2. Windows of knowledge

Sensory organs are the windows to get information from the surroundings to our sense. Our brain analyses the information given by the sensory organs and helps to communicate, to search food, to hear the sound, etc.

I. Eye

♣ Sensory organ for vision.

Protection

a) Eye fixed within the **eye socket** with the help of 3 pair **external eye muscle** – protection from injury.

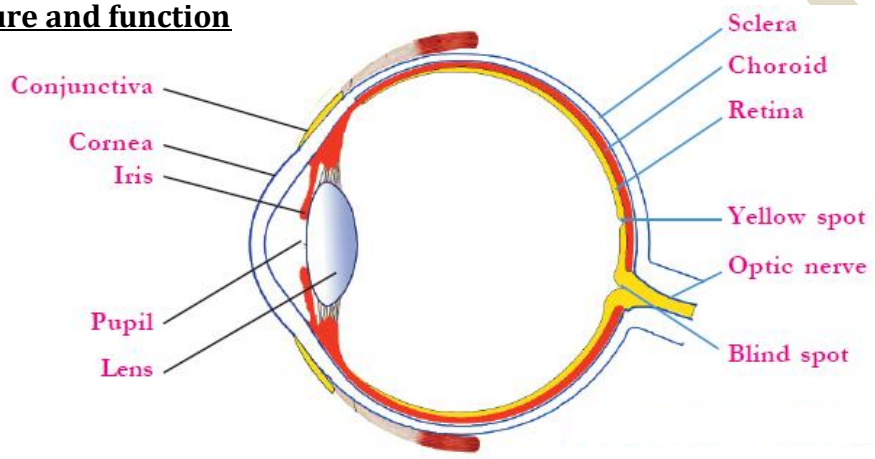
b) **Eye brow, eye lashes, eye lid** – protection from dust, sweat.

c) **Conjuctiva** - secretes mucus which protects the anterior portion of the eye ball from being dry.

d) **Tears** –

- lubricate the anterior part of the eyeball
- Wipes out the dust
- **Lysozyme** – destroys the germs that enter the eye.

Structure and function



	Part	Peculiarity	Function
I	Sclera	The white outer layer made up of connective tissue	Gives firmness to the eye
a)	Cornea	Transparent and projected anterior part	Refracts light to focus onthe retina
b)	Conjuctiva	Layer which covers the front part of sclera except cornea	Protection
II	Choroid	Middle layer with blood vessels	Provide nutrition and O_2 to the eye
a)	Iris	The dark colored (due to the presence of melanin) part seen behind the cornea.	
	Pupil	The aperture seen at the centre of iris	Regulates the entry of light - **Circular muscles of iris contract** in **intense light** and size of pupil decreases - **Radial muscles of iris**

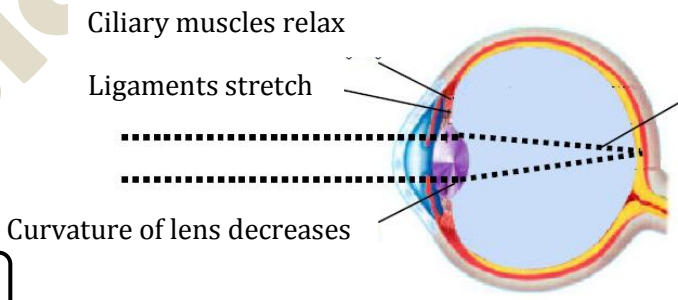
			contract in **dim light** and size of pupil increases
b)	Lens	Elastic transparent convex lens, connected to ciliary muscles by ligaments	Helps to focus light rays on the retina by adjusting focal length
III	Retina	The inner layer with photoreceptors	Impulses are generated according to the image s formed
a)	Yellow spot	Plenty of photoreceptors are present	Point of maximum visual clarity
b)	Blind spot	Photoreceptors are absent	No vision
c)	Optic nerve	Starts from blind spot	Carries impulses from photo recep tors to the brain
•	Aqueous chamber	Chamber between cornea and lens	Is filled with **aqueous humor** which provides nutrition and O_2 to the cornea and lens. This fluid formed from blood and reabsorbed to the blood.
•	Vitreous chamber	Chamber between lens and retina	Is filled with jelly type **vitreous humor**, which helps in maintain the shape of the eye.

Vision - phases

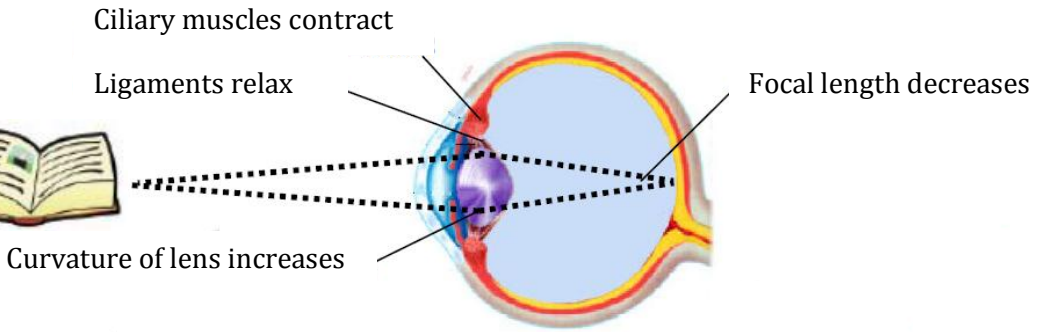
***(Step 1)* Regulation of focal length**

The ability of the eye to adjust the focal length of the lens by changing its curvature in accordance to the distance of the object from the eye and form the image on the retina is called the **power of accommodation of eye.**

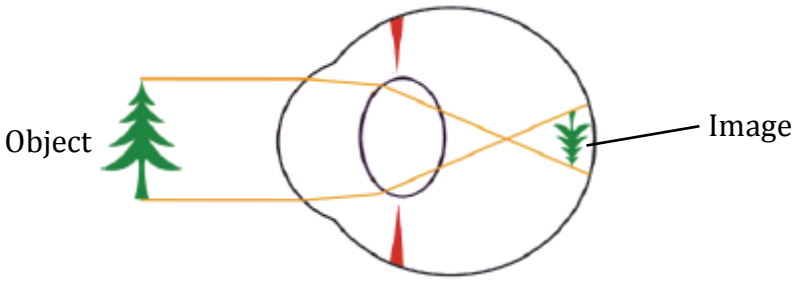
While viewing distant object



While viewing nearby objects



***(Step 2)* Images on retina**



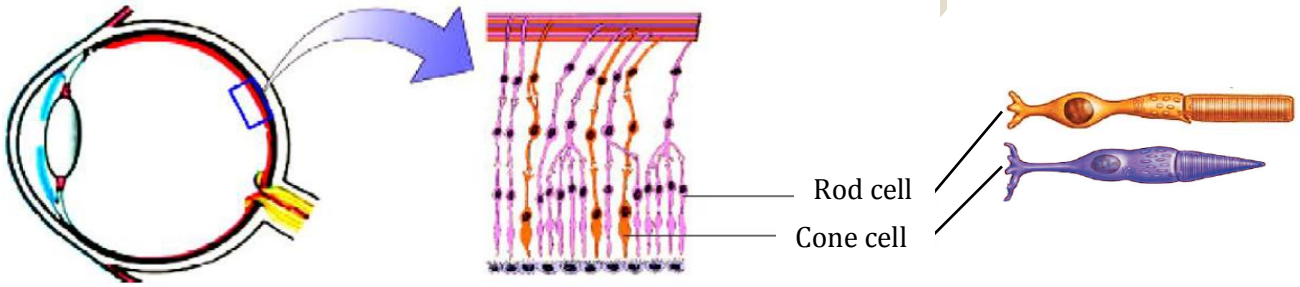
Flow chart of light rays coming from the object

Light ⟶ Cornea ⟶ Aqueous humor ⟶ Pupil ⟶ Lens ⟶ Vitreous humor ⟶ Retina

Peculiarities of image

- ♣ Real
- ♣ Small
- ♣ Inverted

***(Step 3)* Structure of retina and changes due to the formation of images**



The basis of vision is that the dissociation of visual pigments, **rhodopsin** and **photopsin/iodopsin** present in rod and cone cells respectively.

The visual pigments are formed from **opsin** (protein) and **retinal**, derivative of Vit.A.

Vit.A

Rhodopsin / Photopsin ⟷ Retinal + Opsin

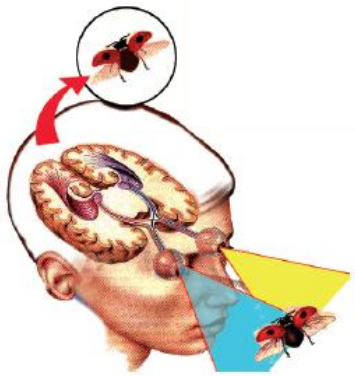
These chemical changes generates impulses.

- ❖ **Rod cells (12 lakh)** – Activated in dim light. It enables black&white vision. Rhodopsin dissociated into retinal and opsin. These fuses in the absence of light.
- ❖ **Cone cells (6 lakh)** – Stimulated in bright light. These cells have an ability to detect colour (because of the dissociation of photopsin/iodopsin only in bright light).

- ✓ The human eye have **3 types of cone cells**, which are stimulated by the red, green and blue light rays. This diversity is due to the difference in the amino acids in the opsin molecule.

***(Step 4)* Impulses to the brain – sense of sight**

Retina ⟶ Impulses ⟶ Optic nerve ⟶ Cerebrum ⟶ sense of sight



i. Photoreceptors are stimulated when the light (image) falls on retina
ii. Impulses are generated
iii. Impulses reach the cerebrum through optic nerve
iv. Cerebrum enables three dimensional image by combining 2 images of same object from both eyes. This is called **binocular vision**.

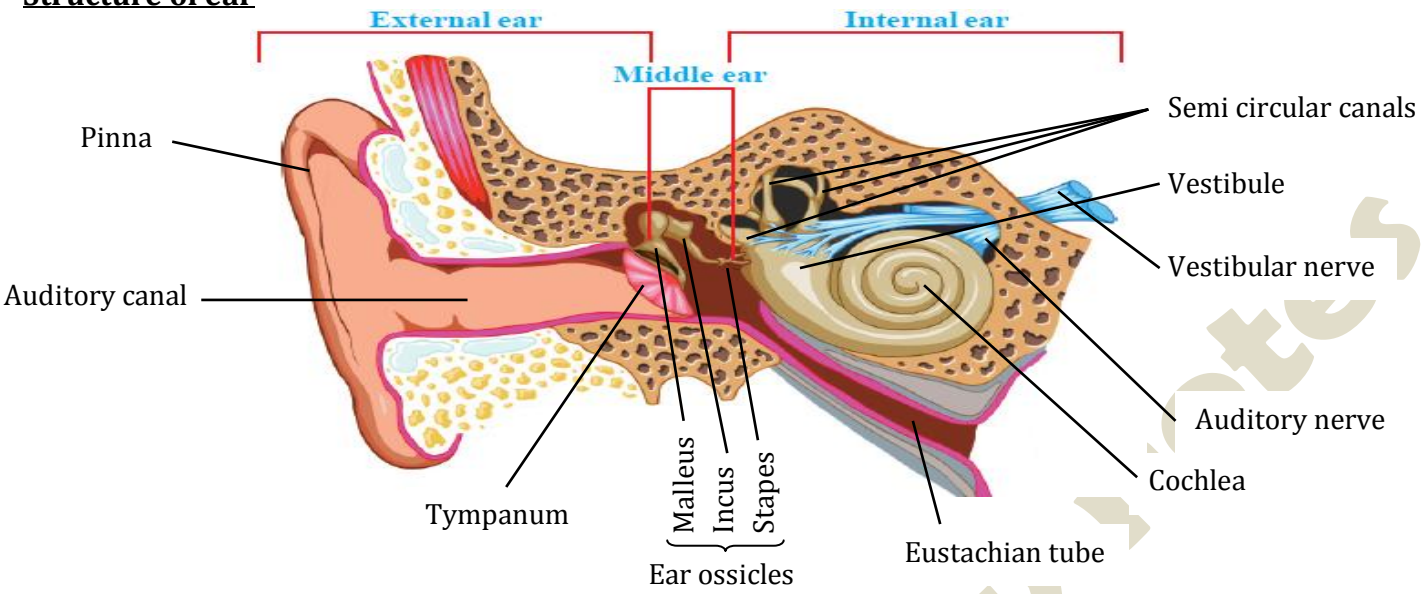
Defects and diseases of eye

Defect / Disease	Causes	Symptom	Remedy
Myopia(short sightedness)			Concave lens
Hypermetropia(Long sightedness)			Convex lens
Presbiopia	Loss of elasticity of lens	Can't see near object clearly	Convex lens
Astigmatism			Cylindrical lens
Night blindness	Deficiency of Vit.A results in low production of retinal, this prevents resynthesis of rhodopsin	Can't see clearly in dim light	Vit.A contained diet
Xerophthalmia	Prolonged deficiency of Vit.A	Cornea and conjuctive become dry and opaque	Vit.A contained diet
Colour blindness	Defect of cone cells	Cannot distinguish red and green colours	No remedy
Glaucoma	Reabsorption of aqueous humor does not occur	Pressure inside the eye increases	Laser surgery
Cataract	Lens become opaque	Leads to blindness	Lens replacement surgery
Conjuctivitis	Infection of conjuctiva by bacteria, virus etc.		Self hygiene

II. Ear

- The sensory organ for hearing
- Also, ear helps to maintain body balance.

Structure of ear



	Part		
I	External ear		
a)	Pinna		Carries sound waves to auditory canal
b)	Auditory canal	Small hairs and wax are helps to prevent dust and foreign particles	Carries sound waves to tympanum
c)	Tympanum	Circular membrane that separates middle ear from external ear	It vibrates resonance with sound waves
II	Middle ear	Chamber between external ear and internal ear	
d)	Ear ossicles	The chain of malleus, incus and stapes connects tympanum to the internal ear through oval window	Amplify and transmit vibration of tympanum to the oval window
e)	Eustachian tube	Connects middle ear and pharynx	Regulates pressure on both sides of tympanum
III	Internal ear	The parts seen inside the bony labyrinth of brain	
f)	Oval widow (above)	The holes covered by membranes in the wall that separate middle ear and internal ear	Spreads the vibration of stapes into the inner ear
g)	Round window (below)		Helps in the movement of fluid inside cochlea
•	Perilymph	The fluid filled between membraneous and bony labyrinth	
•	Endolymph	The fluid filled in the memraneous labyrinth	
h)	Cochlea	The snail shell like tube has 3 chambers. The upper and lower chambers filled with perilymph and middle chamber is filled with endolymph. The **auditory receptors seen in basilar membrane**	Helps in the hearing

		(organ of corti) that separate middle and lower chambers is	
i)	Auditory nerve	Starts from cochlea	Carries impulses from the organ of corti to the cerebrum
j)	Semi circular canals	Endolymph is filled in the semi circular canals that are perpendicular to each	Impulses formed due to the movements of hair cells by the movement of endolymph according to the body movement.
k)	Vestibule	Chambers of vestibule is filled with endolymph	
l)	Vestibular nerve	It starts from vestibule and semi circular canals	Carries impulses from vestibule and semi circular canals to the cerebellum

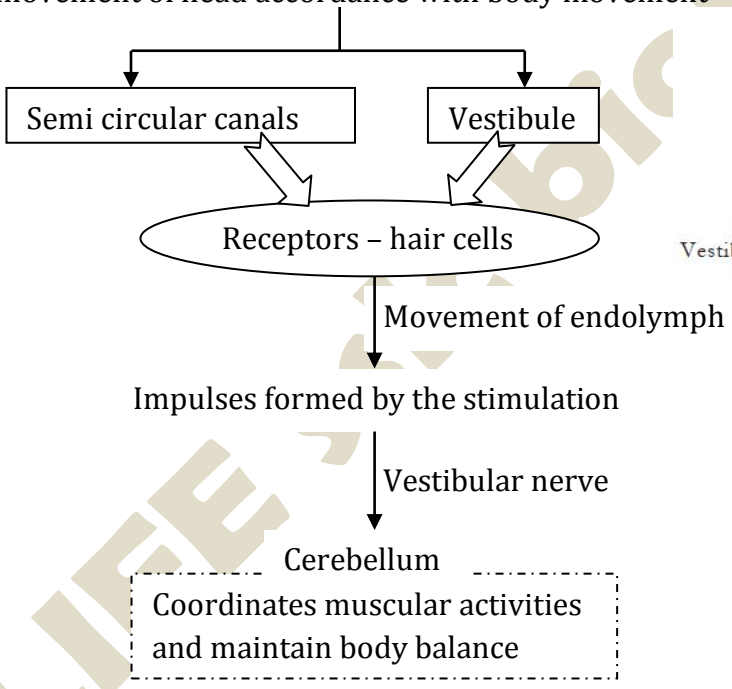
Sense of hearing

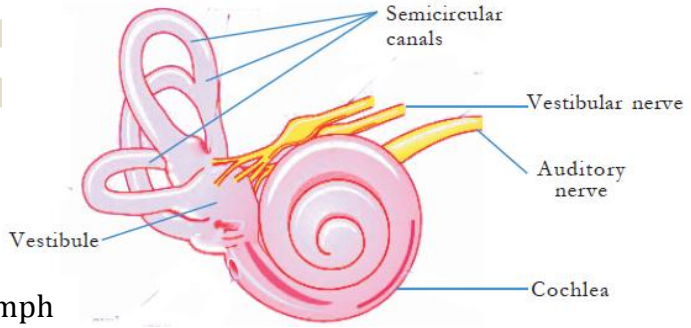
Sound waves ⟶ Pinna ⟶ Auditory canal ⟶ Tympanum ⟶ Ear ossicles ⟶ Oval window ⟶ Cochlea ⟶ Perilymph ⟶ endolymph ⟶ Organ of corti ⟶ Impulse ⟶ Auditory nerve ⟶ Cerebrum ⟶ Sense of hearing

Body balancing

♣ The 3 semi circular canals and vestibule are helps to maintain body balancing.

The movement of head accordance with body movement

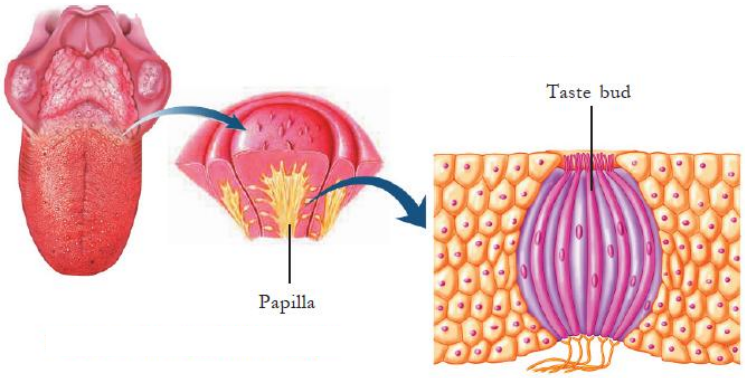




III. Tongue

- The taste buds seen in tongue and cheek are helps in the detection of taste
- There are different types of taste buds to detect different tastes like sweet, sour, bitter, salt and umami

Structure

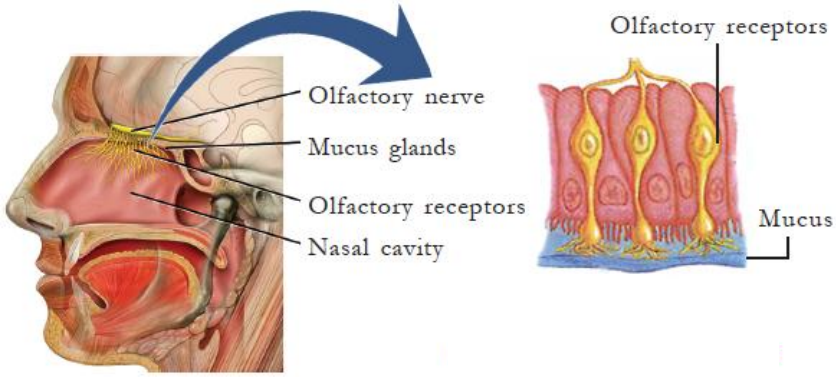


Sense of taste

- Substances responsible for taste dissolved in saliva
- Chemo receptors in taste buds are stimulated
- Impulses generated
- Through nerve
- Reach the site of taste in cerebrum
- Sense of taste

IV. Nose

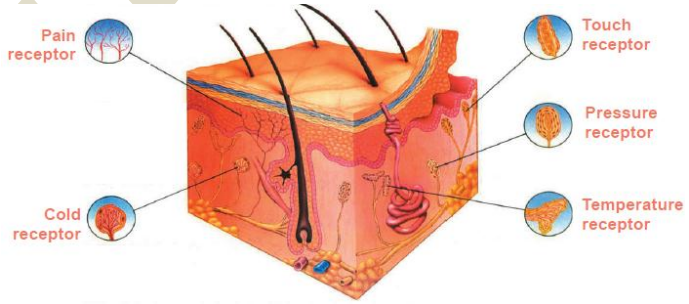
Structure



Sense of smell

- Aromatic particles diffuse in the air and enter the nostrils
- These particles dissolve in mucus and reach the olfactory receptorts
- Olfactory receptors are stimulated and impulses generated
- Impulses reach the site of smell in the cerebrum
- Sense of smell

V. Skin

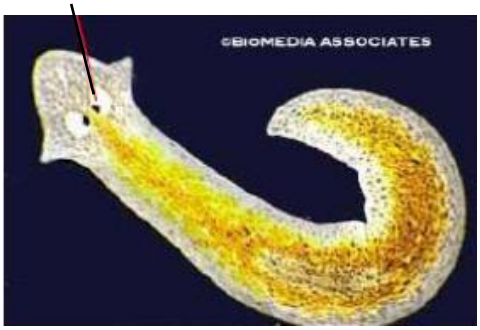


- **Temperature, pressure, pain, touch, cold** receptors get stimulated
- Impulses generated
- Impulses reach the cerebrum through related nerves
- Experiences different sensations

Receptors in various organisms

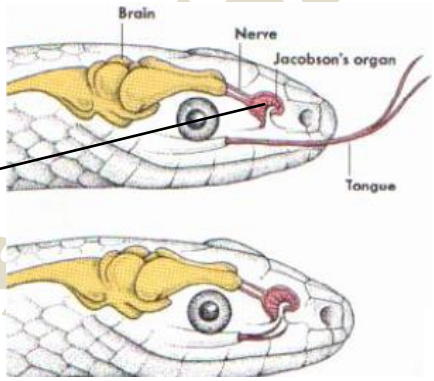
Organism	Receptors	Peculiarity
Planaria	**Eye spot**	Reacts with the variation of light
Insect (House fly)	**Ommatidia**	Impulses from thousands of ommatidia reach the brain. Brain enables vision by the fusion of images.
Snake	**Jacobson's organ**	The aromatic particles stick on the tongue reach the Jacobson's organ seen on the roof of mouth cavity. Then the receptors get stimulated.
Shark	**Lateral line**	Help to detect the change in body balance
	Highly sensitive olfactory receptors	Help to detect smell

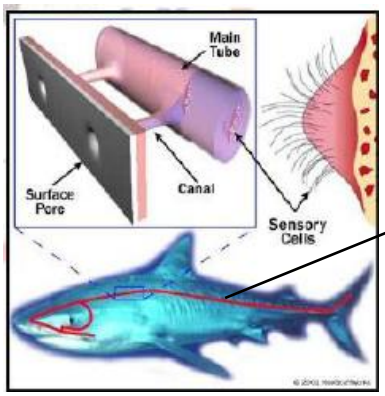
Eye spot



Ommatidia

Jacobson's organ





Lateral line

Prepared by Muhammed Rasheed