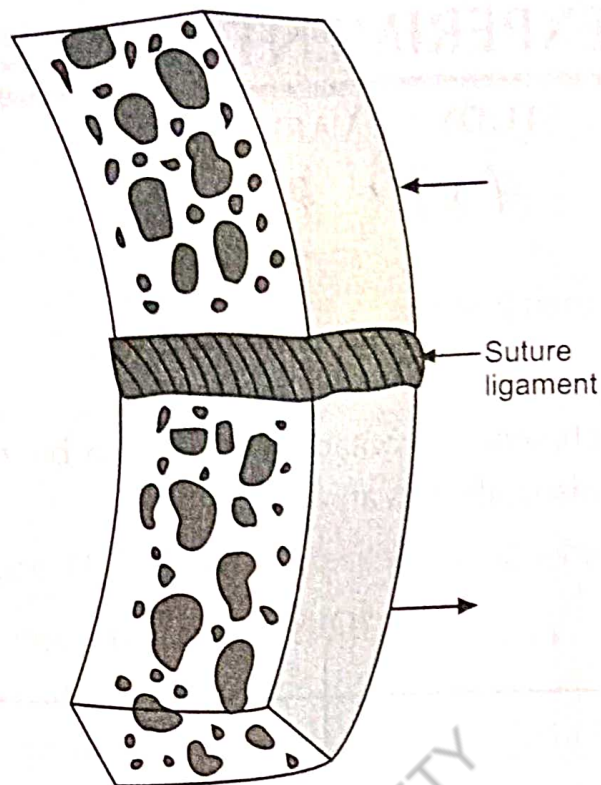


Figure 32.1 : Suture ligaments

Interosseous membrane : It consists of dense irregular connective tissue which binds the adjacent bone and allows slight movements e.g. interosseous membrane between radius and ulna; tibia and fibula (figure 32.3).

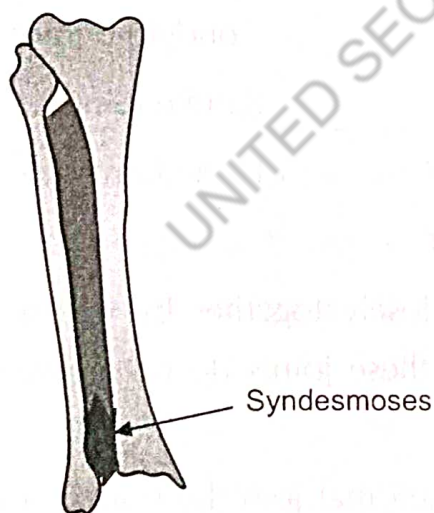


Figure 32.2 : Syndesmoses of tibia and fibula

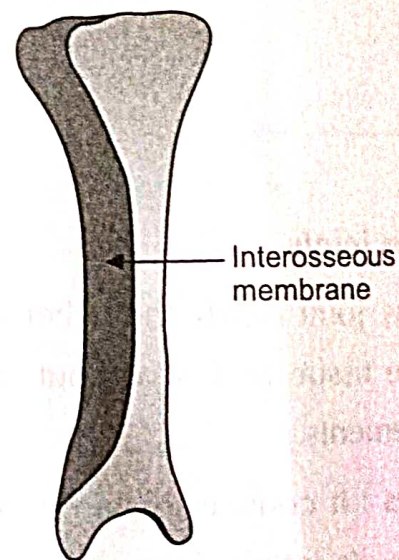


Figure 32.3 : Interosseous membrane between tibia and fibula

2. Cartilaginous joints

Cartilaginous joints permit slow movements or no movements due to absence of synovial cavity. The bones of these joints are tightly joined by hyaline cartilages.

chondroses : It is a cartilaginous joint in which the epiphyseal plate of each end of a bone connects the epiphysis of growing bones by either hyaline cartilage or fibrocartilage (figure 32.4).

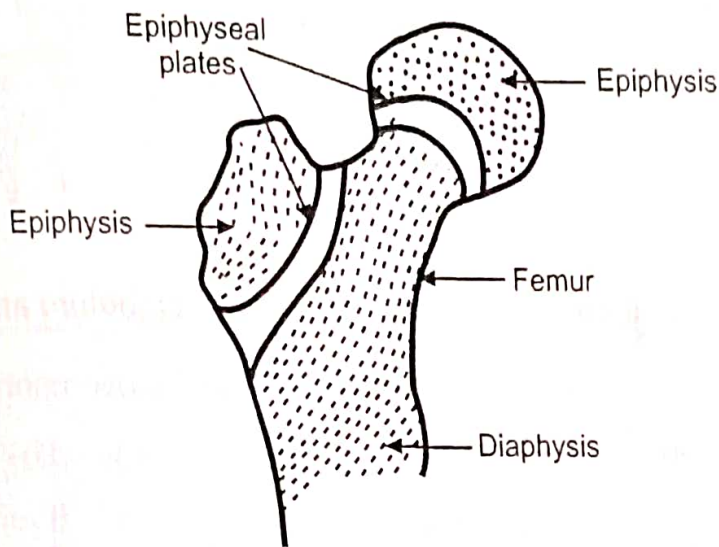


Figure 32.4 : Synchondrosis

symphyses : The ends of articulating bones are covered with hyaline cartilage and connect the bones. e.g. the pubic symphyses found in symphysis between the frontal faces of hip bone (figure 32.5).

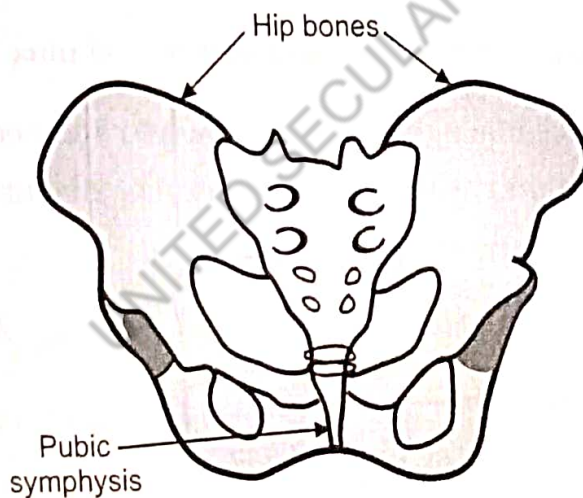


Figure 32.5: Symphysis

3. Synovial joints

It consists of synovial cavity which offers movements of joints and thus these joints are freely movable. The cartilages of these joints are smooth and slippery for free movements.

Ball and socket joint : It consists of depression or cavity on one side of a bone and ball like surface on the another bone, this arrangements permits them to fit closely to each other and allows free movements. The shoulder and hip joints are the examples of ball and socket joint (figure 32.6).

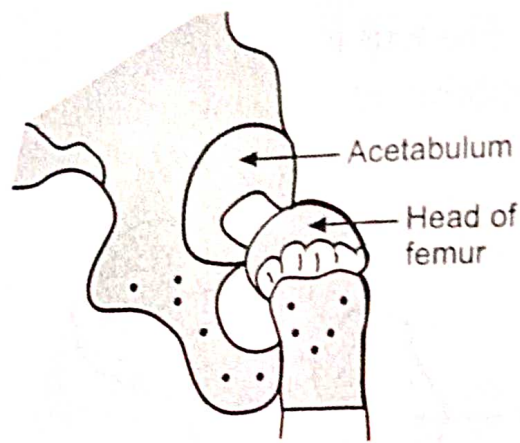


Figure 32.6: Ball and socket joint between acetabulum and femur

Hinge joints : These joints permit unidirectional movements e.g. elbow joint, interphalangeal joint (figure 32.7).

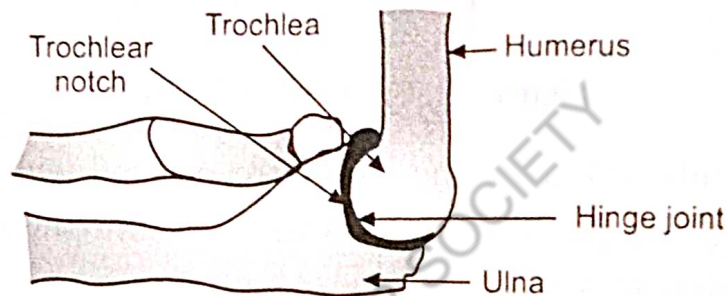


Figure 32.7 : Hinge joint between humerus and ulna (at elbow joint)

Pivot joints : The round surface of the bone attach to another bone partly by ligaments and allow the movement around its longitudinal axis. e.g. atlanto-axial joint (figure 32.8)

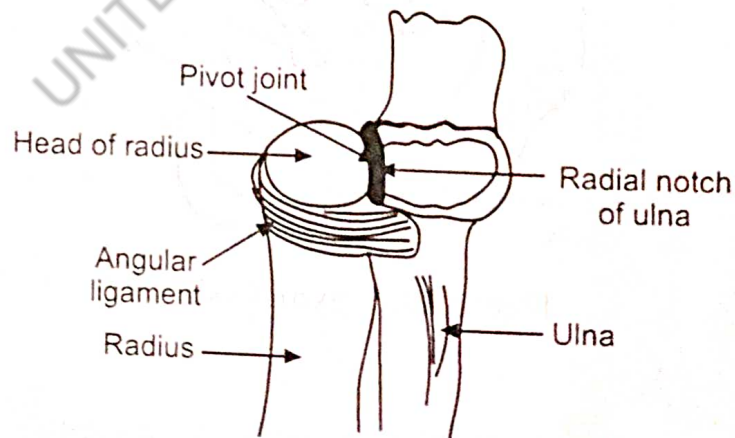


Figure 32 .8 : Pivot joint between head and radius and radial notch of ulna

Condyloid joints or ellipsoidal joints : It is the convex oval shaped bone fused into depression of another bone and permits two sided movements e.g. radiocarpal and metacarpophalangeal joints (figure 32.9).

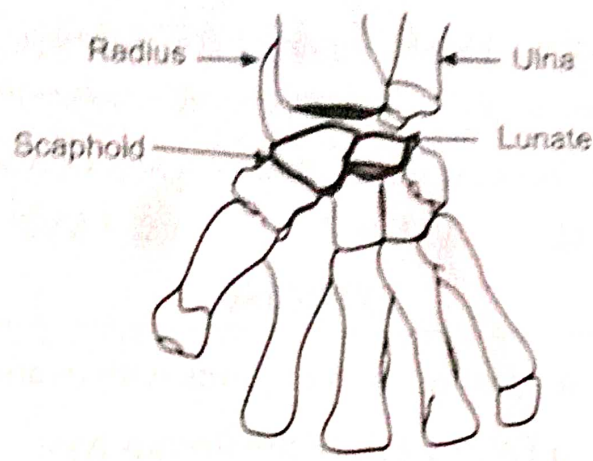


Figure 32.9: Condyloid joint of radius and lunate and scaphoid bones of carpus (wrist joint)

Saddle joint or seller joint : In this, one bone is saddle shaped and the other bone is used into the saddle. It allows the two sides movements same as that of ellipsoidal joints. e.g. carpometacarpal joints (figure 32.10).

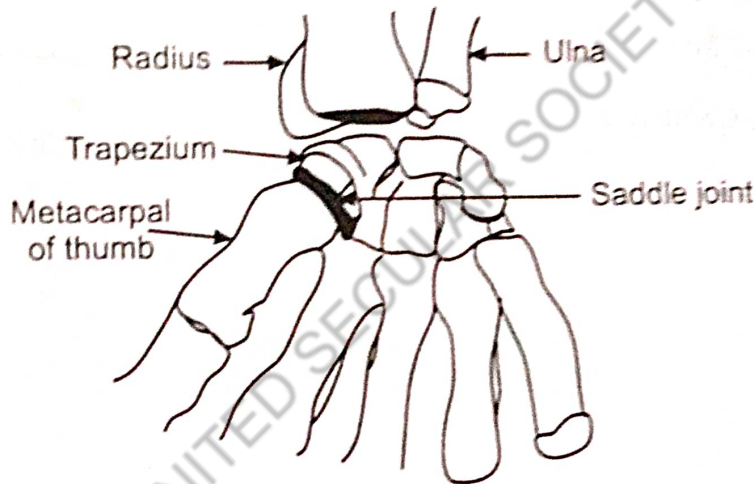


Figure 32.10 : Saddle joint between trapezium of capus and metacarpal of thumb

➤ Significance

Rheumatism : It is the disorder of joints and connective tissues characterised by pain, inflammation and difficulty to initiate movements.

Osteoarthritis : It is a group of mechanical abnormalities involving degradation of joints, including articular cartilage and subchondral bone characterised by pain, tenderness, stiffness, and locking.

Rheumatoid arthritis : It is an autoimmune disease that results in a chronic, systemic inflammatory disorder that may affect many tissues and organs. It is characterised by inflammation of joints, swelling and loss of function.

Ankylosing spondylitis is a chronic inflammatory disease of the axial skeleton with variable involvement of peripheral joints and nonarticular structures. It is characterised by pain and stiffness in the hips and lower back that progress upward along the backbone.

Result - Joint was studied.

EXERCISE

1. Define a joint. Give the classification of joints with examples
2. What are fibrous joints? Enlist joints of the fibrous type.

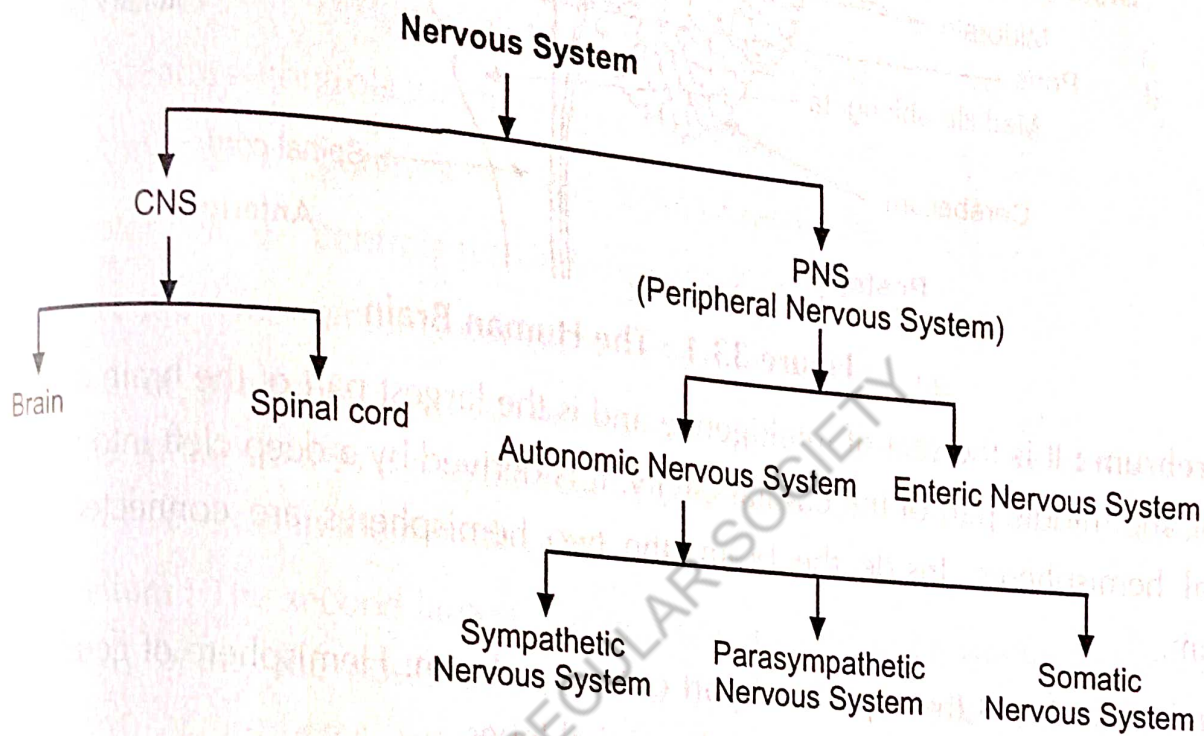
exp- 21

Aim

To study the human central nervous system (CNS)

Theory

Nervous system is divided into -



The CNS : The main function of CNS is to maintain integration of sensory input and motor output, thus it enables a person to identify sensory information and formulate responses to changes that alter haemostatic balance. Apart from this function, the nervous system is also involved in perceptions, behaviours, memories, and all voluntary movements. The nerves (neurons) are a bundle of thousands of axons plus associated connective tissue and blood vessels that lie outside the brain and spinal cord.

The CNS consists of brain and spinal cord

The Brain : The brain lies within the cranial cavity, and constitutes $\frac{1}{5}^{\text{th}}$ of the body weight and consists of cerebrum, brain stem (mid brain, pons), medulla oblongata, and cerebellum (figure 33.1).

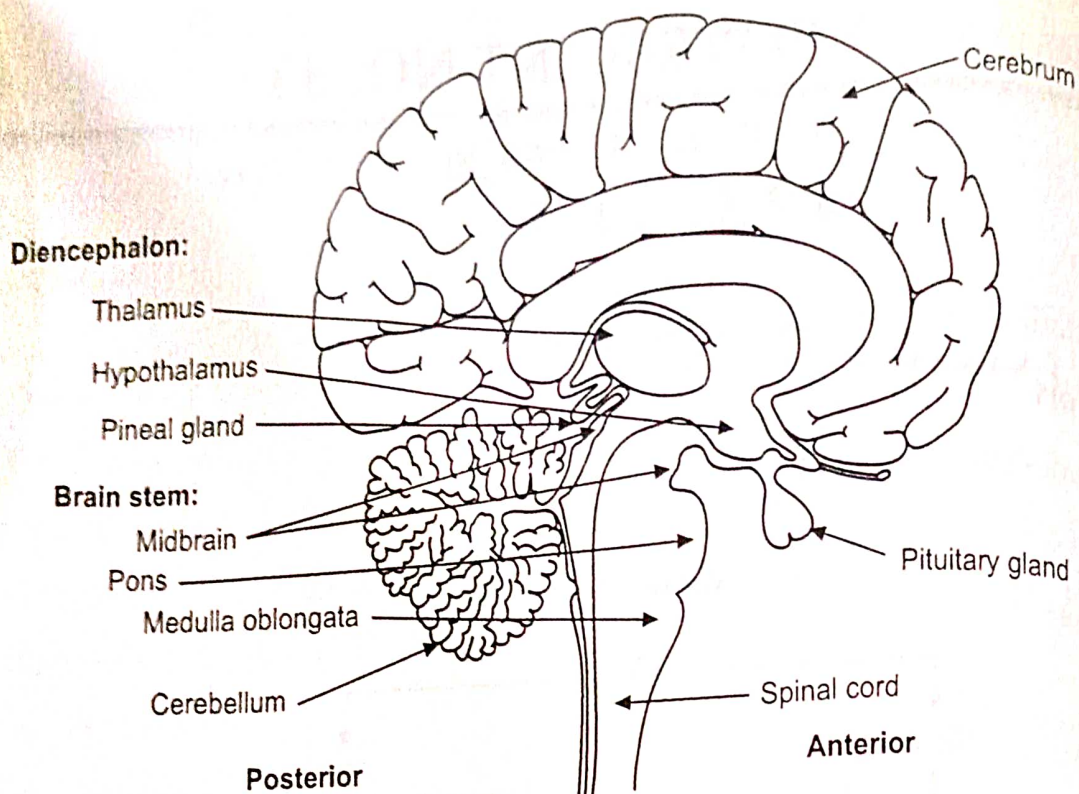


Figure 33.1 : The Human Brain

Cerebrum : It is the seat of intelligence and is the largest part of the brain and occupies the anterior and middle part of the cranial cavity. It is divided by a deep cleft into right and left cerebral hemispheres. Inside the brain, the two hemispheres are connected by corpus callosum.

Cerebral cortex is the superficial part of the cerebrum. Hemisphere of cerebrum has four lobes viz; frontal, parietal, temporal and occipital lobes.

Function of cerebrum : Mental activities are involved in memory, intelligence, sense perception, responsibility, thinking, reasoning, moral sense and learning.

- Sensory perception (pain, temperature, touch, taste, smell)
- Initiation and control of voluntary muscle contraction

Functional areas of cerebrum

1. Motor area
2. Sensory area
3. Brain Stem

(b) Mid brain : It is situated around the cerebral aqueduct between the cerebrum above and pons varolii below. It connects the cerebrum with lower parts of the brain : spinal cord.

(c) **Pons varolii** : It is situated in front of the cerebellum, below the mid brain and above the medulla oblongata. It consists of nerve fibers forming a bridge between the two hemispheres of cerebellum and of fibers passing between the higher level of brain and the spinal cord.

(d) **Medulla oblongata** : Extends from the pons varolii above and is continuous with the spinal cord below. It is pyramid shaped and it lies within the cranium above the foramen magnum. Its anterior and posterior surfaces are marked by central fissures. Cells of the medulla oblongata consist of relay stations for sensory nerves passing from spinal cord to cerebrum.

Vital centers present in medulla oblongata are given as below.

1. Cardiac centre – controls functioning of the heart.
2. Respiratory centre – controls rate and depth of respiration.
3. Vasomotor centre – controls the diameter of blood vessels.
4. Reflex centre – for vomiting, coughing, sneezing, swallowing.

Decussation of pyramids : Motor nerves descending from the motor area in the cerebrum to the spinal cord in the pyramidal or cortico spinal tract, crossing from left side to the right and vice versa in the medulla oblongata.

2. Cerebellum : The second largest part of the brain, situated posterior to pons varolii and immediately below the posterior portion of the cerebrum lying posterior to cranial fossa. It has two hemispheres, separated by narrow median strip called as gray matter which is found on the surface, while white matter is present inside the cerebellum.

Cerebellum performs functions like coordination of voluntary movement, posture, balance and coordinates activities associated with maintenance of balance and equilibrium of the body.

➤ Spinal cord

It is elongated and almost cylindrical part extending from the brain just below the medulla. It is suspended in the vertebral canal and is surrounded by three meninges and cerebrospinal fluid

Meninges are : 1) dura matter, 2) arachnoids and 3) pia matter.

The spinal cord extends from the first cervical vertebra to the lower border of the first lumbar vertebrae, is approximately 42-45 cm long and is about the thickness of the little finger (figure 33.2).

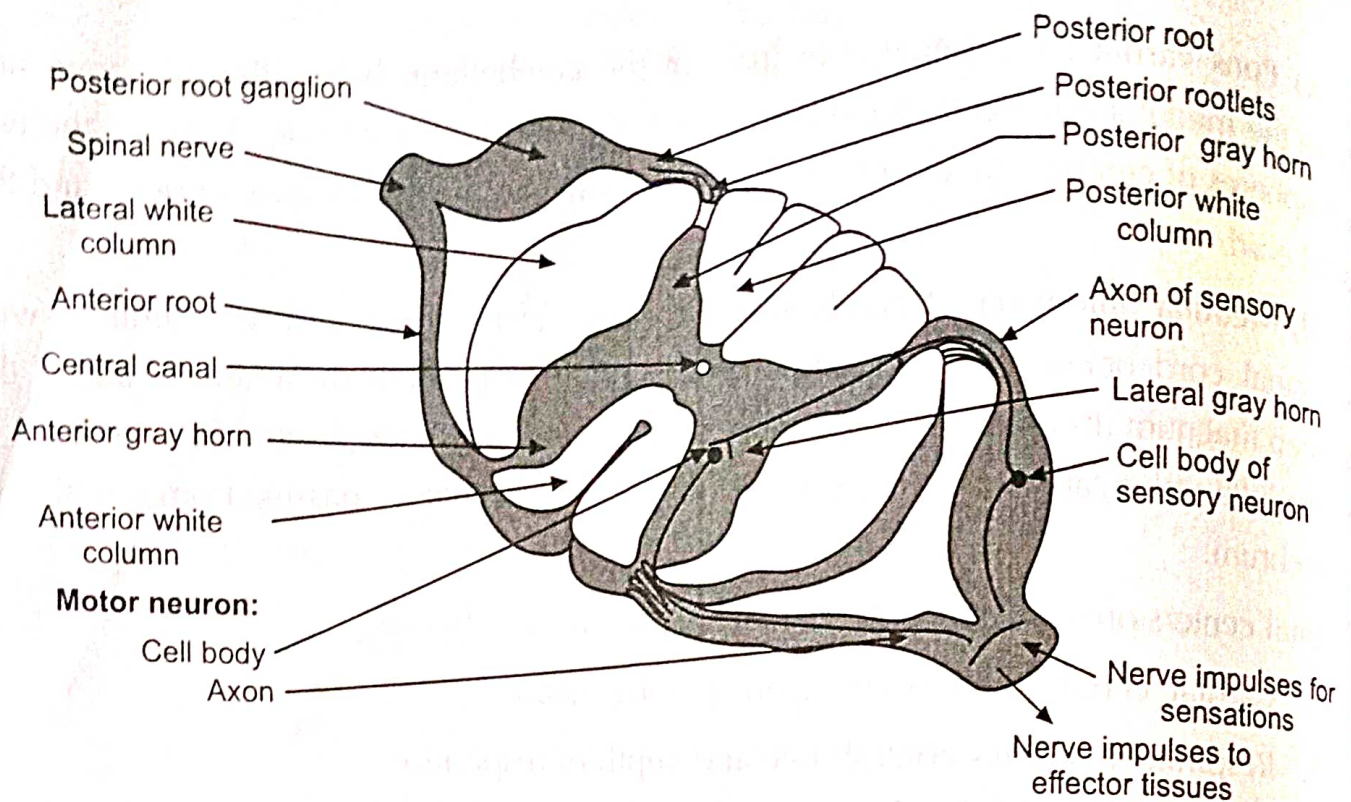


Figure 33.2 : Spinal cord

The spinal cord is the nervous tissue link between the brain and the rest of the body, except the cranial nerves. Motor nerves originating from the brain descend through the spinal cord and supply to various organs and tissues at the appropriate level of the cord. Sensory nerves from different organs and tissue enter and pass through the spinal cord to the brain. This sensory information is conveyed by the dorsal nerve route and spinal cord. The cell bodies of these unipolar, sensory neurons make up a small region of gray matter in the dorsal root ganglia; while fibers of the ventral nerve root carry motor information out of the spinal cord. Cell bodies of these multipolar, motor neurons are in grey motor area that composes the inner core of the spinal cord.

Diencephalon – extends from the brain stem to the cerebrum and surrounds the third ventricle.

It comprises of the thalamus, hypothalamus and epithalamus.

The thalamus has important structures, which relay sensory impulses from the sensory areas to the spinal cord and brain stem. The thalamus receives, relays, and transmits sensory and motor information to and from the cerebral cortex.

Inferiorly to the thalamus is the hypothalamus having a number of nuclei; those involved in various behavioral and physiological functions.

➤ Important functions of the hypothalamus are given below

Regulation of ANS functions like contraction of smooth muscle and cardiac muscle; production of hormones, regulation of emotions and behaviour, food and water intake, equilibrium, control of body temperature and circulating circadian symptoms and consciousness.

Epithalamus is superior to thalamus and contains pineal gland which secretes melatonin involved in induction of sleepiness.

The arrangement of grey matter in the spinal cord resembles the shape of the letter H, having two posterior, two anterior and two lateral columns. The area of grey matter lying transversely is the transverse commissure and it is pierced by the central canal, an extension from the fourth ventricle, containing cerebrospinal fluid.

The white matter of the spinal cord is arranged in three columns or tracts; anterior, posterior and lateral. These tracts are formed by sensory nerve fibers ascending to the brain, motor nerve fibers descending from the brain and fibers of connector neurons.

There are two main sources of sensation transmitted to the brain via the spinal cord.

1. The skin : Sensory receptors (nerve endings) in the skin, called cutaneous receptors, are stimulated by pain, heat, cold and touch, including pressure. Nerve impulses generated are conducted by three neurons to the sensory area in the opposite hemisphere of the cerebrum where the sensation and its location are perceived.

2. The tendons, muscles and joints : Sensory receptors are nerve endings in these structures, called proprioceptors, which are activated in response to stretch phenomenon. Together with impulses from the eyes and the ears they are associated with the maintenance of balance and posture and with perception of the position of the body in space.

Motor neuron stimulation results in contraction of skeletal (striated, voluntary) muscle, contraction of smooth (involuntary) muscle, cardiac muscle and the secretion by glands controlled by nerves of the autonomic nervous system.

➤ Spinal Cord Physiology

It provides conduction pathways to and from the brain and serves as the integrator or reflex center for all spinal reflexes. The white matter tracts in the spinal cord are highways for nerve impulse propagation. The grey matter of the spinal cord receives and integrates incoming and outgoing information.

➤ Pathological Significance

Stroke : It is a neurological disorder due to blockade of blood vessels which supply blood to the brain tissue. Symptoms include paralysis of one part of the body (hemiplegia), loss of sensation, slurred speech, death may also occur.

Predisposing factors include hypertension, atheroma, cigarette smoking, diabetes mellitus, blood clot, high cholesterol in blood vessels, stress etc.

Dementia : It is a permanent or progressive loss of intellectual abilities i.e. impairment of memory, judgment, obstruct twinkling etc.

Meningitis : Inflammation of meninges due to infection caused by bacteria or virus. Symptoms include fever, headache, vomiting, confusion, lethargy and drowsiness.

Epilepsy : It is the disorder of CNS characterised by periodical and unpredictable occurrence of seizures. Seizures occur because of rhythmic, synchronic discharge of neurons due to hyper activity leading to behaviour impairment with or without affecting the motor activity. Depending upon the factors and part of the brain involved, it is of two types, generalised (throughout brain) and partial (local).

Various antiepileptic drugs used in the treatment include- Benzodiazepines, barbiturates, valproic acid, phenytoin etc. alone in combination for certain period.

Depression : Depression is a feeling of intense sadness or unhappiness. It develops due to illness, hormonal imbalance, environmental factors, genetics etc.

Management of depression can be done by psychotherapy and drug treatment (imipramine, fluoxetine etc).

Result - Nervous system was studied.

EXERCISE

1. Give the main functions of the CNS.
2. Enlist the various structural parts of the brain.
3. Give the functions of hypothalamus.
4. Give the physiology of spinal cord.
5. Define the following term
(a) Depression

EXPERIMENT NO. 34

STUDY OF THE LYMPHATIC SYSTEM

25

exp 22

> Aim

To study the lymphatic system

> Theory

The lymphatic system is a part of the circulatory system consisting of a network of lymphatic vessels for transportation of lymph. Lymphatic tissue is a reticular connective tissue that contains a large number of B and T cells (lymphocytes). Lymph enters via vessels of increasing size into a large number of lymph nodes before returning to blood circulation. The lymphatic system helps in circulating body fluids and in defense against diseases causing agents

> Lymph and lymph capillaries

Lymph is a clear, pale yellow fluid (in intestine it is creamy white), similar in composition to that of plasma and interstitial fluid and varies in plasma protein content. It transports the lymphocytes, plasma proteins, bacteria and cell debris of damaged tissues which is filtered and destroyed by lymph nodes.

Lymph capillaries are composed of a single layer of endothelial cells that originate as blind end in the interstitial space. They are more permeable to proteins and cell debris. The minute capillaries join together to form larger lymph vessels which cover the arteries and veins. Lymph vessels consist of numerous cup shaped valves that ensure the unidirectional flow of lymph towards the thorax. The contraction of adjacent muscles and regular pulsation of larger arteries induce milking action which facilitates the onward movements of lymph. The thoracic and right lymphatic ducts are formed by the association of lymph vessels together and they empty the lymph into the subclavian veins.

Lymph node : Lymph nodes are bean shaped, located along lymphatic vessels in a group. It is 1-25 mm long, covered over by a capsule of dense connective tissues that extends into the node, forming the trabeculae, which divide the node into compartments. Lymph node contains lymphocytes and macrophages. Nearly about 4-5 afferent lymph vessels enter the lymph node and only one efferent vessel carries lymph from the lymph

node. Hilum is the concave surface of the lymph node, where in the artery enters and vein leaves. Internal to the capsule is a supporting network of reticular fibers and fibroblasts, which along with capsule and trabeculae constitute the stroma of the lymph node. The parenchyma of lymph node is divided into a superficial cortex and deep medulla. The superficial cortex consists of outer and inner cortex. The egg shaped B cells known as lymphatic nodules are found in outer cortex, while the inner cortex contains T cells and dendritic cells that enter the lymph node from the other tissues. The medulla contains B cells, antibody producing plasma cells and macrophages.

➤ Functions of the lymph node

1. Lymph node acts as a filter and traps foreign particles;
2. Phagocytosis i.e. engulfment of particulate matter, bacteria, cells from malignant tumor;
3. Multiplication and proliferation of T and B lymphocytes

➤ Spleen

Spleen is oval shaped, and is the largest lymphatic organ, 12 cm in length, 2.5 cm in thickness and contains reticular and lymphatic tissue (figure 34.1). It lies in the left hypochondriac region between the stomach and diaphragm. Impressions are the notches found in the adjacent organs of lymph which includes gastric impression (stomach), renal impression (left kidney), and the colic impression (left colic flexure of large intestine). Similar to lymph node, spleen also has hilum, through which splenic artery, vein and efferent lymphatic vessels enter. The capsule, trabeculae, reticular fibres and fibroblasts form the stroma; the functional part i.e. parenchyma of the spleen consists of red and white pulp. Red pulp consists of a dense network of fine reticular fibres, continuous with those of the splenic trabeculae, to which are applied flat, branching cells. The meshes of the reticulum are filled with blood. The removal of ruptured, worn out, or defective blood cells and platelets by macrophages, storage of platelets and blood cell production during foetal life are the important functions carried out in the red pulp of the spleen. The white pulp consists of lymphocytes and macrophages. The blood circulates into spleen via splenic artery as it enters the central arteries of the white pulp.

B and T cells perform immune functions and macrophages are involved in phagocytosis in white pulp of spleen.

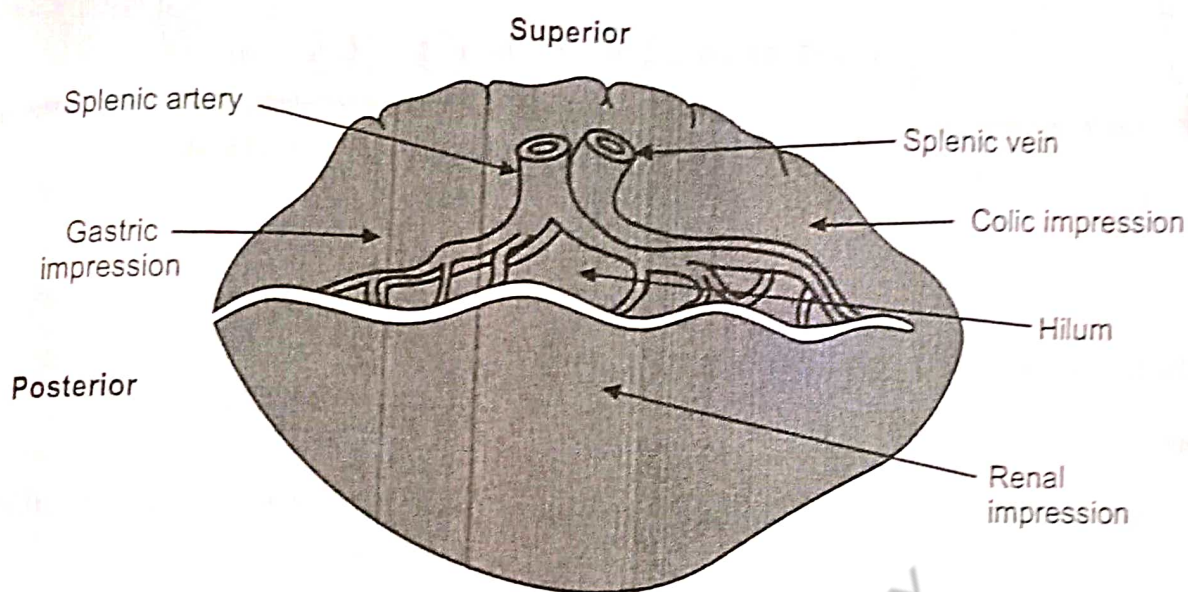


Figure 34.1 : The spleen

➤ Thymus gland

It is located anterior to the sternum and posterior to the heart having weight of approximately 30-40 g in adults. It consists of 2 lobes attached by areolar tissue. The lobules of thymus consist of framework of epithelial cells and T lymphocytes. Thymus gland is involved in development and production of mature T lymphocytes. The maturation of T lymphocytes is initiated by hormone called as 'thymosin'.

➤ Pathological significance

Lymphoma - the cancer of the lymph nodes

Hypersplenism - abnormal splenic activity because of enlargement of spleen associated with excessive destruction of blood cells.

Ref Result - Lymphatic system was studied successfully.

EXERCISE

1. What is lymph?
2. Give the role of lymph capillaries.

STUDY OF THE MALE REPRODUCTIVE SYSTEM

experi^o - 23

> Aim

To study the male reproductive system.

> Theory

Reproduction is a process in which an animal or plant produces an individual like itself.

The male reproductive system consists of external genital organs viz, scrotum, penis and urethra and internal reproductive organs such as testes, vas deferens, seminal vesicles and prostate gland bulbourethral gland etc.

Scrotum : It is a pouch like structure hanging from the base of the penis (figure 35.1). The scrotal septum divides vertically into two sacs, each one containing testes. The position of scrotum and contraction of its muscle fibers regulate the temperature of testes.

Testes : Testes are two in number, suspended in each sac of scrotum by spermatic cord. Each testis is about 5 cm in length, 2.5 cm in diameter with 10-20 gm in weight and covered by tough fibrous capsule. Each testis contains spermatogenic cells and sertoli cells in seminiferous tubules, supporting the process of spermatogenesis. Seminiferous tubules produce sperms, which during intercourse, enter the vagina and into fallopian tube of female reproductive system where it fertilises the ovum (released from ovaries) in the fallopian tubes. Testes are involved in spermatogenesis and secretion of male sex hormones i.e. testosterone from interstitial or Leydig cells.

Penis : It is a male genital organ for reproduction consisting of urethra for excretion of urine as well as semen ejaculation. It is cylindrical in shape and consists of glans penis, and the body. The body of the penis is composed of fibrous tissue known as tunica albuginea. The dorsolateral muscles are called the corpus cavernosa. Upon dilation of blood vessels of corpus cavernosa, erection of penis takes place causing maximum blood to enter into blood sinus (figure 35.1).

Epididymis : It is a 4 cm long, comma shaped organ that lies along the posterior border of each testis. It is divided into head, body or tail. The tail continues as vas deferens. It is the site for sperm maturation, where the sperms acquire motility. Epididymis is also the storage site for sperms and helps to propel them by contraction of vas deferens.

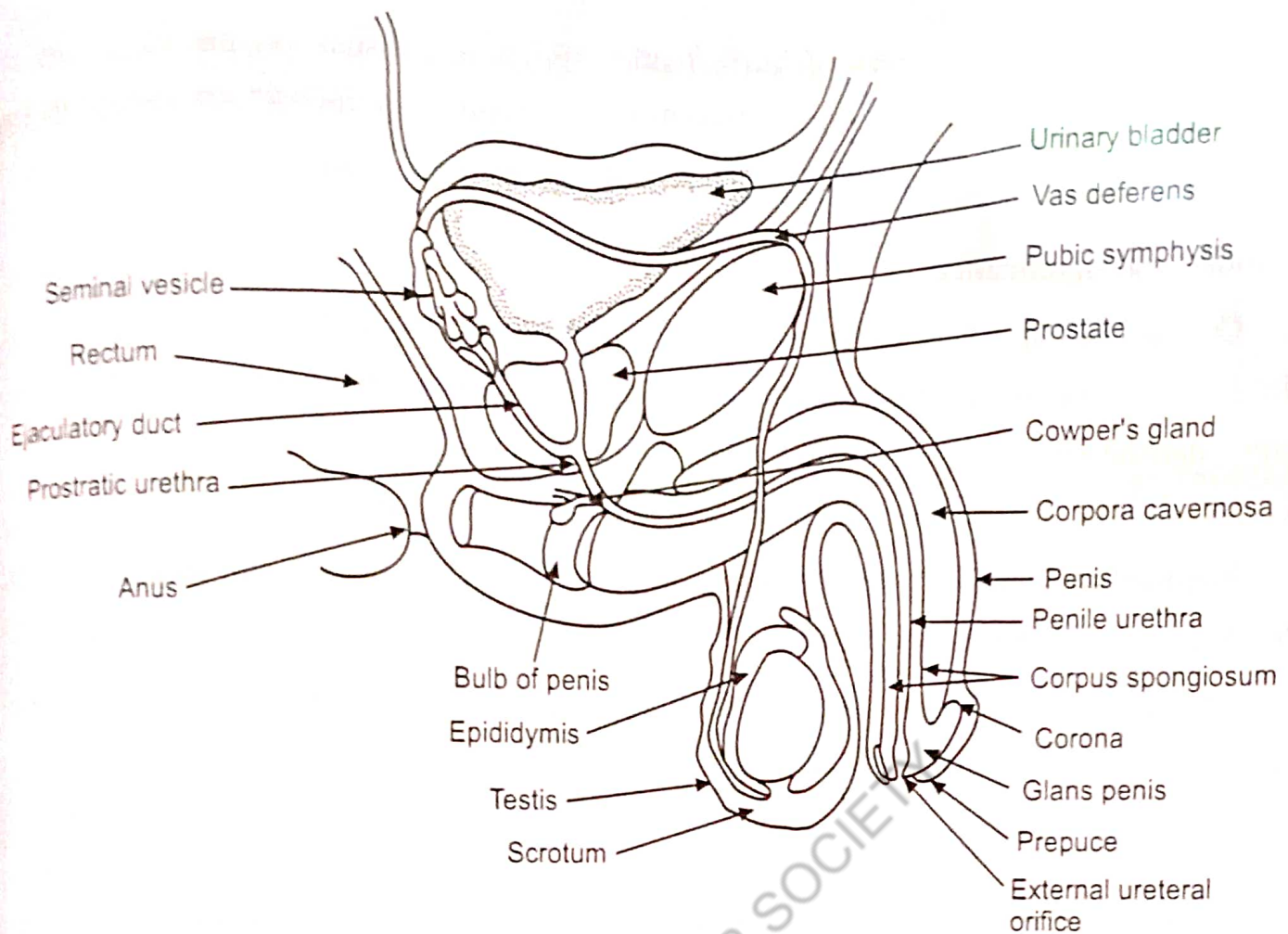


Figure 35.1 : Male reproductive system

Vas deferens : As the tail of epididymis continues, it leads to vas deferens, which is about 45 cm long; dilated part of vas deferens is called as ampulla.

Vas deferens stores and expels the sperm during ejaculation by contraction of muscular wall.

The urethra : It forms the terminal part of the duct of the reproductive and urinary system, and is the common pathway for semen and urine

The seminal vesicle : It is the accessory sex gland of the male. It consists of two pouch like structure, 4 -5 cm in length. Each seminal vesicle secretes a viscous alkaline fluid which contains fructose for ATP production by spermatozoa. Each seminal vesicle communicates to form ejaculatory duct. Fluid secreted by seminal vesicle normally constitutes about 60% of the total volume of semen.

Prostate gland : Prostate gland is located in the pelvic cavity anteriorly to the rectum. The prostate gland secretes milky alkaline fluid, which aid in lubrication during intercourse. It composed of citric acid, proteolytic enzyme and constitutes about 25% of total volume of semen.

Bulbourethral gland : This gland situated inferior to prostate on the either side of membranous urethra. It secretes alkaline fluid into urethra in sexual stimulation. It also secretes mucus that helps in lubricating the penis during intercourse.

Pathological significance

Cryptorchidism : It is a condition in which testes remain at undescended position in the inguinal ring, sometimes in abdomen. Cryptorchidism may occur due to short spermatic cord, narrow inguinal canal, adhesion to peritoneal or inadequate testosterone secretion. Cryptorchidism may result in infertility, inguinal hernia and malignancy.

Elephantiasis : It is the thickening of scrotum skin which looks like elephant's hide, leading to enlargement of scrotum.

Prostatitis : It is the inflammation of prostate gland occurs commonly due to bacterial infection mainly through urethral route.

Result of Male Reproductive system studied.

EXERCISE

1. Enlist the various male reproductive organs with their functions.
2. Give the anatomy and histology of the male reproductive system.

EXPERIMENT NO. 36

STUDY OF THE FEMALE REPRODUCTIVE SYSTEM

exp-24

Aim

To study the female reproductive system.

Theory

Female reproductive system consists of ovaries, fallopian tubes, vagina, vulva (external genital organs) and breasts (figure 36.1).

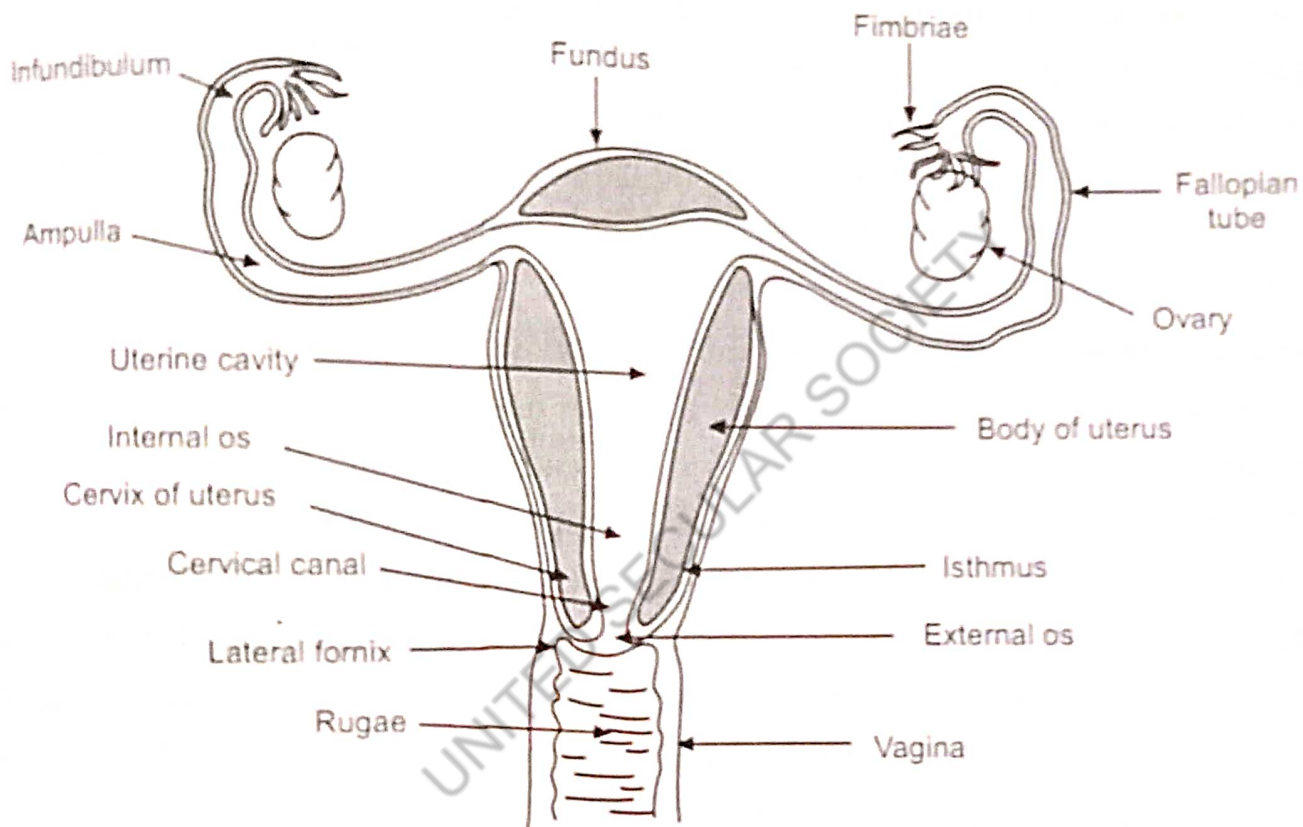


Figure 36.1 : Female reproductive tract

Vagina : It is a tube lined structure, 10-12 cm long that begins from the cervical region of the uterus. It functions as a passage for the foetus at the time of delivery, menstrual blood during menses and sperms during sexual intercourse. A recess called fornix is attached to the cervix on which the intrauterine devices (contraceptive device) especially diaphragm are placed. Vaginal smooth muscles adequately stretch during child birth and intercourse. The superficial layer of the vagina, called the adventia is composed of connective tissue. At the vaginal orifice, there is a thin membrane called hymen, forming border of the orifice (os) that get ruptured during intercourse.

Vulva : It includes the following structures-

Mons pubis : It is anterior to the urethral and vaginal openings and is composed of adipose tissue, covered with skin and pubic hair.

Labia majora : These are two folds extending from mons pubis, to the perineum. It is made up of adipose tissue, sebaceous glands, and sweat glands with pubic hair.

Labia minora: These are two folds on both side of the vagina composed of fatty tissue, sebaceous glands and sweat glands.

Clitoris : It is located anterior to the labia minora. It is a cylindrical mass of erectile tissue. The stimulation of clitoris produces sexual excitement in female.

Vestibule : It is the space between the labia minora (inner labia or vaginal lips, flaps of skin on either side of the vaginal opening and is surrounded by labia majora) and is occupied by the vaginal orifice, the hymen and the urethral orifice. This tissue helps to narrow the vaginal orifice during sexual intercourse which puts pressure on the penis. Within the urethra and vaginal orifice are the paraurethral mucus secretion and bartholins gland respectively. These glands secrete mucus during sexual excitement and aids in lubrication during intercourse.

Breasts (mammary glands) : This gland is responsible for synthesis and expression of milk under the influence of hormone viz; prolactin and oxytocin. Each breast has nipple, behind which are present the lactiferous ducts and sebaceous glands. Pigmented area around the nipple is the areola .The breast is supported by suspensory ligaments, which pass through the skin lying deeply inside the breast. Each breast has 20-25 lobes separated by adipose tissue .The lobules of breast contain alveoli and is surrounded by myoepithelial cells. Contraction of these cells under the influence of oxytocin (a hormone released from the posterior lobe of pituitary gland) results in the expression of milk. Lactation is the process of synthesis and ejection of milk from breasts.

Ovaries : These are two in number which produce sex hormones (estrogen and progesterone) and the ova. Each ovary lies in the shallow cavity on the lateral wall of the pelvis attached to uterus by broad ligament called as mesovarium. Each ovary measures about 2-4 cm in length, 2 cm in breadth and is 1.20 to 1.40 cm thick, consisting of fibrous tissue, blood and lymphatic vessels, nerves etc (figure 36.2).

Fallopian tubes : These are two in number, lying one on each lateral side of fundus of the uterus. Each tube measures about 10 cm long. These tubes are responsible for transport of ovum towards the uterus. The funnel shaped region of fallopian tube is known as infundibulum. The infundibulum has finger like projections. The fallopian tube is made up of three layers of viz. serosa, muscularis and mucosa which help in the movement of the

fertilised ovum. Also due to peristaltic action of the muscularis, ovum is propelled along the tube.

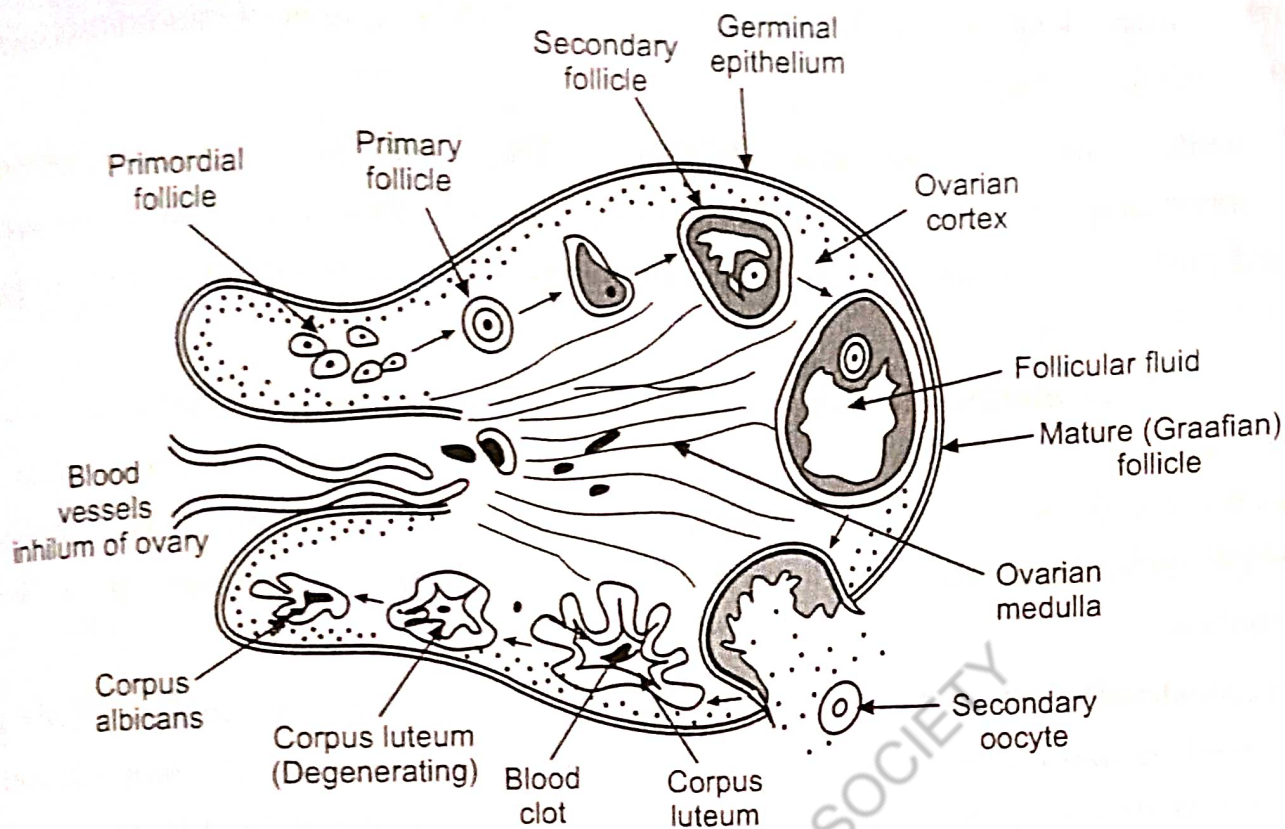


Figure 36.2 : Ovary

Uterus : Uterus is present between the bladder and rectum. It is the site for implantation of fertilised ovum, development of the embryo and foetus and also a passage for menstrual bleeding. It is a pear shaped organ having 7.5 to 8 cm long, 5 cm wide and 2.5 cm thick having fundus, body and cervix. Uterine cavity is the space between the uterine walls. Uterus also has three layers, outer layer is perimetrium, myometrium (middle having smooth muscle) and endometrium. Myometrium produces coordinated contraction under the influence of oxytocin during labor, helps expulsion of foetus from the uterus. Endometrium has two important layers, stratum functionalis and basalis. Stratum functionalis sloughs off (rupture) at the onset of menstruation while stratum basalis gives rise to formation of new stratum functionalis after menstrual bleeding.

➤ Pathological significance

Dysmenorrhea : Pain during menstruation occurs due to tumour, formation of ovarian cysts, pelvic inflammatory disorder, intrauterine devices, oral contraceptive usage etc.

Pelvic inflammatory disease : Bacterial infection of pelvic organs (uterus, uterine tube, ovaries) characterised by pelvic soreness, lower back pain, abdominal pain etc

Vulvovaginal candidiasis : It is characterised by itching, thick yellowish vaginal discharge, pain, and commonly occurs due to fungal infection with *Candida albicans*. Antifungal drugs like Fluconazole are commonly used for treatment of candidiasis infection due to *Candida albicans*.

Polycystic ovarian syndrome (PCOS) : This syndrome is characterised by oligomenorrhoea, anovulation, infertility, hirsutism and obesity in young female with enlarged and cystic ovaries. This may be due to excess androgen secretion and less follicle stimulating hormones.

Dysfunctional uterine bleeding : Excessive bleeding during or in between menstrual periods without a causative uterine lesion. It occurs commonly in association with anovulatory cycle i.e. menarche (beginning of the cycle) and menopause (cession of menstrual cycle). Anovulation occurs due to hyper secretion of estrogen alone without progesterone.

Premenstrual syndrome : It is cystic disorder characterised by edema, weight gain, breast swelling, pain, constipation, anxiety, irritability, headache, etc. A complete and diet with carbohydrates, proteins, fibre and analgesic drugs (ibuprofen or diclofenac sodium) can reduce the severity of this disorder.

Endometriosis : It is a condition in which cells from the lining of the endometrial layer grow outside the uterine cavity and is characterised by symptoms such as bleeding, severe pain during menstruation and infertility. The main sites for abnormal endometrial development are ovaries, uterine ligaments, rectovaginal septum, pelvic peritoneum, vagina, vulva, etc.

Result:-

EXERCISE

1. Enlist the various organs of the female reproductive tract
2. Describe the anatomy of the ovary
3. Define the following terms
 - (a) Endometriosis,
 - (b) Dysmenorrhea,
 - (c) Pelvic pain

EXPERIMENT NO. 37

STUDY OF THE HUMAN EYE

29

exp:- 25

Aim

To study the human eye.

Theory

The eye is a special organ for the sense of sight. It is located in the orbital cavity; it is spherical in shape and 2.5 cm in diameter. The eye ball measures about 2.5cm diameter. The orbit of the eye is formed by different bones which protect the eye ball. Anatomically, the wall of the eye ball is divided into 3 layers. Outer layer is a fibrous coat; consisting of sclera and cornea, the middle layer is a vascular coat consisting of choroid, ciliary body and iris. The inner layer known as retina consists of nervous tissue (Figure 37.1).

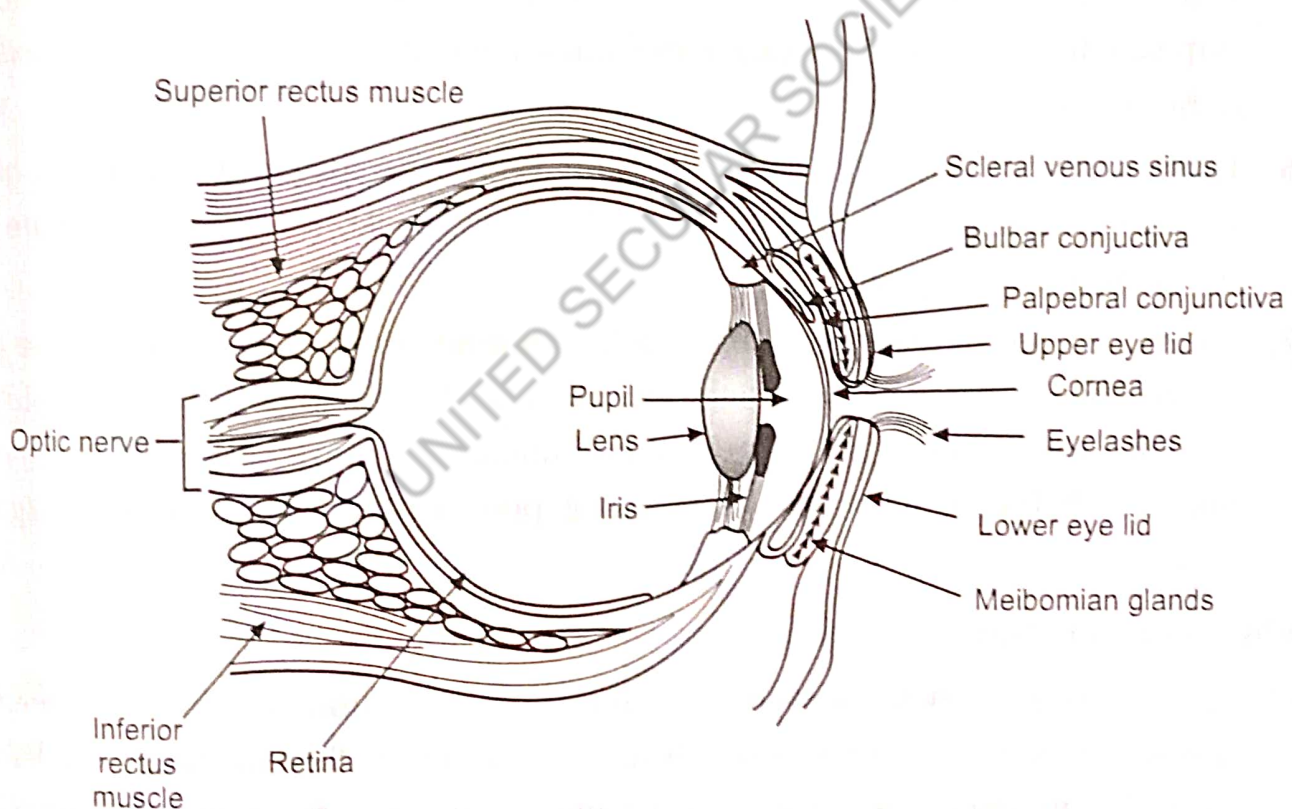


Figure 37.1 : The Human Eye

1. **Sclera** : The white region of eye is made up of collagen fibers and fibroblast. The fibrous tissue of sclera maintains the shape of the eye and also provides site for attachment to the extrinsic muscles of the eye.

2. **Cornea** : It is 0.5-1.0 cm thick, made up of epithelium, it functions in transmission light toward retina as well as provides effective barrier against bacterial invasion.
3. **Choroid** : It is situated posterior to the sclera and is very vascular, deep chocolate brown in colour. Light enters the eye through activating the nerve ending in the retina and finally absorbed by choroid.
4. **Ciliary body** : Presents anteriorly to the choroid, consists of the non – striated muscle fibers, epithelial cells and contains ciliary process. Secretion from epithelial cells forms aqueous humor. The size of pupil changes due to contraction and relaxation of ciliary muscles under postsynaptic stimulation and oculomotor nerve.
5. **The iris** : It is anterior to ciliary body, between the cornea and lens, consists of circular and radial smooth muscles. At the centre of the iris is the pupil; the size of the pupil changes during contraction of circular muscle and radial muscle. Circular muscle has parasympathetic innervations and upon activation it contracts (meiosis) and the size of pupil reduces; this is observed in bright light. In bright light, the sympathetic nerve innervates the radial muscle and its activation leads to relaxation of radial muscle (mydriasis).
6. **Lens** : It is a circular- biconvex transparent body. The suspensory ligaments of the ciliary body holds the lens enclosed within the capsule. It is elastic in nature and lies posterior to the pupil.
7. **Retina** : It lines in the inner surface of the choroid and is composed of nerve cells fibers. They acts as rods and cones and are activated depending upon the intensity of light passing into the eye. The vitreous humour in the eyeball cavity, posterior to the lens, helps in maintaining intraocular pressure to support the retina against choroid.

➤ **Physiology of vision**

Photoreceptors and photo pigments – Stimulation/ activation of the photo receptors takes place when the image of the object is focused on retina, thereby transferring light to bipolar cells. The rhodopsin of rod and other pigments of cones are responsible for colour vision.

Optic tracts : It is the pathway posterior to the optic chiasma. The tract consists of nasal fibers of retina. The tract goes back side to meet lateral geniculate into the cerebrum. Lateral geniculate situated posterior and lower to the thalamus and is the relay center for visual information received from the retina of the eye. It collects information

from the ascending retinal ganglion cells through the optic tract and from the reticular activating system and thus neurons send their axons via optic radiation.

Pathological significance

Cataract : It is the clouding of the lens inside the eye which leads to decrease in vision. It is the most common cause of blindness and is conventionally treated with surgery.

Glaucoma : It is a group of ocular disorders with multi-factorial etiology, characteristic with increase in intraocular pressure-associated optic neuropathy that results in impairment in vision.

Cycloplegia : It is paralysis of the ciliary muscle of the eye, resulting in loss of accommodation.

Result —

EXERCISE

1. Give the anatomy of the human eye.
2. What is the role of retina?
3. Give the physiology of vision.
4. Describe the following

EXPERIMENT NO. 38

STUDY OF THE HUMAN EAR

exp. 26

30

➤ Aim

To study the human ear

➤ Theory

Ear is the organ of hearing. The cranial nerve (8th cranial nerve) carries sensation of hearing towards the cerebral cortex which is a region for the integration and interpretation of information.

Ear is divided into 3 regions

External Ear : Collects sound waves and transmits towards middle ear.

Middle Ear : Middle ear also called as tympanic ear, which conveys sound vibrations to the oval window

Internal Ear : Receives and interprets the sound for hearing and equilibrium.

External ear : Consists of the following parts.

Pinna OR Auricle : It is the expanded part, made up of fibroblastic cartilage covered with skin. The expanded outer edge is known as helix and lower most part is the lobule. Ligaments and muscle attach the pinna to the head.

External auditory canal : It is an irregular shaped long tube about 2.5cm in length which lies in the temporal bone and leads from auricle to the ear drum. It is divided into cartilaginous and osseous part. Cartilaginous part is about 1/3rd of auditory and contains ceruminous glands which secrete wax called cerumen that helps to trap the entry of unwanted particles into the ear.

Middle ear : It is small and filled with air and is known as tympanic cavity. The middle ear contains a chain of three small bones called auditory ossicles of which one end is connected to the ear drum and other end to fenestra vestibuli. Auditory ossicles also contain malleus, incus and stapes (figure 38).

The handle of the malleus attaches to the internal surface of the ear drum. The head of the malleus articulates with the head of stapes. The base of the stapes fits into the oval window.

Internal ear : Internal ear is bony and in the form of a membranous labyrinth. The space between two labyrinths contain perilymph fluid, whereas, membranous labyrinth contains endolymph fluid.

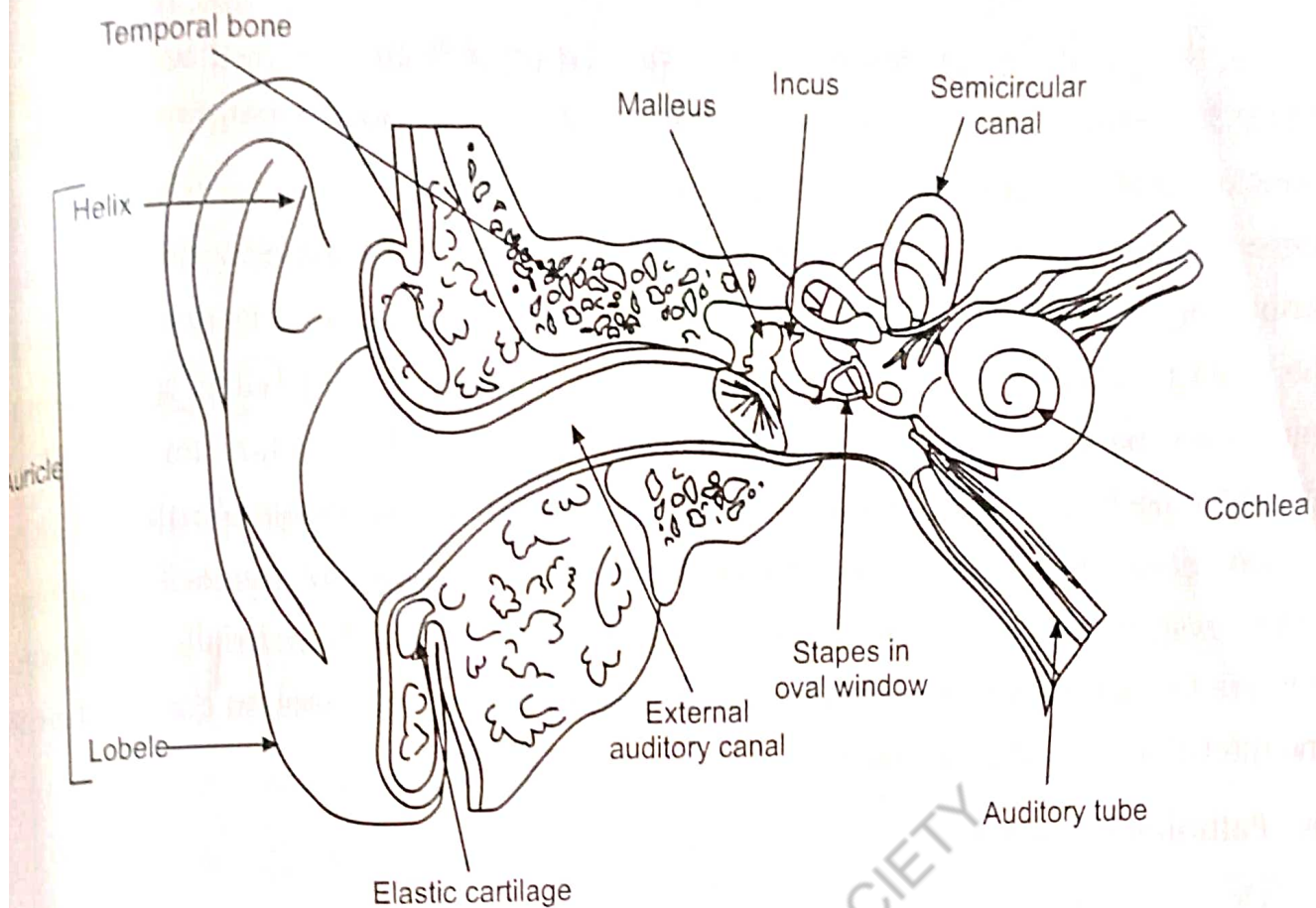


Figure 38.1 : The ear

The bony labyrinth is divided into 3 parts

Vestibule is an expanded part of the middle of ear contains fenestra vestibule and cochlea.

The **cochlea** is snail shaped organ having broad base and apex. The three canals are continuous with the vestibule. The membranous labyrinth in the vestibules consists of sac called utricle and saccule which are connected by small ducts.

At one end of each semicircular canal is a swollen enlargement called the ampulla. The vestibular branch of the vestibulocochler nerve (13th cranial nerve) consists of ampullary, utricular and saccular nerves. Cell bodies of the sensory neurons are located in vestibular ganglia. Auditory nerve goes posteriorly through temporal bone and reaches the hearing area of the cerebral cortex.

➤ Physiology of hearing

The auricle or pinna collects the sound waves and transmits them into the external auditory canal, where it strikes the ear drum. Because of the change in the pressure of air, the ear drum vibrates. The central area of the ear drum connects to malleus, which also vibrates. These vibrations are transferred to incus and in turn to stapes. As the stapes

vibrate, the membrane of oval window is pushed in and out. The oval window vibrates about 20 times more vigorously than the ear drum because of transmission of small vibration oscillates over a larger surface area. The movement of oval window sets up fluid pressure waves in the perilymph of the cochlea. As the oval window bulges ahead, it pushes the perilymph of the scala vestibuli. The scala vestibule transmits pressure waves to the scala tympani and then to the round window, causing it to bulge outward in the middle ear building pressure waves in the endolymph (rich in potassium ions) present inside the cochlear duct. Vibration of basilar membrane in the endolymph, allows hair cell movement of spiral organ against tectorial membrane. Bending of stereocilia (mechano sensing organelles of hair cells)leads to receptor potential which results in the nerve impulse formation through auditory nerve to hearing area of the cerebral cortex where the interpretation of wave take place.

➤ Pathological significance

Deafness : hearing impairment, or hearing loss is a partial or total inability to hear.

Otitis : Inflammation of ear due to infection.

Result ✓

EXERCISE

1. Enlist the various parts of ear
2. Give the anatomy of the ear.
3. Give the physiology of hearing.
4. What is deafness?

RECORDING OF ELECTROCARDIOGRAM

EX-27

> Aim

To record Electrocardiogram (ECG)

> Requirements

Electrocardiograph with leads

> Theory

Electrical current generated in the heart by action potential can be detected/recorded by ECG on the body surface. This will record the signals generated by heart muscle fibers during each heartbeat. The ECG is recorded by the use of chest leads and limbs leads. These leads positioned on the chest, arms and legs, amplify electrical signals and thus produce various tracings that enable the determination of conduction pathway, size of heart, causes of chest pain and areas of heart damage etc. The instrument used to record these changes is called as an electrocardiograph.

> Procedure

1. Ask the subject to lie down and relax.
2. Apply the jelly at left and right wrist and left and right leg above the ankle joint to hold the leads.
3. Connect the electrodes at the above mentioned positions.
4. Switch on the machine and keep the stylus at the centre of the paper.
5. Adjust the sensitive to get standard.
6. Adjust the lead select or knob to record the ECG.
7. Place the chest electors in proper position on the chest after cleaning and application of jelly.
8. Record the ECG and observe various intervals as shown in figure 16.

Following tracing can be observed in normal ECG

P Wave – Deflection produced by atrial depolarisation

QRS complex – Represents rapid ventricular depolarisation. Impaired or abnormal conduction of heart results in widening of QRS complexes

T Wave- Indicates ventricular depolarisation

ST Interval-Represents the time when the ventricular contractile fibers contract during plateau phase. ST intervals increase during myocardial infarction and reduce in coronary ischemia, hypokalemia and digitalis toxicity.

QT Interval - Represents the electrical depolarisation and repolarisation of the left and right ventricles. Prolongation of QT interval is observed in ventricular tachyarrhythmias and shortened QT can be associated with hypercalcemia.

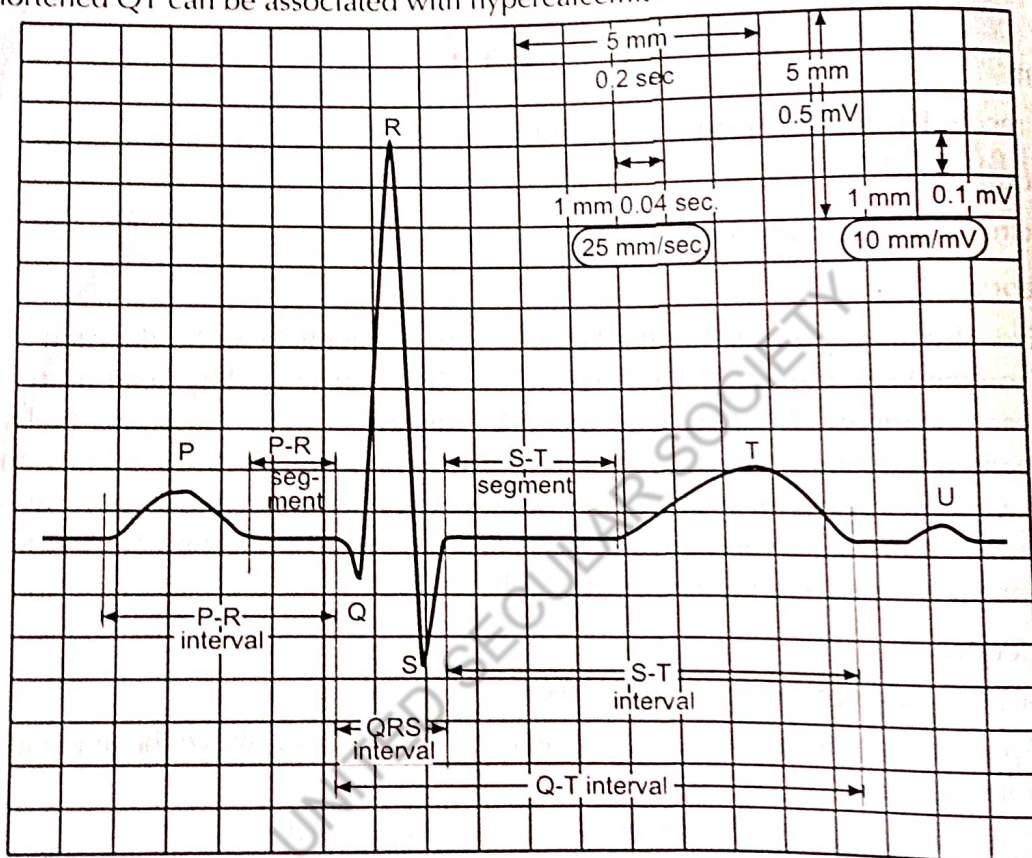


Figure 16.1 : ECG graph

➤ Pathological Significance

1. The use of ECG is used to analyse the relative size of the heart
2. Study of distribution of rhythmical quality and conduction system of heart

Diagnosis of myocardium ischemia, pericarditis caused due to *Mycobacterium* infection and hyperkalemia (high K^+)

Result

EXERCISE

1. What is ECG?

➤ Aim

To measure the

➤ Theory

Body temperature is a safe and effective healthy body mechanism for thermoregulation. It varies, although accompanied by controlled chemical thermostat set i

➤ Technique

1. Oral cavity: reliable
2. Tympanic: emissive, audiotape factor
3. Axillary: therm
4. Rectal: mea

JIAP - Practicals

Adm.

S.No.	Practical
1	To record the body temp. using the thermometer
2	To record the blood pressure of a subject
3	To study the gross anatomy and physiology of Digestive System.
4	To study the anatomy and physiology of epithelial tissues.
5	To study the anatomy and physiology of muscular tissues.
6	To study the anatomy and physiology of Nervous system.
7	To determine the bleeding time of one's own blood.
8	To determine the blood clotting time of one's own blood.
9	To study of microscope.
10	To Record own pulse rate. (Page No- 65)
11	To determine the no. of WBCs in one's blood sample.
12	To determine the no. of RBCs
13	To determine the Blood group of one's own Blood sample.
14	To study the Cardiovascular system.
15	To study the human digestive system.
16	To study the human respiratory system.
17	To study the human urinary system.
18	To study the human skin
19	To study the human pectoral girdle and bones of the upper limb.
20	To study the bones of the vertebral column.
21	To study the various human joints
22	To study the human central nervous system
23	To study the lymphatic system.

S.NO

Practical

24.

To study the male reproductive system.

25

To study the female reproductive system.

26

To study the human eye.

27

To study the human ear.

28

To record Electrocardiogram (ECG).

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