!! JAY AMBE !!

B. PHARM SEM – II

HUMAN ANATOMY AND PHYSIOLOGY - II

PRACTICALS

PREPARED BY

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CERTIFICATE

Class:_____ **Year:**_____

This is to certify that Mr./Miss. _____

of _____at _____

Enrollment No. _____ & Roll No. _____ has satisfactory completed his/her _____ out of _____ experiments/practicals for the subject _____ for the academic year 20 __ to 20 __.

Signed by:

_____ _____ _____

Head of Department **External Examiner** **Subject Teacher**

Date of certified:

INDEX

Reference: Tortora, G. J., & Derrickson, B. (2009). Principles of anatomy and physiology (12th ed.). Hoboken, N.J.: John Wiley.
Thanks to author: Gerard J. Tortora & Grabowski, Bryan Derricson.

Basic Requirements for the practical

1. Apron
2. Cap & Mask
3. Record Book
4. Dissection Box
5. Napkin
6. Wrist watch
7. Calculator
8. Permanent Marker, Pen, Pencil, Eraser and Sharpener
9. Nail Cutter
10. Cellotape
11. Water Bottle
12. Journal
13. Hand Sanitizer
14. Sticky Label or White Small Square Sticker

Instruction for the student

1. Entre in laboratory with neat and clean formal clothes.
2. Do not entre in laboratory with wearing of short, track, and sleeveless kind of dresses.
3. Enter in laboratory with wearing of shoe. (Girls can wear formal sandal)
4. Long hair must be tied back to avoid catching fire and contamination of sample.
5. Keep solids out of the sink.
6. Leave your work station clean and in good order before leaving the laboratory.
7. Wear apron before entering into the laboratory.
8. Remove apron outside the laboratory after completion of experiment
9. Use apparatus or instrument with care
10. Seat in laboratory at your allocated place
11. Ask laboratory assistant, Peon, Teacher or your colleague in emergency.

PRACTICAL NO.: 01 **DATE**

AIM: TO STUDY THE INTEGUMENTARY AND SPECIAL SENSES USING SPECIMEN AND MODELS.

REQUIRMENTS: Charts and Model of Skin, Tongue, Nose, Eye, Ear.

THEORY:

INTEGUMENTARY SYSTEM:

The integumentary system is the largest organ of the body. It forms a physical barrier between the external environment and the internal environment and protect the body.

The integumentary system includes

1. Skin (epidermis, dermis)
2. Hypodermis
3. Associated glands
4. Hair
5. Nails.

1. SKIN:

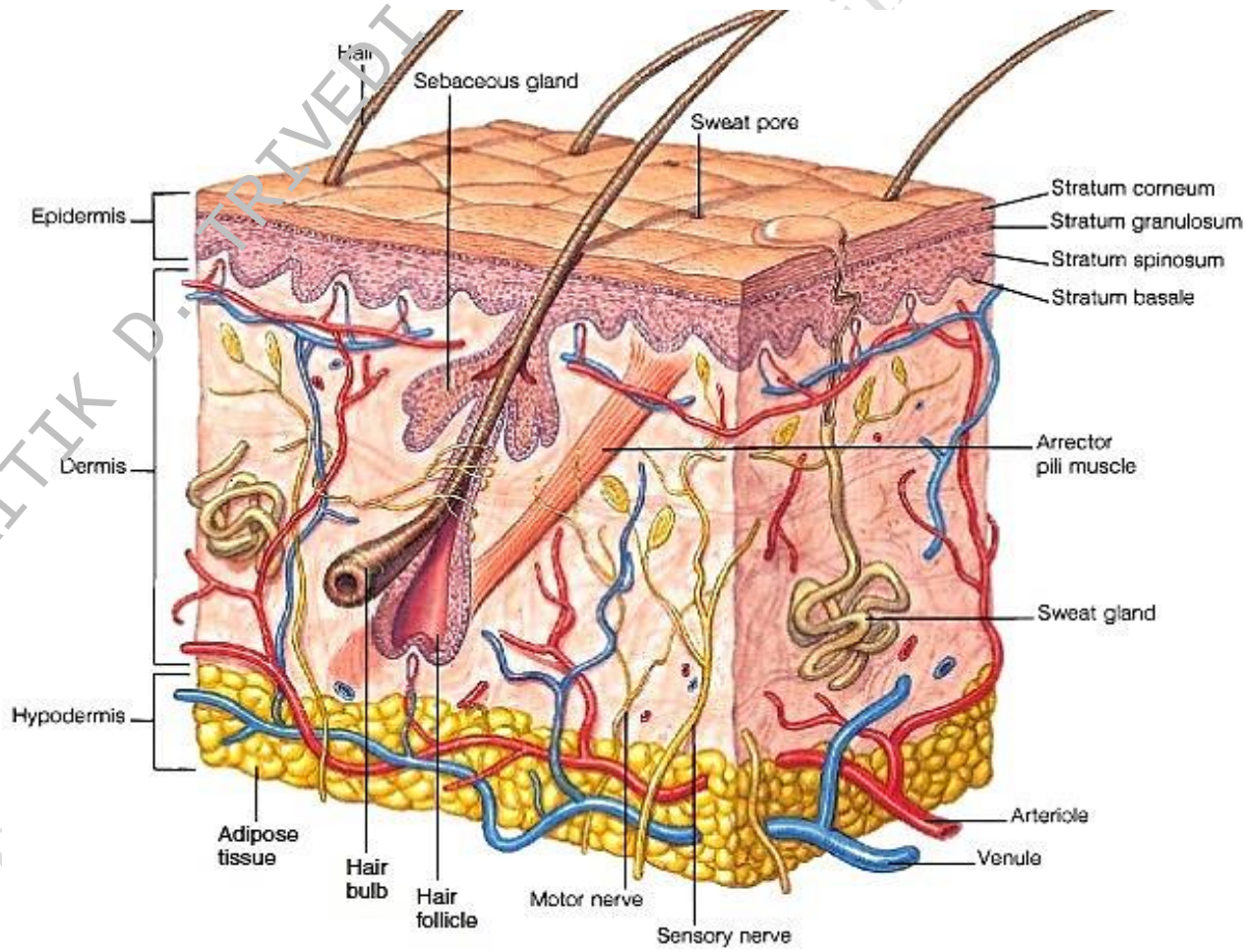


Diagram of Skin

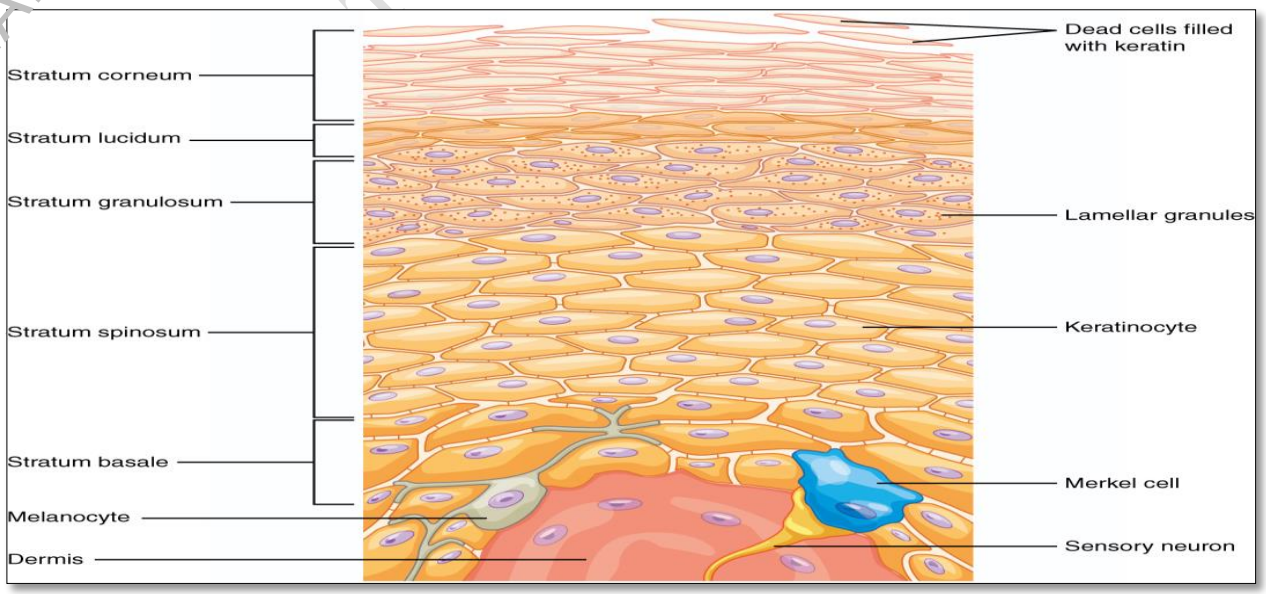
- Skin occupy 16% of our total body weight
- Skin is made up by two layers:

i. Epidermis:

- It is a superficial layer of the skin
- It contains four principal types of cells: **keratinocytes, melanocytes, Langerhans cells, and Merkel cells**
- About 90% of epidermal cells are **keratinocytes** which are arranged in four or five layers and produce the protein keratin, tough layer.
- About 8% of the epidermal cells are **melanocytes** which produce pigment melanin. Melanin is a yellow-red or brown-black pigment that contributes to skin color and absorbs damaging ultraviolet (UV) light.
- **Langerhans cells** develop from red bone marrow and migrate to the epidermis. They protect us from microbes.
- **Merkel cells** located in the deepest layer of the epidermis, it detect touch sensations.

Layers of Epidermis: (from deep to superficial):

a. Stratum basale or germinatum – single row of cells attached to dermis; youngest cells
b. Stratum spinosum – Made up of bundles of protein resist tension
c. Stratum granulosum – layers of flattened keratinocytes producing keratin.
d. Stratum lucidum- (only found in thick skin – that is, the palms of the hands, the soles of the feet and the digits)
e. Stratum corneum – horn cornified superficial layer



Layers of epidermis

ii. Dermis:

- It is a deep layer of skin made up by fibre and it having good tensile strength.
- It is divided in papillary and reticular region.

a) **The Papillary Dermis**: The papillary dermis is the more superficial of the two, and lies just beneath the epidermal junction. It is relatively thin and is made up of loose connective tissue, which includes:
   - Capillaries
   - Elastic fibers
   - Reticular fibers
   - Collagen

b) **The Reticular dermis**: The reticular dermis is the deeper and thicker layer of the dermis, which lies above the subcutaneous layer of the skin. It contains dense connective tissue, which includes:
   - Blood vessels
   - Elastic fibers (interlaced)
   - Collagen fibers (in parallel layers)
   - Fibroblasts
   - Mast cells
   - Nerve endings
   - Lymphatics

2. HYPODERMIS:

- The hypodermis lies between the dermis and underlying organs.
- It is also known as subcutaneous layer.
- It is composed of loose areolar tissue and adipose tissue.
- This layer provides additional cushion and insulation through its fat storage function and connects the skin to underlying structures such as muscle.

3. ASSOCIATED GLANDS:

- Integumentary system has four types of exocrine glands, which secrete their product or substance outside the cells and body.

i. Sudoriferous glands:

- Sweat glands excrete sweat via very small openings at the skin's surface.
- The purpose of sudoriferous glands is to emit perspiration to help cool the body off when the body temperature rises.

ii. Sebaceous glands:

- It is responsible for releasing oil into the hair follicle to help lubricate and protect the hair shaft, keeping it from becoming hard and brittle.

iii. Ceruminous glands:

- Located in the ear canal. It produce ear wax known as cerumen.

- Cerumen prevent entry of dust, bacteria and harmful agent in the ear.

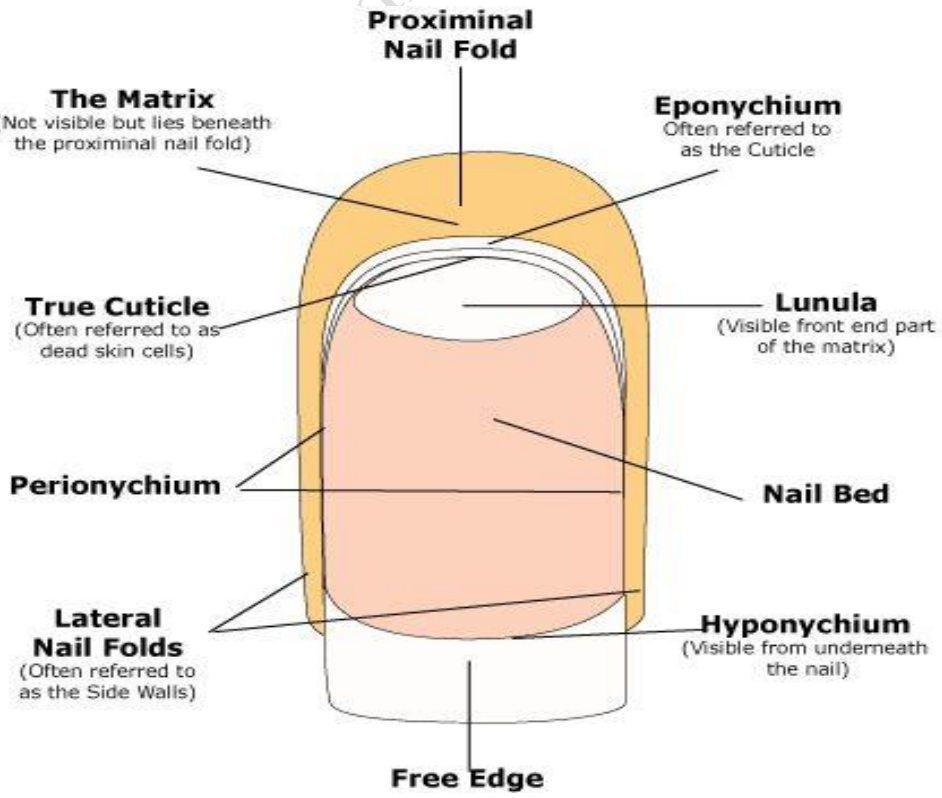
iv. Mammary glands:

- There are two mammary glands located one at each side of the front of the chest wall.
- Both men and women have mammary glands, but in men, these glands are underdeveloped. In females, the glands function to produce breast milk after giving birth.

4. HAIR:

- Hair is derived from the epidermis but grows its roots deep into the dermis.
- Its structure divides into the externally visible hair shaft and the hair follicle within the skin.
- Hair is primarily comprised of a fibrous protein and contains a very small amount of lipids (fats) and water.
- Hair comes from follicles, which are simple organs made up of cells called epithelial cells

5. NAIL:



- Nails consist of several segments, including:
  i. **The nail plate:** The part of the nail that is visible.
  ii. **The nail bed:** The skin that lies beneath the nail plate.
  iii. **The cuticle:** The thin line of tissue that is located at the base of the nail and overlaps the nail plate.
  iv. **The nail folds:** The folds of the skin located on the sides of the nail plate.
  v. **The lunula:** The white-colored half moon-shaped area located at the base of the nail plate.
  vi. **The matrix:** Part of the nail that is not visible, located underneath the cuticle, this is the area responsible for the growth of the fingernail.

Functions of integumentary system:

- It act as barrier so it provides physical protection against bacteria and germs.
- It heal abrasions, cuts and other injuries.
- It protect us from the sun's ultraviolet (UV) rays and sunburn.
- It remove waste by excreting sebum, sweat and other waste from our body.
- It maintain our body temperature by heat evaporating and absorbing as needed.
- It give us sensation for heat, cold and detect other sensations.
- It helps to synthesizes vitamin D.
- It Stores fat for a source of energy
- It Keeps the body from becoming dehydrated

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SPECIAL SENSES:

THEORY

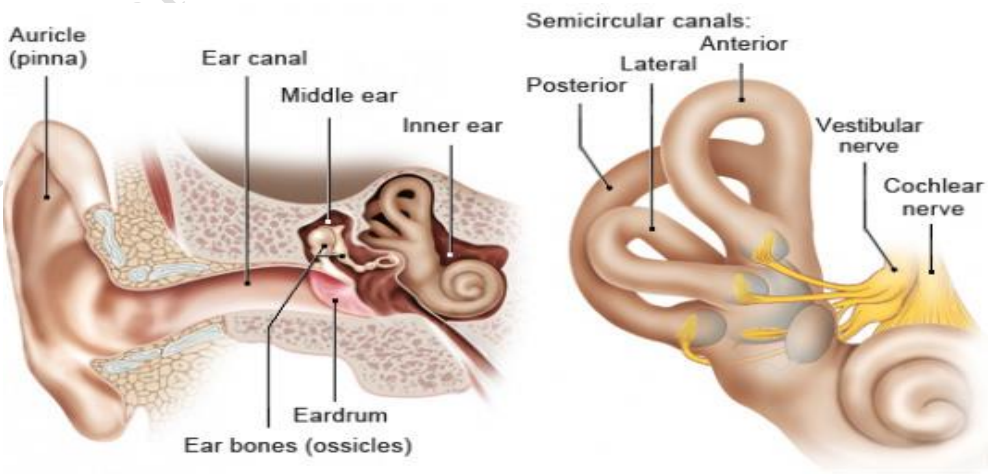
Humans have five special senses:

1. Equilibrium (balance and body position)
2. Olfaction (smell)
3. Gustation (taste)
4. Vision, and
5. Hearing.

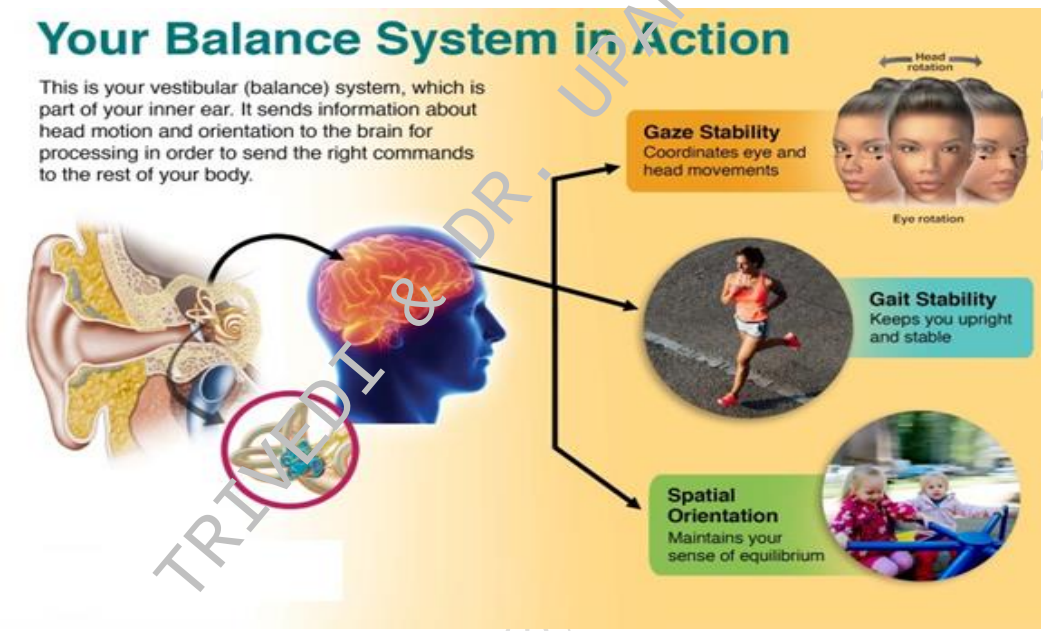
Additionally, we have general senses, also called somatosensation, which respond to stimuli like temperature, pain, pressure, and vibration.

1. EQUILIBRIUM (BALANCE AND BODY POSITION):

- The vestibular system is the sensory apparatus of the inner ear that helps the body maintain its postural equilibrium.
- The information provided by the vestibular system is also essential for coordinating the position of the head and the movement of the eyes.
- It is made up of three semicircular canals and two otolith organs, known as the utricle and the saccule. The semicircular canals and the otolith organs are filled with fluid.
- **The semicircular canals**, which respond to rotational movements **(angular acceleration);** and **the utricle and saccule** within the vestibule, which respond to **changes in the position of the head with respect to gravity (linear acceleration).**
- Functionally these organs are closely related to the cerebellum and to the reflex centres of the spinal cord and brainstem that govern the movements of the eyes, neck, and limbs.



- Both **proprioception** (perception of body position) and **kinesthesia** (perception of the body's movement through space) interact with information provided by the vestibular system.
- In action, our vestibular system has three main functions: gaze stability, gait stability, and spatial orientation.



A. Gaze Stability

- Stare or look at a fixed point on the wall in front of you then move your head from side to side.
- During the moving of your head from side to side, Your eyes fixed on that point, rather than moving with your head. That would be because of your vestibular system.
- As you turn your head, your vestibular system helps rotate your eyes. This is called the vestibule-ocular reflex.

B. Gait Stability

- It Maintain an upright position on one or two feet requires constant communication between the sensory signals from the feet, legs and spine to the brain.
- These muscle signals are sent to the brain and then back down to make adjustments in your body that will keep you upright and stable in a variety of activities — like keeping you steady while running.

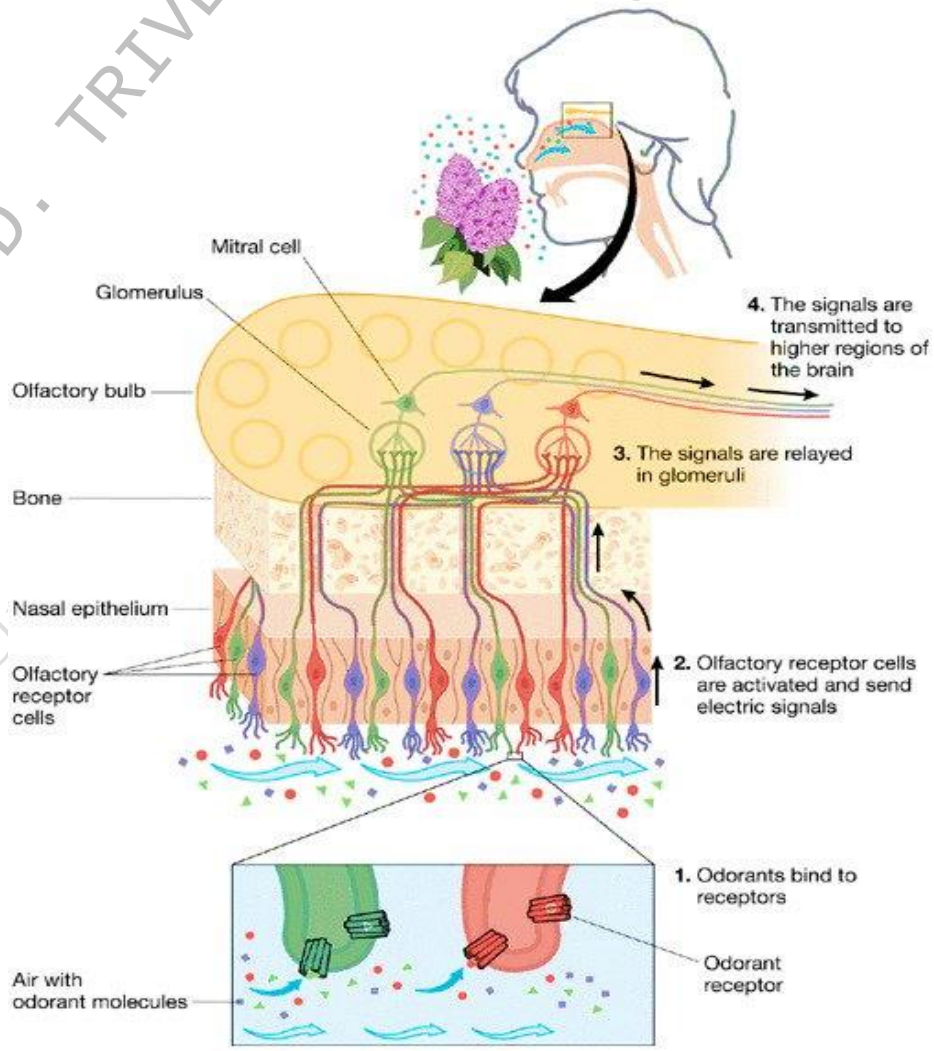
C. Spatial Orientation

- The vestibular system helps you perceive which way you are spinning on a merry-go-round, which way you are tilting on a boat and simply, which way is up.

- These perceptions contribute to your sense of equilibrium (state of physical balance) and keep you safe from falling.
- Next time you are walking around or enjoying a boat ride, think about how your vestibular system is working to help you maintain your stability and sense of balance! Round and round we go!

2. OLFACTION (SMELL):

- Olfaction is the sensation of smell.
- Along with vision, taste, hearing, and balance, olfaction is a special sense.
- When an odor or smell binds to a specific receptor within the nasal cavity, transmitting a signal through the olfactory system.
- Glomeruli of nasal cavity collective signals from these receptors it transmit them to the olfactory bulb. In olfactory bulb the sensory input will start to interact with parts of the brain responsible for smell identification, memory, and emotion.



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3. GUSTATION (TASTE):

- The receptors for sensations of taste are located in the taste buds. There are nearly 10,000 taste buds located the tongue of adult and some of are found on the soft palate, pharynx (throat), and epiglottis (cartilage lid over voice box).
- The number of taste buds declines with age. Each taste bud is an oval body consisting of three kinds of epithelial cells:
    i. Supporting cells,
    ii. Gustatory receptor cells, and
    iii. Basal cells.
- The supporting cells surround about 50 gustatory receptor cells in each taste bud.
- A single, long microvillus also known as a gustatory hair, projects from each gustatory receptor cell to the external surface through the taste pore, an opening in the taste bud.
- Basal cells, stem cells are found at the periphery of the taste bud near the connective tissue layer, produce supporting cells, which then develop into gustatory receptor cells. Each gustatory receptor cell has a life span of about 10 days.
- At their base, the gustatory receptor cells synapse with dendrites of the first-order neurons that form the first part of the gustatory pathway.
- The dendrites of each first-order neuron branch profusely and contact many gustatory receptor cells in several taste buds.
- Taste buds are found in elevations on the tongue called papillae which provide a rough texture to the upper surface of the tongue.
- Taste buds contain three types of papillae:
    i. **Circular vallate (circumvallate) papillae:** It form an inverted V-shaped row at the back of the tongue. Each of these papillae houses 100 – 300 taste buds.
    ii. **Fungiform papillae:** These are mushroom-shaped elevations scattered over the entire surface of the tongue that contain about five taste buds each.
    iii. **Foliate papillae:** These are are located in small trenches on the lateral margins of the tongue, but most of their taste buds degenerate in early childhood.
- In addition, the entire surface of the tongue has filiform papillae. These pointed, threadlike structures contain tactile receptors but no taste buds. They increase friction between the tongue and food, making it easier for the tongue to move food in the oral cavity.

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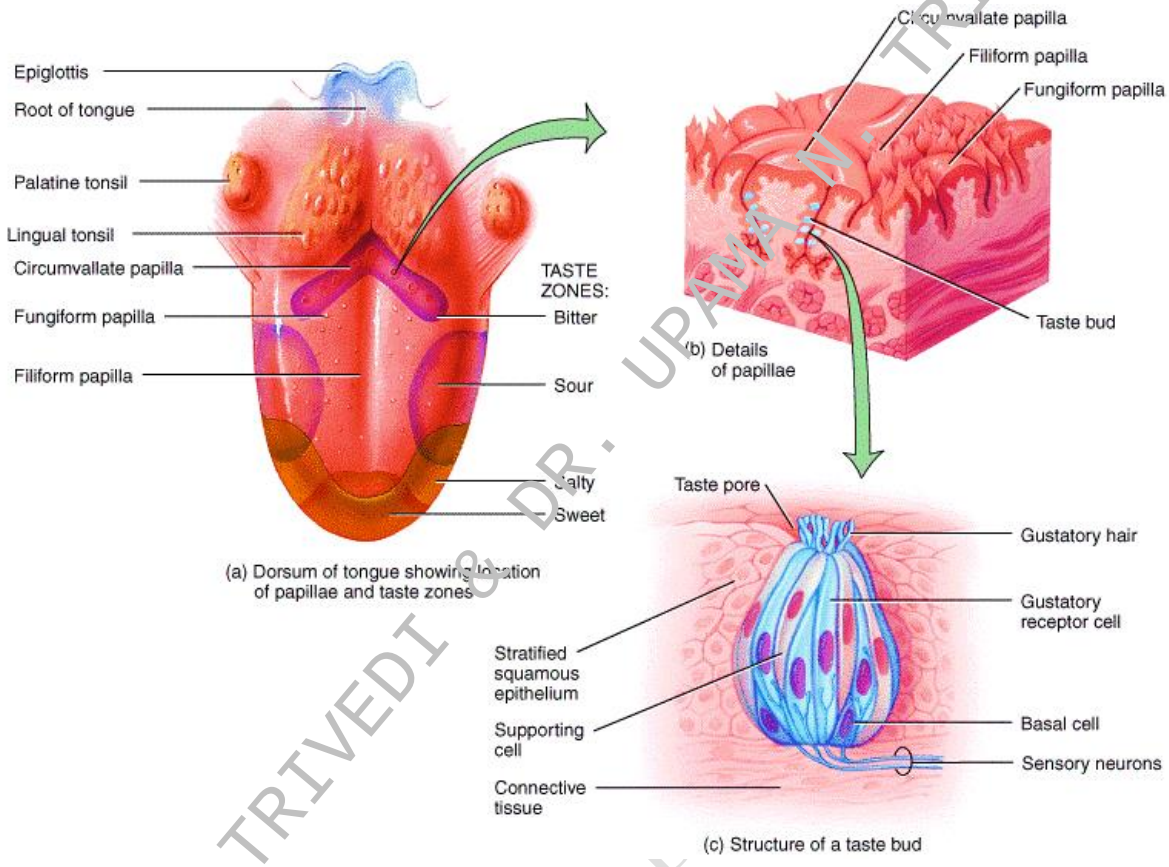


Physiology of Gustation:

- Chemicals that stimulate gustatory receptor cells are known as tastants.
- Once a tastant is dissolved in saliva, it can make contact with the plasma membrane of the gustatory hairs, which are the sites of taste transduction.
- Due to this effect a receptor stimulates exocytosis of synaptic vesicles from the gustatory receptor cell.
- This effect secret neurotransmitter molecules that trigger nerve impulses in the first-order sensory neurons that synapse with gustatory receptor cells. Which identify 5 basic tastes—sweet, sour, salty, bitter, and umami.

The Gustatory Pathway:

Three cranial nerves contain axons of the first-order gustatory neurons that innervate the taste buds.

i. The facial (VII) nerve serves taste buds in the anterior two-thirds of the tongue;

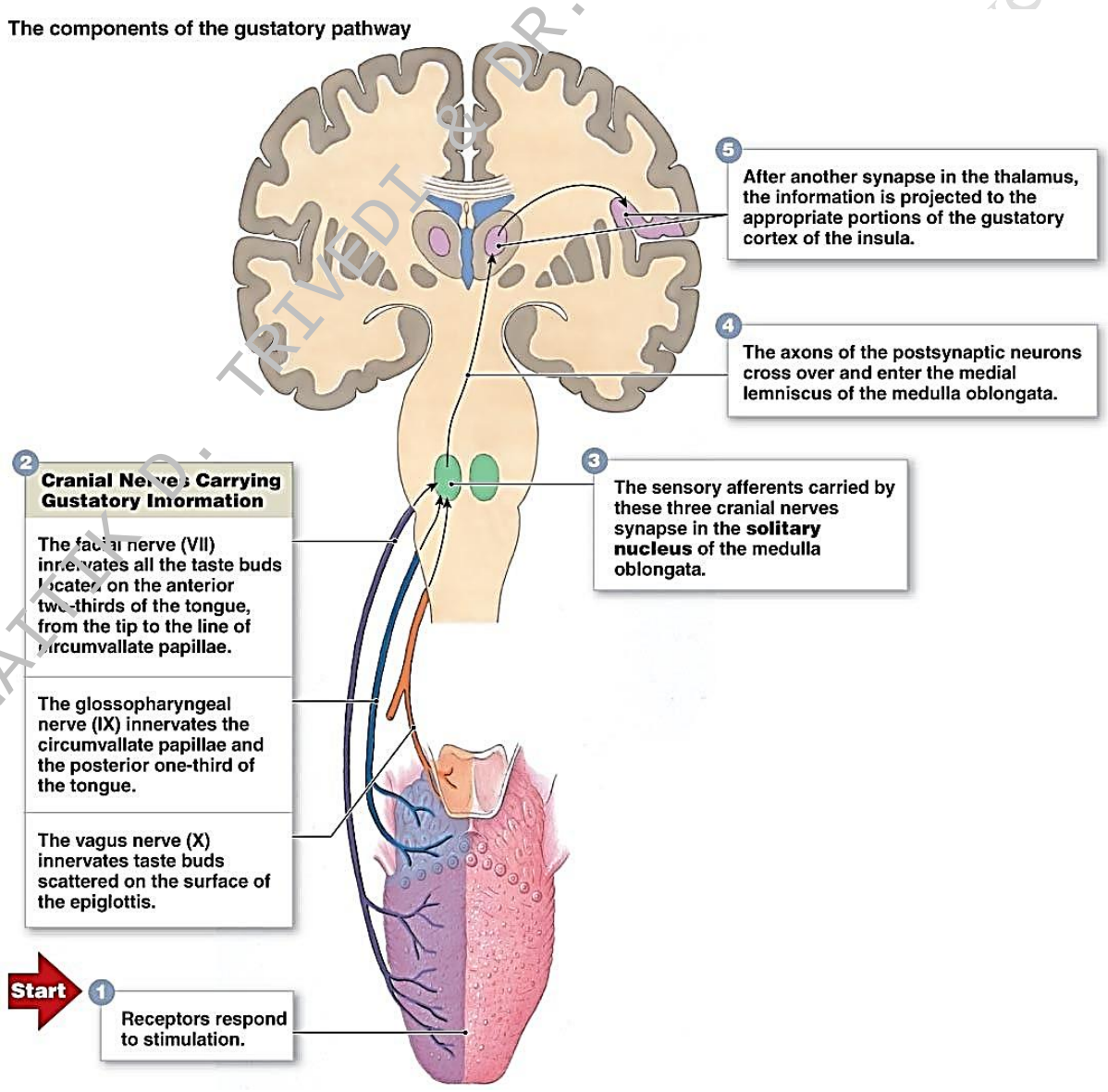
ii. The glossopharyngeal (IX) nerve serves taste buds in the posterior one-third of the tongue; and

iii. The vagus (X) nerve serves taste buds in the throat and epiglottis.

From the taste buds, nerve impulses propagate along these cranial nerves to the gustatory nucleus in the medulla oblongata.

From the medulla, some axons carrying taste signals project to the limbic system and the hypothalamus; others project to the thalamus.

Taste signals that project from the thalamus to the primary gustatory area in the parietal lobe of the cerebral cortex give rise to the conscious perception of taste.



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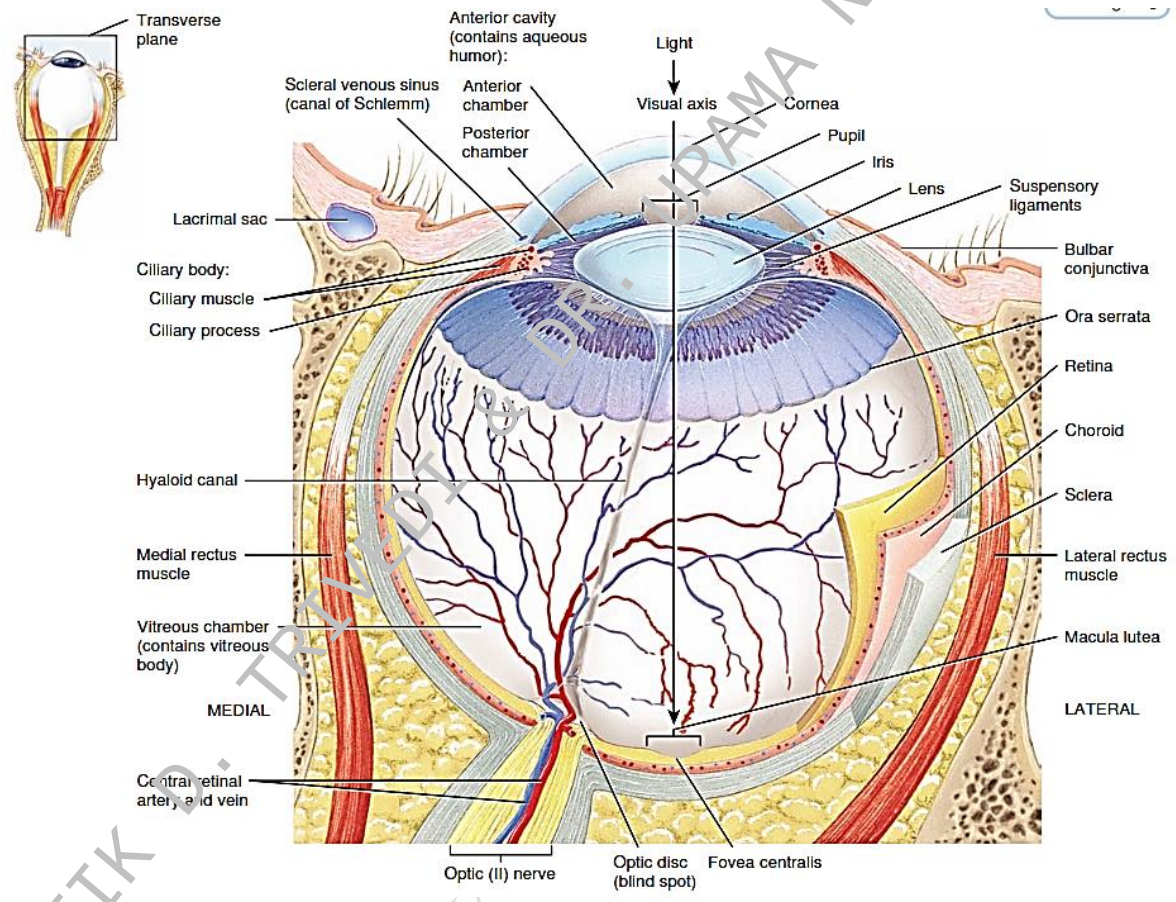
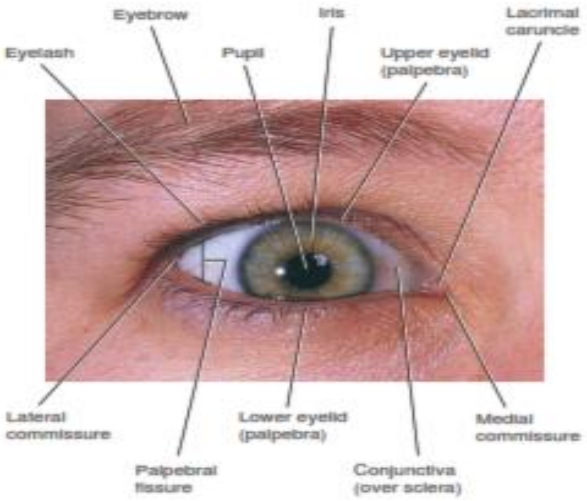
4. VISION:

The eyes are responsible for the detection of visible light, the part of the electromagnetic spectrum with wavelengths ranging from about 400 to 700 nm.



Accessory Structure of Eye:

The accessory structures of the eye include the eyelids, eyelashes, eyebrows, the lacrimal (tearing) apparatus, and extrinsic eye muscles.



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Eyelids

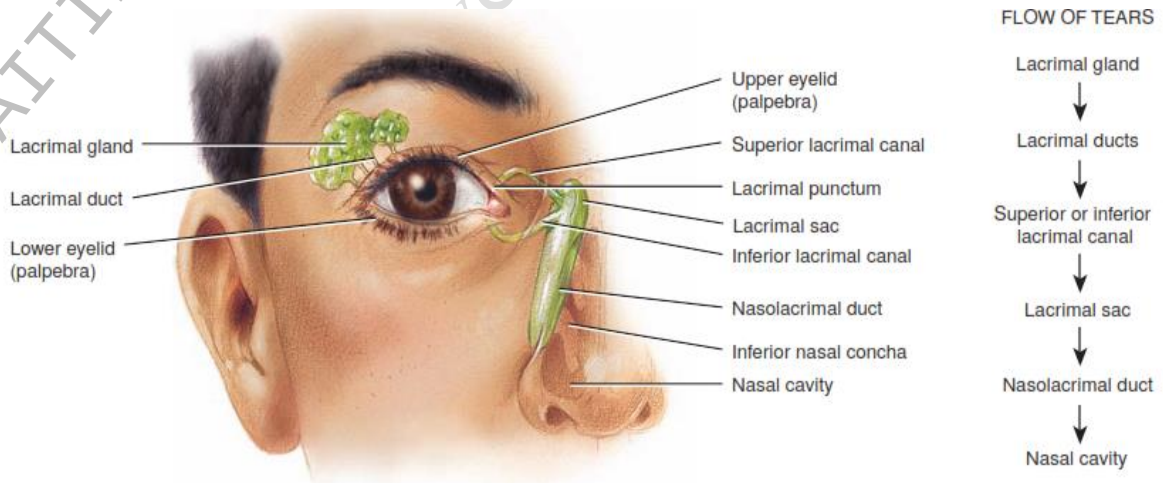
- The upper and lower eyelids shade the eyes during sleep, protect the eyes from excessive light and foreign objects, and spread lubricating secretions over the eyeballs.
- The upper eyelid is more movable than the lower.

Eyelashes and Eyebrows

- The eyelashes from the border of each eyelid and the eyebrows which located transversely above the upper eyelids.
- It helps to protect the eyeballs from foreign objects, perspiration, and the direct rays of the sun.

The Lacrimal Apparatus

- The lacrimal apparatus is a group of structures that produces and drains lacrimal fluid or tears.
- The lacrimal glands, each about the size and shape of an almond, secrete lacrimal fluid, which drains into 6–12 excretory lacrimal ducts that empty tears onto the surface of the conjunctiva of the upper lid.
- From here the tears pass medially over the anterior surface of the eyeball to enter two small openings called lacrimal puncta.
- Tears then pass into two ducts, the lacrimal canals, which lead into the lacrimal sac and then into the nasolacrimal duct.



Anatomy of the Eye Ball:

The adult eyeball size is about 2.5 cm (1 in.) in diameter. Out of total surface area, only the anterior one-sixth is exposed and the remaining part is protected by the orbit in to which it fits.

The wall of the eyeball consists of three layers:

i. Fibrous tunic:

- The fibrous tunic is the superficial layer of the eyeball and consists of the anterior cornea and posterior sclera.
- The cornea is a transparent coat that covers the colored iris. Because it is curved, the cornea helps focus light onto the retina.
- The sclera is the white portion of the eye.
- The sclera covers the entire eyeball except the cornea.

ii. Vascular tunic:

- The vascular tunic also known as uvea. It is the middle layer of the eyeball.
- It is composed of three parts: **choroid, ciliary body, and Iris.**

Choroid

- It is the posterior portion of the vascular tunic and its lines most of the internal surface of the sclera.
- The choroid also contains melanocytes that produce the pigment melanin, which causes this layer to appear dark brown in color.

Ciliary processes

- These are protrusions or folds on the internal surface of the ciliary body.
- They contain blood capillaries that secrete aqueous humor.

Iris

- It is the colored portion of the eyeball.
- It is located between the cornea and the lens and is attached at its outer margin to the ciliary processes.

iii. Retina.

- It is the third and inner layer of the eyeball.
- The retina, lines the posterior three-quarters of the eyeball and is the beginning of the visual pathway.
- The retina consists of a **pigmented layer and a neural layer.**
- The pigmented layer is a sheet of melanin-containing epithelial cells located between the choroid and the neural part of the retina.

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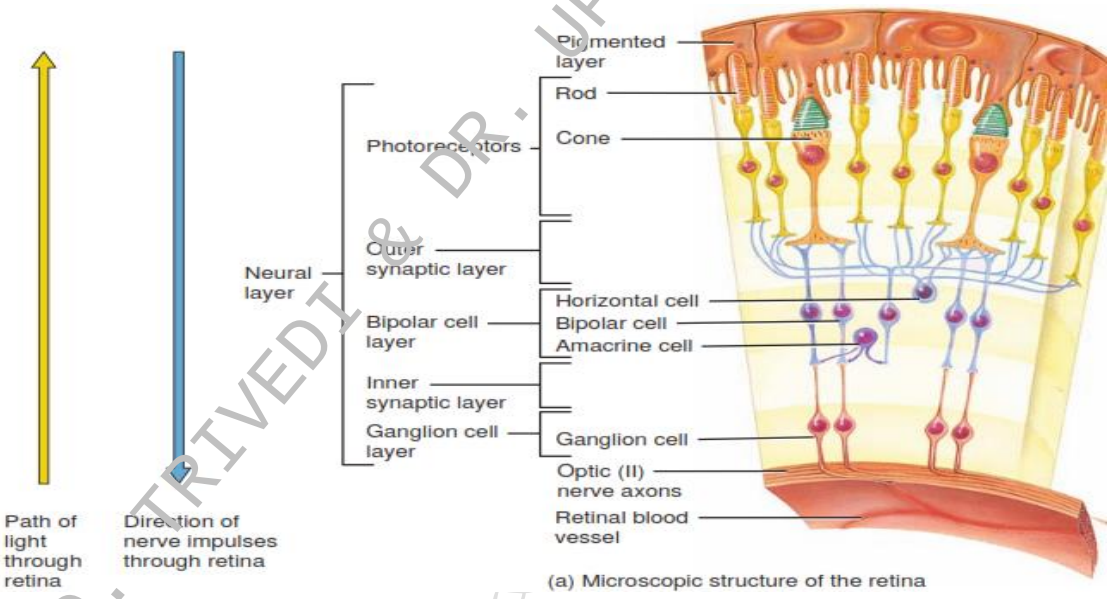
- The neural (sensory) layer of the retina is a multilayered outgrowth of the brain that processes visual data extensively before sending nerve impulses into axons that form the optic nerve.
- Three distinct layers of retinal neurons are: The photoreceptor layer, The bipolar cell layer and The ganglion cell layer which are separated by two zones, the outer and inner synaptic layers



- Photoreceptors are specialized cells that begin the process by which light rays are ultimately converted to nerve impulses.
- There are two types of photoreceptors: rods and cones.
- Each retina has about 6 million cones and 120 million rods.
- Rods allow us to see in dim light, such as moonlight. Because rods do not provide color vision, in dim light we can see only black, white, and all shades of gray in between.
- Brighter lights stimulate cones, which produce color vision. Three types of cones are present in the retina: (1) blue cones, which are sensitive to blue light, (2) green cones, which are sensitive to green light, and (3) red cones, which are sensitive to red light
- From photoreceptors, information flows through the outer synaptic layer to bipolar cells and then from bipolar cells through the inner synaptic layer to ganglion cells.
- The axons of ganglion cells extend posteriorly to the optic disc and exit the eyeball as the optic (II) nerve.

- The optic disc is also called the blind spot.
- Because it contains no rods or cones, we cannot see an image that strikes the blind spot.
- Normally, we are not aware of having a blind spot, but we can easily demonstrate its presence.
- Hold this page about 20 in. from your face with the cross shown below directly in front of your right eye. You should be able to see the cross and the square when you close your left eye.
- Now, keeping the left eye closed, slowly bring the page closer to your face while keeping the right eye on the cross.
- At a certain distance the square will disappear from your field of vision because its image falls on the blind spot.

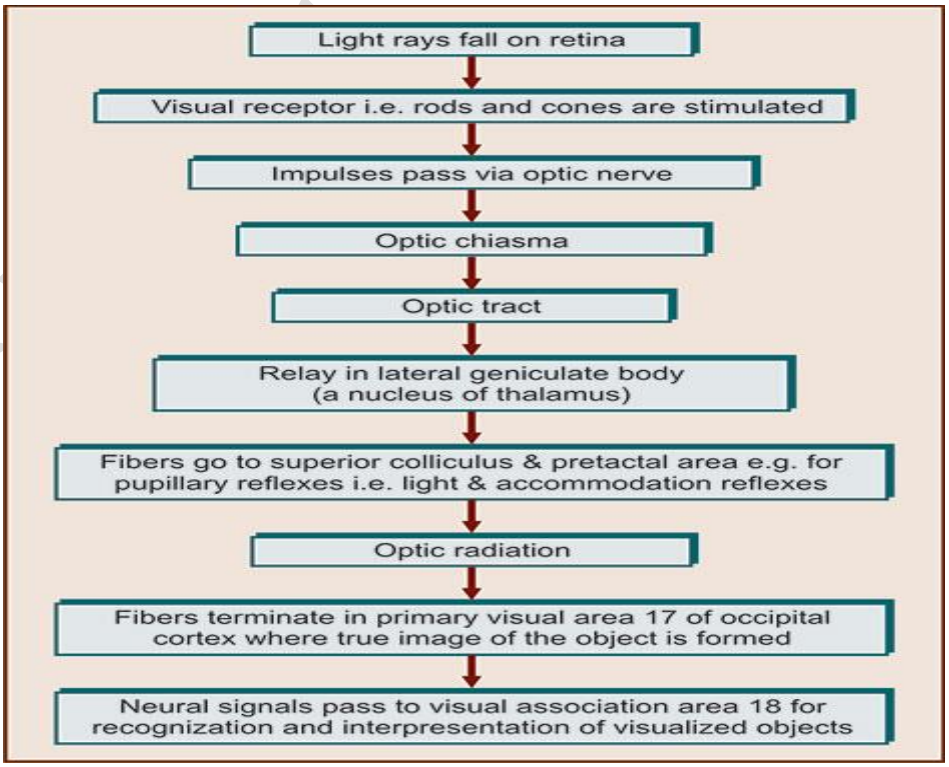
+ ■

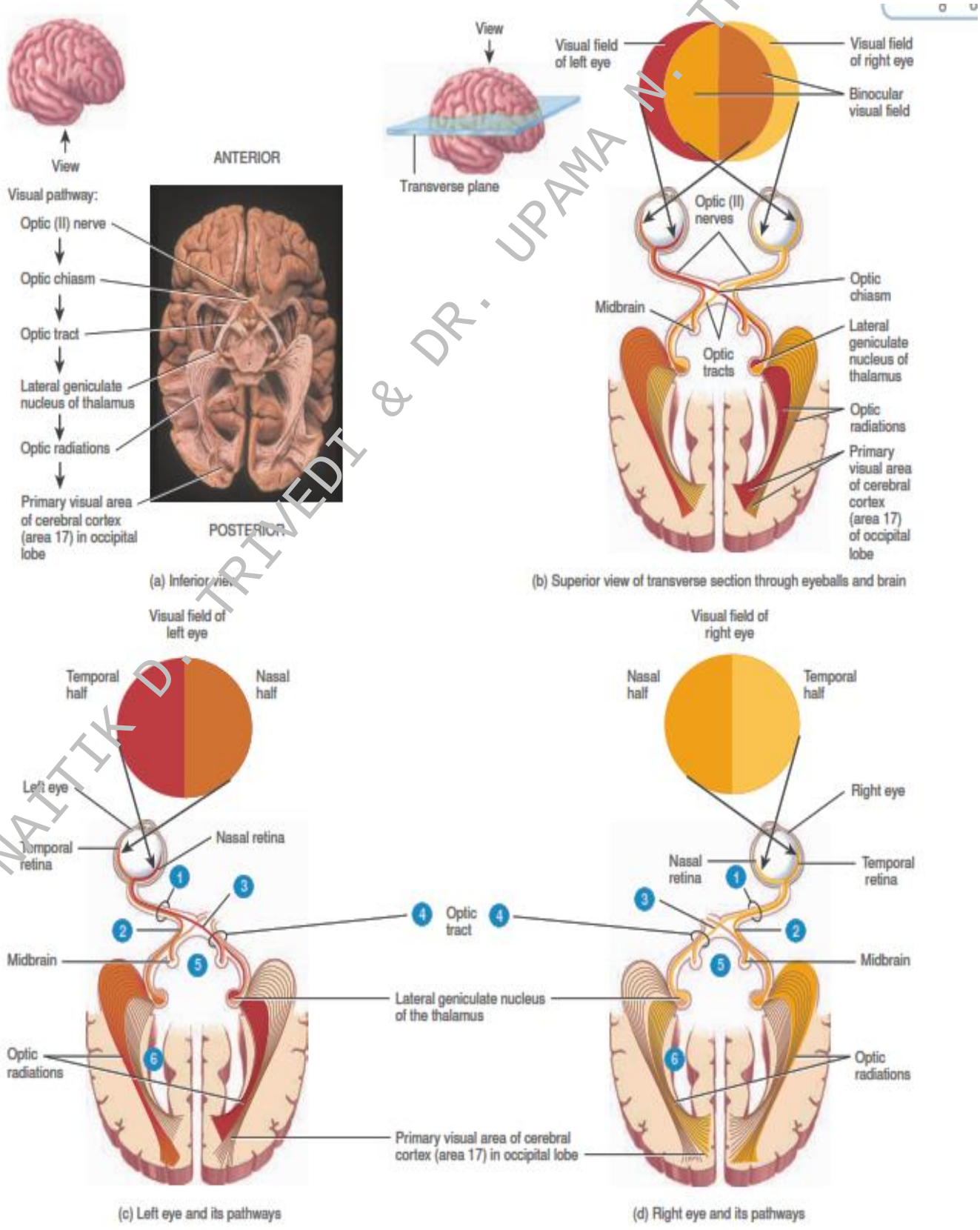
- The macula lutea is in the exact center of the posterior portion of the retina, at the visual axis of the eye.
- The fovea centralis a small depression in the center of the macula lutea, contains only cones.

Lens

- It is located behind the pupil and iris, within the cavity of the eyeball.
- It is made up by proteins called crystallins.

Visual Pathway:





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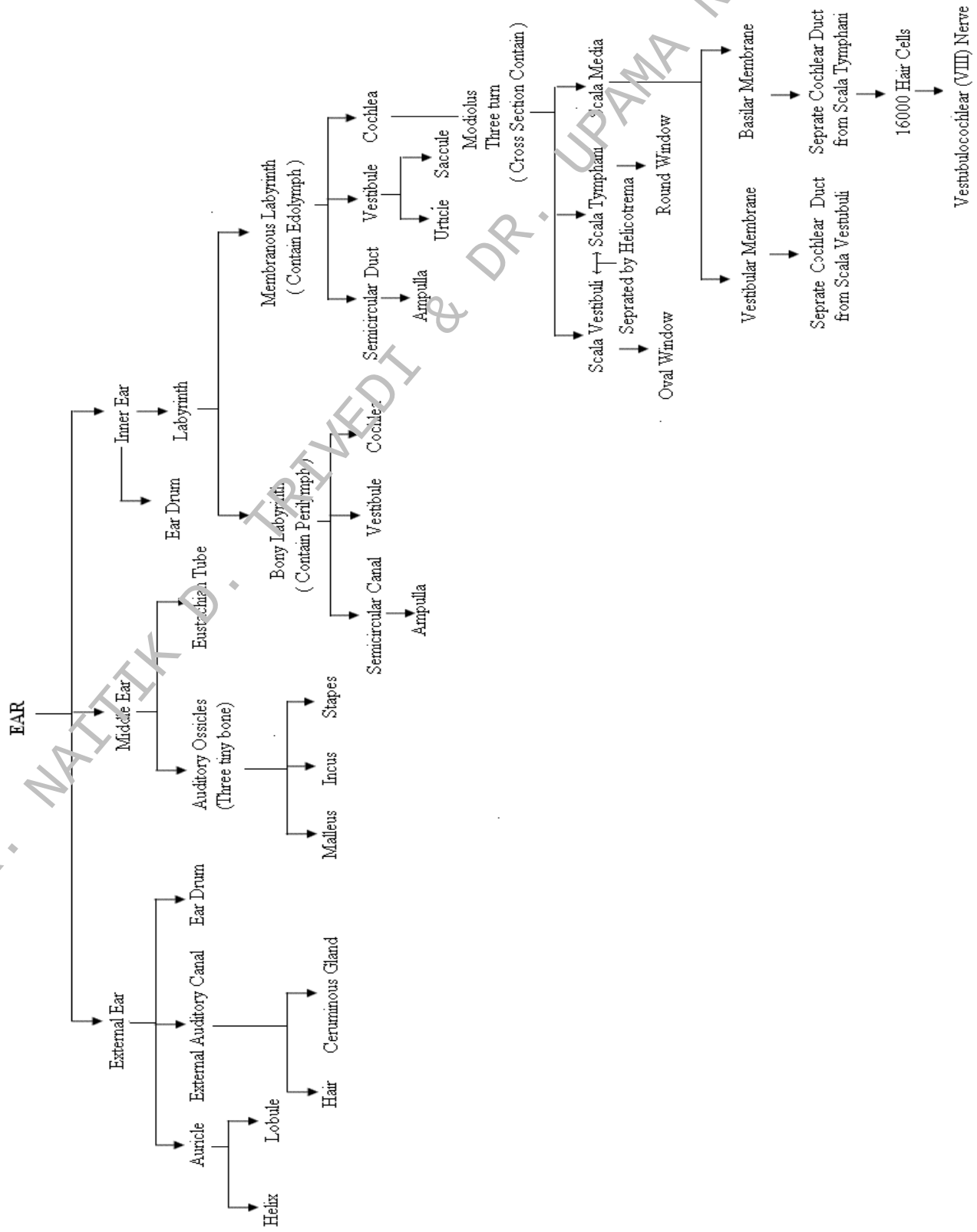
5. HEARING:

Hearing or audition is the sense of detecting sound through the ear.

Anatomy of Ear:



The ear is divided into three main regions:

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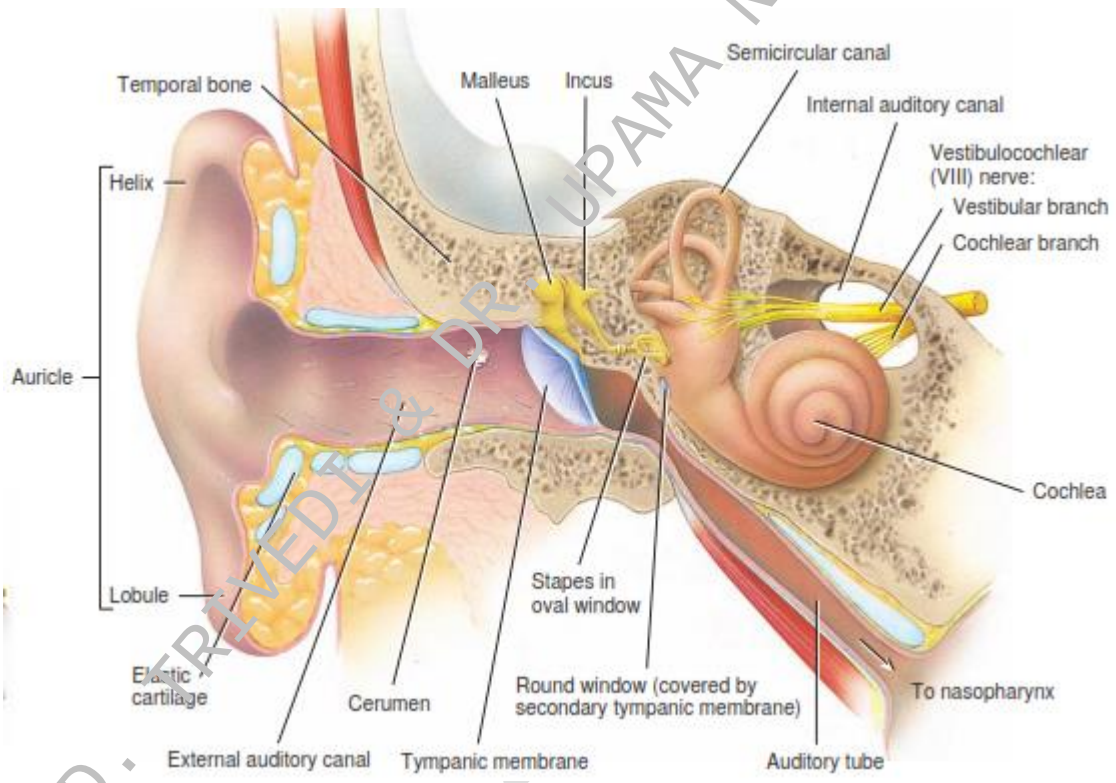
1. The external ear, which collects sound waves and channels them inward;
2. The middle ear, which conveys sound vibrations to the oval window and
3. The internal ear, which houses the receptors for hearing and equilibrium.



External (Outer) Ear:

- The external (outer) ear consists of the auricle, external auditory canal, and eardrum.
- The auricle is made up by helix and lobule.
- The external auditory canal is a curved tube about 2.5 cm (1 in.) long that lies in the temporal bone and leads to the eardrum.
- The tympanic membrane or eardrum is a thin, semitransparent partition between the external auditory canal and middle ear.
- Near the exterior opening, the external auditory canal contains a few hairs and specialized sweat glands called ceruminous glands that secrete earwax or cerumen.
- Both hairs and cerumen prevent the entry of dust and foreign objects in the ear.
- Cerumen helps to protect the delicate skin of the external ear canal by water and insects. Cerumen usually dries up and falls out of the ear canal automatically.
- In, some people ceruminous glands secret large amount of cerumen, that produce disturbance in hearing. So it is essential to remove cerumen regularly.

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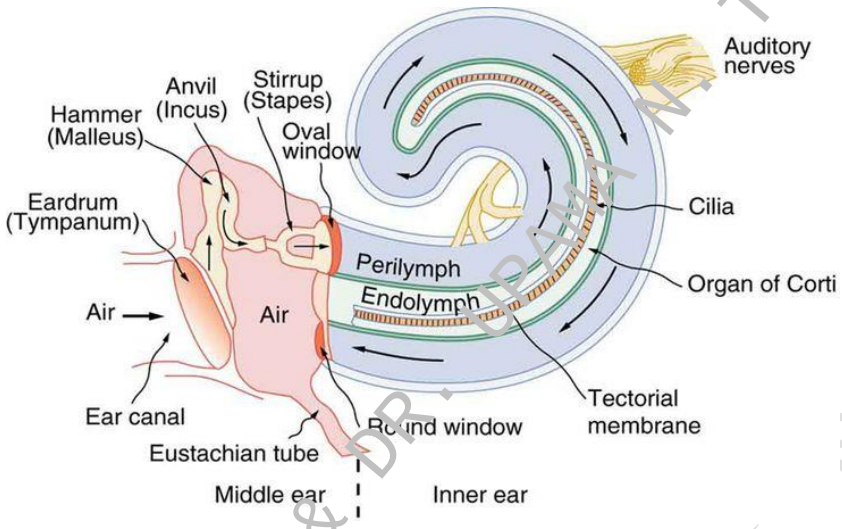
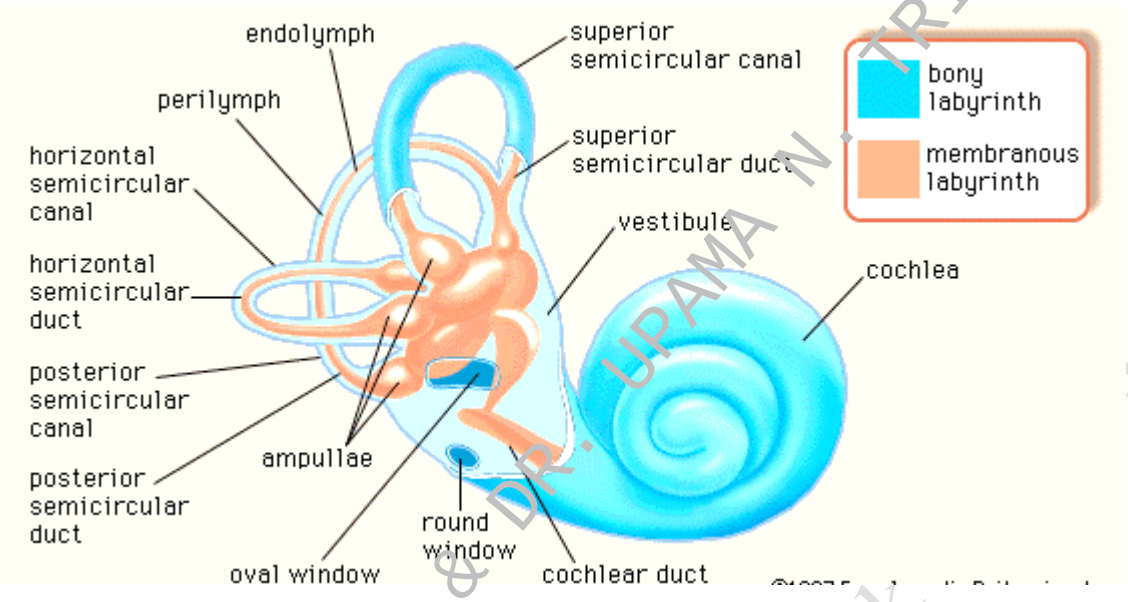
Middle Ear:



- It is a small, air-filled cavity.
- It is separated from the external ear by the ear drum and from the internal ear by a thin bony partition that contains two small membrane-covered openings: the oval window and the round window.
- Middle ear consist three bones.
    i. Malleus – Hammer Shape
    ii. Incus – Anvil Shape
    iii. Stapes – Stirrup Shape (Smallest Bone of the Body)
- The "handle" of the malleus attaches to the internal surface of the tympanic membrane or ear drum and the head of the malleus articulates with the body of the incus.
- The incus attached with the head of the stapes.
- The base or footplate of the stapes fits into the oval window.
- Below the oval window there is another opening known as the round window, which is enclosed by a membrane called the secondary tympanic membrane.
- The anterior wall of the middle ear contains an opening known as the eustachian tube or auditory tubes.
- It connects the middle ear with the nasopharynx and its main function is modifying the sound.

Internal (Inner) Ear

- The internal or inner ear is also called the labyrinth because it consist complicated series of canals.



- There are two main divisions of the inner ears:

i. Outer bony labyrinth :

- The bony labyrinth contains fluid known as perilymph. This fluid, which is chemically similar to cerebrospinal fluid.
- The bony labyrinth is divided into three areas:

a) **The semicircular canals:** Three bony semicircular canals, known as anterior, posterior, and lateral semicircular canals out from the vestibule.

b) **The vestibule:** The vestibule is the oval central portion of the bony labyrinth its end portion is swallow and known as amulla.

c) **The cochlea:** Anterior to the vestibule there is snail shaped structure known as the cochlea which having three snail shell like turn known as modiolus.

ii. Membranous labyrinth:

- The membranous labyrinth contains fluid known as endolymph.
- The membranous labyrinth in the vestibule consists of two sacs called the utricle and the saccule which are connected by a small duct.

- **The cochlea** is divided into three channels:

i. Cochlear duct: It is a continuation of the membranous labyrinth into the cochlea; and it consist endolymph.

ii. Scala vestibule: It located above the cochlear duct which ends at the oval window. It is the part of bony labyrinth and it consist perilymph.

- Scala tympani: It located below the cochlear duct which ends at the round window. It is the part of bony labyrinth and it consist perilymph.

- The scala vestibuli and scala tympani are completely separated by the cochlear duct.
- The vestibular membrane separates the cochlear duct from the scala vestibuli, and the basilar membrane separates the cochlear duct from the scala tympani.
- Basilar membrane is the spiral organ consist coiled sheet of epithelial cells consist 16,000 hair cells, which are the receptors for hearing.
- At the apical surface of hair consist microvilli and at their basal ends, inner and outer hair cells synapse both with first-order sensory neurons and with motor neurons from the cochlear branch of the vestibulocochlear (VIII) nerve.

Physiology of hearing:

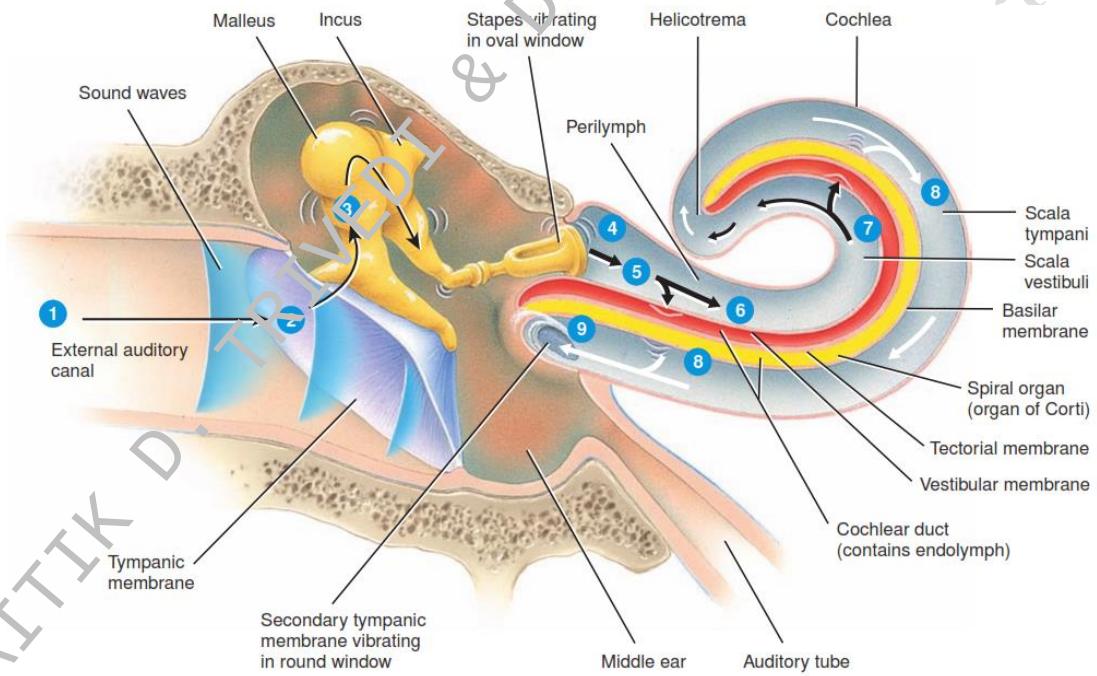
Hearing involved following steps:

- The auricle of outer ear send sound waves into the external auditory canal to ear drum.
- When sound waves strike the tympanic membrane or ear drum, the alternating high- and low-pressure of the air causes the tympanic membrane to vibrate back and forth.
- The eardrum vibrates slowly in response to low-frequency (low-pitched) sounds and rapidly in response to high-frequency (high-pitched) sounds.
- The central area of the eardrum connects to the malleus, which also starts to vibrate. The vibration is transmitted from the malleus to the incus and then to the stapes.
- As the stapes moves back and forth, it pushes the membrane of the oval window in and out.
- The oval window vibrates about 20 times more vigorously than the eardrum because vibrations spread over a large surface area (eardrum) into a smaller surface (oval window).
- The movement of the oval window sets up fluid pressure waves in the perilymph of the scala vestibule of cochlea.
- Pressure waves are transmitted from the scala vestibuli to the scala tympani and eventually to the round window, causing it to bulge outward into the middle ear.

- As the pressure waves deform the walls of the scala vestibuli and scala tympani, they also push the vestibular membrane back and forth, creating pressure waves in the endolymph inside the cochlear duct.

- The pressure waves in the endolymph cause the basilar membrane to vibrate, which moves the hair cells of the spiral organ against the tectorial membrane.

- This leads to bending of the hair cell stereocilia or villi, which produces receptor potentials that ultimately lead to the generation of nerve impulses.

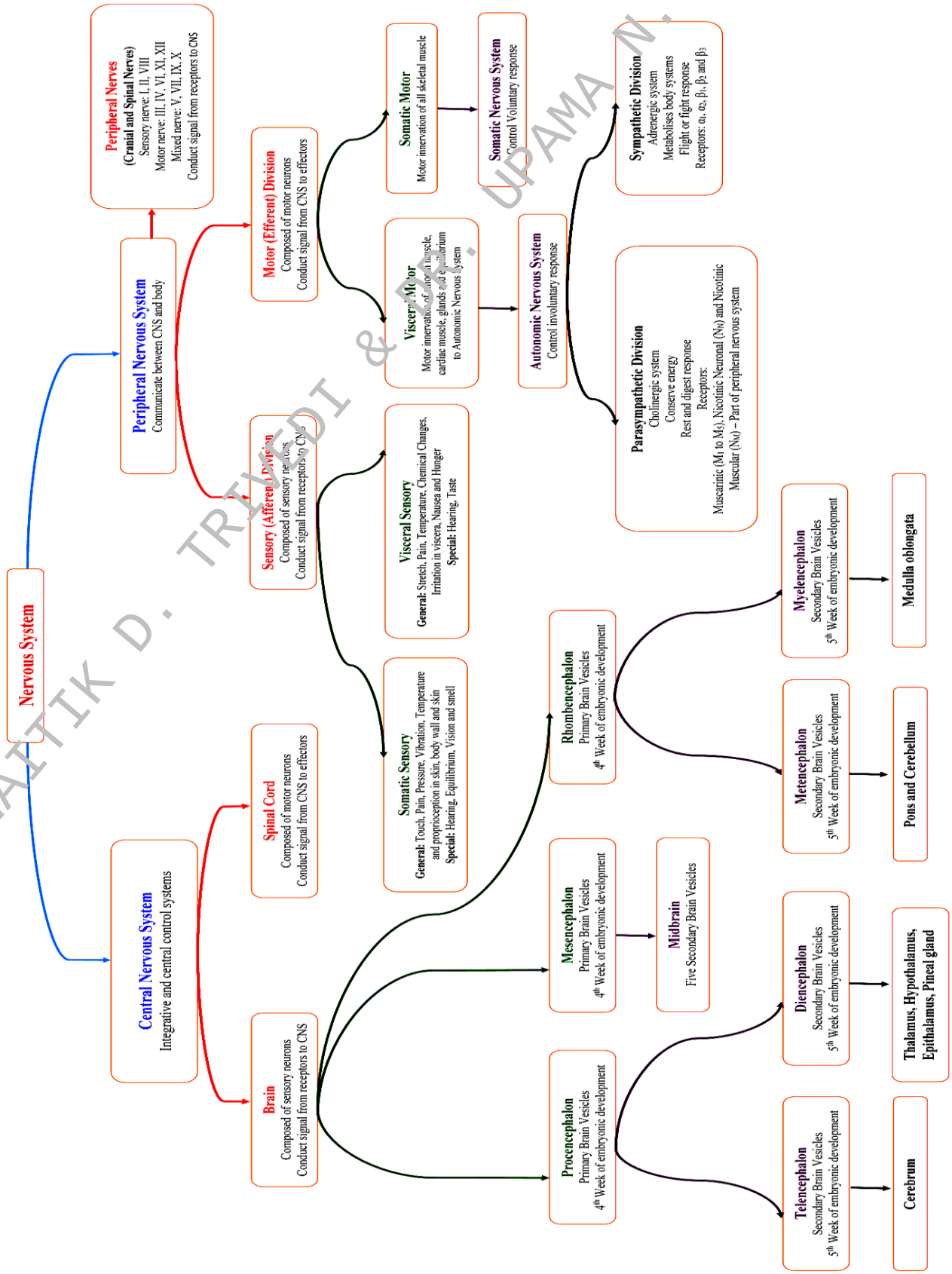


Signature of Teacher

PRACTICAL NO.: 02 **DATE**

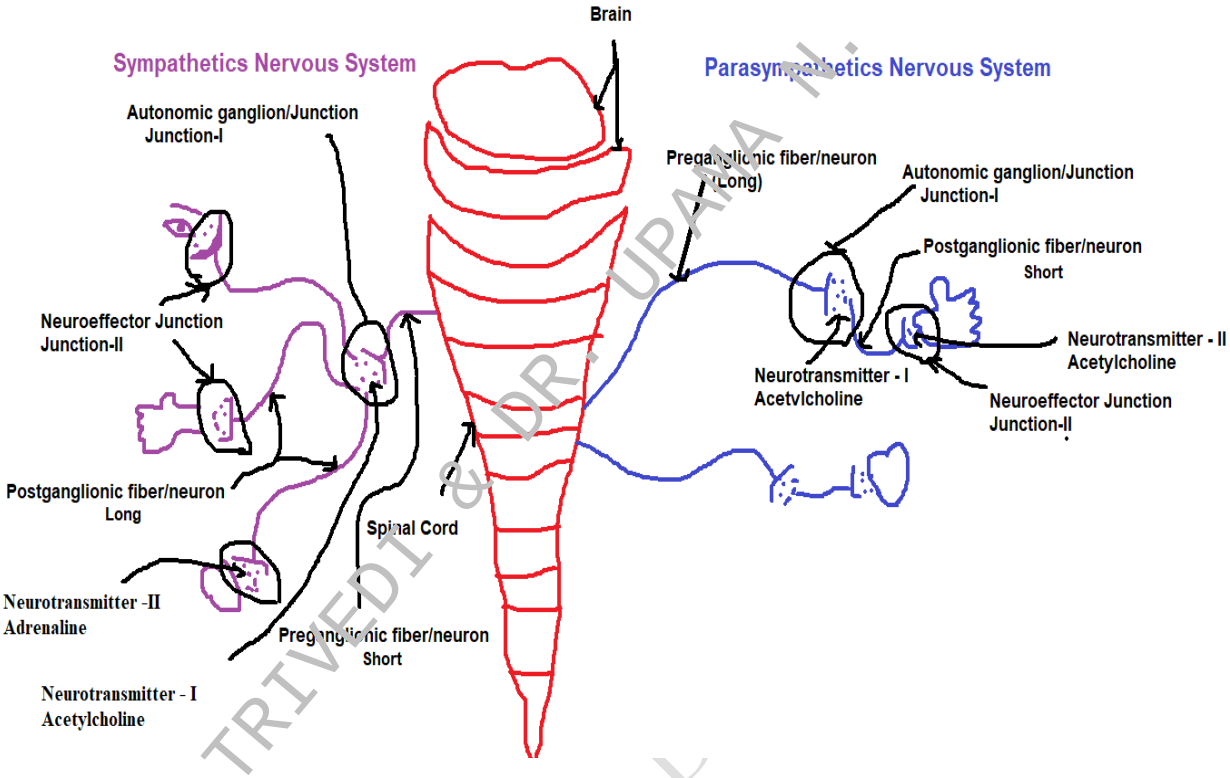
AIM: TO STUDY THE NERVOUS SYSTEM USING SPECIMEN AND MODELS

REQUIREMENTS: Charts and Models of Human Brain, Spinal Cord, Autonomic Nervous system



PRACTICAL NO.: 02 **DATE**

AUTONOMIC NERVOUS SYSTEM



THEORY

Introduction of Autonomic Nervous System (ANS):

It is the part of nervous system that deals with the involuntary movements. It is also known as visceral nervous systems. It works under the conscious and unconscious conditions and maintain the involuntary functions. It control automatically, pumping of blood, beating of heart, contraction of blood vessel, lungs and GI tract, secretion of saliva, lacrimal fluid etc….

Anatomy of Autonomic Nervous System (ANS):

Hypothalamus

↓ Coordinate with

Midbrain/Spinal Cord

↓

Stimulate Preganglionic Neuron/Fiber

↓ Release Neurotransmitter – I at Autonomic Ganglion

Stimulate Postganglionic Neuron/Fiber

↓ Release Neurotransmitter – II at Neuron Effector Junction

It stimulate various receptors of respective organs

↓

Produce various autonomic action

PRACTICAL NO.: 02 **DATE**

Autonomic nervous system is subdivided into the two portion:

1. Parasympathetic Nervous System (Cholinergic Nervous System)
2. Sympathetic Nervous Systems (Adrenergic Nervous System)

1. PARASYMPATHETIC NERVOUS SYSTEM (CHOLINERGIC NERVOUS SYSTEM):

Anatomy of Parasympathetic Nervous System (Cholinergic Nervous System)

Superior control by anterior and middle part of hypothalamus

↓

Centre of III, VII, IX and X cranial nerve and sacral part of spinal cord

↓

Activate preganglionic neuron/fiber (Long)

↓

Release neurotransmitter-I (Ach) in Autonomic Ganglion/Junction (Junction-I)

↓ Stimulate (N_N) or (M_1) receptor

Activate postganglionic neuron/fiber (Short) after that Ach is destruct by Acetylcholine Esterase

↓

Release neurotransmitter-II (Ach) in Neuron Effector Junction (Junction-II)

↓ Stimulate (M_1), (M_2), (M_3) or (N_N) receptor

Produce various action after that Ach is destruct by Acetylcholine Esterase (AchE)

*Preganglionic neuron/fibers are long and post ganglionic neuron/fibers are short in parasympathetic nervous system.

* One preganglionic neuron/fiber, one or two post ganglionic neuron/fiber are originated except Auorbach's plexus - inner circular and outer longitudinal layers of the muscularis externa).

* Acetylcholine esterase (AchE) is the enzyme which destruct the Acetyl Choline (Ach) after their action.

* Parasympathetic system consist two types of receptors: 1) Muscarinic (M_1, M_2, M_3, M_4, M_5) and Nicotinic (N_N – Nicotinic Neuronal, N_M – Nicotinic Muscular).

Location of parasympathetic receptors and their functions:

Parasympathetic receptors

- **Muscarinic**
  - **M_1**
  - **M_2**
  - **M_3**
  - **M_4**
  - **M_5**
- **Nicotinic**
  - **Nicotinic Neuronal (N_N)**
  - **Nicotinic Muscular (N_M)**

- **M_1 receptors:**

Location	Function
Autonomic ganglion/junction (Junction – I)	Activation of post ganglionic neuron/fiber

- **M_2 receptors:**

Location	Function
Heart	Decrease force of contraction (Negative Inotropic) Decrease heart rate (Negative Chronotropic) Decrease conduction (Negative dromotropic)

- **M_3 receptors:**

Location	Function
GI smooth muscle	Contraction of GI smooth muscle
Bronchial smooth muscle	Contraction of bronchial smooth muscle (Lungs contraction)
Urinary tract	Contract detrusor – urinary bladder muscle which relax trigon of urinary bladder and produce micturition.
Salivary secretion	Increase secretion of saliva
Lacrimal secretion	Increase secretion of tear/lachrymal fluid
Gastric secretion	Increase secretion of HCl in GI tract
Eye	Produce meiosis (Contraction of pupils) Iris consist two types of smooth muscles 1) Sphincter pupillae 2) Dilator pupillae (Radial Muscle). Contraction of sphincter pupillae constrict pupil known as meiosis and contraction of dilator pupillae produce dilation of pupil known as mydriasis.

N_N receptors:

Location	Function
Autonomic ganglion/junction (Junction – I)	Activation of post ganglionic neuron/fiber
Adrenal medulla	Release of adrenalin and some nor adrenalin
CNS	Complex undefined action but inhibitory

N_M receptors:

Location	Function
Neuromuscular Junction	Contraction of skeletal muscle

Synthesis, storage, release and hydrolysis of Ach

Choline + Acetyl Co-A
↓ Choline acetylase
Ach (Store in vesicle)
↓ Release of Ach when needed
Ach produce various action through receptors
↓ Acetylcholine Esterase (AchE) destruct Ach
Ach convert in acetate and choline

PRACTICAL NO.: 02 **DATE**

2. SYMPATHETIC NERVOUS SYSTEMS (ADRENERGIC NERVOUS SYSTEM)

Anatomy of sympathetic nervous system (Adrenergic System)

Superior control by posterior and lateral part of hypothalamus

↓

Preganglionic fibers origenate from Thoracic 1 to Lumber 3 segments

↓

Activate preganglionic neuron/fiber (Short)

↓

Release neurotransmitter-I (Ach) in Autonomic Ganglion/Junction (Junction-I)

↓ Stimulate (N_N) or (M_1) receptor

Activate postganglionic neuron/fiber (Long) after that Ach is destruct by Acetylcholine Esterase

↓ Release neurotransmitter-II (Adr)

Stimulate (α_1), (α_2), (β_1), (β_2) or (β_3) receptor in Neuron Effector Junction (Junction-II)

↓

Produce various action

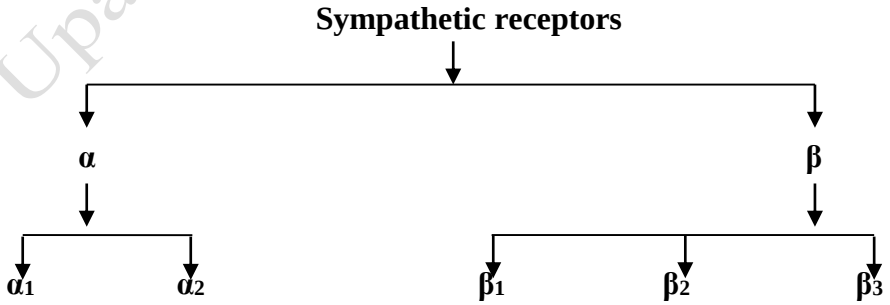
*Preganglionic neuron/fibers are short and post ganglionic neuron/fibers are long in sympathetic nervous system.

* One preganglionic neuron/fiber emerge out 20 to 100 post ganglionic neuron/fiber.

* Sympathetic nervous system consist both the neurotransmitter that is acetylcholine in autonomic ganglion/junction and noradrenalin in neuron effector junction.

* Parasympathetic system consist two types of receptors: α (α_1, α_2) and β (β_1, β_2, β_3)

Location of sympathetic receptors and their functions:



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- **α_1 receptors:**

Location	Function
Blood vessels	Produce vasoconstriction
Iris	It contract radial muscles and dilate the pupil known as mydriasis
GI tract	Contract the GI sphincter and relax the the GI muscle
Urinary bladder	Contract the trigon and relax the urinary bladder
Glands	Increase the secretion of glands
Uterus	It produce contraction in nonpregnant uterus
Heart	Weak action on heart
Male sex organ	Penile erection and ejaculation
Skin	Contraction of pilomotor muscles.

- **α_2 receptors:**

Location	Function
Presynaptic nerve ending	It reduce release of noradrenalin
Blood vessels	Produce constriction of blood vessels
CNS	Reduction in central sympathetic flow due to decrease of Noradrenalin level
Pancreas	Reduce insulin level so increase blood sugar level
Platelets	Aggregate platelets
GI muscle	Relaxation of GI muscle

- **β_1 receptors:**

Location	Function
Heart	Increase force of contraction (Positive Inotropic) Increase heart rate (Positive Chronotropic) Increase conduction (Positive dromotropic)
Kidney	Release of renin, so renin activate angiotensinogen I which convert in angiotensinogen II by the help of angiotensinogen converting enzyme (ACE) and activate the aldosterone. Which retain the Na^+ and water and increase the blood volume as well as angiotensinogen act on AT-I and AT-II receptor and contract the blood vessels.

- **β_2 receptors:**

Location	Function
Blood vessels	Dilation of blood vessels
Lungs	Dilation of bronchial smooth muscles and lungs
GI muscle	Relaxation of GI muscle
Bladder	Relaxation of detrusor produce relaxation in urinary bladder (contract the trigon)
Liver	Produce glycogenolysis means conversion of glycogen to glucose and increase blood sugar level
Pancreas	Increase glucagon secretion which increase blood sugar level
Adipose tissue	Lipolysis (Break down of fats)
Uterus	Produce relaxation in pregnant uterus

- **β_3 receptors:** Role and functions of β_3 receptors are not clearly defined.

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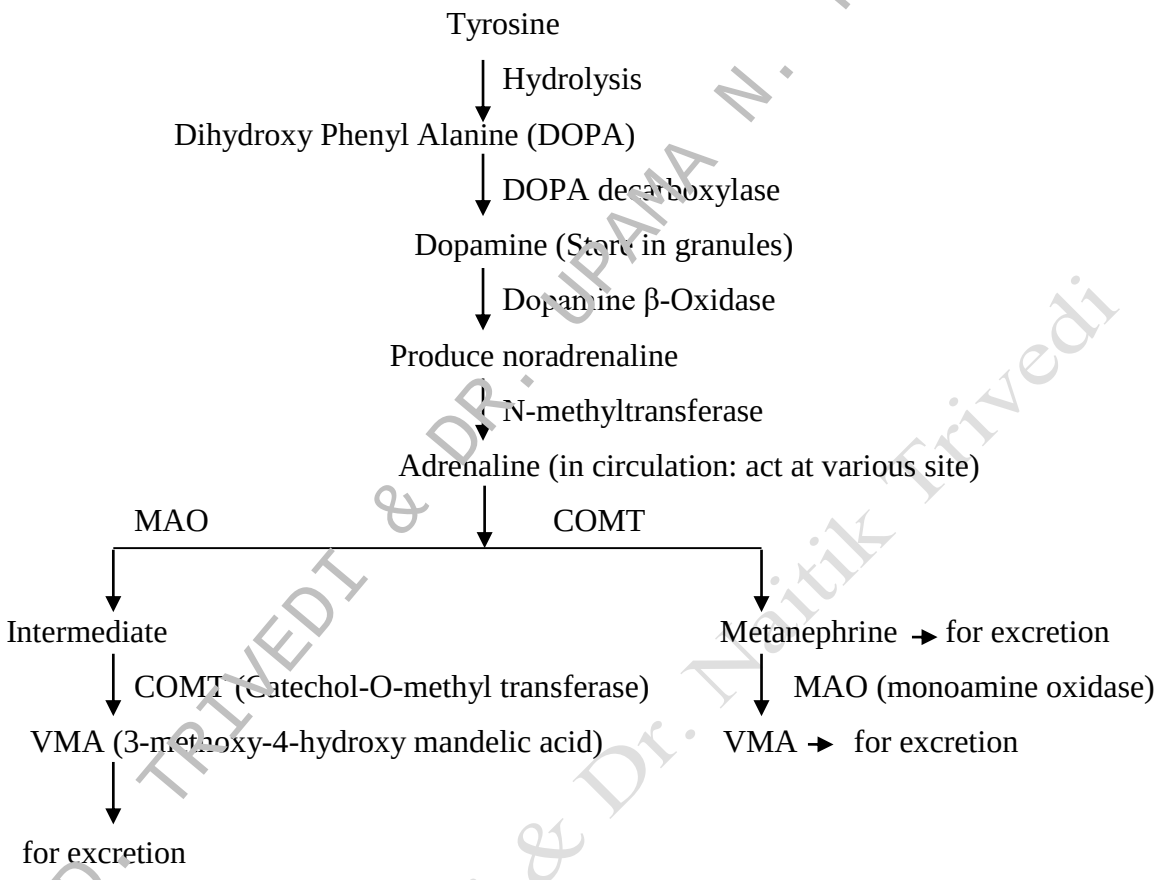
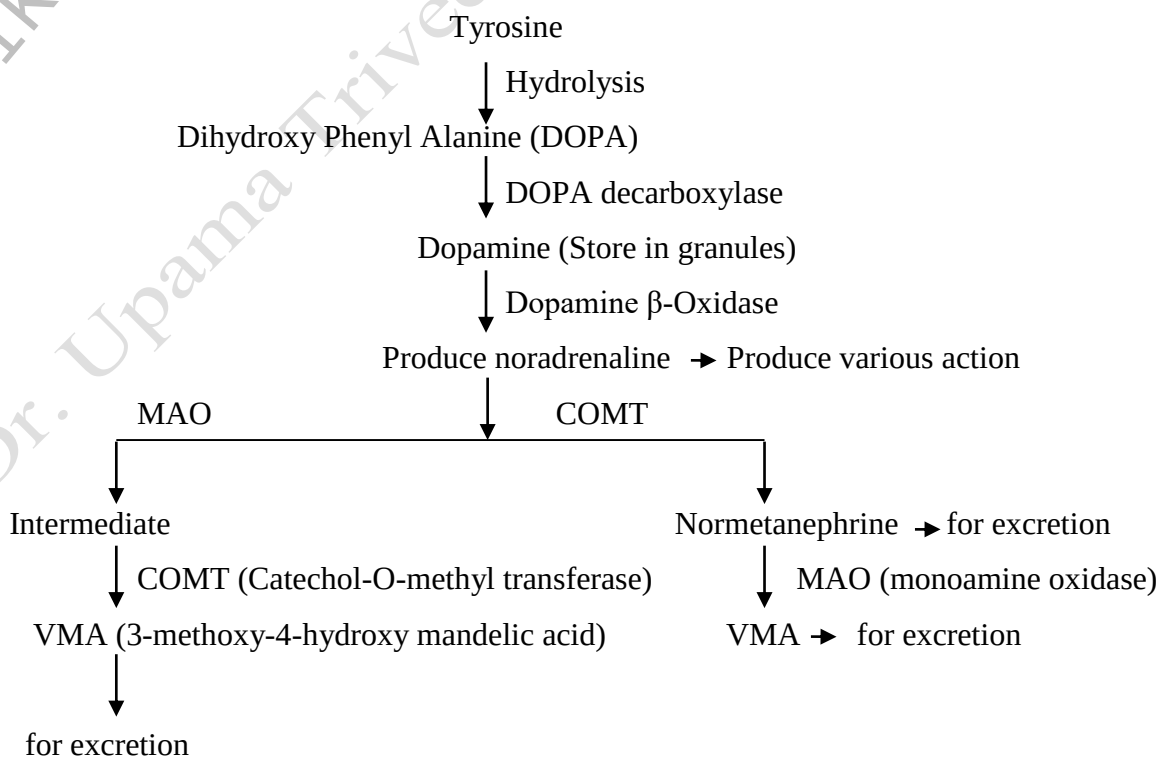
Synthesis, storage, release and hydrolysis of adrenaline

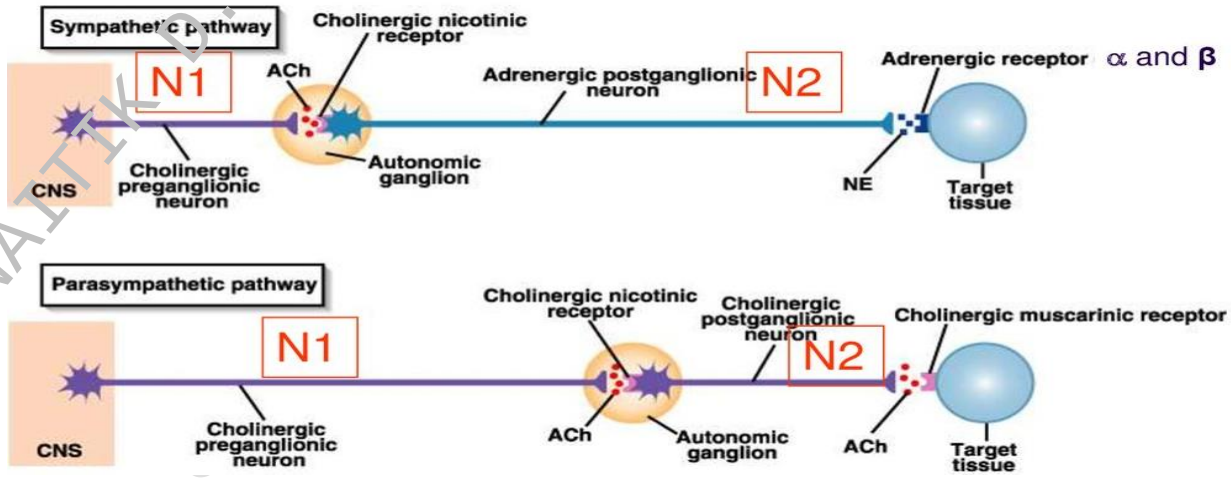


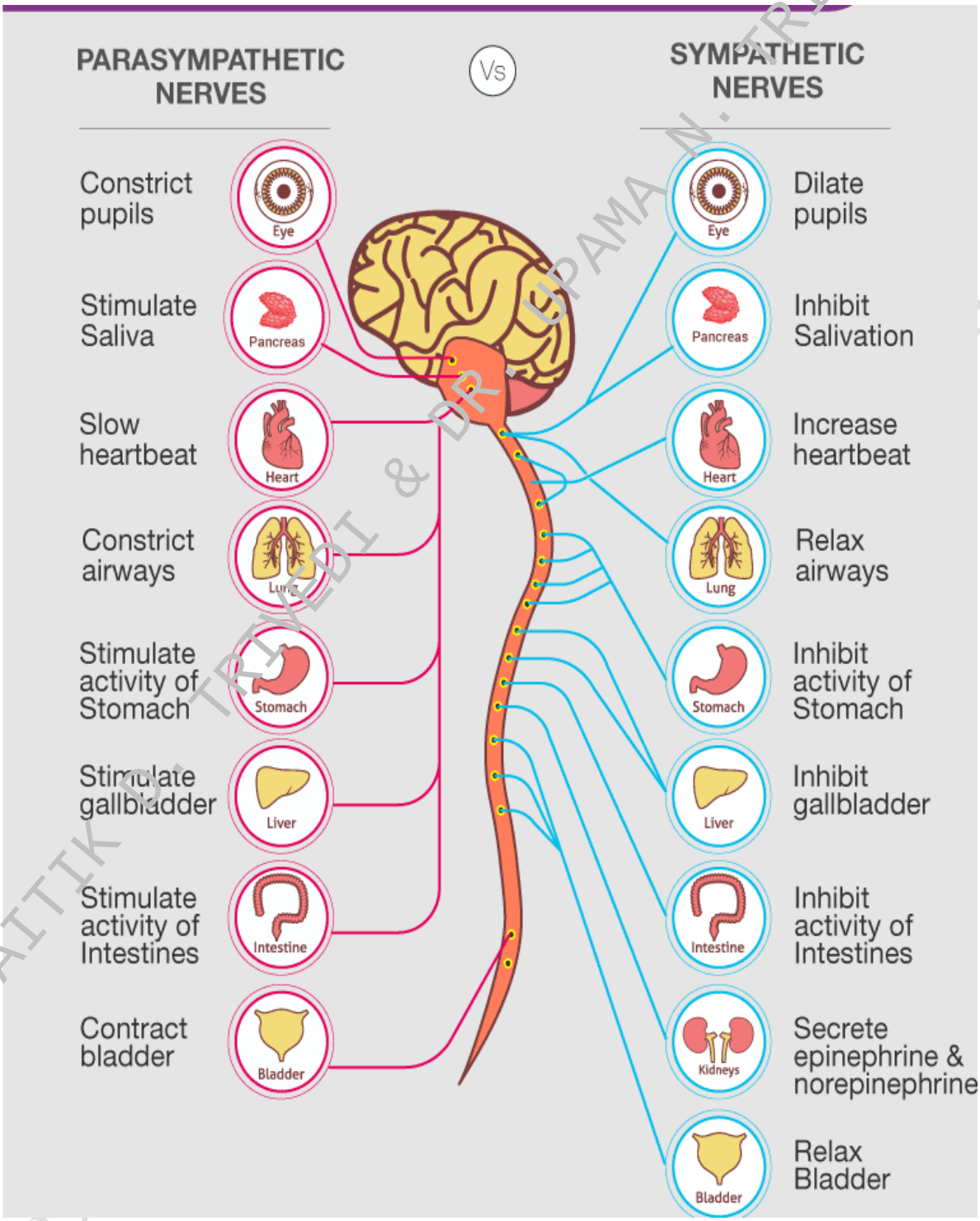
Synthesis, storage, release and hydrolysis of noradrenaline

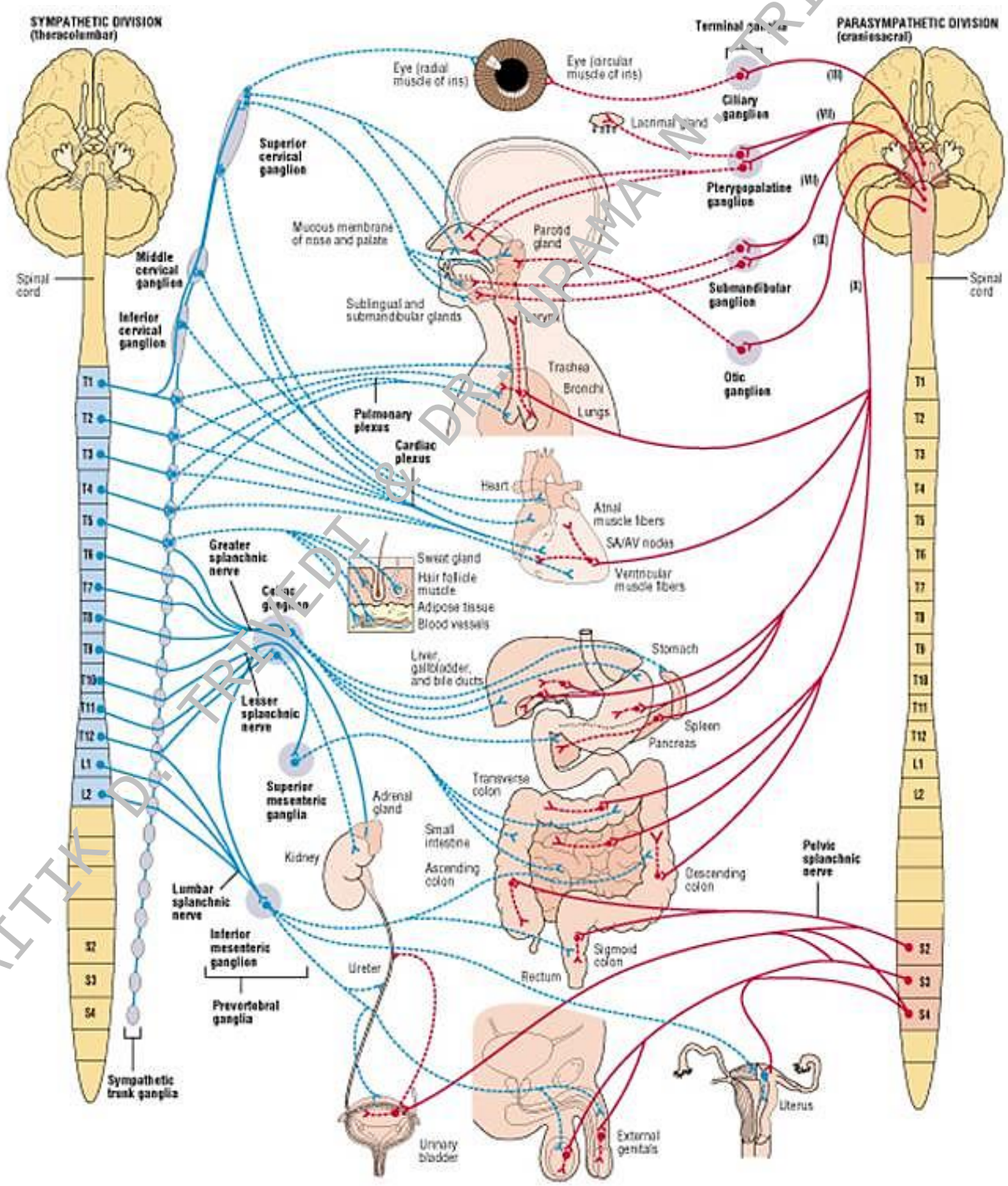


Sympathetic and Parasympathetic Effects		
Structure	Sympathetic	Parasympathetic
Eye (pupil)	Dilation	Constriction
Nasal Mucosa	Mucus reduction	Mucus increased
Salivary Gland	Saliva reduction	Saliva increased
Heart	Rate increased	Rate decreased
Arteries	Constriction	Dilation
Lung	Bronchial muscle relaxation	Bronchial muscle contraction
Gastrointestinal Tract	Decreased motility	Increased motility
Liver	Conversion of glycogen to glucose increased	Glycogen synthesis
Kidney	Decreased urine	Increased urine
Bladder	Contraction of sphincter	Relaxation of sphincter
Sweat Glands	↑Sweating	No change

Neurotransmitter	Neurotransmitter – I is acetylcholine and Neurotransmitter – II is Adrenalin	Neurotransmitter – I and II both are acetylcholine
Preganglionic fiber	Short	Long
Postganglionic fiber	Long	Short
Receptor	α and β	Muscarinic (M) and Nicotinic (N)







Sympathetic and parasympathetic nervous system (Ref: Tortora)

PRACTICAL NO.: 02 **DATE**

CENTRAL NERVOUS SYSTEM

THE BRAIN

Anatomy of Brain:

Adult brain consist average 100 billion neurons and 1000 billion neuroglia. Weight of the adult brain is approximately 1.3-1.5 kg in human. Brain mainly divided into four parts:

1. Brain Stem: It is the superior portion and continuous with the spinal cord consist medulla oblongata, pons and midbrain.
2. Cerebellum: It located posterior to the brain stem.
3. Diencephalon: It is located superior to the brain stem. It consist thalamus, epithalamus, subthalamus, hypothalamus and pineal gland.
4. Cerebrum: It look like cap of mushroom. It occupies the most of the part of cranium and it is divided into right and left halves known as cerebral hemispheres.

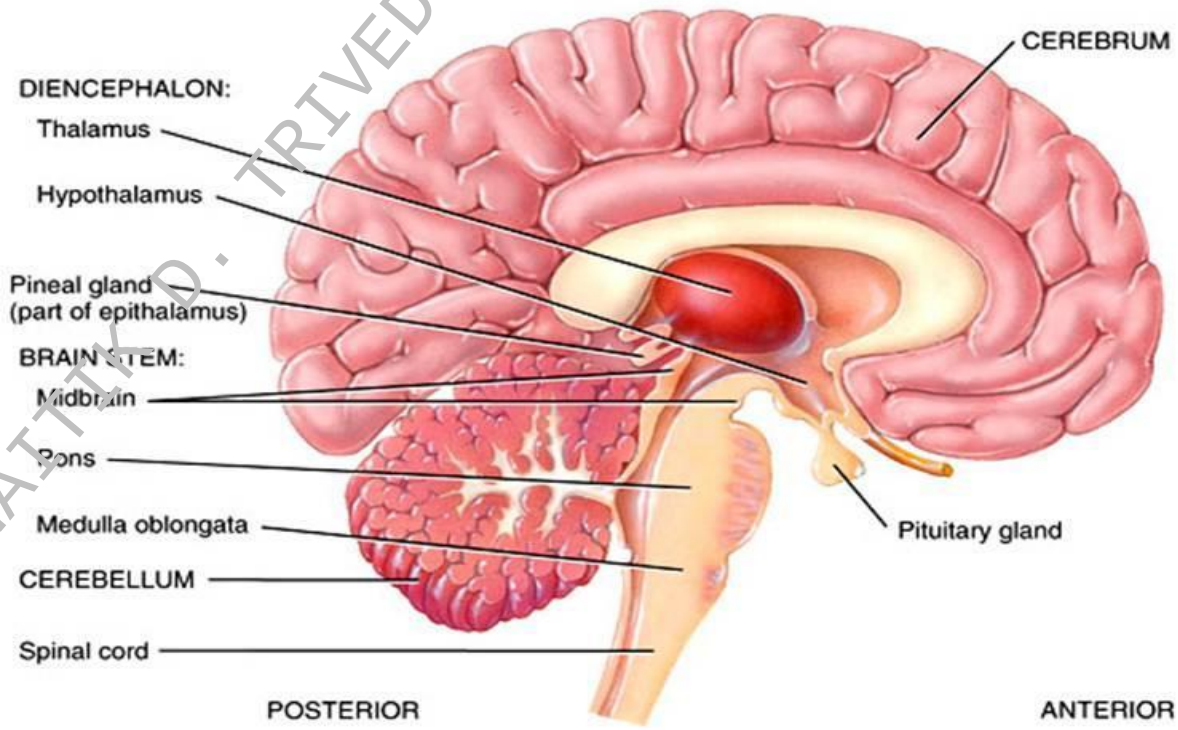


Diagram of brain

According to the embryonic development brain is divided mainly into the three parts at the third weeks of embryonic development which is also known as primary brain vesicles:

1. Prosencephalon – Forebrain
2. Mesencephalon – Midbrain
3. Rhombencephalon – Hindbrain

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During the further development of the embryo primary vesicles is divided and form secondary vesicles at the 5th weeks of embryonic development.

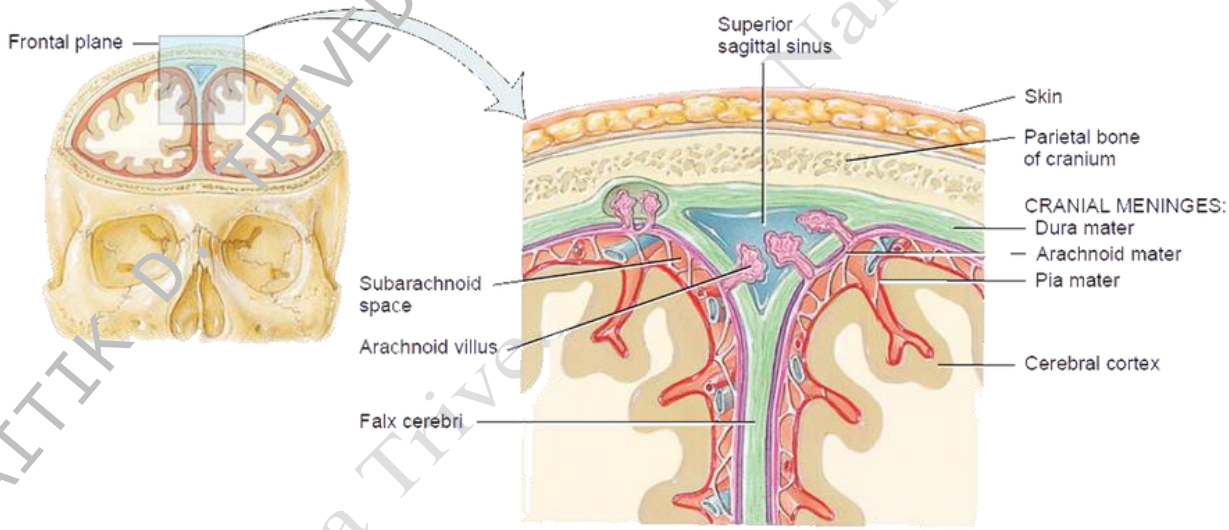
- Procencephalon develop telencephalon and diencephalon
- Mesencephalon develop midbrain
- Rhombencephalon develop metencephalon and myelencephalon

At the final stage of embryonic development:

- Telencephalon forms cerebrum
- Diencephalon forms epithalamus, hypothalamus, subthalamus, thalamus and pineal gland
- Metencephalon forms pons and cerebellum
- Myelencephalon forms medulla oblongata

The brain grow rapidly during the first few years of life (between the ages of 1-12 years).

PROTECTION AND COVERING OF THE BRAIN:



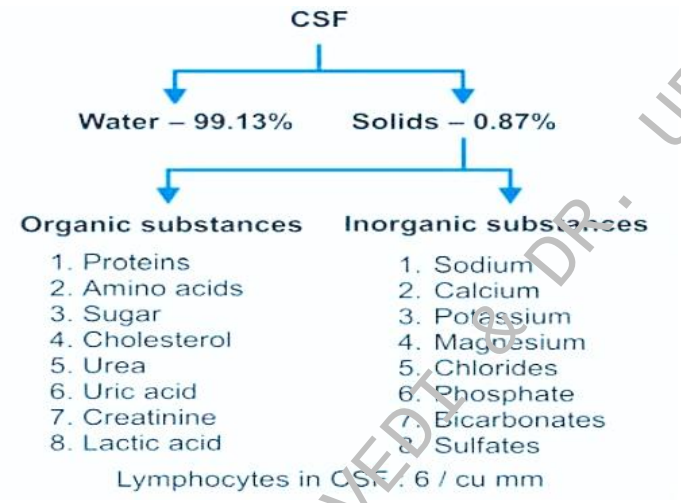
- Cranial bones and cranial meninges mainly protect the brain.
- Cranial bones produce the superficial layer of the brain.
- Cranial meninges surrounds the brain and continuous towards the spinal cord and known as spinal meninges.
- In the brain, outer portion of the cranial manages known as dura meter, middle portion known as arachnoid and inner portion is known pia meter.

PRACTICAL NO.: 02 **DATE**

CEREBROSPINAL FLUID (CSF):

The entire central nervous system contains between 80 – 150 mL of CSF, and about 500 mL is generated every day.

Compositions of cerebrospinal fluid:

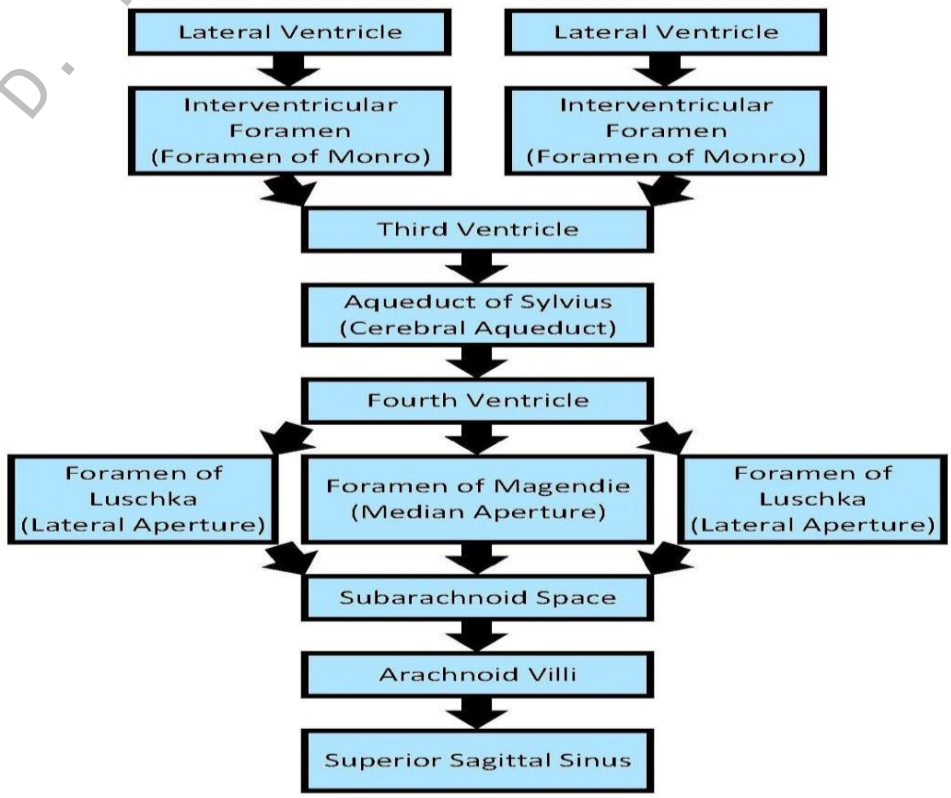


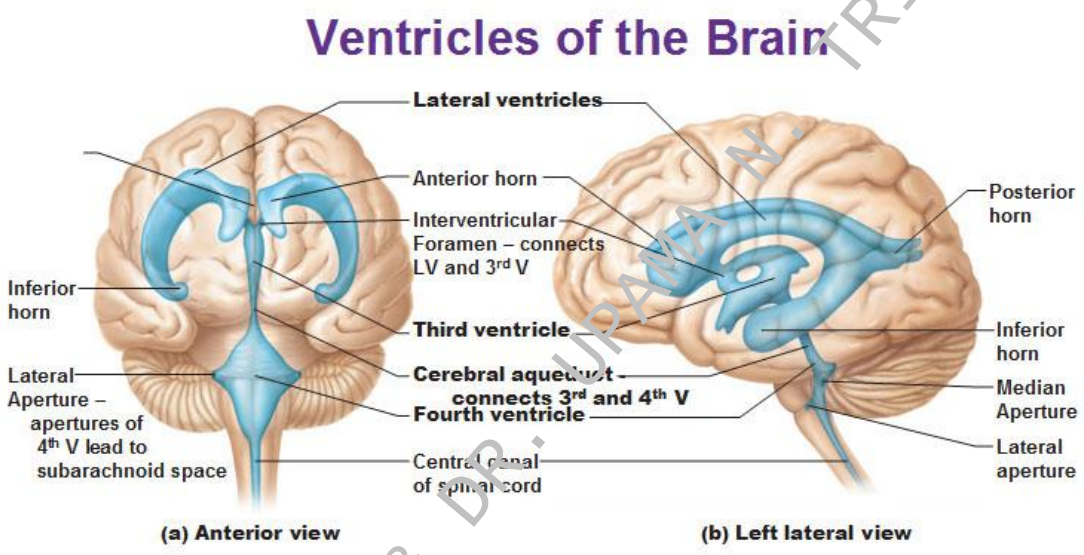
Composition of CSF

Substance	Plasma	CSF
Na^+ (mEq/l)	145.0	150.0
K^+	4.8	2.9
Ca^{++}	5.2	2.3
Mg^{++}	1.7	2.3
Cl^-	108.0	130.0
HCO_3^-	27.4	21.0
Lactate	7.9	2.6
PO_4^{---}	1.8	0.5
Protein	7000.0	20.0
Glucose	95.0	60.0

(protein and glucose expressed as mg/100 ml)

Flow/circulation of cerebrospinal fluid:

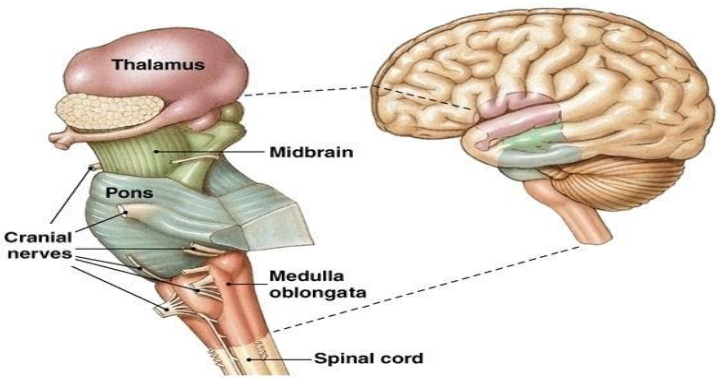




Functions of cerebrospinal fluid (CSF):

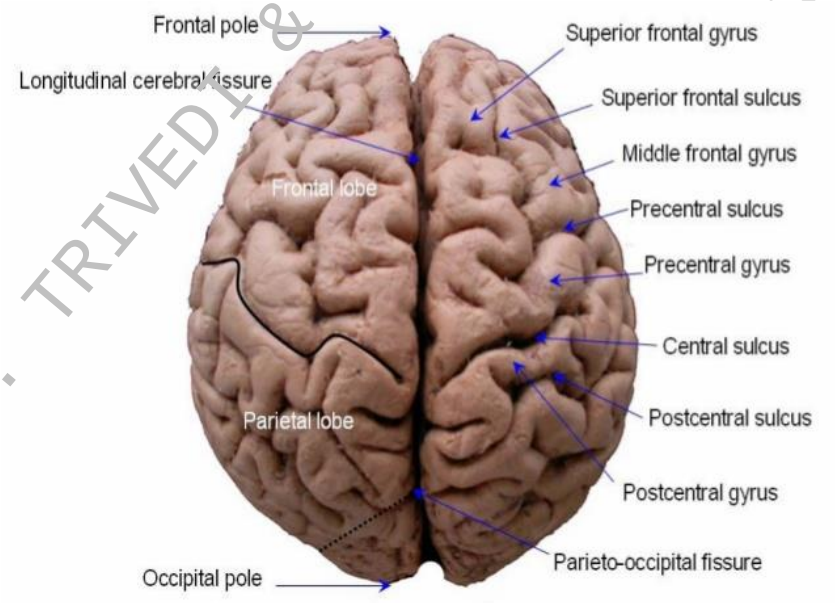
1. Mechanical Protection:
   - Cerebrospinal fluid absorb the shock and protect the delicate tissue of the brain and spinal cord.
   - It also act as a lubricating fluid and reduce the friction during the movement.
2. Chemical Protection:
   - It maintain the electrolytes and chemical balance which is required for regulation of post synaptic potential and action potential.
3. Provide nutrients:
   - It provide the essential nutrient through the circulation in brain and spinal cord.
4. Provide immunity:
   - It consist some amount of the WBCs which can fight against the harmful bacteria and virus.
5. Remove the toxin:
   - CSFs remove the metabolites, waste products and toxin from the brain and spinal cord through the circulation.

BRAIN STEM:



- The midbrain, pons and medulla oblongata of the hindbrain are collectively referred to as the “brain stem”. These structures connects brain to the spinal cord.
- The midbrain coordinates sensory representations of the visual, auditory and somatosensory perceptual spaces.
- The pons is the main connection with the cerebellum. The pons and the medulla regulate several crucial functions, including the cardiovascular and respiratory systems.
- The cranial nerves connect through the brain stem and provide the brain with the sensory input and motor output associated with the head and neck, including most of the special senses.
- The major ascending and descending pathways between the spinal cord and brain, specifically the cerebrum, pass through the brain stem.

CEREBRUM:



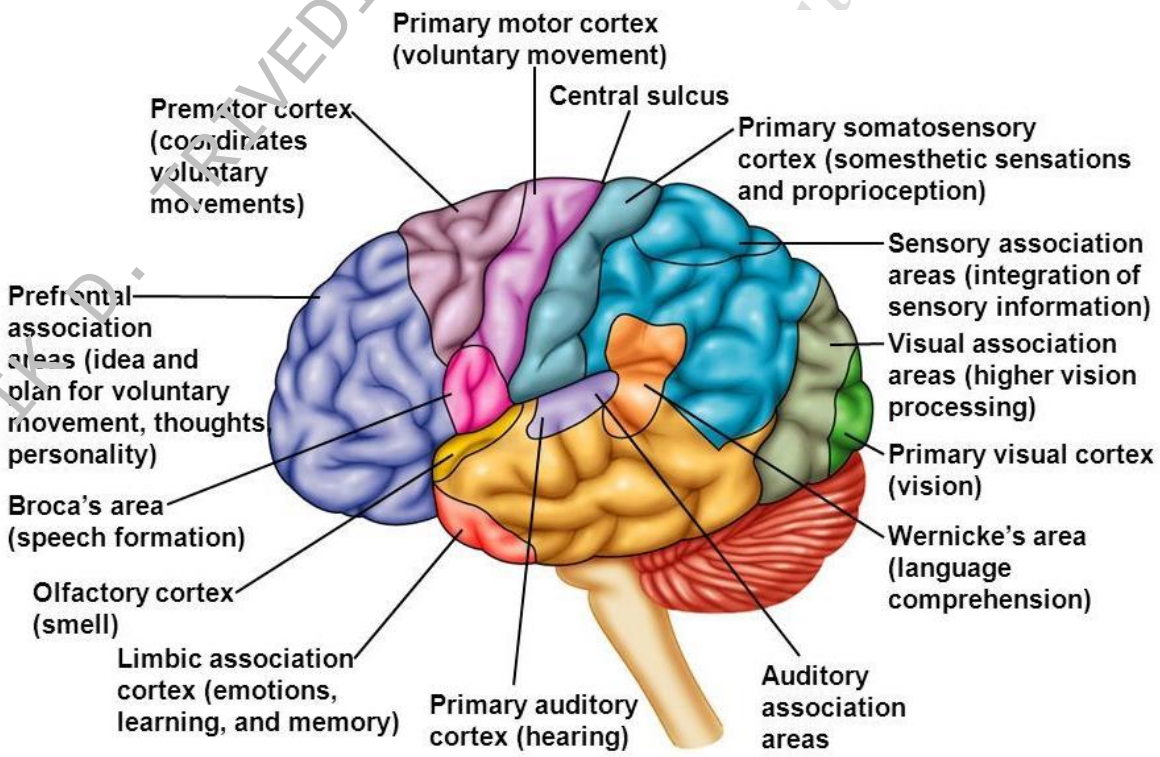
- Cerebrum support diencephalon and brainstem. It develop from the telencephalon.
- The superficial layer of the cerebrum is gray matter which is known as cerebral cortex.
- Cerebral cortex is 2-4 mm thick and consists billion of neurons.
- Deep to the cerebral cortex consist white matter.
- During the embryonic development when brain size increase rapidly the gray matter of the cortex enlarge much faster than the white matter so cortical region rolls and folds itself. The folds are known as gyri.
- The deepest grooves between folds are known as fissures and the narrower grooves between folds are known as sulci.
- The most prominent fissure is longitudinal fissure which separates cerebral in right and left hemispheres. These hemispheres are joined internally by the white matters.

- Each hemisphere controls the opposite side of the body. If a stroke occurs on the right side of the brain, your left arm or leg may be weak or paralyzed.
- Not all functions of the hemispheres are shared. In general, the left hemisphere controls speech, comprehension, arithmetic, and writing. The right hemisphere controls creativity, spatial ability, artistic, and musical skills. The left hemisphere is dominant in hand use and language in about 92% of people.

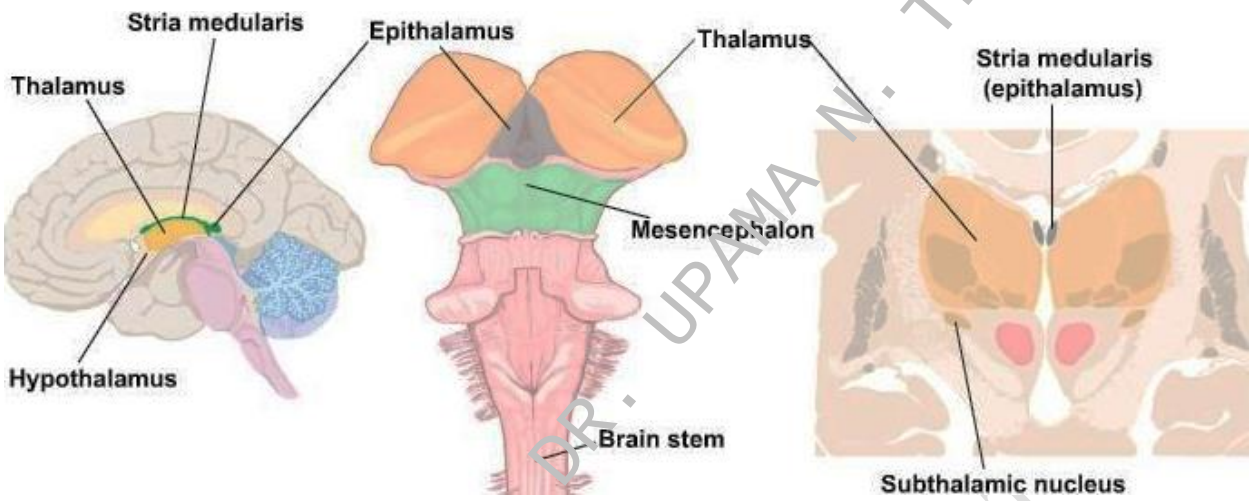
Functional area of the cerebral cortex:

Cerebral cortex consist mainly three kinds of functional areas.

1. Sensory areas: receives and interpret sensory impulses.
2. Motor areas: control muscular movements
3. Association areas: deals with more complex integrative functions such as memory, emotion, reasoning, will, judgment, personalities, intelligence etc.

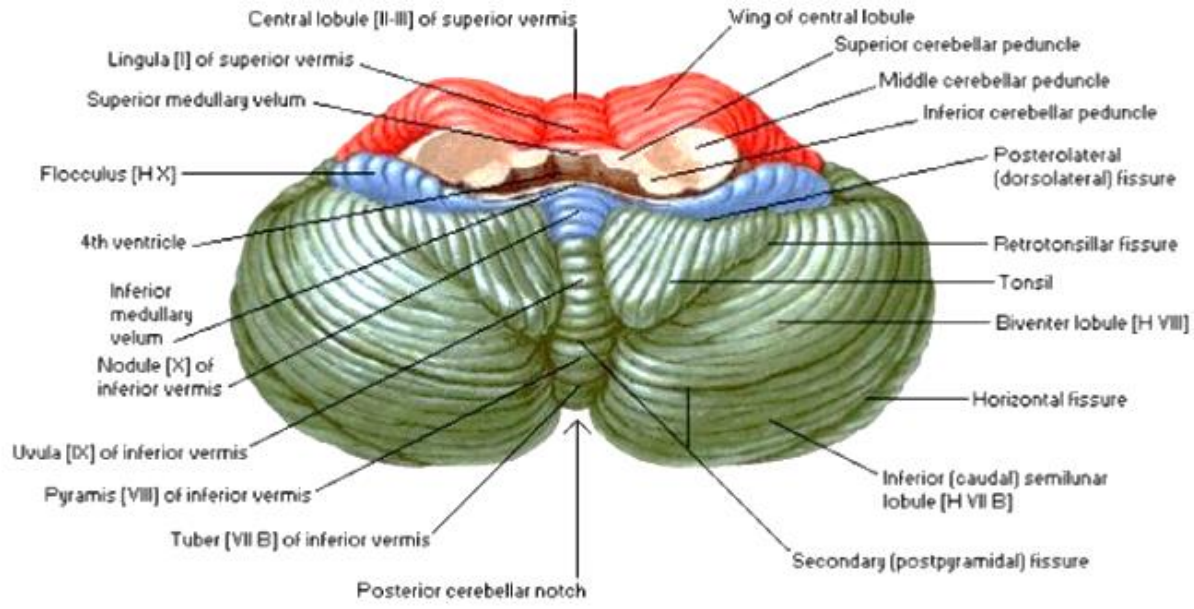


DIENCEPHALON:



- The diencephalon is the connection between the cerebrum and the rest of the nervous system, with one exception.
- The rest of the brain, the spinal cord, and the PNS all send information to the cerebrum through the diencephalon.
- Output from the cerebrum passes through the diencephalon. The single exception is the system associated with olfaction, or the sense of smell, which connects directly with the cerebrum.
- The diencephalon is deep beneath the cerebrum and constitutes the walls of the third ventricle. The diencephalon consists thalamus, hypothalamus, epithalamus, subthalamus and pineal gland.

CEREBELLUM:



PRACTICAL NO.: 02 **DATE**

Anatomy of Cerebellum:

- The cerebellum, which stands for "little brain", is a structure of the central nervous system. It has an important role in motor control.
- In particular, it is active in the coordination, precision and timing of movements, as well as in motor learning.
- The cerebellum is located at the back of the brain, immediately inferior to the occipital and temporal lobes, and within the posterior cranial fossa. It is separated from these lobes by the tentorium cerebelli, a tough layer of dura mater.
- It lies at the same level of and posterior to the pons, from which it is separated by the fourth ventricle.
- The cerebellum consists of two hemispheres which are connected by the vermis, a narrow midline area. Like other structures in the central nervous system, the cerebellum consists of grey matter and white matter:
- Grey matter – located on the surface of the cerebellum. It is tightly folded, forming the cerebellar cortex.
- White matter – located underneath the cerebellar cortex. Embedded in the white matter are the four cerebellar nuclei (the dentate, emboliform, globose, and fastigi nuclei).
- There are three ways that the cerebellum can be subdivided – anatomical lobes, zones and functional divisions
- There are three cerebellar zones. In the midline of the cerebellum is the vermis. Either side of the vermis is the intermediate zone. Lateral to the intermediate zone are the lateral hemispheres. There is no difference in gross structure between the lateral hemispheres and intermediate zones

PRACTICAL NO.: 02 **DATE**

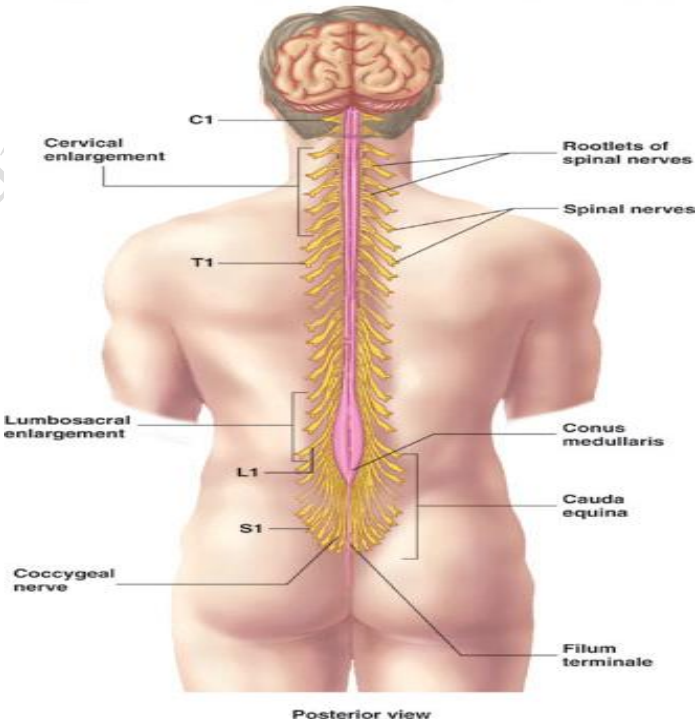
THE SPINAL CORD

FUNCTIONS:

- The spinal cord with its 31 pairs of *spinal nerves* serves two important functions.
- It is the connecting link between the brain and most of the body.
- It is involved in spinal reflex actions, both somatic and visceral.

BASIC EXTERNAL ANATOMY OF THE SPINAL CORD:

- The spinal cord extends caudally from the brain for about 45 cm and has a width of ~14 mm. Its upper end is continuous with the brain (medulla oblongata). The cord is slightly thicker than a pencil.
- There are 31 pairs of spinal nerves: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and coccygeal. The roots of the lumbar and sacral are called *cauda equina*.
- Surrounding and protecting the spinal cord is the vertebral column.
- The spinal cord is slightly flattened dorsally and ventrally, with two enlargements-cervical and lumbosacral from which the spinal nerves emerge that innervate the upper and lower limbs.
- The cervical enlargement supplies nerves to the pectoral girdle and upper limbs.
- The lumbar enlargement supplies nerves to the pelvis and lower limbs.
- Inferior to the lumbar enlargement, the spinal cord becomes tapered and conical-conus medullaris.
- Filum terminale-slender strand of fibrous tissue that extends from conus medullaris.

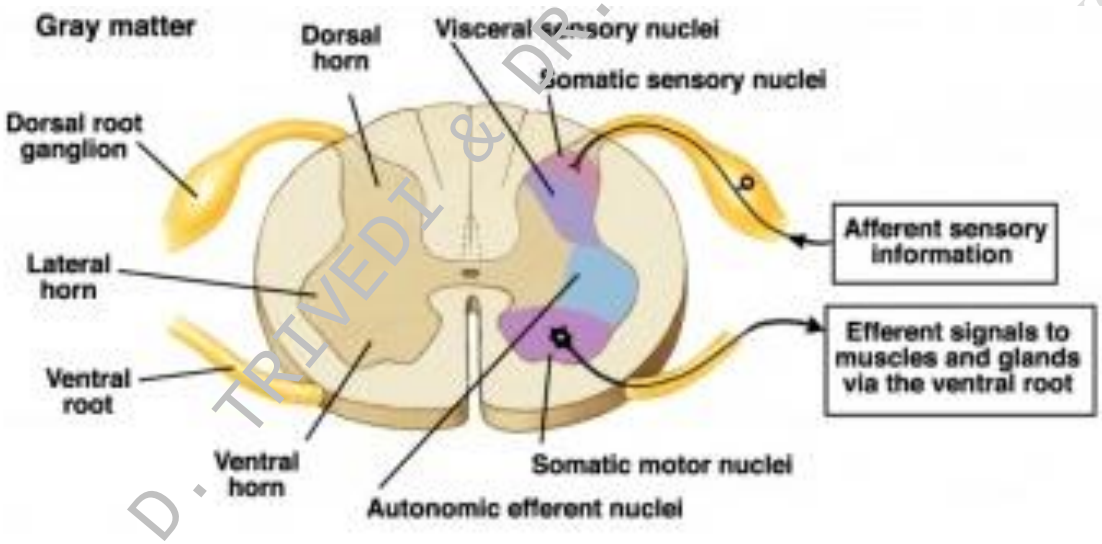


Posterior view

PRACTICAL NO.: 02 **DATE**

Basic Internal Anatomy of Spinal Cord:

- If the spinal cord is cut in X.S., a tiny central canal is observed, which contains CSF.
- There is a dark portion of H-shaped or butterfly shaped "gray matter", surrounded by a larger area of "white matter".
- The spinal cord is divided into more or less symmetrical halves by a deep groove called the anterior (ventral) median fissure and a median septum called posterior (dorsal) median sulcus.
- Extending from the spinal cord are the ventral and dorsal roots of the spinal nerves.



GRAY MATTER:

- The gray matter of the spinal cord consists of nerve cell bodies, dendrites and axon terminals (unmyelinated) and neuroglia. It is pinkish-gray color because of a rich network of blood vessels.
- The gray matter forms an H shape and is composed of three columns of neurons-posterior, anterior and lateral horns. The projections of gray matter toward the outer surface of spinal cord are called horns.
- The two that run dorsally-posterior horns which function in afferent input. The two that run ventrally-anterior horns which function in efferent somatic output. The two that extend laterally-lateral horns.
- The nerve fibers that form the cross of the H are known as gray commisure-functions in cross reflexes.

WHITE MATTER:

- The white matter gets its name because it is mainly composed of myelinated nerve fibers, and myelin has a whitish color.

- The white matter is divided into three pairs of columns or funiculi of myelinated fibers- anterior, posterior, lateral and a commisure area.
- The bundles of fibers within each funiculus are divided into tracts called fasciculi.
- Ascending tracts-sensory fibers carry impulse up the spinal cord to the brain.
- Descending tracts-motor neurons transmit impulse from the brain down the spinal cord.

CRANIAL NERVES

- The brain communicates with the body through the spinal cord and twelve pairs of cranial nerves.
- Ten of the twelve pairs of cranial nerves that control hearing, eye movement, facial sensations, taste, swallowing and movement of the face, neck, shoulder and tongue muscles originate in the brainstem. The cranial nerves for smell and vision originate in the cerebrum.
- The Roman numeral, name, and main function of the twelve cranial nerves:

Number	Name	Function
I	olfactory	smell
II	optic	sight
III	oculomotor	moves eye, pupil
IV	trochlear	moves eye
V	trigeminal	face sensation
VI	abducens	moves eye
VII	facial	moves face, salivate
VIII	vestibulocochlear	hearing, balance
IX	glossopharyngeal	taste, swallow
X	vagus	heart rate, digestion
XI	accessory	moves head
XII	hypoglossal	moves tongue

Signature of Teacher

PRACTICAL NO.: 03 **DATE**

AIM: TO STUDY THE ENDOCRINE SYSTEM USING CHARTS & SPECIMENS.

REQUIRMENT: - Human endocrine system chart & model.

THEORY:-

- The nervous and endocrine systems act together to coordinate functions of all body systems.
- The endocrine system also controls body activities by releasing mediators, called hormones, but the means of control of the two systems are very different.
- A hormone is a mediator molecule that is released in one part of the body but regulates the activity of cells in other parts of the body.
- Most hormones enter in interstitial fluid and then the bloodstream.
- The circulating blood delivers hormones to cells throughout the body.
- Both neurotransmitters and hormones exert their effects by binding to receptors on or in their "target" cells.
- Several mediators act as both neurotransmitters and hormones.
- One familiar example is norepinephrine, which is released as a neurotransmitter by sympathetic postganglionic neurons and as a hormone by chromaffin cells of the adrenal medullae.

The body contains two kinds of glands:

1. Exocrine glands &
2. Endocrine glands

Sr. no	Exocrine glands	Endocrine glands.
1	Exocrine glands (exo- _ outside) secrete their products into ducts that carry the secretions into body cavities, into the lumen of an organ, or to the outer surface of the body.	Endocrine glands (endo- _ within) secrete their products (hormones) into the interstitial fluid surrounding the secretory cells rather than into ducts.
2	Exocrine glands include sudoriferous (sweat), sebaceous (oil), mucous, and digestive glands.	From the interstitial fluid, hormones diffuse into blood capillaries and blood carries them to target cells throughout the body.

- The endocrine glands include:
  - ✓ 1- The Pituitary,
  - ✓ 1- Thyroid,
  - ✓ 4- Parathyroid,
  - ✓ 2- Adrenal
  - ✓ 1-Pineal glands
  - ✓ 1- Pancreatic gland
  - ✓ 2- Ovaries
  - ✓ 2- Testis
  - ✓ 1- Thymus

PRACTICAL NO.: 03 **DATE**

HYPOTHALAMUS AND PITUITARY GLAND

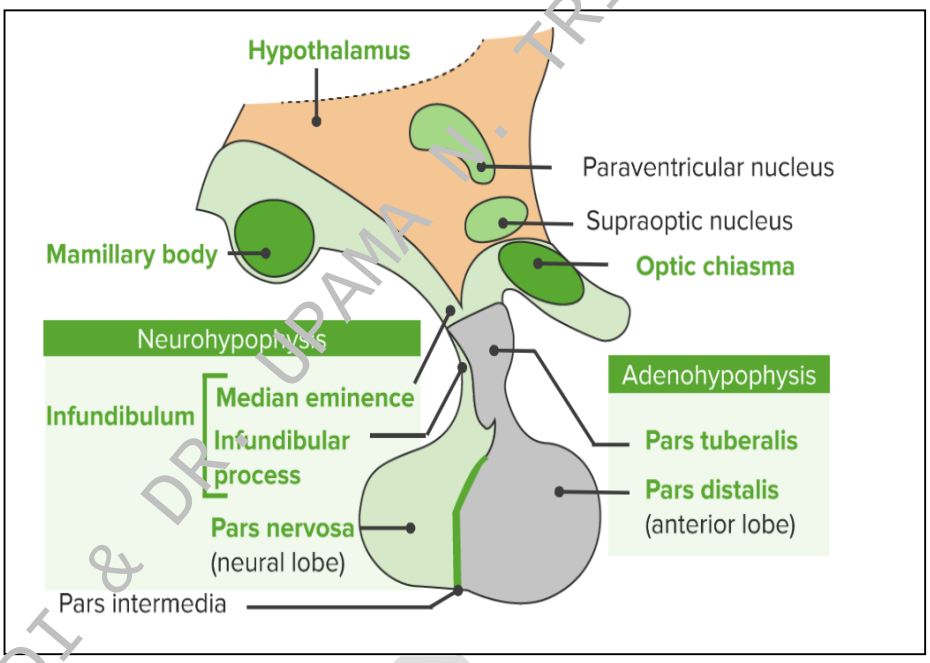
- The pituitary gland (or hypophysis) was called the "master" endocrine gland because it secretes several hormones that control other endocrine glands.
- The pituitary gland itself has a master—the hypothalamus.
- This small region of the brain below the thalamus is the major link between the nervous and endocrine systems.
- Cells in the hypothalamus synthesize at least nine different hormones, and the pituitary gland secretes seven.
- Together, these 16 hormones play important roles in the regulation of virtually all aspects of growth, development, metabolism, and homeostasis.
- Hypothalamus secreting 9 hormones
    1. Thyrotropin-releasing hormone (TRH)
        - Stimulates release of TSH (thyrotropin) and Prolactin
    2. Corticotropin-releasing hormone (CRH)
        - Stimulates release of ACTH (corticotropin)
    3. Gonadrotropin-releasing hormone (GnRH)
        - Stimulates release of FSH and LH (gonadotropins)
    4. Growth hormone releasing hormone (GHRH)
        - Stimulates release of growth hormone
    5. Growth hormone release inhibiting hormone (GHRIH)
        - Inhibits release of growth hormone
    6. Prolactin-releasing hormone (PRH)
        - Stimulates release of prolactin
    7. Prolactin release inhibitory hormone (PRIH)
        - Inhibits release of prolactin
    8. Dopamine
- Pituitary glands secreting-
    1. Growth hormone (GH)
    2. Prolactin
    3. Adrenocorticotropic hormone (ACTH, Corticotrophin)
    4. Thyroid stimulating hormones (TSH, Thyrotrophin)
    5. Gonadotrophins- Follicle stimulating hormone (FSH)
    6. Luteinizing hormone (LH)
    7. Oxytocin
    8. Antidiuretic hormone (ADH, Vasopressin)

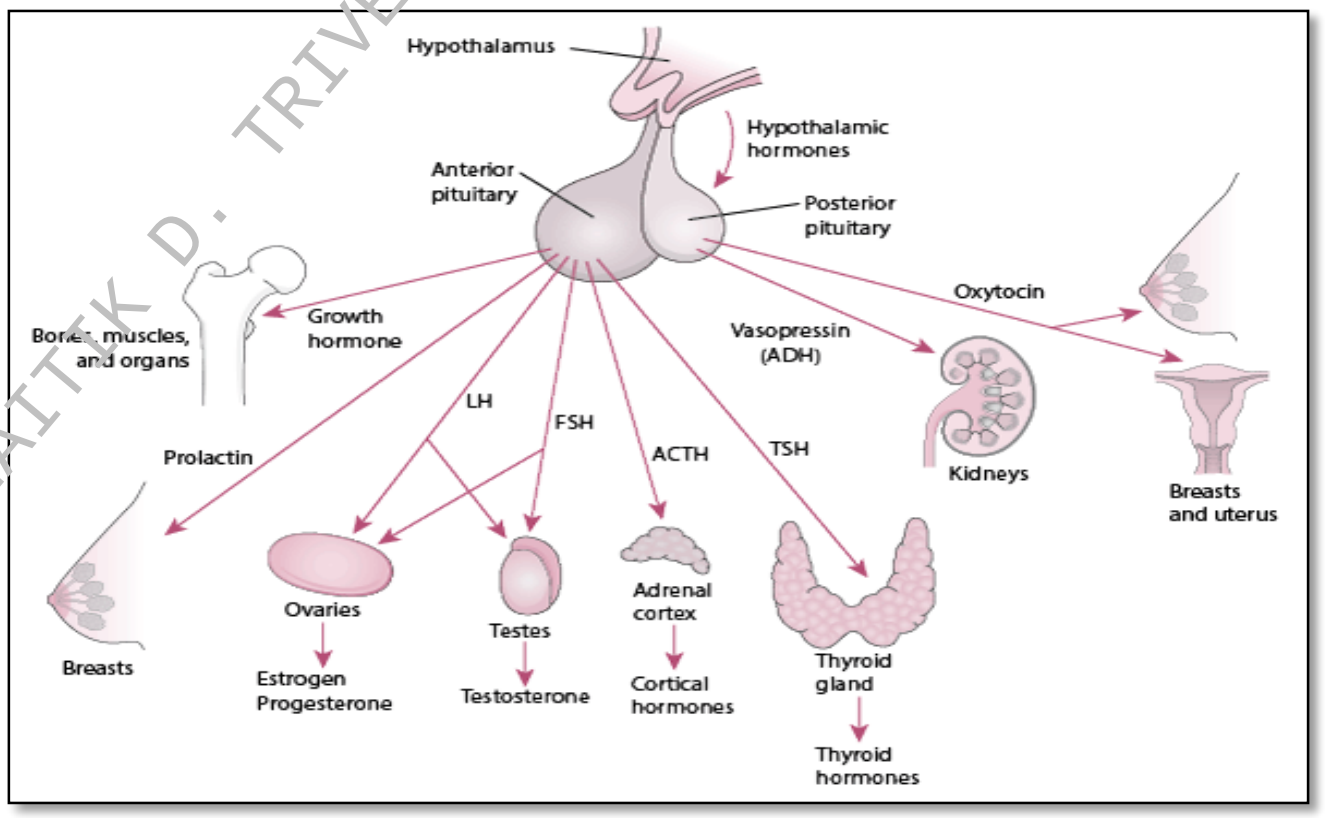
Structure of pituitary gland

- The pituitary gland is a pea-shaped structure that measures 1–1.5 cm (0.5 in.) in diameter
- It lies in the hypophyseal fossa of the sphenoid bone.
- It attaches to the hypothalamus by a stalk, the infundibulum.
- It has two anatomically and functionally separate portions:
    - ✓ Anterior pituitary
    - ✓ Posterior pituitary

PRACTICAL NO.: 03 **DATE**

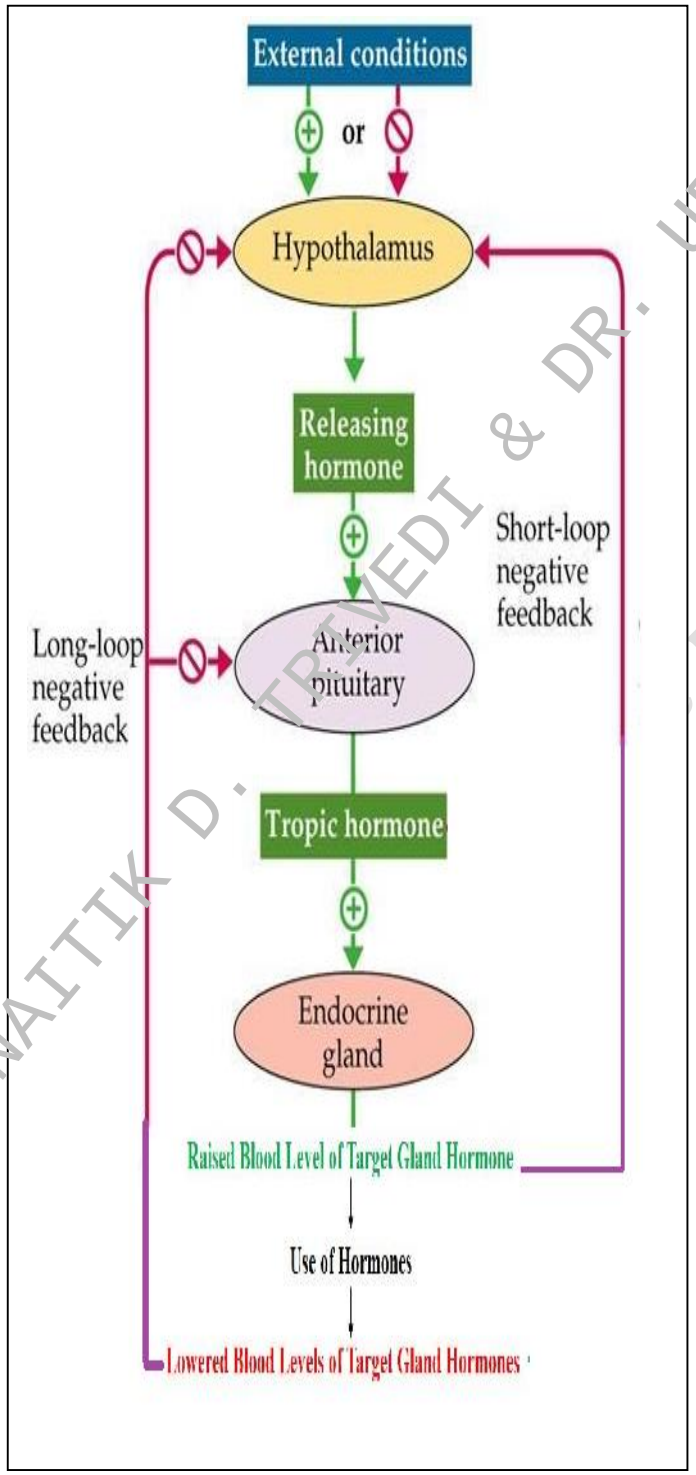
- The anterior pituitary (anterior lobe), also called the adenohypophysis, accounts for about 75% of the total weight of the gland.
- The posterior pituitary (posterior lobe), also called the neurohypophysis.
- A third region of the pituitary gland called the pars intermedia.





PRACTICAL NO.: 03 **DATE**

FEEDBACK MECHANISM OF ENDOCRINE HORMONE SECRETION



- The neurosecretory cells synthesize the hypothalamic releasing and inhibiting hormones in their cell bodies and package the hormones inside vesicles, which reach the axon terminals by axonal transport.
- Nerve impulses [external stimuli] stimulate the vesicles to undergo exocytosis.
- The hormones then diffuse into the primary plexus of the hypophyseal portal system.
- The hypothalamic hormones flow with the blood through the portal veins and into the secondary plexus.
- Hypothalamic hormones then act on anterior pituitary cells.
- Hormones secreted by anterior pituitary cells pass into the secondary plexus capillaries, which drain into the anterior hypophyseal veins and out into the general circulation.
- Anterior pituitary hormones then travel to target tissues throughout the body.
- Those anterior pituitary hormones that act on other endocrine glands are called tropic hormones

PRACTICAL NO.: 03 **DATE**

ENDOCRINE GLANDS AND THEIR SECRETIONS

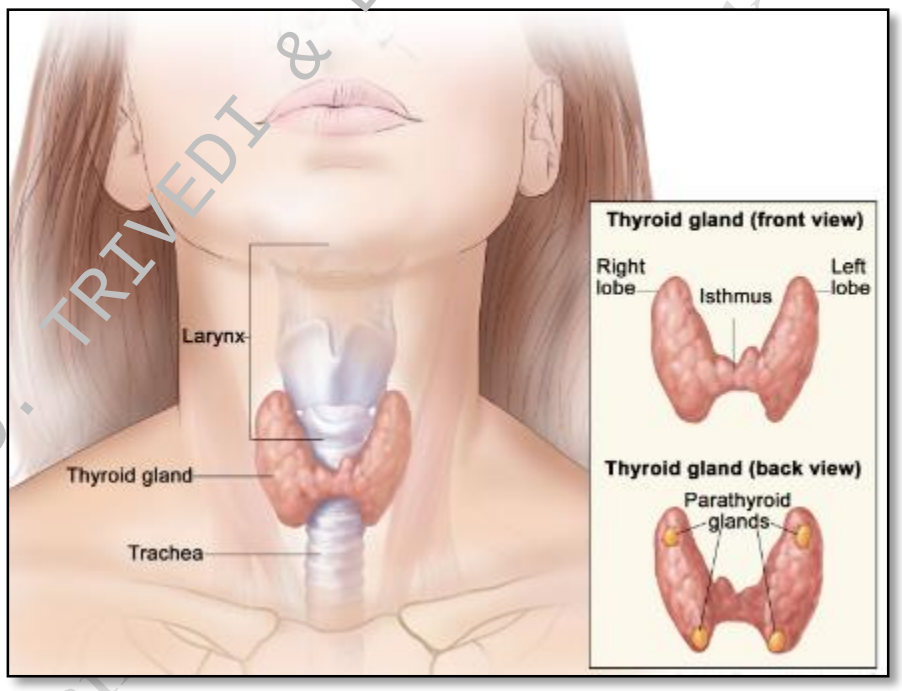
Sr. No	Endocrine Gland	Hormone	Function
1	Anterior Pituitary Gland	Growth Hormone [Gh]	Promotes growth of cells
		Prolactin	Promotes breast-milk production
		Thyrotrophic Hormone [TSH]	Stimulating thyroid gland
		Follicle Stimulating Hormone [FSH]	Controls the production of eggs and sperm
		Luteinizing Hormone [LH]	Controls oestrogen and testosterone production as well as ovulation
	Intermediate	Melanocyte Stimulating Hormone [MSH]	Stimulates melanin in skin
	Posterior Pituitary Gland	Oxytocin	Helps with lactation, childbirth, and mother-child bonding
		Vasopressin	Promote the retention of water by the kidneys and increase blood pressure.
2	Thyroid Gland	Thyroid Hormone [T_3 & T_4]	Helps control several body functions, including the rate of metabolism and energy levels
3	Parathyroid Gland	Parathyroid Hormone [PTH]	Regulation of blood level of Calcium, Magnesium & Hypophosphate Controls calcium levels in bones and blood
4	Adrenal Gland	Adrenaline	Increases blood pressure, heart rate, and metabolism in reaction to stress
		Aldosterone	Controls the body's salt and water balance
		Cortisol	Plays a role in stress response
		Dehydroepiandrosterone Sulfate (DHEA-S)	Aids in production of body odor and growth of body hair during puberty
5	Pancreas	Glucagon	Helps increase levels of blood glucose (blood sugar)
		Insulin	Helps reduce your blood glucose levels
6	Pineal Gland	Melatonin	Controls sleep-wake cycles
7	Ovary	Progesterone	Helps prepare the body for pregnancy when an egg is fertilized
		Estrogen	Works to regulate the menstrual cycle, maintain pregnancy, and develop female sex characteristics; aids in sperm production
8	Ovary, Testes, Adrenal	Testosterone	Contributes to sex drive and body density in males and females as well as development of male sex characteristics

NOTE: Key to remember name of Pituitary hormones-------"GOAT FLAP"
GH, Oxytocin, ACTH, TSH, FSH, LH, ADH, Prolactin.

PRACTICAL NO.: 03 **DATE**

THYROID GLAND

- The butterfly-shaped thyroid gland is located just inferior to the larynx (voice box).
- It is composed of right and left lateral lobes, one on either side of the trachea.
- The normal mass of the thyroid is about 30 g. It is highly vascularized and receives 80–120 mL of blood per minute.
- Microscopic spherical sacs called thyroid follicles make up most of the thyroid gland.
- The follicular cells produce two hormones: thyroxine which is also called tetraiodothyronine because it contains four atoms of iodine, and triiodothyronine, which contains three atoms of iodine.
- T3and T4 together are also known as thyroid hormones.
- A few cells called parafollicular
- cells or C cells lie between follicles. They produce the hormone calcitonin homeostasis, which helps regulate calcium.

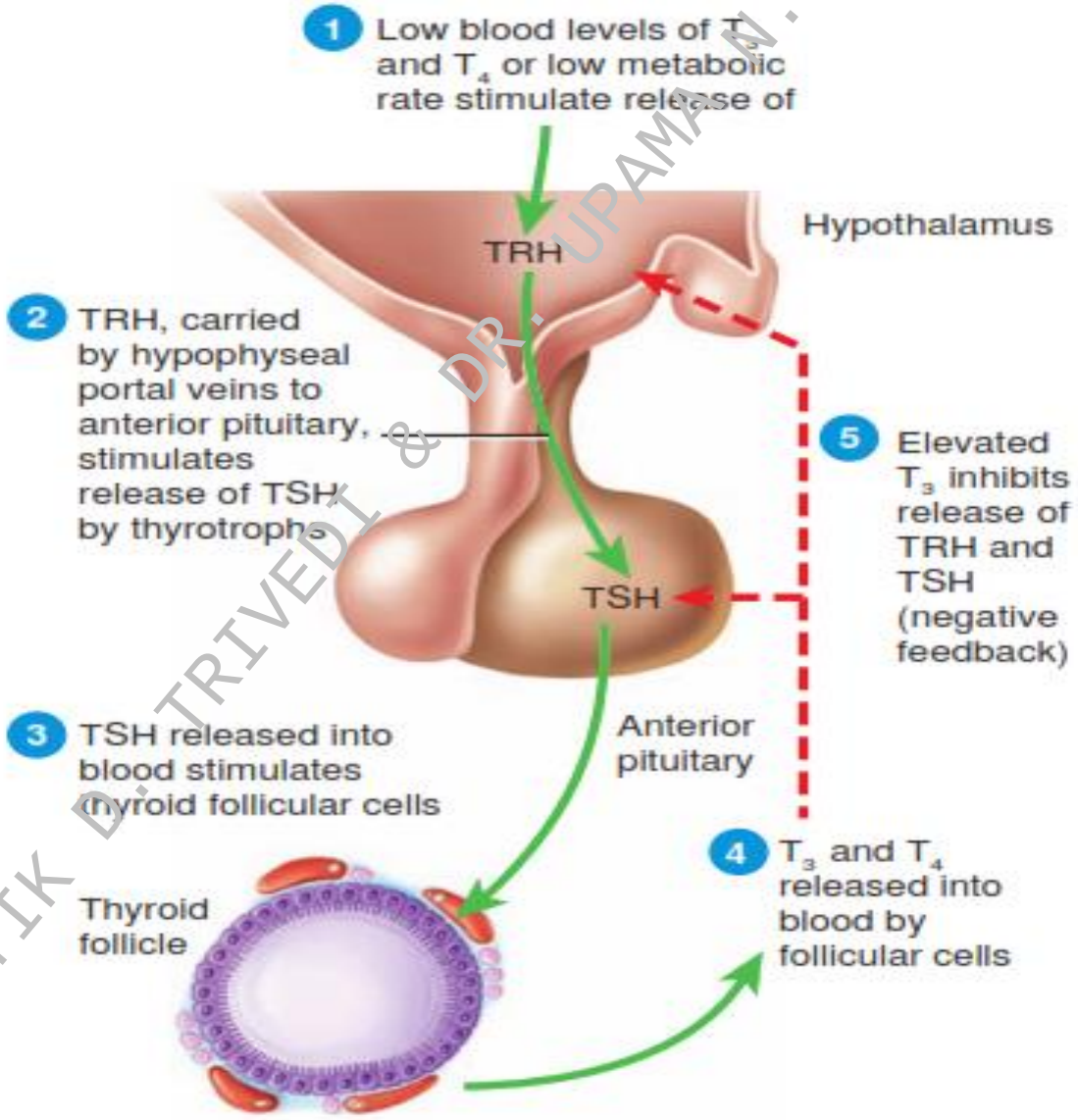


Actions of Thyroid Hormones:

- Increase basal metabolic rate
- Stimulate protein synthesis
- Increase body temperature (calorigenic effect)
- Stimulate synthesis of Na/K+ ATPase
- Increase the use of glucose and fatty acids for ATP production
- Regulate development and growth of nervous tissue and bones
- Enhance some actions of catecholamines
- Stimulate lipolysis

PRACTICAL NO.: 03 **DATE**

REGULATION OF THYROID HORMONE



PARATHYRIOD GLAND

- Partially embedded in the posterior surface of the lateral lobes of the thyroid gland are several small, round masses of tissue called the parathyroid glands.
- Each has a mass of about 40 mg.
- Microscopically, the parathyroid glands contain two kinds of epithelial cells.
- The more numerous cells, called chief (principal) cells, produce parathyroid hormone PTH), also called parathormone.
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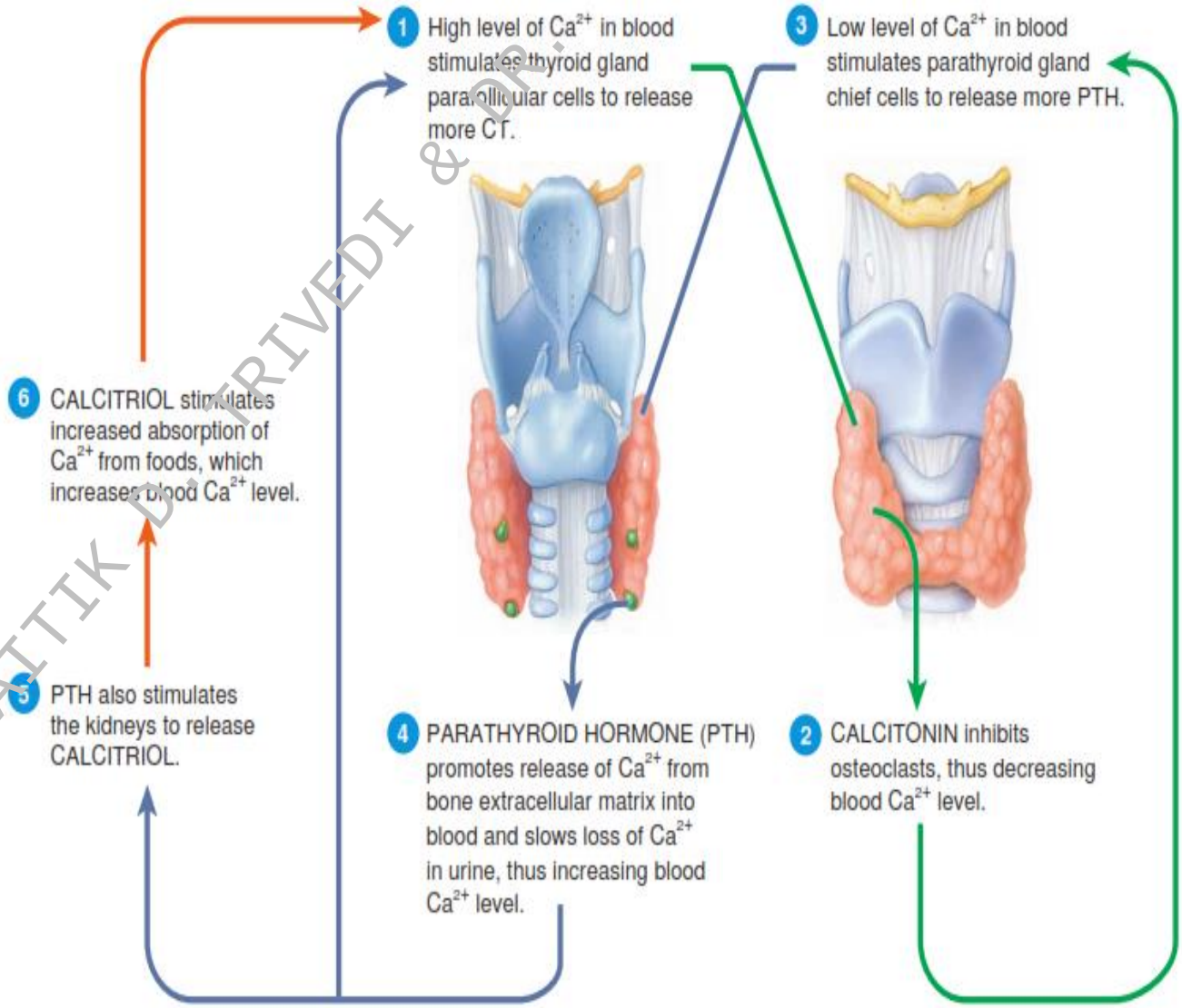
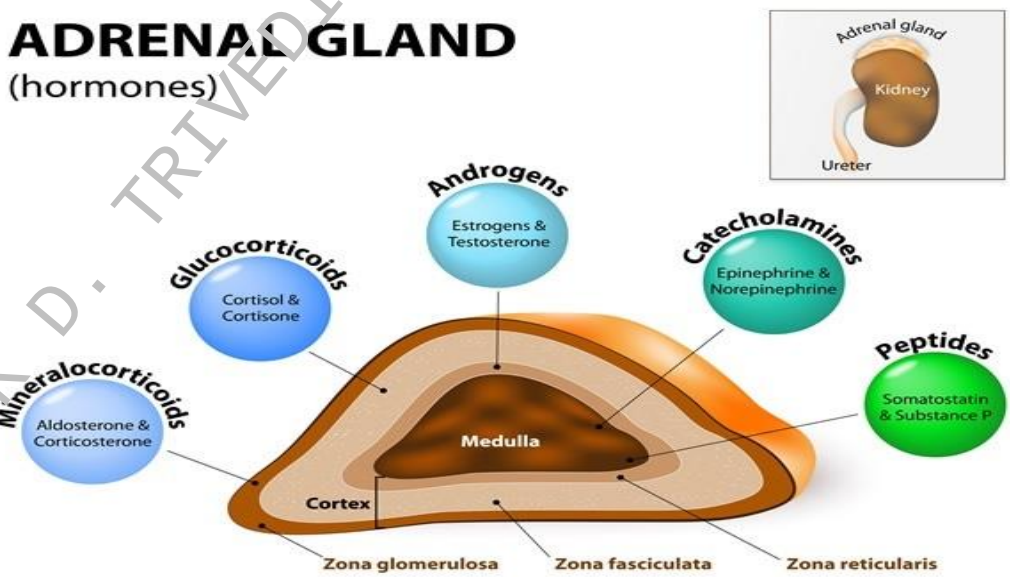


PRACTICAL NO.: 03 **DATE**

ADRENAL GLANDS

- The paired adrenal (suprarenal) glands, one of which lies superior to each kidney in the retroperitoneal space, have a flattened pyramidal shape.
- Each adrenal gland is 3–5 cm in height, 2–3 cm in width, and a little less than 1 cm thick, with a mass of 3.5–5 g.
- During embryonic development, the adrenal glands differentiate into two structurally and functionally distinct regions:
    1. A large, peripherally located adrenal cortex, comprising 80–90% of the gland, and
    2. A small, centrally located adrenal medulla
- A connective tissue capsule covers the gland.
- The adrenal glands, like the thyroid gland, are highly vascularized.
- The adrenal cortex produces steroid hormones that are essential for life.
- Complete loss of adrenocortical hormones leads to death due to dehydration and electrolyte imbalances in a few days to a week, unless hormone replacement therapy begins promptly.
- The adrenal medulla produces three catecholamine hormones—norepinephrine, epinephrine, and a small amount of dopamine.



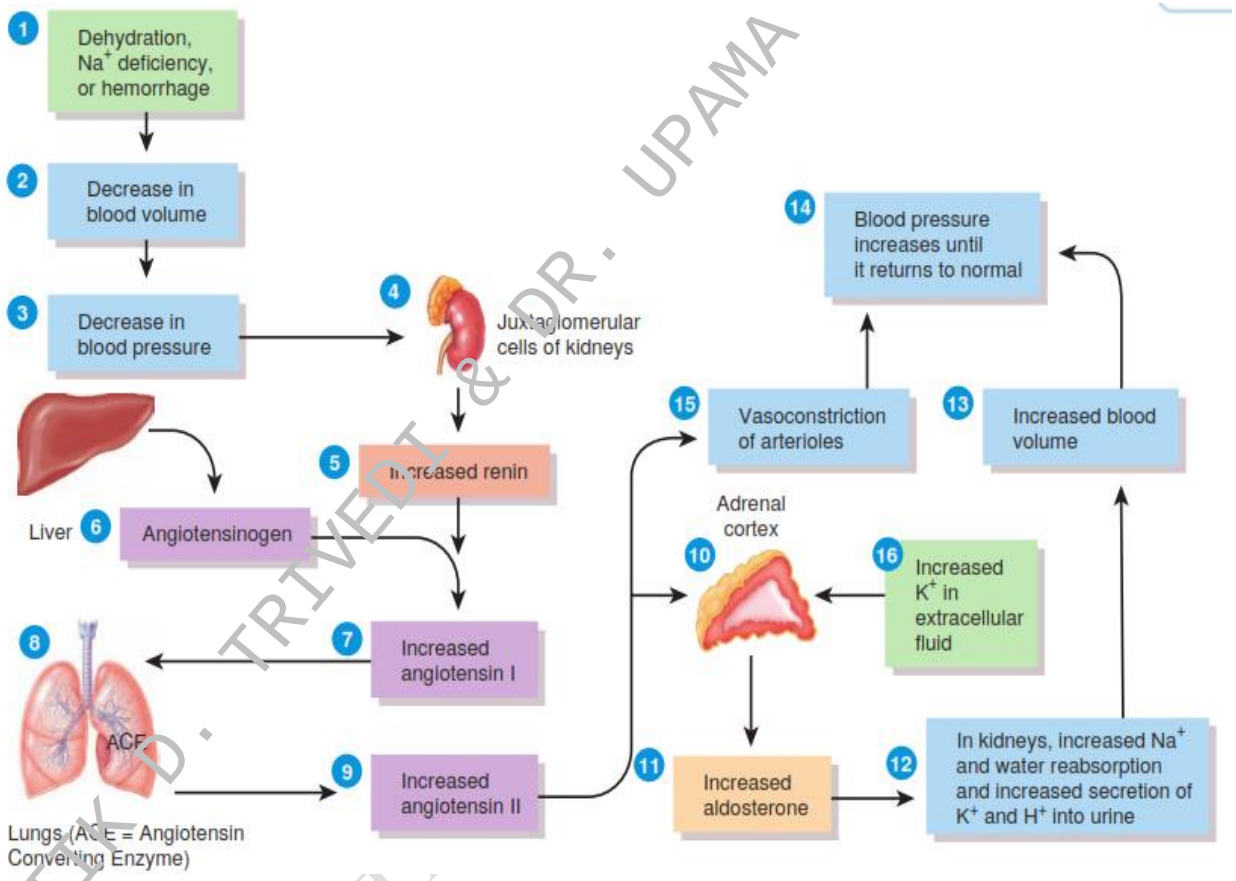
Adrenal gland:

- Medulla: MEN –Medulla, Epinephrine, Norepinephrine.
- Cortex: has 3 layers: GFR- Glomerulosa, Fasiculata, Reticularis
- their hormones are: Make Good Sweets
- Mineralocorticoids, (aldosterone) , Glucocorticoids, (cortisol) , Sex hormone, (androgen) .
- All adrenal gland hormones together: “CANES”
- Cortisol, Aldosterone, Norepinephrine, Epinephrine, Sex hormone.

PRACTICAL NO.: 03 **DATE**

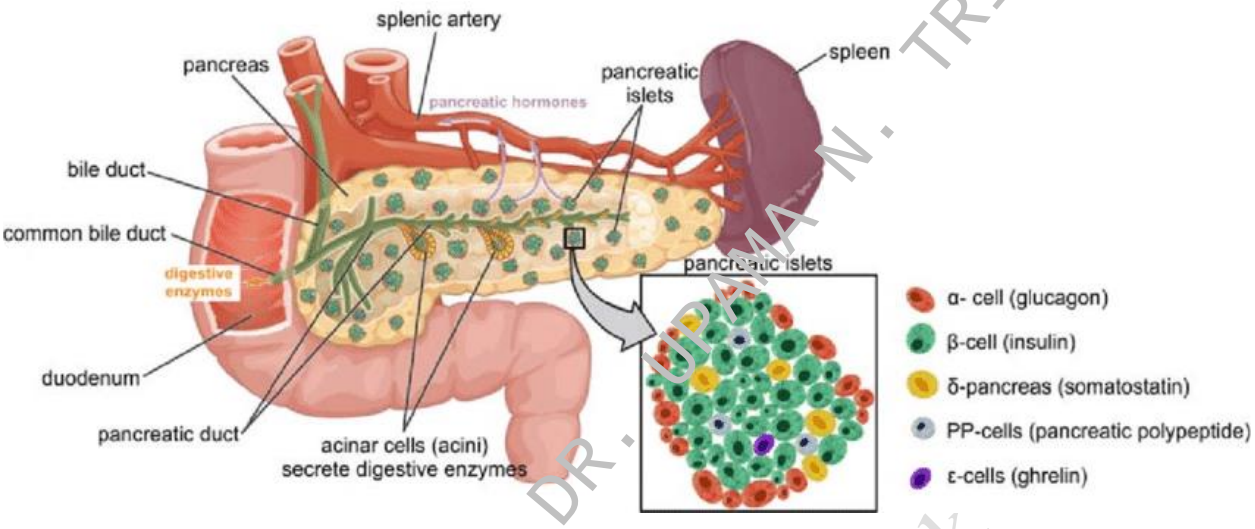
Aldosterone

- Regulation of aldosterone secretion by the renin–angiotensin–aldosterone (RAA) pathway.
- Aldosterone helps regulate blood volume, blood pressure, and levels of Na, K, and H in the blood.



PANCREAS

- The pancreas is both an endocrine gland and an exocrine gland.
- A flattened organ that measures about 1 2. 5–15 cm (4.5–6 in.) in length, the pancreas is located in the curve of the duodenum, the first part of the small intestine, and consists of a head, a body, and a tail.
- Roughly 99% of the cells of the pancreas are arranged in clusters called acini.
- The acini produce digestive enzymes, which flow into the gastrointestinal tract through a network of ducts.
- Scattered among the exocrine acini are 1–2 million tiny clusters of endocrine tissue called pancreatic islets or islets of Langerhans.
- Abundant capillaries serve both the exocrine and endocrine portions of the pancreas.

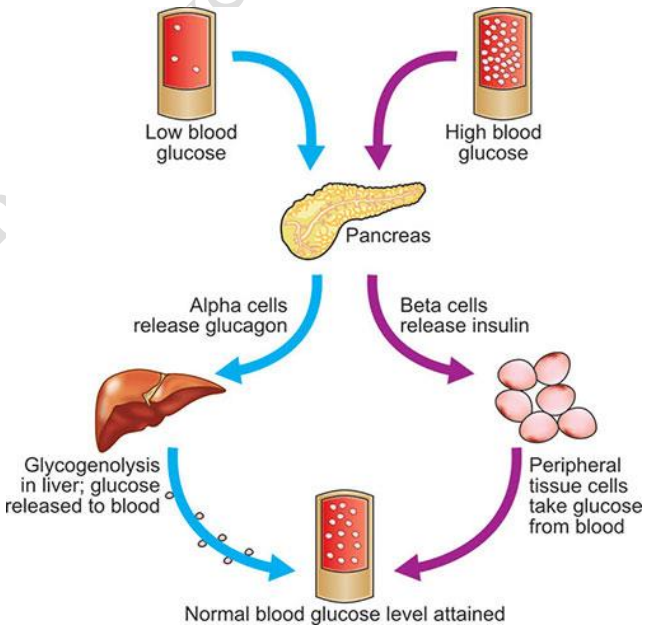


Cell Types in the Pancreatic Islets

Each pancreatic islet includes four types of hormone-secreting cells:

1. Alpha or A cells constitute about 17% of pancreatic islet cells and secrete glucagon.
2. Beta or B cells constitute about 70% of pancreatic islet cells and secrete insulin.
3. Delta or D cells constitute about 7% of pancreatic islet cells and secrete somatostatin.
4. F cells constitute the remainder of pancreatic islet cells and secrete pancreatic polypeptide.

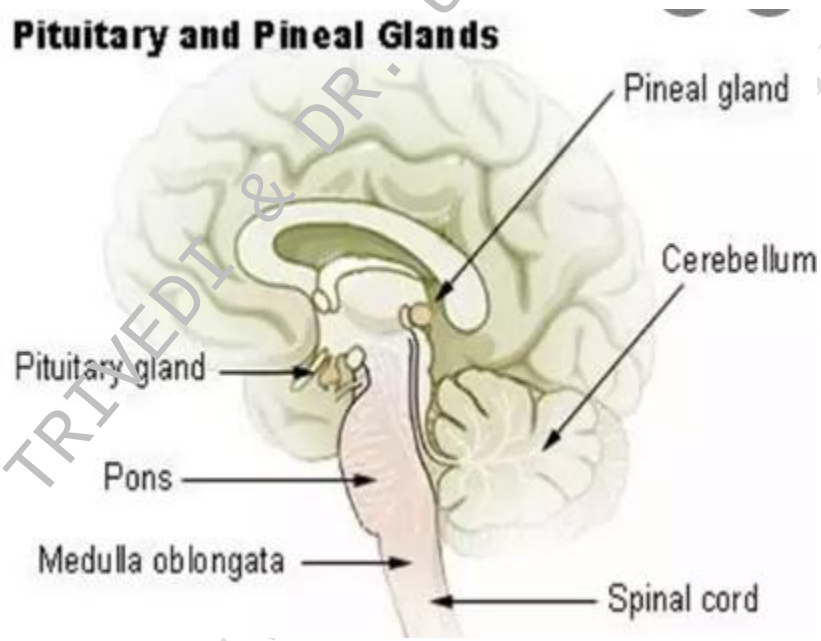
Low blood glucose stimulates release of glucagon; high blood glucose stimulates secretion of insulin.



PRACTICAL NO.: 03 **DATE**

PINEAL GLAND

- The pineal gland is a small endocrine gland attached to the roof of the third ventricle of the brain at the midline.
- Part of the epithalamus, it is positioned between the two superior colliculi, has a mass of 0. 1–0.2 g, and is covered by a capsule formed by the pia mater.
- The gland consists of masses of neuroglia and secretory cells called pinealocytes.
- The pineal gland secretes melatonin, an amine hormone derived from serotonin.
- Melatonin appears to contribute to the setting of the body's biological clock and maintain sleep.



Signature of Teacher

PRACTICAL NO.: 04 **DATE**

AIM: TO DEMONSTRATE THE GENERAL NEUROLOGICAL EXAMINATION

THEORY:

A neurological examination is the assessment of sensory neuron and motor responses, especially reflexes, to determine whether the nervous system is impaired. This typically includes a physical examination and a review of the patient's medical history, but not deeper investigation such as neuroimaging.

There are 7 categories of the neurological exam:

1. Mental status
2. Cranial nerves
3. Motor system
4. Reflexes
5. Sensory system
6. Coordination
7. Station and gait

1. MENTAL STATUS NEUROLOGICAL EXAM:

There are 7 components of the mental status exam:

i. Level of consciousness
ii. Attention
iii. Orientation
iv. Language — fluency, comprehension, repetition, naming, reading, writing
v. Memory — immediate recall, recent, remote
vi. Higher intellectual function—general knowledge, abstraction, judgment, insight, reasoning
vii. Mood and affect

2. CRANIAL NERVES NEUROLOGICAL EXAM:

i. CNI: Olfactory nerve:

- It is also called smell identification test.
- Already described in practical 5.
- It cannot be evaluated if nasal passages obstructed by rhinitis, polyps, etc.

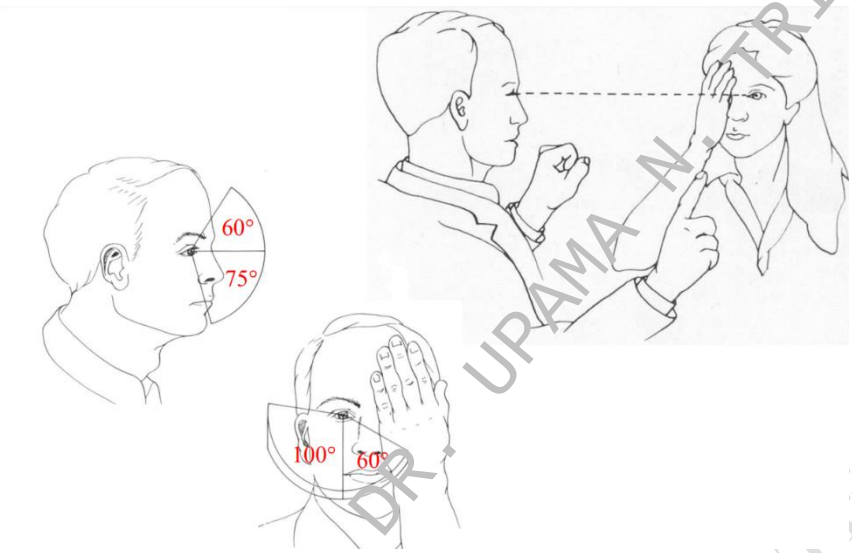
ii. CNII: Optic nerve

- This afferent nerve is assessed during visual acuity, color vision, pupil testing with the swinging flashlight test for afferent pupillary defect and visual field testing.

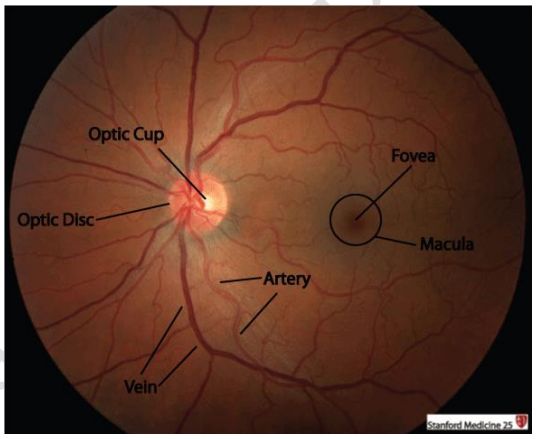
PRACTICAL NO.: 04 **DATE**

- Visual acuity:
  - Hold card at comfortable reading distance
  - Cover 1 eye
  - Glasses on (looking for optic nerve lesion, not refractive error)

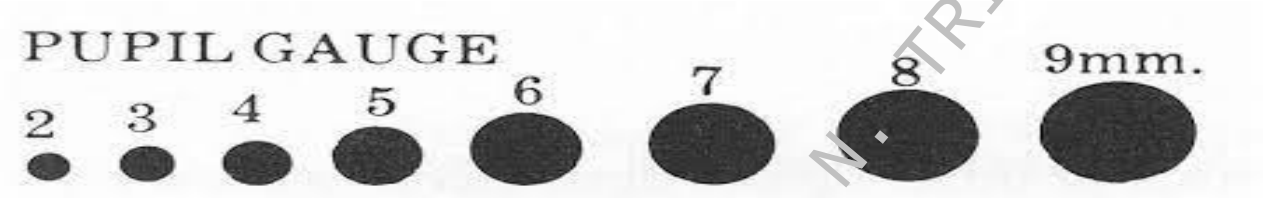
- Visual fields:
  - The confrontational visual field exam is a basic exam performed by your eye doctor. They will sit or stand 3 to 4 feet in front of you. You will be instructed to cover one of your eyes using an occluder, which looks like a large spoon.
  - Your doctor will instruct you to stare straight ahead as they move their hand in and out of your visual field. You will indicate when you are able to see the doctor's hand. This test will then be repeated on the other eye.



- Fundoscopy:
  - Ophthalmoscopy or fundoscopy is an exam to look into the back of your eye. Which shows the retina (which senses light and images), the optic disk (where the optic nerve takes the information to the brain), and blood vessels.



- Afferent limb of pupillary function are some test for these examinations:
  - Normal pupils are equal in size and shape and are situated in center of iris
  - Pupillary size varies with intensity of ambient light, but at average intensity is ≈ 3-4 mm
  - Miosis < ≈2 mm
  - Mydriasis > ≈5 mm
  - Anisocoria = pupillary asymmetry



iii. Some other test for cranial nerves are: Eye movements (III, IV, VI) and pupils (III, sympathetic and parasympathetic), sensory function of face (V), strength of facial (VII) and shoulder girdle muscles (XI), hearing (VII, VIII), taste (VII, IX, X), pharyngeal movement and reflex (IX, X), tongue movements (XII).

Table 1. Cranial Nerve Function and Testing[3]

Cranial Nerve	Function	Test
I – Olfactory	• Sense of smell	• Ask patient to occlude one nostril and close their eyes. • Present a stimulus, such as coffee, and ask the patient to identify the smell.
II – Optic	• Vision	• Visual acuity. • Color vision. • Visual fields. • Pupillary response to light to test for an afferent pupillary defect.
III – Oculomotor	• Ocular motility (superior, inferior and medial recti, inferior oblique) • Lid elevation (levator palpebrae superioris) • Pupillary constriction (efferent limb of light pathway)	• Routinely tested during examination with extraocular motility. • Supraduction. • Infraduction. • Adduction.
IV – Trochlear	• Ocular motility (superior oblique)	• Routinely tested during examination with extraocular motility. Infraduction upon adduction. • Intorsion.
V – Trigeminal	• Facial sensation • Muscles of mastication	• Test the distributions of V_1, V_2 and V_3 separately with a light touch with a cotton wisp to the forehead, upper cheek and jaw, respectively, with the patient's eyes closed. Ask the patient to compare the sensation from right to left, looking for any asymmetry • Assess the motor function of V by feeling either side of the jaw just inferior and anterior to the ear for muscle contraction while asking the patient to clench their teeth. • If indicated, test the corneal reflex (afferent limb: ophthalmic, V_1 and efferent limb, V_2) with a cotton wisp.
VI – Abducens	• Ocular motility (abduction)	• Routinely tested during examination with extraocular motility. • Abduction.
VII – Facial	• Muscles of facial expression • Taste to anterior 2/3 of tongue	• Ask the patient to smile, raise their eyebrows, frown, puff out their cheeks and squeeze their eyelids tightly together while looking for any asymmetry or weakness.
VIII – Vestibulocochlear	• Auditory and vestibular systems	• Hearing can be grossly checked by rubbing your fingers together near a patient's ear and asking if they can identify which ear hears the sound and if they notice any asymmetry in the volume of the sound.
IX – Glosso-pharyngeal X – Vagus	• Palate elevation, gag reflex/ swallowing • Speaking	• Ask the patient to open their mouth and say "ahh" and look for any asymmetry in the palate or deviation of the uvula.
XI – Accessory	• Sternocleidomastoid and trapezius muscle	• Ask the patient to turn their head side-to-side and shrug their shoulders looking for any asymmetry or weakness.
XII – Hypo-glossal	• Muscle action of the tongue	• Ask the patient to stick their tongue out and note if it deviates to one side.

3. Motor system neurological examination:
   - Compare left to right, proximal to distal, arms to legs
     - Bulk (muscle mass)

- Tone (muscle tension at rest)
  - Test with passive manipulation

- Strength
- Speed of movement; extraneous movement
- Endurance

4. REFLEX NEUROLOGICAL EXAMINATION:

Explained in practical number 8.

5. SENSORY SYSTEM NEUROLOGICAL EXAMINATION:

- Sensory system testing involves provoking sensations of fine touch, pain and temperature. Fine touch can be evaluated with a monofilament test, touching various dermatomes with a nylon monofilament to detect any subjective absence of touch perception.
- Sensory
  - Light touch
  - Pain
  - Temperature
  - Vibration
  - Position sense
  - Graphesthesia
  - Stereognosis, and
  - Two-point discrimination (for discriminative sense)
  - Extinction
  - Romberg test – 2 out of the following 3 must be intact to maintain balance: i. vision ii. vestibulocochlear system iii. epicritic sensation

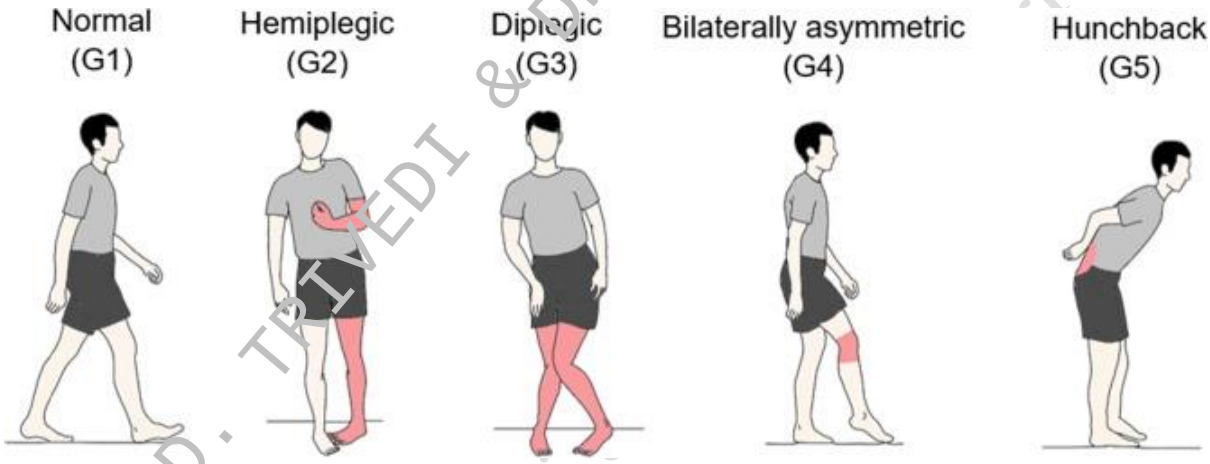
6. COORDINATION NEUROLOGICAL EXAMINATION:

- Coordination is an integral function of the motor, sensory and cerebellar systems. Tests of coordination typically assess cerebellar function, but the contributions of the other systems, including the motor, sensory and vestibular systems, must be considered when interpreting these tests.
- Coordination testing is usually divided into two parts: truncal stability and limb coordination.
- The ability to check movements and vestibular coordination are also assessed if the clinical situation warrants.

PRACTICAL NO.: 04 **DATE**

7. STATION AND GAIT

- Examination of gait is most important in neurology, since it provides invaluable information concerning integrity of the motor system, sensory system, and cerebellum. Gait is evaluated by observing the patient walk briskly and turn corners.
- Particular attention is placed on any asymmetry involving a side or one limb, the distance the feet are kept apart (base), the length of stride and associated arm swing. An important part of the gait examination is to observe a tandem gait, in which the patient is asked to walk heel-to-toe on a line.



Signature of Teacher

PRACTICAL NO.: 05 **DATE**

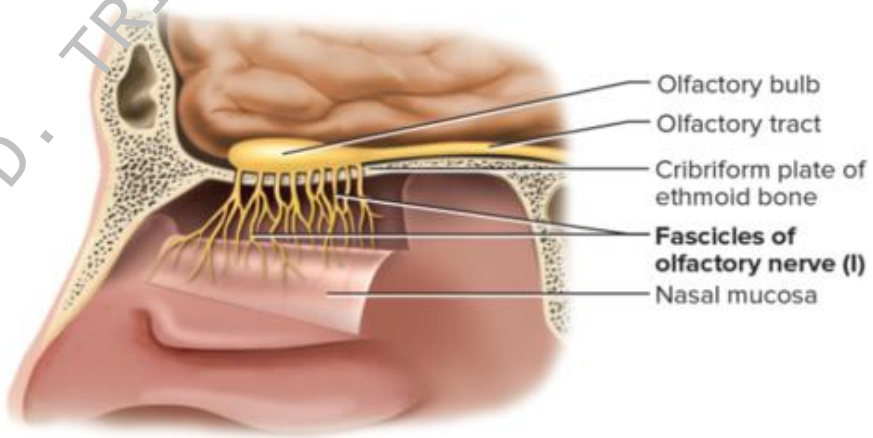
AIM: TO DEMONSTRATE THE FUNCTION OF OLFACTORY NERVE

THEROY:

The olfactory nerve transmits information to the brain from smell receptors in the nose. The olfactory nerve is known as the first cranial nerve, or CN1.

Anatomy

- The olfactory nerve is the shortest nerve in the human head.
- It originates in the olfactory mucosa (mucous membrane) along the roof of your nasal cavity (nostril).
- This nerve is made of many small nerve fibers called fascicles that are bound together by thin strips of connective tissue.
- The bundle extends from the nasal cavity through the ethmoid bone behind the nose. From there, the fascicles go inside a structure called the olfactory bulb.
- There is a bulb for each nostril, and they send the information along what's called the olfactory tract and into the brain.

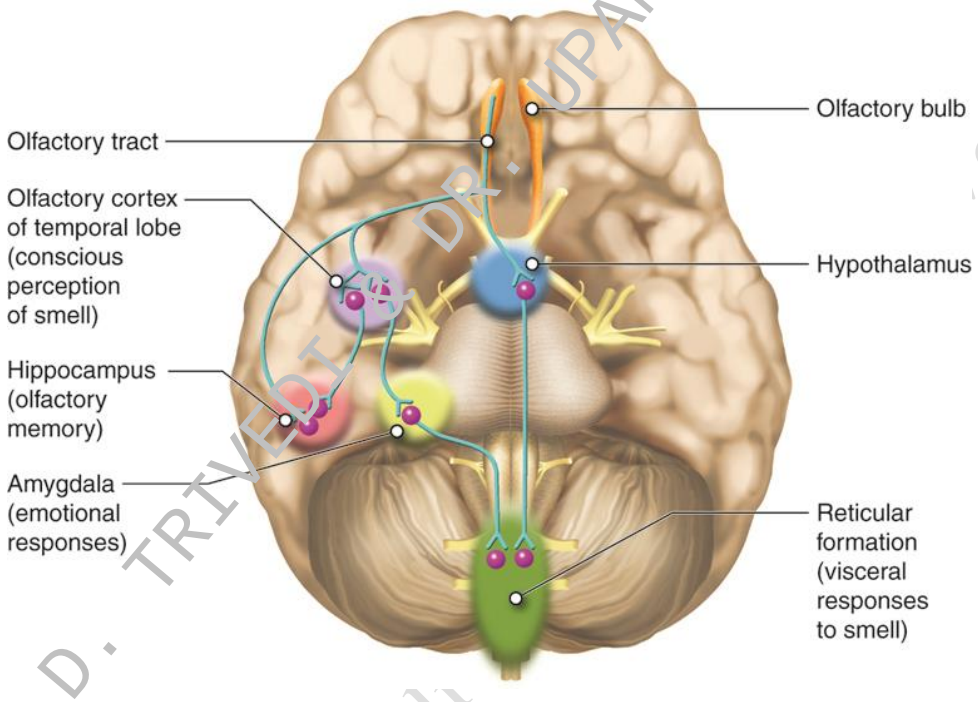


The human nose can sense 10 basic smells, They are as follows:

1. Fragrant (e.g. florals and perfumes)
2. Fruity (all non-citrus fruits)
3. Citrus (e.g. lemon, lime, orange)
4. Woody and resinous (e.g. pine or fresh cut grass)
5. Chemical (e.g. ammonia, bleach)
6. Sweet (e.g. chocolate, vanilla, caramel)
7. Minty and peppermint (e.g. eucalyptus and camphor)
8. Toasted and nutty (e.g popcorn, peanut butter, almonds)
9. Pungent (e.g. blue cheese, cigar smoke)
10. Decayed (e.g. rotting meat, sour milk)

PRACTICAL NO.: 05 **DATE**

- These impulses go to several regions of the brain, including the:
  - Uncus
  - Hippocampal gyrus
  - Amygdala
  - Entorhinal cortex



Identification of Smell:

Procedure:

- Make the solution of above mentioned types of smell product.
- Fill the sample product solution in to the vial and labelled it respectively.
- Instruct student to smell all 10 product one by one at the interval of 2 minutes to prevent saturation of smell receptors and give idea about 10 types of smell.
- Now remove the labelled from the vial and give numbering to each vial from 1 to 10 and note down the number and respective products name on diary.
- Ask student to take any vial and tell them to note down that vial number in their practical note book.
- Instruct student to identify the smell of particular vial and report it.

Result: The given test sample odor/smell is _____

Conclusion: The given test sample may be _____

Signature of Teacher

PRACTICAL NO.: 06 **DATE**

AIM: TO EXAMINE THE DIFFERENT TYPES OF TASTE.

REQUIREMENTS: Coffee, Vinegar, Salt, Sugar, Water

THEORY

The gustatory system is much simpler than the olfactory system.

Five primary taste submodalities are generally recognized:

1. sweet,
2. sour,
3. salty, and
4. bitter and
5. Umami.

Research at the turn of the 20th century led to recognition of the fifth taste, umami, during the mid-1980s. Umami is a Japanese word that means "delicious taste," and is often translated to mean savory. Very recent research has suggested that there may also be a sixth taste for fats, or lipids.

Sweet

- Generally, sweetness is caused by a form of sugar or alcohol. Certain amino acids may also taste sweet.
- Examples of sweet foods include: Honey, strawberries, candy, fruit juice, cake etc…

Sour

- Sourness, or tartness, is the taste of acids. It's brought on by hydrogen ions.
- Example of sweet foods include: Vinegar, lemon juice, cranberries, yogurt, buttermilk

Salty

- Saltiness is usually caused by table salt, or sodium chloride, that's added to food. It can also be caused by mineral salts.
- Salty foods include: Soy sauce, processed meat, preserved olives, fries etc …

Bitter

- Bitterness is due to many different molecules. These molecules are usually found in plants.
- Bitter foods include: coffee, wine, dark chocolate, arugula etc …

Savory

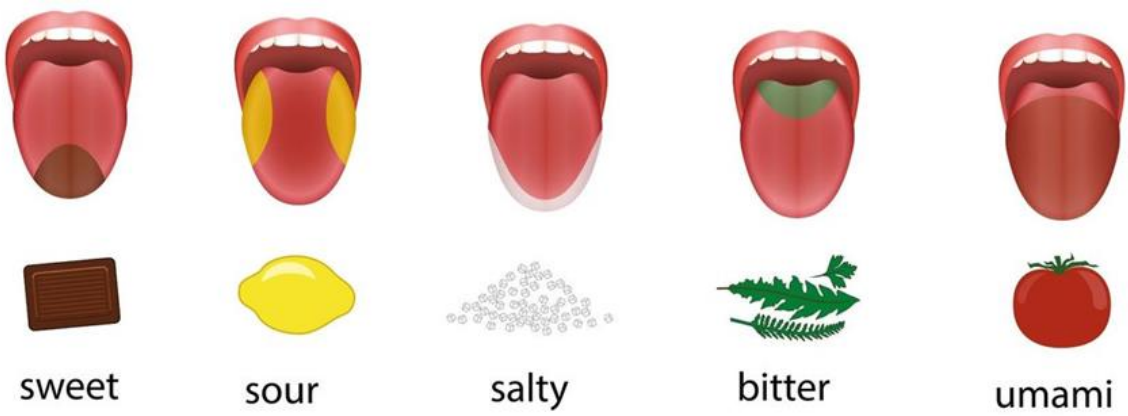
- Savory taste is caused by amino acids. It's commonly brought on by aspartic acid or glutamic acid. Occasionally, savory is also called "umami" or "meaty."
- Savory foods include: Meat broth, aged cheese, ripe tomatoes, asparagus etc …

PRACTICAL NO.: 06 **DATE**

Taste	Taste substance	Common foods
Sweet	Sucrose Fructose Glucose	Sugar  Honey  Candy 
Sour	Acetic acid Citric acid Lactic acid	Vinegar  Lemons  Limes  Yogurt 
Salty	Sodium chloride	Salt 
Bitter	Caffeine Alkaloids Momordicin	Coffee  Bitter melon  Chocolate (90% cacao mass) 
Umami	Glutamate Inosinate Guanylate	Tomatoes  Cheese  Meat  Fish  Dried shiitake mushrooms 

Different regions on the tongue exhibit different maximal sensitivities to the four taste submodalities.

- Tip of the tongue is the most sensitive to sweetness
- Front half of each side of tongue detect saltiness
- Posterior half of each side of tongue detect sour taste.
- Back or rear of the tongue detect bitterness.
- The Umami taste sensation is most intense when coupled with the salty taste.



PRACTICAL NO.: 06 **DATE**

Anatomy of Gustatory Sensation:

Gustation is the special sense associated with the tongue.

The surface of the tongue, along with the rest of the oral cavity, is lined by a stratified squamous epithelium.

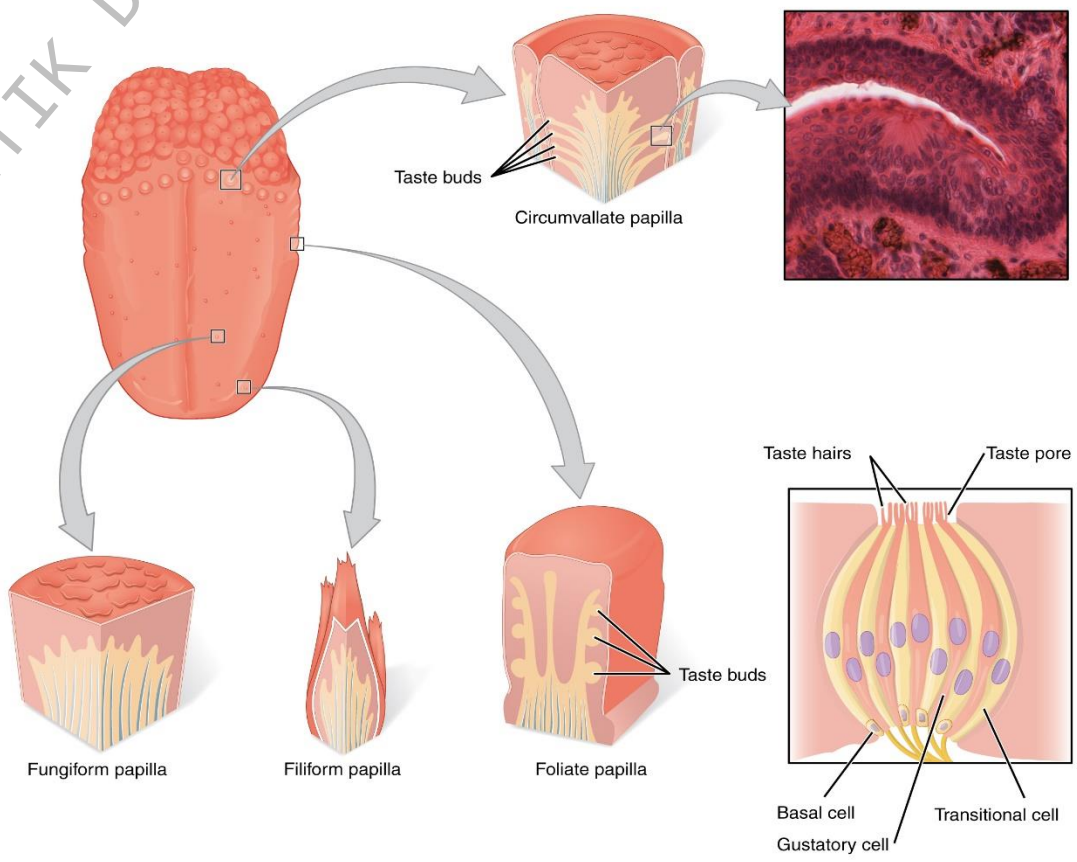
Raised bumps called papillae (singular = papilla) contain the structures for gustatory transduction.

There are four types of papillae, based on their appearance:

1. Circumvallate,
2. Foliate,
3. Filiform, and
4. Fungiform.

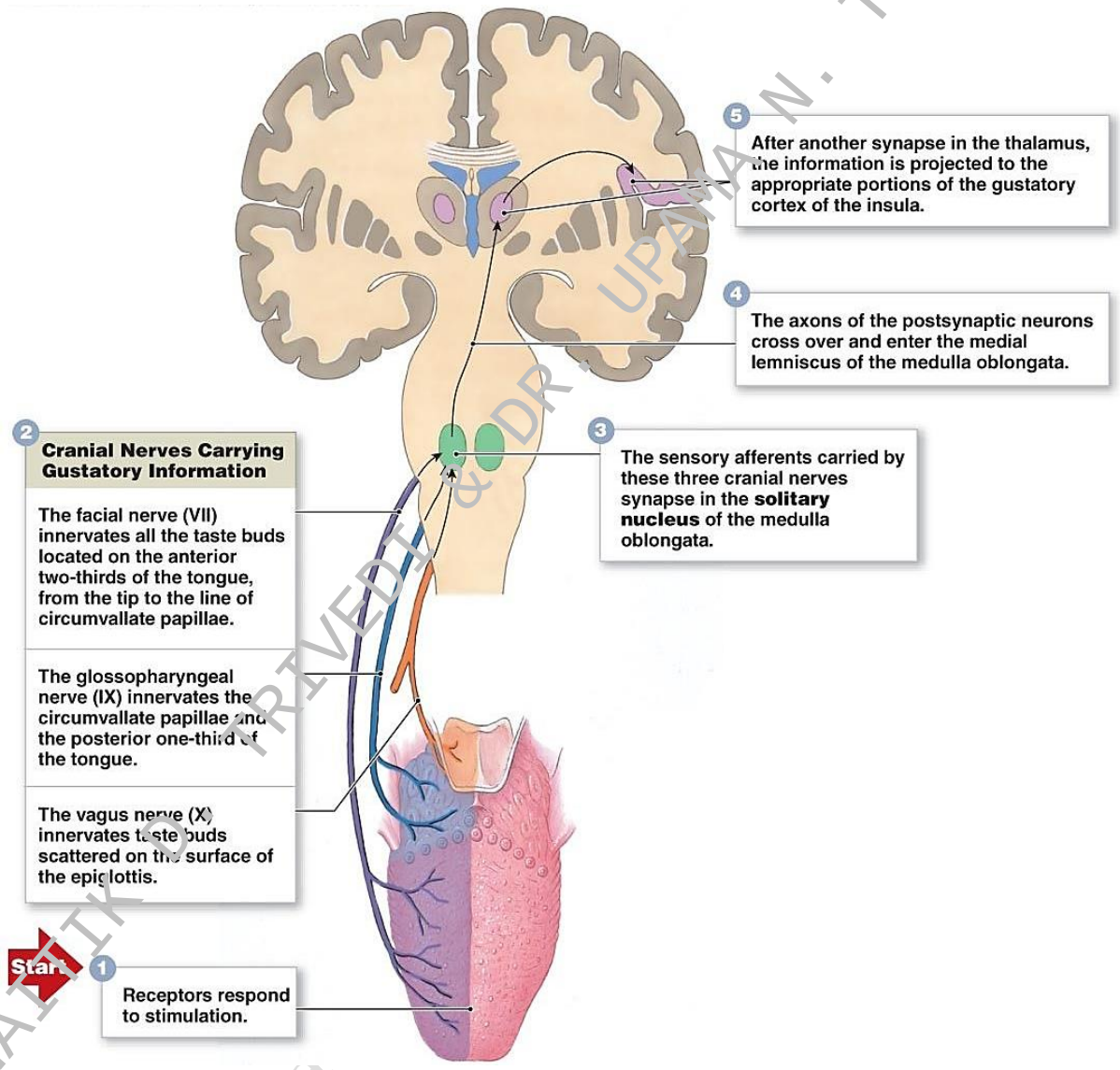
Within the structure of the papillae are taste buds that contain specialized gustatory receptor cells for the transduction of taste stimuli. These receptor cells are sensitive to the chemicals contained within foods that are ingested, and they release neurotransmitters based on the amount of the chemical in the food.

Neurotransmitters from the gustatory cells can activate sensory neurons in the facial, glossopharyngeal, and vagus cranial nerves.



PRACTICAL NO.: 06 **DATE**

Physiology of Gustation:



Procedure:

First prepare the different kind of solution in sufficient quantity in laboratory.

- Sweet: table sugar: ½ teaspoon dissolved in 2 tablespoons water
- Salt: table salt: 1/8 teaspoon dissolved in 2 tablespoons water.
- Sour: vinegar: ½ teaspoon dissolved in 2 tablespoons water
- Bitter: coffee, brewed or made from instant
- (Savory/Umami: because of sensitivities to monosodium glutamate (MSG), it is probably best to avoid testing for these receptors.)

Tell student to come with spoon/dropper to taste the prepared solution.

Advice to the student to wash spoon/dropper immediately after taking each solution.

PRACTICAL NO.: 06 **DATE**

During the time of taste, take a 3 to 5 minute interval between two solutions

Ask them to identify the intensity of each solution on the part of tongue.

Result:

Type of solution	Intensity identify on part of tongue
Sweet	
Sour	
Salt	
Bitter	
Savory	

Conclusion:

- Tip of the tongue is the most sensitive to sweetness
- Front half of each side of tongue detect saltiness
- Posterior half of each side of tongue detect sour taste.
- Back or rear of the tongue detect bitterness.
- The Umami taste sensation is most intense when coupled with the salty taste.

Signature of Teacher

PRACTICAL NO.: 07 **DATE**

AIM: TO DEMONSTRATE THE VISUAL ACUITY

REQUIREMENTS: Snellen Chart, Random E Chart

VISUAL ACUITY TEST

Two commonly used tests are Snellen and random E.

Snellen

- The Snellen test uses a chart of letters or symbols.
- This kind of chat mostly available in a school, nurse's office or eye doctor's office.
- The letters are different sizes and arranged in rows and columns.
- Viewed from 14 to 20 feet away, this chart helps determine how well you can see letters and shapes.
- In this test subject will sit or stand at a specific distance away from the chart and cover their one eye. Subject will read out loud the letters which they can see by uncovered eye.
- Subject will repeat this process with their other eye. Typically, doctor will ask you to read smaller and smaller letters until you can no longer accurately distinguish letters.

Random E

- In the random E test, it is needed to identify the direction the letter "E" is facing.
- Looking at the letter on a chart or projection, you need to point in the direction the letter is facing: up, down, left, or right.
- These tests tend to be more sophisticated when performed at an eye clinic than in a nurse's or school building.
- At an eye doctor's office, the chart might be projected or shown as a mirror reflection. Subject will look at the chart through a variety of different lenses.
- Doctor will switch out the lenses until you can see the chart clearly.
- This helps determine your ideal eyeglass or contact lens prescription, if you need vision correction.

Snellen test Procedure:

This test may be done in a health care provider's office, a school, workplace, or elsewhere.

Visual acuity is usually recorded as:

1. "Uncorrected," which is without glasses or contact lenses
2. "Best corrected," which is with the best possible glasses or contact lens prescription

PRACTICAL NO.: 07 **DATE**

For uncorrected:

- Visual acuity, you will be asked to remove your glasses or contact lenses and stand or sit 20 feet (6 meters) from the eye chart. You will keep both eyes open.
- You will be asked to cover one eye with the palm of your hand, a piece of paper, or a small paddle while you read out loud the smallest line of letters you can see on the chart.
- Numbers, lines, or pictures are used for people who cannot read, especially children.
- If you can't make out any of the letters, numbers, or pictures, the examiner will usually hold up some number of fingers and record at how many feet away you can correctly identify how many are being held up.
- If you are not sure of the letter, you may guess.
- This test is done on each eye, and one at a time.
- If needed, it is repeated while you wear your glasses or contacts.
- You may also be asked to read letters or numbers from a card held 14 inches (36 centimeters) from your face. This will test your near vision.

Line	distance in metres	angle subtended at nodal point	height and width of the letter in centimeters
6/60	60	5'	8.726
6/36	36	5'	5.235
6/24	24	5'	3.490
6/12	12	5'	1.745
6/9	9	5'	1.308
6/6	6	5'	0.872

PRACTICAL NO.: 07 **DATE**

Interpretation of result:

- Record the visual acuity for the examined eye.
- Visual acuity is expressed as a fraction e.g. 6/18.
- The top number refers to the distance you stand from the chart. This is often 20 feet (6 meters)
- The bottom number indicates the distance at which a person with normal eyesight could read the same line you correctly read.
- For example, 20/20 (6/6) is considered normal. 20/40 (6/12) indicates that the line you correctly read at 20 feet (6 meters) away can be read by a person with normal vision from 40 feet (12 meters) away
- Incomplete lines can be added to the last complete line. e.g. 6/12+3, indicating that the patient read the '12' line at 6 metres and three of the letters on the '9' line.
- 20/60 -1 means that all the letter on the 20/60 line were read correctly, except for one.
- If the patient cannot read the largest (top) letter at 6 metres, then move them closer to the chart, 1 metre at a time, until the top letter can be seen – the visual acuity (VA) will then be recorded as 5/60 or 4/60, etc.
- You can also follow this method, hold up your fingers at varying distances (5 metres, 4 metres etc. and record the vision as counting fingers (CF) at the maximum distance they can see between 5 and 1 metre, i.e. VA = CF 5m or VA = CF 1m.
- If the patient cannot count fingers at 1 metre, wave your hand and check if he/she can see this. This is recorded as hand movements (HM): VA = HM.
- If the patient cannot see hand movements, shine a torch in the eye and ask if they can see the light. If they can, record 'perception of light (PL)': VA = PL. If they cannot see the light, record 'no perception of light': VA = NPL.
- To determine the visual acuity use one of the following formulas:

$$1.\ VA = \frac{\text{Viewing Distance Used (meters)}}{\text{M-value}}$$

OR

$$2.\ VA = \frac{\text{Viewing Distance Used (meters or feet)}}{\text{3 meters (10 feet)}} \times \text{VA value for 3 meters (10 feet)}$$

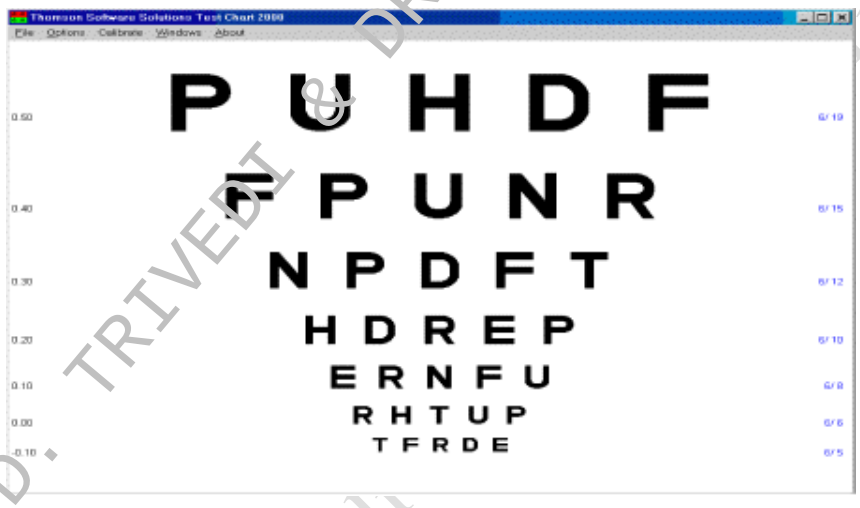
- The M value indicates symbol size or the visual acuity value printed at the threshold line.

PRACTICAL NO.: 07 **DATE**

Disadvantages of Snellen Test Type

- Letters not of equally legible eg; O and E
- Non-uniform progression of letter sizes
- Unequal number of letters on each line
- Irregular spacing between letters and lines
- Inadequate scoring (6/9+2, etc)

The LogMAR alternative to Snellen



Other researchers suggested a logarithmic progression in size of letters on test chart gives most accurate VA measurement

MAR = Minimum Angle of Resolution - the angle subtended within the eye by a letter

Scoring LogMAR

- Each letter has a score value of 0.02 log units; 5 letters per line
- Each line represents a change of 0.1 log units

Advantages of LogMAR

- Equal number of letter per line
- Regular spacing between lines and letters
- Uniform progression in letter size
- Final score based precisely on total of all letters read
- Finer grading scale allows greater accuracy and improved test/retest reliability

PRACTICAL NO.: 07 **DATE**

LogMAR / Snellen equivalent results

LogMAR	Snellen	Decimal
0	6/6	1.00
0.18	6/9	0.67
0.30	6/12	0.50
0.48	6/18	0.33
0.60	6/24	0.25
0.78	6/36	0.17
1.00	6/60	0.10

Importance of visual acuity test:

- The visual acuity test is a routine part of an eye examination or general physical examination, particularly if there is a change in vision or a problem with vision.
- In children, the test is performed to screen for vision problems. Vision problems in young children can often be corrected or improved. Undetected or untreated problems may lead to permanent vision damage.
- There are other ways to check vision in very young children, or in people who do not know their letters or numbers.

Result: My Visual Acuity Score is _____

Teacher's Signature

PRACTICAL NO.: 08 **DATE**

AIM: TO DEMONSTRATE THE REFLEX ACTIVITY

REQUIREMENTS: Medical Torch, Reflex Hemmer

DEFINITION:

A reflex may be defined as a response to a stimulus that does not require the intervention of consciousness.

THEORY:

Reflexes require no thought. They are involuntary and quick response against the stimuli. One example of a reflex is the patellar stretch reflex. Our spinal cord partners with sensors in our muscles, called muscle spindles, to keep track of where our bodies are in space and how stretched or contracted our muscles are. The way that these sensors interact with our spinal cord is through a reflex pathway. Stretching the muscle activates the muscle spindle at the end of the sensory neuron (embedded in your muscle) and starts the reflex. The reflex is to prevent overstretching of the muscle and compensates with a contraction.

MECHANISM OF REFLEX:

Receptor activation: It respond to a stimulus. It monitors change in control condition and send the input information to control center/integrated center via sensory receptor.

Sensory Neurons: It receives information from receptor and sends input messages to integrated center.

Integrated center: It analyze the incoming messages and send the reply via motor receptor. (Brain and spinal cord)

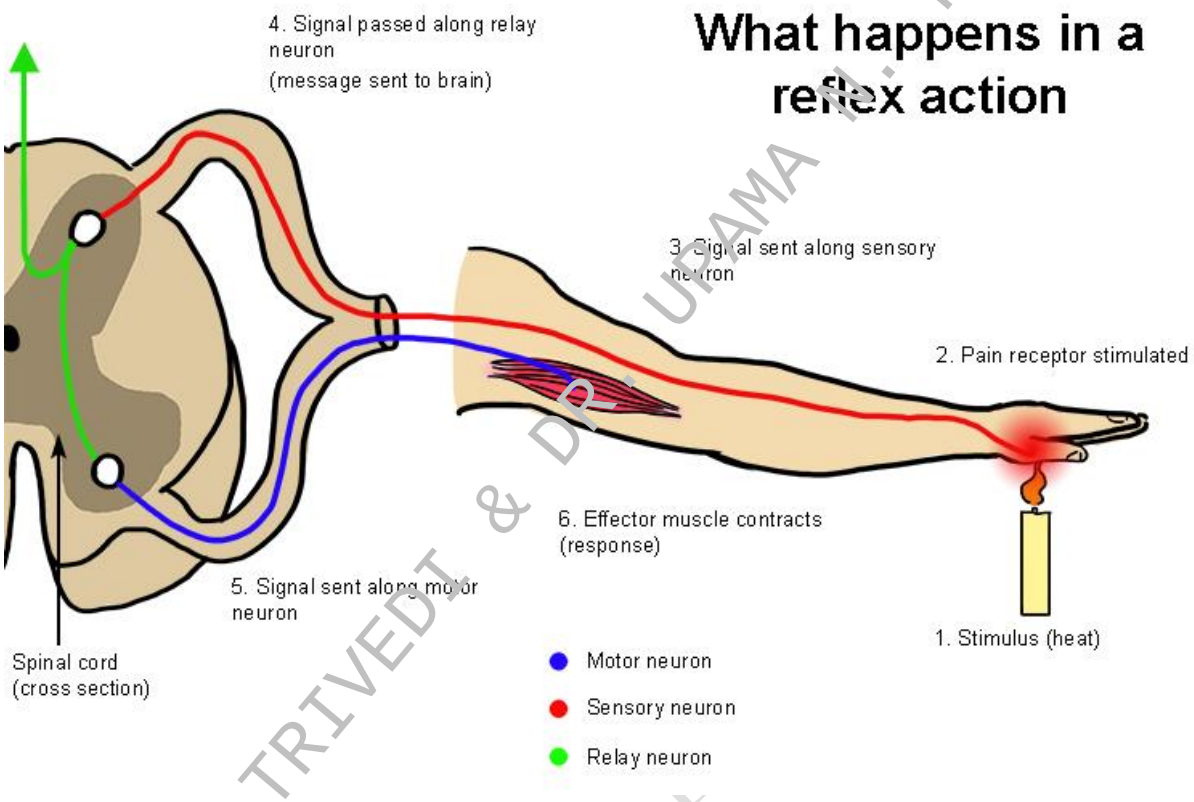
Motor receptor: It send the reply coming from integrated center to effector.

Effectors are the cell or organ that responds according to output command of the control center via motor receptor.

Note: Sometimes homeostasis or Reflex arc mechanism include another neuron i.e relay neuron it not wait for the brain command it immediately send message to the effector via motor neurons and gives fast/immediate response.

PRACTICAL NO.: 08 **DATE**

Reflex Arc: A reflex arc is a pathway that controls a reflex.



EXAMPLES OF REFLEX MECHANISM:

1. Best-known reflex is the pupillary light reflex. If a light is flashed near one eye, the pupils of both eyes contract. Light is the stimulus; impulses reach the brain via the optic nerve; and the response.

   Procedure:

Ask subject to seat on chair with relax position

⬇

Instruct subject to open both the eye in wide position (not to blink)

⬇

Take a torch with low intensity of light to prevent damage of eye.

⬇

Focus the torch in right eye and observe left eye pupil

⬇

Take a break of a minute and do same procedure for left eye.

Result: When we focus the light on Right eye or left eye both eyes pupil size getting decrease. It produce contraction.

PRACTICAL NO.: 08 **DATE**

2. **Knee-jerk reflex:**

It is also called patellar reflex. **S**udden jerking movement of the lower leg in response to a sharp tap on the patellar tendon, which lies just below the kneecap.

Procedure:

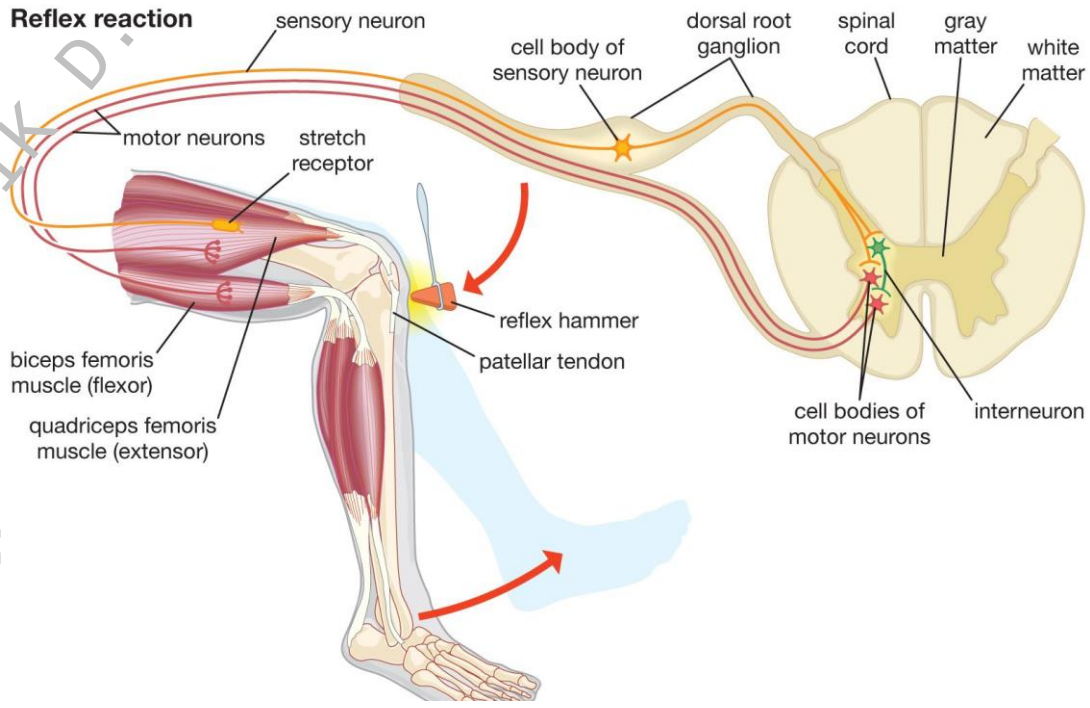
One of the several positions that a subject may take for the test is to sit with knees bent and with one leg crossed over the other so that the upper foot hangs clear of the floor.

The sharp tap on the tendon slightly stretches the quadriceps, the complex of muscles at the front of the upper leg.

In reaction these muscles contract, and the contraction tends to straighten the leg in a kicking motion.

Exaggeration or absence of the reaction suggests that there may be damage to the central nervous system.

Note: The knee jerk can also be helpful in recognizing thyroid disease.



Result: A sharp tap on the patellar tendon with the help of reflex hammer produce sudden jerking movement of the lower leg.

Signature of Teacher

PRACTICAL NO.: 09 **DATE**

AIM: TO RECORD BODY TEMPERATURE OF OWN BODY

REQUIREMENT: Clinical Thermometer

THEORY:-

What is body temperature?

- Body temperature is a measure of the body's ability to generate and get rid of heat.
- The body is very good at keeping its temperature within a narrow, safe range in spite of large variations in temperatures outside the body.
- When you are too hot, the blood vessels in your skin expand (dilate) to carry the excess heat to your skin's surface.
- You may begin to sweat, and as the sweat evaporates, it helps cool your body.
- When you are too cold, your blood vessels narrow (contract) so that blood flow to your skin is reduced to conserve body heat.
- You may start shivering, which is an involuntary, rapid contraction of the muscles.
- This extra muscle activity helps generate more heat.
- Under normal conditions, this keeps your body temperature within a narrow, safe range.

Where is body temperature measured?

- Your body temperature can be measured in many locations on your body.
- The mouth, ear, armpit, and rectum are the most commonly used places.
- Temperature can also be measured on your forehead.

METHOD (SITE)	NORMAL TEMPERATURE RANGE	METHOD (SITE)	NORMAL TEMPERATURE RANGE
ORAL (MOUTH)	36.4-37.2°C 97.6-99.6°F	RECTAL (RECTUM)	37.0-38.1°C 98.6-100.6°F
TYMPANIC (EAR)	35.9-37.6°C 96.6-99.7°F	TEMPORAL (FORHEAD)	35.8-36.9°C 96.5-99.6°F
AXILLARY (ARMPIT)	35.2-36.9°C 95.3-98.4°F		

What are Fahrenheit and Celsius?

Thermometers are calibrated in either degrees Fahrenheit (ºF) or degrees Celsius (ºC), depending on the custom of the region. Temperatures in the United States are often measured in degrees Fahrenheit, but the standard in most other countries is degrees Celsius.

If you'd like to convert a temperature reading in Fahrenheit to Celsius:

1. Start with the temperature in Fahrenheit (e.g., 100 degrees).
2. Subtract 32 from this figure (e.g., 100 - 32 = 68).
3. Divide your answer by 1.8 (e.g., 68 / 1.8 = 37.78)

PRACTICAL NO.: 09 **DATE**

What is a fever?

- In most adults, an oral temperature above 100ºF (37.8ºC) or a rectal or ear temperature above 101ºF (38.3ºC) is considered as a fever.

BODY TEMPERATURE CHART

Condition	Child		Adult	
Hypothermia	<35°C	<95°F	<35°C	<95°F
Normal	35.8°C - 37.5°C	96.4°F - 99.5°F	36.5°C - 37.5°C	97.7°F - 99.5°F
Low Fever (Hyperthermia)	>38.3°C	>100.4°F	>38.3°C	>100.9°F
High Fever (Hyperpyrexia)	>40°C	>104.0°F	>41.5°C	>106.7°F

What can cause a fever?

A fever may occur as a reaction to:

- Infection. This is the most common cause of a fever. Infections may affect the whole body or a specific body part (localized infection).
- Medicines, such as antibiotics, narcotics, barbiturates, antihistamines, and many others. These are called drug fevers. Some medicines, such as antibiotics, raise the body temperature directly; others interfere with the body's ability to readjust its temperature when other factors cause the temperature to rise.
- Severe trauma or injury, such as a heart attack, stroke, heat exhaustion or heatstroke, or burns.
- Other medical conditions, such as arthritis, hyperthyroidism, and even some cancers, such as leukemia, Hodgkin's lymphoma, and liver and lung cancer.
- An abnormally low body temperature (hypothermia) can be serious, even life-threatening.

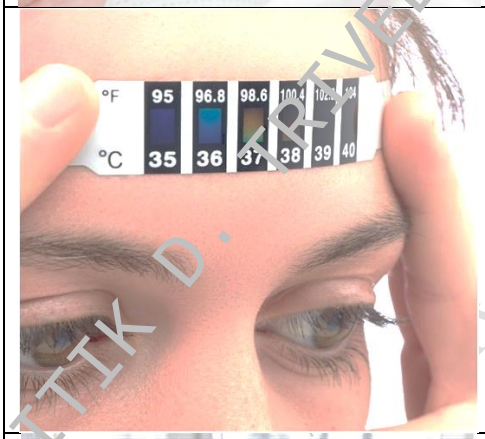
Why It Is Done

Body temperature is checked to:

- Detect fever.
- Detect abnormally low body temperature (hypothermia) in people who have been exposed to cold.
- Detect abnormally high body temperature (hyperthermia) in people who have been exposed to heat.
- Help monitor the effectiveness of a fever-reducing medicine.
- Help plan for pregnancy by determining if a woman is ovulating.

PRACTICAL NO.: 09 **DATE**

SEVERAL DIFFERENT TYPES OF THERMOMETERS ARE AVAILABLE:

Thermometer Figure	Types and Description
	**Electronic thermometers** are plastic and shaped like a pencil, with a display window at one end and the temperature probe at the other end. They work by measuring how well electricity travels through a wire. Electronic thermometers are used in the mouth, rectum, or armpit. They are easy to use and easy to read. If you buy an electronic thermometer, check the package for information about its accuracy.
	**Ear thermometers** are plastic and come in different shapes. They use infrared energy to measure body temperature. The small cone-shaped end of the thermometer is placed in the ear, and body temperature shown on a digital display. The results appear within seconds. Some models also show the corresponding oral and rectal readings. See a picture of an ear thermometer.
	**Disposable thermometers** are thin flat pieces of plastic with colored dots and temperature markings on one end. The color of the dots shows the temperature. Disposable thermometers can be used in the mouth or rectum. A patch form can be used on a baby's skin to measure temperature continuously for 48 hours. These thermometers are safe, but they are not as accurate as electronic or ear thermometers. They do not contain glass, latex, or mercury. You can reuse the thermometer during an illness and then throw it away.
	**Forehead (temporal) thermometers** use skin temperature to determine body temperature. Some have a soft disc that are pressed against the forehead and show the temperature on a digital display. Other types are thin pieces of plastic with numbers on them. You press the strip against a person's forehead, and the temperature makes some numbers change colors or light up. These thermometers are not as accurate as electronic and ear thermometers.
	**Pacifier thermometers** are shaped like a baby's pacifier but have a display that shows the temperature. You place the pacifier in your child's mouth to measure temperature. These thermometers may take longer to get a reading and are not as accurate as other types.

PRACTICAL NO.: 09 **DATE**

How to take an oral temperature

Oral is the most common method of taking a temperature.

1. Place the digital or disposable thermometer under the tongue, just to one side of the center, and close the lips tightly around it.
2. Leave the thermometer in place for the required amount of time. Time yourself with a clock or watch. Some digital thermometers give a series of short beeps when the reading is done.
3. Remove the thermometer and read it.
4. Clean a digital thermometer with cool, soapy water and rinse it off before putting it away.

How to take an armpit (axillaries) temperature

Taking a temperature in the armpit may not be as accurate as taking an oral or rectal temperature.

1. Place the thermometer under the arm with the bulb in the center of the armpit.
2. Press the arm against the body and leave the thermometer in place for the required amount of time. Time yourself with a watch or clock.
3. Remove the thermometer and read it. An armpit temperature reading may be as much as 1ºF (0.6ºC) lower than an oral temperature reading.
4. Clean a digital thermometer with cool, soapy water and rinse it off before putting it away.

Body temperature	
Normal:	The average normal temperature is 98.6ºF (37ºC). But "normal" varies from person to person. Your temperature will also vary throughout the day, usually being lowest in the early morning and rising as much as 1ºF (0.6ºC) in the early evening. Your temperature may also rise by 1ºF (0.6ºC) or more if you exercise on a hot day. A woman's body temperature typically varies by 1ºF (0.6ºC) or more through her menstrual cycle, peaking around the time of ovulation.
Abnormal:	**Oral, ear (tympanic), or rectal temperature** • Fever: 100.4ºF (38ºC) to 103.9ºF (39.9ºC) • High fever: 104ºF (40ºC) and higher
	Armpit (axillary) temperature • Fever: 99.4ºF (37.4ºC) to 102.9ºF (39.4ºC) • High fever: 103ºF (39.5ºC) and higher
	A rectal or ear temperature of less than 97ºF (36.1ºC) means a low body temperature (hypothermia).

RESULT:

My Body temperature was……. [Normal Body temperature is 97 to 99 (˚F)]

Signature of Teacher

PRACTICAL NO.: 10 **DATE**

AIM: TO DEMONSTRATE POSITIVE AND NEGATIVE FEEDBACK MECHANISM

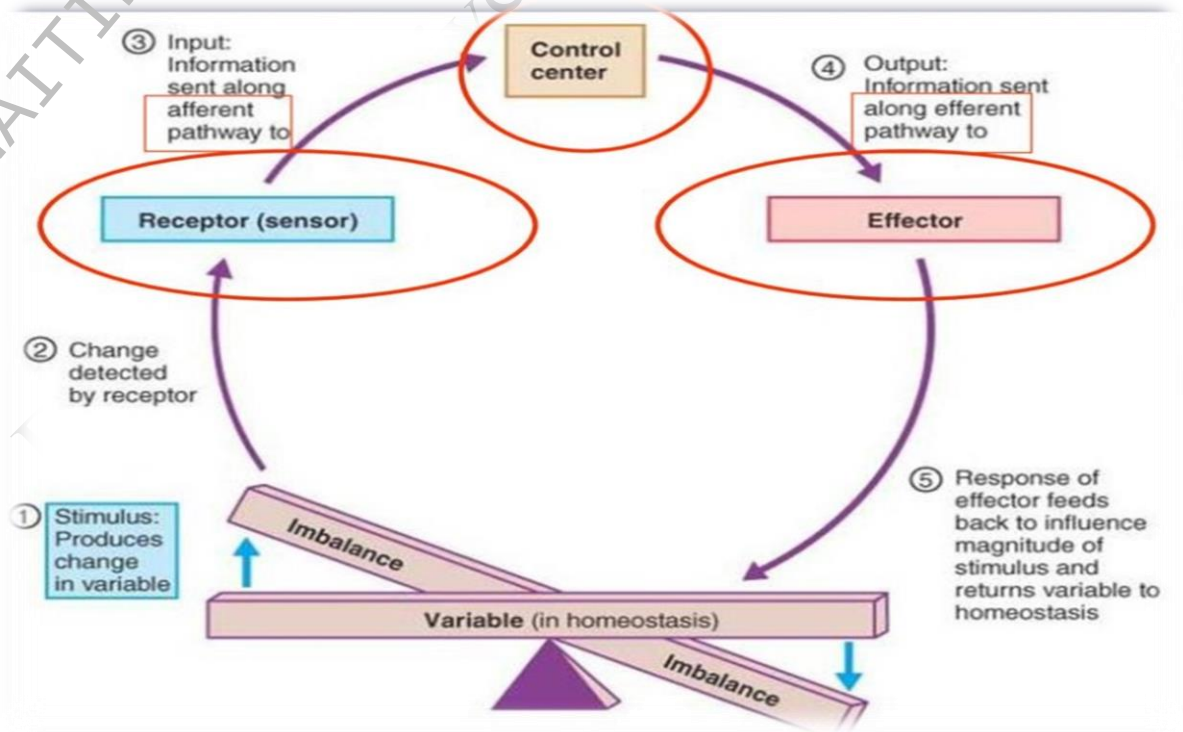
THEORY

HOMEOSTASIS:

- Ability to maintain relatively stable internal conditions despite a changing external environment. Dynamic state of equilibrium, or balance.
- The body is said to be in homeostasis when its cellular needs are adequately met and functional activities are occurring smoothly.
- Virtually every organ system plays a role in maintaining the internal environment.

A homeostatic regulatory mechanism consists of 5 parts:

1. **Receptors:** It act as a sensors/receiver that respond to a stimulus. It monitors change in control condition.
2. **Sensory Neurons:** It send the input information/message to control center, means information from cell/tissue/organ etc to integrated system i.e brain and spinal cord.
3. **Integrated System:** It analyze the incoming message received from the sensory neurons and sends out commands/messages. In the body there are hundred controlled conditions. A few examples are heart rate, blood pressure, temperature and breathing rate.
4. **Motor Neurons:** The output information/message from integrated center (brain and spinal cord) to cell/tissue/organ etc are travelled by motor neurons.
5. **Effectors:** The cell/tissue/organ etc act as effector that responds according to output command of the control/integrated center.

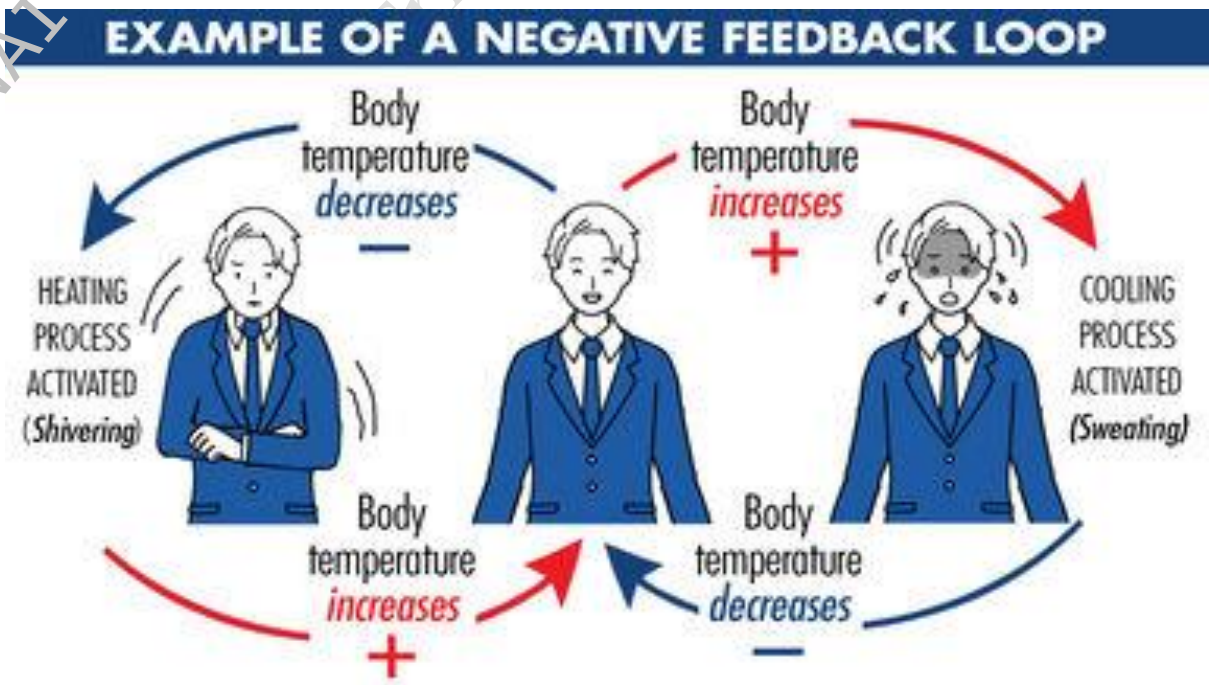


PRACTICAL NO.: 10 **DATE**

Receptors, control center and effectors maintain the homeostasis by two mechanisms:

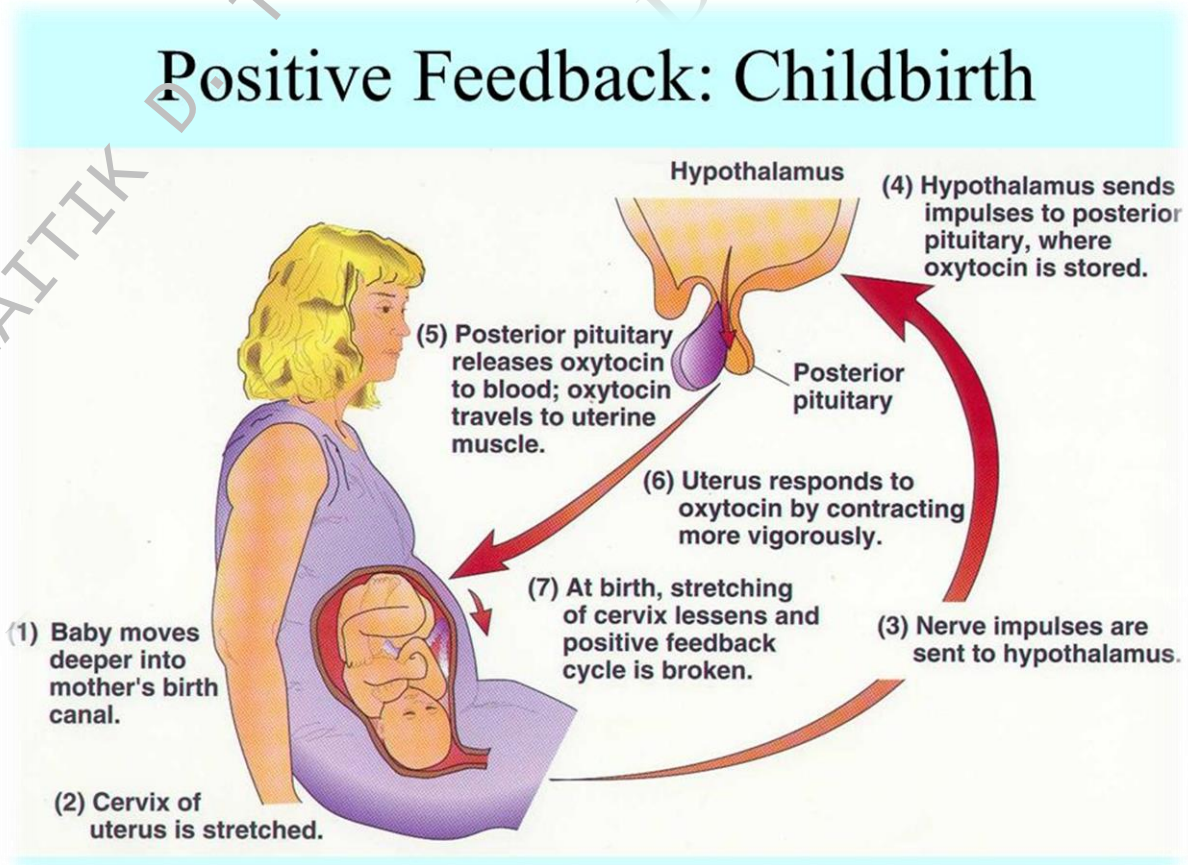
1. **Negative feedback:**

- When the response of effectors opposes the original stimulus, it is called negative feedback because it negates the stimulus.
- An example of negative feedback is the temperature thermostat in your home.
- Temperature sensors turn the air conditioner off and on to maintain air temperature within a specific, limited range.
- In the same way, the brain controls normal body-temperature homeostasis by negative feedback.
  - Some stimulus (Stress) disrupts homeostasis (control condition) by an increase in body temperature.
  - Due to this condition thermoreceptors (temperature sensitive receptors) in the skin and brain activate and send input message via nerve impulse to control center.
  - Control center analyze the input message and send output message to effectors (skin).
  - Effectors according to output message of control center increases sweating from sweat glands causes increased heat loss by evaporation.
  - Finally, decreases the temperature in the form of response and normalize the body temperature (control condition).



2. Positive feedback:

- The effector adds to the initial stimulus instead of negating it, speeding up the process.
  - Labor contraction is the example of positive feedback system.
  - Labor contractions force baby's head or body into birth canal.
  - It produces effect on control condition and increases distention of cervix of uterus.
  - It activates the stretch receptors of cervix and send input message to control center via sensory nerve impulse.
  - Control center activates the hypothalamus and pituitary gland and send the output message to increase oxytocin secretion in blood.
  - Oxytocin produces their effect on to the effector (cervix of uterus) and cause distention of cervix of uterus than the normal value to push the baby further into birth canal.
  - Birth of the baby decreases distention of cervix of uterus and interrupts positive feedback cycle.



Signature of Teacher

PRACTICAL NO.: 11 **DATE**

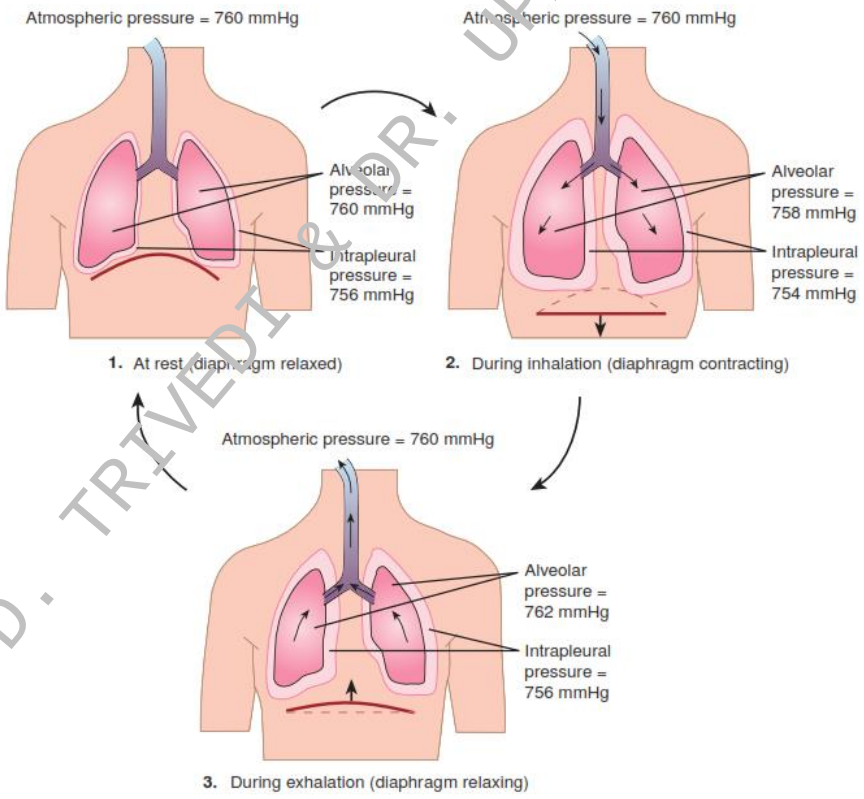
AIM: DETERMINATION OF TIDAL VOLUME AND VITAL CAPACITY

REQUIRMENT: - Spirometer with drum, graph paper, mouthpiece, nose clip, disinfectant, glucose, water tissue paper.

THEORY:

According to Boyle's law pressure is inversely proportional to the volume.

During breathing our body follows Boyle's law.

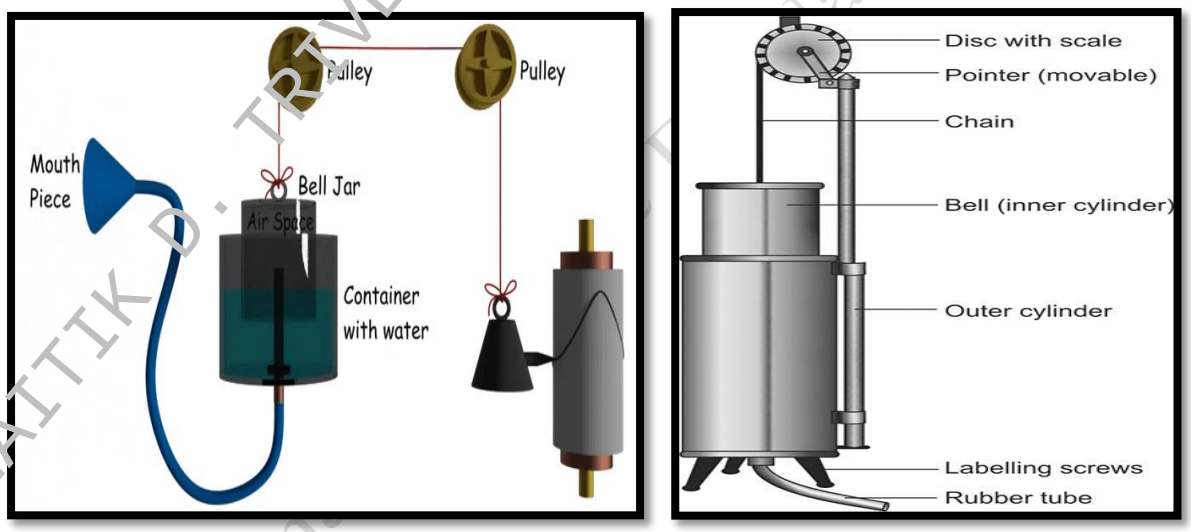


- Spirometer is a biomedical device which measures the lung capacity and lung volume.
- Pulmonary function tests (PFTs) are one of the main diagnostic tools employed by pulmonary physicians.
- They can be used for a variety of purposes including to help identify the etiology of dyspnea, to follow progression of pulmonary diseases and response to treatment and to evaluate fitness to undergo other procedures or treatments such as thoracic surgery or peripheral blood stem cell transplantation.
- Given this wide range of uses, it is critical that a pulmonary physician be able to read and interpret these tests.
- There are essentially four categories of information which can be obtained with routine pulmonary function testing:
    1. Lung volumes which can allow us to measure the maximum volume of the lungs as well as sub-compartments thereof.
    2. Flow rates which measure the maximal flow of gas out of (and sometimes into) the lung.
    3. Diffusing capacity which measures the transfer of gas from the alveolar space into the capillary blood stream.
    4. Maximal inspiratory and expiratory pressures which measure the applied strength of the respiratory muscles.

PRACTICAL NO.: 11 **DATE**

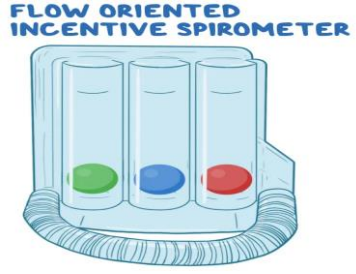
Principle of Spirometer

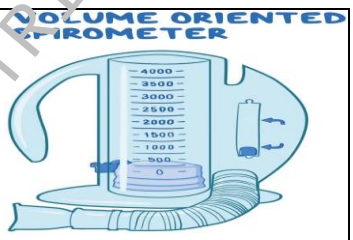
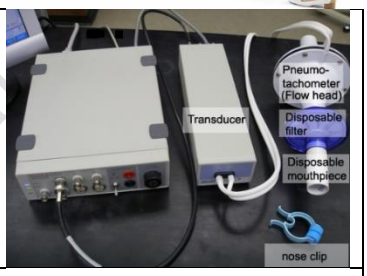
- It is made of metal and consists of two chambers- outer chamber is filled with water and called the water chamber, and inner chamber is a floating drum immersed in water in an inverted manner.
- The drum is counterbalanced by a weight attached to the top of floating drum by means of a chain or string.
- The inner chamber has a small hole at the top, and a long metal tube passes from bottom towards top through inner chamber and penetrates into the outer water chamber above the level of water.
- A rubber tube is connected to the outer metal tube and a mouth piece is attached to the other end of the rubber tube.
- The subject/participant respires through the mouth piece.
- During expiration the inner drum moves up by balancing weight comes down and during inspiration it is vice-versa.
- The upward and downward movements of the counter balancing weights are recorded in the form of ink pen attached to the weight indicating inspiration and expiration, respectively.
- The record of lung volumes and lung capacites can be recorded by a Spirometer as a Spirogram.



Traditional Water Tank Spirometer

Types of spirometer

Sr. No	Types of spirometer	Figure
1.	**Basic Incentive Spirometer** ✓ An incentive spirometer is a handheld medical device used to help patients improve the functioning of their lungs. ✓ By training patients to take slow and deep breaths, thissimplified spirometer facilitates lung expansion and strengthening. ✓ Patients inhale through a mouthpiece, which causes a piston inside the device to rise. ✓ This visual feedback helps them monitor their inspiratory effort.	

	✓ Incentive spirometers are commonly used after surgery or other illnesses to prevent pulmonary complications.	
2.	**Whole body plethysmograph** ✓ This type of spirometer gives a more accurate measurement for the components of lung volumes as compared to other conventional spirometers. ✓ A person is enclosed in a small space when the measurement is taken.	
3.	**Pneumotachometer** ✓ This spirometer measures the flow rate of gases by detecting pressure differences across the fine mesh. ✓ One advantage of this spirometer is that the subject under investigation can breathe in fresh air during the experiment.	
4.	**Fully electronic spirometer** ✓ Electronic spirometers have been developed that compute airflow rates in a channel without the need for fine meshes or moving parts. ✓ They operate by measuring the speed of the airflow with techniques such as ultrasonic transducers, or by measuring pressure difference in the channel. ✓ These spirometers have greater accuracy.	
5.	**Peak flow meter** ✓ The peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR), is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. ✓ It measures the airflow through the bronchi and thus the degree of obstruction in the airways. ✓ Peak expiratory flow is typically measured in units of liters per minute (L/min).	
6.	**Windmill-type spirometer** ✓ Used specially for measuring forced vital capacity without using water and has broad measurements ranging from 1000 ml to 7000 ml. ✓ It is more portable and lighter as compared to traditional water-tank type spirometer. ✓ This spirometer should be held horizontally while taking measurements because of the presence of rotating disc.	

PRACTICAL NO.: 11 **DATE**

Calculation steps for Total Lung volume/Minute Volume:

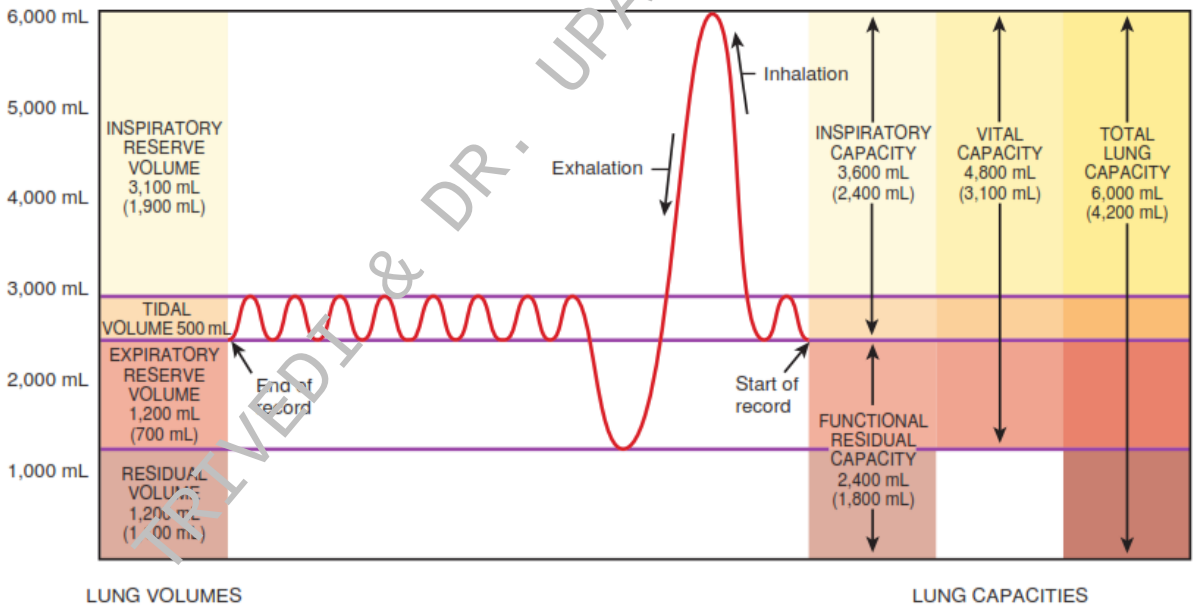
1. **Tidal volume (VT)**
   - ❖ Healthy adult doing 12 breaths in each minute and with each inhalation and exhalation moving about 500 mL of air into and out of the lungs. The volume of one breath is called the tidal volume (VT)
2. **Minute Ventilation (MV)**
   - ❖ We are doing 12 breaths in each minute so the minute ventilation (MV) is the the total volume of air inhaled and exhaled in each minute.

     Minute Ventilation (MV) = Tidal volume (VT) x 12

     = 500 mL/ breath x 12 breaths/min = 6 litres/min
   - ❖ In a typical adult, about 70% of the tidal volume (350 mL) actually reaches the respiratory zone of the respiratory system namely the respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli and participates in external respiration.
   - ❖ The other 30% (150 mL) remains in the conducting airways of the nose, pharynx, larynx, trachea, bronchi, bronchioles, and terminal bronchioles known as dead space because these part does not undergo respiratory exchange of gases.
   - ❖ Not all of the minute ventilation can be used in gas exchange because some of it remains in the anatomic dead space.
3. **Alveolar Ventilation Rate**
   - ❖ The **alveolar ventilation rate** is the volume of air per minute that actually reaches the respiratory zone.
   - ❖ In the example just given, alveolar ventilation rate would be -------

     350 mL/breath x 12 breaths/min = 4200 mL/min.
4. **Inspiratory Reserve Volume**
   - ❖ When we do very deep breath, we can inhale more than 500 mL of air. This additional inhaled air, called the inspiratory reserve volume which is about 3100 mL in an average adult male and 1900 mL in an average adult female
5. **Expiratory Reserve Volume or Force Expiratory Volume**
   - ❖ If inhalation follows forced exhalation we can more air in addition to the 500 mL of tidal volume which is 1200 mL in males and 700 mL in females is called the **expiratory reserve volume or force expiratory volume.**
6. **Residual Volume**
   - ❖ When we do force expiration not all amount of air go out some amount remain in anatomical dead space that is 1200 mL in male and 1100 mL in female which is known as **residual volume.**
7. **Inspiratory capacity**
   - ❖ **Inspiratory capacity** is the sum of tidal volume and inspiratory reserve volume (500 mL + 3100 mL = 3600 mL in males and 500 mL + 1900 mL = 2400 mL in females).
8. **Functional residual capacity**
   - ❖ Functional **residual capacity** is the sum of residual volume and expiratory reserve volume (1200 mL + 1200 mL = 2400 mL in males and 1100 mL + 700 mL = 1800 mL in females).

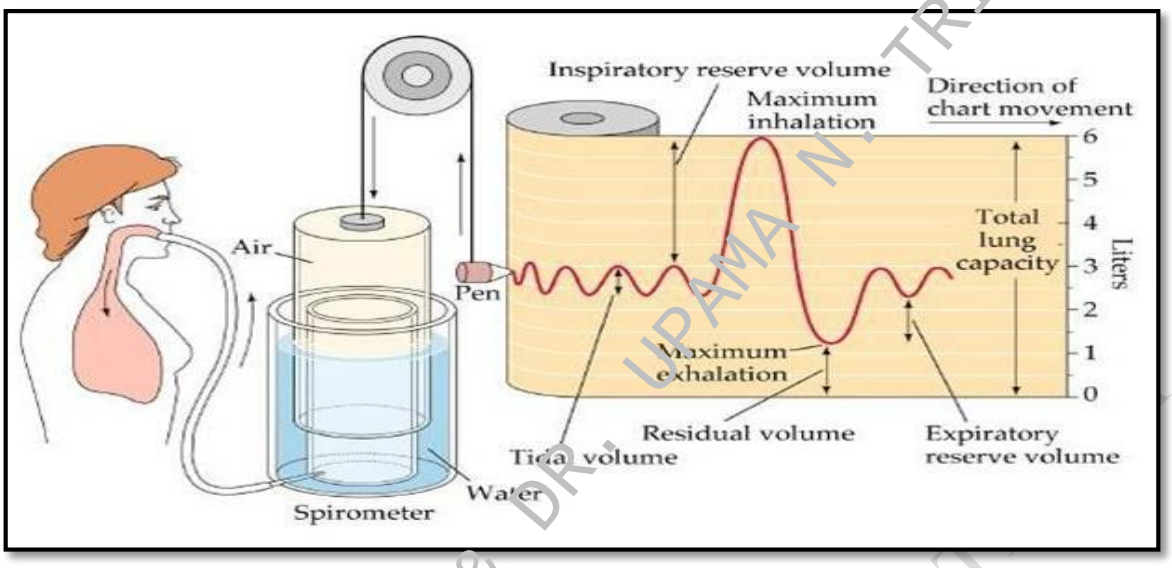
9. **Vital capacity**
   - ❖ **Vital capacity** is the sum of inspiratory reserve volume, tidal volume, and expiratory reserve volume (4800 mL in males and 3100 mL in females).
10. **Total lung capacity**
   - ❖ Finally, **total lung capacity** is the sum of vital capacity and residual volume (4800 mL + 1200 mL = 6000 mL in males and 3100 mL + 1100 mL = 4200 mL in females).



Procedure

1. A graph paper was attached to the rolling cylinder of the wet spirometer and was arranged accordingly.
2. The pen was refilled with ink and was placed.
3. Subject/Participant was asked to sit comfortably on an armed chair in a relaxed state.
4. A sterilized mouthpiece was attached to the spirometer pipe.
5. The vacuum was flushed out of the water tank by opening the knobs attached to it and moving the cylinder up and down steadily.
6. The participant was asked to put the mouthpiece in his mouth over and above teeth and nose clips were placed on the nose of participant to avoid air flow through nose.
7. The nose was closed with the nose clip.
8. The speed of the spirometer's motor was adjusted to 2mm/sec. Then, the participant was asked to breath normally in a relaxed state.
9. After few seconds, the participant was asked to breathe in and out maximally and then again back to normal breathing. The speed of the motor was again adjusted to 12mm/sec.
10. Again, the participant was asked to breathe in and out maximally and back to normal state. Following this, the participant was asked to breathe deep and fast for few seconds and then relaxed breathing.
11. The spirometer was switched off and the participant was asked to remove the nose clip and mouthpiece and placed in disinfectant container.
12. The participant was given a glass of glucose water and asked to relax.
13. The graph was removed carefully from the spirometer and was analyzed the observed record.

PRACTICAL NO.: 11 **DATE**



SPIROMETER

OBSERVATION

1. Tidal Volume: _____
2. Inspiratory reserve volume: _____
3. Expiratory reserve volume: _____
4. Vital capacity: Inspiratory reserve volume + Tidal volume, + Expiratory reserve volume)

=_____+_____+_____

=_____

RESULT:

My own respiratory tidal volume was _____ & Vital Capacity was _____.

CONCLUSION:

1. My respiratory tidal volume is in normal range / abnormal range.
2. My respiratory vital capacity is in normal range / abnormal range.

Signature of Teacher

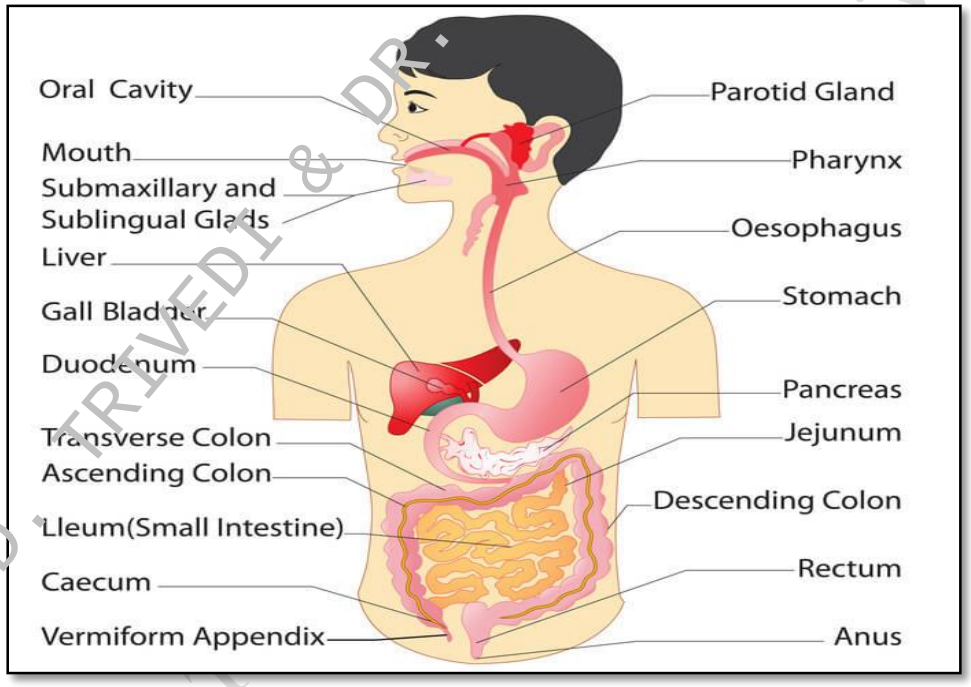
PRACTICAL NO.: 12.1 **DATE**

AIM: TO STUDY OF DIGESTIVE SYSTEMS WITH THE HELP OF MODELS, CHARTS AND SPECIMENS.

REQUIRMENT: - Models, charts and specimens of digestive systems.

THEORY:-

- The *system* by which ingested food is acted upon by physical and chemical means to provide the body with absorbable nutrients and to excrete waste products is called digestive system.
- The organs involved in the breakdown of food—collectively called the digestive system.



The digestive system is divided into two groups of organs

The Gastrointestinal Tract (GIT)	The Accessory Digestive Organs
✓ Mouth	✓ Teeth
✓ Oropharynx	✓ Tongue
✓ Esophagus	✓ Salivary Glands
✓ Stomach	✓ Liver
✓ Small Intestine	✓ Gallbladder
✓ Large Intestine	✓ Pancreas
✓ Rectum	
✓ Anus	

PRACTICAL NO.: 12.1 **DATE**

The Gastrointestinal Tract (GIT)

- The gastrointestinal (GI) tract, or alimentary canal, is a continuous tube that extends from the mouth to the anus through the thoracic and abdominopelvic cavities. The length of the GI tract is about 5–7 meters.

The Accessory Digestive Organs

- The other accessory digestive organs are not come in direct contact with food.
- They produce or store secretions that flows into the GI tract through ducts; the secretions aid in the chemical breakdown of food.

SIX BASIC PROCESSES OF THE DIGESTIVE SYSTEM

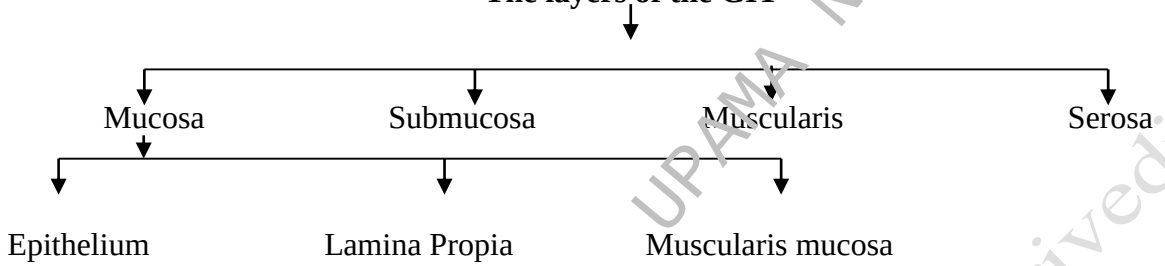
<table>
<tr><td>1</td><td>Ingestion</td><td colspan="2">✓ This is an eating process in which foods & liquids take into the mouth.</td></tr>
<tr><td>2</td><td>Secretion</td><td colspan="2">✓ In one day the secretary cells of the walls of the GI tract and accessory digestive organs secrete a total of about 7 liters of water, acid, buffers, and enzymes into the lumen of the tract.</td></tr>
<tr><td>3</td><td>Mixing & propulsion</td><td colspan="2">✓ Alternate contractions and relaxations of smooth muscle in the walls of the GI tract mix food & secretions & propel them toward the anus.
✓ This capability of the GI tract to mix and move material along its length is called motility or peristalsis movement.</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Digestion</td><td colspan="2">There are two processes of break down ingested food into small molecules</td></tr>
<tr><td>Mechanical digestion
▪ teeth cut and grind food &
▪ then smooth muscles of the stomach and small intestine churn the food
▪ food molecules become dissolved & thoroughly mixed with digestive enzymes</td><td>Chemical digestion
▪ The large carbohydrate, lipid, protein, and nucleic acid molecules in food are split into smaller molecules by hydrolysis
▪ Digestive enzymes catalyzed the catabolic reactions</td></tr>
<tr><td>5</td><td>Absorption</td><td colspan="2">✓ The transfer of ingested and secreted fluids, ions, and the products of digestion into the epithelial cells lining the lumen of the GI tract is called absorption.
✓ The absorbed substances pass into blood or lymph and circulate to cells throughout the body.</td></tr>
<tr><td>6</td><td>Defecation</td><td colspan="2">✓ Wastes, indigestible substances, bacteria, cells sloughed from the lining of the GI tract, and digested materials that were not absorbed in their journey through the digestive tract leave the body through the anus in a process called defecation.
✓ The eliminated material is termed feces.</td></tr>
</table>

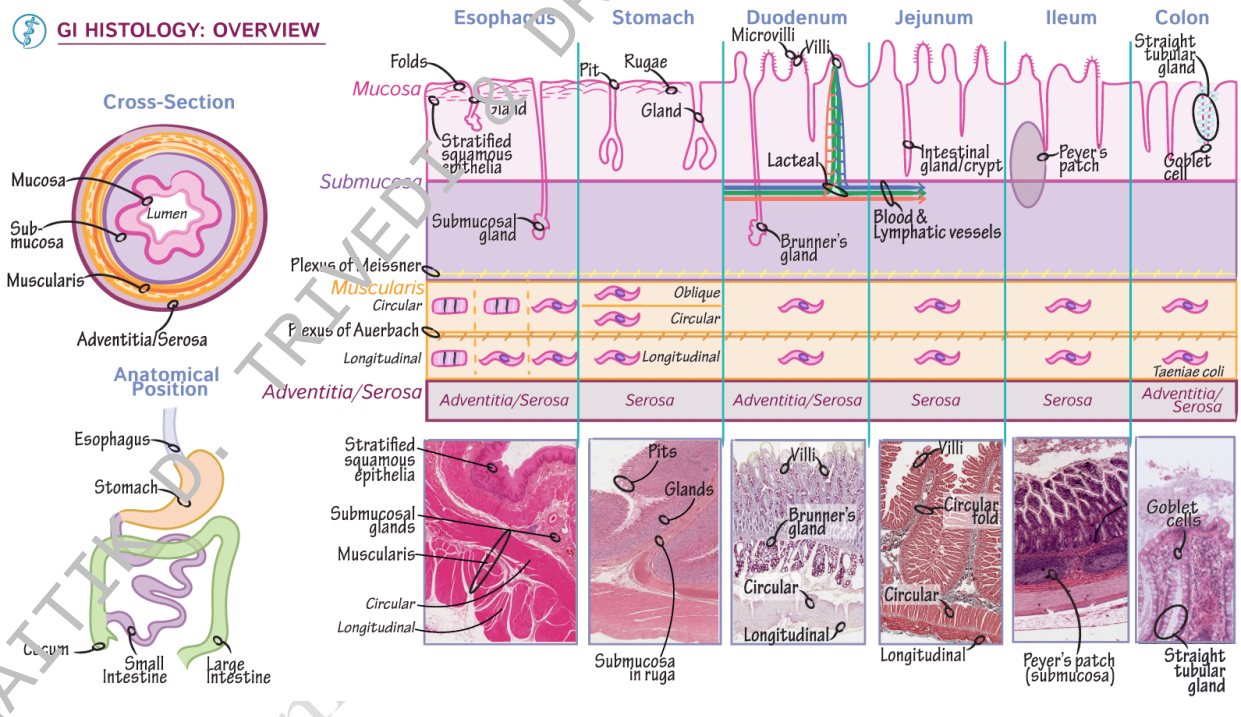
PRACTICAL NO.: 12.1 **DATE**

THE LAYERS OF THE GIT

- The wall of the GIT having same basic, four-layered arrangement of tissues.
- The four layers of the tract, from deep to superficial, are the

The layers of the GIT





1. MUCOSA

- The mucosa is the innermost layer of the GI tract. The mucosa surrounds the lumen, or open space within the digestive tube. This layer comes in direct contact with digested food (chyme). It is absorptive & secretary layer of GIT.
- The epithelium of the mucosa is particularly specialized, depending on the portion of the digestive system.
- It is made up of three layers:
  i. The epithelium
     - ✓ A layer of epithelium in direct contact with the contents of the GI tract
     - ✓ It is the innermost layer and it is responsible for most digestive, absorptive, and secretory processes.

ii. The lamina propria
- ✓ It is a layer of connective tissue that is unusually cellular compared to most connective tissue.

iii. The muscularis mucosae
- ✓ It is a thin layer of smooth muscle.

- In the esophagus, the epithelium is stratified, squamous, and non-keratinizing, for protective purposes.
- In the stomach. the epithelium is simple columnar, and is organized into gastric pits and glands to deal with secretion.
- In the small intestine, the epithelium (particularly the ileum) is specialized for absorption, with villi and microvilli increasing surface area.

2. SUBMUCOSA
- The submucosa consists of areolar connective tissue that binds the mucosa to the muscularis.
- The submucosa is relatively thick, highly vascular, and serves the mucosa.
- The absorbed elements that pass through the mucosa are picked up from the blood vessels of the submucosa.
- It also contains that receive absorbed food molecules.
- Also located in the submucosa is an extensive network of neurons known as the submucosal plexus.
- The submucosa may also contain glands, lymphatic vessels & lymphatic tissue.

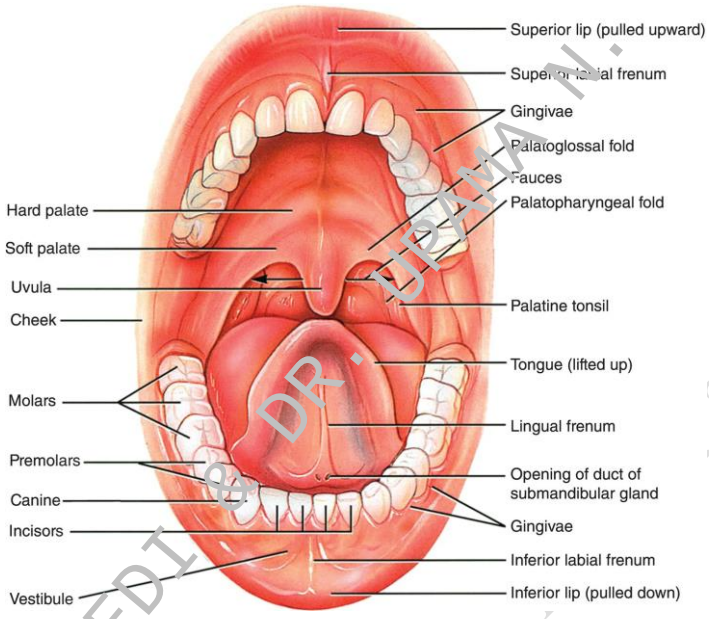
3. MUSCULARIS
- The third layer of the alimentary canal is the **muscalaris** also called the **muscularis externa**.
- The muscularis in the small intestine is made up of a double layer of smooth muscle:
  - inner circular layer
  - outer longitudinal layer.
- The contractions of these layers promote mechanical digestion, expose more of the food to digestive chemicals, and move the food along the GI tract.
- The stomach is prepared for its churning function by the addition of a third layer, the oblique muscle.

4. SEROSA
- Those portions of the GI tract that are suspended in the abdominopelvic cavity have a superficial layer called the serosa.
- Instead of serosa, the mouth, pharynx, and esophagus have a dense sheath of collagen fibers called the adventitia.
- These tissues serve to hold the alimentary canal in place near the ventral surface of the vertebral column.

PRACTICAL NO.: 12.1 **DATE**

PARTS OF DIGESTIVE SYSTEM

1. **Mouth**



- Food begins its journey through the digestive system in the mouth, also known as the oral cavity.
- Inside the mouth are many accessory organs that aid in the digestion of food the tongue, teeth, and salivary glands.
- The set of 32 **teeth** chop food into small pieces, which are moistened by saliva before the tongue and other muscles push the food into the pharynx.
- The **tongue** is a small organ made up of several pairs of muscles covered in a thin, bumpy, skin-like layer. The taste buds on the surface of the tongue detect taste molecules in food and connect to nerves in the tongue to send taste information to the brain. The tongue also helps to push food toward the posterior part of the mouth for swallowing.
- **Salivary Glands**. Surrounding the mouth are 3 sets of salivary glands. The salivary glands are accessory organs that produce a watery secretion known as saliva. Saliva helps to moisten food and begins the digestion of carbohydrates. The body also uses saliva to lubricate food as it passes through the mouth, pharynx, and esophagus.

2. Pharynx

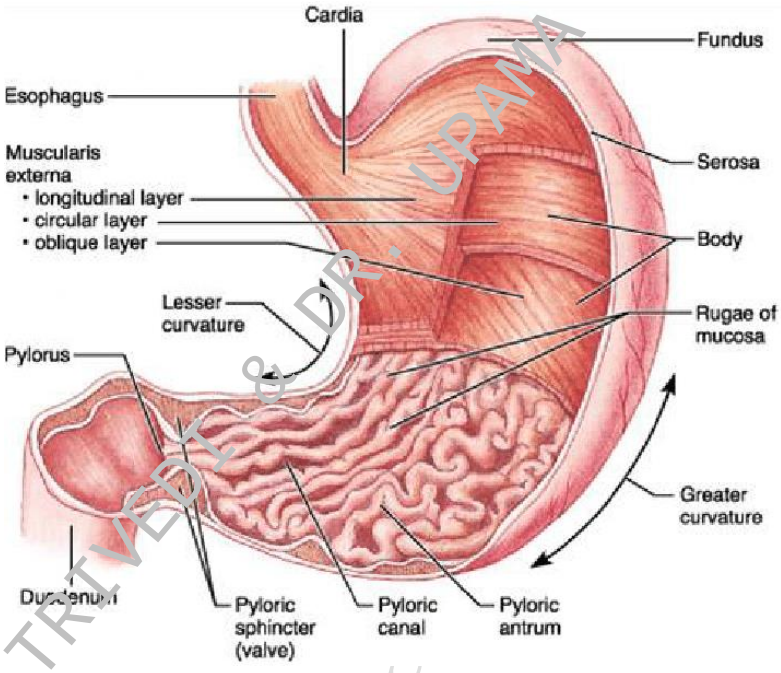
- The pharynx, or throat, is a funnel-shaped tube connected to the posterior end of the mouth. The pharynx is responsible for the passing of masses of chewed food from the mouth to the esophagus.
- The pharynx also plays an important role in the respiratory system, as air from the nasal cavity passes through the pharynx on its way to the larynx and eventually the lungs.
- Because the pharynx serves two different functions, it contains a flap of tissue known as the epiglottis that acts as a switch to route food to the esophagus and air to the larynx.

3. Esophagus

- Esophagus, the fibromuscular tube that food passes through aided by peristaltic contractions the pharynx to the stomach.
- It carries swallowed masses of chewed food along its length.

- At the inferior end of the esophagus is a muscular ring called the lower esophageal sphincter or cardiac sphincter.
- The function of this sphincter is to close of the end of the esophagus and trap food in the stomach.

4. Stomach



- The stomach is a muscular sac that is located on the left side of the abdominal cavity, just inferior to the diaphragm.
- In an average person, the stomach is about the size of their two fists placed next to each other. This major organ acts as a storage tank for food so that the body has time to digest large meals properly.
- The stomach also contains hydrochloric acid and digestive enzymes that continue the digestion of food that began in the mouth.

5. Small Intestine

- The small intestine is a long, thin tube about 1 inch in diameter and about 10 feet long.
- It is located just inferior to the stomach and takes up most of the space in the abdominal cavity.
- The entire small intestine is coiled like a hose and the inside surface is full of many ridges and folds. These folds are used to maximize the digestion of food and absorption of nutrients. By the time food leaves the small intestine, around 90% of all nutrients have been extracted from the food that entered it.
- Parts of small intestine
  - ✓ Duodenum: Here the digestive juices from the pancreas and the gallbladder (bile) mix together. The digestive enzymes break down proteins and bile and emulsify fats into micelles. The duodenum contains Brunner's glands that produce bicarbonate, and pancreatic juice that contains bicarbonate to neutralize hydrochloric acid in the stomach.

- ✓ Jejunum: This is the midsection of the intestine, connecting the duodenum to the ileum. It contains the plicae circulares and villi to increase the surface area of that part of the GI tract.
- ✓ Ileum: This has villi, where all soluble molecules are absorbed into the

6. Liver & Gallbladder

- ❖ The liver is a roughly triangular accessory organ of the digestive system located to the right of the stomach, just inferior to the diaphragm and superior to the small intestine.
- ❖ The liver weighs about 3 pounds and is the second largest organ in the body.
- ❖ The liver has many different functions in the body, but the main function of the liver in digestion is the production of bile and its secretion into the small intestine.
- ❖ The gallbladder is a small, pear-shaped organ located just posterior to the liver. The gallbladder is used to store and recycle excess bile from the small intestine so that it can be reused for the digestion of subsequent meals.

7. Pancreas

- ❖ The pancreas is a large gland located just inferior and posterior to the stomach. It is about 6 inches long and shaped like short, lumpy snake with its "head" connected to the duodenum and its "tail" pointing to the left wall of the abdominal cavity.
- ❖ The pancreas secretes digestive enzymes into the small intestine to complete the chemical digestion of foods.

9. Large Intestine

- ❖ The large intestine is a long, thick tube about 2 ½ inches in diameter and about 5 feet long. It is located just inferior to the stomach and wraps around the superior and lateral border of the small intestine.
- ❖ The large intestine absorbs water and contains many symbiotic bacteria that aid in the breaking down of wastes to extract some small amounts of nutrients. Feces in the large intestine exit the body through the anal canal.
- ❖ The large intestine has four parts:
  - ✓ Cecum, the vermiform appendix that is attached to the cecum.
  - ✓ Colon, which includes the ascending colon, transverse colon, descending colon, and sigmoid flexure. The main function of the colon is to absorb water, but it also contains bacteria that produce beneficial vitamins like vitamin K.
  - ✓ Rectum
  - ✓ Anus

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PRACTICAL NO.: 12.2 **DATE**

AIM: STUDY OF RESPIRATORY SYSTEM WITH THE HELP OF CHART AND MODELS.

REQUIREMENT: Models, charts and specimens of respiratory system

THEORY

Respiration:

Respiration means exchange of gases—oxygen and carbon dioxide—between the atmospheric air, blood, and tissue cells. Inhalation and exaltation, inspiration and expiration, breathing in and breathing out known as respiration.

The respiratory system consists of the nose, pharynx (throat), larynx (voice box), trachea, windpipe), bronchi, and lungs.

Its parts can be classified according to either structure or function.

Structurally, the respiratory system consists of two parts:

1. **The upper respiratory system:** It includes the nose, pharynx, and associated structures.
2. **The lower respiratory system:** It includes the larynx, trachea, bronchi, and lungs.

Functionally, the respiratory system also consists of two parts:

1. **The conducting zone**:
   - It consists of a series of interconnecting cavities and tubes both outside and within the lungs.
   - These contain the nose, pharynx, larynx, trachea, bronchi, bronchioles, and terminal bronchioles.
   - Their function is to filter, warm, and moisten air and conduct it into the lungs.
2. **The respiratory zone**
   - It consists of tissues within the lungs where gas exchange occurs.
   - These include the respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli. They are the main sites of gas exchange between air and blood.

Types of respiration:

There are 3 types of respiration:

1. **Pulmonary Ventilation:** Exchange of Oxygen and Carbon Dioxide between air and lungs known as pulmonary ventilation.
2. **External respiration:** Exchange of Oxygen and Carbon Dioxide between lungs and blood known as external respiration.
3. **Internal Respiration:** Exchange of Oxygen and Carbon Dioxide between blood and cell known as internal respiration.

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1. NOSE:

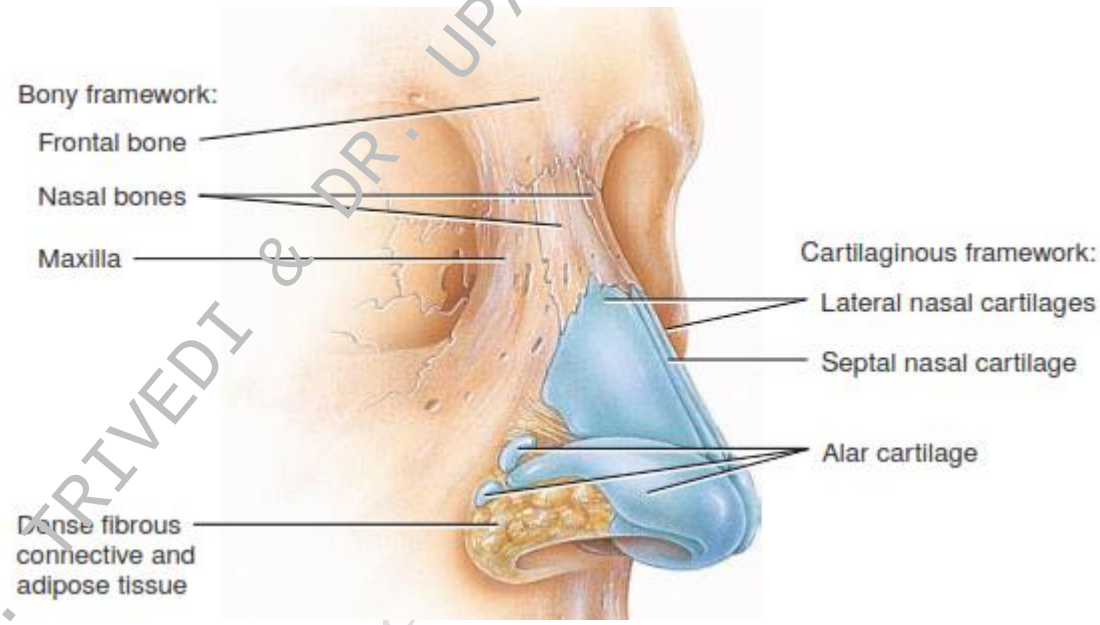
Nose is made up by two kind of frame work:

i. Bony frame work:

It is made up by Frontal bone, Nasal Bone and Maxilla

ii. Cartilage Frame Work:

It is made up by Lateral Nasal Cartilage, Septal Nasal Cartilage and Alar Cartilage



The nose can be divided into external and internal portions.

The external nose:

- it is the portion of the nose visible on the face and consists of a supporting framework of bone and hyaline cartilage covered with muscle and skin and lined by a mucous membrane.
- The external nose is somewhat flexible because it consist hyaline cartilage.
- External nose consist two opening which is known as external nares or nostrils divided by vertical septum.
- External nose also consist of hair inside the nostril.
- The external nose have three functions:
  - i. Warming, moistening, and filtering incoming air;
  - ii. Detecting olfactory stimuli or identify the smell
  - iii. Modifying speech

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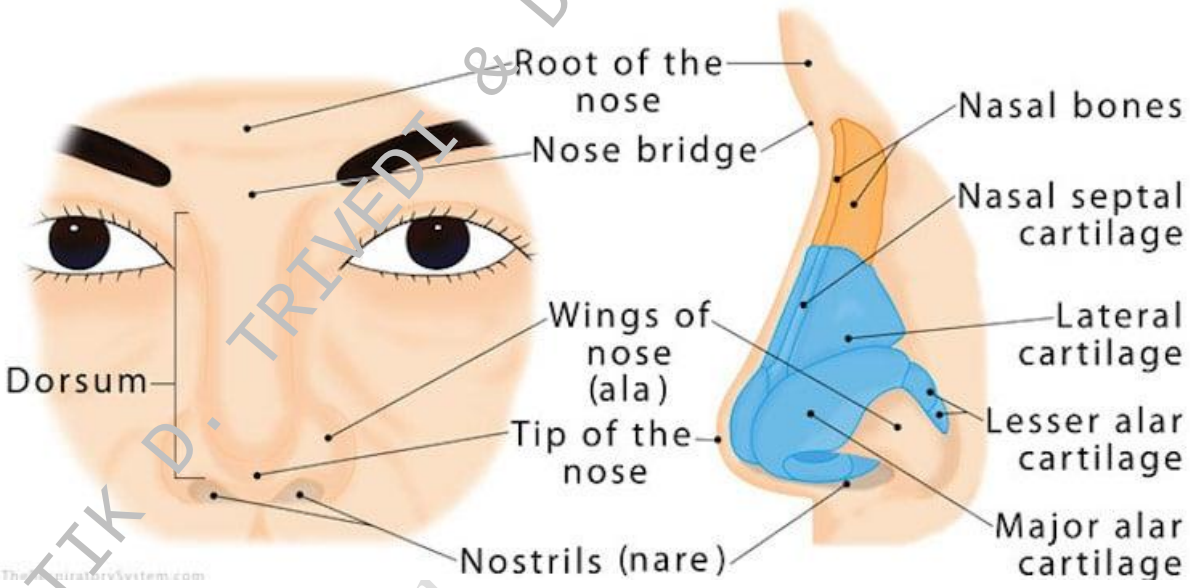
The internal nose:

- Anteriorly, the internal nose merges with the external nose, and posteriorly it communicates with the pharynx through two openings called the internal nares or choanae.
- The space within the internal nose is called the nasal cavity.
- The anterior portion of the nasal cavity just inside the nostrils, called the nasal vestibule, is surrounded by cartilage.
- The superior part of the nasal cavity is surrounded by bone.
- A vertical partition, the nasal septum, divides the nasal cavity into right and left sides.



- Superior attachment of the nose to the frontal bone is known as Root.
- Tip of nose known as Apex.

2. PHARYNX (THROAT)

- It is a funnel-shaped tube about 13 cm (5 in.) long
- It starts from the internal nares and extends to the level of the cricoid cartilage, the most inferior cartilage of the larynx (voice box)
- Its wall is composed of skeletal muscles and is lined with a mucous membrane.
- Contraction of the skeletal muscles assists in deglutition (swallowing).
- The pharynx functions as a passageway for air and food.
- It provides a resonating chamber for speech sounds, and houses the tonsils, which participate in immunological reactions against foreign invaders.

- The pharynx can be divided into three anatomical regions:

i. Nasopharynx:

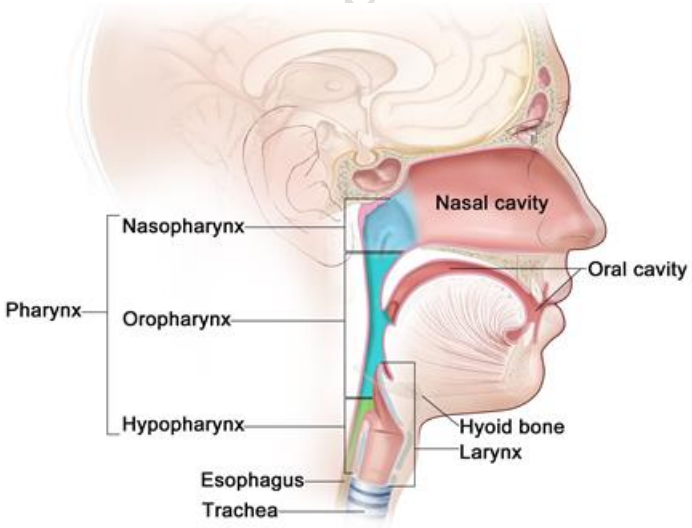
- It is the superior portion of the pharynx.
- It lies posterior to the nasal cavity and extends to the soft palate.
- There are five openings in its wall: two internal nares, two openings that lead into the auditory tubes (commonly known as the Eustachian tubes), and the opening into the oropharynx.

ii. Oropharynx:

- It extend behind mouth from soft palate to level of hyoid bone.
- This portion of the pharynx has both respiratory and digestive functions, serving as a common passageway for air, food, and drink. Because the oropharynx is subject to abrasion by food particles, it is lined with nonkeratinized stratified squamous epithelium.
- Oropharynx consist, the palatine and lingual tonsils.

iii. **Laryngopharynx:**

Its end portion open in to the esophagus (food tube) and the larynx (voice box).



3. LARYNX (VOICE BOX)

- The larynx is known as voice box.
- It connects the laryngopharynx with the trachea.
- The wall of the larynx is composed of nine pieces of cartilage:
  - Three occur singly (thyroid cartilage, epiglottis, and cricoid cartilage), and
  - Three occur in pairs (arytenoid, cuneiform, and corniculate cartilages).

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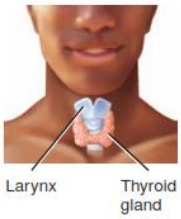
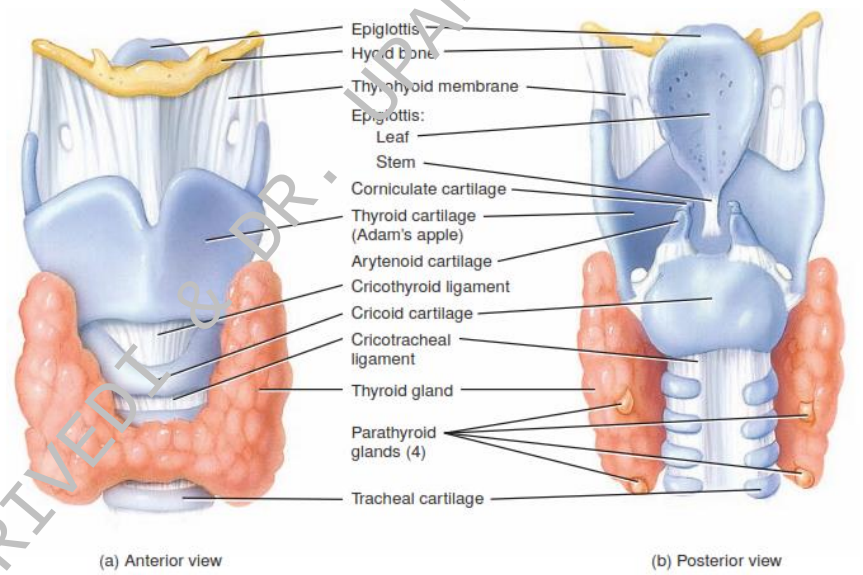
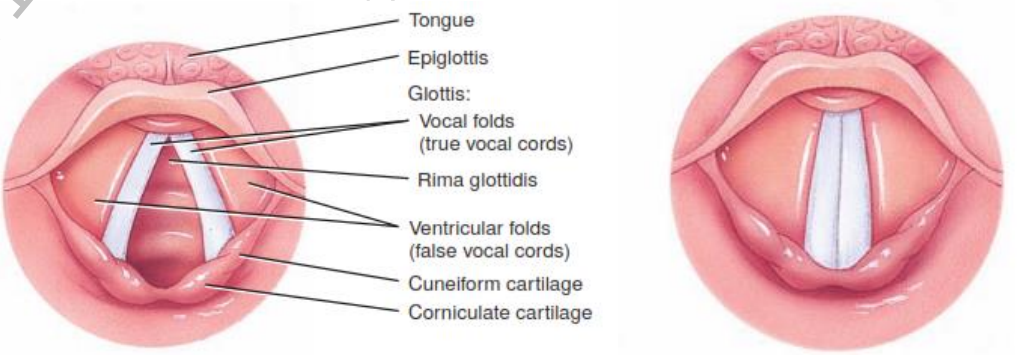
- The arytenoid cartilages are the most important because they influence changes in position and tension of the vocal folds (true vocal cords for speech).
- During swallowing, the pharynx and larynx rise. Elevation of the pharynx widens it to receive food or drink and elevation of the larynx move down the the epiglottis so food not enter into the wind pipes.

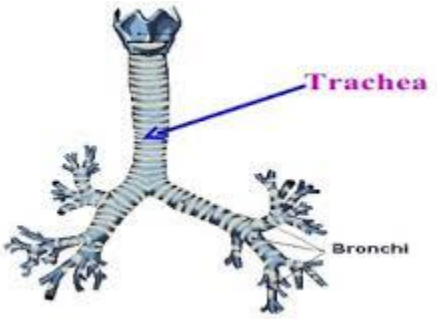




- The mucous membrane of the larynx forms two pairs of folds a superior pair called the ventricular folds (false vocal cords) and an inferior pair called the vocal folds (true vocal cords).



4. TRACHEA



- Trachea is also known as windpipe.
- It is a tubular passageway for air.
- It is about 12 cm (5 in.) long and 2.5 cm (1 in.) in diameter.
- It is extends from the larynx bronchi.
- Trachea consist 16–20 incomplete, horizontal rings of hyaline cartilage resemble the letter C.
- The open part of each C-shaped cartilage ring faces posteriorly toward the esophagus.

5. BRONCHI

- The trachea divides into a right and left primary bronchi.
- Right primary bronchi goes into the right lung, and a left primary windpipe bronchi, which goes into the left lung.
- The right primary bronchi is more vertical, shorter, and wider than the left.
- As a result, an aspirated object is more likely to enter and lodge in the right primary bronchus than the left.
- The primary bronchi contain incomplete rings of cartilage like trachea.
- The primary bronchi in to the lungs divide to form smaller bronchi known as the secondary (lobar) bronchi, one for each lobe of the lung. (The right lung has three lobes; the left lung has two.)
- The secondary bronchi branches known as tertiary (segmental) bronchi it further divide in to bronchioles.
- Bronchioles further divide in to smaller branches known as terminal bronchioles.
- This branch like structure resembles an inverted tree and is commonly referred to as the bronchial tree.

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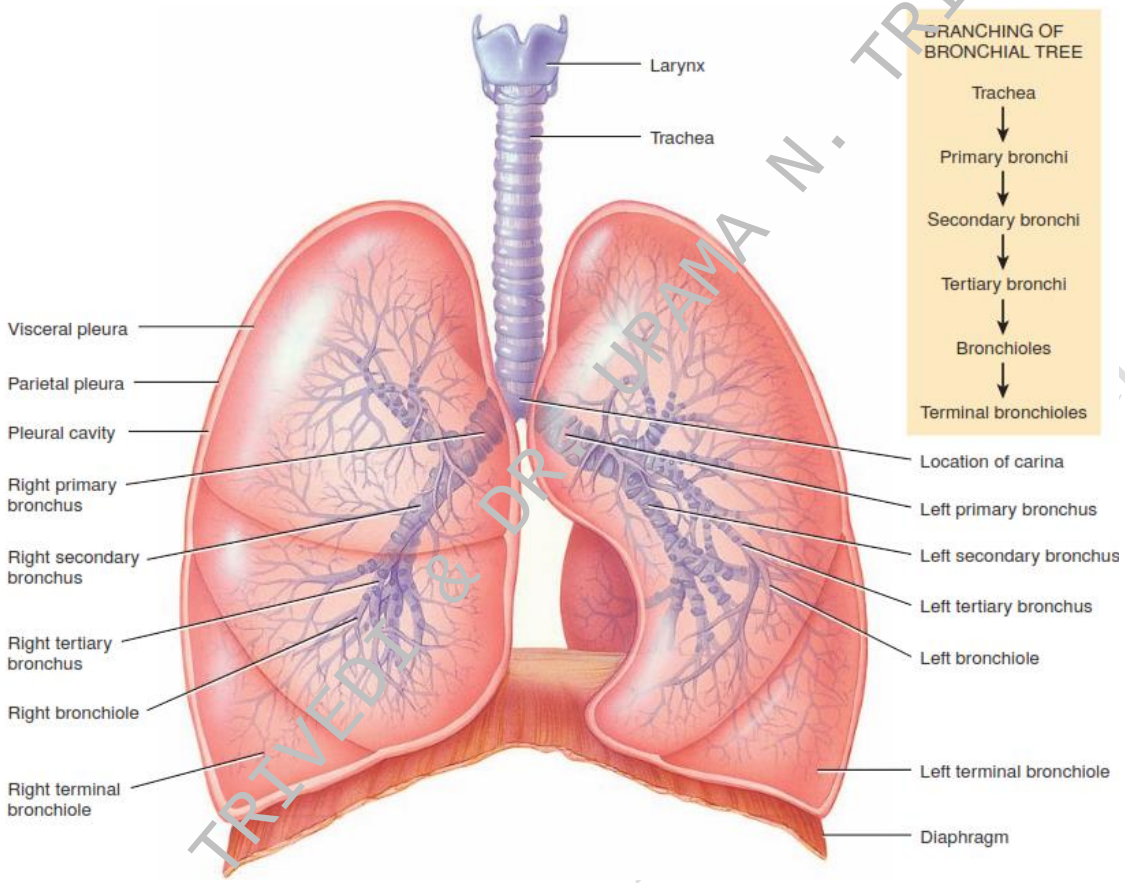
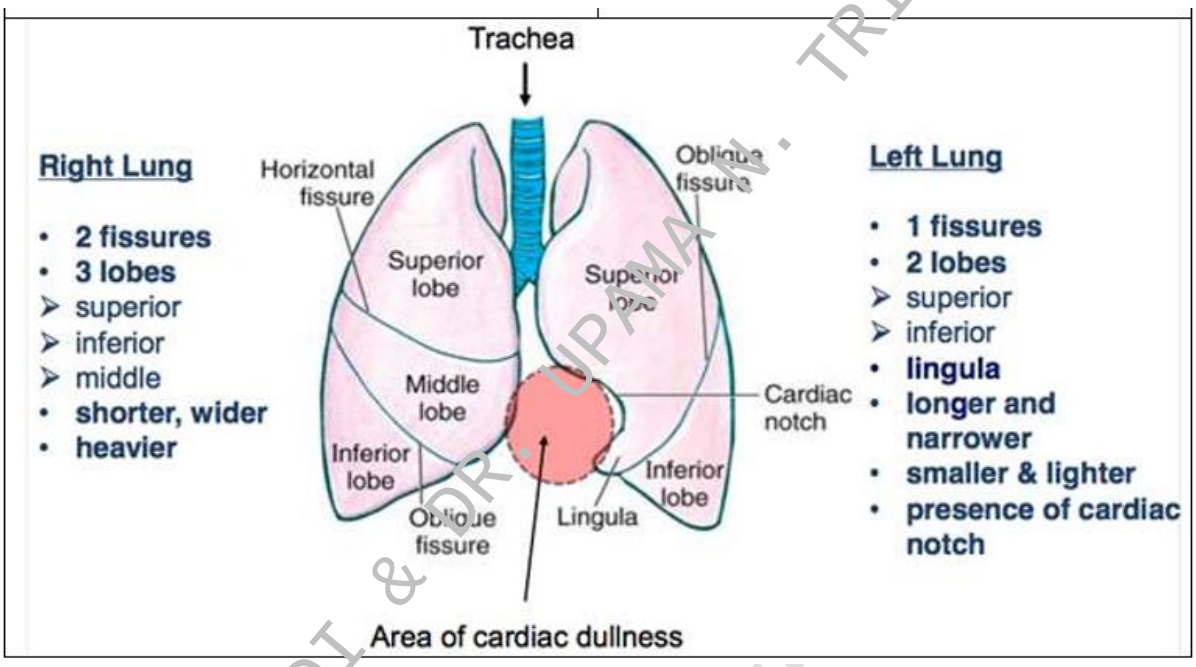


6. LUNGS

- There are two lungs in human body.
- It is cone-shaped organs reside in the thoracic cavity.
- Lungs are separated from each other by the heart and other structures in the mediastinum.
- Each lung is enclosed and protected by a double-layered serous membrane known as the pleural membrane.
- The superficial layer is parietal pleura and the deep layer is the visceral pleura.
- Between the visceral and parietal pleurae there is a small space which is known as the pleural cavity, which contains a small amount of lubricating fluid secreted by the membranes.
- This pleural fluid reduces friction between the membrane of lungs and allowing them to slide easily over one another during breathing.
- The broad inferior portion of the lung is known as the base and narrow superior portion of the lung is the apex.



- Right lung is shorter and wider than the left lungs because right side lobes of liver occupy more space than the left lobes.
- Left lung is long and narrow and it has lingula portion because left side of lung consist cardiac notch.
- Right lung capsular layer is thicker than the left lung.
- Right side of lung consist horizontal and oblique fissure so it divide in to three lobes, 1. Superior lobe 2. Middle lobe 3. Inferior lobe
- Left side of lung consist only oblique fissure so it divide in to two lobes, 1. Superior lobe and 2. Inferior lobe

7. BRONCHIOLES

- It is a smallest branches of respiratory tree having <1mm diameter.
- It do not consist cartilage rings but larger branches may have small patches of cartilage
- Asthma like disease condition affects the smallest terminal bronchioles

8. ALVEOLI

- Smallest bronchioles have clusters of tiny sacs branching off known as alveoli which produce “grapelike clusters.”
- Each lung consist 300-500 million alveoli.
- It is made up by Single cell layer of thick squamous epithelium.
- Alveoli are the “functional units” of the respiratory system
- It is the actual site of gas exchange with blood.

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- Alveoli increase in number and size until adolescence after adolescence, can increase in size only and if damaged, it has limited ability to repair themselves

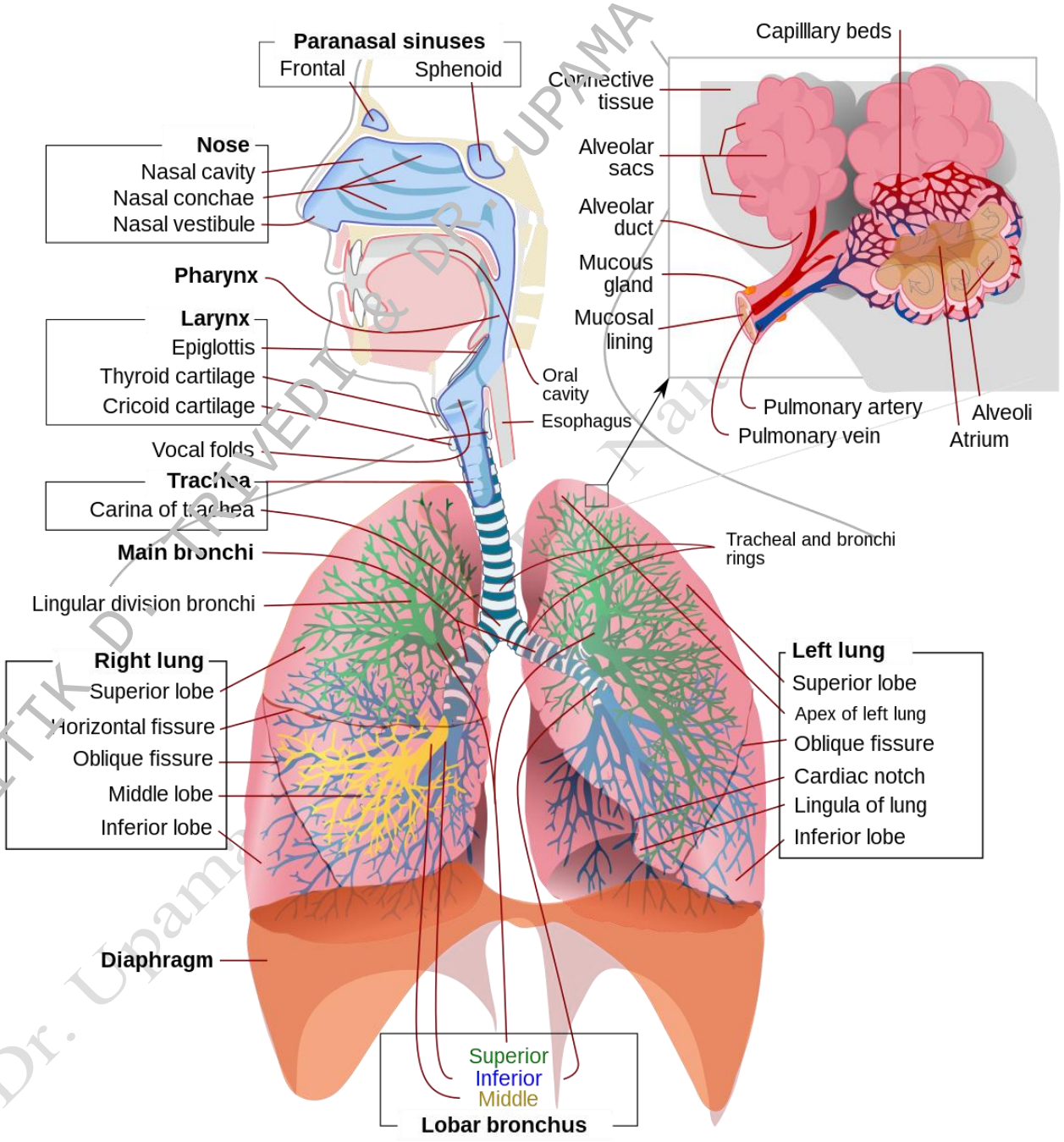


DIAGRAM OF RESPIRATORY SYTEM

Signature of Teacher

PRACTICAL NO.: 12.3 **DATE**

AIM: STUDY OF CARDIOVASCULAR SYSTEM WITH THE HELP OF CHART AND MODELS.

REQUIREMENTS: Models, charts and specimens of cardiovascular system

THEORY:

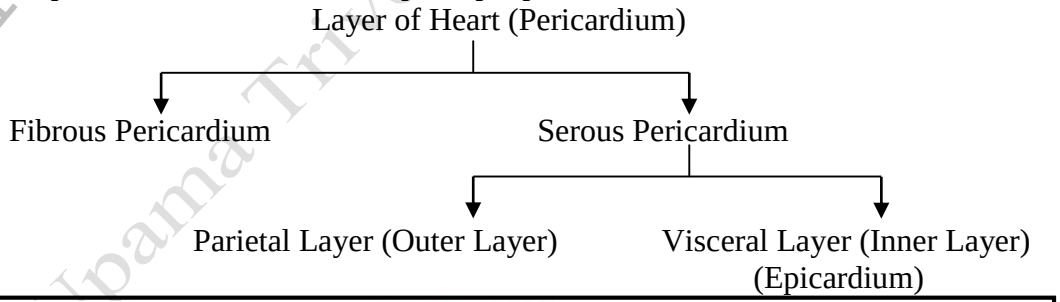
Cardiovascular is the system which includes the study of the heart, blood vessels and blood. These system is some time known as circularly system because it circulate or transport the nutrients, oxygen, carbon dioxide and essential molecules from environment to cells and cells to environment. It is involuntary in nature and gives continuous work. The heart propelling or impelling blood around 100,000 km of blood vessels and it pumps 14000 liters blood in day and 10 million liters in year.

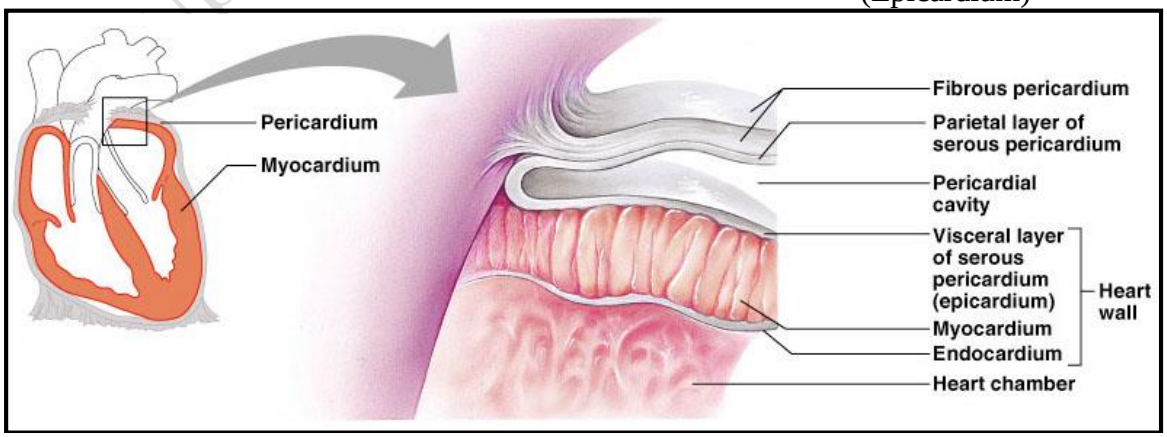
LOCATION OF HEART:

- Cone shaped heart is relatively small, about the same size of closed fist of person.
- It is 12 cm (5 in.) long, 9 cm (3.5 in.) wide and 6 cm (2.5 in.) thick.
- In an adult, average weight of heart is 300gm.
- The heart consist four chambers:
  - **a)** Two atria or atrium
  - **b)** Two ventricles
- It is located near to the middle of thoracic cavity in the mediastinum (the space between the lungs) and it rest on to the diaphragm.
- About two third of the mass of the heart lies to the left of the body's midline.
- Pointed end portion which is formed by the tip of left ventricle is known as apex and opposite to apex the wide superior and posterior margin is known as base.

LAYER OF THE HEART:

- Heart layer is formed by pericardium ("around the heart") which is triple-layered fluid-filled sac that surrounds and protects the heart.
- The pericardium consist of two principle portion





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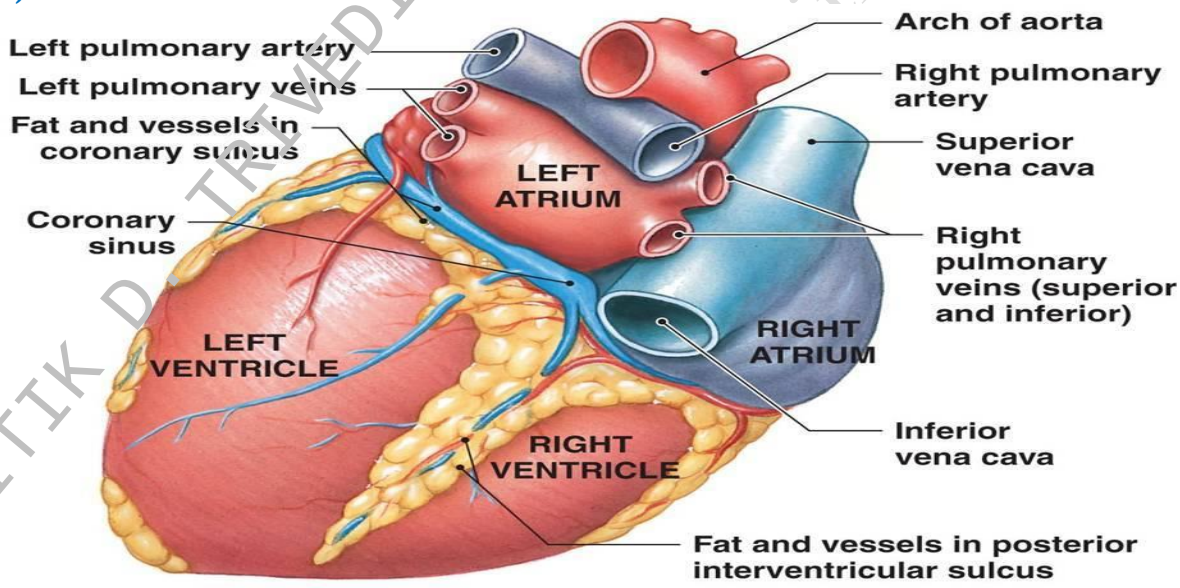
WALL OF THE HEART:

- The wall of the heart is formed by three layers:
  - **a) Epicardium (External layer):**
    - It is also known as the visceral layer of the serous pericardium.
    - It is composed of mesothelium and delicated connective tissue.
    - It is the outer or external wall of the heart.
  - **b) Myocardium (Middle layer):**
    - Myo means muscles so it is made up by cardiac muscles tissue.
    - It provides the bulkiness to the heart and it is responsible for the pumping action of heart.
  - **c) Endocardium (Inner layer):**
    - The endocardium is an innermost, thin, smooth layer of epithelial tissue that lines the inner surface of the heart chambers and valves.

INTERIOR OF THE HEART:

- The heart is divided in to right and left side by partition known as the septum which is made up by myocardium covered by epithelium

a) Chamber of heart:



- Heart consists of four chambers;

i) Two atria:

- The two superior chambers are known as right atrium and left atrium.
- The posterior wall of the atrium is smooth surface while the anterior wall of the atrium is rough surface.
- On the surface of the atrium is wrinkle pouch like structure is known as auricle because it resemble like dog ear.

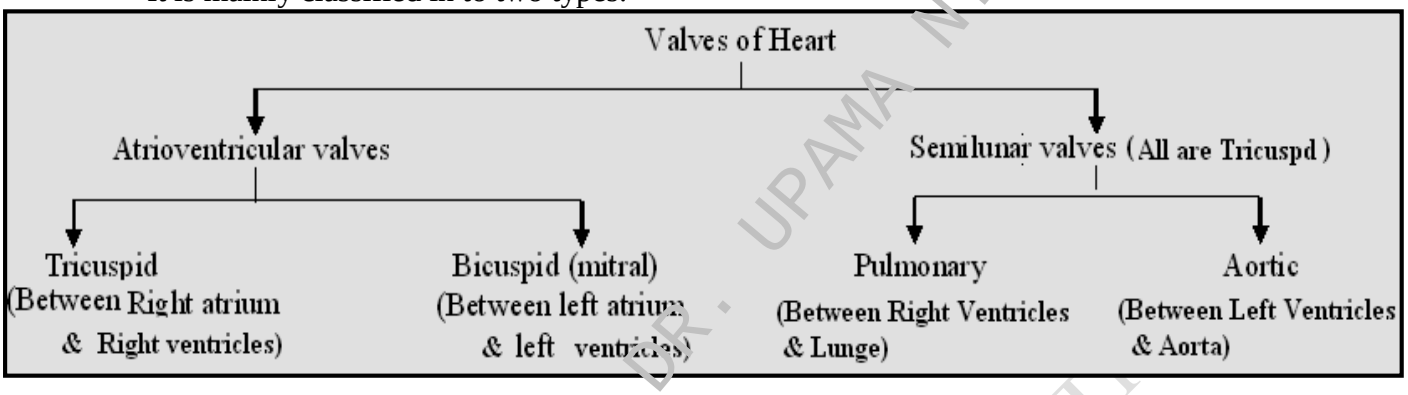
ii) Two ventricles

- The two inferior are known as right ventricle and left ventricles.

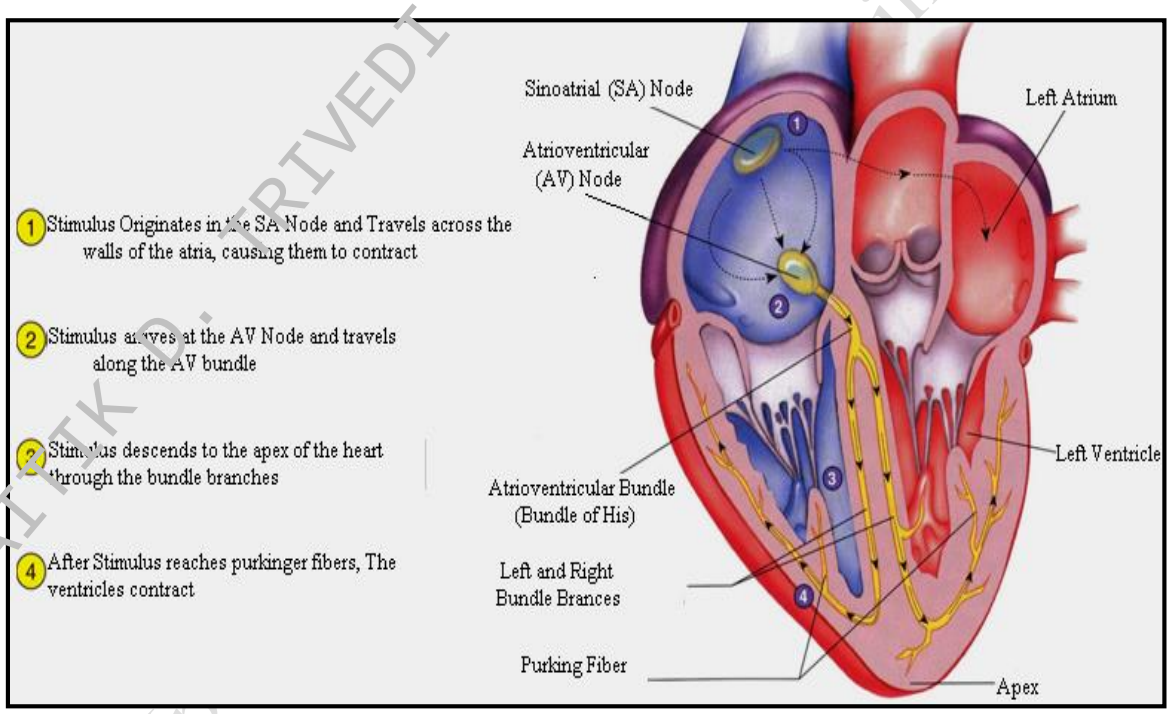
- On the surface of heart grooves like structures known as coronary sulcus which separate the atria to ventricle.
- The thickness of the wall of the four chambers varies according to their function.
- **Example:** The wall of the atria is thin and it pumps blood in to ventricles & the ventricle wall is thick in which right ventricle pumps blood in to lungs and left ventricle pumps blood in to aorta so the work load on left ventricle is high because of that the wall of left ventricle is two to four times thicker than right ventricle.

b) Valve of the heart:

It is mainly classified in to two types:



HEART CONDUCTION SYSTEM:



SA-node➔ AV-node➔ AV bundle➔ Right & Left Bundle braches➔ Purkinje fibers

PRACTICAL NO.: 12.3 **DATE**

CARDIAC CYCLES:

"A cardiac cycle include all the events associated within one heart beat"

- The normal heart beats in healthy adult is 75 beats/min and cardiac cycle last for 0.8 sec.
- In the cardiac cycle due to the pressure changes atria and ventricles alternately contract and relax, and blood flows from areas of higher blood pressure to areas of lower blood pressure.
- The term systole is used for the contraction and diastole used for the relaxation.
- In a normal cardiac cycle, the two atria contract while the two ventricles relax. Then, while the two ventricle contract, the two atria relax.
- Cardiac cycle is described by the following phase:

1) Atrial systole

- In this phase Atrial contraction is begins which is last about 0.1 sec at same time ventricle are relaxed.
- So, the Right and Left AV valves are open and Atria send blood into the relaxed ventricles.
- Atrial systole pushes 25 ml of blood in to ventricles which already contain 105 ml blood so at the end of atrial systole means end of ventricle diastole Ventricles contain maximum blood volume which is 130 ml known as end-diastolic volume (EDV).
- In the ECG or EKG it is noted as P wave.

2. Ventricular systole:

- In this phase ventricles begin contraction which is last for 0.3 sec.
- Pressure in ventricles rises due to contraction and shut the AV valves which is heard by "Lubb" Sound.
- For about 0.05 sec all four valve are closed which is known as isovolumetric contraction.
- Ventricular contraction pushes blood out of the ventricles and opens the both Semilunar valve and ejected 70 ml blood in to aorta and same amount of blood in to pulmonary trunk by respectively left and right ventricles so the 60 ml of blood remains in the each ventricle out of 130 ml.
- This is known as ventricular ejection which last for 0.25 sec

Ventricular systole = isovolumetric contraction + ventricular ejection

= (0.05) + (0.25)

= 0.3 sec.

- The blood volume in the Ventricles at the end of ventricle systole is 60 ml known as end-systolic volume (ESV).
- The blood ejection per beat from each ventricle is known as stroke volume.

Stroke volume = EDV – ESV

= 130 ml – 60 ml

= 70 ml

- It is noted as QRS wave in ECG or EKG.

3. Ventricular Diastole or Relaxation period:

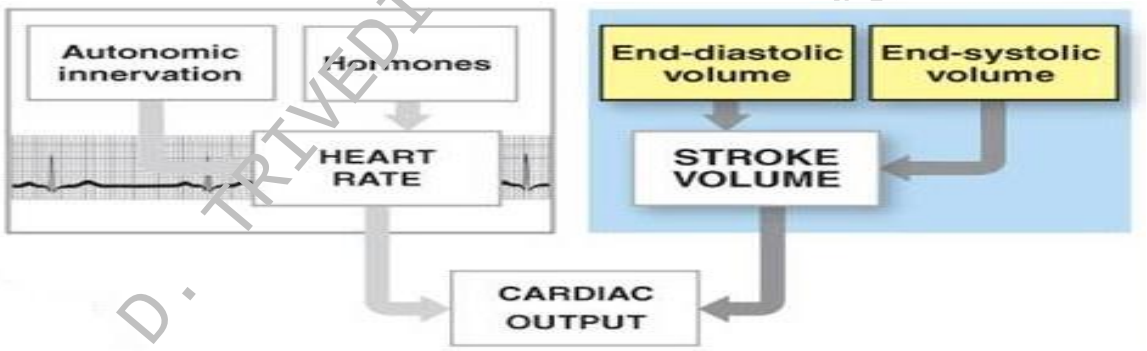
- In this phase both ventricles and atria are in relaxation.
- Relaxation which is last for 0.4 sec.
- Pressure in the ventricles drops so blood in the Pulmonary Trunk and aorta backflows closing the Semilunar Valves.
- This is heard by "Dubb" sound.

- In this period, ventricular pressure is higher than atrial pressure hence all heart valves are closed again and this period is known as isovolumetric.
- It is noted as T wave in ECG or EKG.
- Again the AV valves open and fill up the ventricle and complete the one Cardiac cycle.

Time	*Atria*	*Ventricles*	*Atrioventricular Valves (tricuspid, bicuspid)*	*Semilunar Valves (pulmonary, aortic)*
0.15 sec	Systole	Diastole	open	closed
0.30 sec	Diastole	Systole	closed	open
0.40 sec	Diastole	Diastole	open	closed

CARDIAC OUTPUT:

- Cardiac output is the amount of blood ejected from the left ventricle (or the right ventricle) in to the aorta (or pulmonary trunk) each minute and it is equal to the product of stroke volume and heart rate.



Thus,

Cardiac Output = Stroke volume (ml/beat) * Heart rate (beats/min)
= 70 ml/beat * 75 beats/min
= 5250 ml/min or 5.25 liters/min.

Note: Stroke volume = EDV – ESV = 130 ml/beat – 60 ml/beat = 70 ml/beat

- Means the cardiac out put volume is close to the total blood volume, which is about 5 liters in the typical adult male. The entire blood volume thus flows through the pulmonary and systemic circulations about once a minute.
- When the demand of oxygen is increase or decrease, cardiac output changes to meet the need by increasing or decreasing the stroke volume and heart rate.
- For example during the mild exercise demand of oxygen is increase so the stroke volume may increase to 100 ml/beat and heart rate to 100 beats/min. cardiac output then would be 10 liters/min.

Signature of Teacher

PRACTICAL NO.: 12.4 **DATE**

AIM: STUDY OF URINARY SYSTEM WITH THE HELP OF CHART AND MODELS.

REQUIREMENTS: Models, charts and specimens of urinary system

THEORY:

Urinary system is also known as the excretory system.

The organs of the urinary system include the kidneys, renal pelvis, ureters, bladder and urethra.

The purpose of the urinary system is to filtration of blood and eliminate waste from the body, regulate blood volume and blood pressure, control levels of electrolytes and metabolites, and regulate blood pH.

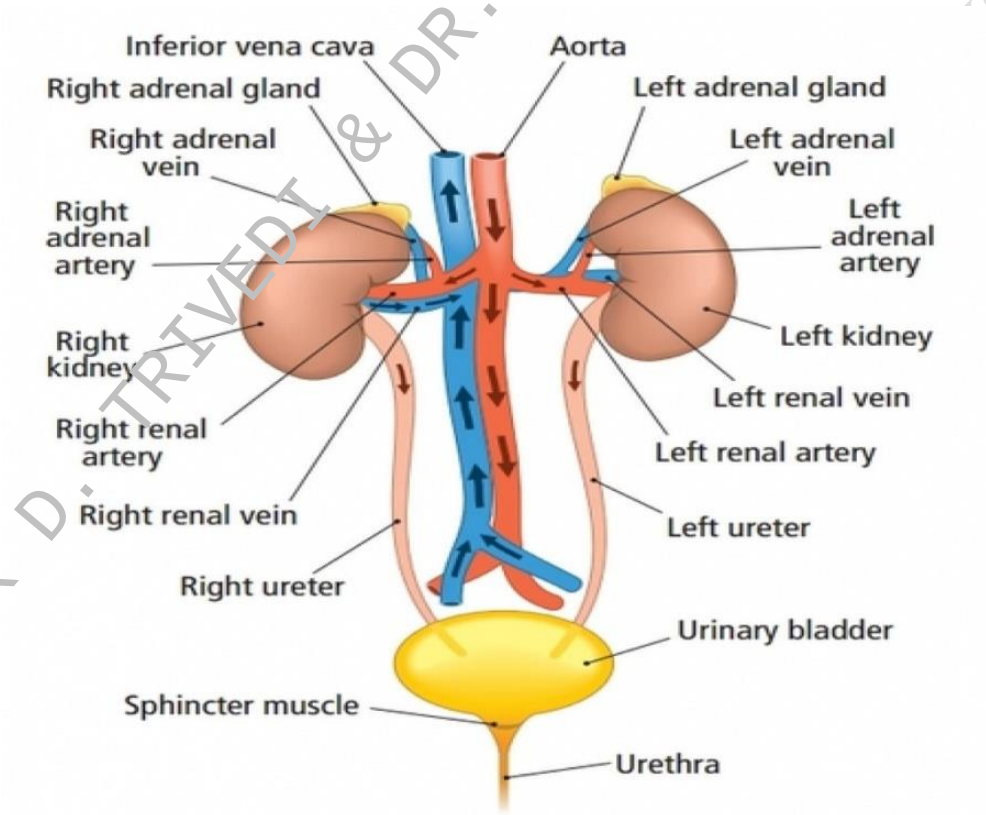


Diagram of Urinary System

FUNCTIONS OF URINARY SYSTEM:

1. **Removal of waste product:**
2. **Reabsorption of electrolytes and nutrients:**
3. **Maintaining pH**
4. **Maintain blood pressure and volume:**
5. **Control the erythropoiesis (Formation of RBCs):**
6. **Maintain the calcium level:**
7. **Provide the glucose during the fasting stage:**

PRACTICAL NO.: 12.4 **DATE**

LAYERS OF KIDNEYS:

Kidney is surrounded by three layers.

1. **Renal Capsule:** It is the inner and deep layer of the kidney. It is transparent, fibrous membrane. It continue with the outer layer of the ureters. This layer maintain the shape of the kidney.
2. **Adipose capsule:** It is the middle layer of the kidney. It is made up by the fatty mass, it protect kidney from the trauma and it holds the kidney in its position.
3. **Renal fascia:** It is the outer layer of the kidney. It is made up by the dense irregular connective tissue.

ANATOMY OF KIDNEY: (EXTERNAL ANATOMY)

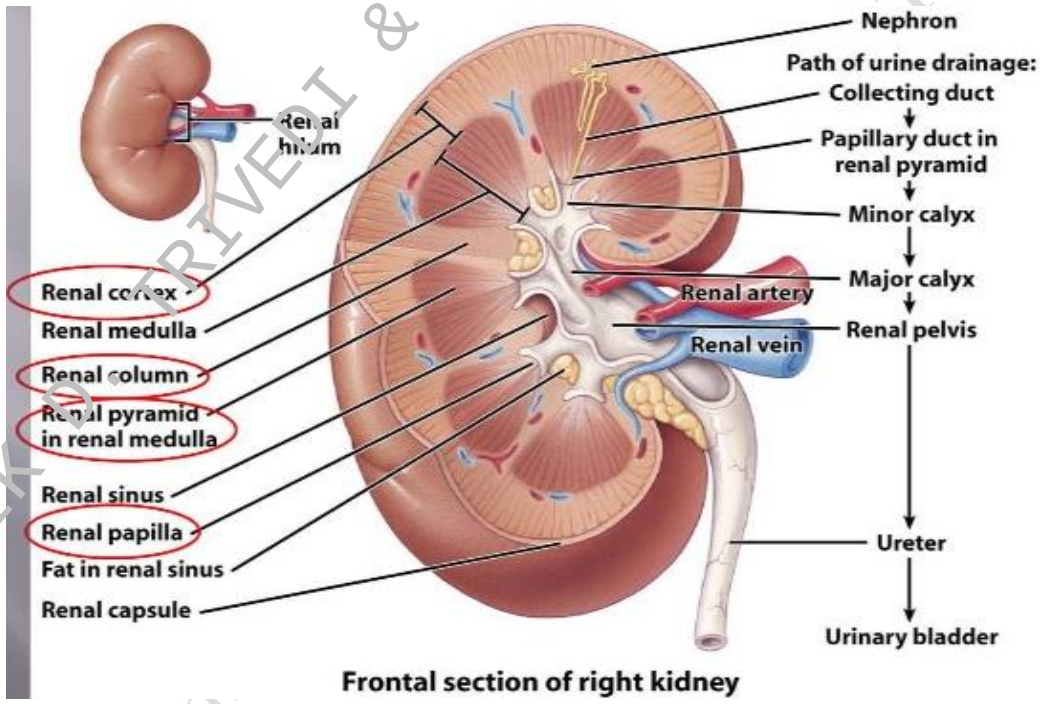
- The paired kidneys are reddish (purplish-brown organs) in color and it is bean shaped.
- They are located just above the waist between the peritoneum and posterior wall of the abdominal cavity so it is also known as retroperitoneal organs.
- It is located at the level of last thoracic and third vertebrae as well as it is partially protected by the eleventh and twelfth pair of ribs.
- Right kidney is slightly lower than the left kidney because right lobes of the kidney occupied more space than the left lobes.
- Adult kidney is 9-12 cm long, 6-9 cm wide and 3 cm thick.
- Each kidney weighs about 125–175 g in males and 115–155 g in females.
- The medial surface of the kidney is concave with a deep vertical fissure known as hilum through which ureters leaves kidney as well as blood, lymphatic vessels and nerves exit and entre the kidney through the renal hilus.

HISTOLOGY OF KIDNEY: (INTERNAL ANATOMY)

- Frontal section of the kidney shows two main region: a) renal cortex b) renal medulla
- Renal cortex is a superficial region and it is reddish in color.
- Renal medulla is a deep region and it is reddish brown in color.
- Renal medulla consist 8-18 cone shaped structure which is known as renal pyramid. Base of the renal pyramid faces towards the renal cortex side and apex of the renal pyramid towards centre of kidney side known as renal papilla.
- Between two pyramids there is a gap like portion is known as renal column.
- Renal pyramids and the portion of renal cortex combine together known as renal parenchyma where the functional units of kidney reside that is nephron.
- Each kidney's renal parenchyma consist about 1 million number of nephrons.

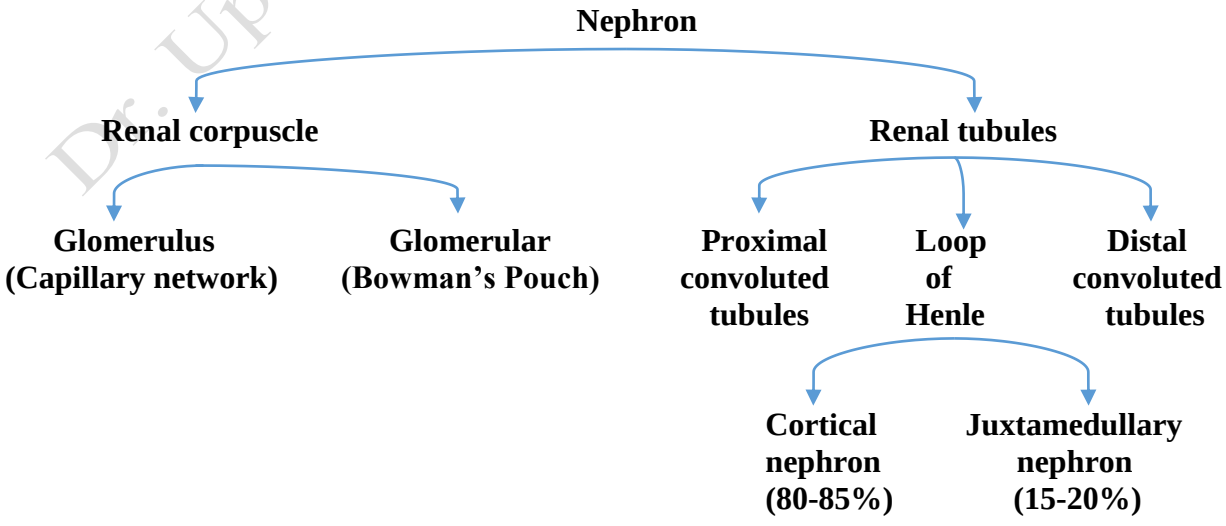
PRACTICAL NO.: 12.4 **DATE**

- The number of nephrons are constant from the birth, if nephrons are died due to injury or infection new nephron cannot form.
- Each kidney filtered blood at 50% rate, but if one kidney get failed other kidney compensate 80 % blood filtration rate.
- Urine formed by the nephron drains into papillary ducts, below that there is a cup like structure known as major and minor calyces.
- Each kidney consist 8-18 minor calyces and 2-3 major calyces.
- Formed urine pass from renal papillae to minor calyces to major calyces, then it flow in to renal pelvis to ureters and it finally drains in to urinary bladder.

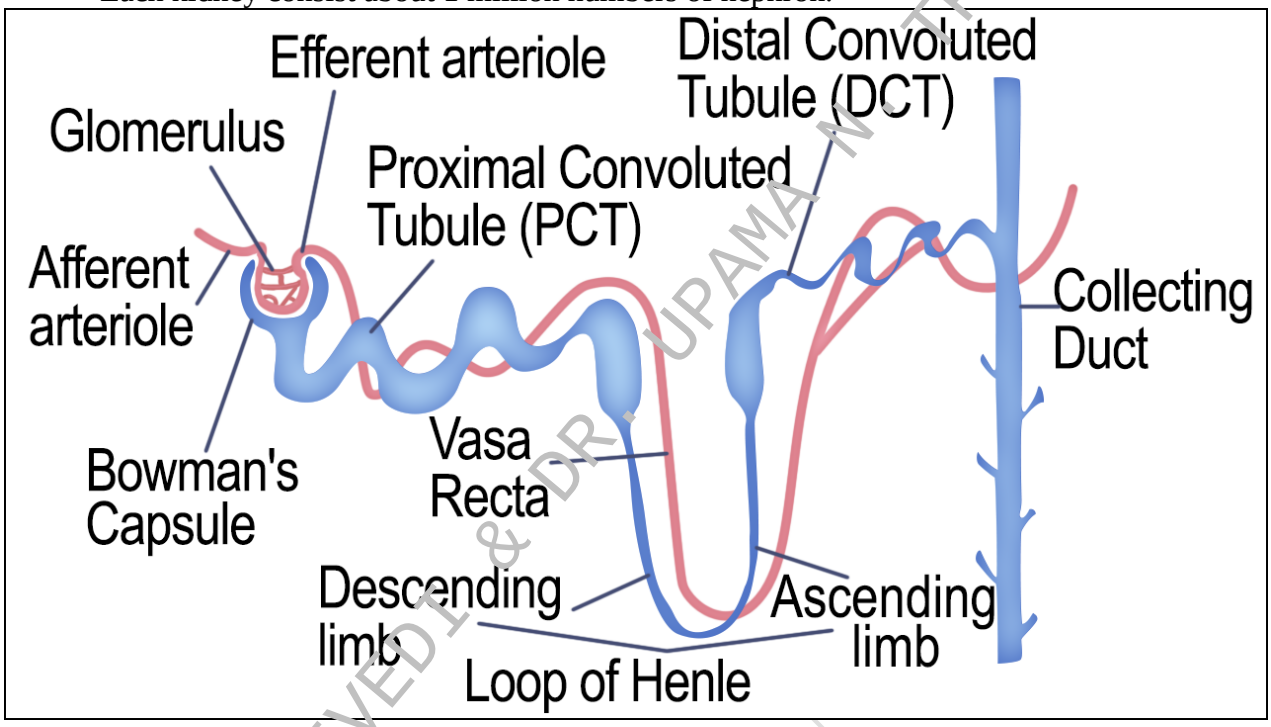


Frontal section of right kidney

NEPHRON:



- Each kidney consist about 1 million numbers of nephron.



- It is divided into two portion:

i. Renal corpuscle:

- ✓ Renal corpuscle is lie into the cortex region of kidney, It is also known as Malpighian body.
- ✓ It consist two portion:

a) **Glomerulus** - This is a cluster of capillaries that absorb protein from blood traveling through the renal corpuscle.

b) **Glomerular (The Bowman capsule) –** It is double layered walled that surround the glomerulus. The remaining fluid, called capsular urine, passes through the Bowman capsule into the renal tubules.

ii. Renal tubules:

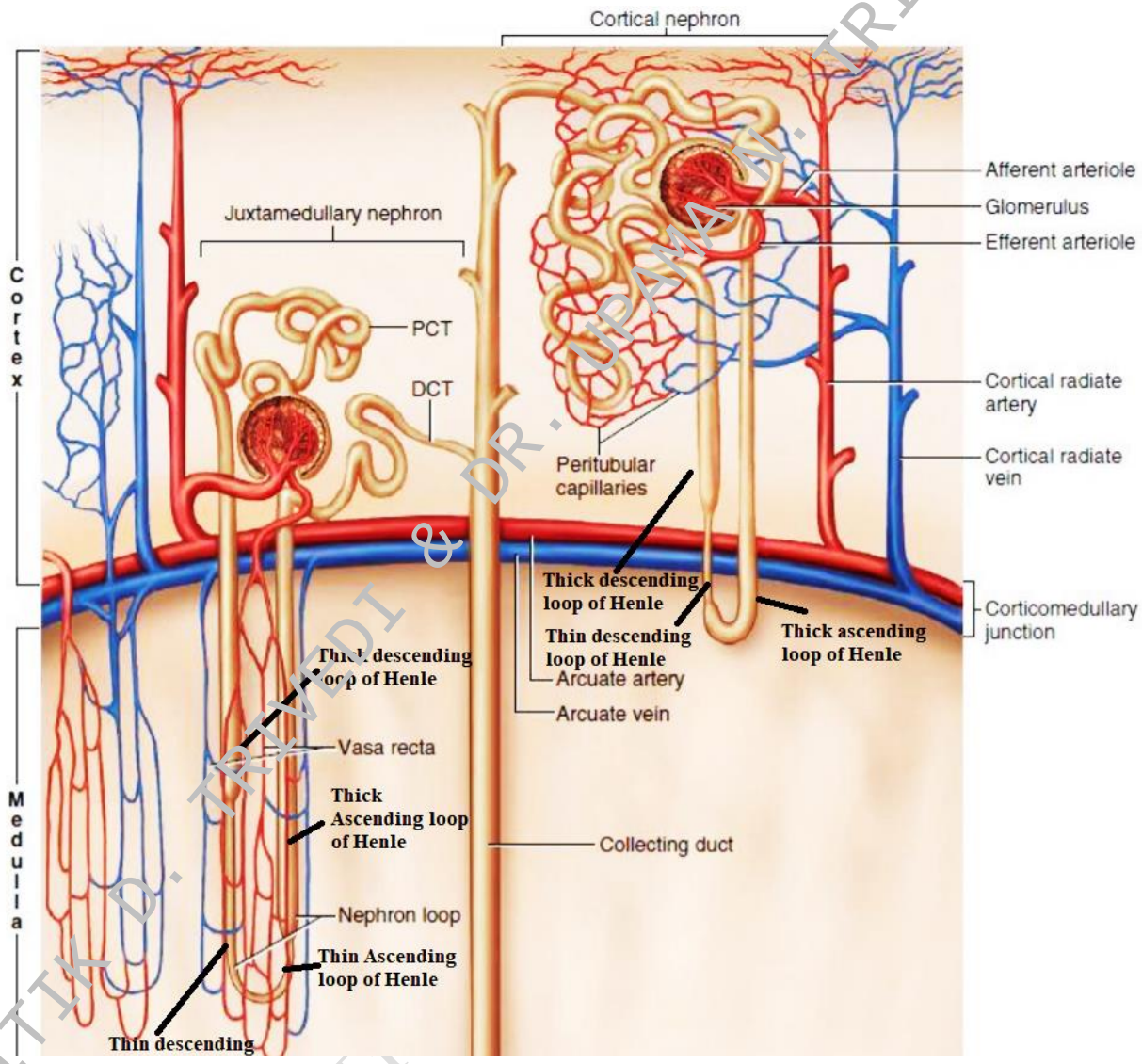
- Filtered fluid from the capsular space enter into the renal tubules, which has three main section.

a. Proximal Convoluted tubules b) Loop of Henle c) Distal convoluted tubules

- According to loop of Henle, nephron is divided into two main types:

a. Cortical nephron:
It is about 80 to 85 % of the total nephron.
It mainly located in the superficial region of the kidney that is known as cortex.
It consist short loop of Henle.
Loop of Henle consists, thick and thin descending portion and thick ascending portion but no thin ascending portion.

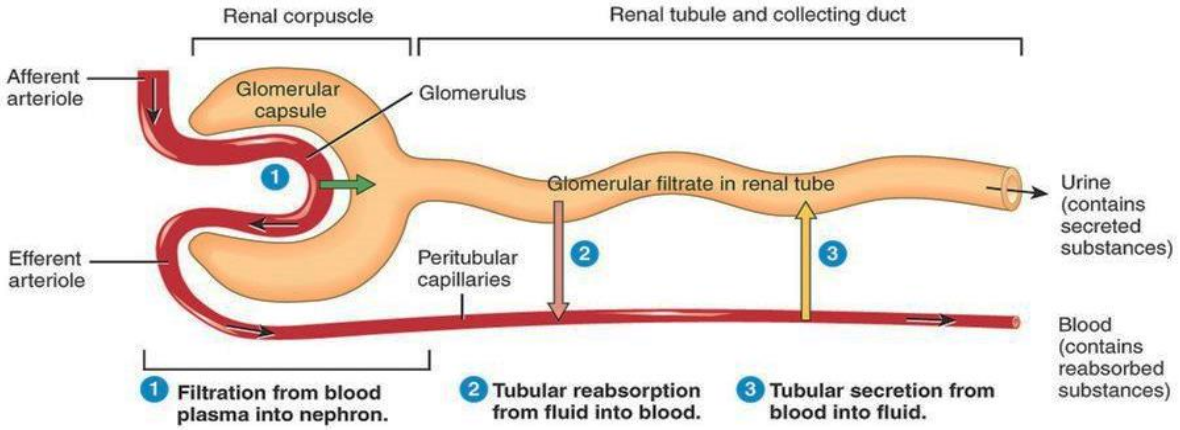
b. Juxtamedullary nephron:
It is about 15 to 20 % of the total nephron.
It mainly located in the deep region of the kidney that is known as medulla.
It consist long loop of Henle.
Loop of Henle consists, thick and thin descending portion as well as thin and thick ascending portion.
It excreted very dilute or very concentrated urine.



PHYSIOLOGY OF URINE FORMATION:

Urine is formed by mainly three process:

1. Glomerular filtration, 2. Tubular reabsorption and 3. Tubular secretion.



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1. Glomerular filtration:

- Afferent arteries have larger diameter than the efferent arteries so pressure is created into the glomerulus. Due to this about 180 liters/day of filtrate entre into the capsular space, with respect to the glomerular filtration rate (GFR) 125 mL/min for an adult male. This represent is 65 times the entire blood plasma volume.
- Out of 180 liters of filtrate 178-179 liters of filtrates get reabsorbed so finally 1-2 liters of urine excreted each day.
- Glomerular filtration is depend on net filtration pressure (NFP) created into the glomerulus.
- The net filtration pressure (NFP) is mainly describe by following three mechanism, in which one process promote the filtration and two oppose the filtration process.

i. Glomerular Blood Hydrostatic Pressure (GBHP):

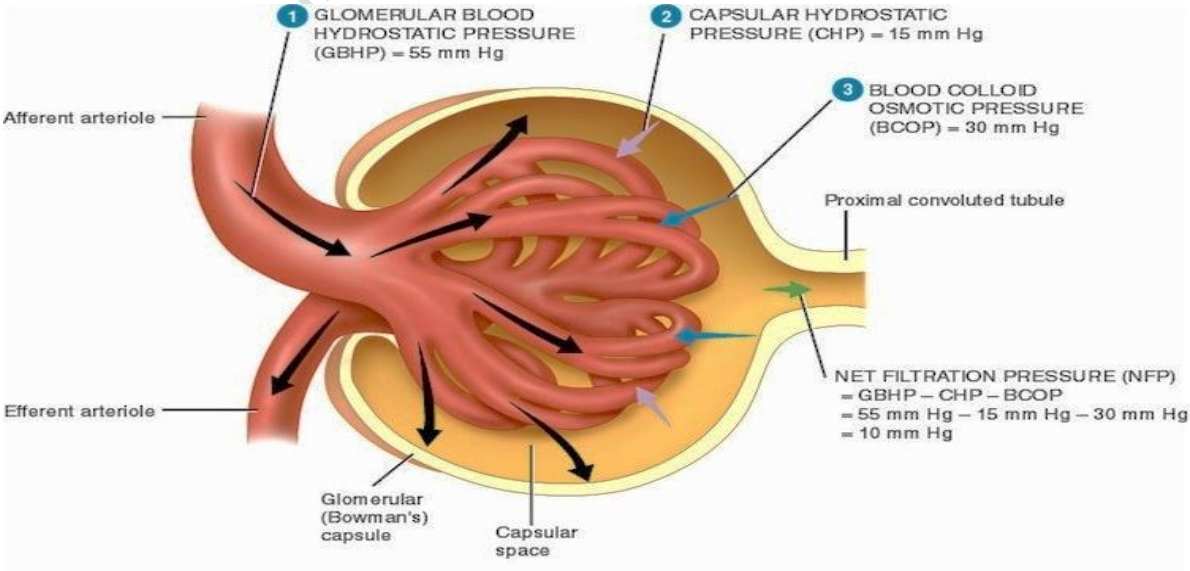
Afferent arteries have the larger diameter and efferent arteries have smaller diameter so large amount of blood comes into the glomerulus and small amount of blood out from the glomerulus it create pressure into the glomerulus that is 55 MmHg. Which is positive and it promote the filtration.

ii. Capsular Hydrostatic Pressure (CHP):

The wall of the capsule where there is no pores as well as the fluid filled into the capsule oppose the filtrate for filtration. This is the negative pressure which oppose the filtration rate that is 15 MmHg.

iii. Blood Colloidal Osmotic Pressure (BCOP):

Some of the protein of blood plasma cannot pass through the endothelial capsular membrane and it block the pore for filtration site, so it oppose the filtration rate and the pressure created by this oppose is 30 MmHg which is also the negative pressure.



2. Tubular reabsorption:

About 99% of Water and other useful small molecules in the filtrate are normally reabsorbed back into plasma by renal tubules.

In tubular reabsorption, water and solute moves from the tubuler lumen back into the blood with in a peritubular capillary or vasa recta.

Here, solutes like glucose, amino acids, urea, anions (Cl^-, HCO_3^-, HPO_4^{2-} etc) and cations (Ca^+, K^+, Na^+ etc) are reabsorbed by both the process active and passive mechanism.

3. Tubular Secretion:

- ✓ Some of the substances which not filtered through the PCT get directly secreted from blood capillary to tubules.
- ✓ Tubular secretion removes Hydrogen ions (H+), Potassium ions (K+), Ammonium ions (NH_4+), creatinine and some drugs like penicillin.
- ✓ Tubular secretion of Hydrogen ions (H+) helps to maintain blood pH and secretion of other substances helps eliminate them from the body.

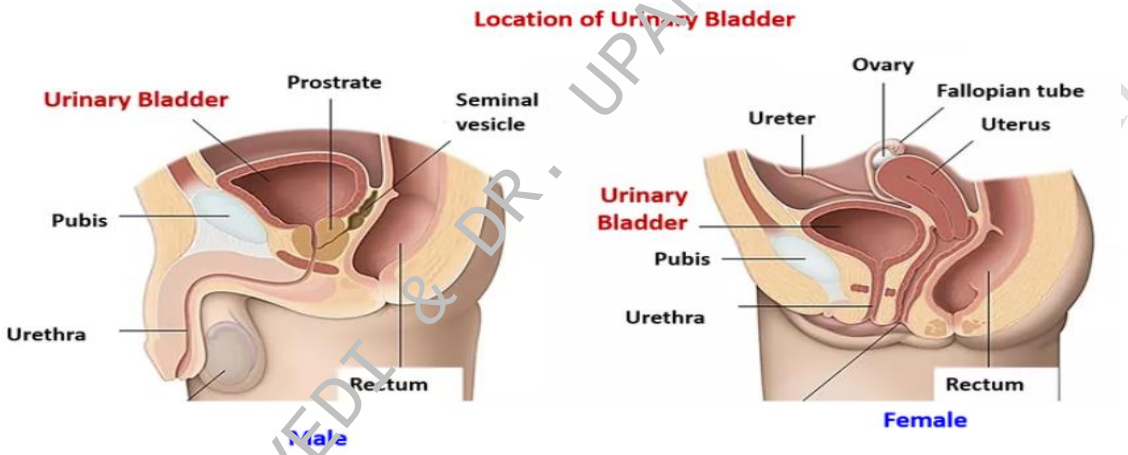
URETERS:

- The ureters are a pair of tubes that carry urine from the kidneys to the urinary bladder.
- The ureters are about 10 to 12 inches long and run on the left and right sides of the body parallel to the vertebral column**.**
- Gravity and peristalsis of smooth muscle tissue in the walls of the ureters move urine toward the urinary bladder. The ends of the ureters extend slightly into the urinary bladder and are sealed at the point of entry to the bladder by the ureterovesical valves.
- These valves prevent urine from flowing back towards the kidneys.
- About every 10 to 15 seconds, small amounts of urine are emptied into the bladder from the ureters.

URINARY BLADDERS:

- This triangle-shaped, hollow organ is located in the lower abdomen.
- In the male it is directly anterior to the rectum and in the female it is directly anterior to the vagina and inferior to the uterus.
- In general urinary bladder have less capacity to store urine in female than male because in female uterus occupies the space just above the bladder in female.
- Expulsion of urine from urinary bladder is known as micturition, commonly known as urination.

- The average capacity of urinary bladder to store urine is 600-700 mL, but when the urine reached near the volume of 200-300 mL in urinary bladder, the stretch receptors in the wall of bladder send message/impulse via sensory response to spinal cord that response analyze by the integrated centre of CNS and generate the reflex action to expel urine known as micturition.



URETHRA:

- The urethra is the tube through which urine passes from the bladder to the exterior of the body.
- The female urethra is around 2 inches long and ends inferior to the clitoris and superior to the vaginal opening.
- In males, the urethra is around 8 to 10 inches long and ends at the tip of the penis. The urethra is also an organ of the male reproductive system as it carries sperm out of the body through the penis.
- The male urethra has three regions: 1. prostatic urethra 2. Membranous urethra 3. Penile urethra.
- The flow of urine through the urethra is controlled by the internal and external urethral sphincter muscles.
- The internal urethral sphincter is made of smooth muscle and opens involuntarily when the bladder reaches a certain set level of distention.
- The opening of the internal sphincter results in the sensation of needing to urinate.
- The external urethral sphincter is made of skeletal muscle and may be opened to allow urine to pass through the urethra or may be held closed to delay urination.

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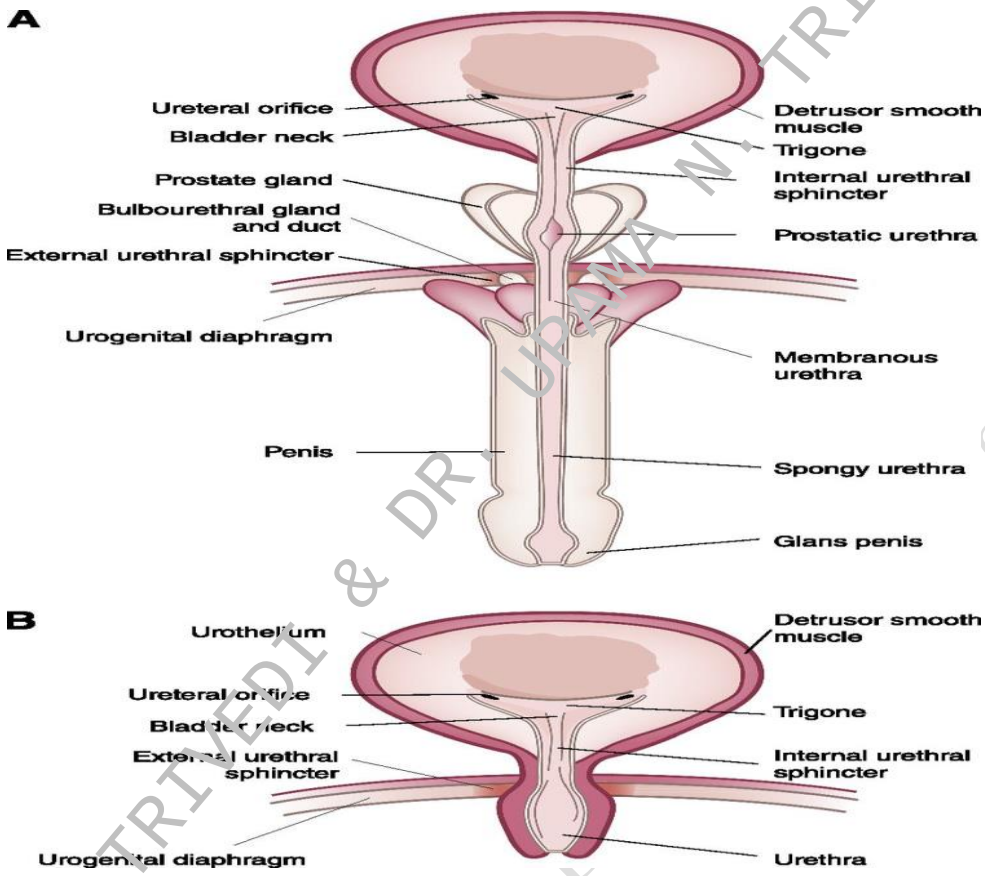


A. **Male Urethra** **B. Female Urethra**

Signature of Teacher

PRACTICAL NO.: 12.5 **DATE**

AIM: STUDY OF REPRODUCTIVE SYSTEM WITH THE HELP OF CHART AND MODELS.

REQUIREMENTS: Models, charts and specimens of urinary system

THEORY:

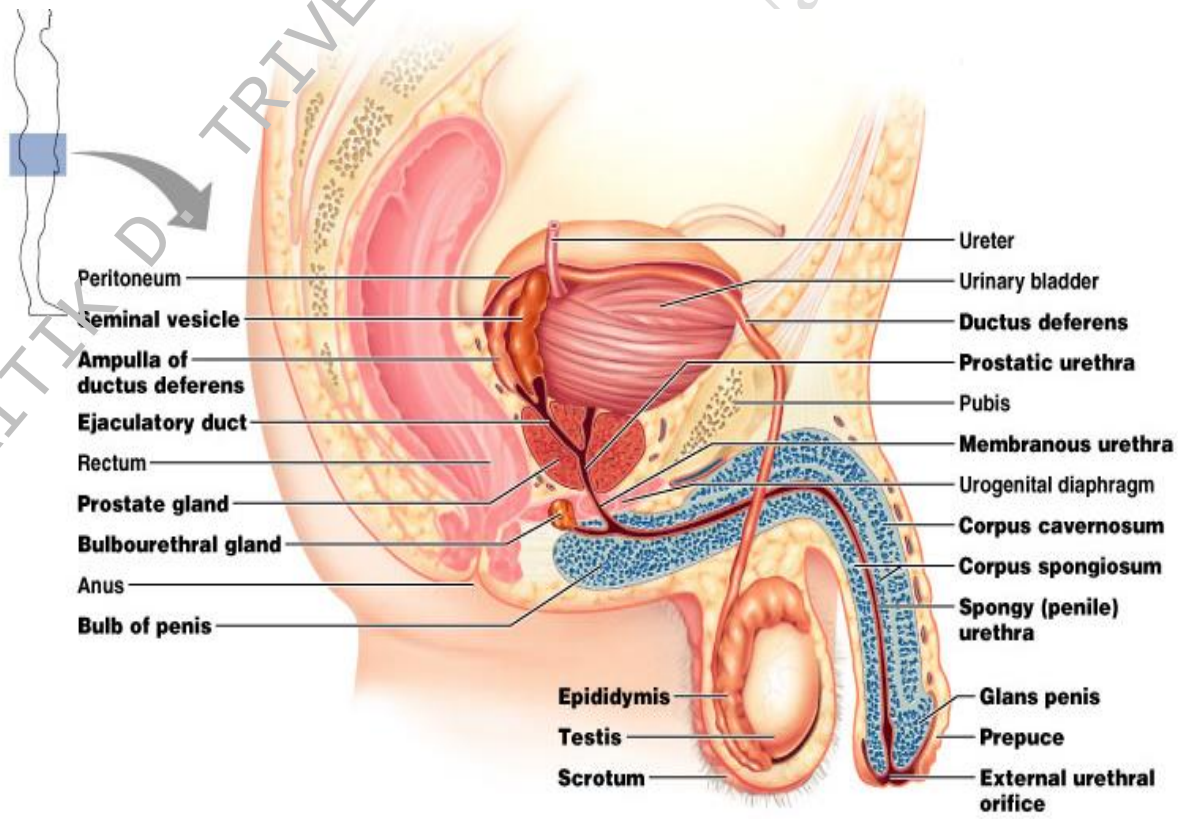
The **reproductive system** or **genital system** is a system of organs within an organism which work together for the purpose of reproduction.

Reproduction is the process by which new individuals of species are produced via which genetic material pass from generation to generation.

According to function, the male and female reproductive organ grouped as under

1. **Gonads (Seeds):** it includes testes and ovaries, the main function of testes are production of gametes and secretion of hormones.
   Male gametes known as sperm
   Female gametes known as oocytes
2. **The ducts:** It transport and store the gametes.
3. **Accessory sec gland:** It produces materials that support gametes.
4. **Supporting Structures:** It includes penis that have important role in reproduction.

MALE REPRODUCTIVE SYSTEM:



External Structures

- **Penis:** External male sex organ
- **Scrotum:** Sac of skin and muscle containing testicles

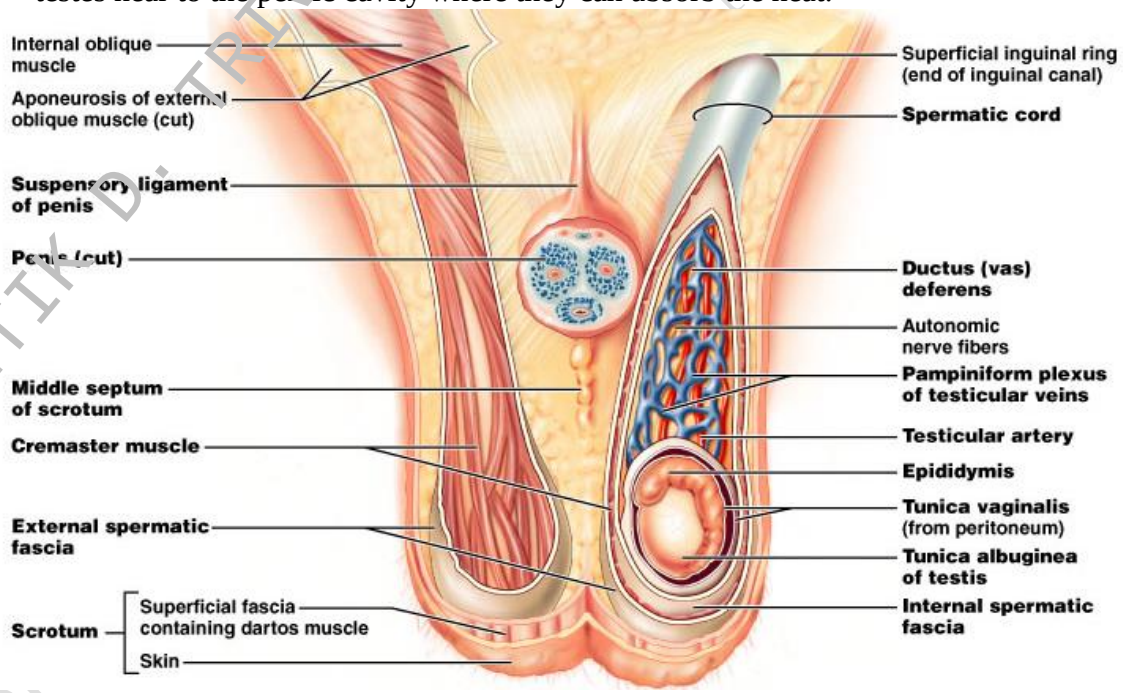
Internal Structures

- **Prostate:** Exocrine gland of male reproductive system
- **Vas Deferens:** Tubes connecting epididymis to ejaculatory ducts
- **Epididymis:** Organ where sperm matures

- **Testicles:** Organ where sperm is created
- **Urethra:** Tube that connects bladder to outside of body

1. Scrotum:

- Scrotum is a sac that hangs from the root of the penis and consists of loose skin and super fasia.
- It is a supportive structure of the penis.
- Internally scrotum consist vertical septum which divide it in to the two sacs.
- Each sec consist a single testes.
- Septum is covered by superficial fascia and muscle tissue known as dartos which consist smooth muscles fibers.
- When dartos muscle contracts it produce wrinkle in the skin of scrotum.
- The location of the scrotum and contraction of its muscle fiber regulate the temperature of testes.
- Both production and survival of sperm required a temperature that is about 3°C lower than the normal body temperature.
- The cremaster muscles is a small band of skeletal muscle present in to the spermatic cord, during the cold and sexual arousal it elevate the testes and this action moves the testes near to the pelvic cavity where they can absorb the heat.



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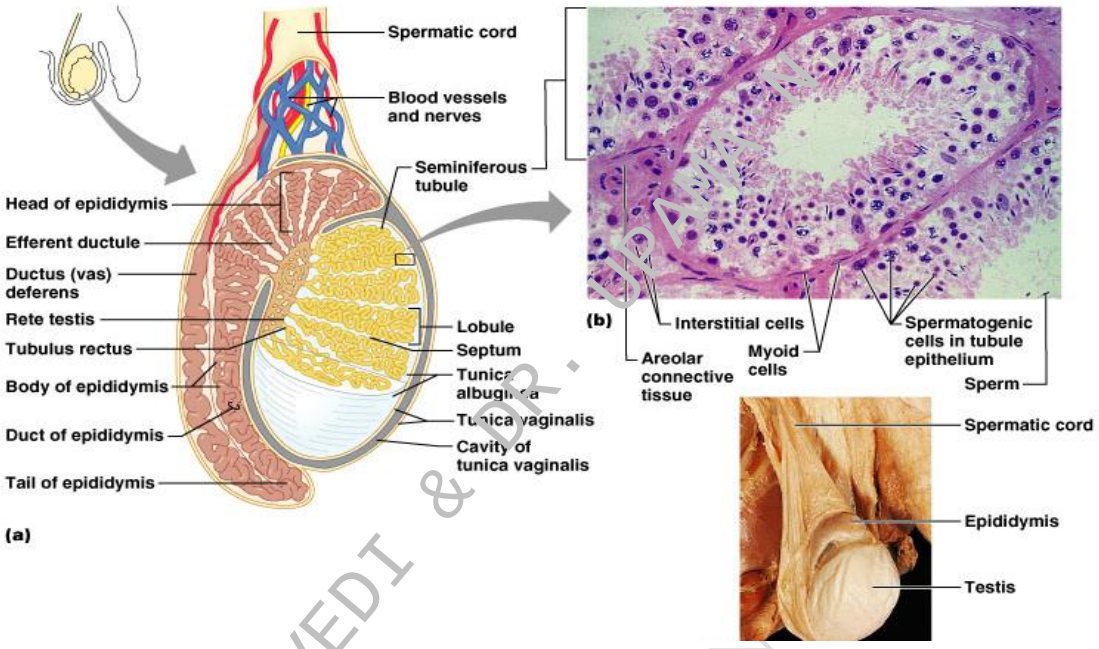
2. Testes:



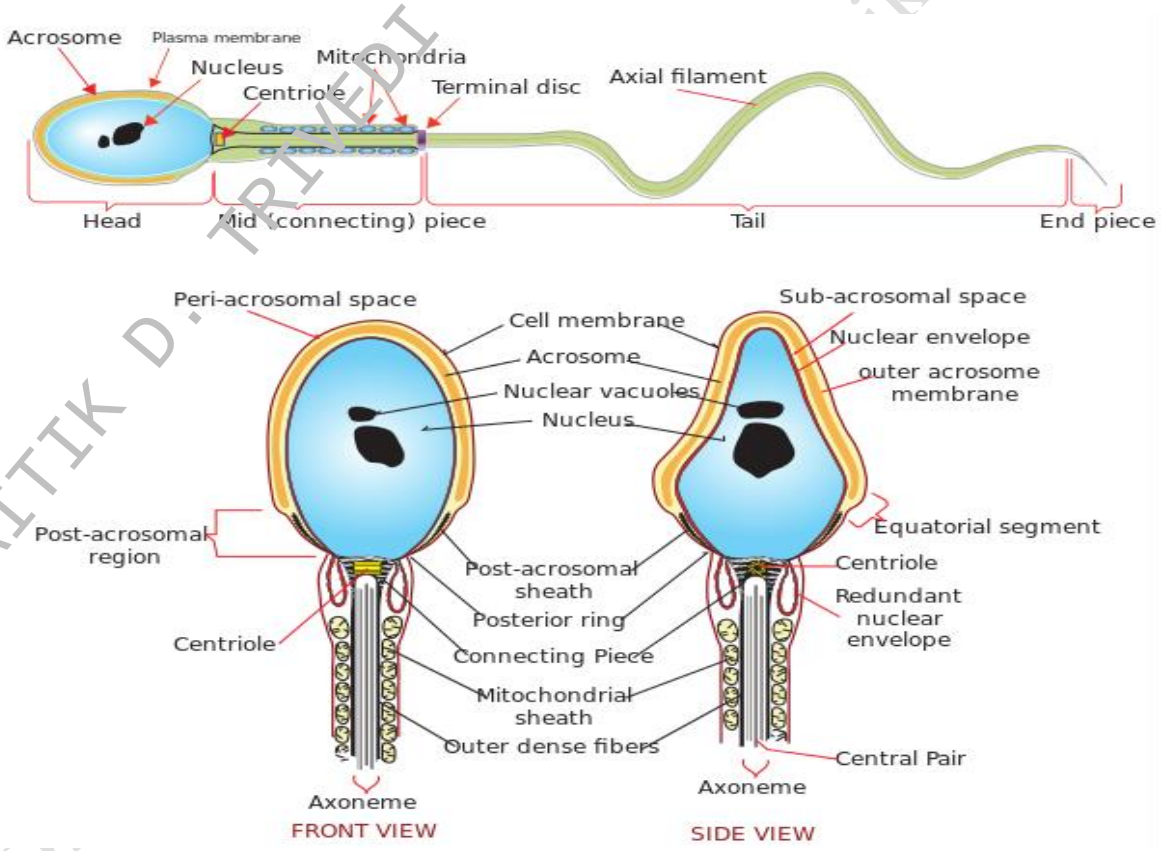
- Testes are formed in abdomen and descend into scrotum at 7th month of development.
- The testes are paired oval glands.
- It is 5 cm length, 2.5 cm in diameter and 10-15 grams of weight of each testis.
- The outer covering of testes is known as tunica vaginalis made up from serous membrane.
- Internal to the tunica vaginalis dense white fibrous capsule known as tunica albuginea.
- Inside extending portion of the tunica albuginea produce lobules. There are 200 – 300 lobules present in each testis.
- Each lobule consist one to three tightly coiled tubules known as semniferous tubules.
- Seminiferous tubule consist spermatogenic cell is taking part in the production of sperm cell, the process is known as spermatogenesis.
- There many sustentacular cells lie between the spermatogenic cell which produce the tight junction known as blood testes barrier.
- These barriers prevent the activation of immune system against the sperm because spermatogenic cell (sperm) consist surface antigen that are recognize as foreign particle by the immune system.
- The sustentacular cells also secret the fluid for the sperm transport as well as it secret the hormone inhibin which regulate the sperm production by inhibiting the secretion of FSH.

3. Sperm:

- The mammalian sperm cell consists of a head, a midpiece and a tail. The head contains the nucleus with densely coiled chromatin fibres, surrounded anteriorly by an acrosome,

which contains enzymes (hyaluronidase and proteinases) used for penetrating the female egg.

- The midpiece has a central filamentous core with many mitochondria spiralled around it, used for ATP production for the journey through the female cervix, uterus and uterine tubes.
- The tail or "flagellum" executes the lashing movements that propel the spermatocyte.
- Human sperm cells can survive within the female reproductive tract for more than 5 days post coitus. Semen is produced in the seminal vesicles, prostate gland and urethral glands.
- Sperm mature at the rate of about 300 million per day.



4. Ducts:

A. Ducts of testis:

- After the production of sperm from the somniferous tubules, release in to the lumen and goes in to straight tubules.
- Newly forming fluid produce by the sustentacular (sertoli) cells produce pressure that moves the sperm ahead.

- These fluids contain potassium ions (K^+), glutamic acid and antigen binding protein (ABP).
- From the straight tubules, fluid moves with sperm in to rate testis, which leads toward an epididymis.
- Epididymis is a comma shaped organ about 4 cm long.
- Next to epididymis is ductus epididymis (Sperm get mature here in 10 – 14 days) is a straight coiled structure 6 m in length continue with the tail epididymis.
- Within the tail of the epididymis, the ductus epididymis becomes less convoluted and its diameter increases. After this point, the duct is referred to as the ductus deference, vas deference or seminal duct.
- The ductus deference (vas deference) or seminal duct is 48 cm long, it store sperm. The dilated terminal portion of this vas deference is known as the ampulla.

B. Ejaculatory ducts:

- Posterior to the urinary bladder are the ejaculatory ducts.
- Each ejaculatory duct is about 2 cm long and is formed by the union of the seminal vesicle and the ampulla.
- The ejaculatory duct ejects the sperm in to the urethra just before ejaculation.

C. Urethra:

- In the male, Urethra is the shared terminal duct of the reproductive and urinary systems.
- It serves as a passageway for both semen and urine.
- The urethra passes through the prostate gland, the urogenital diaphragm and the penis.
- Its measure about 20 cm in length, divided in to three parts:
  - **The prostate urethra:** 2 – 3 cm long, passage from prostate gland.
  - **The membranous urethra:** 1 cm in length
  - **Spongy urethra:** 15-20 cm long.
- Spongy urethral end consist external urethral orifice.

5. Accessory sex gland:

The ducts of male reproductive system store and transport sperm cells while the accessory sex gland secret most of the liquid portion of semen.

A. The paired seminal vesicles:

- It is a convoluted pouch like structure, about 5 cm in length and lying posterior to the urinary bladder and anterior to the rectum.
- It secrete:
  - An alkaline,
  - Viscous fluid that contains fructose, prostaglandins and clotting protein (semenogelin) (differ than the blood clotting protein).

- The alkaline nature of the fluid neutralizes the acid in the female reproductive tract.
- The fructose is used for ATP production by sperm.
- Prostaglandin is useful for the sperm motility and viability also stimulate the muscular contraction in the female reproductive system.
- Seminogelin is the protein that causes the coagulation of semen after ejaculation.
- Seminal vesicle adds 60 % of fluid of the total volume of semen.

B. The prostate gland:

- It is a doughnut shaped gland.
- It is inferior to the urinary bladder and surrounds the prostate urethra.
- The prostate secrete milky and slightly acidic fluid which contains:
  - Citrate: Useful for the ATP production by the sperm.
  - Acid phosphate: Functions are not known
  - Proteolytic enzymes like Prostate specific antigen (PSA) – liquefy the coagulated semen, pepsinogen, lysozyme, amylase and hyaluronidase.
- The secretion of the prostate gland enters the prostatic urethra through many prostatic ducts.
- The secretion of the prostate gland adds 25 % of fluid out of total volume of semen.

C: The bulbourethral or Cowper's gland:

- It is about the size of pea and It lie inferior to the prostate gland.
- During sexual arousal, bulbourethral gland secrete alkaline substance that protect sperm by neutralizing acid in the urethra.
- It also secretes mucus that lubricates the end of penis and the lining of urethra.

6. Semen:

- Semen is the mixture of sperm and seminal fluid.
- The average volume of semen in each ejaculation is 2.5 – 5 mL.
- There are 50 – 150 million sperm present per milliliter (mL).
- When the sperm fall below the 20 million/mL, the male is likely to be infertile.
- The pH of semen is in the range of 7.2 – 7.7.

7. Penis:

- The penis contains the urethra, a passage for ejaculation of semen and for excretion of urine.
- It is cylindrical in shape and consist body, root and gland penis.
- The consensus is that the average erect human penis is approximately 12.9–15 cm (5.1–5.9 in) in length with 95% of adult males falling within the interval 10.7–19.1 cm (4.2–7.5 in). Neither age nor size of the flaccid penis accurately predicts erectile length.

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A. Body of penis:

- It is composed by the three cylindrical masses of tissue:
  - Tunica albuginea
  - Corpora cavernosa penis (Paired dorsolateral masses)
- Tunica albuginea consist corpus spongy penis at the middle part and spongy urethra.
- All the three masses are covered by the facia and skin with the erectile tissue permeated by blood sinuses.
- During the sexual stimulation, which may be:
  - Visual,
  - Tactile,
  - Auditory,
  - Olfactory,
  - Or Imagination large quantities of blood enter in to the penis due to the dilation of arteries (effect of nitric oxide).
- These vascular effects produce erection in penis.
- Ejaculation is the sympathetic reflex. As a part of reflex the smooth muscle spincter at the base of urinary bladder close.
- Thus urine is not expelled during ejaculation.

B. Root of penis:

- It is the attached part, consisting of the bulb of penis in the middle and the crus of penis, one on either side of the bulb. It lies within the superficial perineal pouch.

C. Gland penis:

- The distal end of the corpus spongiosum penis is slightly enlarged, acorn shaped region known as gland penis.
- The margin of gland penis is known as corona.
- Gland penis consist the external urethral orifice.

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THE FEMALE REPRODUCTIVE SYSTEM:

The female reproductive system include

A. Internal genitalia:

— 2 ovaries

— 2 oviducts (uterine or Fallopian tubes)

— Uterus

— vagina

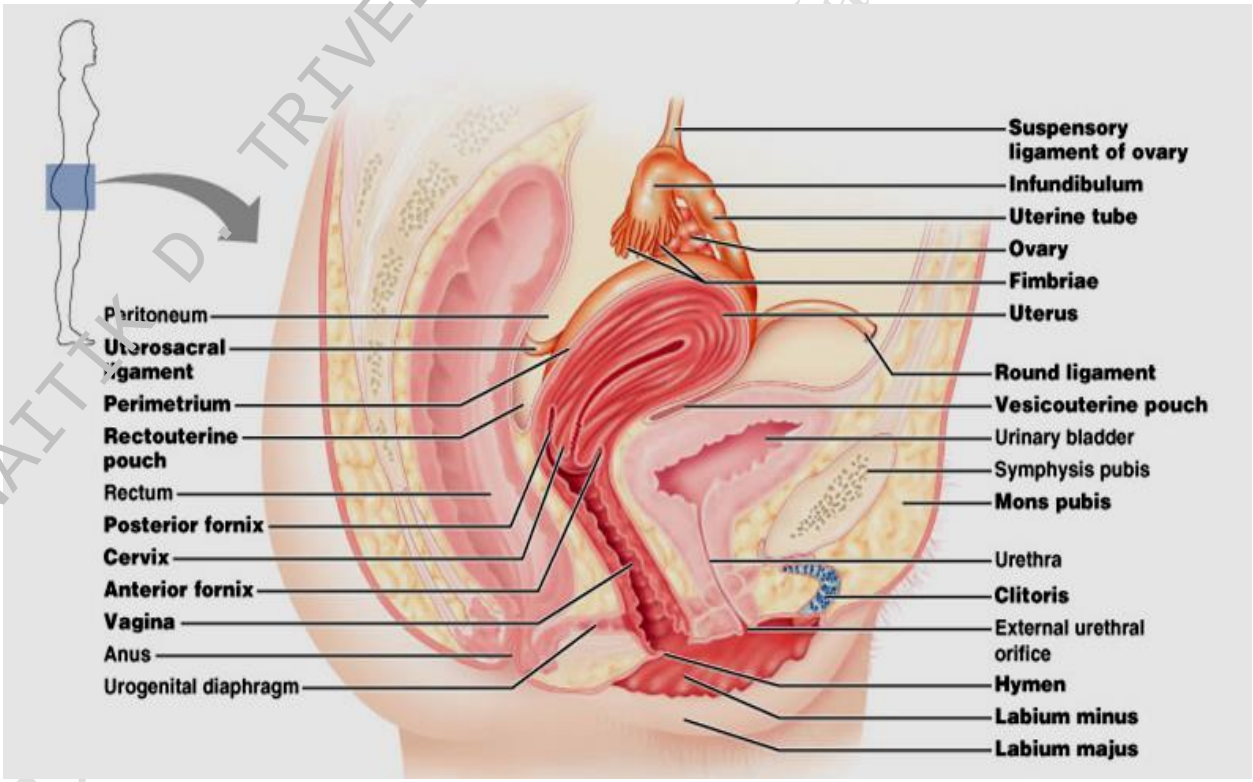
B. External genitalia

— clitoris

— labia minora

— labia majora

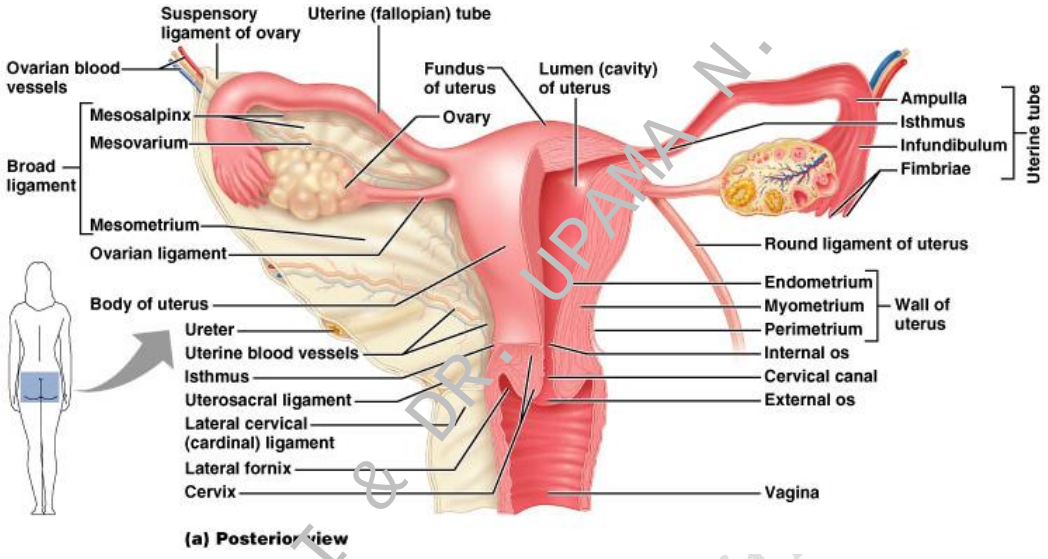
C. Breasts and mammary glands



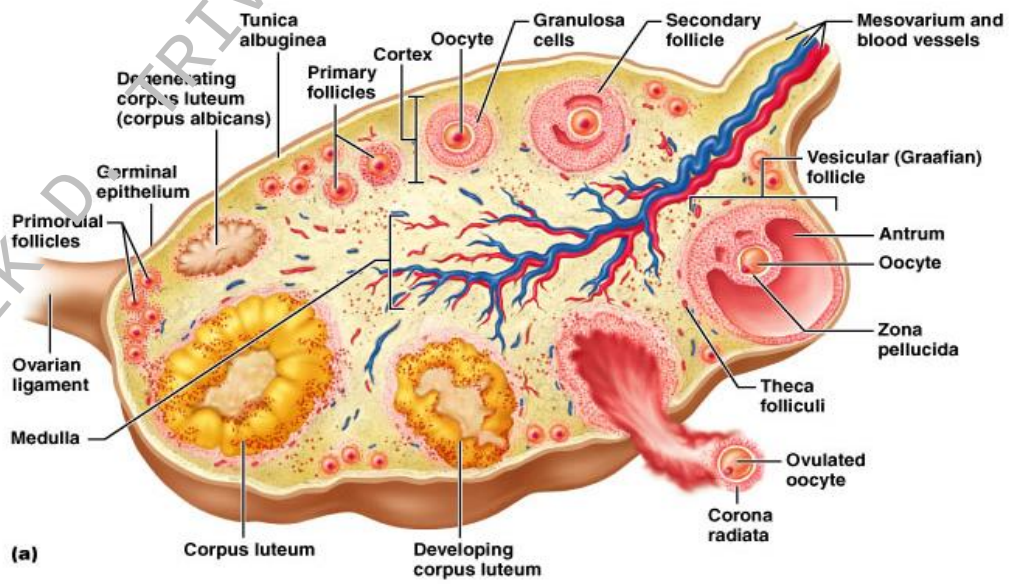
1. Ovaries:

- The paired ovaries are paired glands that resemble unshelled almonds in shape and size.
- Because of the same origins ovaries are homologues to testis.
- The broad ligament of uterus, which is the part of partial peritoneum, attaché to ovaries by double layer fold of peritoneum known as mesovarium.

- The ovarian ligament anchors the ovaries to uterus and the suspensory ligament attach them to the pelvic wall.



A. Structure of ovary:



i) Germinal epithelium:

— It covers the surface of the ovary and it continues with the mesothelium that cover the mesovarium.

ii) Tunica albuginea:

— It is a whitish capsule of dense irregular connective tissue extended deep to germinal epithelium.

iii) Stoma:

— Deep to the tunica albuginea known as stroma.

— It divided in to the two portions, superficial portion known as cortex and deep portion known as medulla.

iv) Ovarian follicle:

— It is lie in to the cortex region of stoma.
— Here the oocytes pass from the various steps of their development with their surrounding cells.
— The surrounding cells produce single layer known as follicular cells.
— Later in developing stage of oocyte, it produces several layers known as granulose.
— These surrounding cells secret estrogen and other fluid so follicle grow larger.

v) Mature (Graafian) follicle:

— It is a large fluid filled follicle after the rupturation of this follicle secondary oocyte get expel out.

vi) Corpus luteum:

— It is the remnant of an ovulated mature follicle.

B. The Ovarian Cycle

i) Follicular phase

— 1[st] approx 14 days but variable
— Egg develops in a follicle
— Stimulated by **FSH**
— Estrogen produced

ii) Ovulation

— Egg released from follicle (**LH** surge)
— Egg in abdominal cavity
— Picked up by fimbria of fallopian tube
— Not necessarily halfway point

iii) Luteal phase

— Postovulatory phase 14 days (more constant)
— Corpus luteum develops from exploded follicle
— Produces progesterone as well as estrogen
— Progesterone stimulates uterus to be ready for baby
— If no pregnancy, corpus luteum degenerates into corpus albicans

2. Uterine (Fallopian) Tubes:

- Female have two fallopian tubes. It stretches from the uterus to the ovaries and measure about 8 to 13 cm in length. It transport the secondary oocytes to the uterus.
- The open, funnel shaped portion of each tube is known as infundibulum, close to the ovary.
- At the end portion of infundibulum has finger like projection known as fimbria, which hold the ovary.
- Widest and longest portion of the uterine tube is known as ampulla and short, narrow, thick walled portion known as isthmus that join the uterus.

3. Uterus:

- The uterus is located inside the pelvis immediately dorsal (and usually somewhat rostral) to the urinary bladder and ventral to the rectum.
- The human uterus is pear-shaped and about 3 in. (7.6 cm) long, 4.5 cm broad (side to side) and 3.0 cm thick (anteroposterior).
- A nonpregnant adult uterus weighs about 60 grams.
- Layers of the uterus:

  Perimetrium: it is the outer layer of the uterus.

  Myometrium: It is the middle layer of the uterus.

  Endometrium: The lining of the uterine cavity is called the "endometrium".
- Parts of uterus:

  Fundus: The dome shaped portion superior to the uterine tube known as fundus.

  Body: The major tapering central portion is known as body.

  Cervix: The inferior narrow portion opens in to the vagina known as cervix

4. Vagina:

- Vagina is the passage for the menstrual flow and child birth.
- It also receives semen from the penis during the sexual intercourse.
- It is 10 cm in length, situated between the urinary bladder and the rectum.
- The vaginal mucosa secret the acidic fluid as well as the mucosal cells of vagina has the antigen presenting cells (APCs) from where the HIV (AIDS) virus gets transmitted.

- The next layer is muscularis is composed of an outer circular layer and inner longitudinal layer of smooth muscle that can stretch considerably to receive the penis during sexual intercourse and allow for birth of a fetus.
- The adventitia is the superficial layer of the vagina.
- At the end of vagina there is vaginal orifice covered by the mucosal membrane known as hymen.
- Sometimes the hymen completely covers the orifice, a condition known as imperforated hymen, which may require surgery to open the orifice and permit the discharge of the menstrual flow.

5. Vulva:

It is known as the external genital organ of the female reproductive system.

i) Mons pubis:

Anterior to the vaginal and urethral opening portion is known as mons pubis. It is an elevation of adipose tissue covered by the skin and hair.

ii) Labia majora:

From the mons pubis, two longitudinal folds of skin known as labia majora. It is homologues to the scrotum and are covered by the pubic hair.

iii) Labia minora:

Middle to the labia majora is to smaller folds of skin called the labia minora. But it not consist the hair and fat. They have few sudoriferous (sweat) glands and sebaceous (oil) gland.

iv) Clitoris:

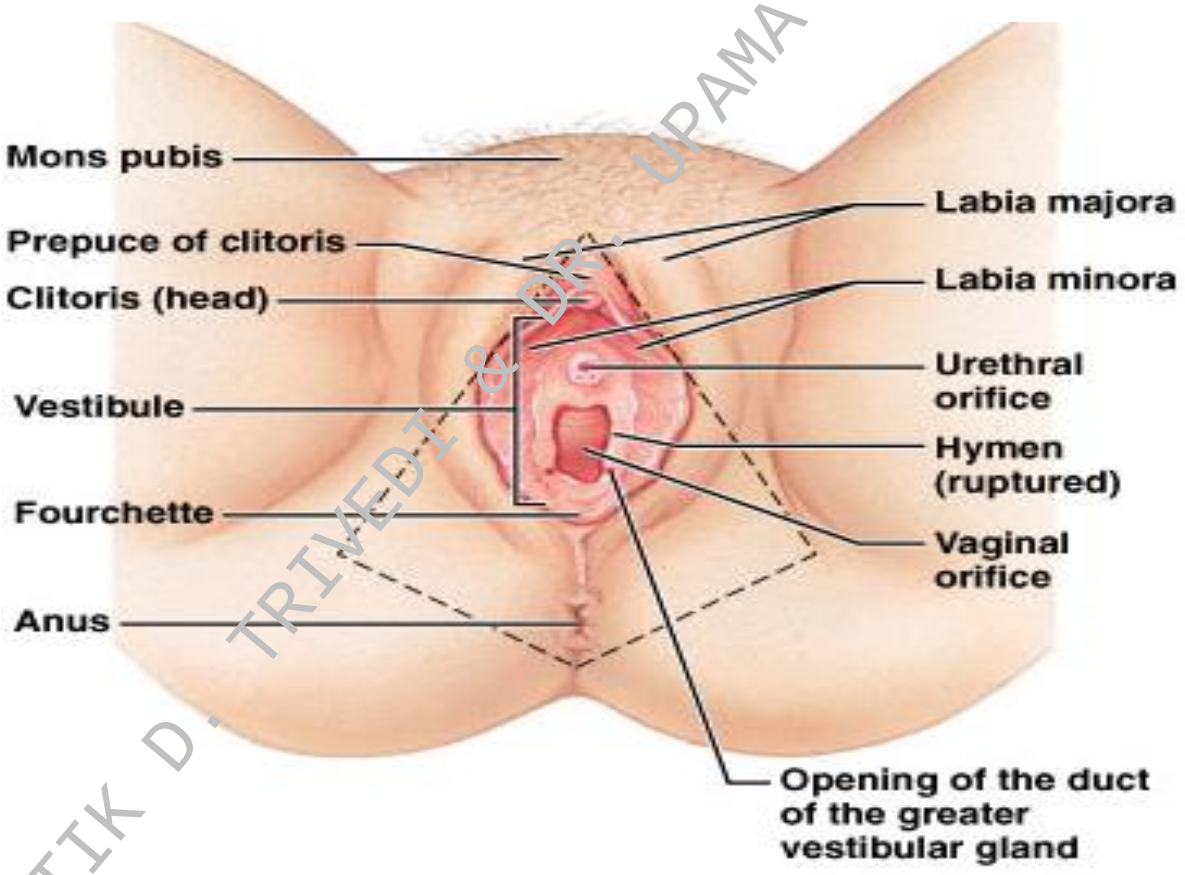
It is the small, cylindrical mass of erectile tissue and nerve. It is located at the anterior junction of the labia minora. It is homologues to the penis and capable of enlargement upon tactile stimulation and it play important role in sexual excitement of the female.

v) Vestibules:

The region between labia minora is known as the vestibules. Hymen, Vaginal orifice, external vaginal orifice are located between the vestibules. The bulb of the vestibules consists of two elongated masses of erectile tissue, during the sexual intercourse it narrowing the vaginal orifice and placing pressure on the penis. Anterior to the vaginal orifice and posterior to the clitoris is the external urethral orifice.

vi) Perineum:

It is the diamond shaped area medial to the thigh and buttocks of both males and females. That contains the external genital and anus.



6. Mammary glands:

- Mammary gland is an organ in female mammals that produces milk to feed baby located in to the breast.
- Each breast has one pigmented projection known as nipple, it have closely spaced opening known as lactiferous ducts from where milk emerges.
- The circular pigmented area of the skin surrounding the nipple known as areola. It appears rough because it contains modified sebaceous (oil) glands.
- Within each breast the memory glands consists 15 – 20 lobes separated by adipose tissue.
- Each lobe have smaller compartment known as lobules composed of grapelike clusters of milk secreting glands known as alveoli.
- Surrounding the alveoli are spindle shaped cells known as myoepithelial cells, whose contraction helps to propel milk towards the nipple.
- Milk path: alveoli – secondary tubules – mammary ducts – lactiferous sinus – lactiferous duct.

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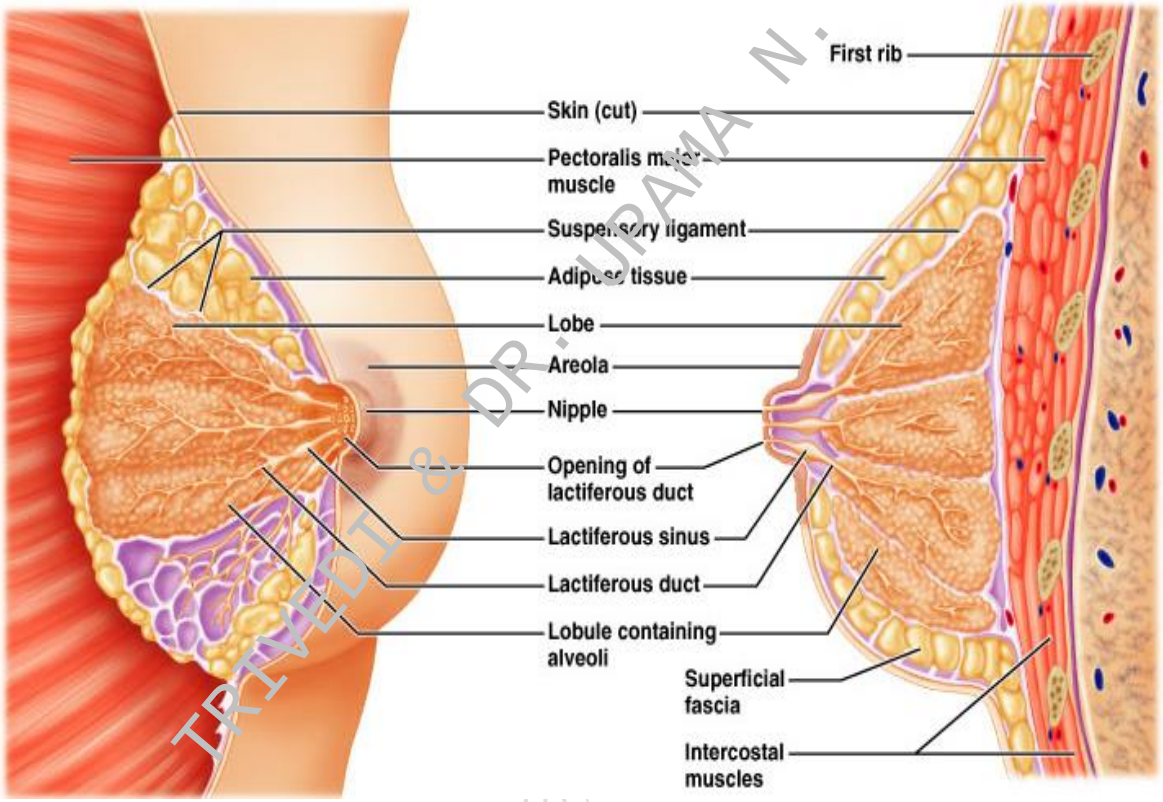
- Milk secretion is stimulated by the hormone prolactin as well as with the contribution of estrogen and progesterone.



Signature of Teacher

PRACTICAL NO.: 13 **DATE**

AIM: RECORDING OF BASAL MASS INDEX

REQUIRMENT: Weighing machine, height measurement chart or tape, Volunteers.

THEORY:-

- Body Mass Index: a measure of body fat that is the ratio of the weight of the body in kilograms to the square of its height in meters.
- BMI is recommended as a practical approach for assessing body fat in the clinical setting.
- It provides a more accurate measure of total body fat compared with the assessment of body weight alone.
- Measurement of BMI is used as one of the diagnostic tests for overweight and obesity.

PRINCIPLE:

Basal or Body Mass Index (BMI) is an internationally accepted measure of the weight status of an individual. It is based on the differences in weights according to heights. BMI is calculated by dividing a person's weight in kilograms (kg) by the square of their height in meters (m) i.e. body weight (kg)/height $(m)^2$. World Health Organisation (WHO) has classified categories as underweight, normal, overweight, or obese based on BMI values.

INTRODUCTION:

Body mass index (BMI) is a person's weight in kilograms divided by the square of height in meters. BMI is an inexpensive and easy screening method for weight category—underweight, healthy weight, overweight, and obesity.

Category	BMI range*	Risk of developing health problems
Underweight	<18.5	Increased
Normal weight	18.5–24.9	Least
Overweight	25.0–29.9	Increased
Obese class I	30.0–34.9	High
Obese class II	35.0–39.9	Very high
Obese class III	≥40.0	Extremely high

*BMI is calculated as follows: metric: BMI = weight (kg)/height $(m)^2$;

PRACTICAL NO.: 13 **DATE**

PROCEDURE:

Measure Weight in Kg or Pound:

1. First set the weigh machine on scale zero.
2. Ask the subject to remove apron, shoe and any heavy items from their pockets like key‘s, wallets etc.
3. Ask subject to stand on weigh machine straight position
4. Wait for the needle/digital screen to settle before recording the measurement.
5. Note down the weight in pound or kilogram

Measure Height in meter or inches:

1. Remove your shoes or Cap, Hat etc..
2. Hang the BMI scale tape (Ruler) and adjust or Set the BMI Scale tap at 0 point.
3. Stand below the BMI Scale tape with your feet flat on the floor with your heels against the corner where the wall and floor meet.
4. Make sure your head, shoulders, and buttocks are touching the wall.
5. Stand up straight with your eyes looking straight ahead.
6. Your line of sight and chin should be parallel to the floor.
7. Now lower the BMI Scale till touch to your head.
8. Note down the height in meter or inches.

Observation Table:

Weight in Kg/Pound	Height in Meter/Inches

Calculation:

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2\ (m^2)}$$ or $$BMI = \frac{\text{weight (lb)} * 703}{\text{height}^2\ (in^2)}$$

Result:

My own Body mass index (BMI) is _____

Conclusion:

My Body mass index (BMI) is in the range of _____. It indicate I am in the category of _____

Signature of Teacher

PRACTICAL NO.: 14 **DATE**

AIM: STUDY OF FAMILY PLANNING DEVICES AND PREGNANCY DIAGNOSIS TEST

REQUIREMENTS: Contraceptive devices and pregnancy kit.

DEFINITION:

A way of thinking and living that is adopted voluntarily upon the basis of knowledge, attitudes and responsible decisions by Individuals and couples, in order to promote the health and welfare of the family group and thus contribute effectively to the social development of a country.

INTRODUCTION:

Family means a group of people who are related to each other or a social group of parents, children, and sometimes grandparents, uncles, aunts, and others who are related.

Family Planning means to regulate the number and spacing of children in a family through the practice of contraception or other methods of birth control.

METHODS OF CONTRACEPTION

1. **Spacing methods:**
   - **i. Natural methods**
     a) Coitus Interrupts / Withdrawal Method
     b) Safe period / Rhythm Methods
     c) Measurement of Basal Body Temperature Method
     d) Cervical Mucus Method
     e) Lactational Amenorrhea Methods (LAM)
   - **ii. Barrier methods:**
     a) Physical barrier methods
     b) Chemical barrier methods
     c) Intra- uterine devices
     d) Hormonal methods
     e) Post conceptional methods
2. **Terminal/Surgical methods:**
   A) Vasectomy
   B) Tubectomy

PRACTICAL NO.: 14 **DATE**

1. Spacing Methods:

- Help in prevention of pregnancy as long as they are used.
- These methods can help in timing and spacing of pregnancies, preventing unwanted children.
- These methods are temporary methods.

i. Natural Methods:

- Natural methods do not involve the use of any of the man made devices.
- These methods are useful for timing and spacing of pregnancies.

a) Coitus Interrupts / Withdrawal Method:

In this method the penis is withdrawn from the vagina before ejaculation. In this way semen is prevented from entering the uterine cavity and pregnancy does not take place. Since the penis is withdrawn and ejaculation takes place outside the vagina, this method is called coitus interruptus or withdrawal methods.

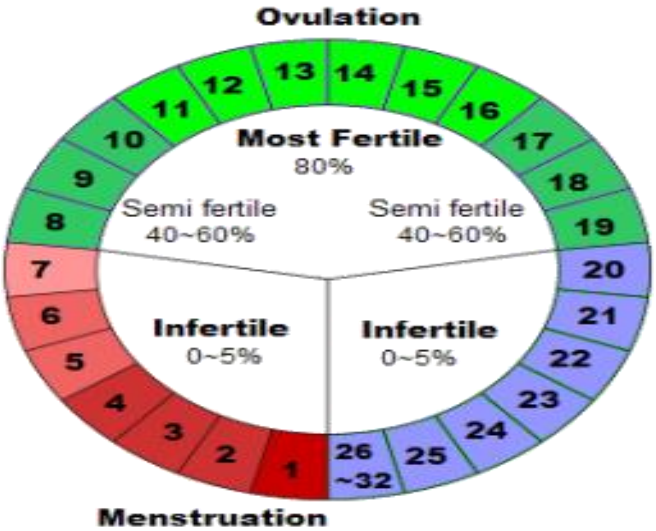
Advantages:

- Involves no cost
- It does not require any other device.
- With self-control and discipline it can be fairly effective.

Disadvantages:

- Require a great deal of self-control.
- Thus failure rate is very high.
- Slightest delay in withdrawal can lead to pregnancy.

b) Safe period / Rhythm Methods:



This method uses accurate records of past menstrual cycles (at least 6 months record of menstrual cycle). To determine fertility, the female subtracts 18 days from the length of her shortest recorded cycle (this tells the first day fertility time commences) and 11 days from the longest recorded cycle (this tells the last day of the fertility time). The duration of time thus obtained from the first day fertility time commences to the last day of the fertility time (as determined from the calculation) is her fertile period. Couples are to avoid sex during this fertile period or compulsorily use a condom/diaphragm if sex cannot be avoided to prevent conception. The calender rhythm method is the least effective of the natural family planning methods due to variance in menstrual cycle lenghts. On the average, women with monthly cycle lengths between 26 - 29 days must abstain from sex from the 8th day of menstrual cycle all through to the 18th day. Greater differences in cycle lengths will increase the required periods of abstinence from sex

To use the Standard Days method:

Count the days in your menstrual cycle, starting with the first day of your period as day 1. Continue counting each day of your cycle until your next cycle starts.

On days 1-7, you're not considered to be fertile and can have unprotected sex, though you may have menstrual bleeding on those days.

On days 8-19, you're considered to be fertile. Avoid unprotected sex or abstain from sex to avoid pregnancy. Or, if you're trying to get pregnant, these are the days to have unprotected sex.

On day 20 through the end of your cycle, you're no longer fertile and can have unprotected sex.

When you get your next period, start the counting over at day 1.

Advantages:

- Does not require any man made device.

Disadvantages:

- Require self-control by the partners during the highly unsafe period.
- Not suitable for the women who does not have regular periods.
- Failure rate is high.
- Require great deal of will power and motivation

c) Measurement of Basal Body Temperature Method

- The measurement of basal body temperature is an effective method used in determining ovulation and fertile period in a woman as basal body temperature rises by about 0.5°C (or 0.9°F) after ovulation.
- To do this the woman measures her body temperature with a thermometer before getting out of bed every day.
- Temperature readings must be taken same time every morning and recorded.
- She should watch for a rise in her body temperature by about 0.5°C.
- This occurs immediately after ovulation.
- The couple are to avoid sex for at least 72 hours after this rise in temperature.

Advantages:

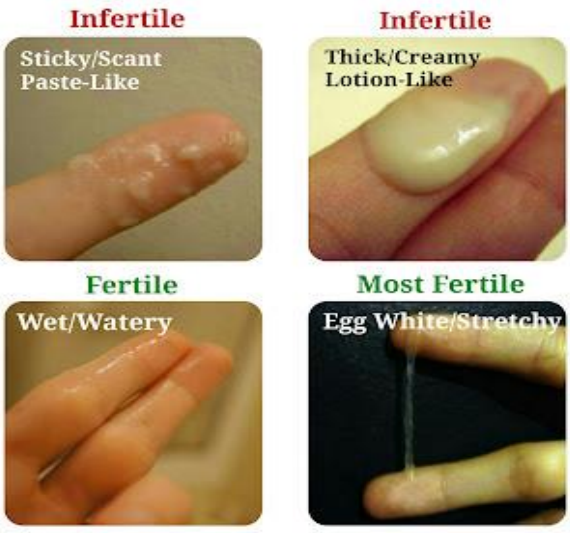
- Cheap methods
- Involves no cost

Disadvantages:

- Due to some illness chance to rise body temperature.
- Require more accuracy

d) Cervical Mucus Method

- The cervical mucus method serves as an accurate indicator of fertility period as an increase in cervical mucus usually occurs near the time of ovulation.
- The hormone that controls menstrual cycle in women also makes the cervix produce mucus.
- This mucus which collects in the vagina undergo changes in quantity and quality just before and during ovulation.



- To use the cervical mucus method the woman needs to recognize these changes and mucus patterns. They include;
- At start of menstrual cycle, menstrual blood flow covers mucus, so no mucus is seen. (Unsafe period)
- After menstrual blood flow end, there are a few days without mucus (dry days). These are infertile (safe) periods if a woman has long menstrual cycle (not safe if menstrual cycle is short)
- Once an ova (female egg cells) starts to ripen at the ovaries more mucus is produced. It appears at the vagina as a thick, cloudy, yellow or white coloured mucus. They also feel sticky. (Unsafe periods)
- Mucus secretion is highest just before ovulation and it appears like raw egg white, easily stretched with the fingers. The days this occurs are refered to as wet days and signifies the fertility (Unsafe) period in the woman.
- Wet days last for about 4 days (Unsafe period). After that mucus secretions become cloudy again and feel sticky until it finally dries out (dry days). These (dry days) are infertile (safe) periods until the next menstrual bleeding starts.
- It must be noted that the woman's mucus secretions is often altered by breastfeeding, hormonal contraceptives, emergency contraceptives and sexually transmitted infections. These change agents should be avoided when using the cervical mucus method
- Once all these changes are understood, the woman will have sex during the safe periods and abstains from unprotected sex during the unsafe periods (as indicated above).

Advantages:

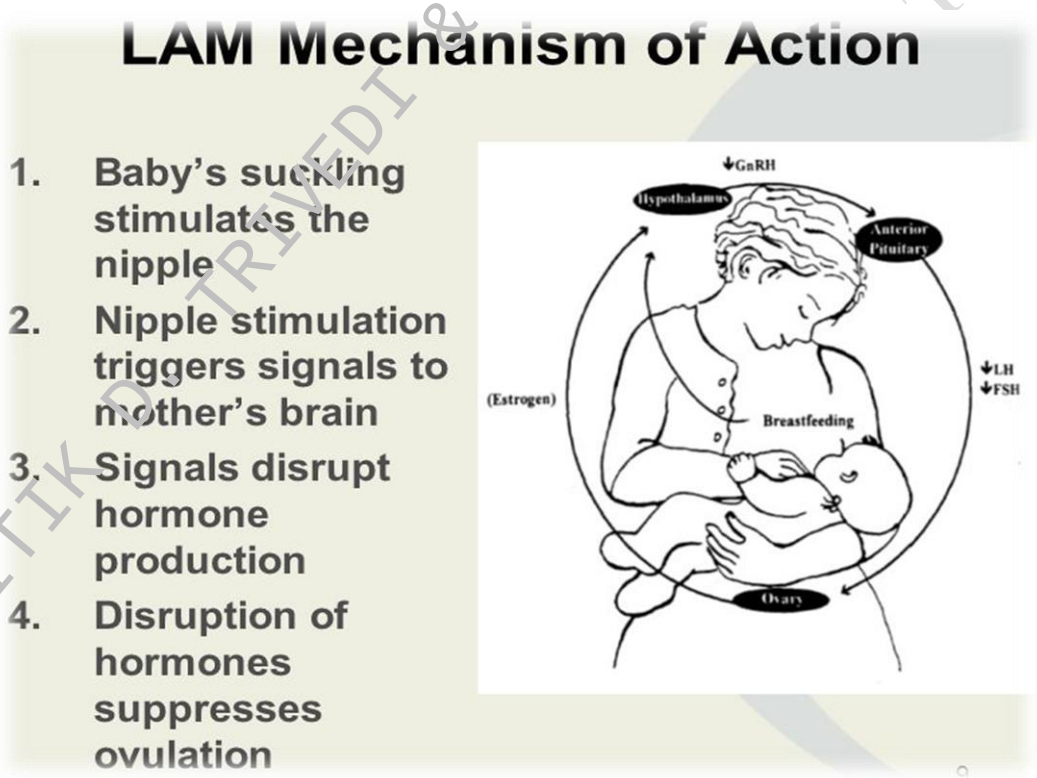
- Cheap methods
- Involves no cost
- No artificial device required

Disadvantages:

- Require more accuracy
- Sometimes unhygienic methods
- Required privacy to measure

e) Lactational Amenorrhea Methods (LAM):

- The lactational amenorrhea method (LAM) is a highly efficient tool for the individual woman to utilize physiology to space births.
- Suckling induces a reduction in gonadotropin releasing hormone, luteinizing hormone and follicle stimulating hormone release, resulting in amenorrhea, through an intracerebral opioid pathway: beta-endorphins inhibit gonadotropin releasing hormone and dopamine secretions, which, in turn stimulates prolactin secretion and milk production.
- Reduced suckling precipitates the return of ovulation. During lactation, menses before 6 months are mostly anovulatory, and fertility remains low.



Advantages:

- Universally available.
- 98% effective (or more)
- Begins immediately postpartum.
- Health benefits for mother and infant.
- No commodities/supplies required.
- Bridge to other contraceptives.
- Builds on established cultural and religious practices.
- Improves breastfeeding and weaning patterns.

Disadvantages:

- Breastfeeding pattern may be difficult to maintain.
- No STD or HIV protection.
- Duration of method limited.
- Only useful for breastfeeding women.

ii. Barrier Methods:

Barrier methods are those methods which prevent meeting of sperms with the ovum. There are many major types of barrier methods.

a. Physical Barrier Methods:

1) Nirodh (condom):

- It is a thin rubber sheath which is use by men.
- It is rolled over the erect penis before having sex.
- This rubber sheath prevents the entry of semen into the vagina.
- The condom must be held carefully when taking out the penis from the vagina to prevent spilling of semen into the vagina.
- It is available free of cost from urban or rural family welfare centers.

TYPES : 1) dry nirodh 2) deluxe nirodh 3) super deluxe nirodh 4) Extra time nirodh

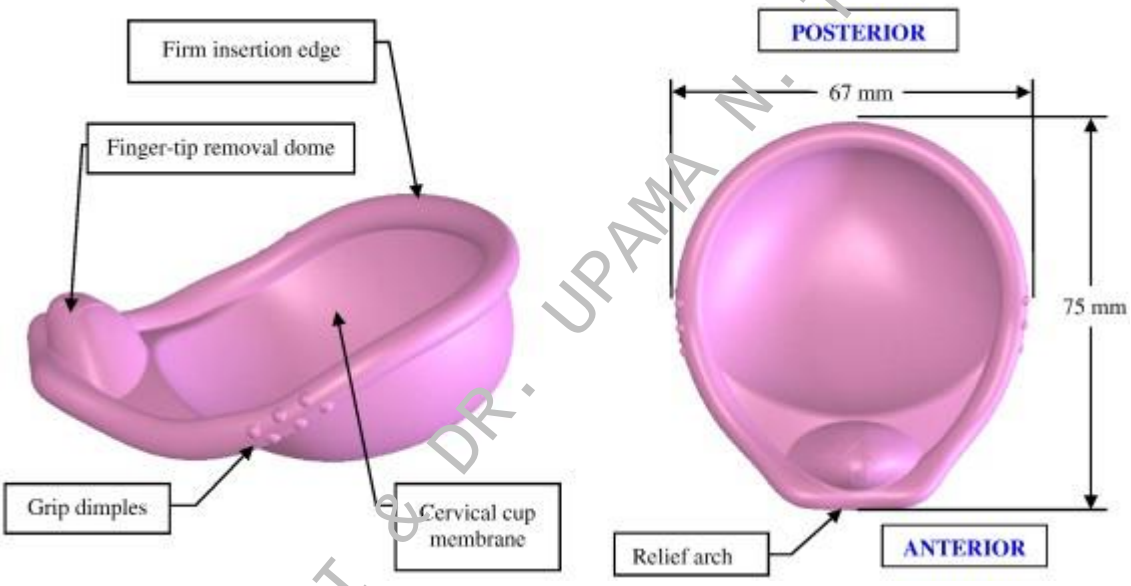
Advantages:

- It is most simple and effective methods
- Easy to use
- Disposable
- No medical supervision is required
- Protects from sexually transmitted disease

Disadvantages:

- If not used correctly it may slip or get tear of and the semen gets spilled into vagina.
- In some rare cases the person may have allergic to rubber.
- Some people may not enjoy sex because of interference with the sensation.

b) Diaphragm:



- The diaphragm is used by women in her vagina to form a barrier in front of the cervix. The diaphragm is dome shaped and is like a shallow cap.
- It is made of soft synthetic rubber or plastic with a stiff but flexible rim around the edge. It is also known as DUTCH CAP.
- Diaphragm id available in different ranging from 5-10cm.
- It is held in position partly because of the tension created by the spring and partly because of the muscle tone of vagina.
- It is very important to observe the vaginal muscle tone otherwise the diaphragm may not remain in position.

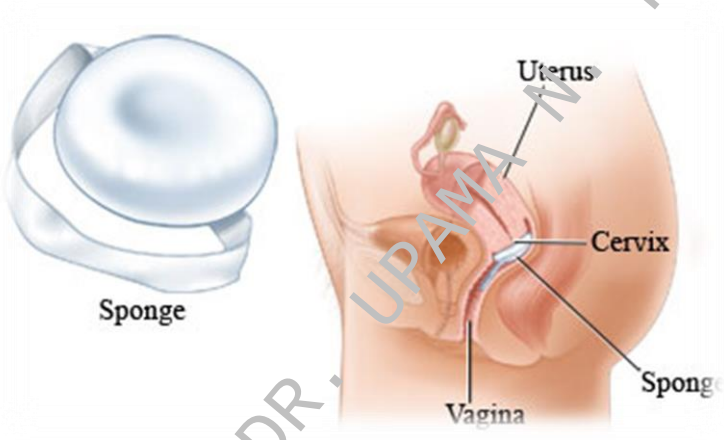
Advantages:

- A diaphragm along with spermicidal is very effective.
- Failure rate is low.
- There is no risk or any kind of contraindication.

Disadvantages:

- It requires the assistance of doctor and any other health personnel.
- It requires privacy and time to place it in the vagina.
- It requires periodical check up because one size not fit to all women.
- It requires facilities for its proper care and storage.

c) Vaginal Sponge:



- It is small polyurethane foam sponge, diffused with spermicide.
- The sponge is shaped in a way that it can be filled on to the cervix and has a loop on its outer surface which can be to pull out the sponge after use.
- Should be inserted before the coitus.
- Provides protection for 24 hours.
- It should remain be there for at least 6 hours after coitus.
- Sperms are trapped on in the sponge and are destroyed.
- It is better than not to use any method.

d) Chemical Barrier Methods:

- These method usually kills the sperms and this way chemical contraceptives help in preventing the pregnancy.
- The chemical contraceptives which are in use are: FORM OF TABLETS AROSOLS, CREAM JELLY, SUPPOSITORIES

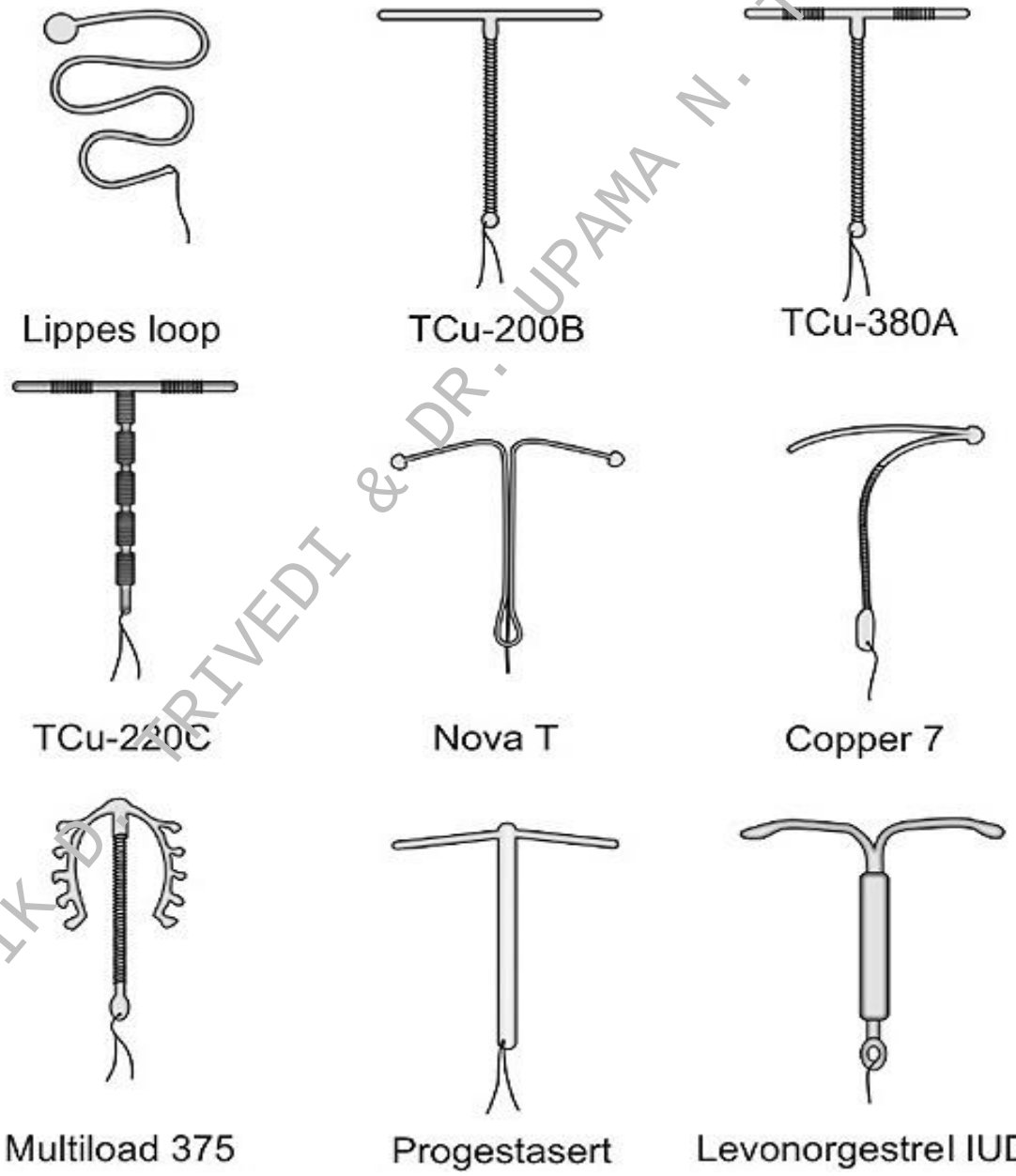
Advantages:

- They are easy to administer
- Available free in health centres
- Not very expansive

Disadvantages:

- Most be inserted deep down and in all such points where sperms are likely to reach.
- Must be applied each time before sex.
- May cause irritation and burning.

e) Intra Uterine Devices:



- These are the devices which are placed in the uterine cavity.
- Earlier these devices were made up of silk worm gut, silk and gold. Three different types of IUD'S generations are:

First Generation IUD'S: These devices were made of polyethylene and are non-medicated. These are available in different sizes and shapes such as coils, spirals, loops. The lippes loop is the most popular and commonly used devices. It is made of polyethylene and contains barium sulphate which makes it possible to be located when required by x-ray. The loop is double 'S' shaped and has an attached made of Fine Nylon Threads.

Second Generation IUD'S: These are also made of polyethylene but copper is added into these. The copper enhances the contraceptive effect. Variety of copper devices are :- Copper-7 and copper t-200, Variants of T devices: TCU: 220C and TCU: 380A, Multi load devices: ML-CU: 250, ML:375, Nova T : TCU- 380, All cu devices are more effective and less chances of side effects I.e. pain and bleeding.

Third Generation IUD'S: These contains hormones which is released slowly in the uterus. The hormone affects the lining of the uterus and cervical mucus. It may affects the sperm. There are two types of hormone IUD'S:- 1. Progestaserl 2. Levonogestrel device

Advantages:

- Can be used for longer period
- Can be easily removed when couple wants to have child
- Do not interfere with coitus
- Inexpensive
- Very effective and failure rate if less
- Do not require hospitalization

Disadvantages:

- Bleeding, abdominal pain, perforation of uterus, expulsion.

f) Oral Contraceptives:

There are variety of oral contraceptive pills.

i. Combined pills: The pills is composed of two : Hormones i.e. synthetic oestrogen and progesteogen in very small doses. Its action is to inhibit ovulation of ovum by blocking the secretion of gonadotropin from pituitary gland. progestogen also thickens the mucosa of the cervix which prevents the entry of sperm into the genital canal. There are two types of pills available with the name of MALA-D , MALA-N. MALA -D: D-Norgestrol – 1.0mg Ethynil estradiol – 0.03mg MALA-N: Norethisterion – 0.50mg Ethynil Estadiol- 0.04mg

Advantages:

- It is 100% effective if taken regularly.
- Easy to use and does not interfere with coitus.
- Reduce the risk of anemia because menstrual bleeding is lass.
- Reduce the risk of pelvic inflammatory disease, cyst and uterine cancer.

Disadvantages:

- Failure rate increase if take irregularly.
- Minor side effects like dizziness, nausea, vomiting, headache, weight gain etc. Increases the risk of heart problems if women is already at risk.
- May increases the risk of gall bladder disease and cervical cancer.

ii. PROGESTRON ONLY PILL: The pill also known as mini pill. It contain only progestogen and it thickens the cervical mucus cavity. Mini pills are taken throughout the menstrual cycle and these are not used widely because of its high failure rate.

iii. Once –A MONTH PILL: it is modified combined pill. It contains long acting oestrogen and short acting progestogen. These pills are not in use because experimental results revealed high pregnancy rate and irregularity in the menstrual cycle.

iv. Depot Formulations: These are long acting hormonal contraceptive contains only synthethic progestogen. These are available in three forms: 1. Injectable 2. Subdermal implants 3. Veginal ring

g) Injectable Contraceptives:

It is again of two :

a. Progestagen Only Injectable:

There are two preparataions which are available. I. DMPA (Depot medroxy progestrone acetete) II. NET-EN (Norethiseterone anante) Both of these contain synthetic progestogen. Progestogen prevents ovulation.

Advantages:

- It is easy to administer, highly effective and irreversible , do not interfere with lactation and does not cause any effect on infant.

CONTRAINDICATION: Abnormal uterine bleeding any malignancy of the genital tract, suspected malignant growth and caner breast.

b) Combined Injectable Contraceptives:

These contains progestogen and oestrogen contraceptive action is similar to that of progestogen only injectable. The injection is given once in a month three days early or three days late. It is contraindicated in pregnancy, women, having any other problem like diabetes with complications, vascular disorder, suspected malignancy.

h) Subdermal Implants:

There are two varieties. The earlier one is known as Norplant and latest one is Norplant R-2 • The Norplant has six small silicon rubber tubes. Each of these tubes contains 30mg of progestogen . • The norplant-R-2 has two small rods. • Both of these devices are placed under the skin of the arm. The tubes or the rods allow steady diffusion of steroids into the blood stream for apriod of five years to give effective contraceptive effects.

i) Vaginal Rings:

- This methods is not much in use.
- It consist of ring which contains small amount of progestogen.
- The ring is fitted into the vagina for three weeks of menstruation cycle, after which it is removed for a week and then reworn after menstruation cycle.
- The steroid is directly absorbed by the mucus lining of the vagina.

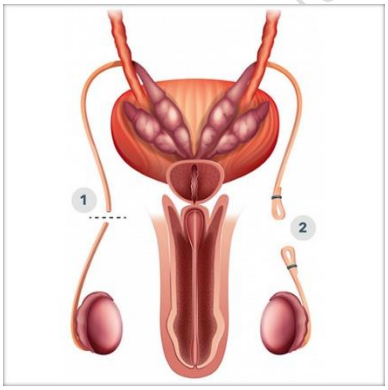
2. Termination methods:

Sterilization is only method which gives permanent protection from conception from conception.

Either husband or wife can undergo sterilization by a simple surgical operation i.e. vasectomy or tubectomy.

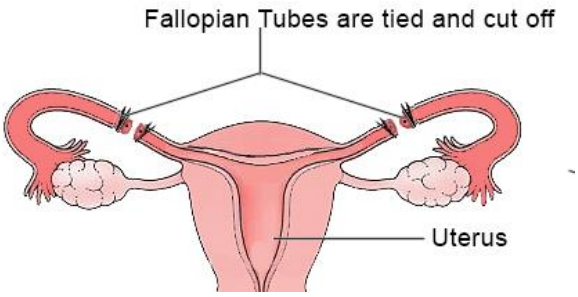
i. Vasectomy:

- Vasectomy is sterilization of male. It is very simple and minor operation which takes hardly 15-20 min.
- The operation involves a small cut on both sides of scrotum then a small portion of vasdeferens (about 1cm) on either side of the scrotum is cut and ligated, folded back and sutured. The operation is done not affect the sexual characteristics and sex life in any form. The sperms are produces but not ejaculated along with semen.



ii. Tubectomy:

- It is sterilization of female. This is done by resecting a small part of fallopian tubes and ligate the sected ends. The closing of tubes can also be done by using other methods like closing the tubes the tubes with bands clips and electro cautery. The operation can be done through abdominal or vaginal approach. The most common abdominal procedure are laparoscopy and minilaprotomy.
- The tubectomy can be done after delivery, between delivery and after abortion.



PRACTICAL NO.: 14 **DATE**

PREGNANCY DIAGNOSIS TEST

THEORY

- The diagnosis of pregnancy requires a multifaceted approach using 3 main diagnostic tools.
  1. History & Physical Examination
  2. Laboratory Evaluation
  3. Ultrasonography
- Currently, physicians may use all of these tools to diagnose pregnancy at early gestation and to help rule out other pathologies.

1. HISTORY AND PHYSICAL EXAMINATION

- The diagnosis of pregnancy has traditionally been made based on history and physical examination findings.
- Important aspects of the menstrual history must be obtained.
- The woman should describe her usual menstrual pattern, including date of onset of last menses, duration, flow, and frequency.
- Items that may confuse the diagnosis of early pregnancy are an atypical last menstrual period, contraceptive use, and a history of irregular menses.
- Additionally, as many as 25% of women bleed during their first trimester, further complicating the assessment.
- The classic presentation of pregnancy is a woman with menses of regular frequency who presents with amenorrhea, nausea, vomiting, generalized malaise, and breast tenderness.
- Upon physical examination, one may find an enlarged uterus after bimanual examination, breast changes, and softening and enlargement of the cervix.
- The Chadwick sign is a bluish discoloration of the cervix from venous congestion and can be observed by 8-10 weeks.

2. ULTRASONOGRAPHY

- With the advent of trans-vaginal ultrasonography (TVUS), the diagnosis of pregnancy can be made even earlier than is possible with transabdominal ultrasonography (TAUS).
- TVUS is the most accurate means of confirming intrauterine pregnancy and gestational age during the early first trimester.

PROCEDURE

The instructions included with kit, the process typically follows these steps:

1. Wait one to two weeks after your first missed period to get the most accurate results.
2. Plan to use the test the first time you urinate after waking up. This urine is the most concentrated and will contain the highest hCG levels of the day.
3. Remove the testing device from the foil pouch by tearing at the notch.
4. If it is cassette then need to put 3 drops of urine collected in the dropper provided in the kit onto the test card. Or if it is a strip then hold the strip at the colored end. (Do not touch the arrow end; do not touch the test window/the middle part of the strip) Holding the strip vertically, immerse the end of the strip with the arrows into the urine container (Do not immerse past the MAX line). And if it is midstream the open its cap and hold it under urine stream..
5. Allowed it to run the sample to the test window. Lay the strip (MAX side facing up) flat on a clean, dry, non-absorbent surface.
6. It only takes about 5 to 10 minutes for a result to appear. Typically, a colored line or plus symbol will appear on the test stick to indicate a positive result. The absence of a colored line or a negative sign usually indicates a negative result.

3. LABORATORY EVALUATION

- Several hormones can be measured and monitored to aid in the diagnosis of pregnancy.
- The most commonly used assays are for the beta subunit of hCG.
- Other hormones that have been used include progesterone and early pregnancy factor.

Beta-human chorionic gonadotropin

- hCG is a glycoprotein similar in structure to follicle-stimulating hormone (FSH), luteinizing hormone (LH), and thyrotropin. hCG is composed of alpha and beta subunits.
- The alpha subunit of hCG is similar to the alpha subunit of FSH, LH, and thyrotropin.
- The free beta subunit of hCG differs from the others in that it has a 30–amino acid tailpiece at the COOH terminus.
- Free beta subunits are degraded by macrophage enzymes in the kidney to make a beta subunit core fragment, which is primarily detected in urine samples.

A pregnancy test is done using blood or urine.

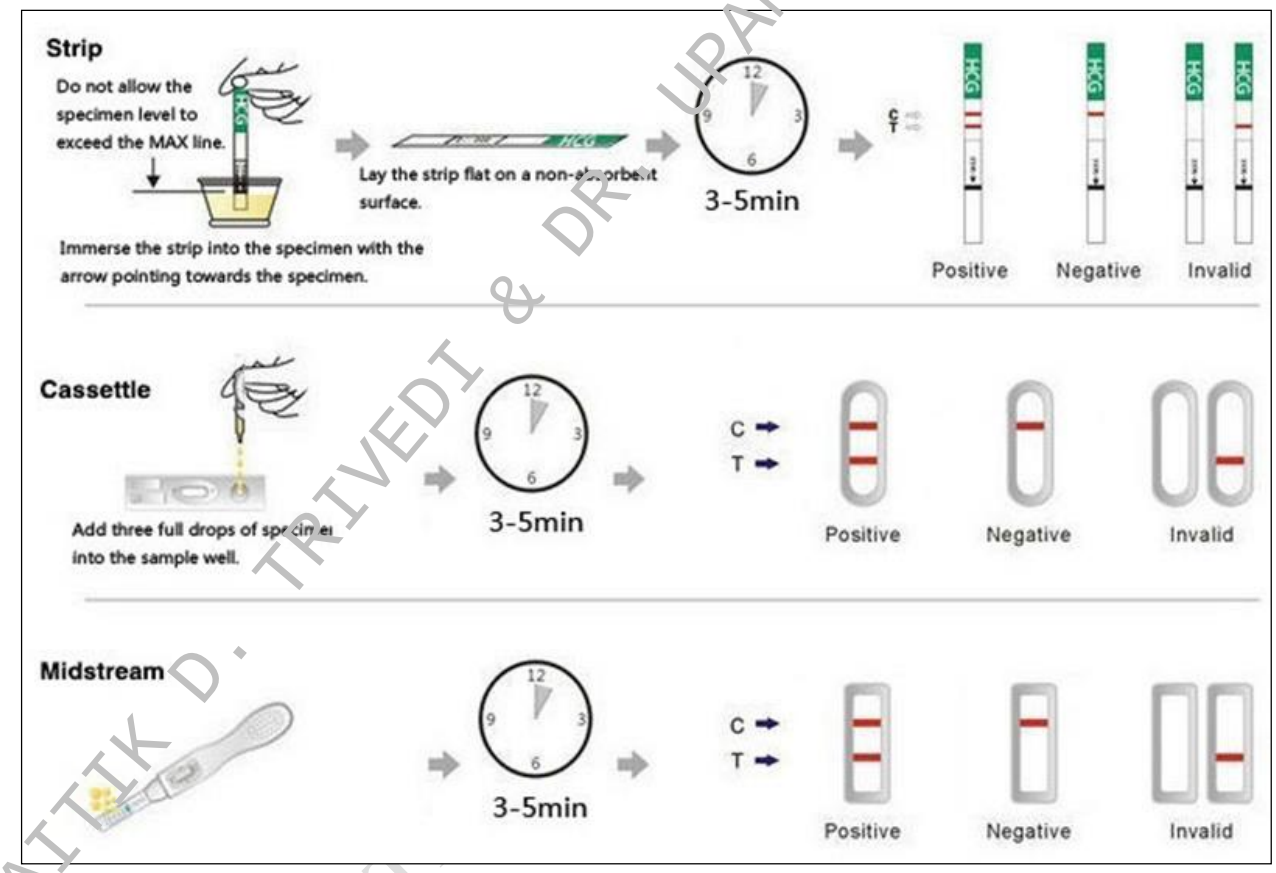
a) Blood hCG tests:

1) Qualitative, which measures whether the hCG hormone is present
2) Quantitative, which measures how much hCG is present
3) The blood test is done by drawing a single tube of blood and sending it to a laboratory. Result obtained in few hours to more than a day.

b) Urine hCG test

1) It is usually performed by placing a drop of urine on a prepared chemical strip. It takes 1-2 minutes for a result.
2) A human chorionic gonadotropin (hCG) urine test is a pregnancy test.
3) A pregnant woman's placenta produces hCG, also called the pregnancy hormone.
4) If woman is pregnant, the test can usually detect this hormone in her urine about 10 days after first missed period.
5) This is when the fertilized egg attaches to the uterine wall.

6) hCG urine tests are commonly sold in kits that anyone can use at home. The hCG urine test often is referred to as a home pregnancy test. The hCG urine test confirms pregnancy about one to two weeks after your missed period.
7) This is a qualitative test, which means that it will tell you whether or not it detects the hCG hormone in urine.
8) The presence of hCG in your urine is considered a positive sign of pregnancy.



OBSERVATIONS AND

- **1 Line = Not Pregnant**
  - ✓ If only 1 colored line appears as the control line, the test is negative and you can assume you are not pregnant.

- **2 Lines = Pregnant**
  - ✓ If 2 colored lines appear, 1 as the testing line and 1 as the control line, the test is positive and we can assume the lady is pregnant.
  - ✓ Even if the lines are very light in color, you can still assume you are pregnant.

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OBSERVATION TABLE

- After 10 minutes observed lines to confirm the result. The test should not be evaluated after 30 minutes. The exact color of the line is not important.

Observation	Inference

RESULT:

The given sample of urine was showed positive/ negative test for pregnancy.

Signature of Teacher

PRACTICAL NO.: 15 **DATE**

AIM: DEMONSTRATION OF TOTAL BLOOD COUNT BY CELL ANALYSER

REQUIREMENTS: Hematoanalyser or cell analyser, Syringe, Needle, Cotton swab, Spirit

PRINCIPLE:

The blood sample drawn for a complete/total blood count is analysed in a medical laboratory. The complete blood count analysis is routinely and reliably done by automated machines in most laboratories known as blood cell analyser. A small sample of the blood drawn from a person is fed into the machine and within a few minutes, the values of the components of the complete blood count are displayed and printed for review. This is called an automated cell count.

THEORY:

The complete blood count values are usually reported based on the number of cells in a specific volume of blood. The normal values may differ slightly based on the reference range and the machine used in the laboratory and, therefore, the results may be slightly different from one laboratory to the next. The normal reference range is typically provided and printed with the results of the complete blood count for accurate interpretation. Different laboratories may report slightly different reference ranges.

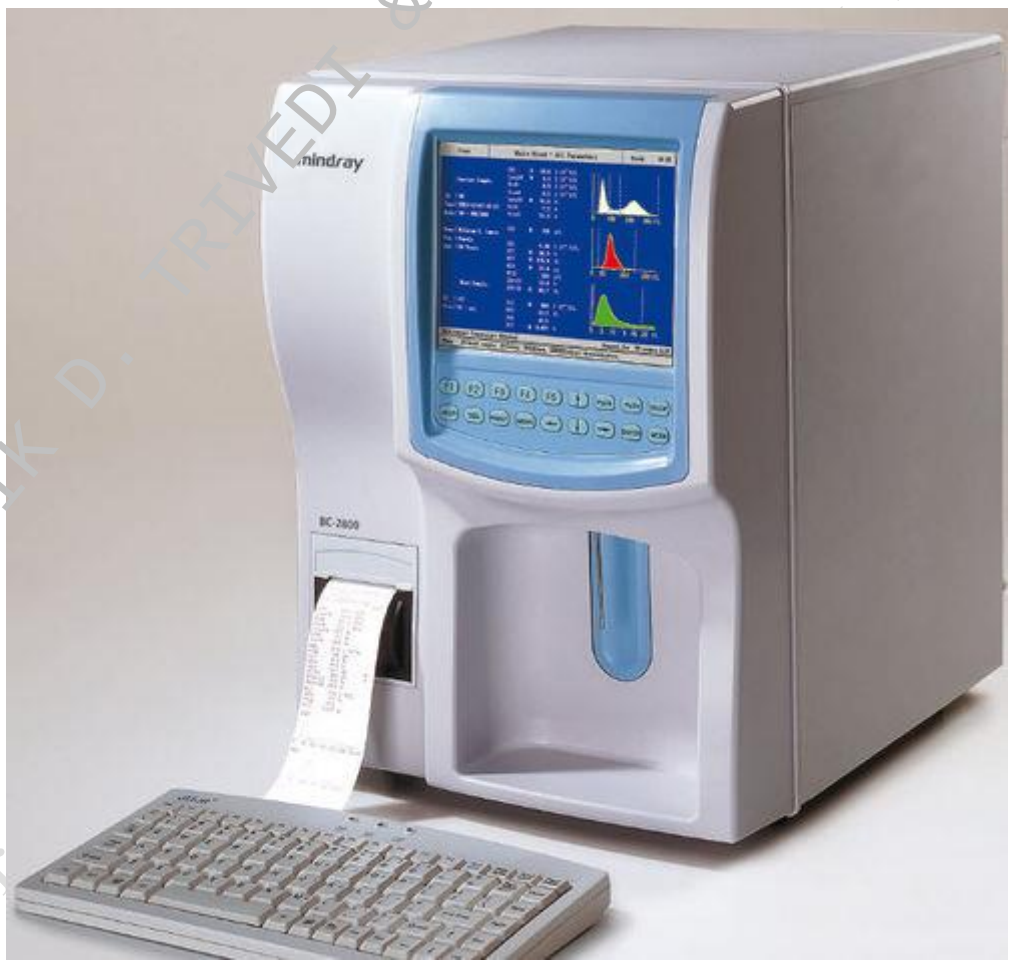
Typical Values and Ranges of the Components of the Complete Blood Count (CBC) Chart	
Components	**Values and Ranges**
WBC (white blood cell)	4000 and 11000 cells per cubic millimeter (cmm)
RBC (red blood cell)	4.2 to 5.9 million cells per cmm
Hemoglobin (Hbg)	13.8 to 17.2 grams per deciliter (g/dL) for men and 12.1 to 15.1 g/dL for women
Hematocrit (Hct)	45% to 52% for men and 37%-48% for women
Mean corpuscular volume (MCV)	80 to 100 femtoliters (a fraction of one-millionth of a liter)
Mean corpuscular hemoglobin (MCH)	27 to 32 picograms (a small fraction of a gram)
Mean corpuscular hemoglobin concentration (MCHC)	32% to 36%
Red cell distribution width (RDW) size and shape	11 to 15
Platelet count	150,000 to 400,000 per cmm
Mean platelet volume (MPV)	6 to 12 femtoliters (a very small fraction of a liter)

PRACTICAL NO.: 15 **DATE**

The three main physical technologies used in hematology analyzers are:

1. Electrical impedance,
2. Flow cytometry, and
3. Fluorescent flow cytometry.

- These are used in combination with chemical reagents that lyse or alter blood cells to extend the measurable parameters.
- For example, electrical impedance can differentiate red blood cells (RBCs), WBCs, and platelets by volume.
- Adding a nucleating agent that shrinks lymphocytes more than other WBCs makes it possible to differentiate lymphocytes by volume.



Mindray Hematology Analyzer BC 2800

Collect the subject/patient blood in sufficient amount by venipuncture methods for the total blood count. Perform the following methods using hematoanalyser.

PRACTICAL NO.: 15 **DATE**

1. Electrical impedance

Principle:

- The traditional method for counting cells is electrical impedance, also known as the Coulter Principle. It is used in almost every hematology analyzer.

Procedure:

- Whole blood is passed between two electrodes through an aperture so narrow that only one cell can pass through at a time.
- The impedance changes as a cell passes through.
- The change in impedance is proportional to cell volume, resulting in a cell count and measure of volume.
- Impedance analysis returns CBCs and three-part WBC differentials (granulocytes, lymphocytes, and monocytes) but cannot distinguish between the similarly sized granular leukocytes: eosinophils, basophils, and neutrophils.
- Counting rates of up to 10,000 cells per second can be achieved and a typical impedance analysis can be carried out in less than a minute.

2. Flow cytometry

Principle:

- It work on the laser beam absorbing capacity of cell.

Procedure:

- A single-cell stream passes through a laser beam.
- The absorbance is measured, and the scattered light is measured at multiple angles to determine the cell's granularity, diameter, and inner complexity.
- These are the same cell morphology characteristics that can be determined manually from a slide.
- Laser flow cytometry is more expensive than impedance analysis, due to the requirement for expensive reagents, but returns detailed information about the morphology of blood cells. It is an excellent method for determining five-part WBC differentials.

3. Fluorescent flow cytometry:

Principle:

- Cell according to dye absorbing capacity shows florescence in the machine and machine analyse the rays of florescence coming from the cell.

PRACTICAL NO.: 15 **DATE**

Procedure:

- Adding fluorescent reagents extends the use of flow cytometry to measure specific cell populations.
- Fluorescent dyes reveal the nucleus-plasma ratio of each stained cell.
- It is useful for the analysis of platelets, nucleated RBCs, and reticulocyts.

Result:

My total blood count values are:

Components	**Values and Ranges**
WBC (white blood cell)	
RBC (red blood cell)	
Hemoglobin (Hbg)	
Hematocrit (Hct)	
Mean corpuscular volume (MCV)	
Mean corpuscular hemoglobin (MCH)	
Mean corpuscular hemoglobin concentration (MCHC)	
Red cell distribution width (RDW) size and shape	
Platelet count	
Mean platelet volume (MPV)	

Observation:

Components	**Definition/Function**	**Interpretation**
WBC (white blood cell)	Five types of WBC protect us from infection	High value shows infection Low value shows autoimmune disease
RBC (red blood cell)	RBC carry the oxygen	High value shows dehydration, lungs disease or cancer Low value shows kidney disorder, bone marrow disorder, haemorrhage
Hemoglobin (Hbg)	Component of RBC that carry oxygen	High value shows living at high altitude, medication side effect Low value shows anemia, Bone marrow disorder
Hematocrit (Hct)	Amount of space in the blood that is occupied by RBC	High value shows dehydration, lungs or heart disease Low value shows anemia, nutrient deficiency, blood lose
Mean corpuscular volume (MCV)	Average size of the RBC	High value shows Vit. B Deficiency Low value shows Anemia, Blood lose

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Components	Definition/Function	Interpretation
Mean corpuscular hemoglobin (MCH)	Average amount of Hb in each RBC	Anemia, Thalassemia, Malnutrition
Mean corpuscular hemoglobin concentration (MCHC)	Average amount of Hb in each RBC compare to the average size of the RBC	Anemia, Thalassemia, Malnutrition
Red cell distribution width (RDW) size and shape	Amount of variation in the size of RBCs	Anemia, Thalassemia, Malnutrition
Platelet count	It helps in blood clotting mechanism	High value shows anemia, certain cancer, bone marrow disorder Low value shows alcohol abuse, certain kidney disease, bleeding and cltting disorder
Mean platelet volume (MPV)	Average size of the platelets	High value shows anemia, certain cancer, bone marrow disorder Low value shows alcohol abuse, certain kidney disease, bleeding and cltting disorder

Signature of Teacher

PRACTICAL NO.: 16 **DATE**

AIM: PERMANENT SLIDES OF VITAL ORGANS AND GONADS

THEORY:

Vital organs: The heart, lungs, kidneys, liver, and spleen are knows as vital organs.

Gonads (Seeds): It includes testes and ovaries, the main function of testes are production of gametes and secretion of hormones.

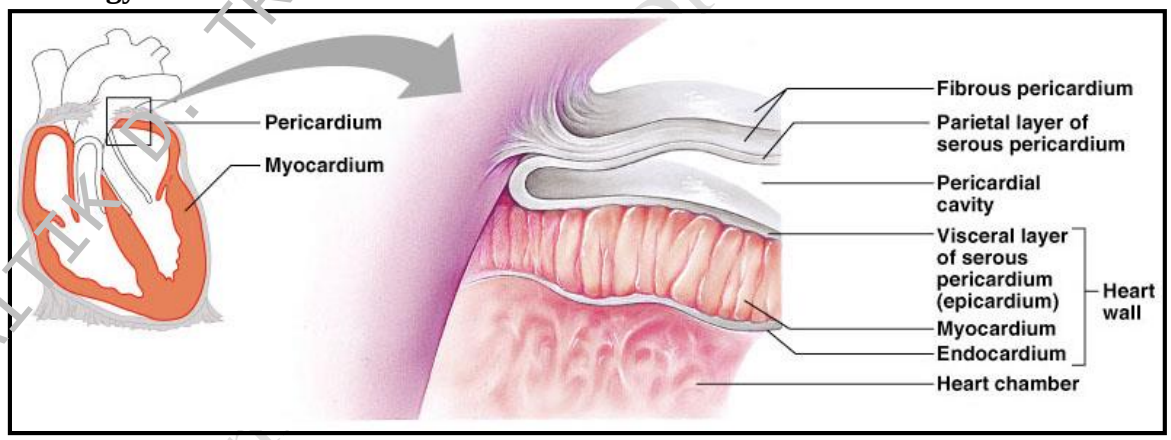
- Male gametes known as sperm
- Female gametes known as oocytes

Procedure:

1. Clean the slide and microscope's eye and objective lenses with the help of lens cleaning paper using any cleaning fluid.
2. Place the slide on the stage of the microscope and observe first under lower magnification and then in higher magnification.
3. Observe various slide and write your observation in record book or journal.
4. Try to draw the diagram as you can observe in the microscope and give label to each and every parts of diagram according to standard figure.

VITAL ORGANS

1. Histology of Heart:



- Histologically, the heart is mainly composed of cardiomyocytes and connective tissue.
- Dense connective tissue with elastic fibers is present in the cardiac/fibrous skeleton.
- Certain stains such as the Masson's elastic trichrome stains can help visualize these components.
- Heart layer is formed by pericardium ("around the heart") which is triple-layered fluid-filled sac that surrounds and protects the heart.
- The pericardium consist of two principle portion:

a) Fibrous pericardium:

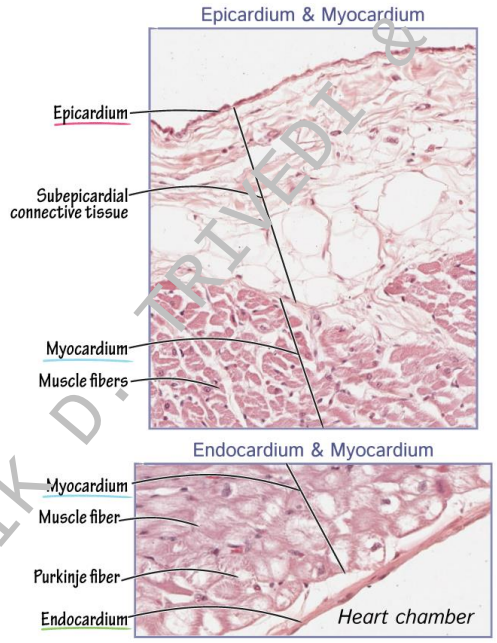
- It is a strong layer of dense connective tissue.
- It adheres to the diaphragm inferiorly, and superiorly it is fused to the roots of the great vessels that leave and enter the heart.
- The fibrous pericardium acts as a tough outer coat that holds the heart in place and keeps it from overfilling with blood.

- It prevents overstretching of the heart, provides protection and fix the heart in mediastinum.

b) Serous pericardium:

- It is a Deep to the fibrous pericardium and form double layer around the heart.
- The outer layer is known as parietal layer which is fused to the fibrous pericardium.
- The inner layer is known as visceral layer also known as epicardium.
- Between the outer layer (parietal layer) and inner layer (visceral layer) is gap known as pericardial cavity filled by fluid is known as pericardial fluid.
- This fluid ac as lubricant and reduces friction between the layer during contraction and relaxation.

Histology of heart shows that human heart is made up by three wall.



a) Epicardium (External layer):

- It is also known as the visceral layer of the serous pericardium.
- It is composed of mesothelium and delicated connective tissue.
- It is the outer or external wall of the heart.

b) Myocardium (Middle layer):

- Myo means muscles so it is made up by cardiac muscles tissue.
- It provides the bulkiness to the heart and it is responsible for the pumping action of heart.

c) Endocardium (Inner layer):

- The endocardium is an innermost, thin, smooth layer of epithelial tissue that lines the inner surface of the heart chambers and valves.

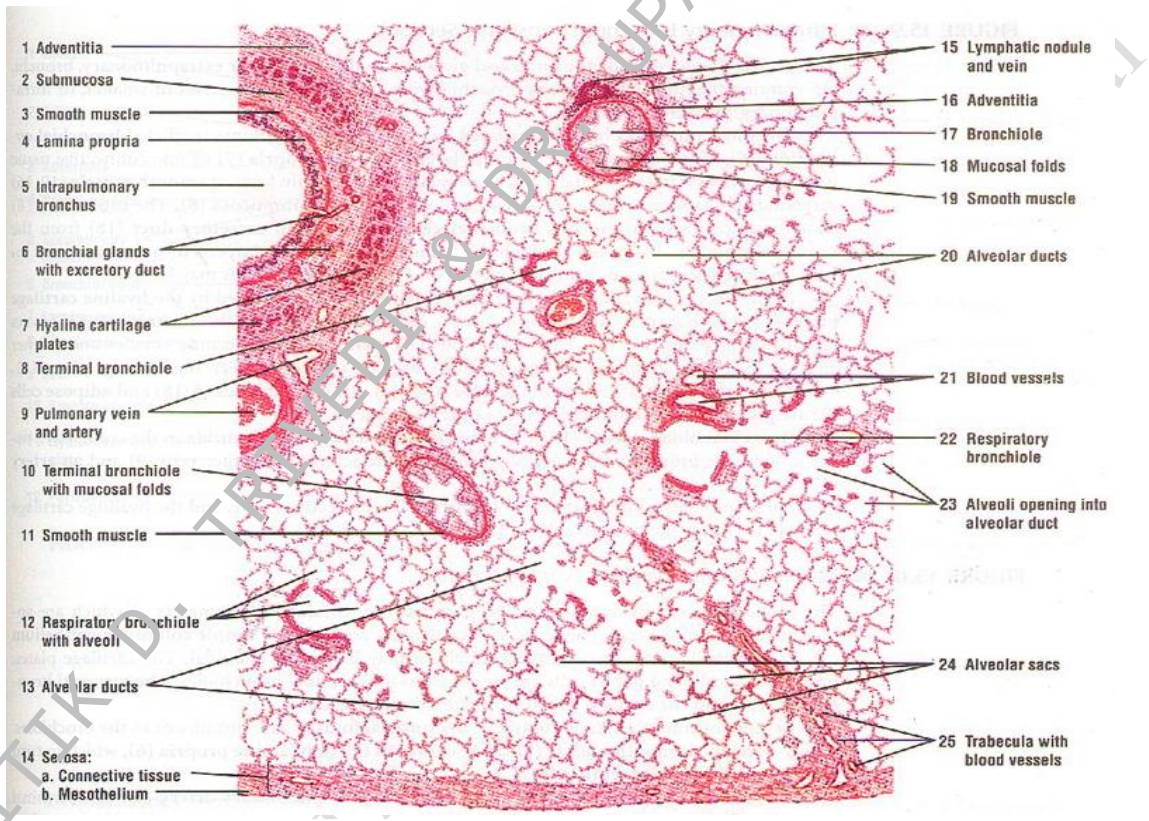
2. Histology of Lungs:

- Each lung is enclosed and protected by a double-layered serous membrane known as the pleural membrane.
- The superficial layer is parietal pleura and the deep layer is the visceral pleura.
- Between the visceral and parietal pleurae there is a small space which is known as the pleural cavity, which contains a small amount of lubricating fluid secreted by the membranes.
- The histological structure of the epithelium and the underlying connective tissue of the bronchi corresponds largely to that of the trachea and the main bronchi. In addition, bronchi are surrounded by a layer of smooth muscle, which is located within the lamina propria. The submucosa Contains muco-serous glands (submucosal glands), The

PRACTICAL NO.: 16 **DATE**

Hyaline cartilage supporting the bronchi is typically found in several small pieces. The cartilage is surrounded by adventitiaSmallest bronchioles have clusters of tiny sacs branching off known as alveoli which produce "grapelike clusters."

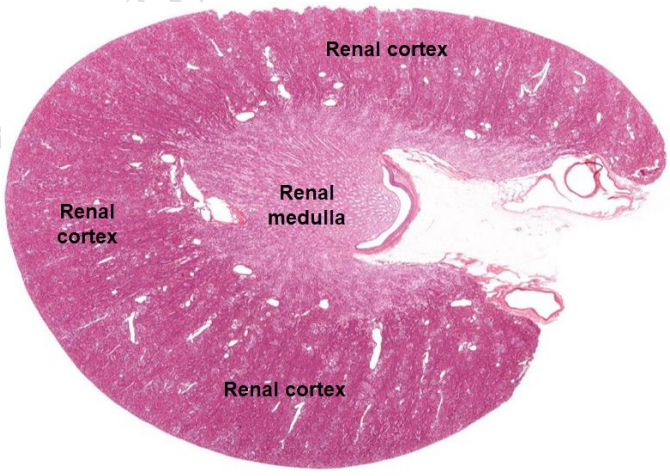
- Each lung consist 300-500 million alveoli. It is made up by Single cell layer of thick squamous epithelium.



Hematoxylin and eosin stained histological section of lungs at low power

3. Histology of kidney:

- Frontal section of the kidney shows two main region: a) renal cortex b) renal medulla

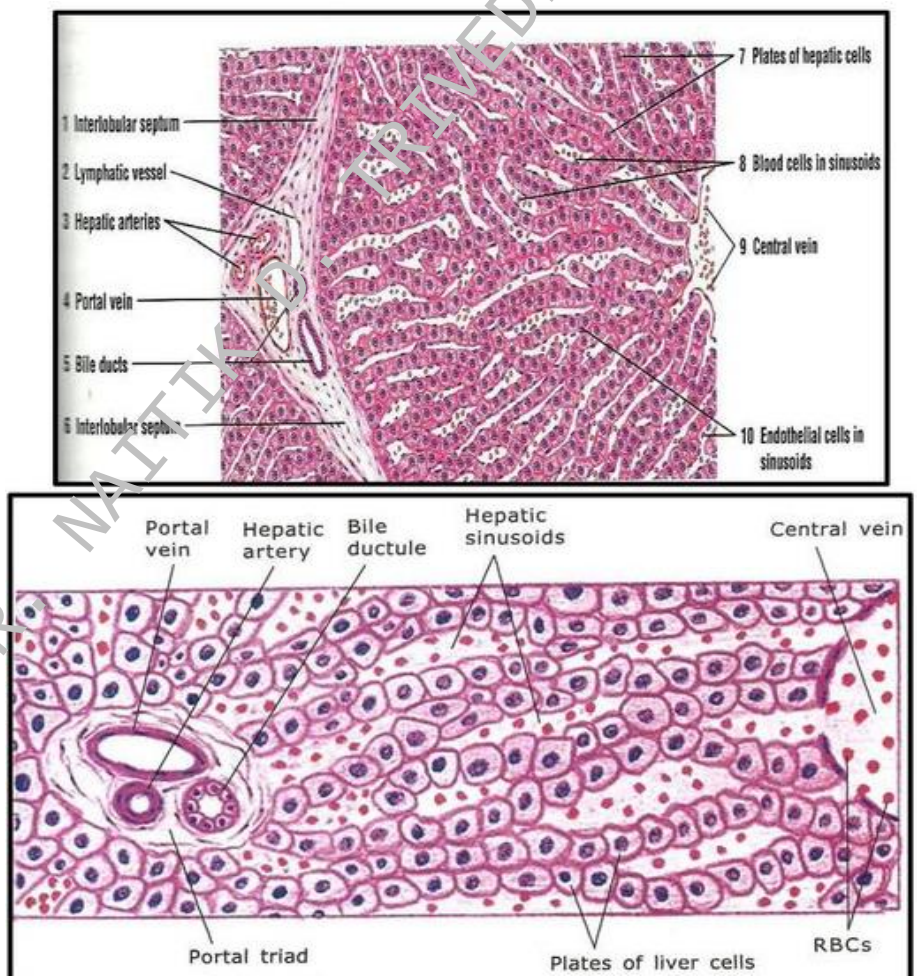


- Renal cortex is a superficial region and it is reddish in color.
- Renal medulla is a deep region and it is reddish brown in color.
- Renal medulla consist 8-18 cone shaped structure which is known as renal pyramid. Base of the renal pyramid faces towards the renal cortex side and apex of the renal pyramid towards centre of kidney side known as renal papilla.

- Between two pyramids there is a gap like portion is known as renal column.
- Renal pyramids and the portion of renal cortex combine together known as renal parenchyma where the functional units of kidney reside that is nephron.
- Each kidney's renal parenchyma consist about 1 million number of nephrons.
- Urine formed by the nephron drains into papillary ducts, below that there is a cup like structure known as major and minor calyces.
- Each kidney consist 8-18 minor calyces and 2-3 major calyces.

4. Histology of liver:

Liver is surrounded by a capsule of fibrous connective tissue called Glisson's capsule. If we look at the liver from an inferior view, which is a view from the bottom of the liver, we can see that the liver is divided into a large left lobe and right lobe, as well as two smaller lobes, called the quadrate and caudate lobes. The liver parenchyma or functional tissue of the liver is organized into thousands of hepatic lobules, which have a dual blood supply that comes from terminal branches of the hepatic portal vein and hepatic artery.



The blood then flows through sinusoids surrounded by hepatocytes before draining into the lobule's central vein.

Hepatocytes are the main functional cells of the liver that perform a large variety of functions, including the production of bile, a number of plasma proteins, and non-essential amino acids; the metabolism of fat, carbohydrate, and protein; the storage of glucose, vitamins, and iron; and the breakdown

or detoxification of metabolic waste products, drugs, and toxins. At lower magnification, the hexagonal shape of the hepatic lobules can be identified by their slightly darker edges and the prominent central veins in the center of each lobule. The portal triad consists of a bile ductule, portal venule, and arteriole. After identifying the lobule, it can be easier to locate portal triads in an image since they're typically located at the corners of the lobules.

If we take a closer look at just one portal triad, we can more easily identify the portal venule by its large diameter and thin walls compared to the arteriole, which has a much smaller diameter and thicker walls.

Similar to this image, the portal tract can sometimes have more than one bile duct. The bile ducts can be identified by their prominent simple cuboidal epithelium. Also in this image are a couple small lymphatic vessels, which have even thinner walls than the venule.

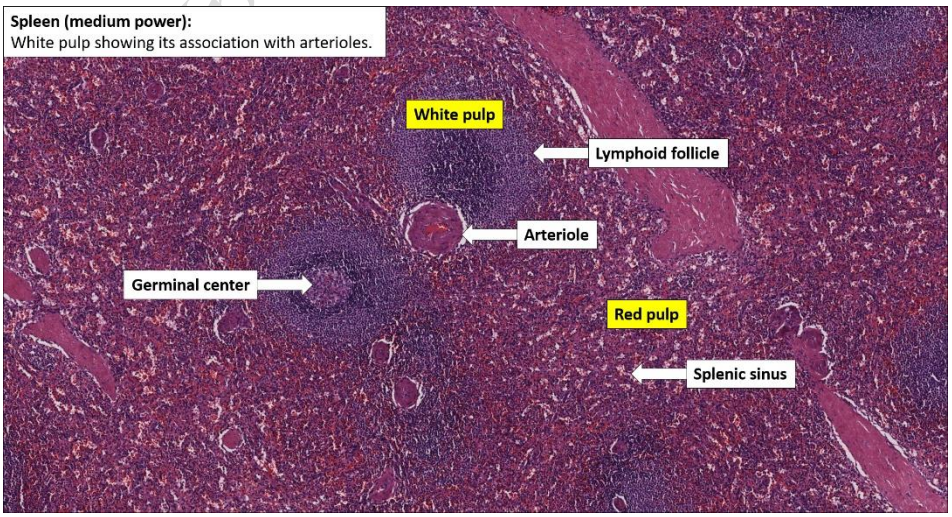
Let's now take a closer look at the hepatocytes, which are large polygonal epithelial cells that form branching plates that are only one-cell thick, separated by sinusoids, and radiate outward from the central vein.

The sinusoids carry blood from the hepatic arteriole and portal venule to the central vein, while the bile canaliculi or capillaries carry the bile produced by hepatocytes in the opposite direction in order to drain into the bile ductules.

The hepatocyte's cytoplasm is very eosinophilic, or pink because they contain a lot of mitochondria.

5. Histology of Spleen:

The spleen is the largest lymphatic organ in the body. It is surrounded by a connective tissue capsule, which extends inward to divide the organ into lobules. The spleen consists of two types of tissue:

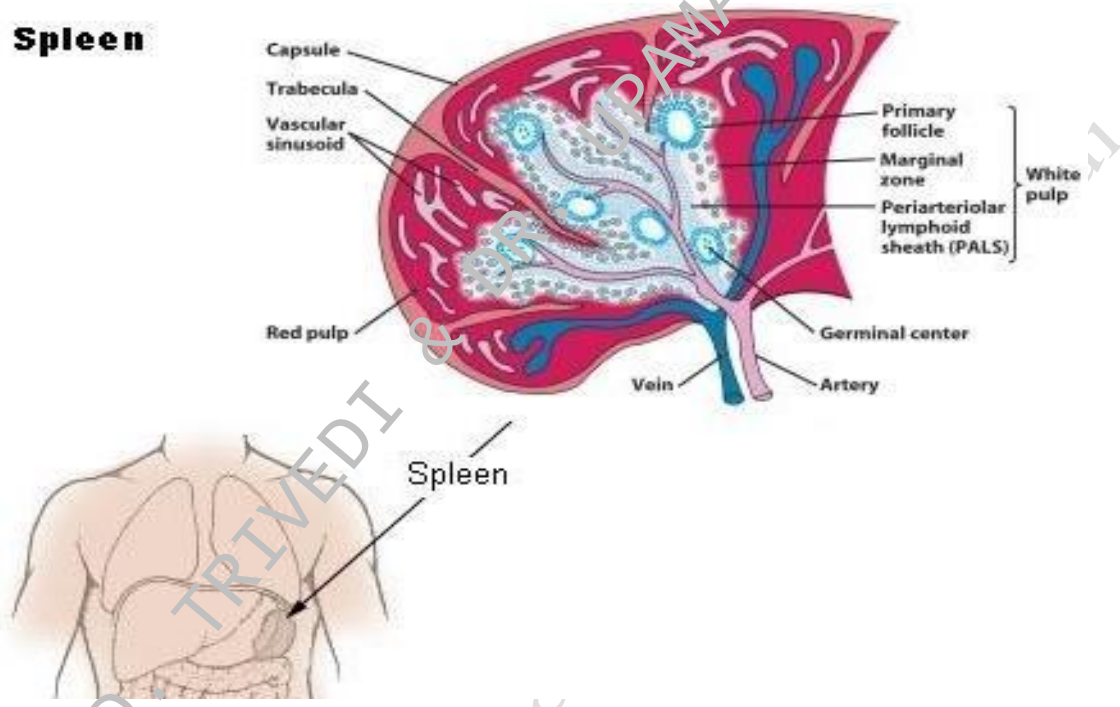


White pulp

Red pulp.

The white pulp is lymphatic tissue consisting mainly of lymphocytes (B cell) around arteries.

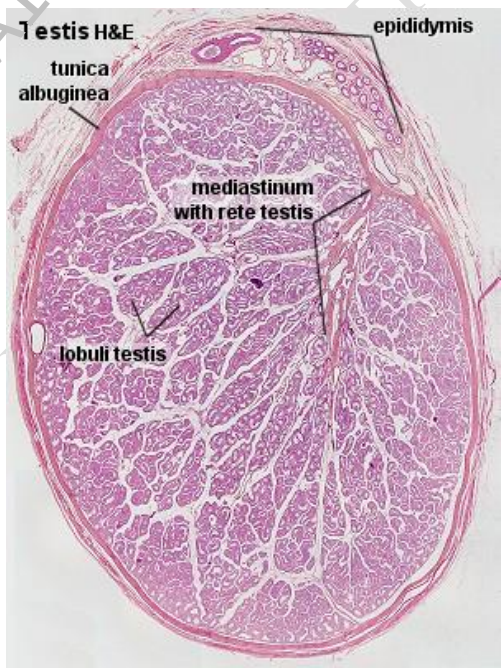
- The red pulp consists of venous sinuses filled with blood and cords of lymphatic cells, such as lymphocytes and macrophages.
- Blood enters the spleen through the splenic artery, moves through the sinuses where it is filtered, then leaves through the splenic vein.
- It does not filter the lymph because it has no afferent artery.



GONADES:

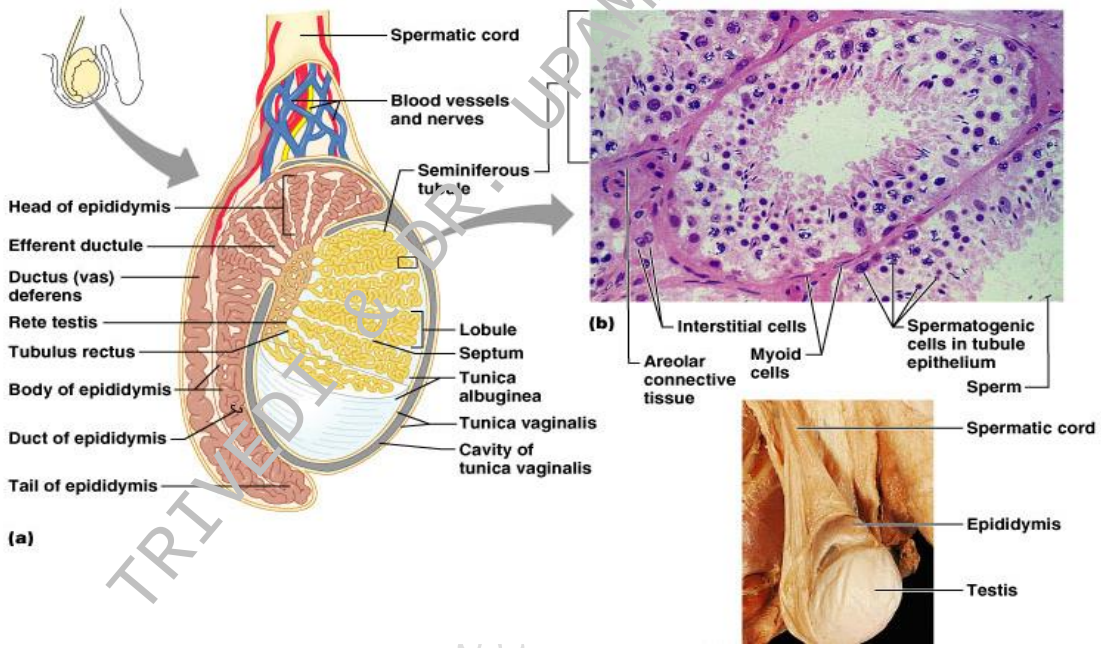
1. **Testis:**

- Testes are formed in abdomen and descend into scrotum at 7th month of development.



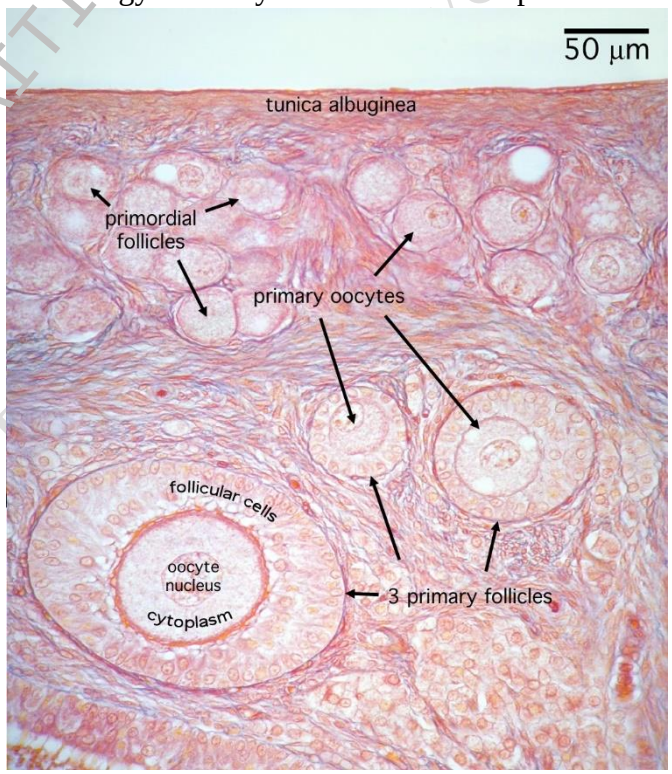
- The testes are paired oval glands.
- It is 5 cm length, 2.5 cm in diameter and 10-15 grams of weight of each testis.
- The outer covering of testes is known as tunica vaginalis made up from serous membrane.
- Internal to the tunica vaginalis dense white fibrous capsule known as tunica albuginea.
- Inside extending portion of the tunica albuginea produce lobules. There are 200 – 300 lobules present in each testis.
- Each lobule consist one to three tightly coiled tubules known as semniferous tubules.
- Seminiferous tubule consist spermatogenic cell is taking part in the production of sperm cell, the process is known as spermatogenesis.
- There many sustentacular cells lie between the spermatogenic cell which produce the tight junction known as blood testes barrier.

- These barriers prevent the activation of immune system against the sperm because spermatogenic cell (sperm) consist surface antigen that are recognize as foreign particle by the immune system.
- The sustentacular cells also secret the fluid for the sperm transport as well as it secret the hormone inhibin which regulate the sperm production by inhibiting the secretion of FSH.



2. Histology of Ovary :

Histology of ovary shows Germinal epithelium. It covers the surface of the ovary and it continues with the mesothelium that cover the mesovarium. Tunica albuginea is a whitish capsule of dense irregular connective tissue extended deep to germinal epithelium. Deep to the tunica albuginea known as stroma. It divided in to the two portions, superficial portion known as cortex and deep portion known as medulla. Ovarian follicle lie in to the cortex region of stoma.



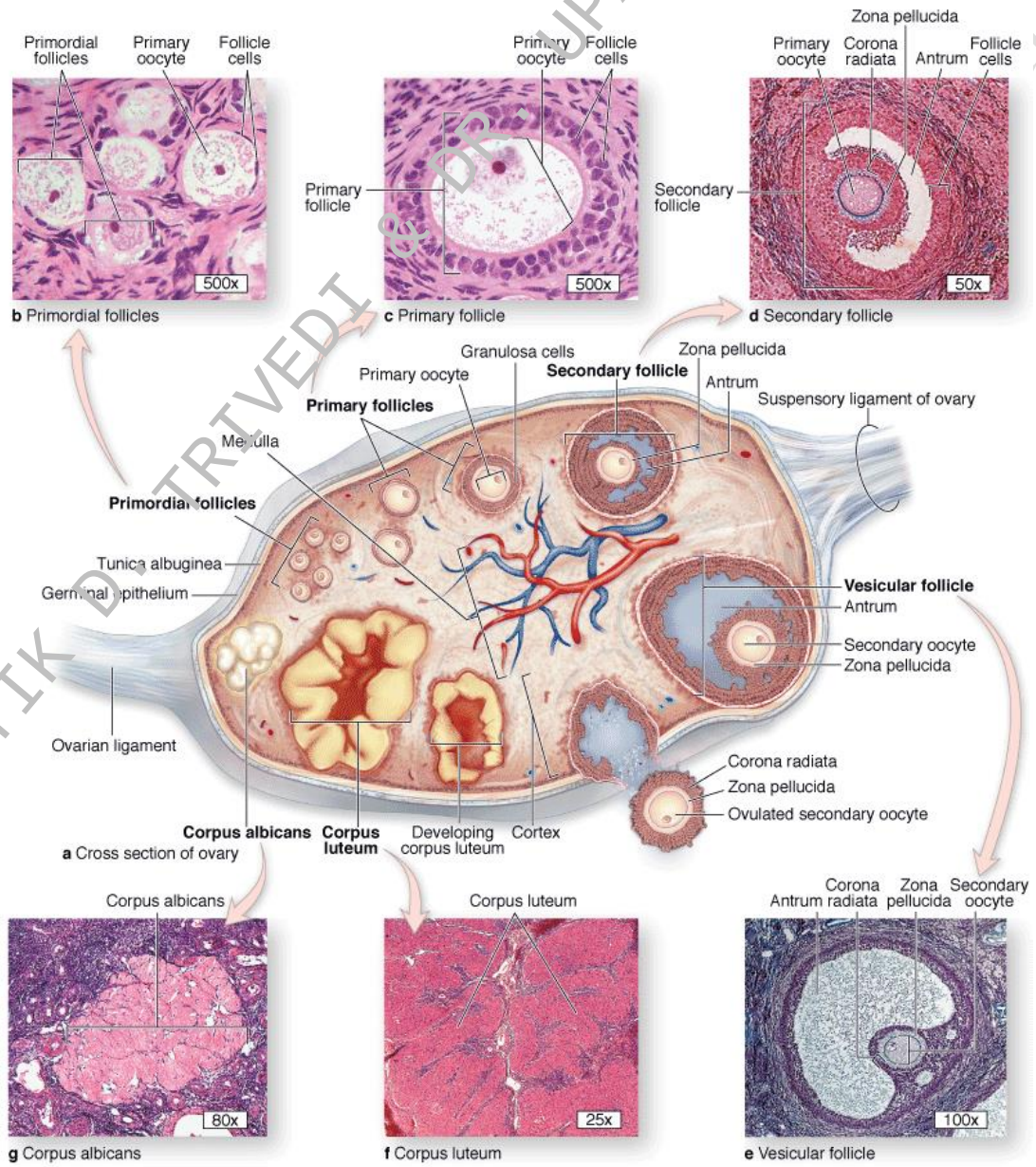
Here the oocytes pass from the various steps of their development with their surrounding cells.

PRACTICAL NO.: 16 **DATE**

The surrounding cells produce single layer known as follicular cells.

Later in developing stage of oocyte, it produces several layers known as granulose.

These surrounding cells secret estrogen and other fluid so follicle grow larger. Mature (Graafian) follicle is a large fluid filled follicle after the rupturation of this follicle secondary oocyte get expel out. Corpus luteum is the remnant of an ovulated mature follicle.



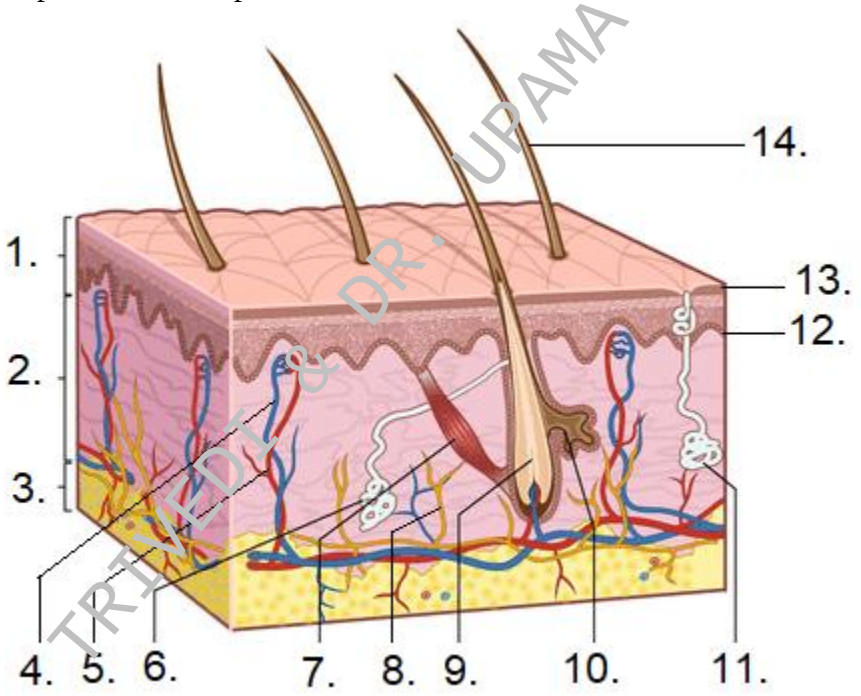
Histological Figure of Ovary

Signature of Teacher

PRACTICAL NO.: 01 **DATE**

AIM: TO STUDY THE INTEGUMENTARY AND SPECIAL SENSES USING SPECIMEN AND MODELS.

1. Write the parts of skin at particular number:



1. -
2. -
3. –
4. –
5. –
6. –
7. –
8. –
9. –
10. –
11. –
12. –
13. –
14.

2. Skin occupy _____ % of our total body weight

   a. 16 b. 20 c. 100 d. 1%

PRACTICAL NO.: 01 **DATE**

3. Skin is made up by _____ and _____ layer

   a. Epidermis & Dermis b. Mucosa & Serosa

   c. Hypodermis & Villi d. Aventis & serosa

4. Skin contains _____, _____, _____ and _____ four principal types of cells:.

   a. keratinocytes, melanocytes, Langerhans cells and mucus neck cell.

   b. keratinocytes, melanocytes, Langerhans cells, and Merkel cells.

   c. keratinocytes, melanocytes, parietal cell, and Merkel cells.

   d. keratinocytes, chief cell, parietal cell, and Merkel cells

5. _____ is a yellow-red or brown-black pigment that contributes to skin color and absorbs damaging ultraviolet (UV) light.

   a. Keratin b. Melanin c. Markel Cell d. Langerhans cells

6. Hypodermis is known as _____

   a. Epidermis b. Dermis c. Subcutaneous layer d. First layer

7. Sweat glands is the example of _____ glands.

   a. **Sudoriferous** **b. Sebaceous** **c. Ceruminous** **d. Mammary**

8. Hair is derived from the _____ layer of skin

   a. Hypodermis b. Dermis c. Epidermis d. Subcutaneous layer

9. Write the functions of integumentary system:

10. Enlist the 5 special senses.

11. In balance and equilibrium, the semicircular canals, which respond to _____.

a. Angular acceleration b. Linear acceleration
c. Triangle acceleration d. Up-down acceleration

12. Describe gaze stability, gait stability, and spatial orientation in brief.

13. Sensation of smell is known as _____

a. Olfaction. b. Auditory c. Gustatory d. Touch

14. Taste buds contain three types of papillae except _____

a. Circumvallate papillae b. Fungiform papillae

c. Foliate papillae d. Budgie papillae

15. Describe The Gustatory Pathway:

16. The eyes are responsible for the detection of visible light, the part of the electromagnetic spectrum with wavelengths ranging from _____

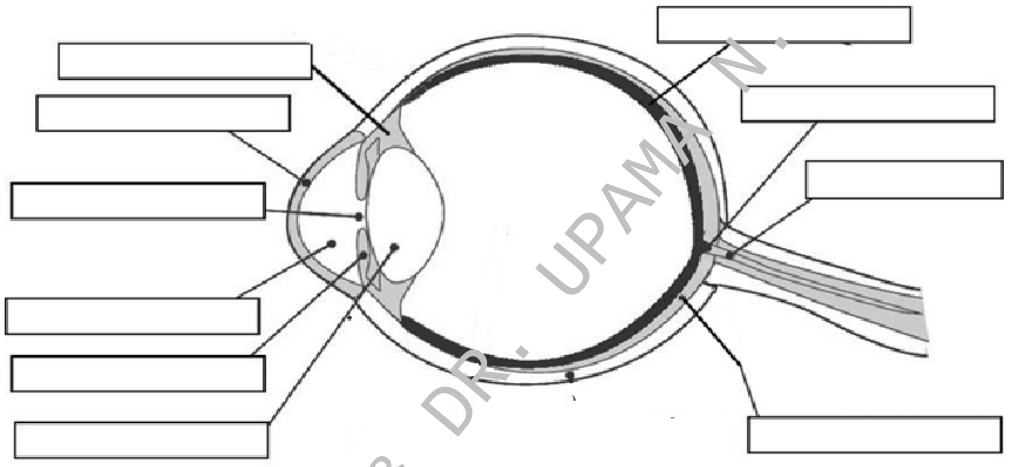
a. 800-1200 nm b. 400-700 nm c. 100-300 nm d. above 1200 nm

17. _____ receptor of eye is useful for color vision.

a. Rod b. Cone c. Gamma d. Delta

PRACTICAL NO.: 01 **DATE**

18. Labelled the given diagram of eye



19. The optic disc is also called the _____

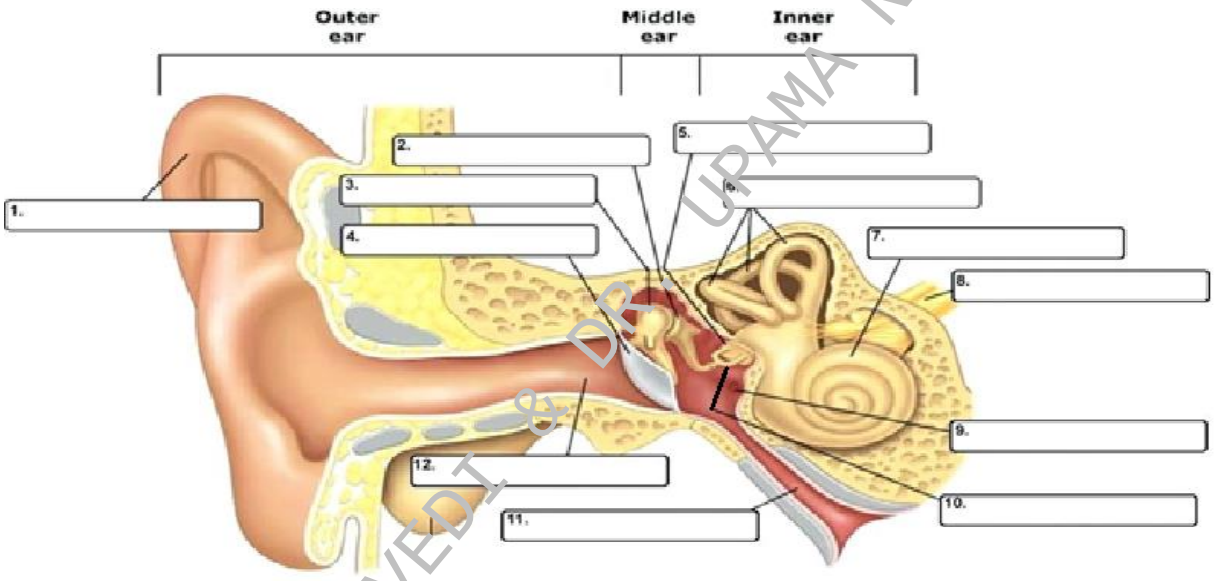
a. blind spot b. Hot spot c. Retina d. Cornea

20. Writ flow diagram of visual pathway.

21. Anvil shape bone in the middle ear is known as _____

a. Malleus b. Incus c. Stapes d. Humorous

22. Labelled the diagram of ear



23. Write flow chart of physiology of hearing.

PRACTICAL NO.: 02 **DATE**

AIM: TO STUDY THE NERVOUS SYSTEM USING SPECIMEN AND MODELS

1. **Write classification of nervous system.**

PRACTICAL NO.: 02 **DATE**

2. **Write difference between sympathetic nervous system and parasympathetic nervous system.**

3. Adult brain consist _____ amounts of neurons and _____ amount of neuroglia.

   a. 100 billion & 1000 billion b. 100 million & 1000 million

   c. 100 trillion and 10 million d. 10 million and 100 million

4. Out of 31 pairs of spinal nerves cervical are _____

   a. 12 b. 8 c. 7 d. 16

5. Cranial nerve II is known as _____

   a. Optic nerve b. Olfactory nerve c. Occulomotor nerve d. Facial nerve

PRACTICAL NO.: 02 **DATE**

6. Draw neat and labelled diagram of brain

PRACTICAL NO.: 03 **DATE**

AIM: TO STUDY THE ENDOCRINE SYSTEM USING CHARTS & SPECIMENS.

1. Write difference between endocrine and exocrine glands.

2. _____ hormone is not secrete by the Hypothalamus
   a. Thyrotropin-releasing hormone b. Gonadrotropin-releasing hormone
   c. Prolactin release inhibitory hormone d. Oxytocin
3. Hormones: Thyroxine is known as _____
   a. Tetraiodothyronine b. Triiodothyronine
   c. Diiodothyronine d. Monoiodothyronine
4. Delta or D cells of pancreatic islet cells secrete _____
   a. Somatostatin b. Glucagon c. Insulin d. Pepsin
5. Write flow char for regulation of aldosterone by renin angiotensin system

PRACTICAL NO.: 03 **DATE**

6. Write flow chart for feedback mechanism of endocrine hormone secretion.

PRACTICAL NO.: 04 **DATE**

AIM: TO DEMONSTRATE THE GENERAL NEUROLOGICAL EXAMINATION

1. Enlist the 7 categories of the neurological examination.

2. Name the test for Optic nerve function assessment.

PRACTICAL NO.: 05 **DATE**

AIM: TO DEMONSTRATE THE FUNCTION OF OLFACTORY NERVE

1. The olfactory nerve is known as

   a. CN 1 b. CN 12 c. CN 5 d. CN 9

2. The human nose can sense _____ basic smells.

   a. 10 b. 15 c. 20 d. 100

3. Enlist types of smell with their examples

PRACTICAL NO.: 06 **DATE**

AIM: TO EXAMINE THE DIFFERENT TYPES OF TASTE.

1. The gustatory system is useful for the sensation of _____
   a. Taste b. Smell c. Hearing d. Balance
2. Enlist the types of taste with examples.

3. Back or rear of the tongue detect_____
   a. Sweet taste b. Bitter taste c. Sour taste d. Salty taste
4. Write flow chart for Physiology of Gustation

PRACTICAL NO.: 07 **DATE**

AIM: TO DEMONSTRATE THE VISUAL ACUITY

1. What is the formula to calculate visual acuity

2. Write Disadvantages of Snellen Test

3. Write the Advantages of LogMAR test.

4. Explain importance of visual acuity test.

PRACTICAL NO.: 08 **DATE**

AIM: TO DEMONSTRATE THE REFLEX ACTIVITY

1. Define reflex.

2. Write flow chart for reflex mechanism.

3. What is Reflex Arc ?

4. Give any two example of reflex action.

PRACTICAL NO.: 09 **DATE**

AIM: TO RECORD BODY TEMPERATURE OF OWN BODY.

1. What is the normal body temperature range of mouth in Celsius.

2. Convert a temperature reading of 101 degree Fahrenheit to Celsius

3. What is hyperpyrexia?

4. Name any 4 types of thermometer useful to record body temperature.

5. Name any four site of body where we can able to measure body temperature.

PRACTICAL NO.: 10 **DATE**

AIM: TO DEMONSTRATE POSITIVE AND NEGATIVE FEEDBACK MECHANISM

1. Name the five parts that regulatory homeostatic mechanism.

2. **Give two examples for negative feedback mechanism.**

3. **Give two examples for positive feedback mechanism.**

PRACTICAL NO.: 11 **DATE**

AIM: DETERMINATION OF TIDAL VOLUME AND VITAL CAPACITY

1. _____ instrument is useful to measure vital capacity/tidal volume.
   a. Spirometer b. Hemoglobinometer c. Cell analyser d. Neubauer chamber
2. In each minutes healthy human doing _____ respiration.
   a. 19 b. 100 c. 108 d. 12
3. Tidal volume is _____
   a. 1200 mL b. 500 mL c. 6000 mL d. 2400 mL
4. Vital capacity is = _____
   a. Inspiratory reserve volume + tidal volume + expiratory reserve volume
   b. Inspiratory reserve volume + tidal volume + expiratory reserve volume
   c. Tidal volume + expiratory reserve volume
   d. Tidal volume + expiratory reserve volume + residual value
5. Minute volume/Total Lungs capacity of healthy human is _____
   a. 6000 mL b. 500 mL c. 1200 mL d. 2400mL

PRACTICAL NO.: 12.1 **DATE**

AIM: TO STUDY OF DIGESTIVE SYSTEMS WITH THE HELP OF MODELS, CHARTS AND SPECIMENS.

1. Enlist the main layer of digestive system

2. Enlist the parts of small intestine.

3. Define digestion.

4. Draw neat and labelled diagram of GIT tract.

PRACTICAL NO.: 12.2 **DATE**

AIM: STUDY OF RESPIRATORY SYSTEM WITH THE HELP OF CHART AND MODELS.

1. Explain types of respiration.

2. Explain the functions of external nose.

3. Enlist the three division of pharynx.

4. Nasopharynx consist how many opening in their wall _____

   a. 10 b. 6 c. 12 d. 2

5. _____ is known as voice box.

   a. Pharynx b. Larynx c. Nasopharynx d. Trachea

6. _____ cartilage prevent the food entry in wind pipe.

   a. Epiglottis b. Arytenoid c. Cuneiform d. Corniculate

7. _____ is known as wind pipe.

   b. Pharynx b. Larynx c. Nasopharynx d. Trachea

8. Differentiate between right lung and left lung.

9. Draw neat and labelled diagram of right and left lungs

PRACTICAL NO.: 12.3 **DATE**

AIM: STUDY OF CARDIOVASCULAR SYSTEM WITH THE HELP OF CHART AND MODELS.

1. Enlist the types of layer of heart.

2. Enlist the wall of heart.

3. Out of four chamber of heart _____ chamber wall is thicker than other.
   a. Right Ventricle b. Left Ventricle c. Right Atrium d. Left Atrium
4. _____ is known as mitral valve.
   a. Right AV Valve b. Left AV Valve c. Semilunar Valve d. Aortic Valve
5. A cardiac cycle include all the events associated within _____
   a. One heart beat b. 72 Hear beats c. 108 Hear beats d. 12 Hear beats
6. Draw neat and labelled diagram of human heart

PRACTICAL NO.: 12.4 **DATE**

AIM: STUDY OF URINARY SYSTEM WITH THE HELP OF CHART AND MODELS.

1. Write the functions of urinary system

2. _____ kidney is slightly lower than _____ kidney.

   a. Right, Left b. Left, Right

3. Each kidney consist _____ minor calyces

   a. 8-18 b. 100 c. 25-28 c. 1 -3

4. Each kidney consist _____ amount of nephrons.

   a. 10 million b. 1 million c. 1 billion d. 10 billion

5. Differentiate between cortical and juxtamedullary nephron.

PRACTICAL NO.: 12.4 **DATE**

6. Draw internal/histological diagram of kidney.

7. Net filtration pressure is _____

a. 30 MmHg b. 45 MmHg c. 10 MmHg d. 15 MmHg

8. Each day kidney filtered _____ amount of filtrate.

a. 180 L b. 108 L c. 12 L 205 L

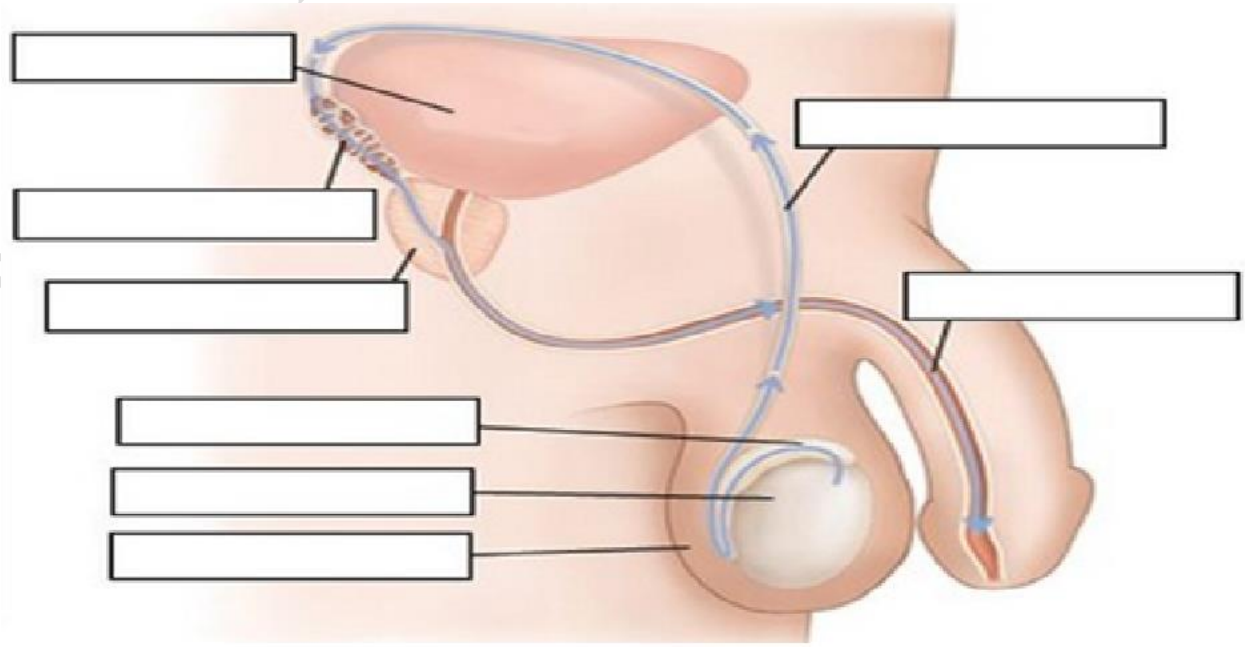
9. The average capacity of urinary bladder to store urine is _____

a. 600-700 mL b. 180 L c. 12 – 15 L d. 205 L

PRACTICAL NO.: 12.5 **DATE**

AIM: STUDY OF REPRODUCTIVE SYSTEM WITH THE HELP OF CHART AND MODELS.

1. _____ contracts produce wrinkle in the skin of scrotum.
   a. Dartos muscle b. Cremaster muscles c. Adipose muscle d. Mastic muscle
2. Each testis consist _____ lobes.
   a. 1000-2000 b. 200-300 c. 10-50 d. 1-10
3. _____ cells produce blood testis barrier.
   a. Sustentacular cells b. Seminiferous cells c. Sperm cells d. Gonad cells
4. Each day _____ amount of sperm produce in healthy adult male.
   a. 20 million b. 50 million c. 1 million d. 300 million
5. _____ is not a layers of the uterus.
   a. Perimetrium b. Myometrium c. Endometrium d. Endocardium
6. pH of semen is in the range of _____
   a. 7.2 – 7.7 b. 14.5 – 16.5 c. 3 – 5 d. 4.5 – 6.5
7. _____ part of the female reproductive system is homologues to male penis.
   a. Vagina b. Clitoris c. Labia majora d. Labia Minora
8. _____ part of the female reproductive system is homologues to male scrotum.
   b. Vagina b. Clitoris c. Labia majora d. Labia Minora
9. _____ gland in the female reproductive system produce milk after child birth.
   a. Sebaceous b. Mammary c. Pineal d. Adrenalin
10. Name the parts of male reproductive system



PRACTICAL NO.: 13 **DATE**

AIM: RECORDING OF BASAL MASS INDEX

1. Write BMI range and their category and risk ratio index.

2. _____ is the formula for BMI calculation.

   a. Body Weight in Kg / Height in (meter)^2 b. Height in (meter)^2 / Body Weight in Kg

   c. Body Weight in (Kg)^2 / Height in meter d. Height in meter / Body weight in (Kg)^2

3. Write down the principle of BMI.

PRACTICAL NO.: 14 **DATE**

AIM: STUDY OF FAMILY PLANNING DEVICES AND PREGNANCY DIAGNOSIS TEST

1. Define family planning.

2. Enlist the methods of contraceptives.

3. _____ hormone is found in urine or blood to detect pregnancy.

   a. hCG b. BCG c. Prolactin d. Melanin

PRACTICAL NO.: 15 **DATE**

AIM: DEMONSTRATION OF TOTAL BLOOD COUNT BY CELL ANALYSER

1. Blood consist _____ amount of WBCs.

   a) 250,000 – 400,00 mm^3 b) 4000 – 11000 mm^3 c) 11000 mm^3 d) 250 mm^3

2. Blood consist _____ amount of platletes

   a) 250,000 – 400,00 mm^3 b) 4000 – 11000 mm^3 c) 11000 mm^3 d) 250 mm^3

3. Enlist the methods for total blood count by hematology analyzer

4. Write the principle of cell analyser.

5. What is MCH and MCHC ?

6. Write the full form of MCV.

7. Hb value of person is high or low who live at high altitude?

PRACTICAL NO.: 16 **DATE**

AIM: PERMANENT SLIDES OF VITAL ORGANS AND GONADS

1. Enlist the vital organs of human body.

2. Heart layer is formed by _____
   a. Pericardium b. Mucosa c. Muscle d. Connective tissue
3. _____ wall of the heart is responsible for the contraction of hear.
   a. Endocardium b. Myocardium c. Epicardium d. Pseudocardium
4. Lung is enclosed and protected by a double-layered of _____
   a. Serous membrane b. Mucosa c. Muscle d. Connective tissue
5. In the histology of kidney, Reddish superficial layer of kidney known as _____
   a. Cortex b. Medulla c. Papillae d. Calculi
6. _____ are the main functional cells of the liver
   a. Hepatocytes b. Basal Cell c. Mast Cell d. Covering cell
7. Why spleen does not filter the lymph?

8. Testes are formed in abdomen and descend into scrotum at ____ month of development.
   a. 6^{th} b. 7^{th} c. 9^{th} d. 3^{rd}
9. Mature follicle cell in the ovary is known as _____
   a. Graafian follicle b. Germinal Follicle c. Albican follicle d. Oval cell

GUJARAT TECHNOLOGICAL UNIVERSITY

B.Pharm

SEMESTER: II

Subject Name: Human Anatomy and Physiology II
Subject Code: BP201TP

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy

Objectives: Upon completion of the course student shall be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Sr No	Topics	% weightage
1.	**Nervous system:** Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts,reflex activity)	10
2.	**Digestive system** Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT **Energetics:** Formation and role of ATP, Creatinine Phosphate and BMR.	6
3.	**Respiratory system** Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods **Urinary system** Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine	10

	formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney	
4.	**Endocrine system** Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.	10
5.	**Reproductive system** Anatomy of male and female reproductive system. Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition. **Introduction to genetics** Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	9

Practical

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism
11. Determination of tidal volume and vital capacity
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens
13. Recording of basal mass index
14. Study of family planning devices and pregnancy diagnosis test
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A

6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkat