OLGC S.4 HOLIDAY WORK MARCH 2020

READ ALL OF THIS WORK AND ANSWER THE QUESTIONS IN YOUR EXERCISE BOOK.

TOPIC :COORDINATION

SUB TOPIC:SENSE ORGANS OR RECEPTOR ORGANS IN MAMMALS

These are organs that perceive the stimulus and change it into nervous impulse (transduction).

Receptor organs are made up of cells called receptor cells. There are different types of receptor cells depending on the nature of the stimulus they perceive and the organ in which they are contained.

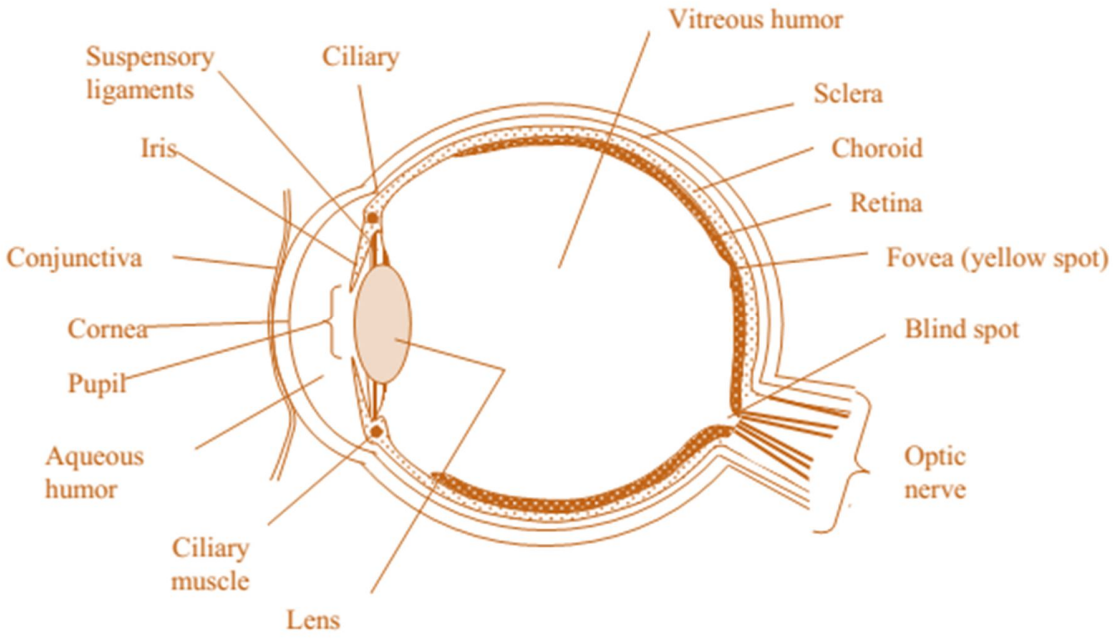
Receptor organs and their functions

Receptor cell	Nature of stimulus	Receptor organs	Function
Photoreceptors	Light	Eye	Vision
Mechanoreceptors	Sound and gravity	Ear	Hearing and balancing
Chemo receptors	Chemicals	Nose	Smelling
Thermo receptors	Temperature	Skin	Detecting temperature
Chemo receptors	Chemicals	Tongue	Tasting
Mechanoreceptors	Pressure	Skin	Detecting pressure changes.

THE MAMMALIAN EYE

The mammalian eye is a receptor organ responsible for sight. It contains photoreceptor cells, which perceive the light stimulus and change it into nervous impulse.

Structure of the mammalian eye



Parts of the eye

1. The conjunctiva:

This is a thin transparent layer lining the inside of the eyelid.

It protects the eye and holds it in position.

It enables the eye ball to move easily by secreting mucus.

2. The sclera:

This is a tough inelastic layer that gives shape to the eye.

It protects the inner most delicate parts.

It provides attachment for the muscles of the eye.

3. The cornea:

This is a transparent layer in front of the eye.

It refracts (bends) light into the eye.

4. The choroid layer:

It is below the sclerotic layer.

It is pigmented and mainly contains black pigment which stops reflection of light rays.

It prevents internal reflection of light.

This contains a network of blood vessels supplying oxygen and food to the eye.

5. The aqueous humour:

It is a solution of sugar, salts and proteins.

The aqueous humor is a watery fluid which maintains the shape of the eye.

It also refracts light into the pupil and the lens.

6. The vitreous humuor:

It is a jelly-like substance that fills the inner cavity of the eye.

It is transparent and maintains the shape of the eye.

It refracts light to the retina.

7. The ciliary body:

This contains ciliary muscles, which control the size of the lens during viewing nearby or distant objects.

8. The lens.

It is transparent and held by suspensory ligaments.

It refracts light to make an image on the retina.

9. The iris

This is made up of an opaque tissue the center of which is a hole called pupil that allows in light to form an image on the retina.

The contraction of the muscles of the iris increases the size of the pupil and relaxation decreases the size of the pupil.

It is therefore responsible for controlling the amount of light entering the eye.

10. The retina

This is a layer containing photoreceptor cells (light sensitive cells)

There are two types of light sensitive cells on the retina

i) Rods

ii) Cones

-The cones are sensitive to coloured light and are responsible for colour vision. They are also sensitive to light of high intensity and are used during daytime.

Most cones on the retina are concentrated on the fovea or yellow spot.

-The rods are incapable of perceiving coloured light and are sensitive to light of low intensity (dim light). They are used during night vision.

Nerve fibers from the photoreceptor cells run to the brain via the optic nerve.

The rods contain a pigment rhodopsin which is rapidly bleached by even a small amount of light but at the same time it is rapidly generated.

The cones contain a pigment called iodopsin which is less sensitive to light and is not bleached so quickly.

The retinas of nocturnal animals have mainly rods. Due to this, nocturnals can't perceive different colours.

Therefore the retina is where the image is formed in the eye.

11. Pupil.

This is a round black hole in the center of the eye lying behind the cornea. It allows light to pass into the eye to the lens.

12. Suspensory ligaments.

These are inelastic fibers that hold the lens in position.

13. The blind spot:

This is a region where the nerve fibers leave the eye to enter the optic nerve. It has no light sensitive cells. When an image falls on this point, it is not taken to the brain thus blind spot.

14. The fovea

This is a small depression in the center of the retina. It has only cones in a high concentration. It is therefore a region on the retina that contains the largest number of sensory cells. Due to this, it produces the most accurate images in the eye.

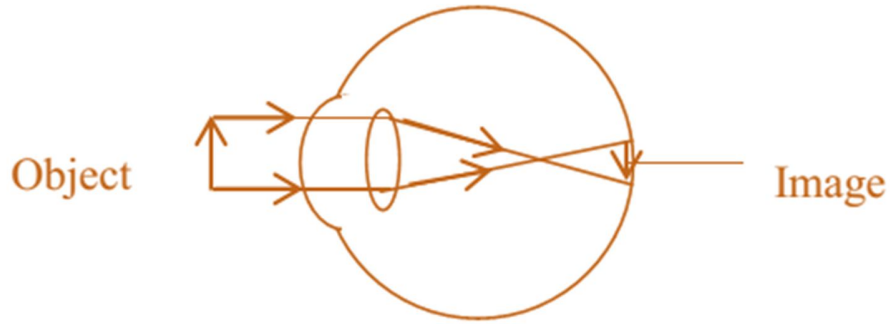
15. Eye lids

These protect the eye and remove any foreign bodies that enter it. Regular blinking enables the spread of the fluid all over the exposed surface of the eye.

16. Eye lashes

They prevent dust particles and other objects from entering the eye.

IMAGE FORMATION AND VISION



-Light from an external object enters the eye.

-It is refracted by the cornea into the aqueous humour.

-The aqueous humour then refracts it to the lens.

-The lens refracts it to the vitreous humour.

-The vitreous humour finally refracts light and focuses it to the retina making an image on the retina. -The photoreceptors in the retina change the light stimulus into a nervous impulse.

-The impulse travels along the optic nerve to the brain where interpretation of the image is made.

-The image formed on the retina is smaller to the real object and it is upside down.

Illustration

CONTROL OF LIGHT AMOUNT ENTERING THE EYE

-The iris controls the amount of light entering the eye.

- It is made up of circular and radial muscles. .

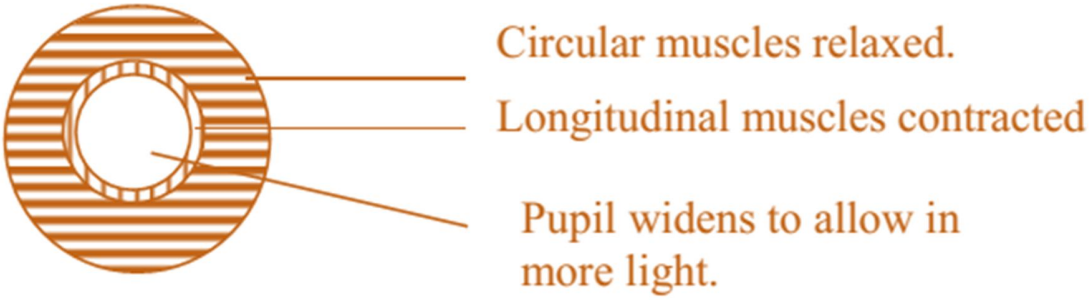
Control of the amount of light rays entering the eye when in dim light:

In dim light, radial muscles contract,

Circular muscles relax,

Pupil widens and more light is admitted into the eye.

Dim light:



Control of amount of light rays entering the eye in bright light:

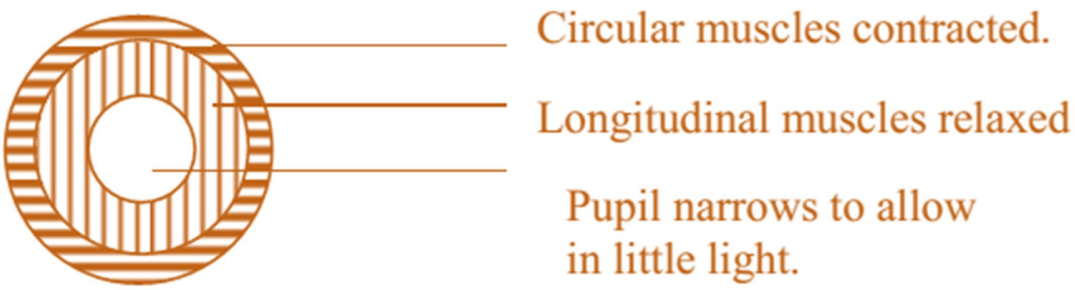
In bright light, circular muscles of the iris contract,

Radial muscles relax,

Pupil becomes smaller and narrower,

Less light is admitted into the eye.

Bright light:



Note answer Qn UNEB

2016 No. 34

34. (a) Describe how the amount of light entering the eye is controlled (06 marks)

(b) Explain how each of the following parts of the eye is adapted to its function.

(i) Retina. (03 marks)

(ii) Choroid. (03 marks)

(iii) Lens. (03 marks)

2009uneb No. 33

ACCOMMODATION OF THE EYE

This is the ability of the eye to change the focal length of the lens when viewing distant or nearby objects.

Accommodation for a nearby object:

-When looking at a nearby object, the ciliary muscles in the ciliary body contract.

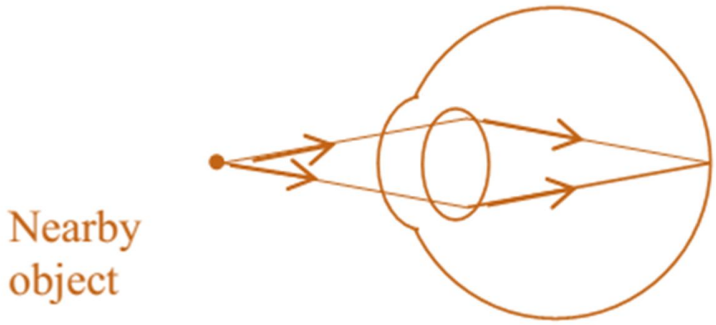
- the suspensory ligaments slacken.

-This makes the lens short and thick.

-This increases the ability of the lens to refract light.

-the focal length of the lens reduces for the nearby object to be seen clearly.

Illustration



Accommodation for a distant object:

When viewing a distant object, the ciliary muscles in the ciliary body relax.

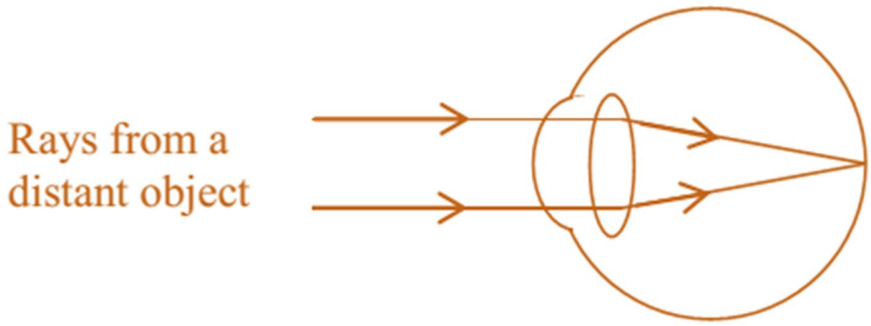
This causes tension in the suspensory ligaments.

The suspensory ligaments pull the lens apart making the lens long and thin.

This decreases the ability of the lens to refract light.

-the focal length of the lens increases for a distant object to be seen clearly.

Illustration



2011uneb No. 37

2006uneb No. 33

EYE DEFECTS

An eye defect is a condition where the eye fails to focus an object well unless aided by external lenses.

The common eye defects include:

1. Short sightedness (myopia):

This is usually caused by a large eyeball or a very strong lens. Light from a distant object is focused in front of the retina. The individual can only see nearby object but not distant ones.

Illustration

This can be corrected by putting on diverging (concave) lenses.

2. Long sightedness (hypermetropia):

This is caused by a small or short eyeball or a very weak lens such that a close object is focused far behind the retina. The individual can see distant objects but cannot see nearby objects.

Illustration

Long sightedness can be corrected by wearing converging (convex) lenses.

3. Astigmatism

This is caused by unequal refraction of the cornea and lens due to uneven curving in them. It results into some parts of the object being well focused on the retina and some not to be focused. It is normally due to old age. This can be solved by wearing cylindrical lenses.

4. Presbyopia

This condition occurs when the lens hardens due to old age and does not focus. It can be corrected by wearing spectacles with convex lenses or often 2 pairs of spots may be necessary i.e. a pair with convex lenses for close vision and a pair of concave lenses for distant vision or the 2 types of lenses can be combined into one pair known as bi-focal spectacles.

5. Cataract

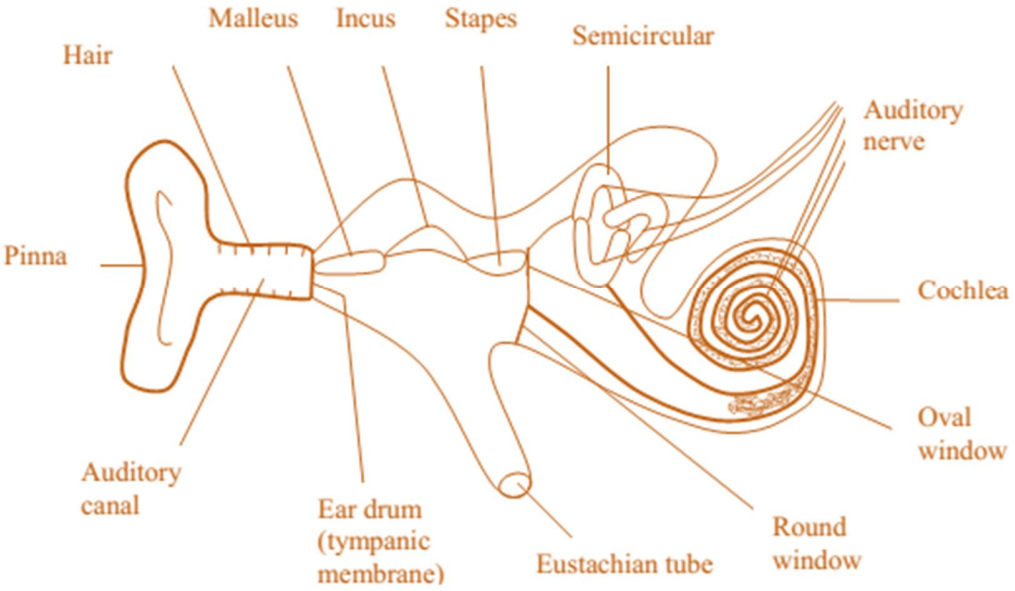
It is a condition which occurs when an individual is aging. It is caused by the eye lens becoming opaque due to a thin covering formed on it. It is corrected by surgical removal of the thin opaque layer of the lens.

Other eye defects include trachoma, conjunctivitis, colour blindness and glaucoma.

2003uneb No. 34 2001uneb No. 31

THE EAR

Structure of the ear



The ear has sensory receptors for hearing and balancing. These are mechano-receptors because they respond to pressure and gravity. The ear is made up of three areas i.e. the outer ear, middle ear and inner ear.

1. The outer ear:

This is the tube opening to the side of the head and inwards stopping at the eardrum. It has an outer extension called the pinna. The pinna concentrates and directs the sound vibrations into the ear through the auditory canal. This makes the ear drum to vibrate.

2. The middle ear:

This is a cavity in the skull filled with air. It communicates with the mouth cavity through the Eustachian tube. There are three small bones called ossicles in the middle ear which link the eardrum and the opening of the skull called oval window that leads to the inner ear.

3. The inner ear

The inner ear is filled with a fluid and consists of mainly a coiled tube known as the cochlea. The cochlea has sensory nerve endings leading to the brain. These transmit nervous impulses from the ear to the brain.

Functions of parts of the ear

1. Pinna:

2. Ear ossicles:

These are 3 tiny bones in the middle ear. They are:

Malleus (hammer)

Incus (anvil)

Stapes (stirrup)

They are joined like a chain and they transmit sound vibrations across the middle ear from the ear drum to the oval window. They amplify sounds of low tones.

3. Eustachian tube:

It connects the middle ear to the pharynx of the mouth.

Its function is to equalize air pressure on both sides of the ear drum so that it can vibrate freely.

It opens when one is swallowing and yawning.

It prevents the eardrum from bulging.

The Eustachian tube is used to balance the pressure inside the ear with that outside the ear.

4. Oval window (fenestra ovalis):

It is a flexible membrane which vibrates and sets up vibrations in the fluids of the ear called perilymph in the cochlea.

It receives impulses from the steps and transmits them to the cochlea.

5. Round window:

It is a flexible membrane which controls the displacement in the cochlea created by vibrations of ossicles by releasing pressure when it bulges out wards.

6. Cochlea:

It is a 3 chambered fluid filled tube which is coiled. It contains sensory cells which pick up vibrations in the fluid and transmit them to the auditory nerve.

The sound vibrations move along the auditory nerve and reach the brain where they are interpreted as sound. Its 3 chambers include:

i) The upper canal which starts from the oval window. It contains perilymph.

ii) The lower canal which ends in a smaller membrane called the round window. It also contains perilymph.

iii) Middle canal is located between the upper and lower canal. It is filled with a fluid called endolymph. It contains sensory cells which detect sound.

Semi-circular canal (organ of balance):

These are 3 semicircular canals which are at right angles to each other. They contain a fluid called endolymph. At one end of the canal, there is a swelling called ampulla. It contains sensory cells.

The process of hearing(answer 2007uneb No. 36)

-Sound waves are collected and concentrated into the ear by the pinna.

-They are then directed to the tympanic membrane (ear drum) through the auditory canal.

-This causes the eardrum to vibrate.

-The vibrations of the eardrum are amplified and transmitted by three ossicles starting from the malleus, incurs and finally the stapes hands them over the oval window that leads to the inner ear.

-Vibrations in the oval window make the fluid in the inner ear and cochlea to vibrate.

-Receptors in the cochlea (organ of corti) receive the information, change it into impulses and the impulses are taken to the brain via the auditory nerve.

Note:

The utriculus responds to vertical movement of the head while the succulus responds to lateral movement of the head.

Common ear disorders

1. Ear ache and ear discharge:

It is usually due to an inflammation in the middle ear.

It occurs when microorganisms reach the middle ear via the Eustachian tube. Due to severe inflammation, pus may be formed in the middle ear and the ear drum become perforated. The discharge may lead to permanent deafness.

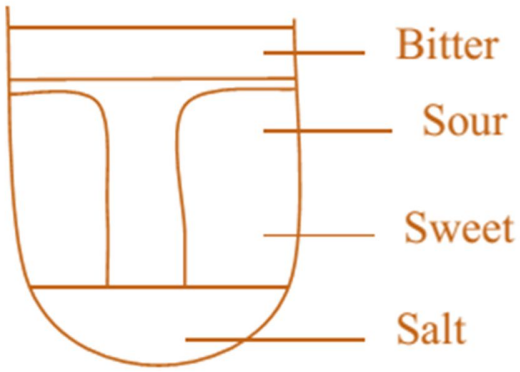
2. Deafness:

This is caused by accumulation and hardening of wax in the outer auditory canal which presses against the eardrum.

Blocking of the Eustachian tube, exposure to loud noise over a long period of time can damage the organ of corti leading to deafness.

Also damage to the cochlea or the hearing centre of the brain can also cause deafness.

THE TONGUE



The tongue is the receptor organ for the sense of taste. It changes chemicals in the mouth into nervous impulses. It contains chemo-receptors, which carry out this function. The tongue contains taste buds, which contain the chemo-receptor cells. The tongue distinguishes between four different kinds of tastes, i.e. sweet, sour, salt and bitter.

The taste buds for the different tastes are located in different parts of the tongue as shown in the diagram below.

When a chemical is placed in the mouth, it dissolves in the moisture (saliva) in the buccal cavity. The dissolved chemicals then stimulate the taste buds in the different parts of the tongue depending on the type of taste. Impulses are then sent from the tongue through a sensory neuron to the brain and the brain interprets the type of taste.

THE NOSE

The nose is the receptor organ for smell. It is also made up of chemo-receptor cells and it is stimulated by chemicals in air. This helps the organism to respond to chemical stimuli at a distance.