2. WINDOWS OF KNOWLEDGE

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Feeling of senses are possible only when impulses from sense organs reach at the brain through the sensory nerves.

Eyes, Ears, Nose,Tongue & Skin are our sense organs.

A. Eye : for vision. Our eyes are protected by,
- Bony eye socket (orbit) - External eye muscles
- Eyelids & Eyelashes - Eyebrow - Tears (it clean and lubricate the anterior part, washes away the dust particles and destroys germs by lysozyme)
- Conjunctiva (it secretes mucus to prevent the eye from being dry).

The 3 layers of human eye ?

a. **Sclera** –The outermost layer, that gives firmness to eye. Its transparent anterior portion is the cornea. Conjuctiva covers the front part of sclera, except at cornea.

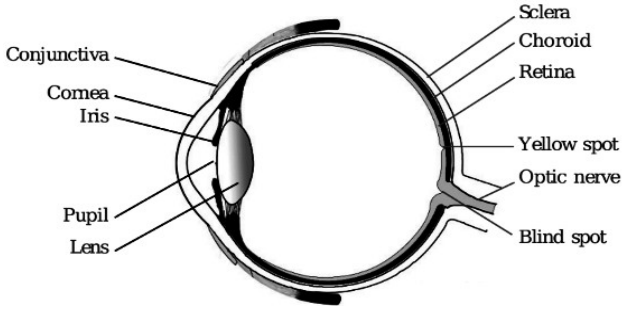
b.**Choroid**- Middle layer of blood capillaries, which supply nutrients and oxygen. Its anterior dark screen with pupil is the iris. The pigment, melanin gives colour to iris.A convex lens, which is connected to ciliary muscles by ligaments, is placed behind the iris.

c. **Retina-** The innermost layer on which, the image forms. Retina contains photoreceptors (cone cells and rod cells). Yellow spot which contains plenty of photoreceptors is the point of maximum visual clarity and the blind spot where no photoreceptors seen due as the begininng of optic nerve is the point of no vision. The optic nerve starts from the retina.

The fluids filled in the chambers of eye ?

* **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]. It helps to maintain the shape of eyeball.



Radial muscles and circular muscles in the iris regulate the size of pupil according to the intensity of light.

In dim light, radial muscles contract to increase size and in intense light, circular muscles contract to decrease the size of pupil.

Ciliary muscles adjust the curvature of eye lense and there by adjusting focal length.

While viewing near by objects, ciliary muscles contract to increase the curvature of lens to decrease the focal length. While viewing distant object, ligaments stretch to relax the ciliary muscles and curvature of lens decreases to increase the focal length.

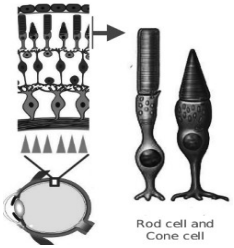
Photoreceptors :

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

Rod cells are more in number than cone cells.

The three types of cone cells (red, green & blue) provide colour vision.

Retinal, the visual pigment found in the photoreceptors, is formed from vitamin A.



Under dim light, rhodopsin dissociates to form retinal and opsin to produce impulses .

Under intense light, photopsin (iodopsin) dissociates to form retinal and opsin to produce impulses.

These impulses are transmitted through the optic nerve to the cerebrum. Thus vision made possible.

Experiencing of vision :

Image on retina – stimulation in the photo receptors – dissociation of rhodopsin / photopsin – impulses form – optic nerve – coordination of images by cerebrum – perfect vision.

Binocular vision is the ability of both the eyes to focus on the same object to get perfect image when brain combines these images. This help us to get a three dimensional image of the object and also to calculate the correct distance, depth, height and width of the object.

Defects and diseases of eyes :

1. Hyper metropia (long sight): Cannot see nearby objects clearly due to shortened eyeball.
2. Myopia (short sight) :Cannot see distant objects clearly due to elongated eyeball.
3. Night blindness : No clear vision in dim light due to deficiency of vitamin A.
4. Colour blindness : Fails to detect red or green colours due to defects in red and green cone cells.
5. Xerophthalmia : Conjunctiva and cornea become

dry and opaque due to prolonged deficiency of vitamin A.

6. Cataract : Lens become opaque resulting blindness
7. Glaucoma : When re-absorption of aqueous humor obstructed pressure inside the eyes increases, resulting damage to retina and photoreceptors. This ultimately leads to blindness.
8. Conjunctivitis : Infection of bacteria or virus causes red eye with pain

Points related with the health of our eyes.

- Avoid falling bright light like sun light to the eyes.
- Avoid the habit of reading under dim light.
- Do not watch TV or other screens continuously.
- Frequently wash our eyes.
- Include vitamin A rich food.

B. Ear : for hearing and body balance.

Main parts:

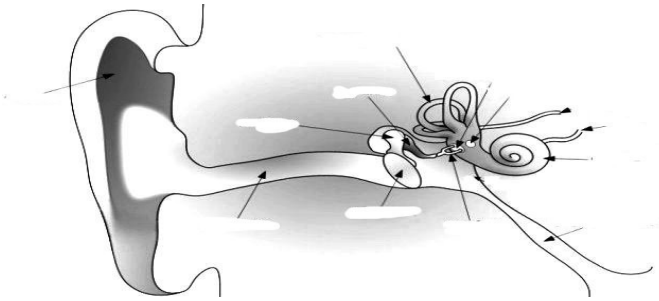
a. **External ear** : Pinna, auditory canal and tympanum.

b. **Middle ear** : Ear ossicles (malleus, incus, stapes) and eustachian tube.

c. **Internal ear** : Cochlea, Auditory nerve, Vestibule, 3 semicircular canals and vestibular nerve.

Oval window and round window.

Fluids inside the internal ear :
Endolymph and perilymph.

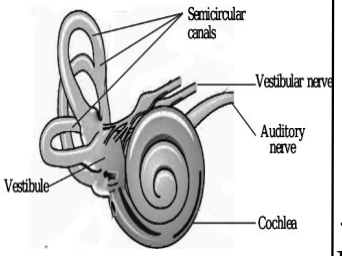


Eustachean tube connects the middle ear to the pharynx. It protects tympanm by balancing the pressure on either sides of it.

Ear ossicles (malleus, incus, stapes) amplify and transmit the vibrations of tympanum to internal ear.

Oval window is attached with stapes, so as to speed the vibrations of ear ossicles to internal ear.

The internal ear, constitutes membraneous labyrinth, seen inside a bony labyrinth. A coiled tube like **cochlea**, auditory nerve,the **vestibular apparatus** (vestibule & 3 semi-circular canals) and vestibular nerve are the parts of internal ear.



The membraneous labyrinth is filled with a fluid, endolymph and the space between the bony labyrinth and membraneous labyrinth is filled with another fluid, named perilymph.

The part, cochlea functions in hearing, while the vestibular apparatus helps to maintain body balance through transmitting impulses to the cerebellum.

Auditory receptors are the hair cells seen in the Organ of Corti of cochlea.

Sensory hair cells are also seen in the vestibule and semicircular canals.

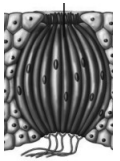
Hearing. (Flowchart).

Sound waves -- ear pinna – auditory canal – tympanum vibrates – ear ossicles amplify it – oval window – cochlear perilymph vibrates -- endolymph vibrates – stimulation in auditory receptors (hair cells) of the basilar membrane of Organ of Corti – impulse form -- auditory nerve – auditory centre of the brain – hearing.

Role of ear in maintaining the equilibrium :

Receptors (hair cells) seen inside the vestibule and semicircular canals,are stimulated according to the movement of head. The impulses formed are transmitted to the cerebellum through the vestibular nerve. Cerebellum functions so as to maintain the equilibrium of body.

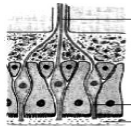
C. Sense of Taste : Chemoreceptors seen inside the mouth and tongue help us to detect taste. They seen inside the papillae of the tongue are the taste buds.



The different taste buds of the tongue include Sweet, salt, sour, bitter, umami etc.

When substances dissolve in saliva, chemo-receptors in the taste buds stimulate and impulses reach the brain through the respective nerves. Then we experience taste.

D. Sense of Smell : by the olfactory receptors in the mucus membrane.



When aromatic particles dissolve in the mucus, the olfactory receptors get stimulate and the impulses reach the brain through the olfactory nerve. Brain helps in feeling smell.

E. Skin : has receptors fto sense Temperature, Cold, Touch, Pressure and Pain.

F. Receptors in a few organisms :

Eye spot in Planaria (to detect light)
Ommatidia (cluster of photoreceptors in housefly)
Jacobson's organ in snake (to detect smell)
Receptors in the Lateral line of shark (to detect changes in the balancing of body)
Olfactory receptors in shark are highly sensitive.

Part 1- https://youtu.be/Q14Texfdi9c
Part 2- https://youtu.be/X5RvWrwrg8U
Part 3- https://youtu.be/377Wct4nVgA