2. WINDOWS OF KNOWLEDGE

CONTENT

- Vision - The protective measures of eyes.
  - Structure of human eye, Working of eye lens,
  - Photo receptors in the retina, Sense of vision.
  - Disorders & diseases of eyes, Hygiene of our eyes.
- Hearing- Structure of human ear, Auditory receptors,
  - Sense of hearing, Body balancing.
- Tasting - Taste receptors in the tongue, sense of tasting.
- Smelling - Olfactory receptors in the nose, sense of smelling.
- Different receptors in the skin
- Sensory receptors in certain other organisms

Video link of this chapter :

Part 1- https://youtu.be/Q14Texfdi9c

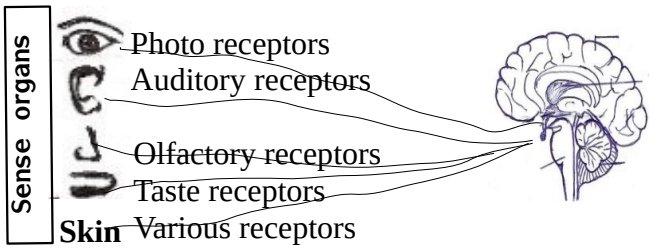
Part 2- https://youtu.be/X5RvWrwrg8U

Part 3- https://youtu.be/377Wct4nVgA

QUESTIONS & ANSWERS

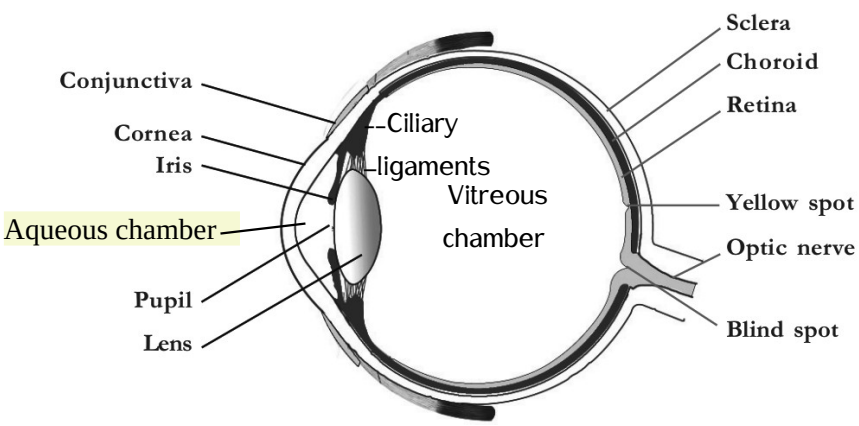
1. How is the feeling of senses made possible ?

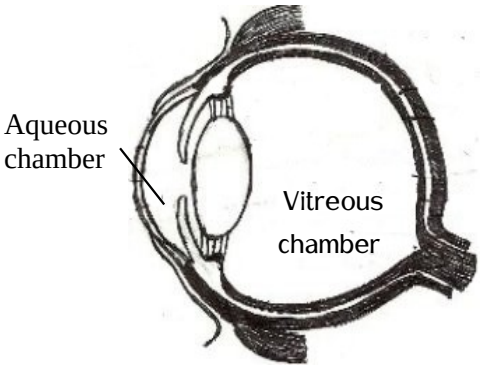
Sense is possible only when impulses from sense organs reach at the brain through the sensory nerves. The ends of sensory nerve from the brain act as the receptors inside the sense organs.



	Receptors	Stimulus	Function
Eye	Photo receptors in the retina (Rod & Cone cells)	Light	Vision
Ear	Auditory receptors in the basilar membrane	Sound	Hearing
Nose	Olfactory receptors	Olfactory particles	Smelling
Tongue	Taste receptors in the taste buds	Taste particles	Tasting
Skin	Receptors for heat, cold, touch, pressure and pain	Heat, cold, touch, pressure or pain	Heat, cold, touch, pressure and pain

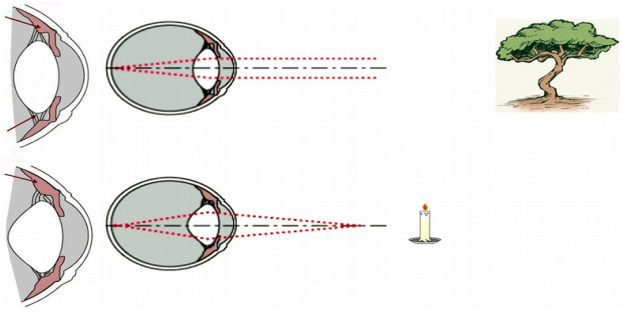
2. How are our eyes protected?
   - Bony eye socket (orbit) - protects eye.
   - External eye muscles – fixes the eye ball in the orbit.
   - Eyelids - protect from dust and other particles.
   - Eyelashes - protect from dust with out obstructing vision.
   - Eyebrow – prevents perspiration or water reaching in to the eyes.
   - Tears - clean and lubricate the anterior part, washes away the dust particles and destroys germs.
   - Conjunctiva – secretes mucus to prevent the eye from being dry.
3. The enzyme contained in tears ? Ans: Lysozyme.
4. Which are the 3 layers of human eye ?
   a. **Sclera** –The outermost, strong layer, that gives shape. Its transparent anterior portion is the **cornea**.
   b.**Choroid**- Middle layer of blood capillaries, which supply nutrients and oxygen.
   Its anterior dark screen with pupil is the **iris**. A convex lens is placed behind the iris.
   c. **Retina**- The innermost layer on which, the image forms. The optic nerve starts from the retina.
5. The fluids filled in the chambers of eye , position and function ?
   * **Aqueous humor** – A watery fluid seen in the aqueous chamber [between cornea and lens] , oozes from the blood. This fluid supplies nutrients and oxygen to cornea and lens.
   * **Vitreous humor** - A jelly like fluid filled with in the vitreous chamber [between lens and retina], helps to maintain the shape of eyeball.





6. Slightly projected transparent anterior part of the sclera ? Ans: Cornea.
7. The transparent membrane which protects the sclera, except the cornea ? Ans: Conjunctiva.
8. The dark coloured anterior part of choroid is --------, which contains the pigment melanin. Ans: Iris.
9. The aperture at the centre of iris ? Ans : Pupil.
10. The antagonistic muscles in the iris that regulate the size of eye pupil ?
    Radial muscles (pupillary dilator) and Circular muscles (pupillary constrictor).
11. When bright light falls, the eye pupil --------- ?
    - Constricts [due to the contraction of the circular muscles]
12. The muscles, which adjust the curvature of eye lense, seen behind the iris ?
    Ciliary muscles.
13. Define the power of accommodation of the eye.
    The capacity of the eye to change the curvature of lens depending up on the distance between the the eye and the object by adjusting the focal length is called the power of accommodation of the eye.
14. How can our lens adjust its focal length according to the distance from objects?
    [How is power of accommodation possible?]
    When we look at a distant object, the ciliary muscles are in a relaxed position so as to keep the ligaments tight. Therefore the curvature of lens decreases to fix the image on retina [figure-1].
    When we look at a near object, the ciliary muscles contract to loosen the ligaments. When ligaments relax, the curvature of lens increases naturally ,to focus the image on retina. [figure-2].

	Viewing distant objects	Viewing near objects
Ciliary muscles	Relaxes	Contracts
Ligaments	tightens	loosen
Curvature of lens	Decreases	Increases
Focal length	Increases	Decreases

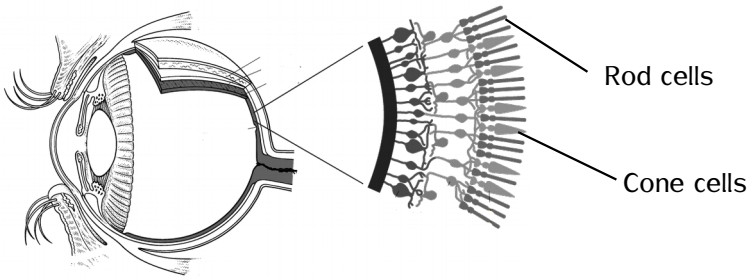


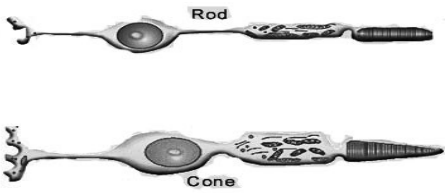
15. The characteristics of images formed on retina ?.
    Real, Small, Inverted and Accommodated.
16. Compare and contrast between the photo receptors seen on the retina.

Photoreceptor	Containing pigment	Function	Related disorder
Rod cells	Rhodopsin	Vision under dim light	Night blindness
Cone cells	Photopsin / Iodopsin	Vision under intense light	Colour blindness

Receptor region of the rod cells is rod shaped and contain the pigment rhodopsin, which will be stimulated under dim light. Receptor region of the cone cells is cone shaped and contain the pigment photopsin (iodopsin) which will be stimulated under intense light.

Under dim light, rhodopsin dissociates to form retinal and opsin to produce impulses from rod cells. Under intense light, photopsin (iodopsin) dissociates to form retinal and opsin to produce impulses from cone cells. The three types of cone cells (red, green & blue) provide us with colour vision.





17. Vitamin A help us for better vision. Give reason.
Retinal, the visual pigment found in the photoreceptors, is formed from vitamin A.

18. Compare between Blind spot and Yellow spot
Blind spot is a part of retina from where the optic nerve begins. No photoreceptors at this spot, hence no vision. Yellow spot is the point of highest vision in the retina, where more cone cells seen. Images form in and around the yellow spot.

19. Point on retina lacking vision : Blind spot ; Point of highest vision in retina : --------- ?
Yellow spot

20. The bird, owl has no vision in day time. Why?
Owl's retina is devoid of cone cells and hence no vision in day time.

21. Animals like cat and owl have more vision at night. Why ?
Cat and owl has more rod cells in their retina, so that they have more vision at night.

22. A kite can locate its prey even from high altitude. How is this possible ?
The eyes of kite are closer to each other and contain a large number of cone cells. Hence it has high power of vision.

23. Flowchart of image formation in retina.
Light rays from the object → Cornea → Aqueous humor / Pupil → Lens → Vitreous humor → Image on retina

24. What are the changes occur in retina when images focus on it ? (Describe that how vision is possible.)
When light rays from the object passes through cornea and pupil fall on the lens, a small, real inverted image forms on the retina. When the image is formed under dim light, rhodopsin in the rod cells dissociate to produce impulses and when the image is formed under intense light, photopsin in the cone cells dissociate to produce impulses. These impulses are transmitted through the optic nerve. The brain coordinates the images from both eyes to feel perfect vision.

25.Experience of vision - Flowchart.
Image on retina → stimulation in the photo receptors → dissociation of rhodopsin / photopsin → impulses → optic nerve → coordination of images by cerebrum → perfect vision.

26. Though images of object are formed in both eyes, we can see only one object. Give reason.
Cerebrum coordinates the two images and hence get a three dimensional view of the object.

27. Define binocular vision.
The ability of both the eyes to focus on the same object is known as binocular vision.
Binocular vision help us to get a three dimensional image of the object. This help us to calculate the correct distance, depth, height and width of the object.

28. What is the need of closing one eye while shooting an object ?
Binocular vision help us to get a three dimensional image of the object and to calculate the correct distance, depth, height and width of the object. But in the case of aiming an object, we need to get correct line instead of common focus through binocular vision.

29. The condition by which certain colours cannot recognize : Colour blindness ;
Decreased vision in dim light : ---------- ? Ans: Night blindness.

30 .---------- and ---------- are the two conditions of eye due to the deficiency of vitamin A.
Night blindness and Xerophthalmia (dry conjunctiva and cornea)

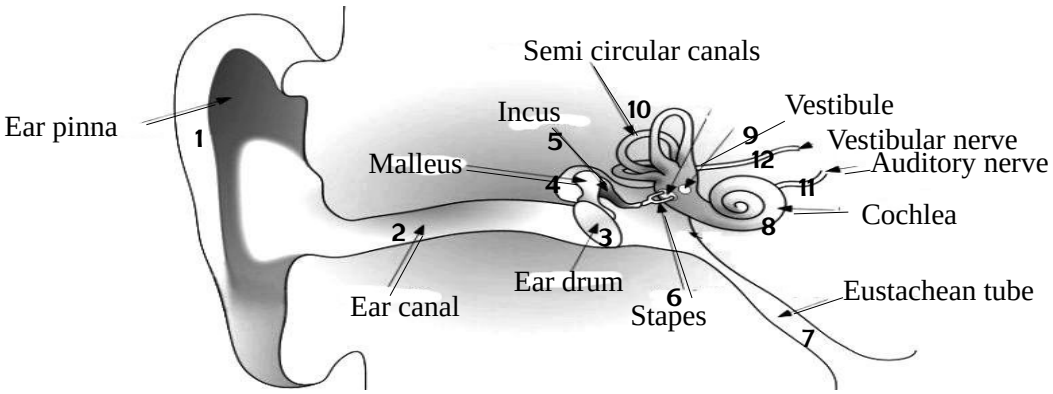
31. A few points related with the health of our eyes.
- Avoid falling of bright source of light directly to the eyes. Don't look at the sun.
- Avoid reading under dim light.
- Do not watch TV or other screens continuously.
- Frequently wash our eyes.
- Include vitamin A contained items in our daily food.

32.Table which shows reason of various disorders and diseases that affect on our eyes.

Disorder/Disease	Reason or Symptom	Remedy
Hyper metropia (long sight)	Due to shortened eyeball images form behind retina. Cannot see nearby objects clearly	Convex lens
Myopia (short sight)	Due to elongated eyeball images form in front of retina. Cannot see distant objects clearly	Concave lens
Night blindness	Due to the deficiency of vitamin A, no clear vision in dim light.	Vitamin A
Colour blindness	Due to the defect cone cells which detect red and green colours and fails to detect those colours	
Xerophthalmia	Prolonged deficiency of vitamin A results dry conjunctiva and cornea	Vitamin A
Cataract	Gradual decrease in the power of lens due to decreasing of transparency of lens	Surgical replacement of lens
Glaucoma	Defective vision due to increased pressure when the re-absorption of aqueous humor obstructed	Early treatment
Conjunctivitis	Infection of bacteria or virus causes red eye with pain	Treatment and rest

33.The functions of human ear ? Ans: Hearing, body balance.

34. What are the main parts of human ear ?



External Ear	Middle Ear	Internal Ear
1. Ear pinna	4. Malleus	8. Cochlea
2. Ear canal	5. Incus	9. Vestibule [Sacule, Utricle]
3. Ear drum / Tympanum	6. Stapes	10. Semicircular canal
	7. Eustachian tube	11. Auditory nerve
		12. Vestibular nerve

35. The safety measures to prevent dust and other particles from entering the ear are, ----------
Hairs and ear wax.

36. When sound waves enter to the ear, …..... starts to vibrate. Ans: Ear drum (tympanum)

37. The smallest bone in the human body ? Ans: Stapes

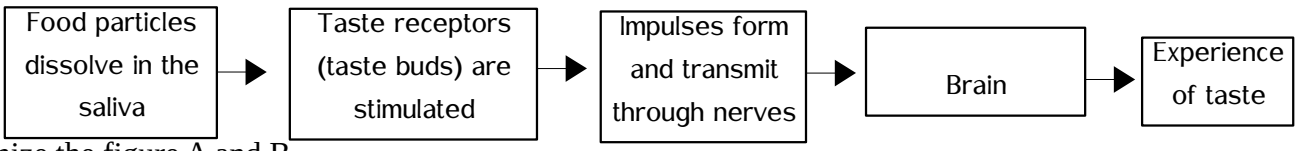
38. Name the bones of ear ossicles. Ans: Malleus, Incus, Stapes.
They amplify sound waves 22 times and pass the vibrations from the ear drum to the oval window.

39. The tube that connects the middle ear to the pharynx ? What is its function ?
Eustachian tube. It helps to regulate the pressure inside the middle ear.

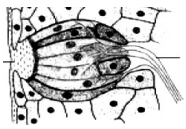
40. The structure of internal ear.
The internal ear, seen inside the bony labyrinth, as membraneous labyrinth. A coiled tube like cochlea and the vestibular apparatus (vestibule & three semicircular canals) are the parts of inner ear. The membraneous labyrinth is filled with a fluid, named endolymph and the space between the bony and membraneous labyrinths is filled with another fluid, named perilymph.

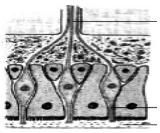
Cochlea of the internal ear functions in hearing, while the vestibular apparatus helps to maintain body balance through transmitting impulses to the cerebellum.

41. What are the different receptors seen inside the vestibular apparatus ?
The cluster of receptors (hair cells) seen inside the utricle and sacule of the vestibule are immersed in a jelly substance and the sensory hair cells in the ampulla of the semicircular canals are also immersed in a jelly substance. All these receptors (hair cells) are stimulated according to the movement of head.
42. Cochlea : Hearing ; ---------- :Equilibrium of the body.
Vestibular apparatus (Vestibule and semicircular canals)
43. The swollen end of semicircular canals. Ans: Ampulla.
44. Cochlea : Auditory nerve : Cerebrum;
Vestibular apparatus : Vestibular nerve : …..... ? Ans: Cerebellum.
45. Hearing. Flowchart.
Sound waves → ear pinna → ear canal → ear drum (tympanum) vibrates → ear ossicles oval window → cochlear perilymph → endolymph → stimulation in auditory receptors of the basilar membrane → impulse transmitted through auditory nerve → auditory centre of the brain → hearing.
46. What is the role of ear in maintaining the equilibrium of the body ? How is it possible ?
Receptors (hair cells) seen inside the ampulla of semicircular canals, sacule and utricle are stimulated according to the movement of head. The impulses formed thus will be transmitted to the cerebellum through the vestibular nerve. Cerebellum functions so as to maintain the equilibrium of body.
47. Why giddiness is felt when you turn round and round ?
When we turn round continuously, the endolymph inside the semicircular canals and vestibule also moves and there will be continuous stimulation of the receptors and passing of impulses to the cerebellum. Hence cerebellum can not coordinates the muscular activities properly and we feel giddiness.
48. How do we sense taste ?
Chemoreceptors seen inside the mouth and tongue help us to detect taste. The chemoreceptors seen inside the papillae of the tongue are called as taste buds. Smell also influences taste.
49. The different taste buds of the tongue. Ans: Sweet, salt, sour and bitter. Other tastes are created by the brain from the primary tastes.
50. The projected structures seen on the tongue surface are known as ----------? Ans: Papillae.
51. Make a flowchart of sensing taste.



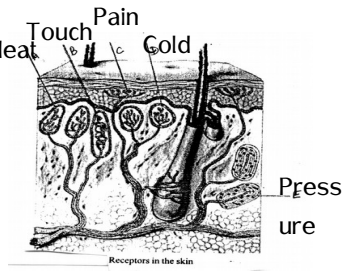
52. Recognize the figure A and B.


A


B

Ans: A. Taste bud B. Olfactory receptors.

53. How can we feel smell ?
When particles enter to the nose and disperse in the mucus, the olfactory receptors in the mucus membrane get stimulate and the impulses reach the brain through the olfactory nerve. Brain helps in the
54. The ability of shark to sense smell is sharp. Why?
Shark has highly sensitive olfactory receptors.
55. The largest sense organ ? Ans: Skin.
56. The stimuli that can be received by our skin ? Ans: Heat, Touch, Pain, Cold and Pressure
57. How skin perform as a sense organ ?
Heat, cold, touch, pressure and pain are felt by our skin. When these receptors are stimulated, impulses form and reach in the cerebrum for its perception.



58. The eyes of an insect consist of a cluster of photoreceptors called --------- ?
Ommatidia.
59. Housefly : Ommatidia Planaria : ---------- ? Ans: Eye spot.
60. The special olfactory organ seen in the mouth of snake ? Ans: Jacobson's organ.
61. How is the lateral lines important to the shark ?
The receptors in the lateral lines help to detect the change in the balance the body.