RECEPTORS

INTRODUCTION : How are environmental changes detected ? In its broadest context, sensation is the conscious or unconscious awareness of external or internal stimuli. Cells which are specialised to receive stimulation called receptors.

10.1 TYPES OF RECEPTORS.

(i) **Exteroreceptors :** Receive stimulation directly from external environment. These may be of following type

(a) **Photoreceptor :** Sensitive to light (Eye)

(b) **Thigmoreceptor :** Sensitive to touch.

(c) **Tectoreceptor :** Sensitive to touch.

(d) **Tangoreceptor :** Sensitive to touch pressure.

(e) **Phonoreceptor :** Sensitive to sound (Ear).

(f) **Olfactoreceptor :** Sensitive for smell (Nose).

(g) **Gustoreceptor :** Sensitive to taste (Tongue).

(h) **Thermoreceptor :** Sensitive to temperature.

(i) **Calo receptor :** Sensitive to heat.

(j) **Fridgo receptor :** Sensitive to cold.

(k) **Galvano receptor :** Sensitive to electric current.

(l) **Rheoreceptor :** Sensitive to water or air current.

(m) **Geo receptor :** Sensitive to gravity.

(n) **Telero receptor :** Sensitive to distance. (Receptors of vision, hearing and smell receive stimuli from a distance hence called teleroreceptor.

(o) **Proprio receptor :** These are situated in deeper part of body in subcutaneous region and sensitive for vibratory changes in earth. (*Ex.* Earthquake) Generally found in sole and feet.

(ii) **Intero receptor :** These are present in internal organ. Ex. receptor for hunger, thirst, pain and balancing.

10.2 Few important receptor.

(i) **Important tangoreceptor**

(a) **Merckel's corpuscles :** Found in dermis of skin.

(b) **Marckel's disk :** Found in dermis of skin.

(c) **Meissner's corpuscles :** Present in skin around the base of hair and feather. These are sensitive for touch and pressure both.

(d) **Genital corpuscles :** These are sensitive cells with nerve endings in skin around the genital organ.

(e) **Grandey's corpuscles :** Found in birds at the base of the beak. These are kidney shaped in structure.

(f) **Herbert corpuscles :** Found in buccal cavity of birds.

(g) **Capsulated corpuscles :** These are sensitive cells encapsulated and found in skin.

(h) **Paccinian corpuscles :** Found in deep layer of dermis and sensitive to touch, pain and pressure.

(i) **Golgi corpuscles and Mazzoni corpuscles :** These are sensitive to touch and found in subcutaneous region.

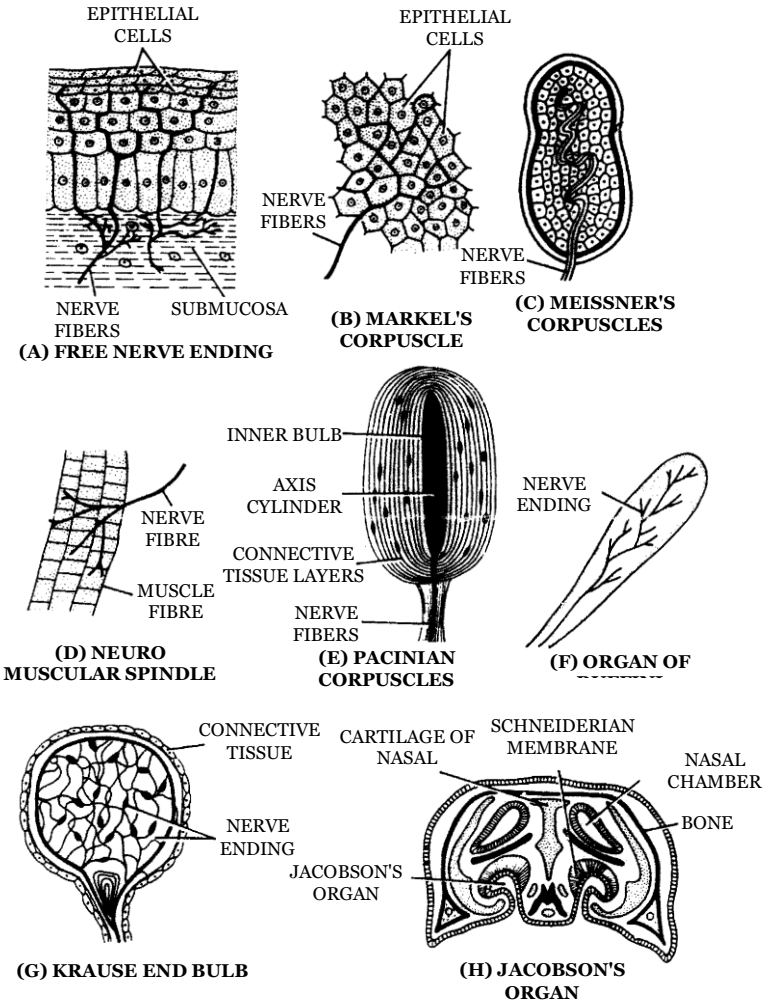


Fig. – Different receptors

(ii) **Important Olfactoreceptor**

Jacobson's organ (Vomero-nasal organ) : It is concerned with smell. These were 1st appear in amphibians and well developed in snake, lizzard and sphenodon that is reptile. These are less developed in birds and mammal. Structure is blind sac like and lined by olfactory epithelium (Shneiderian membrane). Jacobsons organ is not found in rabbit. In man it is vestigeal organ.

(iii) **Important Thermoreceptor**

(a) **Krause end bulb :** These are sensitive for temperature and pain and freidgo in nature. Found in lips, tongue, conjunctiva of eyes and corium of fingure.

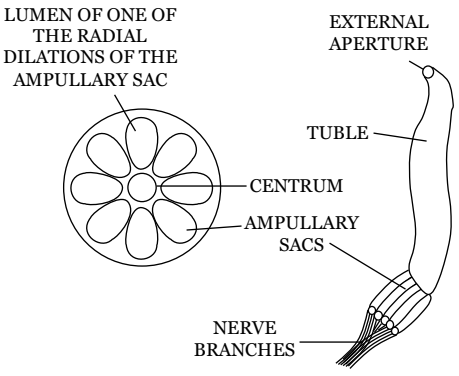


Fig.(I) – Ampulla of Lorenzini

(b) **Organ of Ruffeni :** Sensitive to temperature and mainly related with heat.

(c) **Ampulla of Lorenzini :** Found in snout region of fishes these are helpful in detecting the temperature of water.

10.3 Eye

Human have binocular vision. The eye can discriminate colour, appraise length, width and depth visually and form true inverted image.

(i) **Structure of eye :** The eyes are two in number and lodged in orbits (bony socket) of skull. A very small part (front) is exposed while the rest lies in the orbit. The eye is a hollow, spherical organ, about 2.5 cm in diameter and about 6 to 8 gram in weight. It has two parts –

(a) Protective devices

(b) Eye ball

(a) **Protective devices :** Eye has four protective devices eye brow, eye lids, eye lashes, eye glands and adipose tissue.

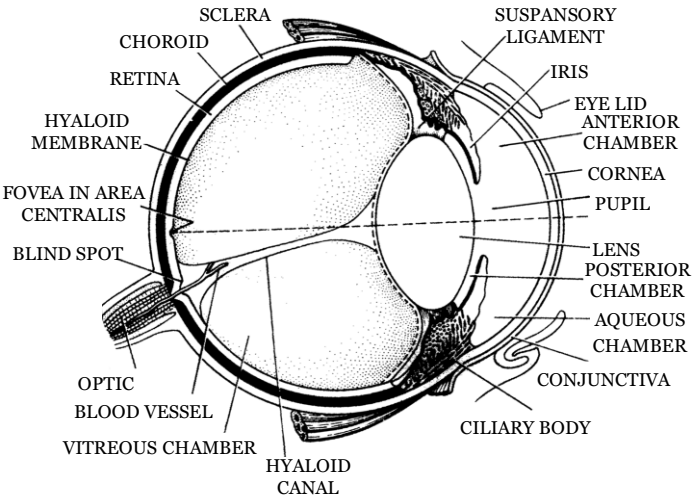


Fig. – Diagrammatic V.S. of mammalian

(1) **Eye brows :** The outwardly directed hair of the eyebrows carry the sweat and rain drops trickling down the forehead to the sides to prevent their falling into the eyes.

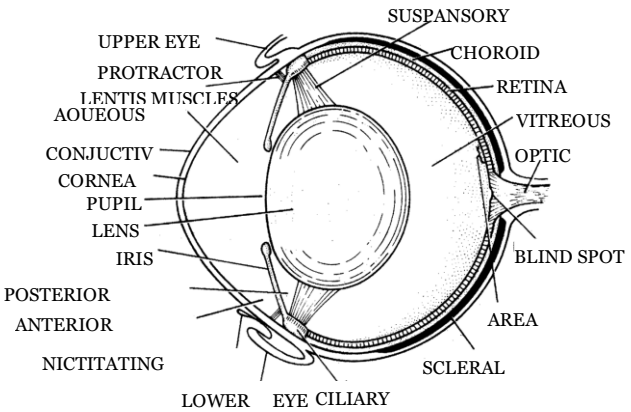
(2) **Eye lids (Palpebrae) :** In man two eyelids are present, upper is movable. They are regularly closed at short intervals to clean the cornea. This is called blinking. In frog out of two upper eyelid is immovable and lower eyelid is movable. Nictitating membrane is present in frog which protect eye in water. Movement of nictitating membrane takes place by retractor bulbi. It becomes folded by levator bulbi.

In rabbit upper eye lid is movable. Hence nictitating membrane is reduced, as in most other mammals, simply to a small fold at the inner angle of an eye. Normally it remains retracted, but can be spread over the conjunctiva when required. A nonfunctional vestigeal nictitating membrane, called plica semilunaris, occurs in human eyes. It remains permanently retracted at the inner angle of each eye.

(3) **Eye lashes :** The eyelids bear at the free edge a row of stiff hair, the eye lashes. These check the entry of dust particles, tiny insects and rain drops into the eyes.

(4) **Eye glands**

- **Meibomian gland :** The eye-lids bear at the free edge a row of meibomian gland that is modified sebaceous gland. (Act as a lumbricant).



Vertical section of frog's eye

❑ **Lachrymal gland or Tear gland :** It lies in the upper outer part of the orbit and secretes a slightly saline, watery fluid that contains a bacteriolytic enzyme named lysozyme. This secretion moistens the surface of the eyeball. The excess of this secretion passes through nasolachrymal duct.

❑ **Harderian gland :** Some aquatic mammals (whale) possess harderian gland which lumbricate nictitating membrane. It is also found in frog and birds.

❑ **Glands of Moll :** It is modified sweat gland and open into the follicles of eyelashes.

❑ In human meibomian lachrymal and Moll's glands are present.

(5) **Connective tissue :** A layer of fatty connective tissue surrounds the eyeball. It serves as a soft shockproof pad.

(b) **Eye ball :** Eye ball is made up of 3 coats

Outer fibrous coat (Sclerotic layer), middle vascular coat (choroid layer) and inner nervous coat (retina). Of these, the fibrous coat alone is complete. Others are incomplete on the front side.

(1) **Sclerotic layer (Fibrous tunica) :** Outer most and opaque, fibrous and non-vascular layer easily seen as white of the eye.

❑ **Cornea :** In the centre, scleroticlayer it merges with the transparent round window called cornea (or in other words – In exposed central part, sclerotic layer form transparent cornea). It is separated from sclera by schlemm's canal. The front part of the cornea is highly curved and convex acting as a lens and forms the first of the refracting surface of the eye.

> ***Cornea grafting :*** *Cornea can be removed from a dead man's eys, stored and grafted on another persons's eye to restore vision, cornea transplantation is successful because it lacks blood vessels. Eye donation is a noble act.*

❑ **Conjunctiva :** The cornea and exposed part of sclera are covered externally by a thin, transparent membrane the conjunctiva. The latter is composed of a stratified epithelium and is continuos with the epidermis that lines the eyelids. The conjunctiva, thus has 2 parts : Occular conjunctiva that covers the front of the eye and palpebral conjunctiva which lines the eyelids. (In man conjunctiva is fused with corneal layer). In sore or "pink" eyes, the conjunctiva gets inflammed, causing conjunctivitis.

(2) **Choroid layer (Vascular tunica) :** Also known as uvea middle. it is vascular layer which supplies nutrients to the eye. It is distinguished into three parts choroid, ciliary body and iris.

❑ **Choroid :** The choroid occurs in the main part of eye ball adhered to the sclerotic. Its inner surface (close to the retina) contains pigment cells that absorb scattered light and so increase the sharpness of focussed image. (The pigment is reddish in rabbit and black, brown or bluish in man). In front it form ciliary body.

Tapetum : *Found in glowing eyes. Ex. Cat, dog, tiger, cattles, fishes. Tapetum is a screen, layer which reflect light rays back so eye glow up. It is present between the retina and choroid layer behind retina. It is secreted by choroid layer. In fishes tapetum lucidum is found. In cattles tapetum fibrosum is found. In carnivorouss cat, dog – tapetum cellulosum is found.*

- **Ciliary body :** Ciliary body is vascular and pigmented like choroid, but it also contains a number of circular, radial and oblique smooth ciliary muscles. The ciliary body is hidden by iris. The ciliary body helps in accommodation by altering the focus of eye from object. (Ciliary body produce aqueous fluid)
- **Iris :** Beyond the ciliary body, the vascular tunic sharply turns inwards, forming a circular, shelf-like diaphragm called iris. The large central aperture of iris is called pupil. In pupil circular and radial muscles are present. Pupil dilate by the contraction of radial muscle and constrict by the contraction of circular muscle. The colour of the iris is responsible for colour of eye e.g. brown, black, blue or green. In albinos, iris is deficient of pigments.

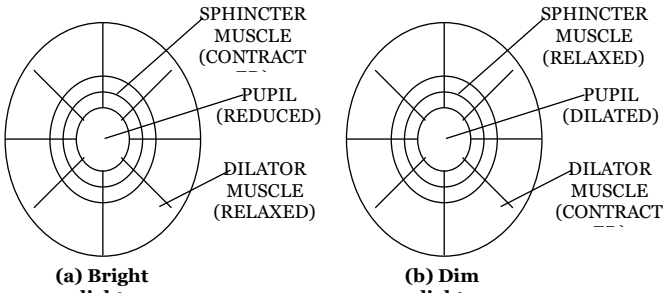


Fig. – Size of pupil in bright and dim light

Lens : Lens is colourless, transparent and fibrous crystaline structure made up of protein and enclosed in lens membrane. It is ectodermal in origin. Lens is lodged in eye ball by suspansory ligament of ciliary body. Suspansory ligaments are known as "Zonula of Zinn". In man lens is biconvex while in frog it is elliptical.

Lens divide the eye ball in 2 chamber outer aqueous chamber (partially divided into a large anterior and a smaller posterior chamber) filled with aqueous humor (watery) formed by ciliary body and inner vitreous chamber filled with vitreous jelly (or Wharton's jelly) containing 99% water, some salt a little mucoprotein (vitrein) and hyaluronic acid. It is the part between lens and retina. At its periphery, the jelly like fluid is condensed to form a hyaloid membrane. A narrow hyaloid canal runs through the vitreous humor obliquely from the region of blind spot upto the middle of posterior face of the lens. An intrinsic network of fine collgen fibres and some rounded cells hyalocytes are suspended in the vitreous humour.

Differences between Aqueous humour and Vitreous humour

S.No.	Aqueous humor	Vitreous humor
1.	It occurs in aqueous chambers.	It occurs in vitreous chamber.
2.	It is a watery fluid	It is a jelly-like substance.
3.	It is secreted by ciliary processes.	It is apparently secreted by retina during development of eye.;
4.	It is continuously absorbed into blood and replaced.	It is not absorbed or replaced
5.	It contains most of the diffusible substances of the plasma	It consists of water (99%) protein vitrein, hyaluronic acid and collagen fibres.
6.	Obstruction in its flow may damage retina by increasing intraocular pressure.	It does not flow.

(3) **Retina (Neurosensory tunica) :** It is innermost, thin and transparent, purplish red due to the present of the eye pigment rhodopsin (in rods) or visual purple which was extracted by Kuhne (1876) and named 'Schpurpur' (Visual purple). Made up of 4 distinct layer –

- Cuboidal pigmented epithelium (towards choroid).
- Layer of rods and cones.
- Layer of bipolar neurons.

❑ Layer of ganglia (Towards vitreous chamber innermost).

Inverted retina : Light rays can enter into a vertebrate eye, not through sclerotic and choroid, but only through the cornea and lens. Obviously, the light rays penetrate the retina from its inner, ganglionic layer. Then, the impulses of photoreception, set up by rod and cone cells, pass back in reverse direction through bipolar ganglionic cells and finally into the fibres of optic nerve. Due to such an arrangement this is an "inverted retina" and the eye is said to be inverted eye.

Ultrastructure of retinal cells : It has been discovered by modern biologists with the help of electron microscopy. Each retinal cell has a nucleated cell body or soma, a photosensitive outer segment resting upon the pigmented epithelium and in inner segment between these two. The outer segment is conical in cone cells and cylindrical in rod cells.

The rods and cones synapse with bipolar cells which, in turn, synapse with ganglion cells. Axons of ganglion cells converge to form the optic nerve. Certain horizontally extending cells connect the axon terminals of rods and cones, establishing an outer plexiform layer. Similarly, certain cells called amacrine cells, having no axons, connect ganglion cells with each other, establishing an inner plexiform layer. These also similarly connect the axons of bipolar cells together. All the above described neuronal elements of retina are bound together by supporting glial cells called mullar cells.

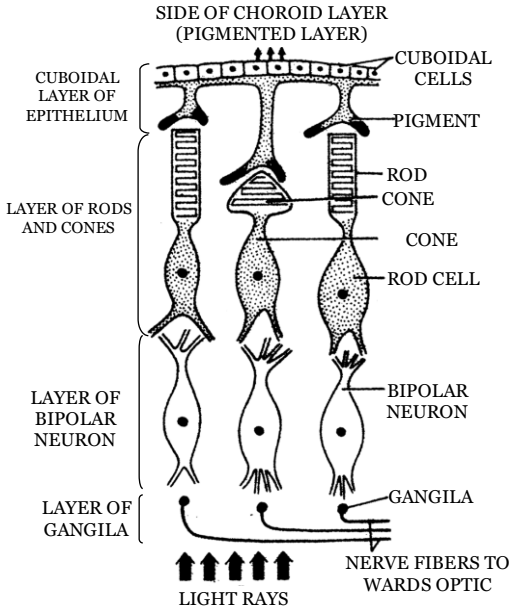


Fig. – Diagrammatic V.S. of mammalian

❑ **Area centralis of retina :** A little part of retina that lies upon the optical axis is called area centralis. Here, the retina is very thin and contains only cone cells filled with a yellow pigment. Hence, this part is called yellow spot or maculla lutea. In man (Rabbits) and other mammals, but not in frogs, this area has a small shallow dispression called fovea centralis. The latter is the most sensitive part of an eye, i.e. the area of most acute vision. It is also claimed that the cone cells in foven centralis are placed somewhat obliquely. So that these can form magnified images of object.

❑ **Blind spot (Optic disc) :** At this point, the optic nerve turns towards the outer side, pierces through the whole thickness of the wall of eyeball, forming an optic foramen and runs to the brain. Obviously, the region of optic foramen has no retina. It therefore, does not take part in image formation and is called blind spot.

Differences between Blind spot and Yellow spot

Blind spot (Optic disc)	Yellow spot (Macula lutea)
It lies a little away from the yellow spot.	It lies exactly opposite the centre of the cornea.

It contains no pigment.	It has a yellow pigment.
Optic nerve starts from this spot.	No nerve starts from this spot.
It lacks a depression.	It has a shallow depression, the fovea centrallis, at its middle.
It lacks visual receptors and is insensitive to light.	It has visual receptors and is sensitive to light.
The eye coats are absent at blind spot.	Eye coats are present at yellow spot.
No image is formed at this place.	Image is formed at this place.

- **Ora seratta :** The function retina terminates anteriorly along an irregular border, the ora seratta.

Differences between Rod cells and Cone cells

Rod cells	Cone cells
Rods secreted by rod cells.	Cones secreted by cone cells
Produce "Rhodopsin" which is visual purple and made up of scotopsin+11 cis retinal. Vitamin-A is needed for the formation of Rhodopsin.	Produce "Idopsin" which is visual violet and made up of photopsin+11 cis retinal.
Rhodopsin is very sensitive to light.	It is sensitive to colour.
Rods are active in dim light or low intensity light.	Cones are active in bright light which is called photopic vision.
Rod cells are absent in fovea centralis of retina.	In fovea centralis only cone cells are present.

Rods are more in number in peripheral region of retina.	Cones are more in number in central region of retina.
Rods are more in nocturnal animals.	Cones are more in diurenal animals.
In owl only rods are present and cones are absent.	In fowls only cones are present and rods are absent.

Function of the parts of human eye

Part	**Function**	**Part**	**Function**
Lens	Refracts and focuses light.	Ciliary body	Holds lens in place.
Iris	Regulates light entrance.	Retina	Contains receptors.
Pupil	Admits light.	Rods	Allow black and white vision
Choroid	Absorbs extra light.	Cones	Allow colour vision.
Sclera	Protects	Optic nerve	Transmits impulse.
Cornea	Refracts light.	Fovea centralis	Region of cones in retina
Humors	Refracts light.		

(ii) **Working of eye**

(a) **Mechanism of light perception :** The human eye has two functional parts – Dioptric or Focussing part and Receptor part.

- **Focussing part :** It consists of conjunctiva, cornea, aqueous humour lens and vitreous humour. These part are transparent and act as lenses. They refract the light rays passing through the eye to bring

them to a focus on the retina. Maximum refraction is caused by the cornea, which places the image approximately on the retina. The lens effects fine adjustment and brings the image into a sharp focus.

❑ **Receptor part :** It comprises the retina. The image formed on the retina is inverted and smaller. It converts the energy of specific wave lengths of light into action potential in nerve fibre.

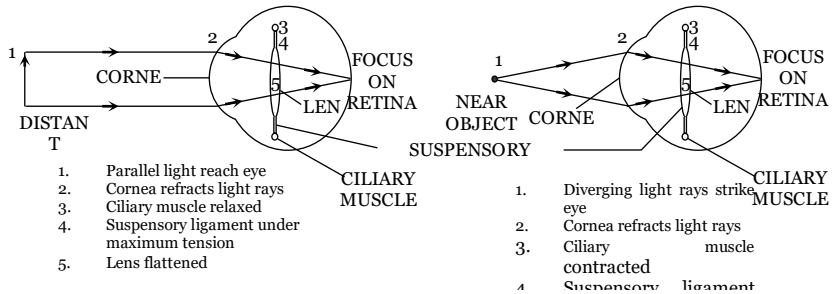


Fig. – Diagram showing changes during

(b) **Pathway of sensory impulses from eye to brain :** The nerve impulses generated in the retina of the eye in response to light follow a definitive path and terminates in visual cortex in each optic lobe which act as primary visual center.

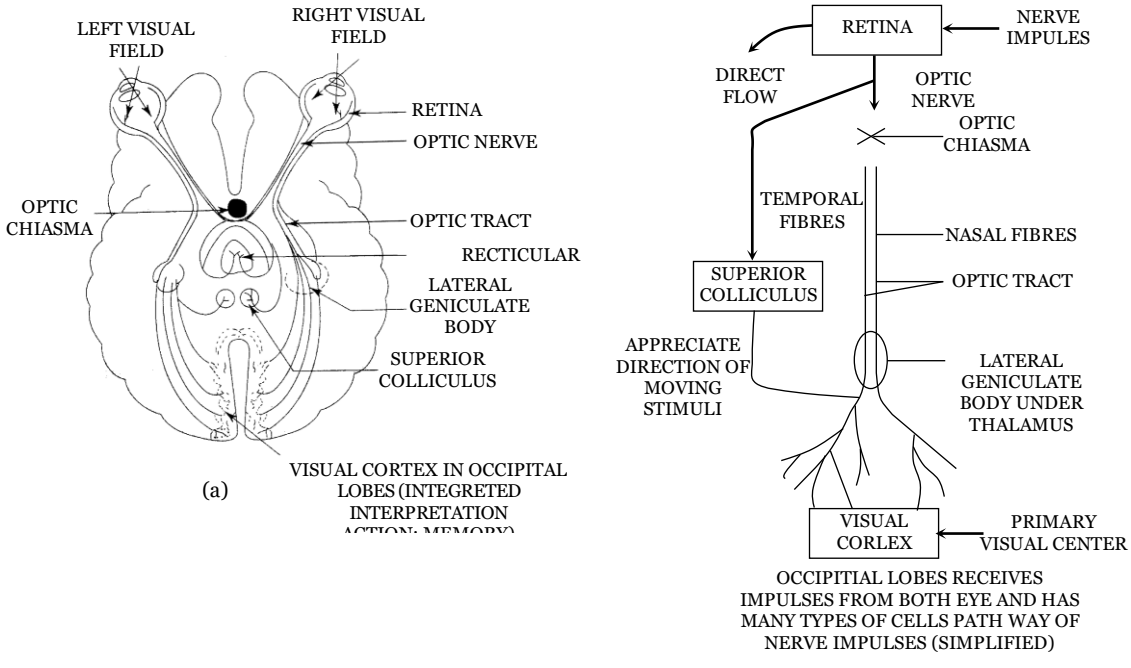
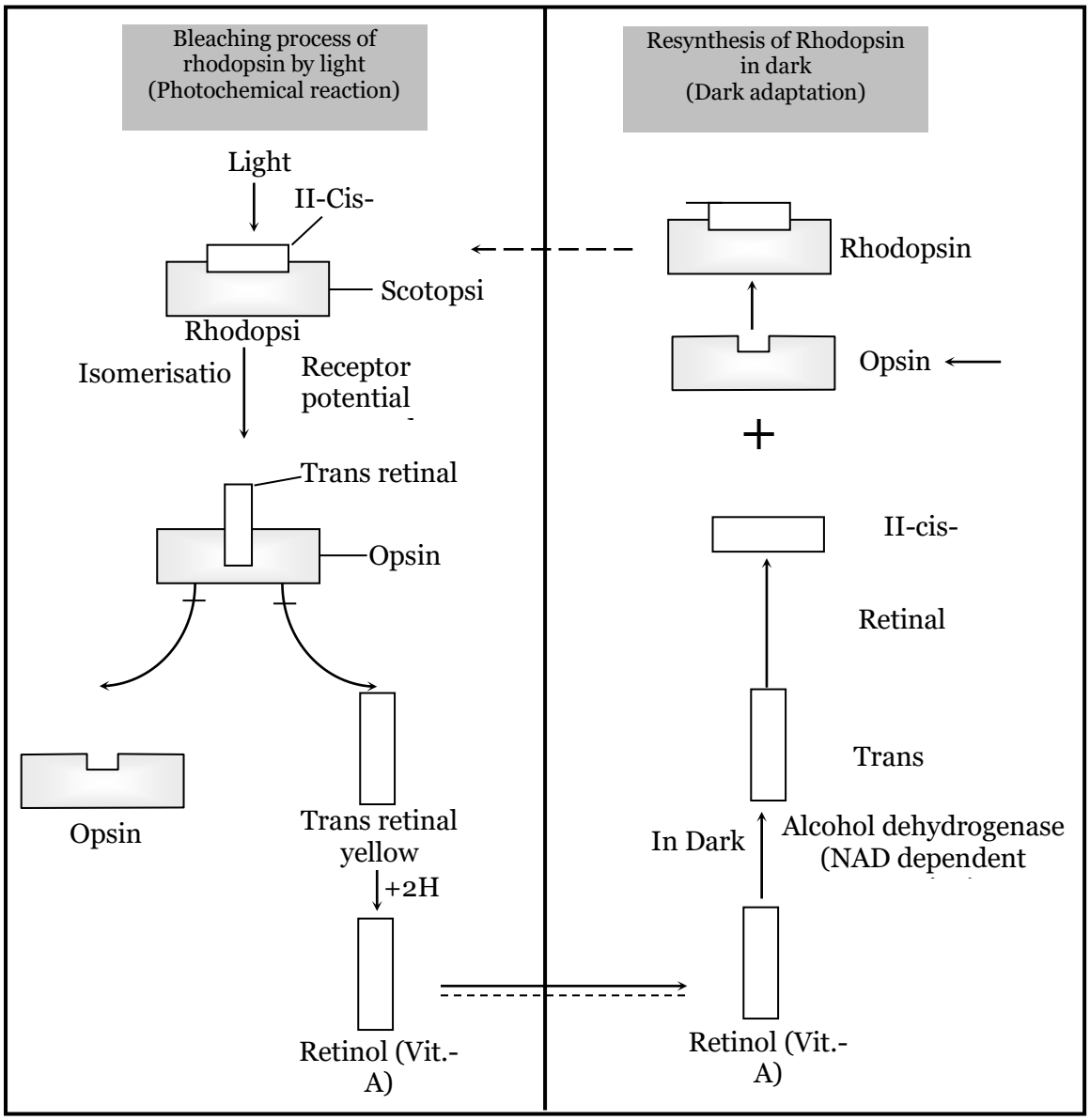


Fig. – Visual pathways

(c) **Biochemistry of eye :** The receptor cells of eye are called photoreceptor or visual cells. They are of two types – Rod cells and Cone cells named after their shapes. Both have light sensitive pigments. Specific wavelengths of light breakdown the light sensitive pigments and this stimulates the receptor cells to set up nerve impulses.

(1) **Rod cells :** The rod cells contain a purplish pigment called visual purple or rhodopsin. They function in dim light and at night. They produce poorly defined images. Bright light splits rhodopsin into a lipoprotein scotopsin and a carotenoid pigment retinal (retinine) a process called bleaching. The

spiliting of rhodopsin depolarizes the rod cell and it releases a neurotransmitter, passing the nerve impulse via bipolar neuron and ganglion cells to the optic nerve. In the dark, rhodopsin is resynthesized from scotopsin and retinal. This process is called 'dark adaptation'. It makes the rods functional. It takes sometime for rhodopsin to be reformed. This is why on entering a dark room at daytime or on coming out of a well lighted room at night we feel blind for a while, when we go from darkness into bright light, we feel difficulty in seeing properly for a moment till rhodopsin is bleached and cones become functional.



(2) **Cone cells :** Cones contain iodopsin which is visual violet and made up of photopsin + retinal. The 3 types of cones are erythrolobe (775 nm sensitive tored), cyanolabe (430 *nm* sensitive to blue) and chlorolabe (sensitive to green 535 *nm*). However, if all the cone, types are simultaneously stimulated by equal amounts of coloured light than sensation for white light is perceived.

Diurnal animals are adapted to see during day light (Photopic vision) and can perceive colour. In dark, colours are not perceived. Such animals have more cones in their eye than rods.

(d) **Accommodation and types of vision**

(1) **Accommodation :** Light passes through many refractive surfaces before it is focussed on the retina forming an inverted and true image. The main sites of refraction are cornea → aqueous humor – iris – lens (position can be altered by ciliary body : accommodation) – posterior chamber (= vitreous humor) → retina (in fovea). The refractive index of the eye varies from 59 diopter (when the lens is at rest) to about 71 diopter (when lens is bulging in maximum accomodation). The accommodation reflex occurs when the eye changes its focus from a far away object to nearer one. The change in strength of the lens provides the physiological basis of accommodation. Radial and circular muscle fibres of ciliary muscles play an important role in this as they contract reflexively (parasympathetic control) and increase lens strength. The pupil constricts. This facilitates increase in sharpness of image. Ageing causes loss of accomodation.

Relationship between structures during accommodation

Object	**Ciliary muscle**	**Suspensory ligament**	**Lens**	**Refraction**
Near	Contracted	No tension (Relaxed)	Thick	Increased
Distant	Relaxed	Tension maximum	Thin	Decreased

(2) **Types of vision**

- **Binocular vision :** Man has binocular vision in which both the eyes are focussed on the same object but from slightly different angles. The visual fields of both eyes overlap and the foveae of both are focused on the same object. This provides depth to the images, i.e., gives stereoscopic or 3D effect and enables man to judge distances correctly.

- **Vision in other animals :** Primates and predatory animals, such as owl and cat, have binocular vision. In some animals, such as rabbit, birds, each eye is focussed on a separate object. This is termed monocular vision.

- **Colour vision :** It is the ability of some animals to detect colours in an object. Humans, apes, monkeys, and most fishes, amphibians, reptiles and birds have strong colour vision. The insects and crayfish also have colour vision. In vertebrates, colour vision results from the activity of cone cells. Most domestic and nocturnal mammals and sharks lack colour vision. They probably see objects in shades of grey (monochrome vision).

❑ **Nocturnal and Diurnal vision :** Man has both day vision and night vision as he has both rods and cones in considerable numbers in the retina. Most birds have only day vision as their retina contains mainly cones. Owls have much better night vision than day vision for they possess a large number of rods and few cones in their retina.

❑ **Range of vision :** The visible range of spectrum varies in animals. Bees, ants, spiders and goldfish can see ultraviolet light, which is invisible to man.

Correspondence between Camera and Eye

Camera	Eye
1. Box	1. Sclera
2. Black inner paint	2. Choroid
3. Shutter	3. Eyelids
4. Diaphragm	4. Iris
5. Light hole	5. Pupil
6. Lens	6. Lens
7. Light-sensitive plate or film	7. Retina
8. Image small and inverted	8. Image small and inverted

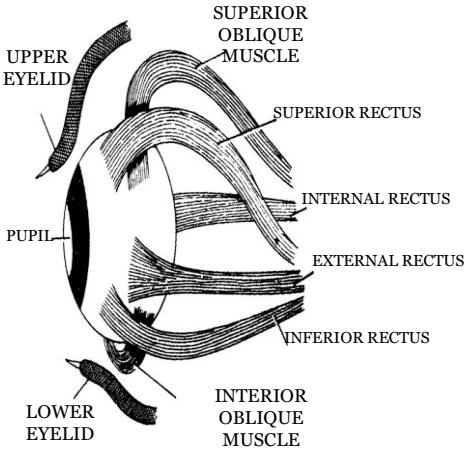


Fig. – Extrinsic muscles of eyeball

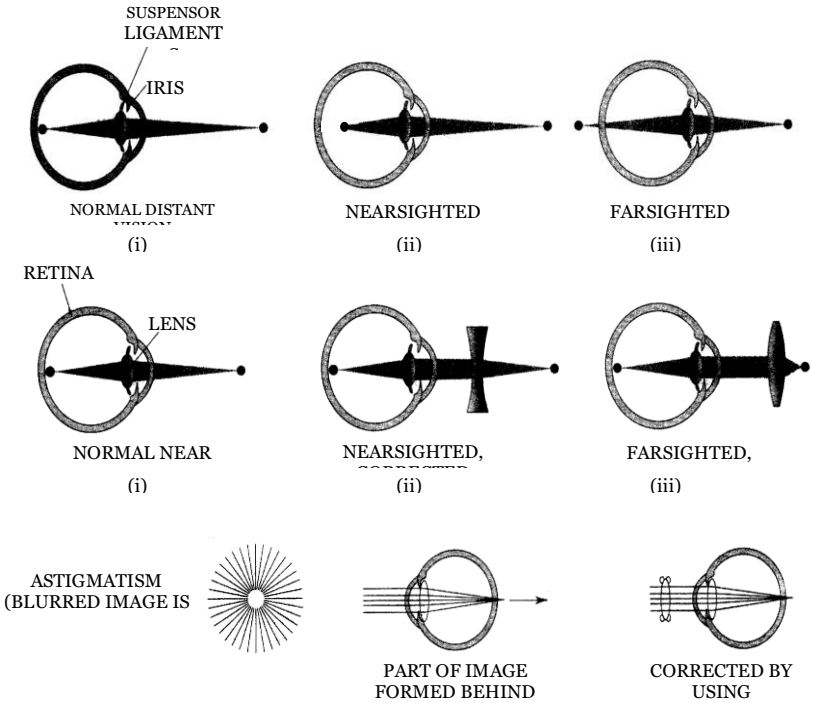


Fig. – Focussing of the human eye

(e) **Eye movement**

- In eye orbit eyeball remain attached with 6 extrinsic muscles.
- Out of six, four are rectus and two are oblique muscles.
- Four rectus muscles are
  (1) Anterior rectus or Internal ractus
  (2) Posterior rectus or External ractus
  (3) Inferior rectus
  (4) Superior rectus
- Oblique muscles are

(1) Inferior oblique muscle (2) Superior oblique muscle

(iii) **Eye defects**

(1) **Myopia**

- Also known as near sightness.
- Short sightness.
- Near object is clear. Far object is not clear.
- Eyeball become longer.
- Image is formed before retina. Can be removed by concave lens.

(2) **Hypermetropia**

- Also known as hypermetropia or long sightness.
- Far sightness.
- Far object is clear, near object is not clear.
- Eye ball become short.
- Image is formed behind the retina.
- Can be removed by convex lens or lens convient.

(3) **Astigmatism**

- Curvature of cornea become irregular and image is not clearly form.
- Can be removed by cylindrical lens.

(4) **Cataract**

- It is due to defective protein metabolism.
- During this lens or cornea sometime both become opaque.
- Operation is needed.

(5) **Gloucoma**

- It is due to increase in intraocular pressure in aqueous chamber.
- Operation is needed at early stage due to blockage of shlemm's canal.

(6) **Trachoma**

- It is increased in redness of eye and more secretion of watery fluid.
- It is due to infection of bacteria, chlamidia trachamastis.
- Due to this follicles may form in conjunctiva.

(7) **Xerothalmia**

- It is due to deficiency of vitamin A. (A_2)
- During this conjunctiva or cornea becomes keratinized.
- It may lead to blindness.

(8) **Strabimus**

- In this type eyeball remain in some what in bended position.
- It is due to long extra ocular muscles during development of eye.
- Operation is needed at early stage.
- Also associated with squint.

(9) **Presbiopia**

- During this power of accommodation of lens decreases due to age factor and defected metabolism.
- Also known as age sightness.
- Can be removed by bifocal lens.

(10) **Photofobia**

- No clear image in bright light.

(11) **Emmetropia :** Normal vision.

10.4 Phonoreceptor and Mechanism of hearing

Also known as stato-acuostic organ. It is the receptor for balancing and hearing which is sensitive for gravity and sound waves. It is also sensitive in orientation of body. It is also known as mechano receptor because of it change mechanical energy of sound waves in to action potential.

(i) **Structure of Ear :** Ear of mammal is divided in to 3 parts –

(a) External ear (b) Middle ear (c) Internal ear

(a) **External ear :** It is made up of pinna and auditory meatus. Pinna is found in only mammals. Its upper rounded part is helix and lower is ear lobe. It is made up of adipose connective tissue and elastic cartilage and has ear muscles which are vestigeal in case of human beings. Pinna collect the sound waves and drive towards auditory meatus.

Auditory meatus is 25 *mm*. long canal and made up of fibro elastic cartilage. It possesses ceruminus gland which secrete cerumin (ear wax). Cerumin trap the dust particles and microbes.

Tympanic membrane : It is also called ear drum and present at the junction of auditory meatus and tympanic cavity. Tympanum (Ear drum) is made up of fibrous connective tissue covered by stratified

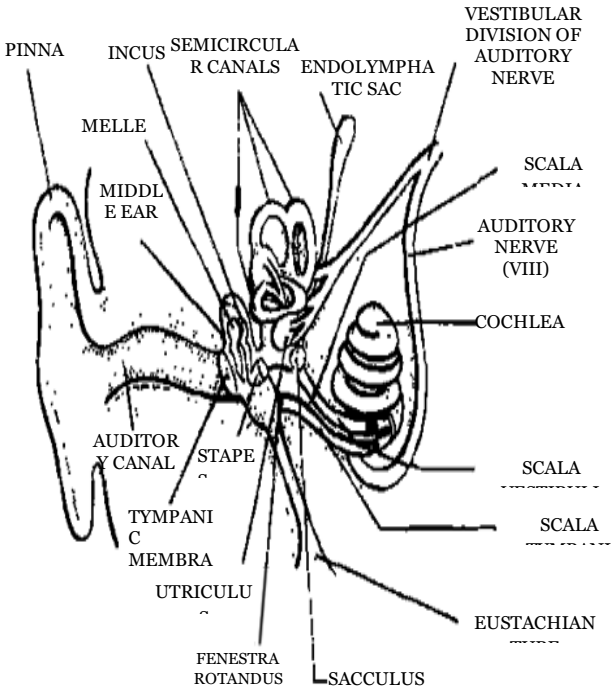


Fig. – Ear of man

epithelium on external side and mucous membrane on the inner side. Its central region is known as umbo.

(b) **Middle ear :** The cavity of middle ear is known as tympanic cavity which is enclosed by tympanic bulla bone of skull and filled with air.

Ear ossicle : A chain of three small, movable bones, the auditory or ear ossicles crosses the tympanic cavity. The outer ossicle is attached to the inner surface of the tympanic membrane.

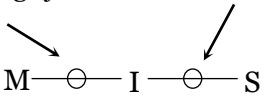
Ear ossicle	Shape	Modification of
M – Malleus	Hammer shaped	Articular bone of lower jaw.
I – Incus	Anvil shaped	Quadrate bone
S – Stapes	Steirrup shaped	Hyomandibular of columella

Size M > I > S

In man ear ossicles are known as H.A.S. stapes is the smallest bone of the body. In frog only stapes is present.

Joints

Synovial hinge joint Ball and socket joint



Muscles

Tencer tympani : It connect malleus to tympanic cavity.

Stepadius : It connect stapes to incus. It is the smallest muscles of the body.

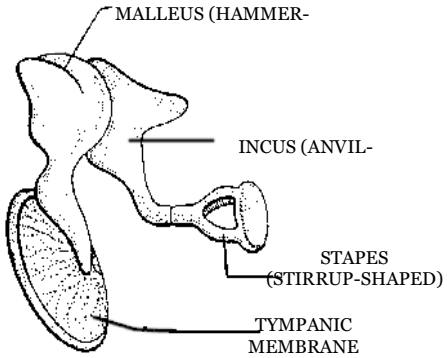


Fig. – Ear

Eustachian tube : It is made up of elastic cartilage and it connect middle ear to nosopharynx. It maintain equilibrium in and out side of the tympanic membrane. Blocking of eustachian tube impairs hearing due to imperfect vibrations of drum. Lining of eustachian tube is pseudostratified epithelium (P.S.E.). P.S.E. is also present in trachea, bronchi and Larynx.

Fenestrae : Between middle ear and internal ear a thin bony membrane is present which possess two apertures (Windows).

Fenestra ovalis : It is upper window, connect middle ear to internal ear and guarded by membrane. End of stapes is fit on the upper window. It is towards vestibule so it is also known as *F. vestibuli.*

Fenestra rotundus : It is ventral window, connect middle ear to internal ear and guarded by membrane. It is towards scala tympani so it is also known as *F. Tympani* (also known as *F. cochleae*).

(c) **Internal ear (Membranous labyrinth) :** Internal ear is also known as membranous labyrinth and enclosed by bony labyrinth. Bony labyrinth is formed by periotic bone or petrous. A cavity is

present between membranous labyrinth and bony labyrinth known as perilymphatic space. It is filled with perilymph and endolymph is found in membranous labyrinth. The membranus labyrinth consists of 2 parts – Vestibule and Cochlea.

- **Vestibule :** The vestibule is a central sac like part. It further consists of 2 chambers large – Utriculus (Upper) and smaller – sacculus (lower).

Semicircular canal : From utriculus 3 semicircular canals arise these are

Anterior semicircular canal (Superior)

Posterior semicircular canal (Inferior)

Horizontal semicircular canal (External)

They are perpendicular each other.

Crus commune : A common part of anterior and posterior semicircular canal arise from dorsal region of utriculus is known as crus commune.

Ampulla : Terminal part of the each semicircular canal is enlarged to form an ampulla.

Crista : Each ampulla has a sensory spot called crista ampullaris or simply crista, for equilibrium.

Sacculus : It is a lower chamber of vestibule. From the lower part of the sacculus arises a short tube, the ductus reuniens, that joins the cochlear duct.

Ductus endolymphaticus : It is filled with endolymph and arises from the junction of utriculus and sacculus.

Macula : are present in utriculus and sacculus. it is a group of sensory cells. In man (Rabbit) 2 maculas are present. (A crista resembles a macula in structure except that lies on an elevation, the acoustic ridge, its sensory cells have longer "hair", and its gelatinous mass is dome shaped, lacks otoliths and is called cupula.)

The macula and cristae differ from each other in the following respects

S.No.	Crista	Macula
1.	Found in ampulla of semi-circular canal	Found in vestibule i.e. sacculus and utriculus.
2.	Their total number is 3	Only 2 are present
3.	No otolith	Otolith present
4.	Long auditory hairs	Short auditory hair
5.	Facilitate maintenance of dynamic equilibrium and angular acceleration e.g.	Help in static equilibrium and linear acceleration e.g. tilting of head or body at rest and

	rotational movement of head	rapid forward movement.

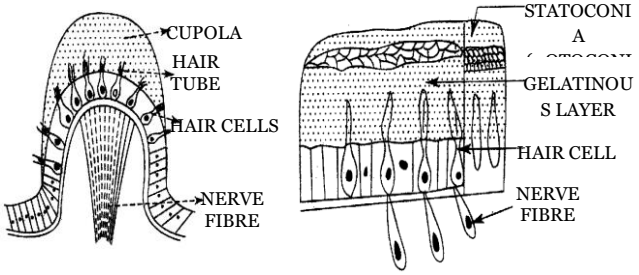


Fig. – Crista and macula of ear

❑ **Otolith :** Also known as otoconia made up of protein and calcium carbonate and present in endolymph.

❑ **Cochlear duct and Cochlea :** It is a spirally coiled tube (2 – 3 coiling) which is connected to sacculus by a short duct. It is divided into 3 chambers by 2 membranes.

Scala vestibuli : Upper filled with – perilymph - connect with middle ear by *F. ovalis*.

Scala media (Real cochlear duct) : Middle filled with – endolymph.

Scala tympani : Lower filled with – perilymph connect with middle ear by *F. Tympani*.

Reissner's membrane : Present at the roof of scala media, it saparate S.M. to S.V.

Basilear membrane : Present at the base of S.M. It is thicker than Reissner's membrane and it separates S.M. to S.T.

Modiolus : In man pillar like central structure is present in cochlea.

Helicotrema : A aperture present in scala media which connect scala vestibuli to scala tympani is known as helicotrema.

Tectorial membrane : Tectorial membrane is a leaf like gelatinous structure present at the dorsal side of organ of corti.

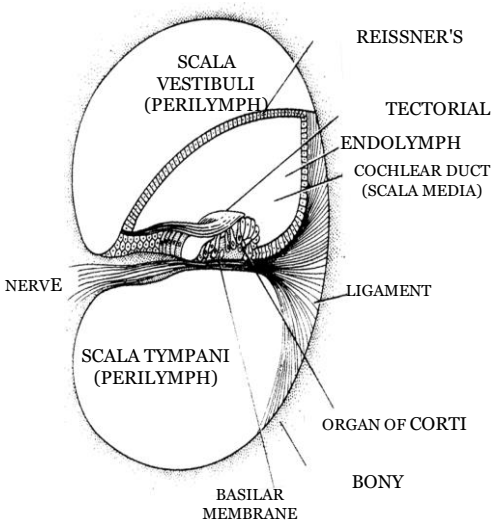


Fig. – Cochlear apparatus in T.S.

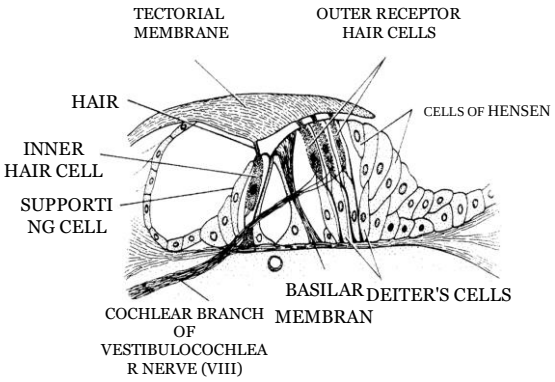


Fig. – Detailed structure of organ of corti (vertical section).

Organ of corti : based on Italian anatomist Alfanso-Corti. Also known as ridges of corti which are present in basiler membrane. Organ of Corti contains a variety of cells. They receives nutrients from endolymph. The cells of organ of Corti are following

Types

Sensory cells (Hair cells) : Have a non motile hair tuft (Stereocilia) on one side and a nerve fibre on other side (Cells are columnar sensory cells).

Supporting cells : It has 3 types of supporting cells

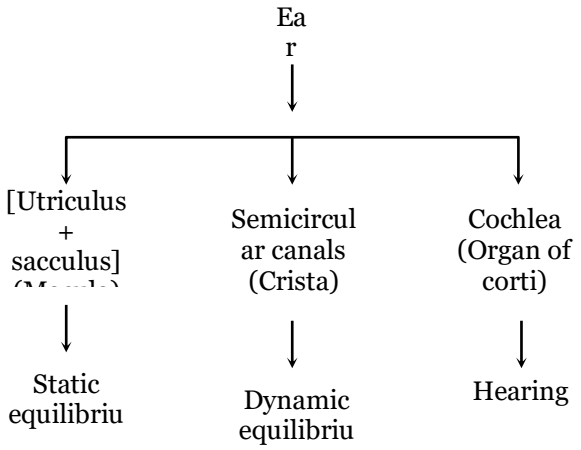
(1) Hensen's cell (2) Dieter's cells and (3) Pillar cells.

Characteristics of cells of organ of Corti etc.

1. Receptor cell (=Hair cells)	**2. Supporting cells**	**3. Tectorial membrane**	**4. Peripheral membrane**
(a) Two type (i)- inner hair cells – in one layer and number 3500, while the (ii) outer hair cells are in 3 – 4 rows (20,000)	(a) Support hair cells, These rest on basilar membrane	Flap of fibrous and gelatinous tissue, the outer right plate is called reticular lamina which is supported by rods or corti anchored to basilar membrane	Has restricted elasticity respond to low to high frequencies within audible region
(b) Hair of outer hair cell extend into scala media and embeded in roof like tectorial membrane.	(b) Provide nutrients and physical support to the hair cells		
(c) Inner hair cells respond to the velocity of movement of the basilar membrane. While the outer hair cells are primarily concerned with the displacement of the basilar membrane by the sound waves.	(c) They are nut involved in sound transduction		
(d) Hair cells have a basal body just under			

the hair. The basal body facilitates transduction of the mechanical signal to a neural signal (electrogenesis)			

(ii) **Mechanism of sound perception :** *Vone Beskey* won the Nobel prize for his work on ear. The mechanism found in ear involve two unrelated functions : Hearings and equilibrium.



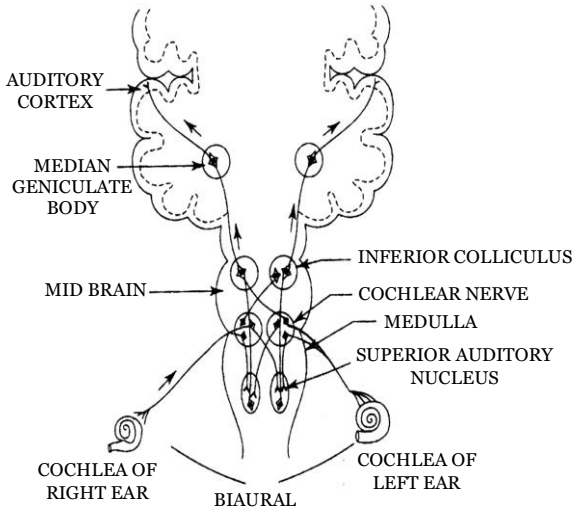


Fig. – Pathway of sound perception from organ of corti in cochlea to auditory cortex of cerebrum

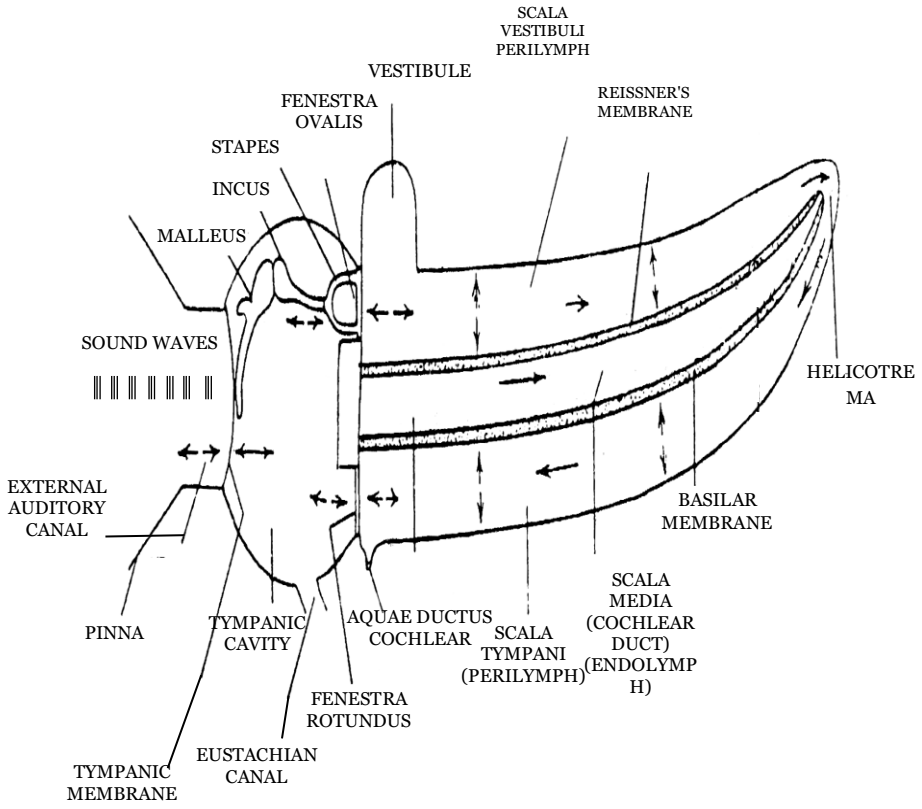
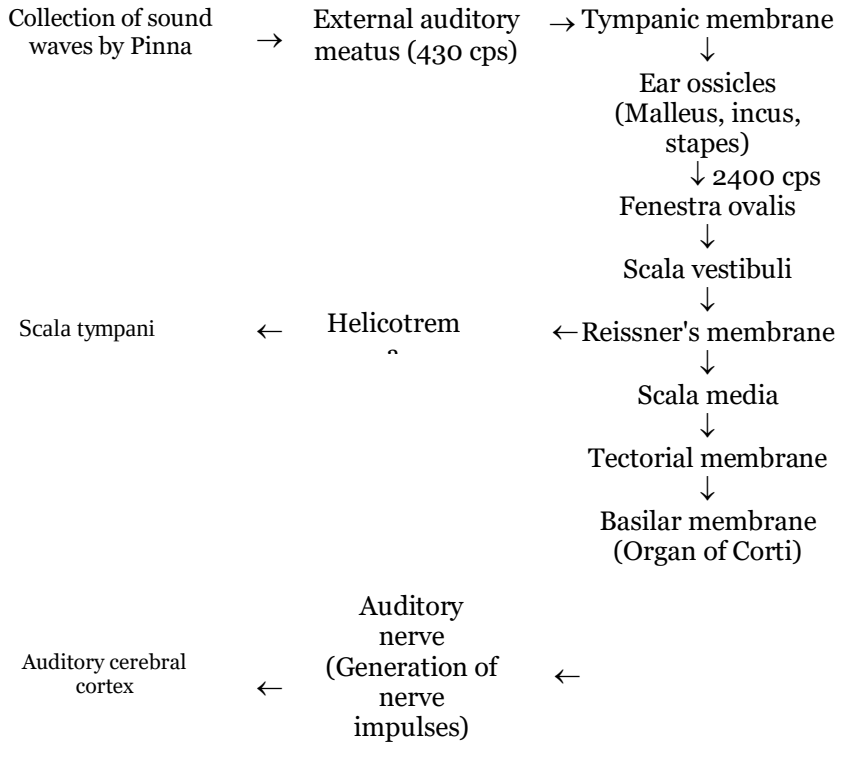


Fig. – Diagram showing the conduction of sound vibrations in the ear

(a) **Hearing :** The ear not only detects sound but also notes its direction, judges its loudness and determines its pitch (frequency) sound waves are collect by the pinna and directed inward through the external auditory meatus (frequency 430 cycle per second). Here they strike the tympanic membrane. The latter begins to vibrate at the same frequency as that of the sound waves. From the tympanic membrane, the vibration are transmitted across the tympanic cavity by the ear ossicles to the membrane of the fenestra ovalis. The force of vibrations is considerably increased in the middle ear by leverage of the ossicles and also by much smaller surface area of the membrane of fenestra ovalis than that of the tympanic membrane. (The frequency is 2400 cycle/sec). Increase in frequency is important because the sound wave are transmitted from air to a fluid medium. The membrane of fenestra ovalis transmits the vibrations to the perilymph of the scala vestibuli and hence via Reissner's membrane to the endolymph in the scala media. From here the vibrations are transferred to the basilar membrane and the perilymph in the scala tympani.

Vibration of the endo lymph of the scala media cause the basilar membrane of this chamber vibrate. Vibrations of the basilar membrane make the "sensory hair" of receptor cells in the organ of corti move in the overlying gelatinous membrane (Tectorial membrane) and get distorted. This stimulation causes depolarisation of the receptor cells and initiation of nerve impulse in the fibres of the auditory nerve. The nerve impulse travels via relay centers *e.g.* spiral ganglion → cochlear nuclei → superior



auditory nuclei → inferior colliculi → auditory cortex of cerebrum (The cerebral cortex interprets the impulses as sound). The various steps in the mechanism of hearing Human ear can hear a frequency of 2000 *cps*. However, it can hear the complete range of frequencies from 20 *cps* – 20,000 *cps* only with intense sound. Sound energy is measured in terms of units called decibels (dB). Sounds in our city homes average 40 – 50 *dB*, but street noise averages 70 – 80 *dB*. Sounds up to 80 *dB* are considered bearable by man, but higher sound intensity are hazardous, causing nervous stress, irritability, increased blood pressure etc. Non stop noise of 90 or more *dB* produces temporary deafness. 160 *dB* sound can cause total deafness by rupturing our ear drum.

(b) **Equilibrium**

(1) **Static equilibrium and linear acceleration :** Maculae detect changes in the head (or body) with respect to gravity (static equilibrium) and in the movement in one direction (linear acceleration). With a change in the position of the body, the otoliths, being heavier than the endolymph, press upon the sensory hairs of the maculae. This stimulates the sensory cells which initiates nerve impulse in the fibres of the auditory nerve. The macula of utricle responds to vertical movements of the head, and the macula of saccule responds to lateral (sideways) movement of the head.

On rapid forward movement, the otoliths, because of having greater inertia than the surrounding endolymph, lag behind and press back the sensory hair, stimulating the sensory cells to generate nerve impulses.

(2) **Dynamic equilibrium :** Cristae detect turning or rotational movements of the head (angular acceleration). When the head is turned, the endolymph in the semicircular ducts, due to its inertia, does not move as fast as the head and the sensory cells of the crista, but continues to move after the head stops moving. Because of this difference in the rate of movement, the sensory hair of the cristae are swept through the endolymph and become bent over. This disturbance stimulates the sensory cells and sets up action potential in the fibres of the auditory nerve, which transmits it to the brain. Since the three semicircular ducts are arranged in three different planes, a movement of the head in any direction will stimulate the sensory cells of at least one crista.

(iii) **Defects of ear**

(a) **Labyrinthine disease :** Malfunction of inner ear.

(b) **Meniere's disease :** Loss of hearing due to defect in cochlea.

(c) **Otitis media :** Acute infection of middle ear.

(d) **Eustachitis :** Inflammation of eustachian tube.

(e) **Myringitis (Tymanitis) :** Inflammation of eardrum.

(f) **Otalgia :** Earache (pain in ear)

External auditory meatus (430 cps)

10.5 Nose

10.6 Tongue

10.7 Skin

Important tips

- **Nystagmus –** An uncontrolled oscillation of the eyes, is one of the symptoms of an inner-ear disease called Meniere's disease (from Prosper Meniere, French physician, 1799-1862.) The early symptom of this disease often, 'ringing in the ears' or tinnitus. Since the fluid of the cochlea and that of the vestibular apparatus are continuous through a tiny canal, the vestibular symptoms of vertigo (loss of equilibrium) and nystagmus often accompany hearing problems in this disease.
- Cones are absent in noctural animals like shrews, hedge hogs, rodents and bats.
- During night the eyes of carnivores like cat, dog, lion, seal glow. It is due to tapetum lucidum a reflecting layer next to retina, which is made of crystaline layer with zinc, cysteine and guanin.
- Bees can see ultraviolet light.
- In vision, light energy in converted into chemical energy.
- The normal eye is known as emmetropic.
- Acute vision is found in birds like vulture.
- Deer has biggest eyes in proportion to body size.
- Except rabbit and man, harderian glands are found in whale, mice, shrews and some other mammals.
- Diurnal animals are adapted to see during day light (photopic vision) and can perceive colour. In dark, colours are not perceived. Such animals have more cones in their eye than rods.
- Nocturnal animals have more rods than cones in their eye. The image formed has no colour but is black or grey, the edges are not sharp.
- **Colour blindness –** It is known as daltonism. It is in between red and green colour. It is genetic defect.
- Colour blind is sexlinked character (X-linked).
- Cones are important for colour vision and day vision.
- Colour vision is due to presence of specialise cone cell in Retina which value the sensitivity for different colours.
- **Night blindness –** During this rhodopsin is not resynthesized or regenerate in dim light.
- **Monocular vision –** Found in frog, rabbit and horse.
- **Binocular vision –** Primates, ape, monkey.
- **Colour vision –** Fishes, reptiles, amphibia.
- **Perfect colour vision –** Primates (mammals)

- **Telescopic vision –** Birds
- **Stereoscopic vision –** Man, (3-Dimensional vision)
- Largest eyeball present in horse.
- Shortest sight in present in monkey.
- Sharpest vision is present in eagle.
- **Sty –** Sebaceous gland infection leading to its inflamination.
- Microphthalmic or a opthalmic state (a congenital disorder).
- **Visual reflexes –** Several types are known, e.g. (a) Pupil light reflex state when eyes are suddenly exposed to bright light, their pupils contract by reflex. It is under autonomic nervous control. (b) Accomodation reflex contraction of ciliary muscles in the process of accomodation for viewing near objects, as well as, the simultaneous constriction of pupil are reflex reactions. (c) Conjunctival reflex if conjunctiva is stimulated by S and particles which accidently falls on it, the eye suddenly blinks by reflex.
- **Iridial part of Retina –** It is also thin and is like wise composed only of a layer of pigmented cells. It lies in contact with the iris.
- There are only four basic modalities of taste, which are sensed most acutely in particular regions of the tongue. These are sweet (tip of the tongue), sour (sides of the tongue), bitter (back of the tongue) and salty (over most of the tongue.)
- **Vitamin A and eyesight –** Vitamin A is essential for good eye sight as it forms retinal, a component of visual pigments in the rods and cones. Deficiency of vitamin A causes night blindness (nyctolopia).
- Sclera and Uvea are mesodermal, rest of the eye is ectodermal.
- Conjunctiva, lens and retina are ectodermal.
- Iris is the third portion of the vascular tunic.
- Pupil is the black hole in the centre of the iris.
- Atropine is a chemical used by doctors of dilate the pupil before testing.
- Vitamin A is required for proper vision.
- Photopic vision is associated with cones.
- Visual pigment for colour vision are erythropsin (sensitive to red), chloropsin (sensitive to green) and cyanopsin (sensitive to blue).
- Colour vision in man is trichromatic.
- Apes, monkeys, human beings, birds, lizards, turtles and some fishes possess colour vision.
- Retina of owl contains only rods, while retina of fowl contains only cones.

ASSIGNMENT

FEW IMPORTANT RECEPTORS

Basic Level

1. The sense organ for touch present in the skin is
(a) Free nerve ending (b)Pacinian corpuscles
(c) Meissner's corpuscles (d)Auerbach plexus

2. The chemoreceptors in the body are
(a) Proprioceptors (b) Meissner's corpuscles
(c) Olfactory and taste organs (d)Free nerve endings

3. Statolith is an organ which helps in
(a) Vision (b) Equilibrium
(c) Tactile stimulation (d) Chemical stimulation

4. Meissner's corpuscles are located in
(a) Pancreas and secrete trypsinogen (b) Adrenal and secrete epinephrin
(c) Spleen and destroy worn out erythrocytes (d) Skin and perceive gentle pressure

5. All the following are chemoreceptors except
(a) Taste (b) Arterial oxygen (c) Blood glucose (d) Free nerve endings

6. In the deep layer of skin the receptors of pressure are known as
(a) Krause 's and bulbs (b) Corpuscles of Ruffini
(c) Meissner's corpuscles (d) Pacinian corpuscles

7. Organs of Ruffini are receptors of
(a) Heat (b) Cold (c) Pressure (d) Touch

8. A Meissner corpuscle functions as a
(a) Chemical receptor (b) Touch receptor (c) Heat receptor (d) Pressure receptor

9. Osphardium of *Pila globosa* is
(a) Photoreceptor (b) Chemoreceptor (c) Thermoreceptor (d) Tangoreceptor

10. The pacinian corpuscle present in the skin is for
(a) Pain (b) Pressure (c) Movement (d) Temperature

11. Which type of sensation occurs in pepper and chilies
(a) Sour (b) Bitter (c) Pain (d) Salty

12. Bat can travel with
(a) Eyes open (b) Eyes plugged and ears open
(c) Ears plugged and eyes open (d) Ears closed and eyes plugged

13. End bulbs of Krause perceive the sensation of bulbs
(a) Touch (b) Heat (c) Cold (d) Pressure

14. Merkels discs take part in perceiving the sensation of
(a) Pressure (b) Cold
(c) Heat (d) Constant touch and its localisation

15. Ruffini's free endings are..... receptors
(a) Tango (b) Calalo (c) Frigido (d) Rheo

16. Sensation of stomach pain is due to
(a) Interoceptors (b) Exteroceptors (c) Proprioceptors (d) Teloreceptors

17. Nasal chamber has
(a) Two pairs of nasal conchae (b) Three pairs of nasal conchae
(c) Four pairs of conchae (d) Five pairs of nasal conchae

18. Nasal conchae
(a) Decrease the surface area (b) Increase the surface area
(c) Prevent entry of dust particles (d) None of these

19. Ruffini's corpuscles respond to
(a) Touch (b) Pressure (c) Temperature (d) Cold

20. Turbinal bones are present in the nasal passage for conditioning the air in
(a) Amphibians (b) Birds (c) Mammals (d) Reptiles

21. Thermoreceptors are sensitive to
(a) Cold (b) Heat (c) Temperature (d) Pressure

22. Which of the following is not a teloreceptor
(a) Eye (b) Tongue (c) Nose (d) Ear

23. Rheoreceptors are receptors for
(a) Electric current (b) Water current (c) Vision (d) None of these

24. Response to contact is known as
(a) Thigmotaxis (b) Chemotaxis (c) Galvanotaxis (d) Thermotaxis

25. Receptors of skin are called
(a) Interoceptors (b) Gland receptors (c) Somatic receptors (d) Visceral receptor

26. The receptor receiving stimuli from distance is called
(a) Caloreceptor (b) Osmo receptor (c) Teloreceptor (d) Proprioceptor

27. The receptors for both taste and smell are
(a) Mechanoreceptors (b) Chemoreceptors (c) Thermoreceptors (d) Osmoreceptors

28. Proprioreceptors are found in
(a) Sole of feet (b) Adrenal cortex (c) Hypothalamus (d) Medulla

Advance Level

29. Jacobson's organ is found in
(a) Nose (b) Eye (c) Ear (d) Kidney

30. The stimuli of hunger, thirst, pressure of blood and body balance are received by the
(a) Proprioceptors (b) Interoceptors (c) Tango-receptors (d) Algesi-receptors

31. Jacobson's organ in man
(a) Functions as smelling organs (b) Functions as gustatory organ
(c) Is a vestigial organ (d) Functions as pain sensory organ

32. Some cells like micro corpuscles are found deep in the skin. These are
(a) Laminated corpuscles of pacini (b) Meissner's corpuscles
(c) Bulbous corpuscles of Krause (d) Markel's corpuscles

33. Tactile receptors in mammals are maximum on
(a) Body (b) Limbs (c) Face (d) Head

34. Vibrissae are associated with the function of
(a) Theromoregulation (b) Gustation (c) Tactile perception (d) Reproduction

35. Match the following

Receptors	**Stimuli**
A. Statoreceptors	1. Frequencies of vibrations
B. Gustatory receptors	2. Hunger and thirst
C. Enteroreceptors	3. Taste
D. Mechanoreceptors	4. Equilibrium

The correct pairing sequence is
(a) 4, 3, 2, 1 (b) 4, 1, 2, 3 (c) 4, 2, 1, 3 (d) 3, 4, 1, 2

36. Jacobson's organ is not found in
(a) Rabbit (b) Man (c) Both (a) and (b) (d) Frog

37. A receptor
(a) Is the first segment of a reflex arc (b) Initiats nerve impulses
(c) Responds to only one type of stimulation (d) All of these

38. The receptors found in the muscles. tendons and joints are
(a) Teloreceptors (b) Proprioreceptors (c) Interoceptors (d) None of these

39. Proprioreceptors are those, which give the sense of
(a) Chemicals (b) Temperature
(c) Taste (d) Changes in the internal environment of the body

40. Nociceptors detect
(a) Change in temperature (b)Damage to tissue (c) Taste in mouth (d) Light on retina

41. Receptors which are sensitive to pain are known as
(a) Tangoreceptors (b) Algesireceptors (c) Frigidoreceptors (d) Rheoreceptors

42. The amphids are cuticular sensory structures on the ventro-lateral lips of Ascaris. These are
(a) Chemorceptors (b) Tangoreceptors (c) Tactoreceptors (d) Olfactoreceptors

43. Herbst corpuscles are found in
(a) Skin of amphibia (b) Ligament and tendon (c) Nostril of mammals (d) Mouthparts of birds

44. Grandry's corpuscles are found in
(a) Skin of mammals (b) Tongue of snakes (c) Beak base of birds (d) All of these

45. Most sensory cells respond to
(a) Environmental electricity (b) Pressure
(c) Changes in energy (d) Threshold levels of energy

46. Thermoreceptors are
(a) Organ of Ruffini (b) Krause end bulb (c) Ampulla of Lorenzini (d)All of these

47. Corpuscles of Golgi and Mazzoni are found in
(a) Tongue of mammals (b) Nasal chambers
(c) Blood of vertebrates (d) Subcutaneous tissue of fingers

48. The sweet and acidic tastes are better detected by
(a) Tip of the tongue (b) Base of the tongue
(c) Middle of the tongue (d) Lateral sides of the tongue

49. Pressure, tissue vibrations and tension are perceived through
(a) Hair and organs (b) Free nerve endings (c) Ruffini's corpuscles (d) Pacinian corpuscles

50. The cranial nerves associated with taste are
(a) III,V and IX (b) VII, IX and X (c) IV, V and IX (d) VII, VII and X

51. Receptors for touch present in the skin are
(a) Krause's end bulbs (b) Corpuscles of Ruffini
(c) Pacinian corpuscles (d) Meissner's corpuscles

52. Olfactory lobes are most poorly formed in.... with most poor sense of smell
(a) Frog (b) Fish (c) Bird (d) Mammal

53. Sensory receptors in the walls of the right atrium are stimulated when
(a) These regions are distended with blood and wall is stretched
(b) Blood temperature changes
(c) A rise in carbondioxide content of blood occurs
(d)There is a change in oxygen content of blood

54. Our taste organs located on tongue are examples of
(a) Exteroceptors (b) Interoceptors (c) Phonoreceptors (d) Teloreceptors

55. Rheoreceptors are found in
(a) Fishes (b) Birds (c) Mammals (d) All vertebrates

56. Merkel's discs in the skin of rabbit are
(a) Tangoreceptors (b) Painreceptors (c) Thermoreceptors (d) Vibroreceptors

57. Receptors for initial contact and movements of object over the skin are
(a) Pacinian corpuscles (b) Hair end organs (c) Merkel's discs (d) Ruffini's corpuscles

58. Sensation of heat is picked up by
(a) Meissener's capsules (b)Organs of Golgi-Mazzoni
(c) Pacinian corpuscles (d)Ruffini's corpuscles

EYE

Basic Level

59. Which part of the eye controls the amount of light entering in it
(a) Cornea (b) Ciliary body
(c) Iris (d) Suspensory ligament

60. Retina of mammalian eye is composed of
(a) Cones only (b) Rods only
(c) Rods and cones (d) Rods cones and neurological cells

61. Perception of colour is possible among
(a) Birds (b) Reptiles (c) Mammals (d) Men

62. In mammals, the lachrymal glands are concerned with secretion of
(a) Hormones (b) Digestive juices (c) Enzymes (d) Tears

63. The friction between the eyelids and the cornea is avoided by the secretion of
(a) Lachrymal glands (b) Conjunctive and eyelids (c)Hardarian glands (d) Meibomian glands

64. The layer of the epidermis over the eye is
(a) Cornea (b) Conjunctiva
(c) Eyelids (d) Nictitating membrane

65. The iodopsin which is in cones is sensitive for
(a) Light (b) Darkness (c) Colour (d) Fair light

66. In the blind spot where the optic nerves leave the eye
(a) Rods and cones are absent (b) Only cones are present
(c) Only rods are present (d) Special neurons are present

67. Cavity of vitreous humour in the eyes are situated
(a) Behind the lens (b) Infront of the lens
(c) Behind the retina (d) Between the retina and sclerotic

68. Iodopsin is a light sensitive pigment and is present in the
(a) Rods (b) Cones (c) Neuroglia (d) Bipolar cells

69. The part of an eye which acts like a diaphragm of a photographic camera is
(a) Pupil (b) Iris (c) Lens (d) Cornea

70. The rods and cones of the eye retinal layer are modified
(a) Hair (b) Unipolar neurons (c) Bipolar neurons (d) Multipolar neurons

71. The cones are located in
(a) Iris (b) Sclerotic (c) Choroid (d) Retina

72. In a mammal, the eyes are lubricated by secretion of
(a) Harderian glands (b) Nictitating membrane (c) Meibomian glands (d) Lachrymal glands

73. Eye ball will not be moved inwards on the damage of which of following muscles
(a) Internal rectus (b) External rectus (c) Inferior oblique (d) Superior oblique

74. Vitreous humour is seen in
(a) Ear (b) Eye (c) Brain (d) Bone marrow

75. The space between the lens and the cornea of the human eye is
(a) Vitreous chamber (b) Aqueous chamber (c) Retina (d) Iris

76. Human eye lens is
(a) Spherical and can be moved forward (b) Biconvex and cannot be moved forward
(c) Spherical and cannot be moved forwards (d) Biconvex and can be moved forward

77. What is the correct sequence of the parts of the eye that the light rays cross in reaching the retina
(a) Pupil $\rightarrow$ cornea $\rightarrow$ aqueous humour $\rightarrow$ lens $\rightarrow$ vitreous humour
(b) Lens $\rightarrow$ cornea $\rightarrow$ aqueous humour $\rightarrow$ vitreous humour $\rightarrow$ pupil
(c) Aqueous humour $\rightarrow$ vitreous humour $\rightarrow$ cornea $\rightarrow$ pupil $\rightarrow$ lens
(d) Cornea $\rightarrow$ aqueous humour $\rightarrow$ pupil $\rightarrow$ lens $\rightarrow$ vitreous humour

78. In the retina of human eye, the cones are concentrated more at the
(a) Blind spot (b) Edges of retina (c) Fovea (d) Choroid

79. The movement of eye ball is brought about by the
(a) Adductor muscle (b) Rectus muscle (c) Biceps (d) Peroneus

80. The hollow of the eye is divided into aqueous chamber and vitreous chamber by
(a) Optic nerve (b) Retina (c) Lens (d) Iris

81. The central opening of iris is called as
(a) Pupil (b) Cornea (c) Lens (d) Fovea centralis

82. Visual purple is a pigment concerned with
(a) Colour of the eye (b) Colour blindness (c) Perception of image (d) Formation of image

83. The function of iris in the eyes of frog is to
(a) Refraction of light rays (b) Alter the size of the pupil
(c) Move the nictitating membrane (d) Move the lens forward and backward

84. Aqueous humour is present
(a) Infront of the retina (b) Infront of the cornea
(c) Behind the conjunctiva (d) Infront of the lens

85. If the light source infront of an eye becomes bright suddenly
(a) Focus of lens will change (b) Retinal blood supply will cut
(c) Vitreous humour becomes fluid (d) Pupil will contract

86. Modified sebaceous glands on the eyelid of mammal are known as
(a) Lachrymal gland (b) Meibomian gland (c) Pituitary gland (d) Retinal gland

87. In eyes the bipolar cells are present in
(a) Sclerotic (b) Choroid (c) Retina (d) Yellow spot

88. In vision, photons are converted into
(a) Chemical energy (b) Mechanical energy (c) Electrical energy (d) Physical energy

89. How many eye muscles are present which control all types of eye movement
(a) 3 (b) 4 (c) 5 (d) 6

90. Vitamin A is necessary for the proper physiological function of eye because
(a) It is necessary for nerve impulses in retina (b) Rhodopsin is made up of vitamin A

(c) Oxidation of rhodopsin requires vitamin A (d) None of the above

91. The vitreous chamber is perforated from front to behind by a narrow tube which is known as

(a) Vitreous canal (b) Hyaloid canal (c) Vitreous aqueous canal (d) Posterior canal

92. Cones contain a photosensitive chemical known as

(a) Rhodopsin (b) Acetylcholine (c) Acetylcholinesterase (d) Iodopsin

93. How many types of cones are present which are responsible for the colour differentiation

(a) Only one (b) 7 types for seven fundamental colours

(c) 3 types (d) 4 types

94. Function of ciliary muscles

(a) To contract pupil when one move in sunlight (b) To keep valve in position

(c) To rotate eye ball (d) To change shape of lens

95. The visual pigment in rods of retina of vertebrate eye which is responsible for detection of light is

(a) Melanin (b) Retinine (c) Keratin (d) Rhodopsin

96. Sensitive layer of eye is

(a) Sclerotic (b) Retina (c) Cornea (d) None of these

97. Macula lutea is located

(a) Below the lens (b) Below the pupil (c) Below the iris (d) In the middle of the retina

98. In eyes the image which if formed on the retina is

(a) Erect and real (b) Erect and virtual (c) Inverted and real (d) Inverted and virtual

99. Antibacterial agent present in tears is

(a) Urea (b) Lysozyme (c) Albumin (d) Globulin

100. Why owls are able to see only during nights

(a) Because retina of owls contains only rods (b) Because retina of owls contains only cones

(c) Because owls are nocturnal (d) Because of absence of rods and cones both

101. Sclera is the external covering of eye which

(a) Diverts the light (b) Protects and maintains the shape of eye ball

(c) Is the source of tears (d) Is composed of rod cells

102. Choroid is

(a) Middle layer of ear (b) Innermost layer of eye (c) Innermost layer of ear (d) Middle layer of eye

103. Coloured (Pigmented) layer of eye is

(a) Choroid (b) Sclerotic (c) Retina (d) All the above

104. Through which of the following the optic nerve enters the eye ball

(a) Yellow spot (b) White spot (c) Blind spot (d) Brown spot

105. Yellow spot on the retina is known for

(a) Possession of abundant rods (b) Complex blood vascular system

(c) Preponderance of cones (d) High pigmentation

106. In mammals the frictionless blinking of eyelids is due to

(a) Cerunimous gland (b) Harderian gland (c) Lachrymal gland (d) Meibomian gland

107. Approximate number of cones in each eye

(a) 5 million (b) 7 million (c) 75 million (d) Over 100 million

108. Which of the following is absent in the human eye

(a) Choroid (b) Cricoid (c) Retina (d) Sclera

109. In which of the following eyes do not shine at night

(a) Cat (b) Lion (c) Man (d) Fis

110. Density of vitreous humour is equal to the

(a) Air (b) Aquous humour (c) Lens (d) Conjunctiva

111. Lens of eye retina is developed from

(a) Ectoderm (b) Mesoderm (c) Endoderm (d) Ecto-mesoderm

112. In the chemistry of vision in mammals, the photosensitive substance is called

(a) Selerotin (b) Retinol (c) Rhodopsin (d) Melanin

113. Retina is most sensitive at

(a) Optic disc (b) Periphery (c) Macula lutea (d) Fovea centralis

114. The black pigment in the eye which reduse internal reflection is located in

(a) Retina (b) Iris (c) Sclerotic (d) Cornea

115. When the intensity of light is low during night, the light is detected by

(a) Rods (b) Cones (c) Lens (d) Both rods and cones

116. Colour blindness results from

(a) Absence of rods (b) Absence of cones (c) Absence of eyelids (d) Inverted retina

117. In man, the image formation occur on retina for most bright vision is should form on

(a) At the place of entry of optic nerve (b) Blind spot

(c) Yellow spot (d) At the junction of ciliary body and lens

118. Only rods are present in the eyes of one of the following animals

(a) Pigeon (b) Squirrel (c) Fowl (d) Owl

119. The iris of eye is

(a) Photosensitive (b) Chemoreceptor (c) Calororeceptor (d) All of these

120. In nocturnal animals which one of the following is correct

(a) Retina contains more cones (b) Adjustable pupil (c) Deficiency of vitamin A (d) Retina contains more rods

121. Iris of an eye in an extension of

(a) Cornea (b) Sclerotic (c) Retina (d) Both choroid and retina

122. The colour of eye is due to the pigmentation in

(a) Iris (b) Cornea (c) Retina (d) Pupil

123. Acute vision is found in

(a) Vulture (b) Frog (c) Shark (d) Bat

124. Rhodopsin (visual purple) of eye will require

(a) Guava (b) Mango (c) Carrot (d) Wheat

125. Which of the following passes from lens to blindspot

(a) Eustachian canal (b) Canal of Schlemm (c) Hyaloid canal (d) Semicircular canal

126. Colour to the eye is imparted by

(a) Lens (b) Pupil (c) Iris (d) Vitreous humour

127. The size of pupil decreases due to the contraction of

(a) Radial muscles (b) Circular muscles

(c) Both circular and radial muscles (d) Nictiating membrane

128. Cyanolabe pigment helps in distinguishing

(a) Green colour (b) Red colour (c) Blue colour (d) Dim light

129. Perception of colour is possible among

(a) Reptiles (b) Birds (c) Mammals (d) All of these

130. In man's eye, the sclerotic is made up of

(a) Bone (b) Cartilage (c) Muscles and cartilage (d) Fibrous connective tissue

131. A red flower looks black in the evening because of

(a) Change in flower colour (b) Functioning of rods only

(c) Beginning of colour blindness (d) Absence of cones

132. Human eye is most sensitive to

(a) Red colour (b) Green colour (c) Violet colour (d) Orange colour

133. Stereoscopic vision is found in

(a) Fish (b) Frog (c) Snake (d) Man

134. Cornea transplantation is successful as cornea is

(a) Easily available (b) Without blood supply (c) Easily preserved (d) Easily stiched

135. At the point of exit of the optic nerve,

(a) There are no rods and cones (b) There are rods but no cones

(c) There are cones but no rods (d) All types of cells are absent

136. Tapetum lucidum is present

(a) In retina (b) In choroid (c) In sclera (d) Between retina and choroid

137. Perception of colour is possible among

(a) Human being (b) Apes (c) Monkeys (d) All of these

138. Photopic vision is associated with

(a) Rods (b) Cones (c) Both (d) None of these

139. Telescopic vision is reported in

(a) Man (b) Rabbit (c) Bird (d) Frog

140. In rabbit, vision is

(a) Binocular (b) Monocular (c) Both (d) None of these

141. Which of the following vitamins is used for proper vision

(a) *K* (b) *D* (c) *A* (d) *E*

142. Shutter and diaphragm of a photographic camera is compared to structures in human eye

(a) Iris and ciliary body (b) Pupil and ciliary muscles (c) Iris and cornea (d) Eye lids and iris

143. The retina of the eye acts as a

(a) Lens of the camera (b) Aperture of the camera (c) Film of the camera (d) Shutter of the camera

144. The secretion of lacrymal gland is

(a) Watery (b) Acidic (c) Oily (d) Alkaline

145. Sclerotic is the outermost layer of

(a) Nose (b) Ear (c) Heart (d) Eye

146. Sclera of human eye contains many

(a) Yellow fibres (b) Collagen fibres (c) Blood vessels (d) Reticular fibres

147. Iris is part of

(a) Sclerotic (b) Choroid/ Uvea (c) Choroid and retina (d) Sclerotic and choroid

148. Blind spot is the area of the eye where

(a) Colour vision occurs (b) Light intensity is perceived

(c) Rods and cones are irregularly distributed (d) Sensory cells are absent

149. The centre for sight is the

(a) Temporal lobes of cerebrum (b) Parietal lobes of cerebrum

(c) Occipital lobes of cerebrum (d) Frontal lobes of cerbrum

150. Wall of eye ball is made of layers

(a) Three (b) Two (c) One (d) Four

151. Which regulates the amount of light falling on the lens

(a) Pupil (b) Cornea (c) Iris (d) Ciliary body

152. The visual purple is concerned with

(a) Bright light (b) Dim light (c) Moderate light (d) Darkness

153. The visual violet is concerned with

(a) Bright light (b) Dim light (c) Moderate light (d) Darkness

154. At rest, the eyes have

(a) Relaxed ciliary body (b) Contracted ciliary body

(c) Suspensory ligament is loose or relaxed (d) Eye lens is elastic and biconvex

155. Rhodopsin pigment occurs in

(a) RBC (b) Retinal cells (c) Skin (d) Bile

156. Cornea is

(a) Vascular (b) Avascular (c) Both (1) & (2) (d) None of these

157. Canal of schlemm is present at the junction of

(a) Sensory and nonsensory retina (b) Choroid and ciliary body

(c) Sclera and cornea (d) None of these

158. Which of the following is not a basic colour in trichromatic vision

(a) Red (b) Yellow (c) Green (d) Blue

159. Harderian glands are found in **]**

(a) Rabbit (b) Frog (c) Man (d) Pheretima

160. Tears are composed of

(a) Water (b) Salts (c) Lysozyme (d) All of these

161. Which layer of the wall of an eyeball contains abundant blood vessels

(a) Choroid (b) Sclerotic (c) Retina (d) Lens

162. Ciliary and iris muscles are formed from

(a) Ectroderm (b) Mesoderm (c) Endoderm (d) Both (a) and (b)

163. Suspensory ligament is part of

(a) Tongue (b) Brain (c) Heart (d) Eye

164. Cornea is a transparent part of

(a) Choroid (b) Sclerotic (c) Conjunctiva (d) Retina

165. Rhodopsin is a constituent of

(a) Choroid (b) Sclera (c) Cornea (d) None of these

166. Function of iris is to

(a) Move the lens (b) Alter the diameter of pupil (c) Close the eyelid (d) Secrete aqueous humor

167. Suspensory ligament is present in between the

(a) Sclera and choroid (b) Choroid and retina

(c) Ciliary body and lens (d) Lens capsule and ciliary body

Advance

168. Differentiation of colour is the property of the cone: it is because of the

(a) Types of cones sensory to different colours only

(b) Different types of cones alongwith the different types of colour sensory centres in the brain

(c) Single type of cones but it has the properties to differentiate the colour

(d) The colour differentiation is entirely a property of the colour sensory centre in the brain

169. Fovea centralis of retina perceives

(a) Diffused light (b) Dim light (c) Coloured light (d) Coloured and dim light

170. The pupil becomes bigger to allow more light during dark by the

(a) Contraction of radial muscles of the iris (b) Relaxation of radial muscles of the iris

(c) Contraction of circular muscles of the iris (d) Contraction of suspensory ligaments

171. When the eye looks at near objects, the lens becomes more convex due to the

(a) Contraction of ciliary muscles (b) Relaxation of ciliary muscles

(c) Contraction of iris muscles (d) Relaxation of iris muscles

172. Rods contain visual purple or rhodopsin. When light falls on rhodopsin, it is

(a) Absorbed (b) Oxidised (c) Bleached (d) Charged

173. In the yellow spot or fovea centralis, the cells present are

(a) Rods and cones (b) Only rods (c) Only cones (d) Predominantly rods

174. Harderian glands are absent in

(a) Rabbit (b) Man (c) Rabbit and man (d) Crow

175. In mammalian eye, the power of accommodation is controlled by changing the shape of the lens. It is governed by

(a) Cornea (b) Pupil (c) Iris (d) Ciliary body

176. Photosensitive pigment is

(a) Similar in all eyes (b) Similar in all vertebrate eyes

(c) Variable in all eyes (d) Variable in all vertebrate eyes

177. If a bright light falls over eyes, why a person is unable to see for a moment

(a) Because bright light closes the pupil

(b) Because bright light does not stimulate the nerve impulse for a very short time

(c) Because bright light increases chemical breakdown in rods and cones which does not allow another visual impulse to pass for a moment

(d) Because bright light initiates the rhodopsin to dissociate for a moment

178. Human eyes are most sensitive to the wave length of

(a) 1000Å (b) 5000Å (c) 7000Å (d) 20Å

179. The binocular vision in mammals is due to the

(a) Eyes adapted for such vision

(b) Decussation of optic nerve at optic chiasma but no change of fibres of left and right optic nerve

(c) Exchange of left and right optic nerve fibres after decussation at optic chiasma

(d) None of these

180. Mid point of yellow spot contains only cones. This point is known as

(a) Macula lutea (b) Macula corpus (c) Macula lucidium (d) Macula rotendus

181. In mammals, the colour is perceived by or which is responsible for colour detection

(a) Red cells of retina (b) Cone cells of retina (c) Cornea lens complex of eye (d) Rods and cones

182. The nictitating membrane plica semilunaris is a vestigial organ and is present in

(a) Inner to the middle layer of eye (b) Outer to the middle layer of eye

(c) Inner corner of eyes (d) Outer corner of eyes

183. In which of the following does the eye function is different from the camera

(a) Diaphragm controls the amount of light entering in

(b) The images are formed upside down

(c) The lens automatically move backward and forward to focus the image

(d) Any light inside passes through a lens

184. Chief functions of the rods and cones in the eye of a vertebrate are

(a) Rods are important for vision in bright light and cones in dim light

(b) Rods are important for vision in dim light and cones in bright light

(c) Rods are involved in colour vision and cones in distinguishing intensities of light

(d) Rods and cones are both important for vision in dim light

185. Transmission of light into nerve impulse is a

(a) Mechanical process (b) Chemical process (c) Biophysical process (d) Biological process

186. The cornea and lens of the mammalian eyes are both

(a) Richly supplied by nerves

(b) Richly supplied by blood vessels

(c) Transparent and they diverge the light rays to form an image on retina

(d) Transparent and they contribute in the formation of image on retina

187. Cones are concerned with the reception of

(a) Light (b) Colours (c) (a) and (b) Both (d) None of these

188. As compared to rods the cones are..... times less sensitive

(a) 100 (b) 200 (c) 300 (d) 400

189. Human eyes are most sensitive to green colour. Its wave length is approximately

(a) 1000Å (b) 2500Å (c) 5500Å (d) 7000Å

190. What is the alternate name for the yellow spot in retina

(a) Canalis centralis (b) Corpus lutea (c) Fovea centralis (d) Macula lutea

191. The corneal grafting has been specially successful because

(a) Its technique is very easy

(b) Preservation of cornea is easy

(c) Cornea is not concerned with circulatory system and immune system

(d) Cornea is easily available

192. The human eye is sensitive only to light having wavelength ranging from

(a) 80 to 280 nanometres (b) 380 to 760 nanometres (c) 780 to 870 nanometres (d) 880 to 980 nanometres

193. The lens and cornea is not having blood supply. So the nutrients are supplied by

(a) Retina (b) Blind spot (c) Vitreous body (d) Aqueous humour

194. The fovea centralis is located in

(a) Blind spot (b) Yellow spot (c) Macula lutea (d) (b) and (c) both

195. Who got the Nobel prize for describing in detail the visual cycle

(a) Wald (b) Sherrington (c) Young (d) Henson

196. The eyes of cat, cow, buffalo and some nocturnal animals shine in night. It is due to the presence of tapetum lucidum between the choroid and retina. This shining is due to the presence of a pigment made of

(a) Cytocine (b) Uracil (c) Guanine (d) Thiamine

197. Pigment in the cone cells of man responsible for detecting red colour is

(a) Erythrolabe (b) Chlorolabe (c) Cyanolabe (d) Rhodopsin

198. The photosensitive pigments viz. erytholable, chlorolable and cyanolabe are sensitive to the colours respectively

(a) Red, green and blue (b) Blue, green and red (c) Green, red and blue (d) Blue, red and green

199. Find out the right matching from the following pairs

(a) Accommodation - pupil (b) Colour perception - cones (c) Night blindness - rods (d) Binocular vision- iris

200. The eyes of tigers and wolves shine (reflect back the light focused on them) because

(a) Cornea is opaque (b) Choroid is provided with tapetum lucidum

(c) Retina does not have enough rods (d) Retina has only rods and no cones

201. Lens of eye of frog is

(a) Subspherical (b) Oval (c) Biconcave (d) Biconvex-disc

202. Vitreous humor is

(a) Watery fluid (b) Solid crystal (c) Mucoid connective tissue (d) All of these

203. Human eye is sensitive to electromagnetic spectrum of wave length between

(a) 400–4000 *Å* (b) 4000 – 7500 *Å* (c) 5000 – 10000 *Å* (d) 10000 – 15000 *Å*

204. How many stimuli from a distant source fall on our eyes

(a) Light only (b) Light and sound waves

(c) Light, sound waves and odour (d) Light, sound and tension

205. The rods and cones of a vertebrate retina function to

(a) Focus light (b) Amplify light (c) Transduce light (d) Filter light

206. Focusing of image in rabbit's eye is brought about by **[CPMT 1980]**

(a) Shifting of position of lens (b) Altering lens curvature

(c) Shifting of retina close to lens (d) Altering viscosity

207. More than one fovea centralis is found in the eyes to

(a) All birds (b) Predatory birds (c) Mammals and birds (d) Only mammals

208. Umbraculum, a covering on pupil is present in

(a) Cat (b) Dog (c) Camel (d) Anableps

209. Instead of pigment rhodopsin in rods they have protophyrin

(a) fish (b) Birds (c) Reptiles (d) Mammal

210. The normal eye which can sufficiently refract light rays from an object 20 ft. (6mt.) away to focus clear object on Retina is called

(a) Myopic (b) Emmetropic (c) Hypermatropic (d) No specific name

211. The area of the most acute vision in eyes where sharp and bright images are formed is

(a) Yellow spot (b) Fovea centralis (c) Blind spot (d) Both (a) and (b)

212. Round pupil is a vertical slit in eyes of .... at night

(a) All carnivores (b) All herbivores (c) Both about (d) Cat

213. Only organisms with two pupils in each eye

(a) Bird Struthio (b) Turtle Amyda (c) Toad Bufo (d) Fish Anableps

214. In fishes, the cornea is surrounded by water and the refraction at the water cornea interface is negligible because

(a) The optical density of water and the cornea is nearly the same (b) The optical density of water is more than that of cornea (c) The optical density of water is less than that of cornea (d) Refraction is not related to optical density

215. Retina consists of

(a) Pigmented epithelium (b) Rod and cone cells

(c) Bipolar cells and ganglionic cells (d) All of these

216. Range of perfect human vision is from a few centimetres to

(a) A few metres (b) Infinity (c) A few kilometers (d) Several kilometers

217. The pigments found in cones which are responsible for detecting colours includes

(a) Erythrolabe (b) Chlorolabe (c) Cyanolabe (d) All of these

218. Which of the following is not an effect produced by parasynpathetic stimulation

(a) Pupil dilation (b) Increased saliva (c) Increased stomach activity (d) Construction of bronchi

219. When light intensity changes from one to hundred units, the response of eye will be increased by

(a) 2 (b) 10 (c) 100 (d) 001

220. The refractive index of eye lens is

(a) 1.33 (b) 1.46 (c) 1.36 (d) 1.25

221. Packing cells or connective tissue around rods, cones, bipolar and ganglionated cells are

(a) Horizontal (b) Amacrine (c) Muller fibres (d) Schwann cells

222. Stereoscopic binocularvision is characteristic of

(a) All mammals (b) Birds only (c) Primates (d) Both (a) and (b)

223. The function of iris in the eyes of frog is to

(a) Move the nictitating membrane (b) Alter the size of the pupil

(c) Give colour of the eyes (d) Both (b) and (c)

224. Pecten, a comb- like structure is found in the eye of

(a) Fishes (b) Frogs (c) Birds (d) Mammals

225. Which of these has biggest eyes in proportion to body size

(a) Horse (b) Camel (c) Elephant (d) Deer

226. The total number of rods in human retina has been estimated

(a) 80 to 100 million (b) 200 to 400 million (c) 110 to 125 million (d) 300 to 500 million

227. Which of the following is not correct pairing

(a) Glands of Zeis – Modified sebaceous glands (oil glands)

(b) Glands of Moll – Modified sweat glands (sudoriferous glands)

(c) Meibomian glands – Modified sebaceous glands

(d) Harderian glands – Modified sweat glands

228. Suspensory ligament is also called

(a) Palpebra (b) Plica semilunaris (c) Optic disc (d) Zonula of zinn

229. Ora serrata is

(a) Oral cavity of protochordates (b) Anterior edge of sensory portion of the retina

(c) Gland present in oral cavity of frog (d) A part of utriculus of ear

230. Modified sebaceous glands of the eye lids are known as

(a) Meibomian glands (b) Lacrimal glands (c) Pituitary glands (d) Retinal glands

231. Fovea centralis perceives

(a) Dim light (b) Diffuse light

(c) Coloured light and bright light (d) Coloured light and dim light

Basic Level

232. Eye is said to be near- sighted when a

(a) Near object is focussed in front of the retina (b) Distant object is focussed in front of retina

(c) Near object is focussed behind the retina (d) Distant object is focussed behind the retina

233. The defect of eye develops in the old age because

(a) Lens becomes opaque (b) Eye ball becomes long (c) Eye ball becomes long (d) Lens looses its elasticity

234. Person who cannot see distant objects is suffering from

(a) Cataract (b) Hypermetropia (c) Long sightedness (d) Myopia

235. In cataract

(a) Due to ageing or some infection eye lens becomes opaque (b) Elasticity of eye lens is lost

(c) There is irregular curvature of lens (d) Eye ball becomes shorter

236. In uncorrected myopia, the image is formed

(a) In front of the lens (b) At the back of the lens (c) In front of the retina (d) Behind the retina

237. In hypermetropia, the image is formed

(a) Before retina and is corrected by use of convex lens (b) Behind retina and is corrected by use of convex lens (c) Behind retina and is corrected by use of concave lens (d) Before retina and is corrected by use of concave lens

238. Hypermetropia is an old age eye degenerative disease. It can be corrected by using

(a) Convex lens (b) Cylindrical lens (c) Concave lens (d) Plain glasses

239. In short signtedness, the image is produced

(a) At the lens (b) At the retina

(c) After the lens in front of retina (d) Before the lens

240. Deficiency of vitamin A in the body results in insufficient rhodopsin in the rods which leads to

(a) Colour blindness (b) Total blindness (c) Night blindness (d) Myopia

241. Eye is near sighted when

(a) Near object is focussed behind retina (b) Distant object is focussed behind retina

(c) Distant object is focussed in front of retina (d) Near object is focussed in front of retina

Advance

242. When the hydrostatic pressure of aqueous humour increases, it results in the destruction of retina. This disease is known as

(a) Strabismus (b) Hypermetropia (c) Glaucoma (d) Astigmatism

243. Glaucoma is an eye disease arising from

(a) Increased pressure of fluid in eye ball (b) Elongation of eye ball

(c) Shortening of eye ball (d) Irregularity in the surface of cornea

244. Suppose a person wears convex glasses for proper vision. Where you think the image of the object is formed in his eyes when he is not using the glasses

(a) On the blind spot (b) On the yellow spot (c) Behind the retina (d) In front of the retina

245. In a newly born child the eyes are

(a) Extremely hypermetropic (b) Extremely myopic (c) Non functional (d) Normal in function

246. The defective condition of accommodation of the eye in which distant objects are seen distinctly but near objects are indistinct is

(a) Astigmatism (b) Presbyopia (c) Myopia (d) Hypermetropia

247. In the following abnormalities of the eye which one is a serious condition that leads to blindness

(a) Presbyopia (b) Myopia (c) Hypermetropia (d) Glaucoma

248. Retina of spiny ant eater (prototherians) have mainly

(a) Rods (b) Cones (c) Both above (d) None of these

249. Myopia (Short-sightedness) is a defect in human eye in which the image is formed

(a) In front of retina and can be corrected by using a concave lens

(b) In front of retina and can be corrected by using a convex lens

(c) Behind the retina and can be corrected by using a concave lens

(d) Behind the retina and can be corrected by using a convex lens

250. Glaucoma is due to

(a) Loss of transparency of lens (b) Increase of size of eye ball

(c) Blockage of the canal of Schlemm (d) None of these

251. If the lens loses it transparency, becomes opaque, and interferes with transmission of light, it is

(a) Myopia (b) Hypermetropia (c) Old age sight (d) Cataract

252. The defect of the eye in which the focal points are distorted due to irregular cornea or lens is

(a) Hypermetropia (b) Myopia (c) Astigmatism (d) Cataract

253. When the eye ball is bent on to a side in its orbit so that the optic axes can not be directed to same object, it is

(a) Near sightedness (b) Far sightedness (c) Farsightedness of old age (d) Strabimus

254. Colour blindness is also known as

(a) Daltonism (b) Strabimus (c) Trachoma (d) Hypermetropia

255. In old age, the vision of eye becomes dim. It is due to

(a) Myopia (b) Hypermetropia (c) Cataract (d) Astigmatism

256. In the myopia, eye defect the rays of light

(a) Do not enter the eye at all (b) Come to a focus in front of the retina

(c) Come to a focus at back of retina (d) Come to a focus in between retina & irins

257. Conjunctivitis or pink eye is caused by

(a) Bacteria (b) Viruses (c) Protozoa (d) Eyeworms

258. The lens becomes opaque in

(a) Myopia (b) Hypermetropia (c) Astigmatism (d) Cataract

259. Sty is infection of

(a) Gland of zeis (b) Tarsal gland (c) Gland of Moll (d) Lachrymal gland

260. In presbiopia (Presbyopia)

(a) The eye ball becomes short (b) The lens become opaque

(c) The retina gets damaged (d) Diminuation of accomodation of lens due to less of elasticity

261. Too short eye ball and flat lens produce

(a) Near signtedness (b) Farsightness (c) Astigmatism (d) Presbyopia

262. The eye defect astigmatism can be corrected by using

(a) Convex lenses (b) Concave lenses (c) Cylindrical glasses (d) Surgery

Basic Level

263. Hearing in rabbit is better than frog. One reason for this is that rabbit has

(a) Three semicircular canal (b) Vibratile tympanic membrane

(c) Movable pinae (d) Both fenestra ovalis and eustachian tubes

264. Scala vestibuli is connected with

(a) Fenestra rotundus (b) Fenestra ovalis (c) Scala tympani (d) Scala media

265. Endolymph is a fluid present in

(a) Eye (b) Ascaris (c) Nematocyst (d) Internal ear

266. The structure that helps a person to maintain his balance is

(a) Malleus (b) Eustachian tube (c) Cochlea (d) Semicircular canals

267. In man the receptors stimulated by sound waves are

(a) Organ of Corti (b) Semicircular canal (c) Utriculus (d) Sacculus

268. The main function of semicircular canals in the vertebrates is to

(a) Perceive sound vibration (b) Perceive and transmit sound vibration

(c) Direct the animal towards the source of sound (d) Perceive the motion of the head

269. The tympanic cavity is connected with the pharynx by

(a) Columella (b) Ear ossicles (c) Eustachian tube (d) Fallopian tubes

270. The chief function of the utriculus in vertebrates is

(a) To perceive sound vibration (b) To help in body equilibrium

(c) To perceive pressure (d) To act as shock absorber

271. The perception of sound by a mammal involves the stimulation of the mechano receptors located in the internal ear

(a) On the organ of Corti (b) On the Reissner's membrane

(c) In the sacculus (d) In the semicircular canal

272. The sequence of ear ossicles starting from the ear drum is

(a) Malleus, incus, stapes (b) Incus, malleus, stapes (c) Malleus, stapes, incus (d) Stapes, incus, malleus

273. Organ of Corti sends the sound impulses to cerebrum through

(a) Vth cranial nerve (b) VIth cranial nerve (c) VIIth cranial nerve (d) VIIIth cranial nerve

274. Cochlea of mammalian internal ear is concerned with

(a) Hearing (b) Balance of body posture

(c) Both balance and hearing (d) Perception of atmospheric pressure

275. The membranous labyrinth is concerned with

(a) Hearing (b) Balancing (c) Sound production (d) Hearing and balancing

276. The site from which the nerve impulse for hearing originates

(a) Ear ossicles (b) Cochlea (c) Auditory nerve (d) Tympanum

277. Columella auris is a modified

(a) Articular (b) Sphenthmoid (c) Hyomandibular (d) Quadrate

278. Loudness of sound is discriminated by

(a) Intensity of movement of basilar fibres of cochlea (b) Vibration of semicircular canals

(c) Vibration of endolymphatic sac (d) Vibration of tympanic bulla

279. Main function of eustachain tube is to

(a) Protect tympanic membrane (b) Support the bones of middle ear

(c) Equalize pressure on two sides of tympanic membrane (d) Prevent infection entering ear drum

280. Sensation of hearing is produced as a result of the

(a) Presence of the helicotrema

(b) Vibrations set in the external auditory meatus

(c) Vibrations of the ear ossicles

(d) Nerve impulses generated by the hair cells of the organ of Corti

281. Auditory sense organ in man is

(a) Organ of Corti (b) Webrian ossicles (c) Lateral line system (d) Utriculus

282. The organ of Corti in rabbit is concerned with the sence of

(a) Smell (b) Hearing (c) Taste (d) Equilibrium

283. Middle bone in middle ear is

(a) Malleus (b) Incus (c) Stapaes (d) None of these

284. Which of the following senses, is imparied if the tectorial membrane is removed from rabbit

(a) Balance (b) Hearing (c) Smell (d) Touch

285. In the auditory canal which one of the following glands is present

(a) Ceruminous gland (b) Meibomian gland (c) Perineal gland (d) Sebaceous gland

286. Organ of corti is found in

(a) Internal ear (b) External ear (c) (a) and(b) both (d) None of these

287. In the human ear in utriculus and sacculus, there are calcareous particles called otoconia, which respond to

(a) Change of posture (b) Internal pressure (c) Hearing (d) Sense of smell

288. Helicotrema is

(a) An aquatic mammal (b) An aperture in between the III and IV ventricle of brain

(c) An aperture in between two scalae of cochlea of mammal (d) A disease of internal ear

289. Ear drum is known as

(a) Tympanic membrane (b) Tensor tympani (c) Scala tympani (d) Scala vestibuli

290. Function of the eustachian tube is to

(a) Equalize the pressure in middle and internal ear (b) Equalize the pressure in the middle and external ear

(c) To help in hearing (d) To help in vibrating the tympanum

291. Which of the following nerve supplies organ of corti

(a) Auditory (b) Olfactory (c) Trochlear (d) Vagus

292. In mammalian ear, a membranous structure which separate the scala vestibuli and scala media is
(a) Basilar membrane (b) Reissner's membrane (c) Autolith membrane (d) Tectorial membrane

293. The bone that is in contact with fenestra ovalis
(a) Malleus (b) Incus (c) Stapes (d) Auditory

294. Organs of Corti are present in the cavity known as
(a) Scala tympani (b) Helicotrema
(c) Reissner's membrane (d) Scala media (Cochlear canal)

295. The bony labyrinth is filled withy
(a) Endolymph (b) Synovial fluid (c) Perilymph (d) Humour

296. The cristae are present on the acoustic ridges which are present in
(a) Ampulla (b) Sacculus (c) Utriculus (d) Lagena

297. The maculae are present on the acoustic ridges which are found in
(a) Ampulla (b) Semicircular canals (c) Helicotrema (d) Sacculus

298. Malleus is present in the
(a) Inner ear (b) Outer ear (c) Middle ear (d) Eye

299. The part of the ear which distinguishes different pitches of sound is
(a) Auditory nerve (b) Semicircular canal (c) Organ of Corti (d) Scala media

300. Helix is a part of
(a) Pinna (b) Tympanum (c) External auditory canal (d) Malleus

301. Pharynx is connected with tympanic cavity through
(a) Glottis (b) Gullet (c) Eustachain tubes (d) Internal nares

302. The ear ossicle of man is
(a) Malleus (b) Incus (c) Stapes (d) All of these

303. Vestibule is constituted by
(a) Semicircular canals and utriculus (b) Sacculus and utriculus
(c) Sacculus and ampullae (d) Ampullae and lagena

304. Maculae are present in
(a) Semicircular canals (b) Utriculus and lagena (c) Utriculus (d) Utriculus and sacculus

305. Ductus reuniens connects
(a) Utriculus and semicircular canal (b) Cochlea and semicircular canals
(c) Sacculus and cochlea (d) None of these

306. Otoconia are suspended in
(a) Perilymph (b) Endolymph (c) Synovial fluid (d) Haemolymph

307. Scala vestibuli is connected with
(a) Fenestra rotundus (b) Fenestra ovalis (c) Scala media (d) Eustachain tube

308. Anvil-shaped bone is

(a) Malleus (b) Incus (c) Stapes (d) Columella auris

309. Which of the following bones is in contact with oval window

(a) Stapes (b) Malleus (c) Incus (d) All of these

310. The sense of equilibrium is determined by

(a) Basilar membrane of cochlea (b) Tectorial membrane of cochlea

(c) Sensory crista of ampulla (d) Sensory cells of organ of corti

311. The membrane attached to the hair of sensory cells of organ of corti is

(a) Basilar (b) Tectorial (c) Reissner (d) None of these

312. Fenestra ovalis is absent in

(a) Frog (b) Rabbit (c) Man (d) Whale

313. Balancing organs occur in

(a) Sponges (b) Paramecia (c) Only mammals (d) All vertebrates

314. The waxy substance which coats the surface of auditory canal is produced by

(a) Tympanum (b) Ceruminous glands (c) Sebaceous glands (d) Meibomian glands

315. Function of vestibular apparatus is

(a) To maintain body equilibrium (b) To maintain position of ear ossicles

(c) To provide nourishment to internal ear (d) To adjust air pressure inside and outside the ear

316. The impulse of sound is conducted to the brain by

(a) Olfactory nerve (b) Auditory nerve (c) Trochlea nerve (d) Optic nerve

317. The true sense of equilibrium is located in

(a) Utriculus (b) Sacculus (c) Semicircular ducts (d) Cochlea

318. The ear of mammal is contained in

(a) Mastoid bone (b) Ethmoid bone

(c) Tympanic bulla and periotic (d) None of these

319. One end of each semicircular canal is enlarged to form

(a) Macula (b) Ampulla (c) Sacculus (d) Pars neglecta

320. Crus commune is a part of

(a) Brain (b) Spinal cord (c) Eye (d) Ear

321. Cochlea is

(a) Straight (b) Network (c) Jelly-like (d) Spirally coiled

322. The stiff supporting structure in ear pinnae is

(a) Bone (b) Elastic cartilage (c) ligament (d) Hyaline cartilage

323. The canals of cochlea include

(a) Scala vestibuli (b) Scala tympani (c) Scala media (d) All of these

324. Phonorecetpor in man is

(a) Ear (b) Eye (c) Skin (d) Nose

325. Scala vestibuli and scala tympani of the cochlea are filled with

(a) Endolymph (b) Perilymph (c) Haemolymph (d) Lymph

326. Scala media of the cochlea is filled with

(a) Perilymph (b) Lymph (c) Haemolymph (d) Endolymph

327. The sound waves are transmitted from the outer ear to the internal ear by

(a) Cochlea (b) Semicircular canals (c) Ear ossicles (d) Scala vestibuli

328. Sound is transmitted from middle ear to internal ear due to

(a) Vibrations of tympanum (b) Vibrations of stapes (c) Striking of stapes (d) All of these

329. Scala tympani is connected to scala vestibuli by means of

(a) Stapes (b) Helicotrema (c) Basilar membrane (d) Tectorial membrane

330. External ears are characteristic of

(a) Fish (b) Amphibians (c) Reptiles (d) Rat

331. Maculae are the sensory spots in

(a) Cochlea (b) Ampullae (c) Semicircular canals (d) Sacculus

332. The bone attached to the inner surface of the eardrum is called

(a) Stapes (b) Incus (c) Malleus (d) Cochlea

333. The external ear is made up of

(a) Cartilage covered by skin (b) Bone covered by skin

(c) Bone and cartilage covered by skin (d) Skin only

334. The tectorial membrane is found in

(a) Eye of frogs (b) Eye of mammals (c) Ear of mammals (d) Tongue of frog

335. Which of these is an ear ossicle in frog

(a) Malleus (b) Incus (c) Columella auris (d) Stapes

336. Which of the following arises from the sacculus

(a) Semicircular canals (b) Endolymphatic duct (c) Eustachian tube (d) None of these

337. Most mammals possess

(a) Well developed external ear, middle ear and internal ear (b) Middle ear and internal ear

(c) Internal ear (d) External ear and middle ear.

338. Fish has

(a) External ear and middle ear (b) Internal ear

(c) Middle ear and internal ear (d) External ear

339. Frog possesses

(a) Internal ear (b) External and middle ear (c) Middle ear (d) Middle ear and internal ear

340. Snakes have

(a) External ear and middle ear (b) Middle ear and internal ear (c) Internal ear (d) No ear

341. Our ear can hear the frequency of sound waves

(a) 20 to 20,000 cycles/sec (b) 1000 to 2000 cycles/sec (c) 5000 to7000 cycles/sec (d) 5000 to 10,000 cycles/sec

Advance

342. The opening in the nasopharynx that permits air pressure on both sides of tympanic membrane of the ear to be kept equal is

(a) Oval window (b) Tube of cochlea (c) Auditory nerve (d) Eustachian tube

343. Ear is most sensitive to

(a) 20 cycles/sec (b) 1,000 cycles/sec (c) 10,000 cycles/sec (d) 40,000 cycles/sec

344. In the tympanic cavity there is an aperture in which the stapes is fitted. It is

(a) Foramen rotundus (b) Foramen triosseum (c) Fenestra ovalis (d) Foramen of monro

345. Utriculus is the part of internal ear or membranous labyrinth which forms

(a) Lower chamber and is concerned with maintenance of equilibrium

(b) Lower chamber and is concerned with transmission of sound waves

(c) Upper chamber and is concerned with maintenance of equilibrium

(d) Upper chamber and is concerned with perception

346. Vibrations of fenestra ovalis are transmitted to

(a) Perilymph of scala vestibuli (b) Perilymph of scala tympani

(c) Endolymph of scala media (d) Endolymph of scala vestibuli

347. The true sense of equilibrium in mammals are situated in the

(a) Malleus (b) Utriculus (c) Eustachian tubes (d) Semicircular canal

348. Canal joining middle ear with buccal cavity is

(a) Inguinal canal (b) Eustachian canal (c) Haversian canal (d) Aquaduct of Sylvius

349. Suppose you felt an earthquake. Which of the following sense organs would you thin was involved in this feeling

(a) Ears (b) Eyes (c) Skin of your soles (d) Proprioceptors

350. Internal ear in mammals is responsible for

(a) Vertical posture while at rest (b) Balancing while in motion

(c) Fixation of direction (d) Sensing changes in atmospheric pressure

351. A person going upto 10,000 feet high in a hot air balloon may develop severe pain in the ear due to

(a) Blocked eustachian tube (b) Rupture of fenestra rotunda

(c) Endolymph getting into semicircular canals (d) Fear of great height

352. The sense of equilibrium by ear is the function of

(a) Sensory cells of the organ of corti (b) Sensory crista of the ampulla

(c) Tectorial membrane of cochlea (d) Basilar membrane of cochlea

353. In frog, "fenestra ovalis' is the

(a) Air filled cavity of the middle ear

(b) Communication between the pharynx and the tympanic cavity

(c) External opening of tympanic cavity which is covered by the tympanic membrane

(d) Opening in the auditory capsule which separates the middle ear from internal ear

354. Acoustic spots in frog is present in

(a) Ossious labyrinth (b) Carotid (c) Mambranous labyrinth (d) All of these

355. Which of the following is correct pair

(a) Hearing $\rightarrow$ Organ of corti (b) Posterior pituitary $\rightarrow$ Synthesis of oxytocin

(c) Nephron $\rightarrow$ Excretion of all waste material (d) None of these

356. Fishes have very poor sense organs for

(a) Detecting odours (b) Light perception

(c) Sound perception (d) Detecting vibrations in water

357. In the ampulla of semicircular canal of ear sensory hairs are present. When the balance is lost, it is maintained by the action of

(a) Muscles (b) Sensory nerves

(c) Otoconia over the sensory hairs (d) Sensory hairs among them to stimulate the sensory nerves

358. The malleus, incus and stapes are the modified bones of .....respectively

(a) Articular, hyomandibular and quadrate (b) Quadrate, articular and hyomandibular

(c) Articular, quadrate and hyomandibular (d) Quadrate, hyomandibular and articular

359. The intensity of the sound waves is increased .....by the ear ossicles

(a) Five times (b) Six times (c) Eight times (d) Ten to twenty times

360. Haring is controlled by

(a) Carebral hemispheres (b) Temporal lobes (c) Cerebellum (d) Hypothalamus

361. Cupula is present in

(a) Macula (b) Crista (c) Cochlea (d) Saccule

362. Eustachian tube has single opening in the pharynx of

(a) Birds (b) Amphibians (c) Pipa toad (d) Both (a) and (c)

363. Sensory cells have supporting cells in cristae called as

(a) Ratzius (b) Dieters (c) Henson (d) None of these

364. The path of extra sound in the ear is

(a) Scala vestibuli → Scala media → Scala tympani → Fenestra ovalis → Tympanic cavity → Eustachian tube → Pharynx

(b) Scala vestibuli → Helecotrema → Scala media → Fenestra rotunda → Eustachian tube → Pharynx

(c) Scala vestibuli → Helecotrema → Scala tympani → Fenestra rotunda → Tympanic cavity → Eustachian tube → Pharynx

(d) Scala vestibuli → Helecotrema → Fenestra rotunda → Eustachian tube → Pharynx

365. Static balance is maintained by

(a) Maculae (b) Cristae (c) Organ of corti (d) Reissner's membrane

366. Dynamic balance is maintained by

(a) Maculae (b) Cristae (c) Organ of corti (d) Reissner's membrane

367. Malleus, incus and stapes are found in

(a) Internal ear of Frog (b) Internal ear of Rabbit

(c) Middle ear of mammal (d) Middle ear of Frog and Rabbit

368. When a sharp turn is taken by a cyclist, which organ helps maintain equilibrium

(a) Semicircular canals (b) Optic chiasma (c) Cochlea (d) Ear ossicles

369. Myringitis refers to

(a) Pain in internal ear (b) Inflammation of eardrum (c) Loss of hearing (d) None of these

370. Mammalian body employs lever mechanism in

(a) Movement of tongue during swallowing (b) Transmission of sound through middle ear

(c) Conversion of glucose into glycogen (d) Rise and fall of diaphragm

371. Part of ear concerned with hearing is

(a) Reissner's membrane and tectorial membrane (b) Basilar membrane and tectorial membrane

(c) Reissner's membrane and basilar membrane (d) Ampulla

372. Fenestra ovalis is

(a) Air filled cavity of middle ear (b) External opening of tympanic cavity

(c) Opening of auditory capsule (d) Communication between pharynx and trympanic cacity

373. Ear pinnae are absent in

(a) Duckbilled platypus (b) Whale (c) Sea cow (d) All of these

374. The structures in human that provide balance are located in

(a) Outer ear (b) Middle ear (c) Inner ear (d) Eustachian tube

375. Sound is amplified by the

(a) Pinna (b) Tympanic membrane (c) Ear ossicles (d) Round window

376. Malleus is formed by modification of articular bone of lower vertebrates while incus is modification of

(a) Quadrate (b) Jugal (c) Hyomandibularis (d) Both (a) and (b)

377. In frog, the tympanic membrane is stretched over a cartilaginous ring, called

(a) Fenestra ovalis (b) Collumella (c) Annulus tympanicus (d) Periotic

378. The pharyngeal opening of eustachian tube is closed by

(a) Tensor palati (b) Epiglottis (c) Tympanum (d) Basilar membrane

379. The choclea arises from

(a) Utriculus (b) base of lagena (c) Middle ear (d) None of these

380. Which of the following bones is in contact with fenestra rotundus

(a) Malleus (b) Incus (c) Stapes (d) None of these

381. In the human ear, which bone is connected with the tympanum

(a) Anvil (b) Hammer (c) Stirrup (d) None of these

382. Organ of Corti contains

(a) Deiter's cells (b) Cells of Hensen (c) Receptor hair cells (d) All of these

383. Columella auris in middle ear of lower vertebrates is

(a) Hyaline cartilage (b) Modified hyomandibular bone (c) Replacing bone (d) Both (b) and (c)

384. Only one semicircular canal is present in

(a) Bony fish (b) Cartilagenous fish (c) Hag fish (d) Amphibians

385. Deiter' s cells (basal cells) occur in

(a) Utriculus (b) Sebaceous glands (c) Retina of eyes (d) Organ of corti

386. Endolymph can be traced in

(a) Eustachian tube (b) Scala tympani (c) Vestibule (d) Scala vestibuli

387. Rats can perceive sound waves of frequency....KHz

(a) 20 (b) 150 (c) 1000 (d) 100

Miscellaneous

Basic Level

388. The unit of photoreception in a compound eye of cockroach and other insects, is

(a) Ctenidium (b) Osphradium (c) Ommatidium (d) Rhabdome

389. Which of the following have' ommatidia' as unit of eye

(a) Pheretima (b) House fly (c) Pila (d) Sepia

390. Otoconium is found in

(a) Perilympy (b) Haemolymph (c) Synovial fluid (d) Otolithic membrane

391. The part of tongue that perceives the bitter taste very well is

(a) Tip (b) Sides (c) Top (d) Basal

392. What is unique only in humans

(a) Hand use (b) Tool use (c) Social structure (d) Articulated speech

393. Nasal cavity has large number of

(a) Blood cells (b) Ciliated cells (c) Mast cells (d) Goblet cells

394. A substance responsible for making the stratum lucidum cells of the epidermis of skin of rabbit transparent. is

(a) Rhodopsin (b) Eleiden (c) Keratohyaline (d) Luciferin

395. The sweet and acidic tastes are better detected by

(a) Tip of the tongue (b) Base of the tongue (c) Middle of the tongue (d) Lateral sides of the tongue

396. In prosophenosia a person is unable to

(a) Understand spoken language (b) Understand written language

(c) Recognise faces (d) Speak coherently

397. Anosmia is

(a) Related to ear disease (b) Related to eye disease (c) Related to tongue (d) Loss of sense of smell

398. Number of taste buds present on the whole surface of tongue is

(a) About 1000 (b) About 10,000 (c) About 25,000 (d) About 3000

399. Bats have special sensory system called

(a) Eco-balancing system (b) Echo-location system (c) Ecoflying system (d) Econervous system

400. Sonar system is found only in

(a) Bats (b) Whales (c) Bats and whales (d) Otter

401. Which of the following sense organs are unique in fishes

(a) Optic organs (b) Olfactory organ (c) Muscle system (d) Lateral line sense organs

402. Taste buds detect the substance only when the substance is

(a) Solid (b) Semisolid (c) Semiliquid (d) Liquid

403. Which of the following use Radar systems in detecting the target

(a) Birds (b) Bats (c) Dogs (d) Bats and dogs

404. Which of the following can see ultraviolet light

(a) Bats (b) Birds (c) Bees (d) Cats

405. Rhabdome is found in eyes of

(a) Insects (b) Annelids (c) Rabbit (d) frog

406. Function of antennae cockroach is

(a) Tactile and sensory receptor (b) Gustatory receptor

(c) Auditory receptor (d) Olfactory receptor

407. In snakes, eye lids are

(a) Immovable (b) Movable (c) No eye lids (d) All of these

408. Bitter taste is perceived by buds present on the tongue at

(a) Posterior part (b) Tip (c) Lateral side (d) Ventral side

409. Taste buds are located on

(a) Plate (b) Tongue only (c) Pharynx (d) All the above

410. Snakes perceive sound waves through

(a) Air (b) Water (c) Earth (d) internal ears

411. One of the papilla of tongue is not gustatory in function

(a) Vallate (b) Filiform (c) Foliate (d) Fungiform

412. Pit viper can trace its food through

(a) Sensory pits and heat radiations of prey (b) Jacobson's organ

(c) Sharp vision (d) All of these

413. If the threshold for hearing increases 100 times, the hearing loss is

(a) 40 decibels (b) 50 decibels (c) 60 decibels (d) 30 decibels

414. The statocyst of prawn is a

(a) Tangoreceptor (b) Chemoreceptor (c) Gravity receptor (d) Sound receptor

415. In Palaemon, statocyst is situated in the

(a) Antennule (b) Maxillae (c) Maxillulae (d) Antennae

416. Which of the following animal has an acute olfactory sense

(a) Monkey (b) Man (c) Rabbit (d) Dog

417. Superposition image in cockroach is formed during

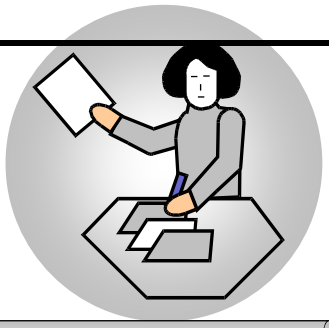
(a) Dark light (b) Dim light (c) Bright light (d) None of these

418. The eye ball protrudes from the orbit with the contraction of

(a) Retractor bulbi muscles (b) Protractor lentis muscles (c) Levator bulbi muscles (d) None of the above

419. Cataract is a disease which refers to

(a) Inflammation in the eye (b) Cloudiness in the eye lens (c) A stye in the eye (d) A defect in the optic nerve



Basic and Advance Level

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	c	b	d	d	d	a	b	b	b	c	b	c	d	b	a	b	b	c	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	b	b	a	c	c	b	a	a	b	c	a	c	c	a	a	d	b	d	b
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	d	c	c	d	d	a	d	b	d	a	c	a	a	a	b	d	c	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
d	d	d	b	c	a	a	b	b	c	d	c	a	b	b	b	d	c	b	c
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
a	d	b	d	d	b	c	c	d	b	b	d	c	d	d	b	d	c	b	a
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	d	a	c	c	d	d	b	c	d	a	c	c	b	a	b	c	d	a	d
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
d	a	a	c	c	c	b	c	c	d	b	b	d	b	d	d	d	b	c	b
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
c	d	c	a	d	b	b	d	c	a	a	b	a	a	b	b	c	b	b	d
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
a	b	d	b	d	b	d	b	c	a	a	c	c	c	d	b	d	b	c	a
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
b	c	c	b	b	d	c	c	c	d	c	b	d	d	a	c	a	a	b	b
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
a	c	b	a	c	b	b	c	a	b	d	d	d	a	d	a	d	a	c	c
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
c	c	d	c	d	c	d	d	b	a	c	b	d	d	a	c	b	a	c	c
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
c	c	a	c	a	d	d	c	a	c	d	c	d	a	c	b	a	d	a	d

261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
b	c	c	c	d	d	a	d	c	b	a	a	d	a	d	b	c	a	c	d
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
a	b	b	b	a	a	a	c	a	b	a	b	c	d	c	a	d	c	c	a
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
c	d	b	d	c	b	b	b	a	c	b	a	d	b	a	b	c	c	b	d
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
d	b	d	a	b	d	c	c	b	d	d	c	a	c	c	b	a	b	d	c
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
a	d	b	c	c	a	d	b	a	b	b	b	d	c	a	c	d	c	d	b
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
b	d	a	c	a	b	c	a	b	b	b	c	d	c	c	a	c	a	b	d
381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
b	d	a	c	d	c	a	c	b	d	d	d	b	b	a	c	d	a	b	a
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	
d	d	b	c	a	a	a	a	d	c	b	a	c	c	a	d	b	c	b	

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