



JHARKHAND
Rai University

UGC RECOGNISED UNIVERSITY

ACCREDITED BY NAAC

PRACTICAL LAB MANUAL

REMEDIAL BIOLOGY

B. Pharm Ist Semester

EXPERIMENT NO.: 1

AIM: STUDY OF COMPOUND MICROSCOPE

Objects which are ordinarily not visible by naked eye are seen with microscope. Generally, an object smaller than 0.1 mm cannot be seen by our eyes. Therefore, to observe an object smaller than this, compound microscope is very helpful. Hand lens (magnifying lens) is also a type of microscope but its magnifying capacity is very low. Dissecting microscope is also used to visualize tiny things, but it has only one lens. Compound microscope is generally used in the laboratories. Therefore, description, use and maintenance of ordinary compound microscope is mentioned here.

1.1 Parts of a Compound Microscope

Take out the microscope from the box holding the arm by one hand and supporting the base by another hand. Place carefully on the table and study the names and functions of the parts as mentioned in the figure. The parts of a compound microscope can be divided into 4 main parts:

- (a) **Base:** This is U-shaped lower portion of the microscope on which the other parts of the microscope lie. Above the U-shaped portion, there is a perpendicular portion known as the pillar. On the top of this, another arm is fixed. This is known as inclination joint. This can be used to tilt the microscope at a desired angle.
- (b) **Arm:** It supports the body tube and base of the microscope. This portion is used to hold or carry the microscope. On the

base of this, stage is fixed. On the top of the arm body tube of the microscope is fixed and two knobs are fitted. One is for the coarse adjustment and the other for the fine adjustment. These are used for focusing the body tube.

- (c) **Body Tube:** This is attached to the knob of the arm. It has one lens on the upper end known as eye piece. This lens can be changed according to the required magnification. On the bottom of this tube there is a nose piece. Two to four lenses can be fitted in this nose piece. Because the lenses are fitted on the objective, these are known as objective lenses. These are fitted in the body tube, known as objective lens body. The objective lens body is fitted into the nose piece.
- (d) **Stage:** It is a platform having a circular hole in the centre to allow the passage for light from below. It is fixed to the base by the stand. One mirror is fixed to the stand. It is known as reflecting mirror. Below the stage is a condenser through which concentrated beam of light passes. Iris diaphragm is also attached to the condenser. The reflecting mirror reflects the light upward through the iris and diaphragm. This beam of light passes through the hole in the stage and provide light to the object kept on the slide. There are two clips for holding

the slide above the hole on the stage.

Operation (Use): Keep a clean prepared slide in the centre of the stage. Use clips to fix the slide on the stage so that it does not move. Now move the body tube by the help of coarse adjustment knobs. Bring the slide in focus under the objective lens. Focusing should be made sharp by the use of fine adjustment knobs. When the focus is sharp then study the slide. The specimen is viewed by keeping one eye on the eye piece and the second eye should be kept open. This type of compound microscope is known as monocular compound microscope.

Some compound microscopes have two body tubes. So, there are 2 eye pieces and specimen can be viewed by both the eyes. Such type of compound microscope is known as binocular compound microscope. In the research work generally binocular compound microscope is used.

1.2 How to use a Compound Microscope

To use the microscope first of all, rotate the nose piece until the low power objective is in line with the body tube and clicks into position. Open the iris diaphragm. Look through the eye piece, adjust the mirror and diaphragm to set a complete field of vision. Place the slide you want to examine on the stage of the microscope and by the help of the clips fix it. Move the slide till the object comes roughly to the centre of the hole or the stage. Bring the object into focus using the coarse adjustment knob. Turn the fine adjustment knob to bring the object into sharp focus.

How much magnification the object needs will be learnt through experience. Eye lenses of 5x, 10x or 15x are available. Some way objective lenses of 4x, 10x & 40x

are also available. The multiplication of magnification of eye piece and nose piece denotes the size of the object under observation.

Maintenance of Microscopes:

Microscope is a costly equipment. Therefore, it should be handled carefully. Always keep the microscope in an upright position while taking it from one place to another. As far as possible don't tilt the arm. Clean the lenses of the microscope with the lens paper or muslin cloth, never with the filter or any other kind of paper. If you are using the high-power objective lens then after the observation is over, turn the nose piece and bring low power objective lens in line with the hole in the stage. Objective lens should be kept at least 1 cm above the stage. After using the microscope always keep it in the box. Take care to see that the stage of microscope, the eye piece, the objective lens is dry and clean. No chemical should stick to these. Adjustment knobs and joints should be protected from rusting by applying Vaseline.

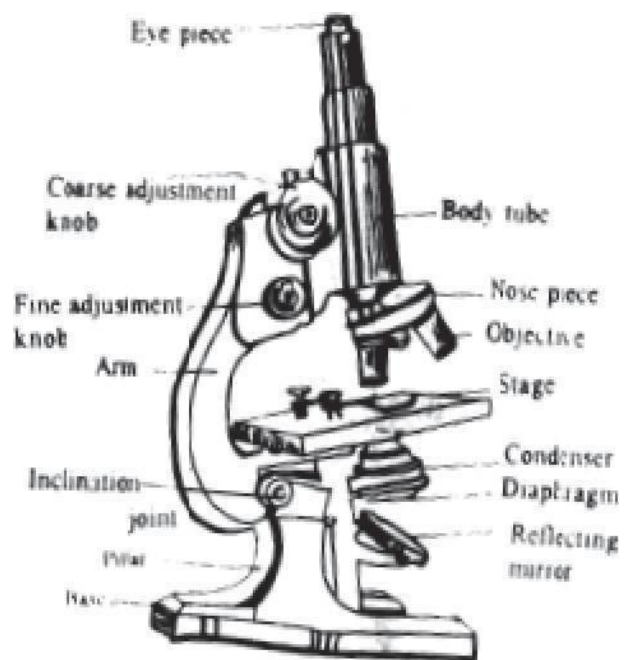
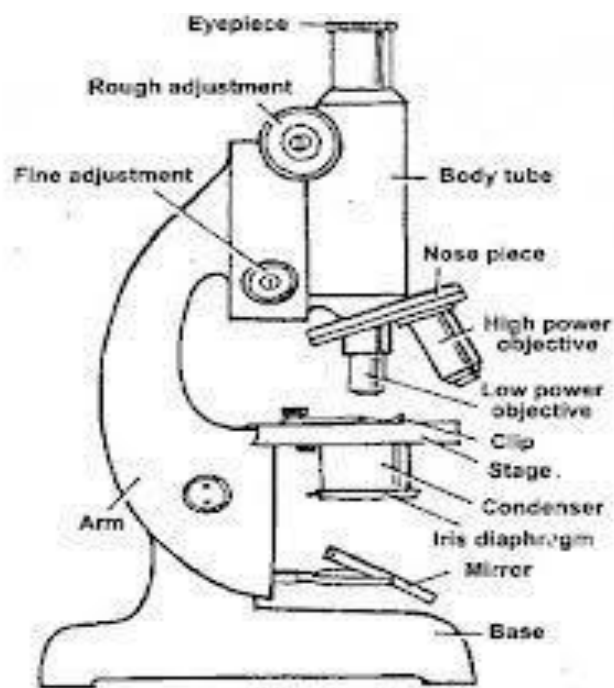
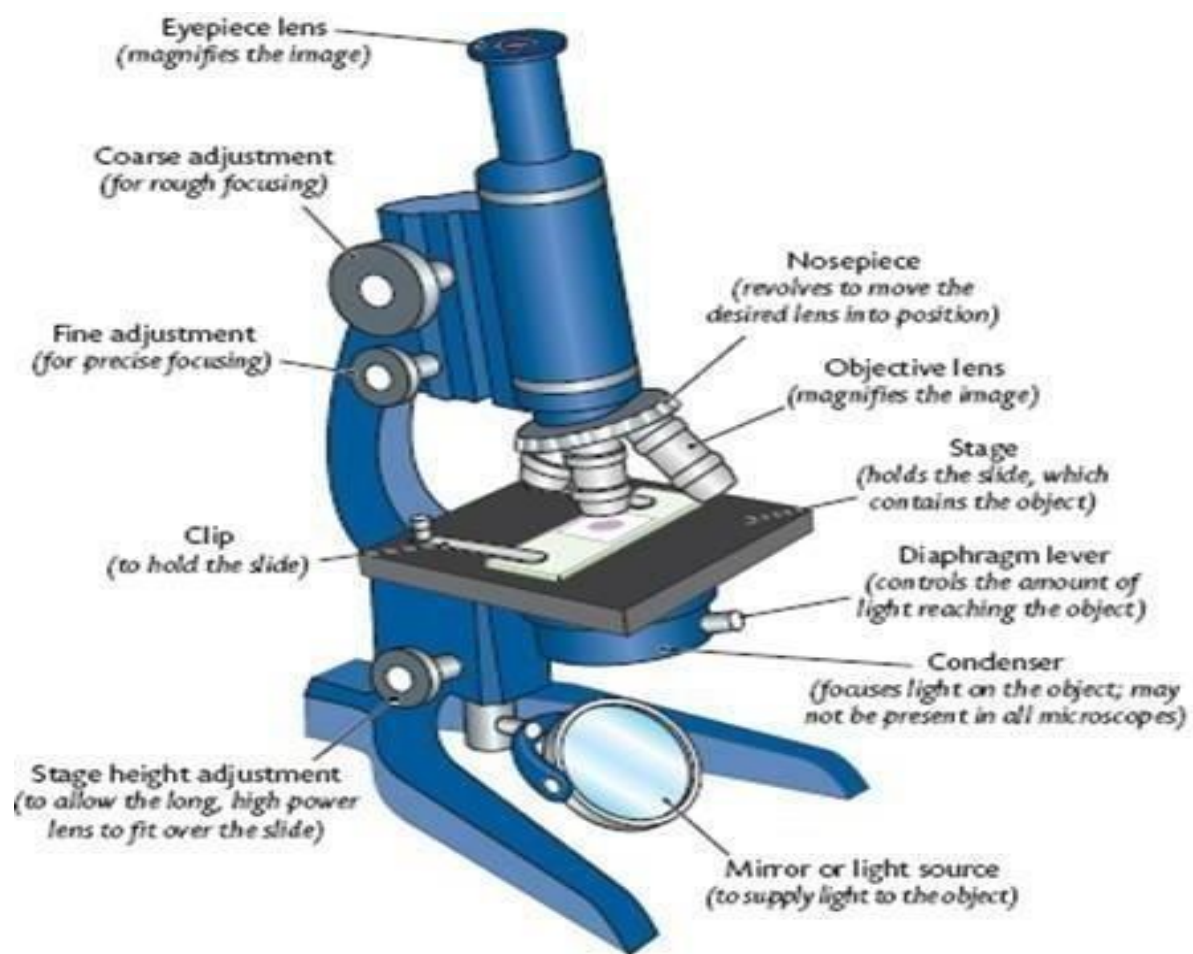


Fig. 1.1 A compound microscope



EXPERIMENT NO.: 2

STUDY OF SECTION CUTTING, STAINING & MOUNTING

Aim: To understand technique of section cutting, staining, and mounting.

Requirements: Fresh or preserved material of sunflower stem, root, fresh or preserved materials of maize stem and root, a sharp blade, microscope, slide, cover slips, watch glass, saffranine (1gm in 100 ml of 50% of ethanol), glycerin, brush, blotting paper.

Section cutting:

Section cutting is an art, where selection of appropriate shape and size of a crude drug sample.

Steps:

- Cut the cube of pith.
- With the help of a blade give vertical cut upto 2/3rd height.
- Slightly pull one side of the cube apart to make a wedge opening.
- Insert the leaf sample prepared into the wedge and press two sides of pith.
- The vertical side of pith may be tapered off upwards for convenience in section cutting.
- Take sections by moving the blade back and forth.
- Section ready for staining.

Staining process:

Steps

- Take a clean watch glass and add the staining solution to it.
- With the help of a brush, transfer the section taken from water to stain solution and keep for 2-3 minutes.
- Pick up the section after 2-3 min and transfer it to watch glass containing plain water.

Mounting process:

Steps

- Take a clean micro slide
- On this slide transfer the section to be mounted with the help of the brush
- Add one or two drops of glycerin –water on the section with a dropper.
- Take a clean cover slip, if any air bubbles slightly lift the cover slip and add a drop of glycerin-water and replace the cover slip till the air bubble is removed.
- With the help of a blotting paper, wipe off excess present in the cover slip. The slide is ready for observation.

EXPERIMENT NO.: 3

PREPARATION OF PERMANENT SLIDES

Aim: To prepare permanent slides using the given sections like leaf, stem and root.

Requirements: leaf, stem, and root.

Theory:

Dehydration preserves the cells and protects them from decaying. There are various dehydration agents but, in this experiment, we will employ the simplest using ethyl alcohol. Specimens that are already dry. When dehydrating the specimen with alcohol, the objective is to slowly replace the water in the cell with alcohol. Since pure alcohol will harden the cell wall and make an impenetrable barrier, it must be done gradually.

Materials and reagent:

Pre cleaned glass, slides, cover slips, lab brush, dissecting needle, compound microscope, ethyl alcohol,

Procedure:

- Prepare a thin stem section using a new blade or scalpel without damaging the tissues
- Take a cleaned watch glass add 3 drops of distilled water and 1 drops of ethyl alcohol and transfer the stem section into watch glass and incubate for 15 min
- After incubation remove the stem section and transfer to new watch glass containing 2 drops of ethyl alcohol and 2 drops of distilled water, leave it for 15 min
- Now again transfer sections into new section into new watch glass containing 3 drops of ethyl alcohol 1 drops of distilled water, leave it for 15 min
- Again, transfer section into another watch glass containing 4 drops of ethyl alcohol and incubate for 15 min
- Eventually transfer the dehydrated section into centre of the pre cleaned glass slides and add a drop of safranin and cover with cover slips. Then seal or cement the cover slips with nail polish.

EXPERIMENT NO.: 4

STUDY OF CELL

Aim: To study about the cell and its inclusions.

Requirements: Chart or model of cell.

Theory:

Cell: The smallest units of structure and functions of cell. There are many different types of human cell, though they all have certain similarities. Each type of cell is made up of chemical and carries out specific chemical reaction. The basic living unit of the body is the cell. Each organ is an aggregate of many different cells held together by intercellular supporting structures.

Each type of cell is specially adapted to perform one or few particular functions. Transport oxygen from the lungs to the tissues. although the red cells are the most abundant of any single type of cell in the body, there are about 75 trillion additional cells of other types that perform functions different from those of the red cell. The entire body, contains 100 trillion cells.

Although many cells of the body often differ markedly from one another, all of them have certain basic characteristics that are alike. For instance, in all cells, oxygen reacts with carbohydrate, fat, protein to release energy required for cell function. Further, the general chemical mechanism for changing nutrients into energy are basically the same in all cells, and all cells deliver end products of their chemical reaction into the surrounding fluids.

Almost all cells also have the ability to reproduce additional cells of their own kind.

Cell and its organelles

Cell membrane: The cell membrane keeps the cell together by containing the organelles with it. cell membranes are selectively – permeable, allowing materials to move both into and outside of the cell.

Cytoplasm: Cytoplasm is a jelly- like substance that is sometimes described as the cell matrix. It holds the organelles in place with the cell.

Nuclear membrane: The nuclear membrane separates the nucleus and the nucleolus from the rest of the contents of the cell.

Nuclear pore: Nuclear pore permits substances to pass both into, and out of the nucleus.

Nucleolus: The nucleolus is responsible for the synthesis of precursor of ribosomes and their storage.

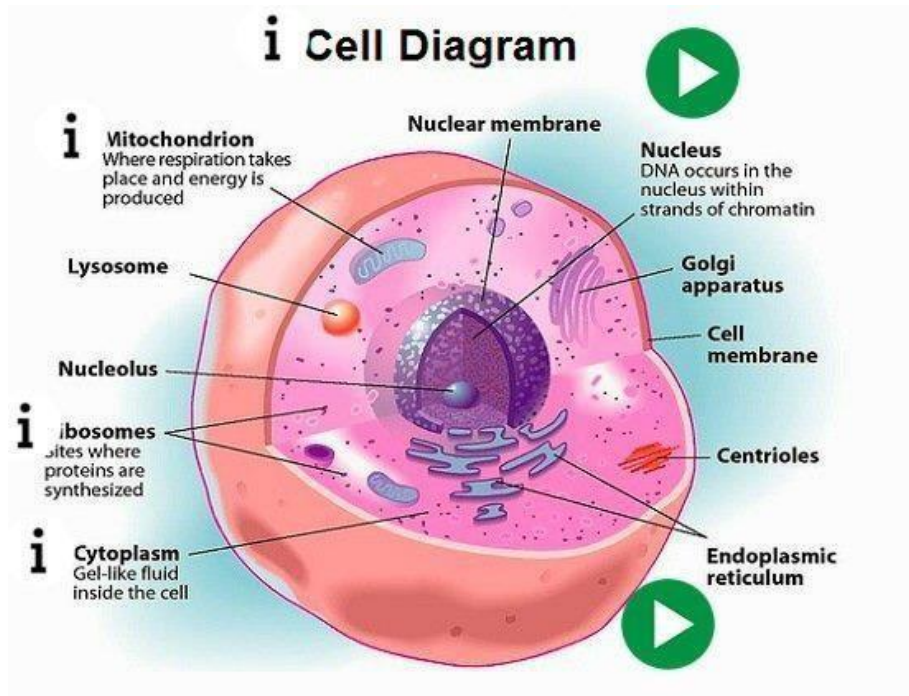
Nucleus: The nucleus is the control centre of the cell, which contains DNA in the form of genes, and also information for the formation of proteins.

Mitochondria: Mitochondria is a plural term, which is appropriate as these are not found alone. The number of mitochondria within the cells varies with the type of cells. These are the energy producers within the cells. They generate energy in the form of adenosine triphosphate.

Ribosomes: Ribosomes interpret cellular information from the nucleus and so synthesize appropriate protein as required

Golgi apparatus: The golgi apparatus of a cell is usually connected to an endoplasmic reticulum (ER)

Centrosomes: The centrosomes contain the centrioles, which are responsible for cell division.



EXPERIMENT NO.: 5

MODIFICATION OF LEAF

Aim: To study the different modification of leaf.

Requirement: preserved specimen of modified leaf's.

Theory: leaf is the most important vegetative organ of the plant. The leaf modifications are:

1. Leaf tendrils: These are thin and sensitive thread like structure that help the plant in climbing up against some support. The entire leaf is modified into tendril in similar the stipules become modified into dendrites.
2. Leaf hooks: The leaf is modified into hooks and help the plant to climb the support.
3. Leaf spines: In some plants the whole leaf or its parts get modified to hard pointed structure called spine. This modification helps the plant to cut down transportation and also protect the plants against the attack of grazing animals.
4. Phyllode: The lamina of leaf falls off its petiole gets flattened and takes on the function and shape of the leaf. This modification petiole is called phyllode.
5. Leaf pitcher: In the pitcher plant the leaf becomes modified into a pitcher. There is a slender stalk which coils like a tendril holding the pitcher vertical and the basal portion is flattened like a leaf. The insect is attracted by this structure and falls into the pitcher to be killed and digested by the plants with the secretion of the hydrolytic enzymes.
6. Leaf bladder: Some of the leaf segments are modified to form bladder. These bladders serve as floats for the aquatic plants and for trapping the insects.

EXPERIMENT NO.: 6

MODIFICATION OF STEM

Aim: To study different modification of stem

Requirements: Preserved specimen of modified stem

Theory: The upright part of the plant which grows from plumule of seed is called stem. Stem bears nodes, leaves and branches. The stem, its branches, leaves, flowers, and fruits constitute the shoot system of the plant. Some stems are modified to perform various functions.

A. UNDERGROUND SYSTEMS

- Rhizomes: They are horizontal, thick, stout, underground stem. They are swollen with the storage of food materials. They have nodes. These perennial structure bear auxiliary buds. The branching of the stem may be racemose (eg. saccharum)
- Corm: Fleshly, spherical stem with flattened base, grows vertically; bears many scale leaves, distinct nodes and internodes, buds and adventitious roots.
Tubers: Swollen tips of underground lateral branches of stem store food as starch, bear, eyes. Each eye is a node which bears bud and scar of scale leaves. (eg.: potato)

B. SUB AERIAL SYSTEM:

Stems are weak, therefore lie prostrate on the ground or may get partially buried in the top soil. The plants bearing such system are called creepers.

- Runner: It has long and thin internodes and the branches creep over the surface of the soil. They develop adventitious roots from the lower sides of the nodes. Ex. Grass oxalis.
- Stolon: Weak lateral branches which grows upwards then arches down to meet the soil, strike roots and produce daughter plants. Ex. Mint.
- Offset: It is a short runner with one internode long. It originates from leaf axil, grows as a short horizontal branch.

C. AERIAL STEMS

- In certain plants, the aerial stems or buds get modified to perform special function like climbing production, protection food storage, vegetative propagation etc
- Stem tendrils: Stem and its branches get modified into thread like spirally coiled leaf like structure which twine around neighbouring objects and help weak plants to climb. Ex. Grape vine
- Thorns: Straight pointed hard structures modifications of auxiliary or terminal buds act as defence organs or as climbing organs.

EXPERIMENT NO.: 7

MODIFICATION OF ROOT

Aim: To study different modification of root

Requirements: Preserved specimen of modified root

Theory: The plant body consist of root and shoot systems. Different parts of the plant perform different function.

A. Tap root modification:

Tap root are modified into different structures, these modified structures carried out specific functions like food storage. There are different types of modified tap roots like fusiform, napiform, conical, tuberous.

B. Adventitious root system:

In some plants the adventitious roots store food and become fleshy and swollen. It may assume the following shapes.

C. Vital Functions:

- Clinging roots: These cling to the host plant for support
- Aerial roots: These roots hang downward. Aerial roots are green in color and have a special outer covering called velamen.
- Photosynthetic root: These are green due to the development of chlorophyll in them.
- Parasitic roots: Theses roots grown into the host and come in contact with its conducting tissues. As they absorb nourishment from the plant and are therefore called suckling roots.

EXPERIMENT NO.: 8

T.S OF MONOCOT STEM

Aim: To cut a transverse section of a given monocot stem and make a temporary stained mount to study its structure

Requirements: Monocot stem of maize, blade petri dish, watch glass, brush, filter paper, glycerin, safranin, slides, cover slips

Procedure:

- Take a piece of monocot stem of maize and cut a transverse section of it with the help of sharp blade.
- The section should be thin and straight. Cut above 8-10 sections and place them in a petri dish containing water.
- Take 2-3 sections and place them on a glass slide in a drop of water and observe them under microscope.
- If the section visible in the microscope are clear, then stain them with safranin in a petri dish.
- Now wash the section with water and mount them in glycerin. Place the cover slip on the slide and ready to mount.

Observation:

1. Epidermis: It is the outermost covering of the stem represented by a single layer of compactly arranged, barrel shaped parenchyma cells.
2. Hypodermis: It lies immediately below the epidermis. It is represented by a few layers of compactly arranged sclerenchyma cells.
3. Ground tissue: The ground tissue is represented by several layers of loosely arranged parenchyma cells enclosing prominent intercellular spaces.
4. Vascular bundle: They are found irregularly scattered in the ground tissue. Each bundle is conjoint, collateral and closed.

EXPERIMENT NO.: 9

STUDY OF STOMATAL INDEX

Aim: To study the distribution of stomata on upper and lower surface of leaves and calculate the stomatal index.

Requirements: Potted plants, filter paper, coverslips, desiccators, cobalt chloride paper, microscope.

Procedure:

1. Remove the peel of a leaf taken from a potted plant and place it on a slide containing a drop of water or glycerin.
2. Observe it under the microscope.
3. Now take the peel from the other surface and repeat the procedure.
4. Compare upper and the lower surface.

Observation: Polygonal cells of epidermis are seen under the microscope stomata with kidney shaped guard cells are also seen here and there. Count the total number of epidermal cells as well as the total number of stomata visible in one field.

Stomatal index % = total number of stomata /total no of epidermal cells + no. of stomata $\times 100$

EXPERIMENT NO.: 10

STUDY OF PLANT TISSUES

Aim: To study the plant tissue- palisade parenchyma, collenchyma's, sclerenchyma, xylem, and phloem from permanent slides.

Theory: The organ of plants consists of different tissues. The study of tissues is called histology. A tissue is a group of cells which are similar in origin, structure and function. Mainly tissues are of two types.

Meristematic tissues

Permanent tissues

1. Parenchyma

Features:

- Cells are spherical or oval and isodiametric
- There are intercellular spaces between the cells
- Cells containing prominent nucleus and reserved food materials
- These are living and thin walled

2. Collenchyma

Features:

- Tissues are made up of isodiametric cells
- Their cell wall is thick more so in corners of the cell
- There is no intercellular spaces
- It provides strength and flexibility to the young stem.

3. Sclerenchyma

Features:

- The cells are long and highly thick walled due to deposition of lignin
- Protoplasm is crushed and the cells become dead at maturity
- The ends of the cell tapers into sharp point
- The cell cavity is very small

4. Xylem

Features:

- It is a complex tissue.
- It is made up of four kinds of elements like tracheids, vessels, xylem, parenchyma and xylem fibres.

5. Phloem

Features:

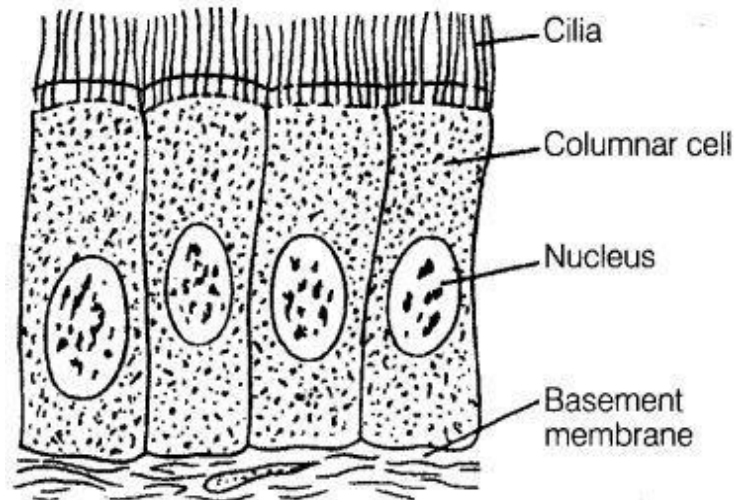
- These compounds are formed of four types of cells.
- They are sieve tube cells, companion cells, phloem parenchyma and fibres.

EXPERIMENT NO.: 11

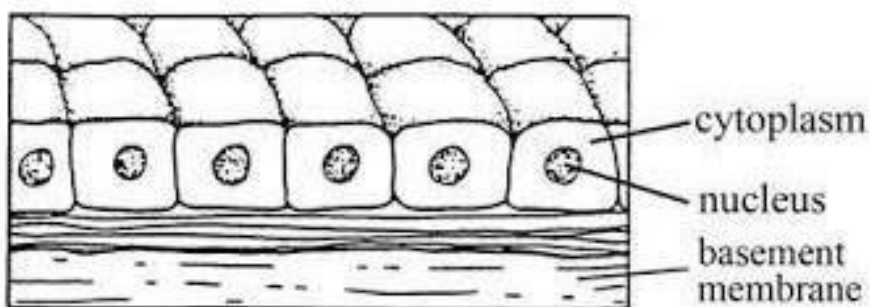
STUDY OF ANIMAL TISSUE

1. Ciliated Epithelium tissue:

Ciliated columnar epithelial cells are rectangular in shape and have between 200 to 300 hair-like protrusions called cilia. The mitochondria are found toward the apical region of the cell while the cell nuclei are found towards the base and are often elongated. Cells are interconnected via desmosomes and tight junctions, creating a semipermeable membrane that is more selective than the membrane found in other types of cells.

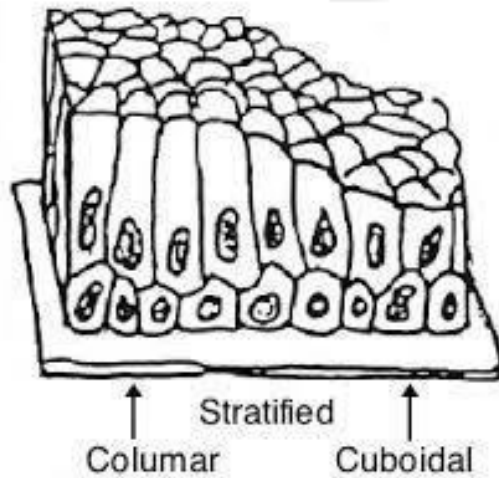


2. Cuboidal Epithelium:



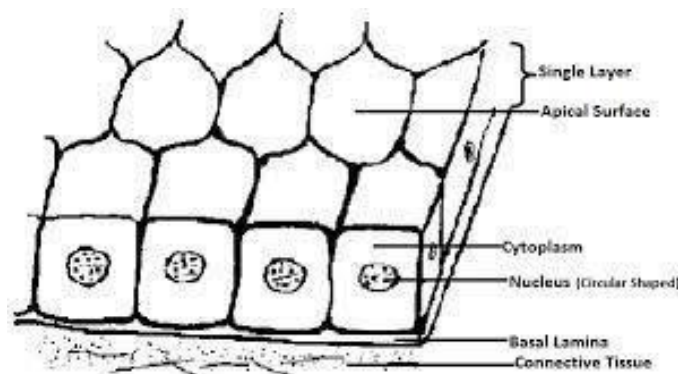
Cuboidal epithelia are epithelial cells having a cube-like shape; that is, their width is approximately equal to their height. They may exist in single layers (simple cuboidal epithelium) or multiple layers (stratified cuboidal epithelium) depending on their location (and thus function) in the body.

3. Stratified Columnar Epithelium:



Stratified columnar epithelia are found in the ocular conjunctiva of the eye, in parts of the pharynx and anus, the female's uterus, the male urethra and vas deferens. Also found in Lobar ducts in salivary glands. The cells function in secretion and protection. In simple terms, we can say that the upper and lowermost layer of cells are columnar in shape. The middle layer contains cuboidal cells. It forms the lining of respiratory tract, ureter, oviduct, etc.

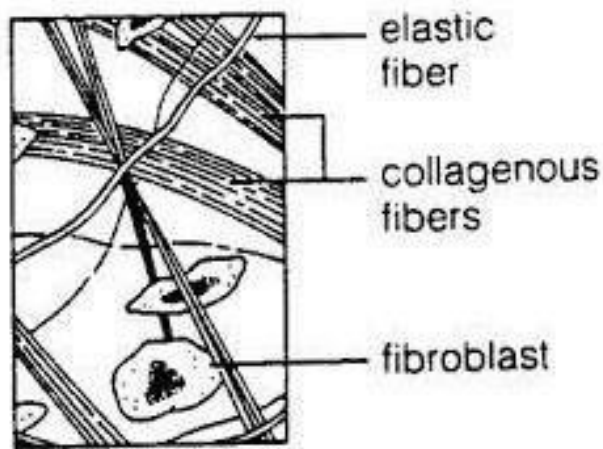
4. Stratified Cuboidal Epithelium:



Stratified cuboidal epithelium is a type of epithelial tissue composed of multiple layers of cube-shaped cells.

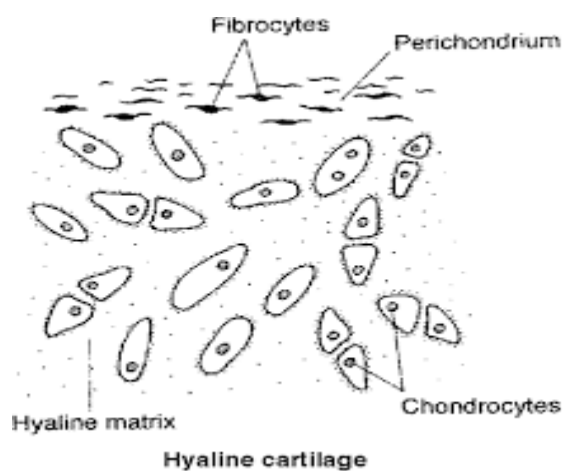
Only the most superficial layer is made up of cuboidal cells, and the other layers can be cells of other types. This is because, conventionally, naming of stratified epithelium is based on the type of cell in the most superficial layer.

5. Areolar connective tissue:



Loose connective tissue is the most common type of connective tissue in vertebrates. It holds organs in place and attaches epithelial tissue to other underlying tissues. It also surrounds the blood vessels and nerves. Cells called fibroblasts are widely dispersed in this tissue; they are irregular branching cells that secrete strong fibrous proteins and proteoglycans as an extracellular matrix. The cells of this type of tissue are generally separated by quite some distance by a gelatinous substance primarily made up of collagenous and elastic fibers.

6. Hyaline cartilage:



Hyaline cartilage is covered externally by a fibrous membrane, called the perichondrium, except at the articular ends of bones and also where it is found directly under the skin, i.e., ears and nose. This membrane contains vessels that provide the cartilage with nutrition. Hyaline cartilage matrix is mostly made up of type II collagen and chondroitin sulfate, both of which are also found in elastic cartilage.

Hyaline cartilage exists on the ventral ends of ribs; in the larynx, trachea, and bronchi; and on the articular surface of bones.

7. Tendon :

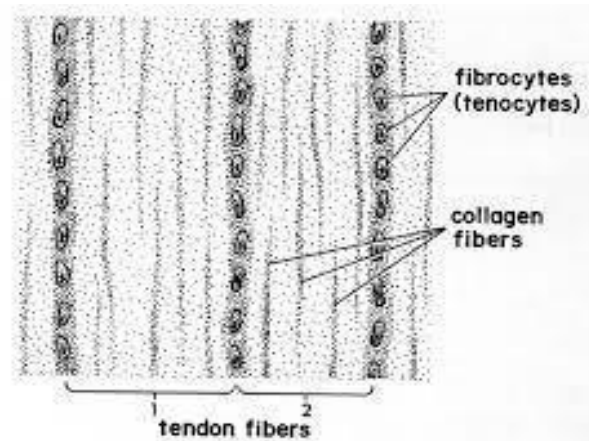
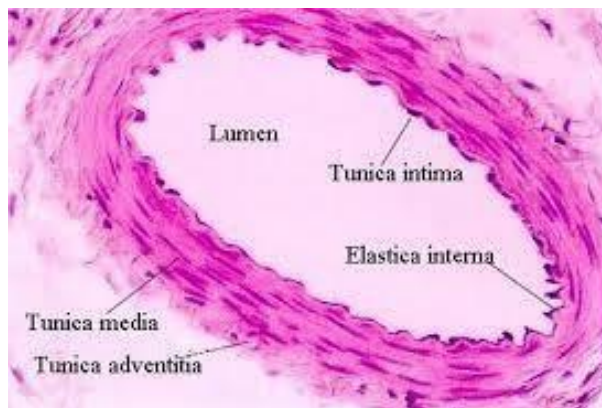


FIG. 69-2 A ligament is a band of relatively nonelastic tissue that unites two or more bones and is composed predominantly of long parallel collagenous fibers.

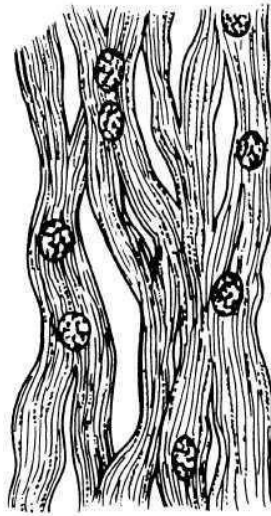
A **tendon** (or **sinew**) is a tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension. Tendons are similar to ligaments and fasciae; all three are made of collagen. Ligaments join one bone to another bone; fasciae connect muscles to other muscles. Tendons and muscles work together to move bones.

8. Human Vein:



Veins (from the Latin *vena*) are blood vessels that carry blood toward the heart. Most veins carry deoxygenated blood from the tissues back to the heart; exceptions are the pulmonary and umbilical veins, both of which carry oxygenated blood to the heart. In contrast to veins, arteries carry blood away from the heart. Veins are less muscular than arteries and are often closer to the skin. There are valves in most veins to prevent backflow.

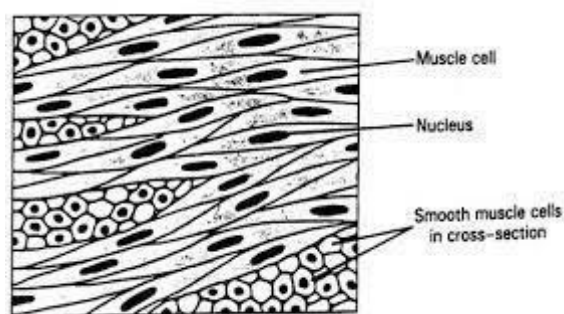
9. Cardiac Muscle:



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Cardiac muscle (heart muscle) is involuntary, striated muscle that is found in the walls and histological foundation of the heart, specifically the myocardium. Cardiac muscle is one of three major types of muscle, the others being skeletal and smooth muscle. These three types of muscle all form in the process of myogenesis. The cells that constitute cardiac muscle, called cardiomyocytes or myocardiocytes, contain only three nuclei. The myocardium is the muscle tissue of the heart, and forms a thick middle layer between the outer epicardium layer and the inner endocardium layer.

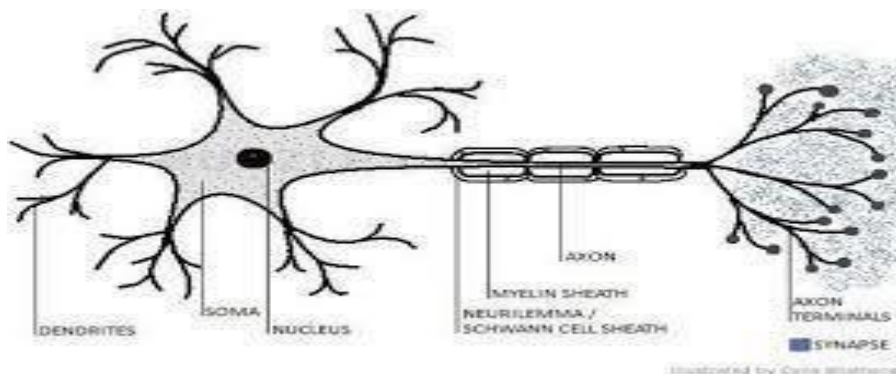
10. Smooth Muscle :



Smooth muscle is an involuntary non-striated muscle. It is divided into two subgroups; the single-unit (unitary) and multiunit smooth muscle. Within single-unit cells, the whole bundle or sheet contracts as a syncytium (i.e., a multinucleate mass of cytoplasm that is not separated into cells). Multiunit smooth muscle tissues innervate individual cells; as such, they allow for fine control and gradual responses, much like motor unit recruitment in skeletal muscle.

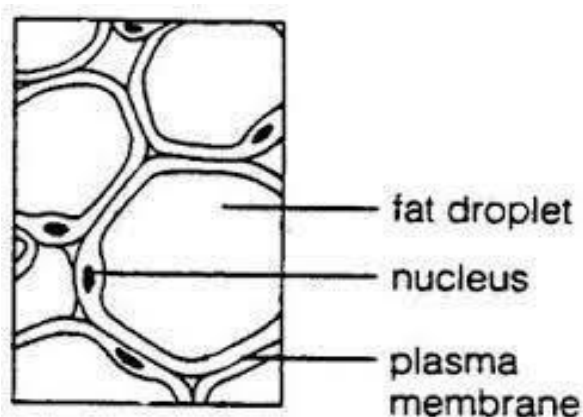
Smooth muscle is found within the walls of blood vessels (such smooth muscle specifically being termed vascular smooth muscle) such as in the tunica medialayer of large (aorta) and small arteries, arterioles and veins. Smooth muscle is also found in lymphatic vessels, the urinary bladder, uterus (termed uterine smooth muscle), male and female reproductive tracts, gastrointestinal tract, respiratory tract, arrector pili of skin, the ciliary muscle, and iris of the eye. The structure and function is basically the same in smooth muscle cells in different organs, but the inducing stimuli differ substantially, in order to perform individual effects in the body at individual times. In addition, the glomeruli of the kidneys contain smooth muscle-like cells called mesangial cells.

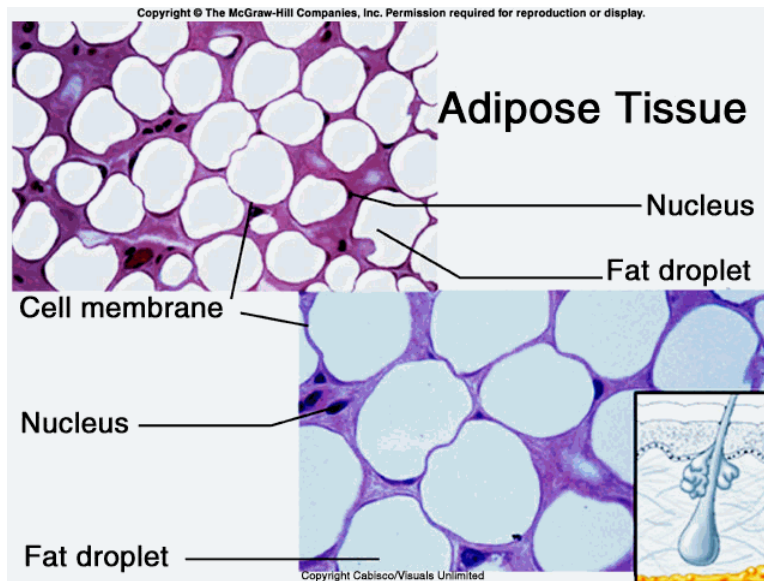
11. Neuron :



Nervous tissue is the main component of the two parts of the **nervous** system; the brain and spinal cord of the central **nervous** system (CNS), and the branching peripheral **nerves** of the peripheral **nervous** system (PNS), which regulates and controls bodily functions and activity.

12. Adipose tissue:



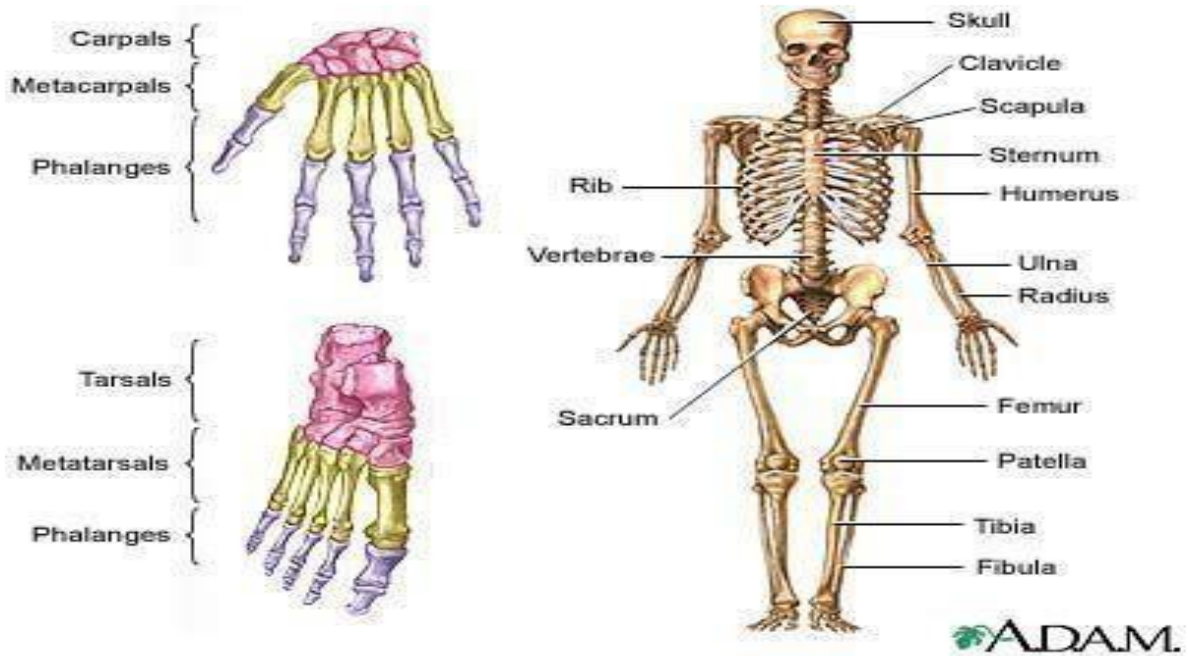


Adipose tissue or **body fat** or just **fat** is loose connective tissue composed mostly of adipocytes. In addition to adipocytes, adipose tissue contains the stromal vascular fraction (SVF) of cells including preadipocytes, fibroblasts, vascular endothelial cells and a variety of immune cells (i.e., adipose tissue macrophages [ATMs]). Adipose tissue is derived from preadipocytes. Its main role is to store energy in the form of lipids, although it also cushions and insulates the body. Far from hormonally inert, adipose tissue has, in recent years, been recognized as a major endocrine organ, as it produces hormones such as leptin, estrogen, resistin, and the cytokine TNF α . Moreover, adipose tissue can affect other organ systems of the body and may lead to disease. The two types of adipose tissue are white adipose tissue (WAT), which stores energy, and brown adipose tissue (BAT), which generates body heat. .

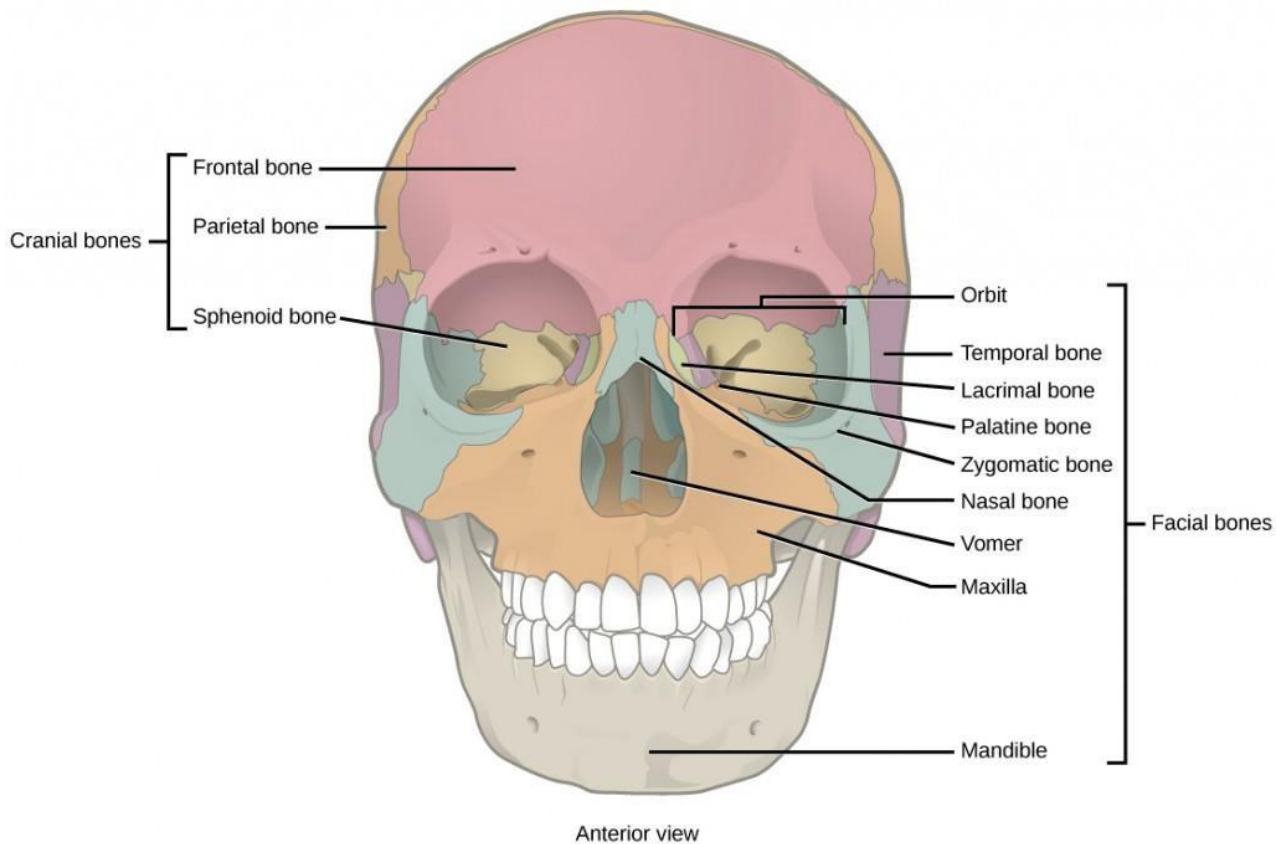
EXPERIMENT NO.: 12

IDENTIFICATION OF AXIAL AND APPENDICULAR SKELETON

Aim : Identification of Axial And Appendicular Skeleton

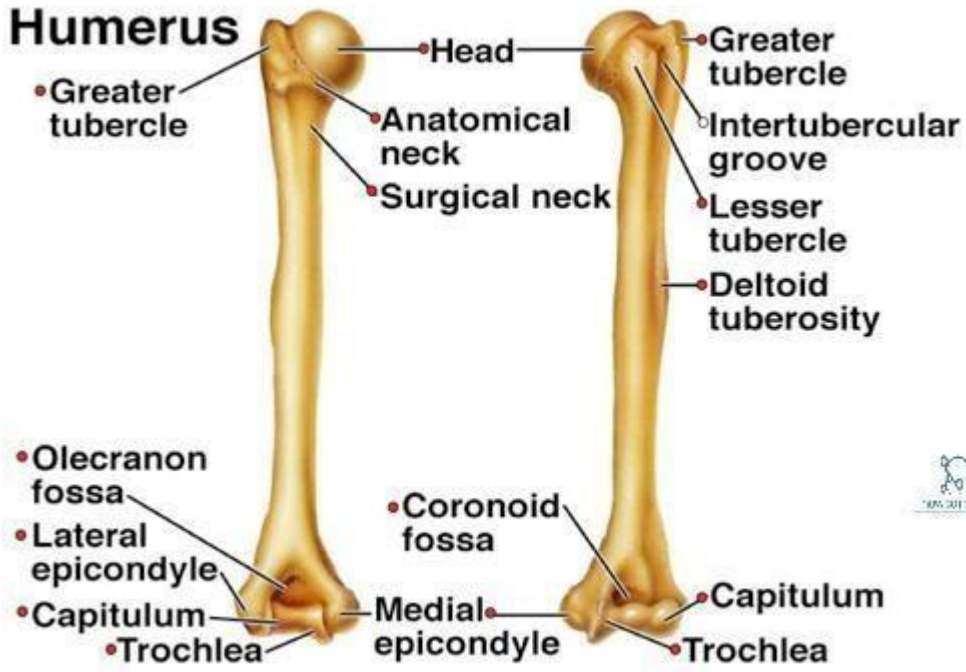


SKULL

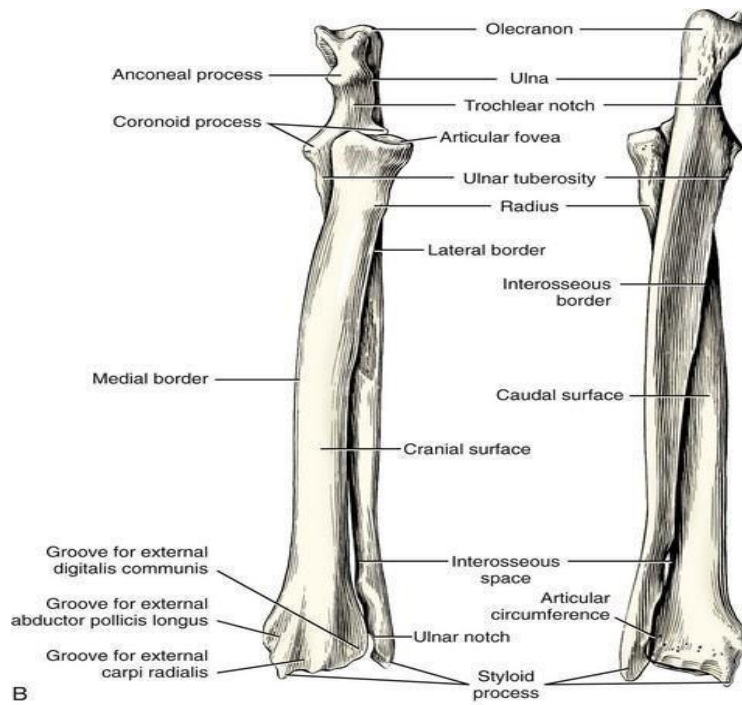


HUMERUS

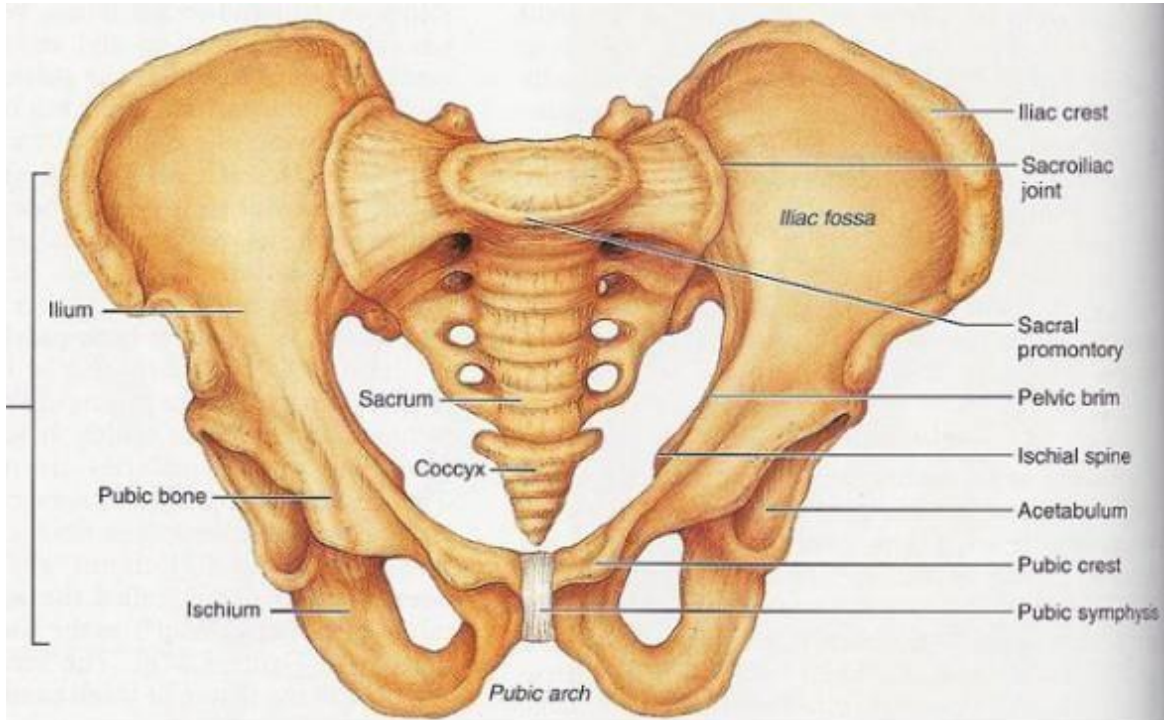
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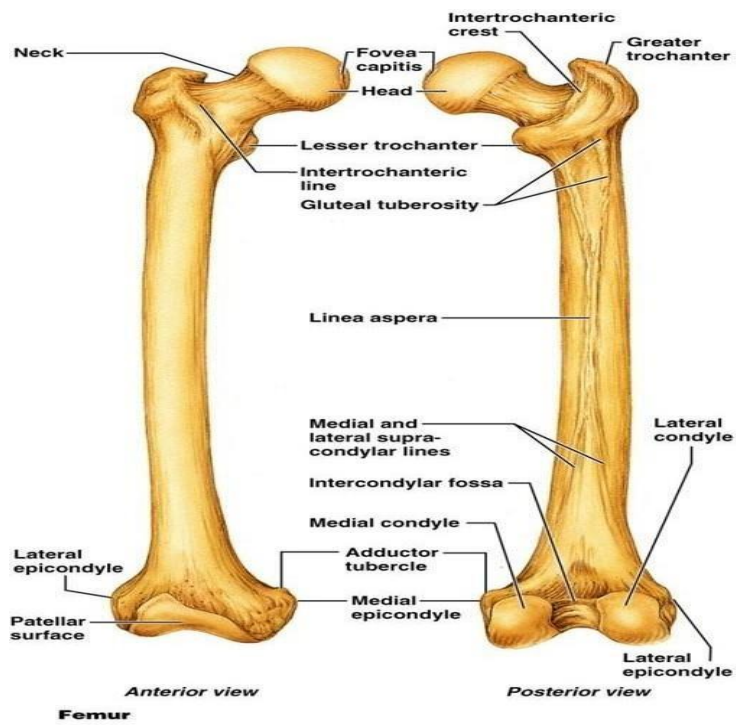
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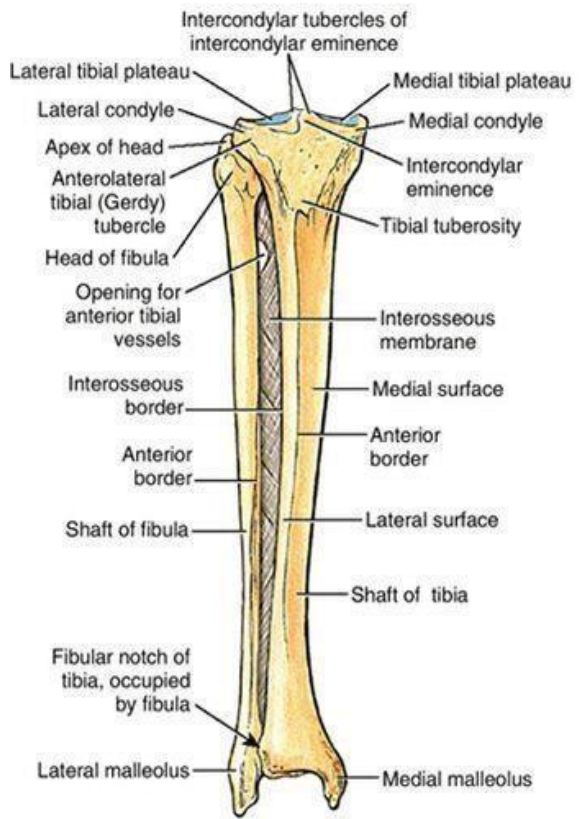
PELVIC GIRDLE



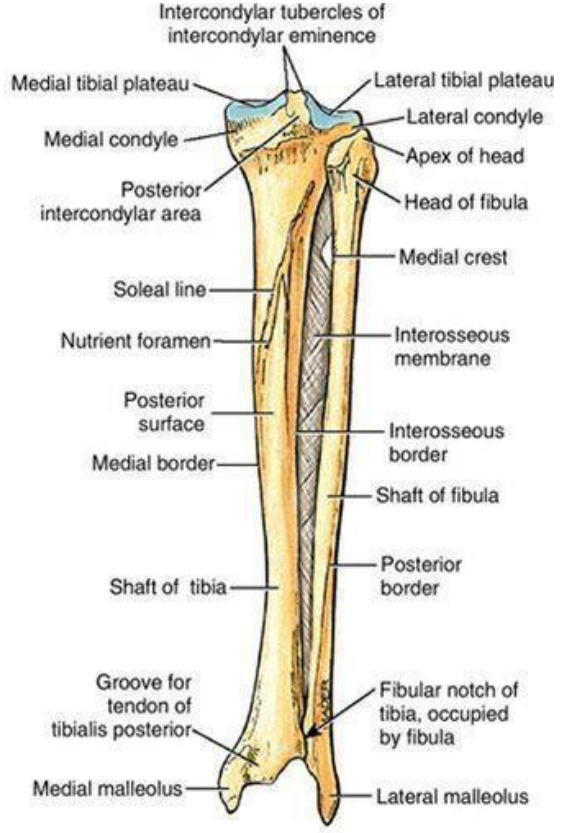
FEMUR



TIBIA FIBULA



A Anterior view

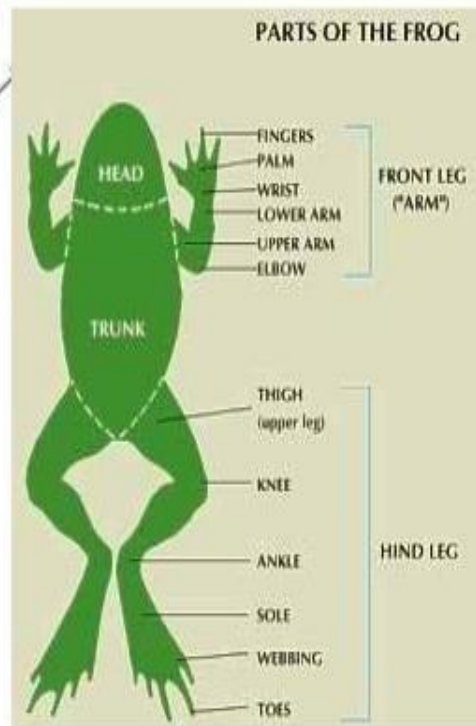
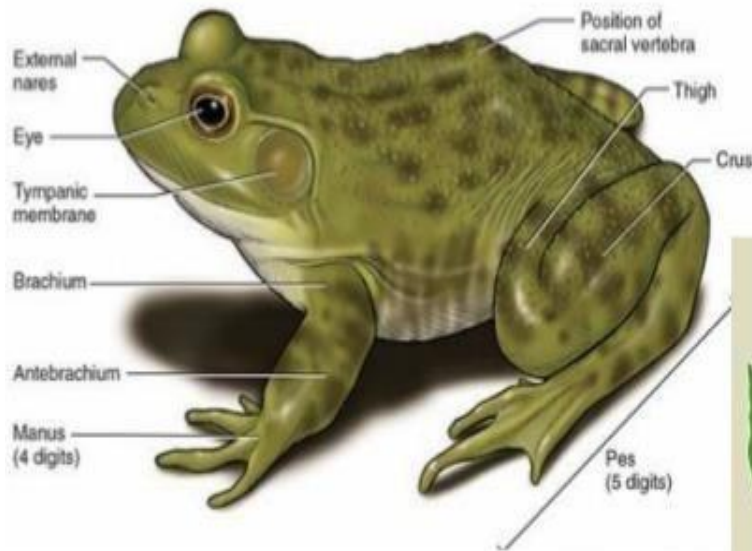


B Posterior view

EXPERIMENT NO.: 13

TO STUDY THE EXTERNAL MORPHOLOGY OF FROG THROUGH PERMANENT SLIDES

External Features of frog



EXPERIMENT NO.: 14

IDENTIFICATION OF BLOOD GROUPS

Aim: Identification of Blood Groups

ABO blood group system, the classification of human blood based on the inherited properties of red blood cells (erythrocytes) as determined by the presence or absence of the antigens A and B, which are carried on the surface of the red cells. Persons may thus have type A, type B, type O, or type AB blood. The A, B, and O blood groups were first identified by Austrian immunologist Karl Landsteiner in 1901. *See* blood group.

Blood containing red cells with type A antigen on their surface has in its serum (fluid) antibodies against type B red cells. If, in transfusion, type B blood is injected into persons with type A blood, the red cells in the injected blood will be destroyed by the antibodies in the recipient's blood. In the same way, type A red cells will be destroyed by anti-A antibodies in type B blood. Type O blood can be injected into persons with type A, B, or O blood unless there is incompatibility with respect to some other blood group system also present. Persons with type AB blood can receive type A, B, or O blood.

The ABO and Rh groups in transfusion

System	Recipient Type	Donor Red Cell Type	Donor Plasma Type
ABO	A	A* or O	A or AB
ABO	B	B or O	B or AB
ABO	O	O only	O, A, B, or AB
ABO	AB	AB*, A*, B, or O	AB
Rh	positive	positive or negative	positive or negative
Rh	negative	negative or positive**, ***	negative or positive**

*Not if the patient's serum contains anti-A1 (antibody to common type A red cell in subgroup A patients).

**Not if the patient is a female less than 45 years old (childbearing possible), unless life-threatening hemorrhage is present and transfusion of Rh-positive blood is lifesaving.

***Not if the patient's serum contains anti-D (antibody to positive red cells), except under unusual medical circumstances.

Blood group O is the most common blood type throughout the world, particularly among peoples of South and Central America. Type B is prevalent in Asia, especially in northern

India. Type A also is common all over the world; the highest frequency is among the Blackfoot Indians of Montana and in the Sami people of northern Scandinavia.

The ABO antigens are developed well before birth and remain throughout life. Children acquire ABO antibodies passively from their mother before birth, but by three months of age infants are making their own; it is believed that the stimulus for such antibody formation is from contact with ABO-like antigenic substances in nature. ABO incompatibility, in which the antigens of a mother and her fetus are different enough to cause an immune reaction, occurs in a small number of pregnancies. Rarely, ABO incompatibility may give rise to erythroblastosis fetalis (hemolytic disease of the newborn), a type of anemia in which the red blood cells of the fetus are destroyed by the maternal immune system. This situation occurs most often when a mother is type O and her fetus is either type A or type B.

EXPERIMENT NO.: 15

BLOOD GROUPING

Aim: Recording of Arterial Blood Pressure

Definition of Blood Pressure Arterial blood pressure is the force exerted by the blood on the wall of a blood vessel as the heart pumps (contracts) and relaxes. Systolic blood pressure is the degree of force when the heart is pumping (contracting). The diastolic blood pressure is the degree of force when the hearts relaxed.

Method of Measuring Arterial Blood Pressure

In the measurement procedure a cuff is wrapped around a person's arm with an inflatable rubberbag inside the cuff centered over the brachial artery. Enough air pressure is pumped into the cuff to close the artery. Air pressure is then released by opening the thumb valve. When the pressure in the cuff is equal to the pressure on the artery, the artery opens and the blood begins to return to the part of the artery that was closed. As the blood returns to the artery, pulse sounds begin. These sounds can be heard through a stethoscope placed over the brachial pulse point. The sounds continue for a time while the cuff deflated slowly, eventually becoming too faint to hear.

The cuff is connected by tubing to a manometer, which shows the amount of pressure on the artery. When the first pulse sounds are heard, the reading on the manometer measures the systolic blood pressure. The last sound heard is the diastolic blood pressure. In children, the muffling of sound or fourth sound is often used as the diastolic blood pressure rather than the disappearance of sound.

Reference ranges for blood pressure in children			
Stage	Approximate age	Systolic	Diastolic
Infants	1 to 12 months	75–100	50–70
Toddlers and preschoolers	1 to 5 years	80–110	50–80
School age	6 to 12 years	85–120	50–80
Adolescents	13 to 18 years	95–140	60–90

EXPERIMENT NO.: 16

DETERMINATION OF VITAL CAPACITY

Aim: Determination of Vital Capacity

Vital capacity is the maximum amount of air a person can expel from the lungs after a maximum inhalation. It is equal to the sum of inspiratory reserve volume, tidal volume, and expiratory reserve volume.

A person's vital capacity can be measured by a wet or regular spirometer. In combination with other physiological measurements, the vital capacity can help make a diagnosis of underlying lung disease. Furthermore, the vital capacity is used to determine the severity of respiratory muscle involvement in neuromuscular disease, and can guide treatment decisions in Guillain-Barré syndrome and myasthenic crisis. A normal adult has a vital capacity between 3 and 5 liters. A human's vital capacity depends on age, sex, height, mass, and ethnicity.

Lung volumes and lung capacities refer to the volume of air associated with different phases of the respiratory cycle. Lung volumes are directly measured, whereas lung capacities are inferred from volumes.

Equipment Setup and use of Spirometer:

1. The equipment and screen should already be set up (see instructor for settings).
2. The tubes of the flow head should always be in the upright position (coming off of the *top* of flow head) to avoid problems with condensation.
3. Avoid turbulent airflow, when breathing into the spirometer make sure no air is escaping around the mouthpiece or through the subject's nose.
4. The spirometer will display flow on channel three; volumes, in liters, will be displayed.
5. Convert all values into **milliliters** as you record them.
6. Do not discard your mouthpieces until the end of the lab, you will be using them several times.

Activity: Measuring Respiratory Volumes:

A. Lung Volumes: TV, IRV and ERV

Each student should collect the following lung volumes and capacities:

TV	=	Tidal Volume
IRV	=	Inspiratory Reserve Volume
ERV	=	Expiratory Reserve Volume
VC	=	Vital Capacity
FVC	=	Forced Vital capacity