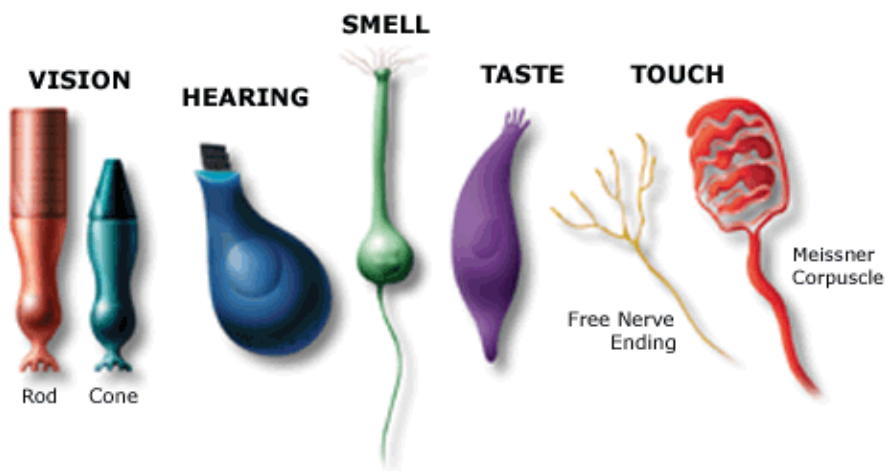


SCIENCE FORM 2
CHAPTER 1 SENSORY ORGAN

Sensory organs



- are the organs that detect stimuli
- five senses: touch, smell, taste, hear and sight ; each sense is provided by separated organs

Stimuli

- are any changes that occur in the surroundings which lead to response
- eg.sound, chemical substances, light intensity
- sensory organs are sensitive to certain types of stimuli

Sense	Sensory Organ	Stimuli detected
Touch	Skin	Touch, pressure, pain, cold, heat
Taste	Tongue	Taste
Smell	Nose	Smell
Sight	Eyes	Light
Hearing	Ears	Sound

Response

- An organism receives a stimulus and react to it

Receptors

- Special structures which sensitive to stimuli and have nerve attached to them
- When a stimulus received by a sensory organ, the receptors in the sensory organ are stimulated, the receptors produce electrical messages known nerve impulses
- The nerve impulses are sent along the nerve to brain, the brain is then interprets the message

Effectors

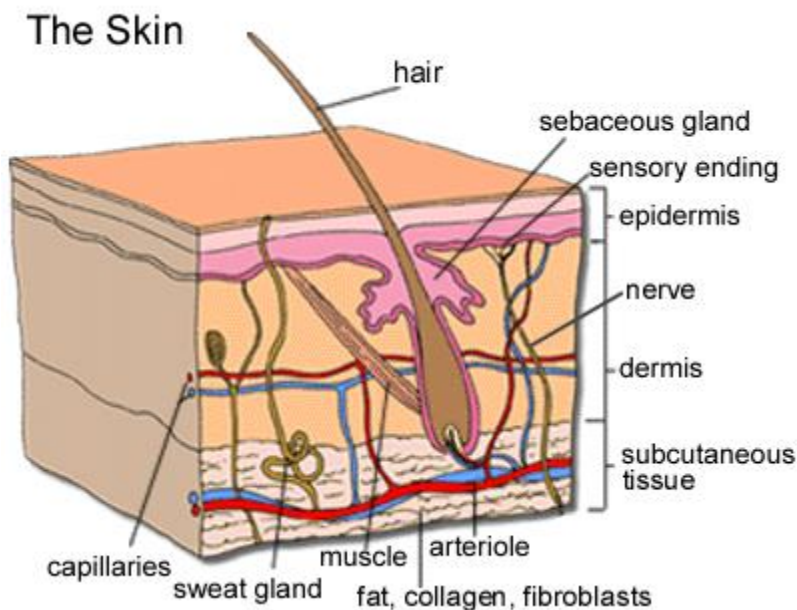
- Are parts of the body that carry out responses, eg muscles and glands

Brain

- Control centre of the body, linked to all parts of the body
- Nervous system : brain and nerves

Stimulus-> Receptor -> Nerve impulse -> Nerve -> Brain -> Nerve -> impulse -> Effectors -> Response

SKIN



- The sense of touch is the sense that is sensitive towards the touch stimulus provided by specific objects.

-Organ involve in the detection of touch stimulus is the skin.

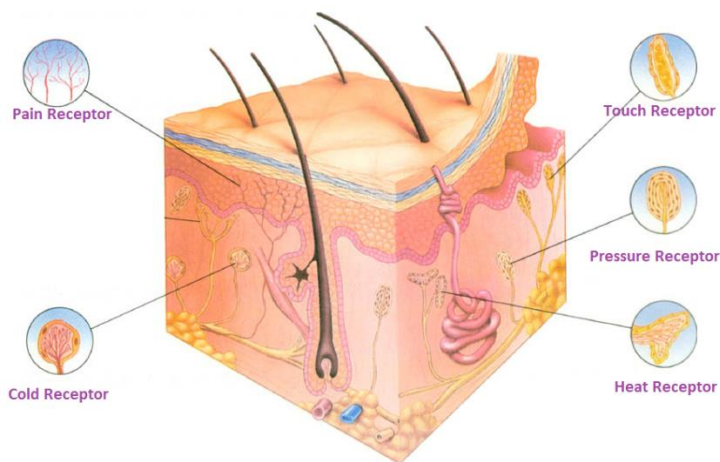
-Structure of human skin:

a) The skin divided into three layer epidermis, dermis, fat layer (subcutaneous layer @ adipose layer @ fat layer)

b) Receptors are cell in our body that detected stimuli.

c) Our body have different types of receptors.

- These are:
- i. pain receptor
 - ii. touch receptor
 - iii. heat receptor
 - iv. cold receptor
 - v. pressure receptor



d) The pain receptor is in the epidermis.

e) The touch, heat and cold receptors are in the dermis. The pressure receptors are in the fat layer.

f) Each type of receptor can detect only one particular stimulus.

g) The part or our body contain receptor are called sensory organs

h) These receptor have nerves attached to them

- The degree of sensitivity of the skin depends on the:

a) Thickness of the epidermis

- The thinner the epidermis, the more sensitive the skin is to the stimulus

b) Number of receptors present

- The more receptors found on the skin the more sensitive is that part of the skin.

- The part of the body that have thin epidermis and many receptors sensitive to touch are

a) lips

- b) fingertips
- c) behind the ears
- d) armpit
- e) the back of the neck

- The part of the body that are not so sensitive to touch are the:

- a) elbow
- b) knee
- c) palm of the hand and sole of the foot
- d) buttocks/hip

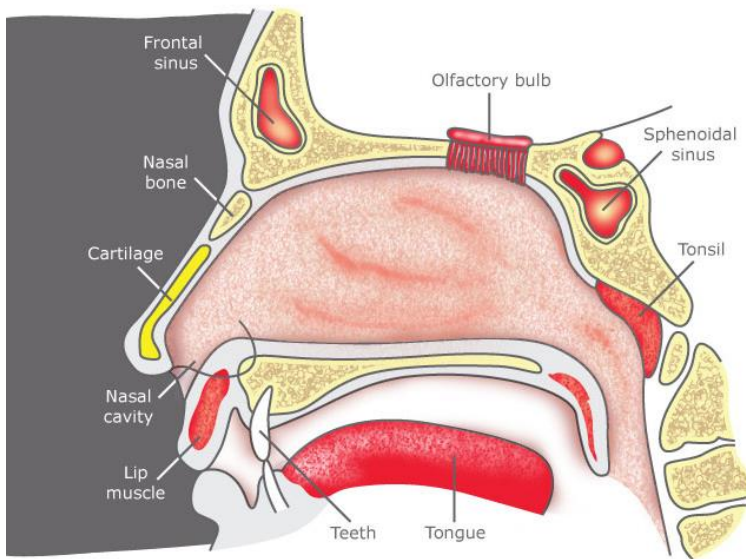
-The parts of the body usually chosen by the doctor for injection are along the upper arm and the buttocks. This is because these parts have thick epidermis and fewer receptors.

- Braille is a code made up of small raised dots on paper. Blind people use their sense of touch to read Braille.

-Other functions of the human skin.

- i. Water proof - prevent water loss from skin.
 - ii. Prevents entry of microorganisms that cause illnesses.
 - iii. Remove waste products - excess water, urea and mineral salts.
 - iv. Produces Vitamin D in the presence of the sunlight.
 - v. Stabilise body temperature
- sweat glands produce more sweat to cool the body if body temperature rises

NOSE



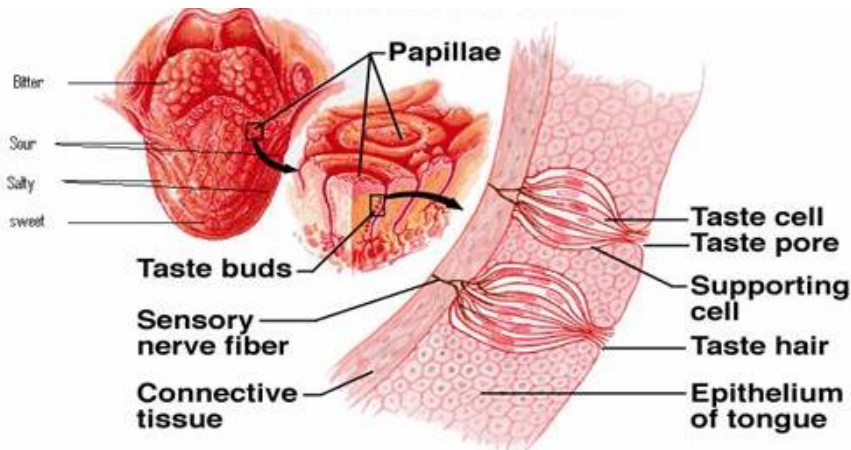
- The nose is sensory organ for smell.
- Cells sensitive to smell (smell receptors) are found on the top of the nasal cavity.
- Structure of the human nose.
 - a. The human nose has a cavity lined with epithelium tissue.
 - b. On the surface of the epithelium tissue are the sensory cells known as olfactory cells.
 - c. The surface of the nasal cavity is moist because of the mucus secreted by the cells of a gland.
 - d. The nasal cavity has a pair of external opening (nostrils) which have hair to filter dust from the air inhaled through the nose.
- The nose detects smell in the following way.
 - i. The inside of the nasal cavity produce mucus
 - ii. The chemical vapor entering nose during breathing dissolves in mucus. The dissolve chemicals stimulates the smell receptor at the top of the nasal cavity. The smell receptor then produce impulse which are sent through the nerves to the brain
 - iii. The brain interprets / evaluates the smell
- When we have a cold or flu, a lot of mucus is produce. The smell receptors are surrounded by this thick layer of mucus and vary little of chemical vapor gets to the smell receptors. Therefore, the smell receptors do not get stimulated enough to effectively function as a sensory organ of smell.

- The sensitivity of the nose towards stimuli is influenced by the following factors:

i. The strength of the smell. A stronger smell will be detected by the nose easily compared with a weaker smell.

ii. The presence of mucus in the nose. A lot of mucus will reduce the sensitivity of the nose.

TONGUE



- The tongue is the sensory organ for taste.

- The surface of the tongue has groups of cells known as taste buds which are sensitive to taste.

- There are four types of taste buds on the tongue sensitive to sweet, bitter, sour and salty.

- The tongue detects taste in the following way:

Dissolved substance → taste receptors → message → brain → type of taste

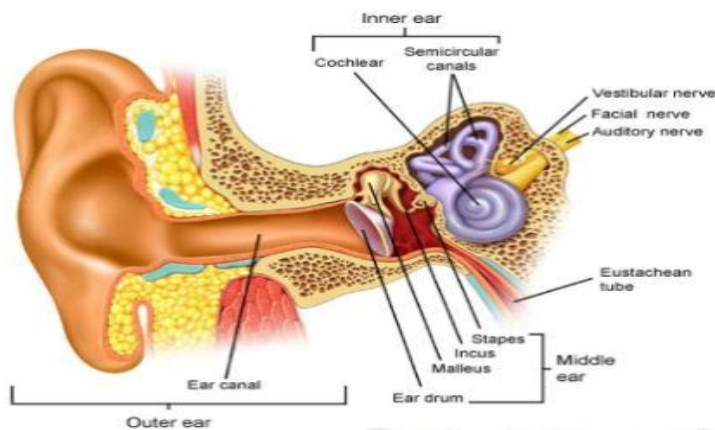
- The sense of smell helps the sense of taste. This explains why food does not taste appetizing when we have a cold or flu because we cannot smell effectively.

TASTE and SMELL

- All our senses work together:- sense of smell and taste are special partners

- When we eat, our tongue gives us the taste and our nose smells of the food.

HEARING



-The ear is the sense organ that is sensitive to sound stimuli produced by vibrating object.

-A human ear has three main part.

- i. the outer ear, filled with air.
- ii. The middle ear, filled with air.
- iii. The inner ear, filled with liquid

FUNCTIONS OF DIFFERENT PARTS OF THE HUMAN EAR

OUTER EAR

- i. Pinna - collects and directs sound waves into the ear canal.
- ii. ear canal / auditory canal - transmits sound waves to the eardrum.
- iii. Eardrum - vibrates and transmits sound waves to the ossicles.

MIDDLE EAR

- i. Ossicles - intensify the vibrations of the sound waves by 22 times before transmitting to the oval window.
- ii. Eustachian tube - balances the air pressure at both side of the eardrum.
- iii. oval window -transmits sound vibrations from the middle ear to the inner ear.

INNER EAR

- i. Cochlea- transforms sound vibrations into impulses.
- ii. semicircular canals - balance the body position.
- iii. auditory nerves - send messages to the brain which interprets the messages as sound.

Limitations of hearing.

- We cannot hear all the sounds around us.
- The range of frequencies of hearing in man is 20 Hz until 20 000 Hz.
- the range of frequencies of hearing of several animals:
 - i. snake 100-800Hz
 - ii. frog 50-10 000Hz
 - iii. dog 10-50 000Hz
 - iv. cat 60-60 000Hz
 - v. bat 1000-120 000Hz
 - vi. grasshopper 100-15 000Hz
 - vii. whale 10-50Hz
- Different people have different limitations of hearing.
- For example, old people generally cannot hear as well as young people.
- Our ear drum become less sensitive to sound as we grow older.

To overcome the limitations of hearing, we use

- i. the stethoscope – enables doctor to detect the soft heartbeats of patients.
- ii. hearing aids – collects sound signals before being sent to the middle ear.
- iii. amplifier – boosts weak sound signals.

Stereophonic hearing

- Stereophonic hearing is hearing using both ears.
- The advantages of stereophonic hearing:
 - i. enables the direction of the source of hearing to be detected more accurately.
 - ii. This is because the ear nearer the source of sound receives sound louder and earlier than the other ear.
 - iii. Animals that have stereophonic sound can detect the presence of preys and predators more quickly.

Properties of sound

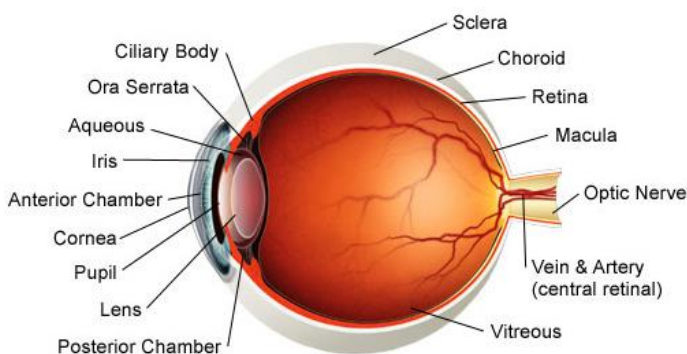
- transfer of sound requires a medium.
- sound can transferred through; b. solids c. liquids d. gases e. cannot be transferred through in vacuum.
- Sound can be transferred fastest in solids and slowest in gases.
- This is because the particles in solids and liquids are closer each other compared to the molecules in gases.
- Vacuum is space that does not have any particles.
- Speed of sound transferred in various media.

Reflection and absorption of sound

- Sound can be reflected or absorbed by the surface of an object.
- The sound reflected repeatedly from one surface is known as echo.
- Surfaces that are smooth, even and hard are good sound reflectors and produce loud echo. For examples, concrete, plank, metal and mirror
- Surfaces that are rough, hollow and soft are good sound absorbers and produce weak echo. For examples cloth, sponge, cork, rubber, carpet and cushion.

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SIGHT



- The sense of sight is the sense that can detect light stimulus.
- Structure of the human eye:

- i. the sclera (outermost)
- ii. the choroids (middle)
- iii. the retina (innermost)

-structure and functions:

- a. Sclera- protect and maintains the shape of the eyeball
- b. Choroid- the blood vessels supply nutrients and oxygen to the eye, the black pigment absorbs the light, thus preventing reflection of light which would make an image less sharp
- c. Retina- detects light and produces nerve impulse, cones enable us to have color vision and rods enable us to see in dim light
- d. Cornea- its curved surface helps to refract (bend) light onto the retina
- e. Conjunctiva – protects the cornea
- f. Iris- controls the size of the pupil, thus control amount of light entering the eye
- g. Pupil- allows light to pass and fall on eye lens
- h. Eye lens – refracts and focuses light to form a sharp image on the retina
- i. Ciliary body- contracts and relaxes to change the thickness of the eye lens
- j. Suspensory ligaments – hold the eye lens in position
- k. Aqueous humour- help s to focus the image onto retina, helps to maintain the shape of the eyes and the pressure in the eye
- l. Vitreous humour- help to focus the image onto the retina, helps to maintain the shape of eyes
- m. Yellow spot (fovea)- detects light or images that falls on it to form nerve impulses
- n. Blind spot- images that fall on this spot cannot be detected
- o. Optic nerve- carries nerve impulse from the retina to the brain

Mechanism of sight

-The lens in the human eye is a transparent convex lens.

-An inverted image is focused on the retina.

- Light rays are refracted by the eye lens. The eye lens focuses the image onto the retina by changing the thickness of the eye lens.

- The thickness of the lens is changed by the ciliary muscles.

i. Focusing near objects To focus near objects onto the retina, the ciliary muscles contract. The eye lens become thicker.

ii. focusing distant object. To focus distant objects onto the retina, the ciliary muscles relax. The eye lens becomes thinner.

Light

- Light is a form of energy.

- light travels at a speed of ;

i. 300,000,000 meter/second (m/s) in the air.

ii. 225,000,000 m/s in water

iii. 200,000,000 m/s in glass

- Light travels in a straight lines.

Reflection of light.

-Light can be reflected. (that's mean change direction)

- When the reflected light rays enter our eyes, we can see the object.

- The image in a plane mirror is,

i. virtual (cannot be formed on a screen)

ii. upright

iii. laterally inverted

iv. the same size as the object

v. the same distance behind the mirror as the object is in mirror.

Refraction of light.

-Refraction of light is the bending of light. This happens when light travels from one transparent medium to another which is of a different density.

- The speed of light decrease when light enters a denser medium.

- Light travels through media like air, water and glass.

Various defect of vision

- Two common vision defects are long-sightedness (hypermetropia) and short-sightedness (myopia).

Short sightedness

- i. Sees near objects clearly but distance objects are blurred
- ii. Eye lenses are too thick or eye balls are too long
- iii. Light from distance object is focused in front of the retina
- iv. Corrected by wearing glasses with concave lenses to diverge light before it enters the eyes.
Thus, light can be focused exactly on the retina

Long sightedness

- i. Sees distant objects clearly but near objects are blurred
- ii. Eye lenses are too thin or eye balls are too short
- iii. Light from near object is focused behind the retina
- iv. Corrected by wearing glasses with convex lenses to converge light before it enters the eyes.
Thus light can be focused exactly on the retina

Astigmatism

- is another vision defect.
 - i. Its caused by the cornea and the eye lens that are not evenly curved.
 - ii. As a result, the image formed on the retina is distorted and not clear (hazy/blurred).
 - iii. This defect can be overcome by wearing glasses with cylindrical lenses or contact lens or by surgery.

Optical illusion.

- I. Optical illusion occurs when the brain cannot interpret impulses received properly.
- II. Examples of optical illusion.

Blind spot

- i. The blind spot is a spot on the retina of the eye that cannot detect light stimulus.
- ii. The image of the object formed at the blind spot cannot be seen by the eye because there are no light-sensitive cells (photoreceptors) at the blind spot.

Monocular and stereoscopic vision

- The stereoscopic vision is vision using both eyes.
- The overlapping area of the vision of both the left and right eyes is called stereoscopic field
- Advantages of stereoscopic vision.
 - a. See three-dimensional pictures of objects.
 - b. Enables more accurate estimation of distance and position.
 - c. Animal predators normally have stereoscopic vision so better estimate the distance when getting to pounce on their prey.
- Monocular vision is a vision using only one eye.
- The advantage of monocular vision is having a wide vision field.
- Its disadvantage is that it cannot estimate distance accurately.
- Animal preys use monocular vision to detect predators coming from all direction.

Appropriate devices to overcome the limitations of

- Optical devices are invented to increase the ability to see minute or very distant objects.
 - i. Microscope -To see minute objects such as microorganisms and bacteria.
 - ii. Telescope - to see far-off objects such as stars and planets.
 - iii. Binocular- to see tiny distant objects such as birds in the sky.
 - iv. Magnifying -to magnify tiny objects to become glass larger than original.

STIMULI AND RESPONSE IN PLANTS

- Movements of any plant parts towards stimuli are known as tropic movement or tropism.
- Type of tropism:
 - a. Growth of plant part towards an external stimulus is known as positive tropism.
 - b. Growth away from an external stimulus is known as negative tropism.
- Tropism responses in plants include:
 - a. Phototropism

b. Geotropism

c. Hydrotropism

d. Thigmotropism – move towards – to obtain support

e. Nastic movement – move run away -



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