Neutral Control & Coordinations

Syllabus

Neutral Control & Coordinations

Sensory System

Name : _____ Contact No. _____

SENSORY SYSTEM

Animals possess some specialised structures to perceive the different type of changes (= stimuli) occurring in their external environment. These structures are known as **sense organs**. After receiving these stimuli, sensory organs transmit these to the central nervous system through the sensory nerve fibers.

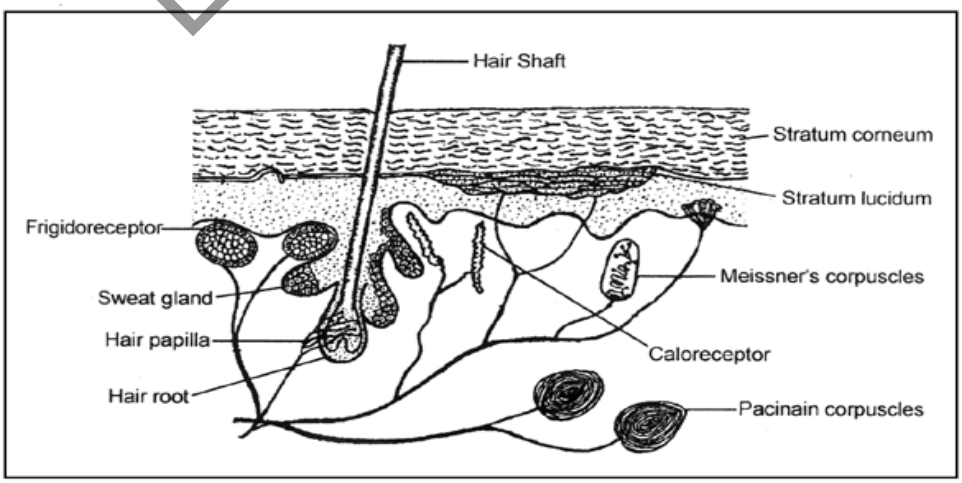
A sensory organ is only sensitive to a specific kind of stimulus to which it is specialized like temperature, chemicals, touch, light etc. Based on their location in the body sensory organs are of three. types :

1. **Exteroceptors : -** These sense organs receive stimuli from external environment because they remain in contact with the external environment. Example – nose, eyes, tongue, ears and skin.
2. **Interoceptors :** These sensory organs are associated with internal environment of body and receive the changes taking place in the internal environment. Examples – changes in the composition of blood, concentration of carbon-dioxide, hunger, thirst, asphyxia etc.
3. **Proprioceptors :** These sensory organs are present in joints, tendons, muscles and connective tissues which perceive the tension and pressure exerted during the activities of equilibrium maintenance and orientations of body.

In human body, five types of exteroceptors are found which are known as sense organs. The main sense organs include skin, eye, nose, ear and tongue.

CUTANEOUS RECEPTORS

Skin envelopes the entire body, and it is considered as tango receptor (fig.) Numerous sensory papillae are found in the dermis of skin to receive the stimuli of touch, pressure, cold, heat, temperature and pain. All these are of simple type of receptors. These sensory structures of skin receive impulses from the nerve endings in skin. These are of following types -



1. **Tactile Receptors : -** These receptors are present nacked endings of sensory nerve fibres on the hair follicles in the dermis of skin. These are excited when the hairs come in contact with some object.

Extensively branched (arborized) endings are of sensory nerves are found in the papillae of dermis. These endings are very small sized encapsulated structures called sensory corpuscles. Those which are

cylindrical and sensitive to touch are called **Meissner's corpuscles**. Their number is much more in nipples, lips, glans penis, palm, sole and in fingers. The number of these corpuscles decreases as a person grows older. The corpuscles sensitive to the strong and sustained contacts (pressure) and situated deep in the dermis and called as **Pacinian corpuscles**.

2. **Pain Receptors (Algesireceptors) :** Numerous branched sensory nerve fibres are scattered among the epidermis as well as dermal cells of skin. These possess nacked nerve endings. These nerve endings are sensitive to chemical, electrical, and mechanical stimuli, which cause the sensations of pain in body.

3. **Thermo Receptors :** A network of sensory nerve fibres is situated closely to the hair follicles in dermis of skin. These nerve fibres are sensitive to the stimuli related to temperature, These thermoreceptors make a person aware to stimuli of cold, heat etc. Because of this sense perception our hairs get erected during excessive cold. The sensory organs excited by cold and heat are known as **frigidoreceptors**.

EYE

- Eye and ear also called **"teleoreceptor"**, because these receive impulse from far places.

(A) Eye (Photoreceptor) : -

- These are photosensitive organs. Eye ball measures about 2.5 cm in diameter.
- Each eye is an empty ball like round structure, it is called eye ball. Each eye ball is situated in the notch of frontal bone of the skull. It is called "Eye orbit". Human eyes are situated in eye orbit lateral to nose.
- Only $1/5^{th}$ part of whole eye is seen from out side the eye orbit, called as cornea.
  Remaining $4/5^{th}$ part is in the eye orbit, called sclera.

(1) Eye lids or palpebrae : -

There are two muscular eyelids for the protection which having lashes at one side. Both the eyelids are named according to their situation i.e. upper & lower eyelids.

- Eyelids are immovable in snakes. Eyelids of fishes are absent.
- There is present one more transparent membrane on the cornea. It is called nictitating membrane or third eye lid. It is actively working in rabbit. It is found form of constricted condition at one corner of eye ball, but at the time of need, it may be expanded over entire eye ball.
- Nictitating membrane is vestigeal in human. It is also called **"Plicasemilunaris"**
- Eye lashes are found at both the eyelids.

(2) Glands : - For the cleaning and for lubrication/moisturising the exposure part of eye.
Following glands are founds in each eye.

(a) Meibomian glands : - These are present at Inner surface of eyelids. They secrete an oily substance, which spread over cornea.

- It prevent firction between two eye lid.
- It also help in frictionless movement of eyelid.

(b) Lacrimal glands : - At outer angle of each eye ball and assoicated with accessory lacrimal gland, which secrete water like substance, which moistures the cornea, eyelids and conjunctiva and cleans it. This water like subatnace is called "Tear". (Slightly alkaline contains bacteriolytic enzyme Lysozyme)

- Tear glands activate after four months of birth in human child.

(c) Gland of zeis : It is situated in margin of eye lid.

Harderian glands : - These are found inside the lower eye lids. These moisten the nictitating membrane.

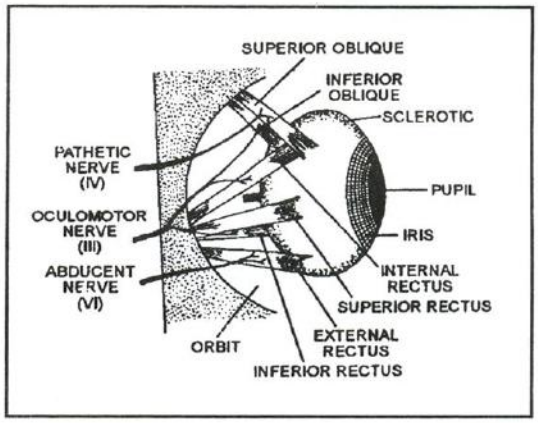
- Harderian glands are absent in rabbit & **human**.
- In place of harderian glands, in mammals, meibomian glands are present. But in some mammals e.g. rats, shrews, whales etc., these harderin glands are found.
- These glands are also found in frog and birds.

(d) Gland of moll : - These are modified sweat gland found in the eye lashes.

(3) Muscles of eye balls : -

There are present 6 voluntary muscles in the eyeball which help to rotate the eye ball into eye orbit. Out of these 4 are rectus muscles and 2 are oblique muscles. They are also called as extra occular muscles.

- Lateral or External Rectus muscle rotates the eyeball towards outside i.e. from nose to ear. Medial or Internal rectus muscle rotates the eyeball toward inside i.e. from **ear** to nose.
- Superior rectus muscle and inferior oblique muscle collectively help the eyeball to rotate upwards.
- Inferior rectus muscle and superior oblique muscle collectively help the eyeball to rotate downwards.
- Rectus and oblique muscles collectively rotate the eye ball to all the sides around its axis.



- Any defect in one of the these eyeball muscles (e.g. muscle may remain small or extra large than required) causes **strabismus** or **squint eyes**. In this defect, eye ball remains inclined to any of the one side. Eye muscles are innervated by occulomotor (III). Pathetic (IV) and Abducens (VI) Nerve.

INTERNAL STRUCTURE OF EYE BALL :

The wall of remaining eye ball has three layers.

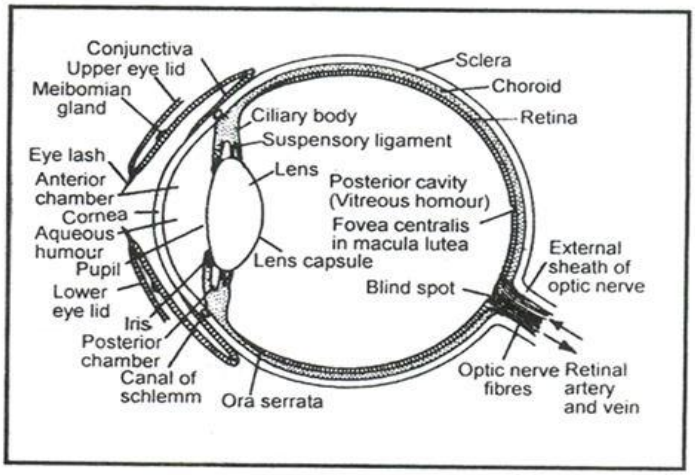
(1) Fibrous tunic : -

- It is mesodermal in origin.
- It is the outermost covering of eye ball. It is made up of hard and thick fibrous connective tissue. It is also called as sclerotic layer.
- The layer is divided into 2 parts.

(a) Cornea : -

It is the outer visible part of fibrous tunic.

- The joint between cornea and sclerotic layer is called **"Limbus"** or "Sclero – corneal junction". Cornea transplantation is successful because it lacks blood vessels.



(b) Sclera : -

It is made up of white, hard, opaque thick fibrous connective tissue in mammals but in frog, it is made up of cartilage. It is the inner portion of eye ball. It is non-vascularised. This layer is of white colour, so it is also called "White of eye"

Inner layer of eyelids remain streched over anterior part of sclera (limbus) in the form of translucent membrane. It is called **conjunctiva**. It is made up of epidermis of skin. The thinnest epidermis is extend up to margin of cornea i.e. conjunctiva is the thinnest epidermis in animal body.

(2) Vascular tunic : -

- It is also mesodermal in origin.
- It is made up of network of blood capillaries.
- It is the middle layer of eyeball Due to the presence of network of blood capillaries it is highly vascularized. Melanin pigment is found in this layer. Due to the presence melanin pigment eye looks like green, blue, brown, black in colour. Eyes of rabbit are red due to red melanin pigments, and in man eyes may be brown, black, blue, green according to the melanin present in it.

This layer has three parts : -

(a) Choroid layer : -

Choroid layer is the part of vascular tunic which lie below the sclerotic layer.

It contains abundant pigment cells & blood vessels.

It is dark brown. It darkens the cavity of eyeball to prevent internal reflection of light.

It nourishes the retina.

(b) Ciliary body : -

It is the lower swollen portion below limbus.

It has ciliary processes which project into eyeball.

It has ciliary muscles (i) circular (ii) meridional.

Inner end of meridional is attached to choroid & outer end at the junction of sclera and cornea.

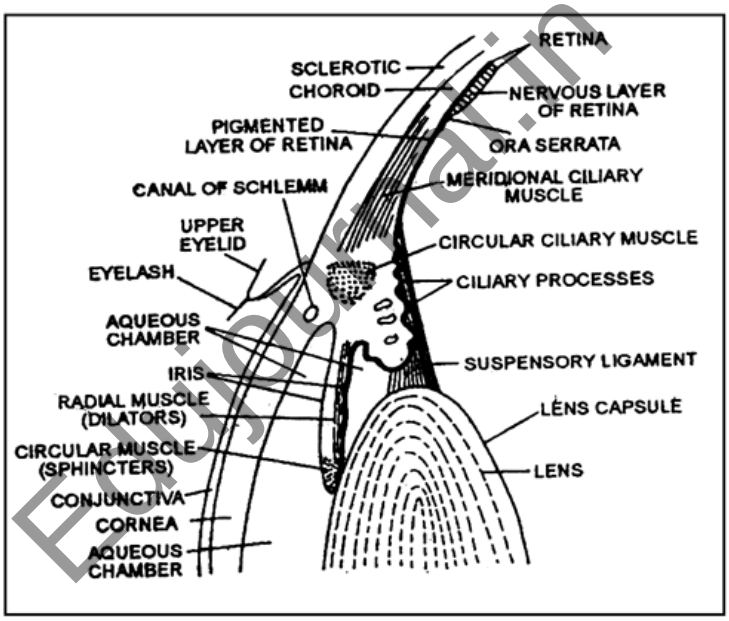
(c) IRIS : -

Choroid layer of vascular tunic separates from sclerotic layer (Just after the cornea) inclines towards inner side and forms a coloured screen, it is called **Iris**. **Muscles of Iris are ectodermal in origin.** There is present an aperture in the Centre of Iris, it is called **Pupil**. Light rays enter in the eye ball through pupil.

2 types of muscles are found with Iris.

(a) Radial dilatory muscles : -

These are outer Involuntary muscles, these are expanded in the iris breadth wise. Iris becomes thick and narrow if these muscles contract and diameter of pupil is increased at that time. It happens in dim light, it is called **Mydriasis**.



(b) Circular sphincter muscles : -

These are scattered in inner part of iris. Due to the contraction (In bright day light or high flashes of light) of these muscles in high light, Iris expands breadth wise and diameter of pupil is decreased. It is called **miosis**.

Iris controls the intensity of light by increasing or decreasing the diameter of pupil i.e. Iris acts as diaphragm of a camera. Except muscle of iris & ciliary body all vascular tunic of eye ball is **mesodermal** in origin. The parasympathetic fibres constrict & sympathetic fibre dilate the pupil. Colour of eye like blue, gray, brown is layer of pigmented cells.

3 Neurosensory tunic : -

- This layer is ectodermal in origin.
- It is the inner most layer of eye ball and has 3 parts : -

(1) Pars ciliaris : - This part is attached with ciliary bodies. There are present spine like projections at the surface of ciliary body, these are called **"Orra serrata:**

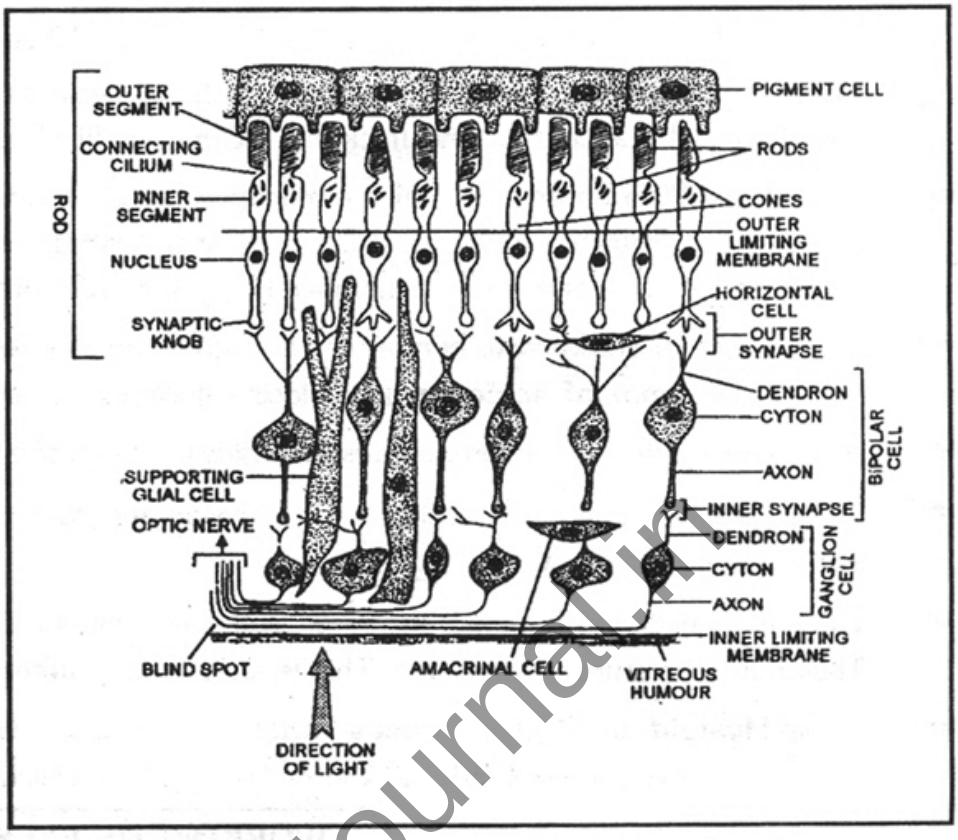
(2) Pars iridica : - This part lies just after the iris. It has a layer of pigmented cells.
Pars iridica and pars ciliaris are made up of simple cuboidal epithelium.

(3) Pars optica : - It is also called **Retina** It is the part just below the choroid layer.
Structure of retina is complicated. It has following layers.

(a) Pigmented layer : - It is the outer most layer. In the cells of this layer, pigment is found called melanin (receptor cells.)

(b) Sensory layer : - This layer is made up of specialized sensory cells. Rods and cones are found in this layer. Receptor cells are also known as photoreceptors/visual cells.

- Rods are long, thin, cylindrical structures/cells. These are nmerous in number. (1110 – 1125 Lacs)
- Rods are differentiates the light and dark. They are more sensitive than cones.
- A purple coloured pigment is found in rods called **Rhodopsin/Visual purple.**
- Cones are thick and small cells which differentiate among different colours in full light (65 Lacs) **Iodopsin/Visual violet** is present in cones.
- Only rods are found in the retina of owl, because it is nocturnal animal, unlike hen which has only cones in its retina.
- Cones are absent in the retina of most of the nocturnal mammals like shrews, bats etc. squirrel has only cones in its retina.
- A neurons layer is present just below the rods and cones. The synapse layer which, developes between photo sensory cells and bipolar neurons are called as outer plexiform layer.
- Each bipolar neuron has a dendron and one axon.



- Axons are jointed together by specific nerve cells, called **Amacrine cells**. Such neurons do not have nerve fibres.
- In between bipolar neurons, supporting cells are found which, are called as **Muller's cells**.

(c) Ganglionic layer : - This layer is made up of multiple nerve. The dendrites of multipolar nerve form synapses with axons of bipolar neurons. This layer of synapse is called as inner plexiform layer.

Axons of all nerve cells combine to form optic nerve. This optic nerve penetrates the retina and goes to brain.

At the point place, at which retina is pierced by optic nerve, cones and rods are absent. So no image will be percieve at that place. This point place is known as **"Blind spot"**.

Just above the blind spot at the optical axis of eye ball, there is a place, where only cones are present. Yellow pigments is found (xanthophyll) in these cones. So this place is known as **yellow spot** or **macula lutea** or **Area centralis**.

- A groove or notch is found in area centralis, called **fovea centralis**. Fovea centralis contain only cone cells.
- Fovea centralis is most sensitive part of eye. Cones are some what obliquely placed at this place. An enlarged image of object is formed here.
- **Lens :** - It is ectodermal origin.
- A transparent, biconvex lens is present just after iris. In frog, lens is spherical in eyebal.

- Lens is connected by ciliary body with the help of **"Suspensory ligaments"** also called as **zonula of zinn"** or **zonules**. These ligaments are flexible and this can slide the lens and can change it's focal length. Lens ans suspensory ligament divides the cavity of eyeball into two chambers.

(a) Aqueous chamber : -

The part of eye ball which lies between cornea and lens is filled with an akaline liquid, it is called aqueous humor. It is a type of transparent tissue fluid. It's divided aqueous chamber into two parts.

(i) Anterior chamber : -

This chamber lies between cornea and iris, it is also called as Venous chamber. Veins carry CO_2, metabolic wastes outside from here.

(ii) Posterior Chamber : -

This chamber lies between iris and lens, it is also called as arterial chamber. Arteries supply O_2 and nutrients here.

(b) Vitreous chamber : - Cavity of eye ball which lies between lens and retina is called vitreous chamber. A jelly like liquid (transparent and thick like albumin) is filled in this chamber, This is called vitreous humor.

- In this liquid 99% water, some salts, a mucoprotein called vitrin and a mucopolysaccharide-Hyaluronic acid are present. Gelatinous nature of vitreous humor is depend upon fibrillar protein & hyaluronic acid. It is form during embryonic stage. In this chamber Hyalocytes cells are found.
- Aquous humor and vitreous humor both the liquids are secreted by the glands of cilliary body. Canal of Schlemm is present between limbus and ciliary body . Aqeous humor leak out by **canal of schlemm** into blood capillaries and again reach upto their veins.
- Both these liquids maintain proper pressure inside the cavity of eye ball. These check the eye ball from collapsing.
- If this canal of schlemm is blocked by any reason and fluids do not return back to veins liquid is increased in the chambers of eye.
- When amount of this humor is increased in the eye chambers then pressure is increased inside the eye ball . Thus retina pressure is increased. This is known as **glaucoma.**
- A thin **Hyaloid canal or Cloquet's or Cloquet's canal** is also found in vitreous humor from blind spot to central point of lens. It provide nourishment to the developing lens which gradually atrophied.

WORKING OF EYES

- Light ryas emitted by any object enter the eye. A small, real and inverted image of object is formed at retinal Sensory cells of retina are sensitized, and optic nerve carries this impulse to brain . At this time animal able to see the object.

- Cornea, aqueous humor biconcave lens and vitreous humor completely refract the light rays coming from ojbect. As a result of this an inverted image is formed at retina. Just like diaphragm of a camera. is Iris of eye, decreases or increases the diamter of pupil acoording to amount of light. Iris expands to decrease the pupil in high intensity
  of light so a small amount of light touches the retina. When light is dim, iris itself constricts to increase the diameter of pupil.

ACCOMODATION OR FOCUSSING -

The ability to change the focal length of lens by changing the curvature of lens, is called **accommodation** power.

- Only mammals and birds have this accommodation power in their eyes.
- This ability is very less in frog and it depends on the sliding of lens forward and backward to some extent.

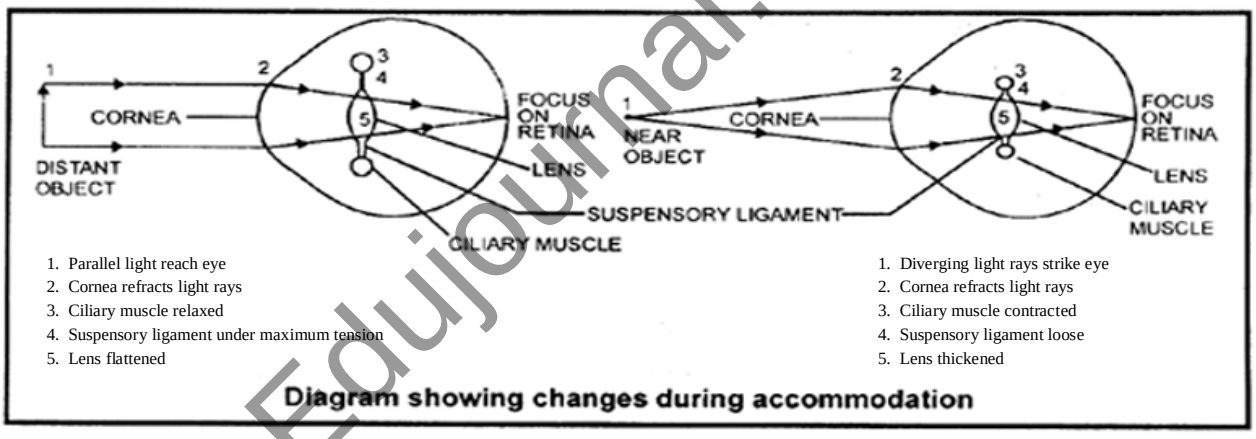


Diagram showing changes during accommodation

- In normal condition muscle fibres of ciliary body remain relaxed and lens is stretched by its suspensory ligaments, and due to this lens is flat. A flat lens has more focal length. As a result of this eye can see long distant objects easily.
- To see near by objects, sphincter muscles of ciliary body contract and ciliary body becomes broad, suspensory ligaments becomes loose and relaxed. As a result of this relaxation lens becomes biconvex, and now tis focal length is reduced. Now animal is able to see near by object easily.

TYPES OF VISION :

(a) Monocular vision or panoramic vision : - Most of the vertebrates have their eyes situated on the lateral sides of head and due to this animal is capable to see the large area of both the sides. It is called monocular vision.
e.g. rabbit, frog, horse (Most of the herbivorous animals have this type of vision)

(b) Binocular vision : - Most of the carnivores mammals have eyes in front of their heads and side by side, so as to focus on one object by both the eyes. It is called binocular vision e.g. Man, monkeys and apes.

(c) Stereoscopic vision : - It is three dimensional vision found in human.

(d) Telescopic vision : - This is found in birds.

- Largest eyeballs are found in horse.
- Sharpest vision is found in eagle.
- Shortest sight is found in monkeys.

Chemical explanation of vision -

Cones and rods of eye are stimulated by light rays. It is a chemical event.

- A shiny visual purple pigment is found in rods of retina called Rhodopsin. It is formed by a protien **opsin** and a coloured pigment **Retinal,** just like haemoglobin of blood.
- Opsin is also called **scotopsin.**
- In bright light. rhodopsin is decomposed into opsin protein and retinal pigments. This chemical change is sight impulse. This sight impulse is carried by optic nerve to the brain, and animal is able to see.
- In dark, rods synthesize rhodopsin again with the help of opsin, retinal and enzyme.
- This is the reason that we can not see any thing, when we move to dark place from a enlighted place (for some time only) In the same way we are unable to see in light if we are coming from dark place because it will take time to synthesize or decompose the rhodopsin
  it is called adaptation of eye.
- For resynthesis of rhodopsin, animal blinks its eyelids.
- Retinin is fomred by vitamin A so deficiency of vit A caused night blindness.
- Cones able us to differentiable among colours and bright light. Cones have a pigment called Iodopsin in place of rhodopsin of rods. It is decomposed into **photopsin** and **retinal.**
  There are three types of cones in retina : -

(a) Erythrolab - Red cones (erythropsin – Sensitive to red)

(b) Chlorolab - Green cones (Chloropsin – Sensitive to green)

(c) Cynolab - Blue cones. (Cynopsin – Sensitive to blue)

- We are able to acknowledge different colours due to these three types of cones their combination.
- In moon light we cannot see colours because only rods are functioning . Due to low light level cones are not functining.
- **Red, green** and **blue ar the primary colours.**

Dimlight vision - Scotopic vision

Bright light vision - Photopic vison

- The eyes of some animals shine at night, because in the eyes of these animals, there is a pigment just outside the retina in the choroid layer of eyeball, which reflects the light rays coming from retina. This layer is called **Tapetum.** Due to this layer, these animals are capable to see in dark also.
- Kangaroo, hoofed mammals, elephants, whales etc. are having a silver shining layer of fibrous connective tissue called Tapetum **fibrosum.**
- In Elasmobranch fishes a reflecting colour pigment called **Guanine** is present is tapetum layer so it is called **tapetum lucidum.**
- Hunters and carnivore mammals like dogs, cats, tiger etc. have a layer in their retina called **tapetum cellulosum.**
- In the eyes of birds a comb like structure of blood vessel is present which, is called **pecten.**
- **Emmetropia : -** Normal vision of eyes is called emmetropia.

Some important defects of eyes : -

1. **Hypermatropia (far sightedness) : -**

- In this defect of eye, person is able to see object placed at far distance but is unable to clear see obejcts close to him or her.
- This defect is due to small size of eyeball or flatness of lens. In this defect image is formed **behind the retina.** To cure this defect person should wear convex lenses in spectacles.
- Sometimes in old age this defect may occur due to reduction in the flexibility of lens or ciliary body, then it is known as **presbyopia.**

2. **Myopia or Nearsightedness or short sightedness : -**

- In this defect of eye, person is able to see objects near/close to him or her but is unable to see objects placed at far distance.
- This is due to enlargement of eyeball or increased convexity of lens.
- In this defects image is formed before the retina because light rays coming from distant objects converge before retina.
- To overcome this defect person should wear concave lenses in spectacles.

3. **Astimgmatism : -** In this defect curvature of cornea is changed as a result of that light rays do not focus on macula lutea but somewhere else, causing incomplete blurred vison. This defect may be cured by cylinderical lenses.

4. **Night blindness : -** This is due to deficiency of vit A. In this disorder synthesis of Rhodopsin is decreased.

5. **Xerophthalmia : -** it is due to keratinisation of cunjunctiva and cornea, and conjuctiva becomes thick. It is also due to deficeincy of vit A.

6. **Trachoma : -** In this defect of eye, a watery fluid oozes out from eyes in excess amount so eyes become red due to irritation. It is caused by a mircrobe Chlamydia trachomatis.

7. **Strabismus : -** It is due to loosening or contraction of the any of 6 voluntary muscles which give the proper position to the eye ball in its orbit. Thus eye ball inclines towards one side of orbit. It is strabismus or squint eyes. Particular muscle may be cured by operation and this defect is cured.

8. **Cataract : -** In this defect, lens becomes more solid, brown or more flat. It occurs in old age mostly. The lens becomes opaque, and reduces its power of accommodation. At this stage person can not see. A new lens is administered in place of defective lens by operation.

9. **Glaucoma : -** If the canal of schlemm is blocked in eyeball, aqueous humour can not return to veins again as a result pressure is increased in eye chambers and retina is damaged and person becomes totally blind.

10. **Photophobia : -** In this defect proper image is not formed in bright light.

11. **Colour blindness : -** It is genetic disorfer of X-chromosome. It is due to recessive gene. Colourblind persons can not different in red and green colour.

EAR

SENSE ORGAN - EAR :

(B) Statoacoustic organ ear : - These are also called phonoreceptors.

☛ All the vertebrates have one pair of ears back to the eyes,
There are two main functions of ears : -

(1) To receive sound waves, hearing

(2) To maintain body balance. Main function of ear is to maintain the balance of body.
Structurally ear may be divided into three parts : -

(a) External ear

(b) Middle ear

(c) Internal ear

(a) External ear : -

It is the outer part of ear. It is well developed in mammals only. External ear may be divided again into 2 parts

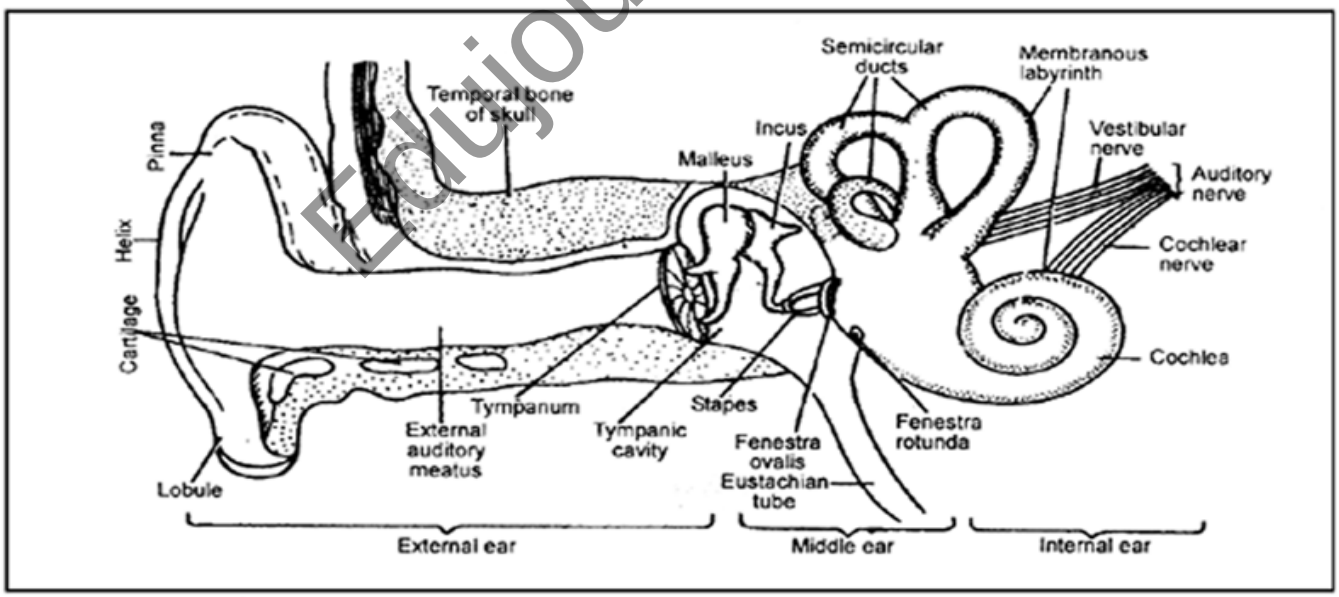
(i) ear pinna

(ii) ear canal

(i) Ear pinna : - These may be small or large, **fan like** structure, important featrue of mammals, but absent in **whale, seal, *Ornithorhynchus*** etc. The skin of ear pinna in hairy. These are having yellow elastic cartilage in them. A rabbit can move its pinna accroding to its will, just like dog, cat, cow etc. But a man can not move his pinnae. Muscles of man's ear are vestigeal. Pinna covers some of the ear canal, this part is called **choncha.**

(ii) Ear canal or External auditory meatus : - It is a 24 mm long canal which is expanded from base of pinna to inner side.

- Along with mammals, **birds** and **reptiles** also have ill or less developed ear canal.
- At the end of ear canal a stretched, thin obliquely placed membrane is present, it is called **ear drum** or **tympanic mmebrane**.This separates the ear canal to middle ear.
- In the wall of external auditory meatus or ear canal there are found modified sweat glands called **ceruminous glands.** These secrete **cerumen** or ear wax, which moisten the ear drum and protects it.
- Ear drum remians always in stretched position because malleus ear ossicle pulls it towards tympanic cavity by tensor tympani muscle.
- Ear drum is a part middle ear.



(b) Middle ear : - Middle ear is also called tympanic cavity. It is filled with air. This cavity is covered by a flask like bone called tympanic bulla. This bone is a part of temporal bone of skull.

- Middle ear cavity is connected by pharyngeal cavity through a canal. It is called **Eustachian duct.**

Due to this tube, pressure at both the side of tympanic membrane remains always equal. This duct acts to maintain sound equilibrium. It exples high volume sounds through mouth, to avoid the damage of ear drum.

- Tympanic cavity is connected by internal ear cavity by two aperture.
  (i) Oval aperture fenestra ovalis (oval window) and
  (ii) Spherical aperture fenestra rotundus (round window). A thin and firm membrane covers each aperture.
- Three ear ossicle are present arranged in a chain with movable joints connected together in tympanic cavity.

  These ear ossicles are : -

  (a) Malleus : - It is situated towards outer ear. It is the largest of three and of hammer shaped malleus is formed by the modification of articular bone of jaw.
  - Inner broad part of malleus is connected by incus. Malleus and incus and Joint together by synovial hinge joint.

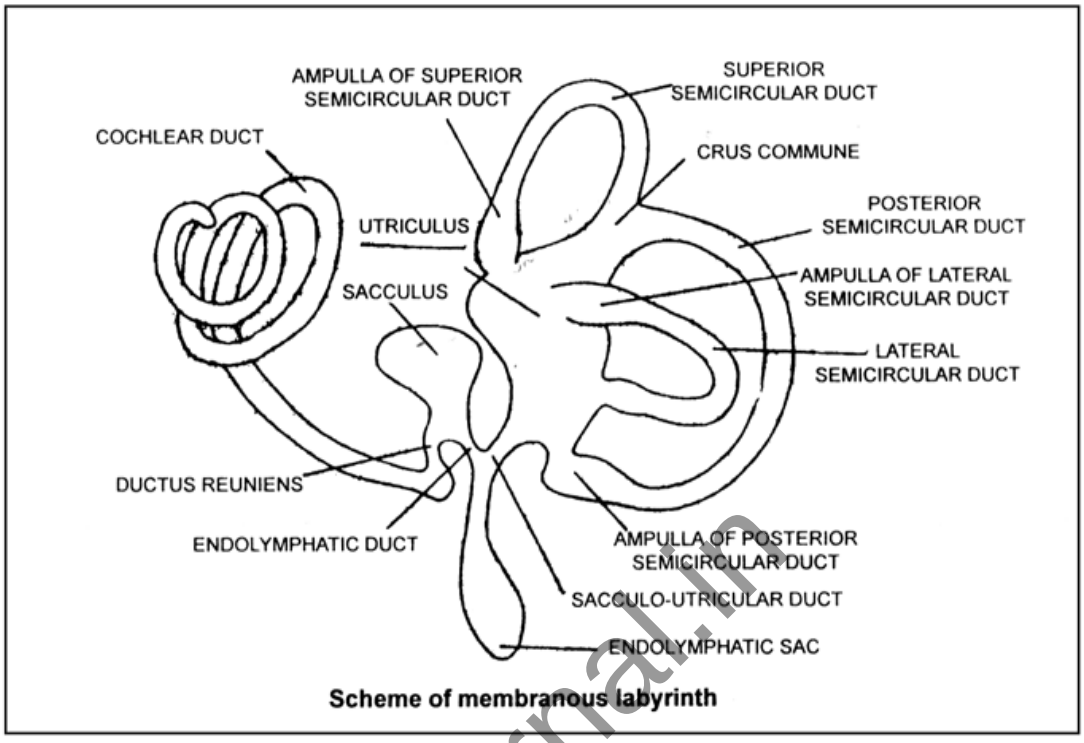
  (b) Incus : - The ossicle is **anvil** shaped. It is formed by the modification of quadrate bone of jaw. It s outer broad part is connected by malleus and inner thin part is connected by **stapes.** Incus is joint by stapes by **ball and socket joint.**

  (c) Stapes : - It looks like stirrup of horse. It is formed by the modification of hyomandibular **bone of jaw.**
- It is the smallest bone of body
- Stapes is connected to incus at one side and on the other side it is connected to membrane stretched over fenestra ovalis.
- [In the tympanic cavity of frog only one ear ossicle is found it is called **columella auris.** Malleus and incus are absent here.]

  All the three ear ossicles are arranged in ear cavity by ligaments. These carry sound wave from ear drum to internal ear through fenestra ovalis.

Internal ear : -

It consist of (1) Bony Labyrinth (2) Membranous Labyrinth.



Scheme of membranous labyrinth

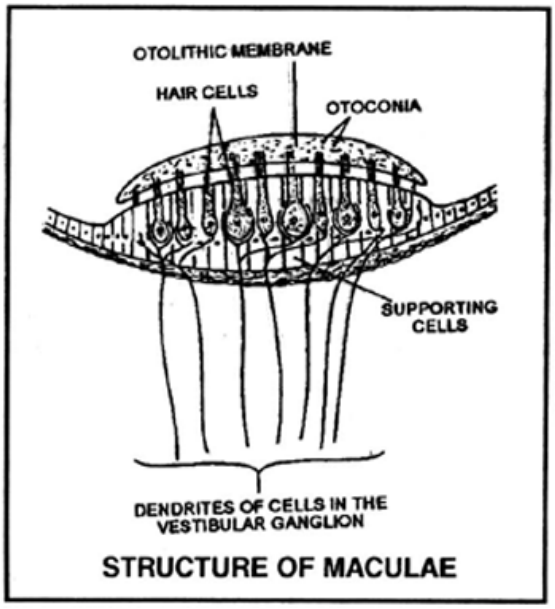
- Internal ear is enclosed in the petrous part temporal bone which form a bony capsule out side the internal ear it is called bony labyrinth. It is the cavity of hearing apparatus.
- Internal ear is a complex structure made up of semi transparent membrane. It is called membranous labyrinth.
- Bony labyrinth an membranous labyrinth are connected by a cavity called perilymph cavity. Perilymph liquid is filled in it.
- Endolymph is filled in membranous labyrinth.

- There are two main bag like chambers in membranous labyrinth, **utriculus and sacculus.**
  Both these chambers are connected together by a thin canal called **sacculo- utricular duct.**
- A thin endolymphatic duct opens into sacculo-utricular duct. This endolymphatic duct opens into **endolymphatic sac** situated at back side of skull on the other side.
  Utriculus is comparatively large. Three semicircular canals arise from utriculus at 90° angle to each other and open into utriculus again these are called
  (i) Anterior or superior semicircular canal
  (ii) Posterior semicircular canal
  (iii) External or lateral or horizontal semicircular canal.
- Anterior and posterior canals arise in the form of a single canal called **"Crus commune"**

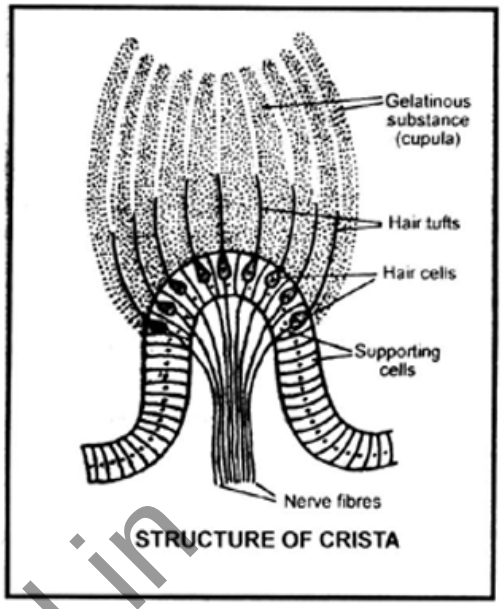
- The distal end of each semiciruclar canal is some what swollen, called **Ampulla.**
- Sacculus is smaller than utriculus. Its back side is coiled like spring. It is called **cochlear canal**. it is also known as **lagena.**
- The length of cochlear canal of human, rabbit and whale are $2\frac{3}{4}$, $2\frac{1}{2}$ and $1\frac{1}{2}$ coils respectively.
- Cochlear canal is connected by sacculus by a small duct called **ductus reuniens**.
- All the coils of cochlear canal are connected together by flexible ligaments.
- In the centre of coils of cochlea in human, there are present a pillar like structure called **modiolus.**

(D) Internal structure of inner ear : -

- The inner wall of membranous labyrinth is lined by cuboidal epithelium and outer wall is line dby connective tissue richly supplied with blood capillaries.
- Membranous labyrinth is empty inside. Its cavity is filled by endolymph which is a milky, mucilagenous fluid.
- Distal end of each semicircular canal becomes swollen called ampulla. In this ampulla, internal cuboidal epithelium form a ridge like projection called **acoustic ridge** small immovable microvilli are found at the free edges of sensory cells of acoustic ridge. These microvilli are numerous in number. These are called stereocilia, along with these there are found single movable cilium called **kinocillium.** Otoconia are absent crista of ampulla. All the microvilli of ridge are bind together like a bag and from **cupula.**
- These sensory cells situated in internal ear are in contact with small nerves. All these thin nerve combine to form **vestibular nerve (branch of auditory nerve).**
- Sensory crista and maculae are related with equilibrium of body
- Cristae control and maintain body equilibrium at the time of movement and maculae regulate this at static position.



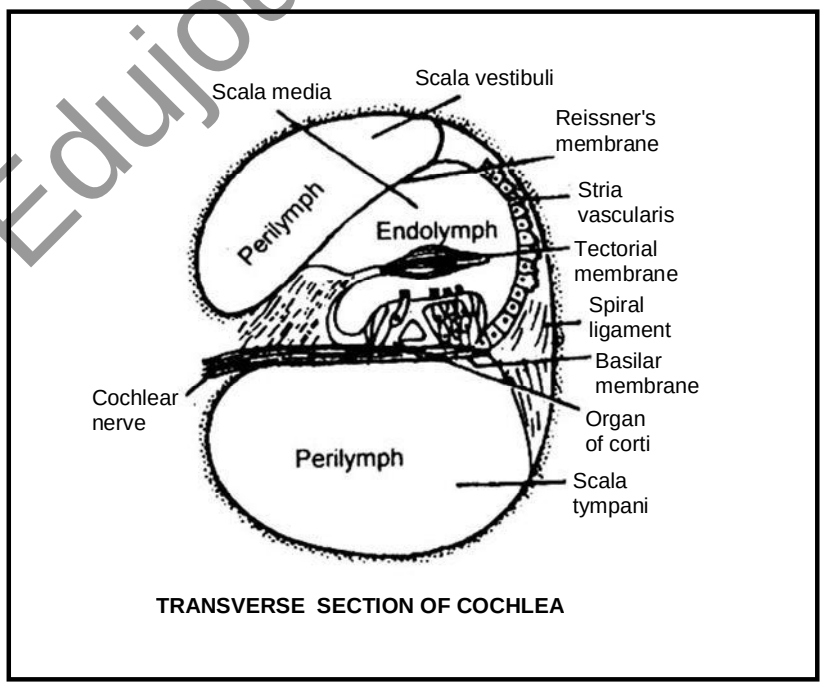
STRUCTURE OF MACULAE



STRUCTURE OF CRISTA

(E) Internal Structure of Cochlea & Cochlear canal

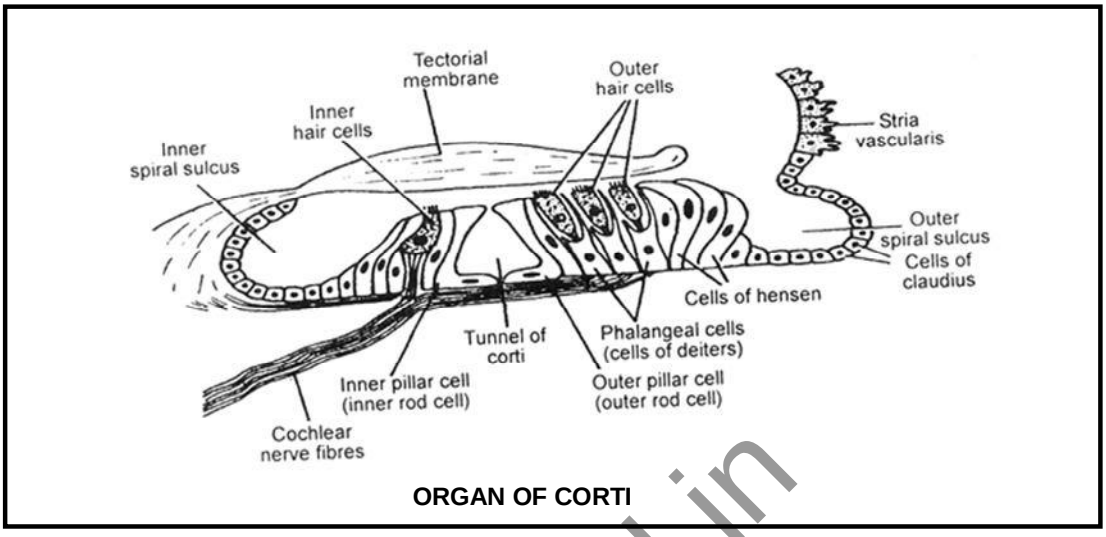
Cochlear duct is connected by bony labyrinth in such a way that it divides the cavity of labyrinth into dorsal and ventral chambers. So in a transverse section of cochlea following three chambers are seen clearly.



TRANSVERSE SECTION OF COCHLEA

(i) Scala vestibuli : - it is situated at dorsal side and is filled with perilymph.

(ii) Scala tympani : - It is situated at the ventral side below the cochlear duct. It is also filled by perilymph.



ORGAN OF CORTI

(iii) Scala media : - It is the triangular cavity of cochlear duct that is situated between scala vestibuli and scala tympani. It is filled with endolymph.

- Thin dorsal wall of cochlear duct is called vestibular membrane or Reissner's membrane.
- Ventral wall of scala media is thick it is called basilar membrane. Scala vestibuli and scala tympani are connected through a small aperture at the free edge of cochlea. This aperture is called **helicotrema.**
- Scala media is blind (closed) at its both the sides.

(F) Organ of Corti : - A sensory ridge is present at the whole of central line at epithelium lining of basilar membrane of scala media. It is called organ of corti. It has two types of cells (i) Sensory cell (ii) Supporting or suspensory cell and three type of suspensory cell
(i) Cells of Dieter's or basal cells (ii) Pillar cells or rod cells (iii) Hensen's cells or rectangular.

- In between the empty spaces of sensory and suspensory cells a lymph like fluid cortilymph is filled. This space is called tunnel of corti.
- Numerous mircrovilli called stereocilia (sensory hair) are present at the free surface of each sensory cell.
- At the ventral surface of sensory cells there are present thin fibres of auditory nerve that form cochlear branch.
- At the organ of corti a thin jelly like membrane is inclined called tectorial membrane. In this membrane, all the sensory hair's free edges are embeded.
- Main credit of hearing goes to "Organ of corti".

(G) WORKING OF EAR : -

- Ears are stato-acoustic organs of body. Thus these help the body to hear and balancing the body.

(a) Equilibrim: - The first and basic function of ears to maintain balance of body.

- This act is done by utriculus, sacculus and three semicircular canals. Equilibrium impulse/sensation is of two types : -

(i) Static balancing : - Its relation is from the point of view of gravity and position of head in static conditions of body and its changes.

- The senses of these changes (of head) are produced and carried mainly by utriculus, sacculus and their sensory cristae i.e maculae.
- Sensory hair of ridge are sensitized by **otoconia or otolith or ear dust.** These sensations or impulses are carried to brain by auditory nerve After it messages of appropriate reactions are send through motor fibres to the skeletal muscles of body.

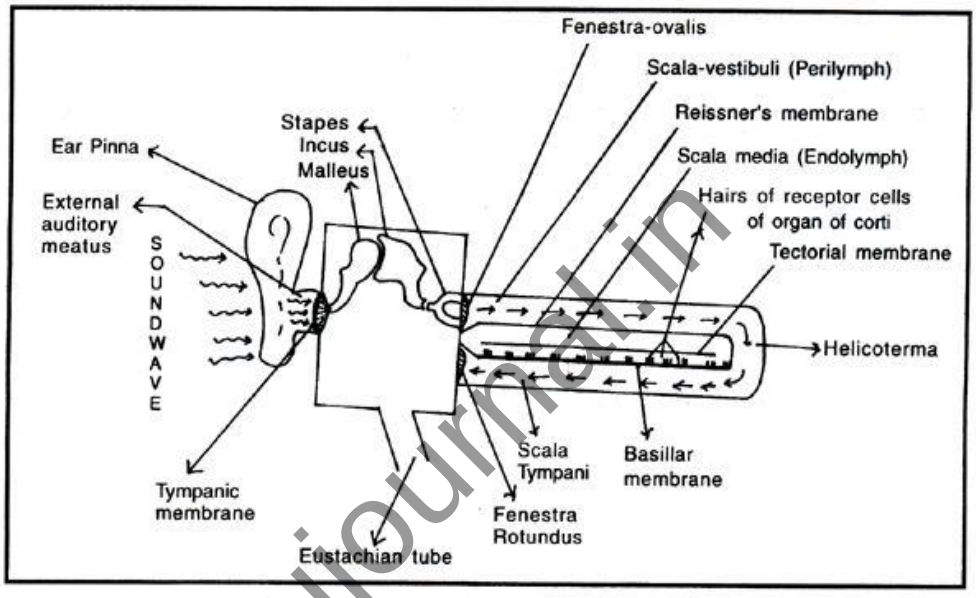
(ii) Dynamic equilibrium : -

- It is the action to maintain balance of body during movement.
- This act is done by sensory ridges of ampula of semicircular canals.
- At the time of movement the endolymph of ampula produces waves in it. Cupula of ampula are effected by these waves and sensory cells cupula are irritated. This sensation or stimulation is carried to brain by auditory nerve and proper messages are send to muscle of legs in reply. Due to this body is balanced at the time of walking.

(b) Hearing : -

- This act is done by "Organ of Corti".
- Sound waves are collected by ear pinnae. These sound waves travel through ear canal and hit the ear drum as a result of it ear drum get vibrated.
- These vibrations reach up to stretched membrane of fenestra ovalis through ear ossicles, ear ossicles work as lever.
- As a result of this travelling (from ear drum to fenestra ovalis) sound waves become more strong.
- When the membrane of fenestra ovalis starts vibrating, perilymph of scala vestibuli also starts vibrating, some vibrations reach up to scala tympani (fenestra rotundus) and its perilymph.
- Due to these vibrating waves, Reissner membrane and Basilar membrane of the walls of scala media also start vibrations. These vibrations travel through endolymph reach upto organ of corti. The organ of corti also starts vibrating.

- Cochlear nerve carries this impulse to brain through auditory nerve. Appropriate messages are send to receptor organs by brain accordingly.
- Vibrations /waves produced by cochlea travel through perilymph, reach up to membrane stretched at fenestra Rotundus and are destroyed.
- Some sound waves are also destroyed, when coming from helicotrema.



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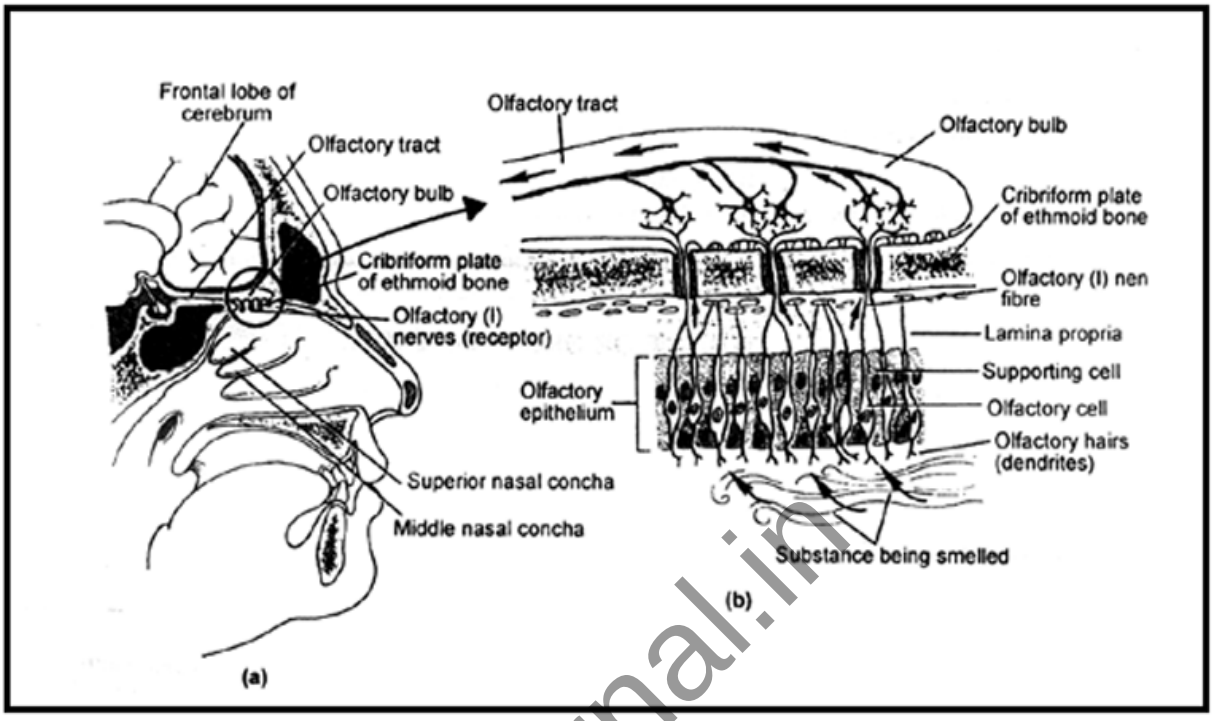


Olfactorecptors :

- Olfactoreceptors are situated in the upper part of nasal chamber in olfactory epithelium.
- This membrane is called **as schnederian membrane.**
- Olfactoreceptors are relatd with olfactory bulb. It is the extension of limbic system.
- This bulb is situated below the frontal lobe of cerebral hemisphere and above the ethampoid bone of nasalchamber.
- Three types of cells are found in the olfactoreceptors. These are –

(i) Bipolar olfactory nerve cells

(ii) columnar epithelial cells

(iii) Mucous glands

(1) Bipolar olfactory nerve cells : It is special types of nerve cells

- Sensory hair are found at the anterior end of olfactory cells. They contact with external environment in nasal chamber.
- Sensory hairs are related with dendrites of bipolar nerve cells.
- Middle part of olfactory cell is cyton.
- Posterior part of olfactory cell is axon which is nonmyleinated.

(2) Columnar epithelial cells : It is also called as supporting cells. They are present arounds the bipolar olfactory cells.

- They provides support to the olfactory cells.
- Some small conical cells are also found at the basal part of olfactoreceptor and provide base to the olfactoreceptor.
- A layer of connective tissue lies below the olfactoreceptor. It is also called as Lamina propria.

(3) Mucous glands : It is called as **Bowman's gland.** It is situated in the Lamina propria. It opens at the outer part of olfacto receptor through fine duct. Their secretory mucous substance dissolve the smell particle and carry to the sensory hair of olfactory cells. Unmyleinated axons of all olfacto sensory cells makes the synapse with dendrites of multipolar neurone of olfactory bulb. The number of receptors stimulated indicates the strength of smell.

In addition to smell receptor, a network of nerves is found in the nose, mouth and tongue.

The network formed by trigeminal nerve of V cranial nerve. It is also known as Dentist's nerve, reacts to messages of pain of teeth. It also convey the message of smell to brain. Such as ammonia, vinegar etc.

The trigeminal can protect by warning about harmful chemical in the air. Bowman's glands inside the nose release mucous fluid to get rid of the irritating susbtances.

Loss of the sense of smell is known as **anosmia.**

TONGUE OR ORGAN OF TASTE

A thick, muscular and movable organ, the tongue is found in the mouth cavity. Tongue bears four types of small papillae which are provided with taste buds. Taste buds are much numerous in the circumvallate and foliate papillae. Taste buds are formed by the transformation of epithelial cells of the tongue. A taste bud possesses two types of cells .-

1. **Supporting cells :** These cells are elongated in middle region they do not bear hairs at their free ends.
2. **Sensory cells :** These cells are alongated, buldge in middle part, they bear sensory hair at their free ends.

Each taste bud is flask or barrel shaped. It's size is 70 μm × 50 μm it's upper part opens at the epithelial surface of the tongue through a fine pore. These sensory hairs, exposed to outside through the gustatory pore are stimulated by the food substances. The sensory cells are chemoreceptor in nature and taste the food while it is dissolved in saliva. Food substances get mixed with saliva to enter into the pores of taste buds.

In human different regions of the tongue are sensitive to different taste. Anterior and free end of the tongue are sensitive to sweet and salty, lateral sides to sour taste, while the posterior part is particulary sensitive to bitter taste.

Types of receptors

- **General Senses –**

Touch	–	Tangoreceptors (Thigmoreceptor)
Temperature	–	Thermoreceptor
Heat	–	Caloreceptors
Cold	–	Frigidoreceptors
Pain	–	Algesireceptors
Current of water	–	Rheoreceptors
Electric current	–	Galvanoreceptors
Gravity	–	Georeceptors
Muscle position	–	Proprioreceptors
Equilibrium	–	Statoreceptors
Hunger, thirst etc.	–	Interoceptors
Blood pressure	–	Baroreceptors
Osmotic pressure	–	Osmoreceptors
Chemical changes	–	Chemoreceptors
Vibration	–	Vibroreceptors

- **Special Senses**

Vision	–	Photoreceptors
Hearing	–	Phonoreceptors
Smell	–	Olfactoreceptors
Taste	–	Gustatoreceptors

(1) Receptors of vision, hearing an smell receive stimuli from distance, hence called teleoreceptors.

(2) Tangoreceptors or mechanoreceptors

(i) Merkel's disc (Corpuscles) : Epidermis of non hairy (glabrous) skin, shallow cup shaped disc.

(ii) Meissner's corpulse : Dermis of skin of the finger tip, lips and nipples. Sense of touch and gentle pressure.

(iii) Pacinian corpuscle : Present in subcutaneous tissue of palm, sole of finger etc. stimulated by strong pressure contact.

(iv) Corpuscle of golgi : Sucutaneous tissue of fingers.

(v) Corpuscle of mazzoni : Sub cutaneous tissue of fingers.

(vi) Grandy's corpuscles : Beak of birds

(vii) Herbst corpuscles : Mouth part of birds

(viii) Free never ending : Present of skin, perceive the sensation of touch.

(3) Thermoreceptors

(i) Ampullae of Lorenzini : Scoliodon (Fishes)

(ii) Organ of ruffini : Caloreceptor - Heat

(iii) End bulb of krause : Frigidoreceptor - cold

(4) Tactile receptors in mammals are maximum on face

(5) Current of water : Rheoreceptors lateral line sense organ in fishes and amphibian of tadpole detect the water current

POINTS TO REMEMBER :

1. Red green colour blindness is hereditory
2. Minimum distance for proper vision of eyes is **25 cm.**
3. Anterior - posterior diameter of eyeball is **17.5mm** at the time of birth normally and in adults it is **20-21mm**.
4. The best colour differentiation is found in **primates** (Advanced mammals)
5. In the retina of man's eyes there are found **110-1125 lacs rods** and **65 lacs cones.**
6. Healthy eye of a person can see clearly from **12 inch** to **20 feet.**
7. Image of object is formed on retina and it is always **inverted & real**
8. Hyalocytes cells are found in vitreous humor.
9. Cilliary body secretes aqueous humor and vitreous humor.
10. In frog and other amphibians sclerotic layer of eyeball is **Cartilaginous**
11. The largest eyes are found in **deers** in vertebrates with respect to body surface area.
12. Owls and cats see only with the help of available light from starts or moon at night
13. The lens of man's eye ball has its diameter of **11 mm.**
14. Atropine, Belladona and Cocane medicines are used to **dilate** the **pupil**
15. In a newlyborn child, eye balls are very small, i.e. babies ar always very much hypermatropic.
17. Cornea and lens of eye lack blood supply.
18. Eyes are most sensitive to the light having approx 5000 Å **wavelength.**

19. Internal or inner ear of rabbit is originated by **ectoderm** of embryo and middle ear (Bony part- mesodermal) and eustachian tube are originated by **endoderm** layer of embryo.
20. Frog's vision is **hypermatropic** in **water** and **myopic** on **land.**
21. Light sensitive organ was discovered by **Steven.**
22. Phaco-emulsification techique in cataract surgery – "Stichlesss" technique. Foldable IOL (Intra – ocular Lens) is used..
23. Gland of moll are modified sweat gland.
24. **Stye** is infection of gland of **zeis**
25. Hordeolum is inflammation sebaceous gland of eyelid
26. The relationship of receptor to bipolar cells to ganglion cells is **1 : 1 : 1** with in the fovea.
27. From the fovea to the periphery, cones dimimish and rods increase in number.
28. Electronic activity of retina is record sequence of potential change known as elctroretinogram.
29. The horizontal cells which transmit signals horizontally in the outer plexiform layer from the rods and cones to the bipolar cell dendrites.
30. The bipolar cells which transmit signals from the rods, cones and horizontal cells to the inner plexiform layer where they synapse with ganglion cell and amacrine cells.
31. The amacrine cells which transmit signals in two direction directly from bipolar cells to ganglion.
32. Lack of red cones – Protanope
33. Lack of green cones – Deuteranope
34. lack of blue cones – Tritanope
35. Unlike nerve and muscle rods and cones do not show action potential by depolarization but by electronic conduction.

EYE

Q.1 Aperture of an eye can be changed by
(1) Aquous humor (2) Vitreous humor
(3) Ciliary muscles (4) Iris

Q.2 Which is responsible for colour detection
(1) Cones (2) Rods
(3) Rods and cones (4) Choroid

Q.3 Pigmented layer in eye is called
(1) Cornea (2) Sclerotic
(3) Retina (4) All

Q.4 Photosensitive pigment is
(1) Similar in all eyes
(2) Different in all eyes
(3) Similar in all vertebrate eyes
(4) Red in all eyes

Q.5 Rhodopsin is a constituent of
(1) Cornea (2) Choroid
(3) Rods (4) Cones

Q.6 If the source of bright light in front of eye suddenly become bright
(1) Pupil contract
(2) Focus of lens changes
(3) Vitreous humor becomes liquid like
(4) Retina blood supply is cut-off

Q.7 Retina of the vertebrates eye consists of
(1) Neurons and neuroglia
(2) Rods, cones, neurons and neuroglia
(3) Rods, cones and neuroglia
(4) Rods and cones

Q.8 The focal length of the lens in eye is controlled by
(1) Vitreous humor
(2) Cillary muscles
(3) Iris muscles
(4) Pupil

Q.9 Night blindness is caused due to
(1) Hypermatropia
(2) Myopia
(3) Defective cornea
(4) Deficiency of rhodopsin in rods

Q.10 During night when the intensity of light is low, it is detected by
(1) Rods (2) Cones
(3) Both (4) Crystalline lens

Q.11 To correct myopia vision one should use
(1) Convex lens (2) Concave lens
(3) Plane lens (4) None

Q.12 Where is the cavity of vitreous humor found
(1) Between sclerotic and choroid
(2) Infront of lens
(3) Behind lens
(4) Between choroids and retina

Q.13 Function of iris is to
(1) Alter diameter of pupil
(2) Close eye lids
(3) Secreted aqueous humor
(4) Move the lens

Q.14 The pigment found in rods is
(1) Retinene (2) Melanine
(3) Photosin (4) Keratin

Q.15 Which pigment helps some noctural animals to see at night
(1) Haemoglobin
(2) Porphyrin
(3) Guanin

(4) Heparin

Q.16 Eye is most sensitive to
(1) 20 Å (2) 1000 Å
(3) 5000 Å (4) 7000 Å

Q.17 Area of most active vision in eye where sharp image is formed is called
(1) Blind spot (2) Yellow spot
(3) Lens (4) Pupil

Q.18 Blind spot in the eye is located
(1) In the centre of pupil
(2) In the centre of lens
(3) In fovea centralis
(4) Where optic nerves leaves retina

Q.19 Lens and retina of vertebrate eye develop from
(1) Mesoderm (2) Ectoderm
(3) Endoderm
(4) Partly from ectoderm and partly from endoderm

Q.20 The common defect of eye which develops in old age is
(1) Glaucoma (2) Astigmatism
(3) Presbyopia (4) Myopia

Q.21 Ciliary muscles are found in
(1) Junction of choroids and iris in eye ball
(2) Inside larynx toregulate tension in eye ball
(3) Between ribs to assist in breathing movement
(4) At base of cilia in ciliated epithelium

Q.22 The aperture controlling the light entering in eye is called
(1) Iris (2) Pupil
(3) Blind spot (4) Sclerotic layer

Q.23 Myopia is a defect in human eyes in which the image is formed
(1) Behind retina and can be corrected by using convex lens
(2) Behind retina and can be corrected by using concave lens
(3) Infront of retina and can be corrected by using concave lens
(4) Infront of retina and can be corrected by using convex lens

Q.24 Iodopsin is related with
(1) Brain (2) spinal cord
(3) Cones (4) kidney

Q.25 Convex lens is used to correct
(1) Hypermatropia (2) Myopia
(3) Cataract (4) Glaucoma

Q.26 Owls moves freely during night since they have
(1) Adjustable pupil
(2) Only cones in retina
(3) Only rods in retina
(4) Vitamin a deficiency

Q.27 Which one of the following diseases in man belongs to the same category as haemophilia
(1) Hyper matropia
(2) Rabies
(3) Nigh blindness
(4) Colour blindness

Q.28 Transmission of light into nerve impulse is a
(1) Mechanical process
(2) Physical process
(3) Chemical process
(4) Biochemical process

Q.29 Colour blindness in human being is due to
(1) Vitamin A deficiency
(2) Sex linked inheritance
(3) Over activity of adrenal gland
(4) Excessive drinking of alcohol

Q.30 How many oblique and rectus muscles are found to move the eye ball in various direction inside the eye orbit
(1) Two (2) Four (3) Six (4) Eight

Q.31 Meiboniam gland are associated with
(1) Eyes
(2) Ears
(3) Reproductive organ
(4) Skin

Q.32 Harderian gland occurs in
(1) Whale (2) Frog
(3) Birds (4) All the above

Q.33 In old age farsightedness is a defect of eye in man, in which
(1) Eye ball becomes short
(2) Eye ball becomes elongated
(3) Lens become more concave
(4) Lens become more spherical

Q.34 Stereoscopic vision is found in
(1) All mammals (2) All vertebrates
(3) Primates (4) Frog

Q.35 Pigmented connective tissue in rabbit occurs in
(1) The eyelids
(2) The choroids of eye
(3) The adipose tissue of skin
(4) The choroids y iris of eye

Q.36 Tear is a
(1) Secretory fluid
(2) Excretory fluid
(3) Pure fluid
(4) Lymphatic fluid

Q.37 The nictitating membrane of rabbit is
(1) Also called third eye lid
(2) Situated in the inner corner of the eye
(3) Movable across the eye ball to clean it
(4) All of the above

Q.38 A small region on the retina of the eye which contains only cones is called
(1) Area centralis (2) Fovea centralis
(3) Blind spot (4) Ora serrata

Q.39 In man nictitating membrane is
(1) Absent (2) Vestigeal
(3) Non-functional (4) Functional

Q.40 Hyalocytes cells occurs in
(1) Aqueous humor
(2) Vitreous humor
(3) Both
(4) None of them

Q.41 For the synthesis of rhodopsin, which of the following food is needed
(1) Mango (2) Rice
(3) Carrot (4) Tomatoes

Q.42 No image formation occurs on blind-spot of retina because
(1) It is not present of the optical axis of the eye
(2) Here cones and rods are absent
(3) On this part only cones are present
(4) The nerve fibres of this region do not contribute in the formation of optic chiasma

Q.43 "Telescopic vision" found in
(1) Amphibians (2) Mammals
(3) Birds (4) None of these

Q.44 Binocular vision found in
(1) Man (2) Monkey
(3) Apes (4) All the above

Q.45 Perception of various colour is possible in
(1) All vertebrates
(2) Most of the mammals
(3) Man only
(4) Birds only

Q.46 Highly vascular and pigmented layer of Rabbit's eyes is
(1) Retina (2) Sclerotic
(3) Choroid (4) None of these

Q.47 The part of Rabbit's eye which acts like diaphragm of camera is
(1) Pupil (2) Iris
(3) Lens (4) Cornea

Q.48 Which of the following medicine is used to dilate pupil is
(1) Atropine
(2) Cocain
(3) Beladona
(4) All of the above

Q.49 A circular canal which found in limbus part of eyes is called
(1) Hyaloid canal
(2) Canal of Schlemm
(3) Canal of Cloquet
(4) Eustachian tube

Q.50 Eye and ear are the example of
(1) Teleoreceptor
(2) Gustato receptor
(3) Extero receptor
(4) Intero receptor

Q.51 Three layers in eye ball from inside to out side are
(1) Retina, choroids, sclerotic
(2) Choroid, retina, sclerotic
(3) Sclerotic, choroid, retina
(4) Sclerotic, retina, choroid

Q.52 In eyes the image which is formed on the retinal is
(1) Erect and real
(2) Erect and virtual
(3) Inverted and real
(4) Inverted and virtual

Q.53 Aqeous humor and vitreous humor are secreted by
(1) Iris (2) Ciliary body
(3) Lens (4) Cornea

Q.54 Pecten a comb like structure is found in the eye of
(1) Amphibians (2) Reptiles
(3) Birds (4) Mammals

Q.55 Lens of eye of frog is
(1) Oval (2) Biconcave
(3) Circular (4) None of them

Q.56 Aqeous humour & vitreous humour are separated by
(1) Cornea (2) Conjunctiva
(3) Lens (4) All

Q.57 In Glaucoma
(1) Eye ball elongates
(2) Eye ball shortened
(3) Fluid pressure increase in eye
(4) Cornea become opaque

Q.58 Space between cornea & lens is
(1) Aqueous chamber
(2) Vitreous chamber
(3) Fovea centralis
(4) Canal of schlemm

Q.59 In frog eyelids are
(1) Functional
(2) Non-functional
(3) Absent
(4) None

Q.60 Colour blind ness is due to
(1) Deficiency of Vit. A
(2) Deficiency of Vit. D
(3) Deficiency of Vit. E
(4) None of these

Q.61 Cavity of aqueous humour is

(1) Behind the lens
(2) Infront of lens
(3) Between choroids and sclerotic
(4) None of these

Q.62 Harderian gland are are absent in
(1) Frog
(2) Birds
(3) Human Human and rabbit
(4) Human and rabbit

Q.63 Vision in frog is
(1) Binocular (2) Monocular
(3) Both of them (4) None of them

Q.64 The eye defect, Astigmatism can be corrected by using
(1) Convex lens
(2) Concave lens
(3) Cylindrical lens
(4) Surgery

Q.65 In Frog eyes are
(1) Myopic on land
(2) Hypermetropic in water
(3) Bulging
(4) All

Q.66 In frog's eye the sclerotic is made up of
(1) Bone
(2) Cartilage
(3) Muscles
(4) Fibrous connective tissue

Q.67 Largest eyes with body surfaces area amongst vertebrates found in
(1) Elephant (2) Deer
(3) Horse (4) Man

Q.68 Supporting cells of organ of corti are
(1) Deiter's cell (2) Rod cells
(3) Hensen's (4) All of the above

Q.69 Mucoprotein which found in vitreous humour is
(1) Albumin (2) Vitrin
(3) Globulin (4) Lysozyme

Q.70 Which of the following in rabbits eyes is responsible for frictionless blinking
(1) Lachrymal glands
(2) Meibomian gland
(3) Harderian gland
(4) All of the above

Q.71 Which of the following glands are found in majority of mammals associated with their eyes
(1) Harderian and meibomian
(2) Lachrymal and suborific
(3) Lachyrmal and meibomian
(4) Harderian and Lachrymal gland

Q.72 Conjuctiva of eye is derived from
(1) Epidermis
(2) Dermis
(3) Mesoderm
(4) Endoderm

Q.73 Supporting cells of retina
(1) Dieter's cells
(2) Hensen's cells
(3) Mullar's cells
(4) Amacrine cells

Q.74 "Miosis" in eye refers to
(1) Reduction in diameter of pupil
(2) Increased diameter of pupil
(3) Reduction division in retina
(4) Shrinkage of eye ball

Q.75 Stye is present due to infection of
(1) Harderian gland
(2) Gland of zeis
(3) Meibomian gland
(4) Lacrimal gland

Q.76 Which one of the following is the correct difference between Rod Cells and Cone Cells of our retina ? **[AIPMT-2008]**

	Rod Cells	Cone Cells
(1) Overall Function	Vision in poor light	Colur vision and detailed vision in bright light
(2) Distribution	More Concentrated in centre of retina	Evenly distributed all over retina
(3) Visual acuity	High	Low
(4) Visual Pigment contained	iodopsin	Rhodopsin

Q.77 Cornea transplant in humans in almost never rejected. This is because **[AIPMT-2008]**

(1) It is composed of enucleated cells
(2) It is a non-living layer
(3) Its cells are lest penetrable by bacteria
(4) It has no blood supply

EAR

Q.78 Fenesta ovalis is the opening of
(1) Cranium
(2) Tympanum
(3) Tympanic cavity
(4) Brain

Q.79 Passage connecting middle ear with pharynx is called
(1) Cochlear canal
(2) Vestibular canal
(3) Tympanic canal
(4) Eustachian canal

Q.80 Arrangement of ear ossicles, starting from ear drum is
(1) Stapes, malleus, incus
(2) Malleus, incus, stapes
(3) Incus, stapes, malleus
(4) Stapes, incus, malleus

Q.81 Organ of corti is found in
(1) Kidneys (2) Heart
(3) Nasal chamber (4) Internal ear

Q.82 The fluid found in semicircular canals of internal ear of rabbit is
(1) Perilymph (2) Endolymph
(3) Haemolymph (4) Lymph

Q.83 Eustachian tube connects
(1) Left atrium with right atrium
(2) Left ventricles with right ventricle
(3) Middle ear with external ear
(4) Middle ear with pharynx

Q.84 Chief function of semicircular canals of internal ear
(1) Balancing and hearing
(2) To perceive sound vibrating of high frequency
(3) To maintain dynamic equilibrium of the body while the body is inbalance
(4) To transmit sound vibration to the auditory nerve

Q.85 In mammals organ of corti occurs in
(1) Main canal
(2) Ear canal
(3) Cochlear canal
(4) Tympanum

Q.86 Organ of corti in rabbit is concerned with the sense of
(1) Smell

(2) Hearing
(3) Taste
(4) Equilibrium

Q.87 Which structure helps a person to maintain equilibrium
(1) Cochlea
(2) Eustachian tube
(3) Semicircular canal
(4) Hammer like bone

Q.88 Cochlea of mammalian ear is concerned with
(1) Balancing of body
(2) Hearing
(3) Pereception of atmospheric pressure
(4) Both and (1) and (2)

Q.89 All bones provide support and protection to body parts which bone is different in it's function
(1) Ribs
(2) Atlas vertebra
(3) Malleus
(4) Radius

Q.90 External ear are characteristic of
(1) Mammals (2) Reptiles
(3) Amphibians (4) Fishes

Q.91 Our ear hear sound waves of the frequency
(1) Above 20,000 cycles/sec
(2) 5-100 cycles/sec
(3) 50-20,000 cycles/sec
(4) 20-20,000 cycles/sec

Q.92 The Eustachian tube which connects middle ear to pharynx is found in
(1) All the land vertebrates in general
(2) All vertebrates
(3) Amphibians only
(4) Mammals only

Q.93 The fluid surrounding to membranous labyrinth of rabbit is called
(1) Perilymph
(2) Endolymph
(3) Haemolymph
(4) Cerebrospinal fluid

Q.94 Rabbit has
(1) Monocular vision
(2) Binocular vision
(3) Conjunctiva
(4) Cornea

Q.95 Cochlea contains
(1) Scala vestibule
(2) Scala tympani
(3) Scala media
(4) All the above

Q.96 By the stimulation of which structure of human ear, the sound waves are perceived by brain
(1) Basilar membrane
(2) Tectorial membrane
(3) Meissner's membrane
(4) Sensory hair cells of organ of corti

Q.97 Which of the following is not an ear ossicle
(1) Incus
(2) Malleus
(3) Humerus
(4) Stapes

Q.98 Cochlea arises from
(1) Utriculus
(2) Sacculus
(3) Middle era
(4) Semicircular canals

Q.99 The other name of internal ear is
(1) Utriculus
(2) Membranous labyrinth
(3) Sacculus

(4) Ductus endolymphaticus

Q.100 External auditorymeatus contains which of the following gland
(1) Ceruminous gland
(2) Lachrymal gland
(3) Harderian gland
(4) Meibomian gland

Q.101 How many semicircular canals are found in internal ear of rabbit
(1) Two (2) Three
(3) Four (4) One

Q.102 Organ of corti is located in
(1) Cochlea
(2) Scala tympani
(3) Scala media
(4) Scala vestibuli

Q.103 Otolith (otoconia) are $CaCO_3$ particles found in
(1) Perilymph
(2) Endolymph
(3) Bones
(4) Vitreous humor

Q.104 Which of the following in anvil shaped ear ossicle
(1) Incus (2) Malleus
(3) Satpes (4) Humerus

Q.105 Which of the following is stirrup shaped ear ossicle
(1) Incus (2) Stapes
(3) Malleus (4) Humerus

Q.106 In man the muscles which move the pinnae are
(1) Absent
(2) Vestigeal
(3) Functional more
(4) Functional

Q.107 The external ears of mammals
(1) Are also called pinnae
(2) Are absent in monotremes
(3) Can be moved in various direction by many mammls
(4) All of the above

Q.108 The ear ossicles of rabbit lie in the
(1) Auditory capsules
(2) External auditory meatus
(3) Tympanic cavity
(4) Tympanic bulla

Q.109 The internal ear of rabbit originates from
(1) Ectoberm
(2) Endoderm
(3) Mesoderm
(4) All of the above

Q.110 In rabbit the muscles which move the pinnae are
(1) Absent
(2) Vestigeal
(3) Non-functional
(4) Functional

Q.111 The middle ear and internal ear of mammals are enclosed in which of the following bones
(1) Mastoid
(2) Ethmoid
(3) Tympanic bulla
(4) Tympanic bulla and periotic bone (temporal bone)

Q.112 Middle ear and eustachian tube of rabbit originates from
(1) Ectroderm
(2) Endoderm
(3) Mesoderm
(4) All the above

Q.113 The scala vestibule communicates with scala tympani through narrow canal called
(1) Ductus endolymphaticus
(2) Helicotrema
(3) Ductus utriculi
(4) Sacculo utricular canal

Q.114 Between malleus & incus is found
(1) Synovial hinge joint
(2) Synovial ball socket joint
(3) Pivot joint
(4) Glinding jont

Q.115 Dieter's cells found in
(1) Reissner's membrane
(2) Malleus
(3) Organ of corti
(4) None

Q.116 The tympanic cavity is
(1) Columella auris
(2) Middle ear
(3) Eustachian tube
(4) Internal ear

Q.117 One of the following is correct
(1) Semicircular canal-balancing
(2) Cochlea-hearing
(3) Utriculus-& sacculus-balancing
(4) All of the above

Q.118 In the tympanic cavity there is an aperture in which the stapes is fitted it is
(1) Foramen rotundus
(2) Foramen triosseum
(3) Fenestra ovalis
(4) Fenestra totandus

Q.119 Cochlea is mainly responsible for
(1) Balance only
(2) Hearing only
(3) Both balancing and hearing
(4) Perception of colour

Q.120 The bone which is in contact with fenestra ovalis is
(1) Malleus
(2) Incus
(3) Stapes
(4) None

Q.121 Ear ossicle from inner side of middle ear are
(1) Malleus, Incus, stapes
(2) Stapes, Incus, Malleus
(3) Incus stapes & malleus
(4) Malleus, stapes, incus

Q.122 Trachoma disease is due to infection of bacteria
(1) Chlamdia trachomastis
(2) Bassilus
(3) E. Coli
(4) Salmonella

Q.123 Endolymph is contains white crystals of $CaCO_3$ called
(1) Otoconia (2) Otoliths
(3) Ear dust (4) All of the above

Q.124 How many coils are present in conchlear duct of man
(1) $1\frac{1}{4}$ (2) $2\frac{1}{4}$
(3) $2\frac{1}{2}$ (4) $2\frac{3}{4}$

Q.125 Ear ossicles which present in middle ear cavity of frog's ear is
(1) Malleus (2) Incus
(3) Stepes (4) Columella

Q.126 Which of the following is part of middle ear
(1) Cochlea

(2) Utriculus
(3) Sacculus
(4) Malleus

Q.127 How many coils are present in cochlear duct of Rabbit

(1) $2\frac{1}{2}$ (2) $2\frac{3}{4}$

(3) $1\frac{1}{2}$ (4) $1\frac{1}{4}$

Q.128 "Tensor tympani" & "Stapediusmuscles" are found in
(1) External ear
(2) Middle ear
(3) Internal ear
(4) External auditory meatus

Q.129 The organ of corti is a modification of
(1) Tectorial membrane
(2) Reissner's membrane
(3) Basilar membrane
(4) Meissner's membrane

Q.130 Malleus, incus and stapes the three ear ossicles are derived respectively from which of the following jaw bones
(1) Articular, quadrate & hyomandibular
(2) Hyomandibular, quadrate & articular
(3) Quadrate, articular & hyomandibular
(4) Humerus, articular & squamosal

Q.131 Function of eustachian tube is to
(1) Provide air to the ear ossicles
(2) Remove dirt from the middle ear
(3) Keep middle ear in proper shape
(4) To maintain proper air pressure in middle ear and internal ear form protecting them from damage by loud sound

Q.132 The damage to ear by sudden explosion (loud sound) is prevented by
(1) Eustachians tubes
(2) Tensor tympani muscles
(3) Stapedius muscles
(4) All of the above

Q.133 The tensor tympani muscles is attached to
(1) Malleus
(2) Stapes
(3) Incus
(4) Tympanum

Q.134 The structure in the internal ear which resembles a "snail shell" is called
(1) Organ of corti
(2) Membranous labirynth
(3) Cochlea
(4) Ear ossicles

Q.135 Serves as "harps of piano" in the ear
(1) Ear drum
(2) Endolymph
(3) Ear ossicles
(4) Cells of organ of corti

Q.136 The sound vibration are finally exhausted in
(1) Organ of corti
(2) Fenestra rotundus
(3) Fenestra ovalis
(4) Tympanic membrane

Q.137 What is the cause of stereoscopic vision in human
(1) Refraction power of eye is high
(2) Well developed retina
(3) High developed cerebral cortex
(4) Presence of biconvex lens

Q.138 Astigmatism is developed when
(1) Lens become opaque
(2) Curvature of conjunctiva is changed
(3) Lens become nonflexible
(4) Curvature of cornea is changed

Q.139 What conditions are developed after deficiency of vitamin A
(1) Nigh blindness
(2) Keratinization of cornea
(3) Keratinization of conjuctiva
(4) All the above

Q.140 Function of vitreous humor is
(1) Nutrition of lens
(2) Maintain intraocular pressure
(3) Reflection
(4) All the above

Q.141 Which of the following structure of eye is artificially implanted
(1) Cornea
(2) Lens
(3) Retina
(4) Corena & lens both

Q.142 When the human comes in bright light then what will happen
(1) Synthesis of rhodopsin
(2) Mydriasis
(3) Miosis
(4) None of the above

Q.143 Which structure of eye is related to focusing of eye
(1) Lens
(2) Cornea
(3) Retina
(4) Aqueous and vitreous humor

Q.144 What statement is wrong about conjuctiva
(1) Ectodermal origin
(2) Presents on the central part of cornea
(3) Vascular
(4) Covers the anterior part of sclera

Q.145 When the canal of schlemm is blocked then what condition is developed
(1) Intraocular pressure is increased
(2) Retina start damage
(3) Person may become blind
(4) All the above

Q.146 Guanin pigment is present in
(1) Tapetum lucidum
(2) Tapetum fibrousum
(3) Tapetu cellulosum
(4) All the above

Q.147 When the person is not having green cones then the condition is called
(1) Tritanopes
(2) Pratanopes
(3) Deuteranopes
(4) Trichromates

Q.148 Which of the following structure is not related to body balance
(1) Maculae
(2) Crista
(3) Organ of corti
(4) Ampulla

Q.149 Scala media is
(1) Part of cochlea
(2) Cochlear canal
(3) Chamber of semicircular
(4) Chamber which is related to perilymph

Q.150 Ear dust is not situated in endolymph of
(1) Utriculus
(2) Ampulla
(3) Sacculus
(4) Endolymphatic sac

Q.151 Body balance during dynamic condition is initiated by which structure -
(1) Otoconia
(2) Cupula
(3) Stereocilia of crista
(4) Kinocillium of maculae

Q.152 Number of coils of cochlear canal in human is

(1) $2\frac{3}{4}$ (2) $2\frac{1}{2}$

(3) $1\frac{1}{2}$ (4) 3

Q.153 Eustachian tube is related with

(1) External ear
(2) Middle ear
(3) Internal ear
(4) Auditory canal

Q.154 Fluid present in the organ of corti is

(1) Endolymph
(2) Perilymph
(3) Cortilymph
(4) Plasma

Q.155 Which of the following muscles are related with middle ear

(1) Tensor tympani
(2) Stapedius
(3) Both (1) and (2)
(4) Extrinsic and intrinsic muscles

Q.156 Merkel's disc in the skin of rabbit are **[CPMT-1992]**

(1) Tangoreceptor
(2) Pain receptor
(3) Thermoreceptors
(4) Vibroreceptor

Q.157 Pacinian corpuscles occur in the skin of certain parts of body. These are **[AIIMS-1998]**

(1) Pain receptor
(2) Types of gland
(3) Nacked tactile receptor
(4) Encapsulate pressure receptor

Q.158 Pacinian corpuscle present in skin detect **[RPMT-1998]**

(1) Pain (2) Temperature
(3) Pressure contact
(4) Movement

Q.159 A feeling of pain in one's stomach would be due **[AIIMS-1998]**

(1) Exteroceptors (2) Teloreceptor
(3) Proprioceptors (4) Interoceptors

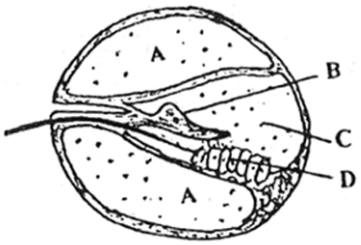
Q.160 Thermoreceptors are **[CPMT-1992]**

(1) Organ of ruffini
(2) Krause end bulb
(3) Ampallae of lorenzini
(4) All of the above

Q.161 Bowman's gland are located in the **[AIPMT-2006, 2007]**

(1) Proximal end of uriniferous tubules
(2) Anterior pituitary
(3) Female reproductive system of cockroach
(4) Olfactory epithelium of our nose

Q.162 Given below is a diagrammatic cross section of a single loop of human cochlea **[AIPMT-2008]**



Which one of the following options correctly represents the names of three different parts ?

(1) D : Sensory hair cells, A : Endolymph B : Tectorial membrane
(2) A : Perilymph, B : Tectorial membrane C: Endolymph
(3) B : Tectorial membrane, C : Perilymph, D : Secretorycells
(4) C : Endolymph, D : Sensory hair cells, A : Serum

Q.1 Maximum refraction of light takes place at **[WEST BENGAL JEE-2007]**

(1) Cornea
(2) lens
(3) iris
(4) aqueous humour

Q.2 Which of the following neve supplies for organ of Corti **[JHARKHAND-2003]**

(1) Auditory (2) Olfactory
(3) Trochlear (4) Vagus

Q.3 Vitreous humor is **[BIHAR-2006]**

(1) colloid
(2) watery fluid
(3) mucoid connective tissue
(4) all of the above

Q.4 Accoustic spots in frog are present in **[UP-CPMT-2002]**

(1) ossious labyrinth
(2) carotid
(3) membranous labyrinth
(4) all of these

Q.5 In the internal ear the 'organ of Corti' which bears hairs cells, is located in…….. **[MP-PMT 2004]**

(1) Scala tympani
(2) Scala media
(3) Scala vestibuli
(4) Sacculus

Q.6 Ear ossicle, incus is modified from of which bone **[MP-PMT 2004]**

(1) Jugal
(2) Articular
(3) Quadrate
(4) Hyomandibular

Q.7 The vitreous humour, a jelly like substance which is found in posterior part of **[MP-PMT-2005]**

(1) Eye
(2) Ear
(3) Nose
(4) Heart

Q.8 Pharynx and middle ear are interconnected by **[MP-PMT 2001]**

(1) Tympanic canal
(2) Eustachian canal
(3) Cochlear canal
(4) Vestibular canal

Q.9 Only rods are present in the eyes of one of the following animals **[MP PMT-2001]**

(1) Pigeon
(2) Squirrel
(3) Fowl
(4) Owl

Q.10 When the intensity of light is low during night the light is detected by **[MP-PMT 2002]**

(1) Rods
(2) Cones
(3) Lens
(4) Both rods and cones

Q.11 The receptors found in the muscles, tendons and joints are : **[MP-PMT-2002]**

(1) Teloreceptors
(2) Proprioceptors
(3) Interoceptors
(4) Thermoreceptors

Q.12 In mammals ear, a membraneous structure which separate the scala vestibule and scala media is **[MP-PMT-2003]**

(1) Basilar membrane
(2) Reissner's membrane
(3) autolith membrane
(4) Tectorial membrane

Q.13 "Organ of Corti" is found in **[MP-PMT-2003]**

(1) Scala rotundes
(2) Scala media
(3) Scala vestibule
(4) Scala tympani

Assertion-Reason based question :

Each of the questions given below consist of Assertion and Reason. Use the following Key to choose the appropriate answer.

(1) If both Assertion and Reason are correct, and Reason is the correct explanation of Assertion.

(2) If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

(3) If Assertion is correct but Reason is incorrect.

(4) If Assertion is false but Reason is correct.

Q.1 **Assertion :** Main function of ear is body balance
Reason : Organ of corti help to maintain body equilibrium

Q.2 **Assertion :** Inverted & real image is formed on retina.
Reason : Aquous humor refract the light

Q.3 **Assertion :** The sensory cells of organ of corti transmit impulse to the cerebral cortex to cause sensation of sound.
Reason : The organ of corti is located in the utriculus

Q.4 **Assertion :** A real and inverted image is obtained on the retina
Reason : Maximum refractive of light is caused by aqueous humor and lens.

Q.5 **Assertion :** Some person unable to see in the dark.
Reason : They lack rhodopsin due to high vitamin 'A"

Q.6 **Assertion :** Rise in pressure of aqueous chamber is useful.
Reason : It provide extra nutrition to retina

Q.7 **Assertion :** Monocular vision found in primates.
Reason : Gap between two eye balls is less os they cannot analyse the dimensions.

Q.8 **Assertion :** Blind spot of the retina of the eye is devoid of the ability of vision.
Reason : The photoreceptor rods & cone cells are absent in the blind spot.

Q.9 **Assertion :** Accomodation is done by Iris of eye.
Reason : Lens is biconcave and flexible in nature and cilliary body muscles does not help for this process.

Q.10 **Assertion :** Accomodation power is present in human eye.
Reason : It depends on the sliding of lens forward and backward.

ANSWER-KEY

EXERCISE # 1

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	4	1	3	3	3	1	2	2	4	1	2	3	1	1	3	3	2	4	2	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	2	3	3	1	3	4	4	2	3	1	4	3	3	4	1	4	2	2	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	3	2	3	4	2	3	2	4	2	1	1	3	2	3	3	3	3	1	1	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	2	4	2	3	4	4	2	4	2	2	3	1	3	1	2	1	4	3	4	2
Que.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	4	2	4	3	3	2	3	2	3	1	4	1	1	1	4	4	3	2	2	1
Que.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	2	3	2	1	2	2	4	3	1	4	4	2	2	1	3	2	4	3	2	3
Que.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
Ans.	2	1	4	4	4	4	1	2	3	1	1	1	1	3	4	2	3	4	4	2
Que.	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
Ans.	2	3	1	2	4	1	3	3	2	2	2	1	2	3	3	1	4	3	4	4
Que.	161	162																		
Ans.	4	2																		

EXERCISE # 2

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	1	1	4	3	2	3	1	2	4	1	2	2	2	1

EXERCISE # 3

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	3	3	3	3	3	4	3	1	3	3