UNIT 14

SPECIAL SENSORY ORGANS

Special sensory organs are the specialized organs composed of sensory neurons which help us to perceive and respond to our surroundings. There are five sense organs:

1. Skin 2. Eye 3. Ear 4. Nose 5. Tongue

SKIN

Skin is the general covering of the entire external surface of the body, including the external auditory meatus and the outer surface of tympanic membrane. Skin is the important organ of the body because of a large number of its functions. The thickness of skin varies from about 0.5 to 3 mm.

Structure of Skin

The skin is made up of two layers.

- Epidermis
- Dermis

1. **Epidermis:** Epidermis is the superficial layer of skin. It is formed by keratinized stratified epithelium tissue. The important feature of epidermis is that, it does not have blood vessels (avascular). The nutrition is provided to epidermis by the capillaries of dermis. The epidermis is made up of five layers.
   a. Stratum corneum
   b. Stratum lucidum
   c. Stratum granulosum
   d. Stratum spinosum
   e. Stratum germinativum or stratum basale

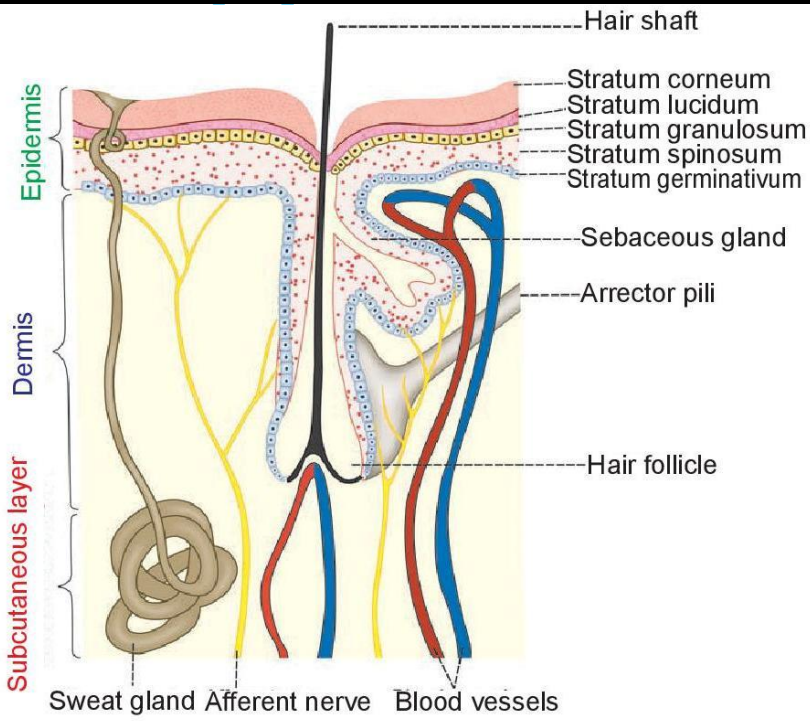


Fig. Structure of skin

2. **Dermis:** Dermis is the deep vascular layer of skin. It is made up of connective tissue containing elastic fibers and collagen fibres. Rupture of elastic fibres occurs when the skin is overstretched, resulting in permanent striae, or stretch marks, which are found in pregnancy and obesity. The collagen fibres bind water and give the skin its tensile strength, but as this ability declines with age, wrinkles develop. The dermis is made up of two layers:

a. **Papillary layer:** Papillary layer projects into the epidermis. It contains blood vessels, lymph vessels and nerve fibers. This layer also has some pigment contains cells known as chromatophores.
b. **Reticular layer:** Reticular layer of dermis is made up of reticular and elastic fibers. These fibers are found around the hair bulbs, sweat glands and sebaceous glands. The reticular layer also contains mast cells, nerve fibers, lymph vessels, epidermal appendages and fibroblast.

Functions of Skin

1. It protects body from external environment particularly in sun light.
2. It stimulates sensation of pain, touch, temperature, pressure etc.
3. It stores fat, water, chloride and sugar.
4. It synthesized vitamin D_3.
5. It regulates body temperature.
6. It absorbs fat soluble substances and some ointments.
7. It excretes small quantities of waste materials like urea, salts and fatty substance.
8. It regulates water balance and electrolyte balance in body by excreting water and salts through sweat.
9. It secretes sweat through sweat glands and sebum through sebaceous glands.

BODY TEMPERATURE

The body temperature can be measured by placing the clinical thermometer in different parts of the body such as:

- Mouth (oral temperature)
- Axilla (axillary temperature)
- Rectum (rectal temperature)
- Over the skin (surface temperature).

Normal Body Temperature

The normal body temperature is 37°C (98.6°F), when measured by placing the clinical thermometer in the mouth (oral temperature). It varies between 35.8°C to 37.3°C (96.4°F to 99.1°F).

HEAT BALANCE

Regulation of body temperature depends upon the balance between heat produced in the body and the heat lost from the body.

1. **Heat production or Heat gain in the body**

The various mechanisms involved in heat production in the body are:

a. **Metabolic Activities:** The heat production in the body is due to the metabolism of foodstuffs (heat metabolism). Heat production is more during metabolism of fat.
b. **Muscular activity:** Heat is produced in the muscle both at rest and during activities. During rest, heat is produced by muscle tone and heat produced during muscular activity is known as heat of activity. About 80% of heat of activity is produced by skeletal muscles.
c. **Role of hormones:** Thyroxine (T4) and adrenaline increase the heat production by accelerating the metabolic activities.
d. **Radiation of heat from the environment:** Body gains heat by radiation. It occurs when the environmental temperature is higher than the body temperature.
e. **Shivering:** Shivering refers to shaking of the body caused by rapid involuntary contraction or twitching of the muscles as during exposure to cold. Shivering is a compensatory physiological mechanism in the body, during which enormous heat is produced.
f. **Brown fat tissue:** It produces enormous body heat, particularly in infants.

2. **Heat loss from the body**

Maximum heat is lost from the body through skin and small amount of heat is lost through respiratory system, kidney and gastrointestinal tract. When environmental temperature is less than body temperature, heat is lost from the body. The heat loss occurs by the following methods:

a. **Conduction:** The three percent (3%) of heat is lost from the surface of the body to other objects such as chair or bed, by means of conduction.

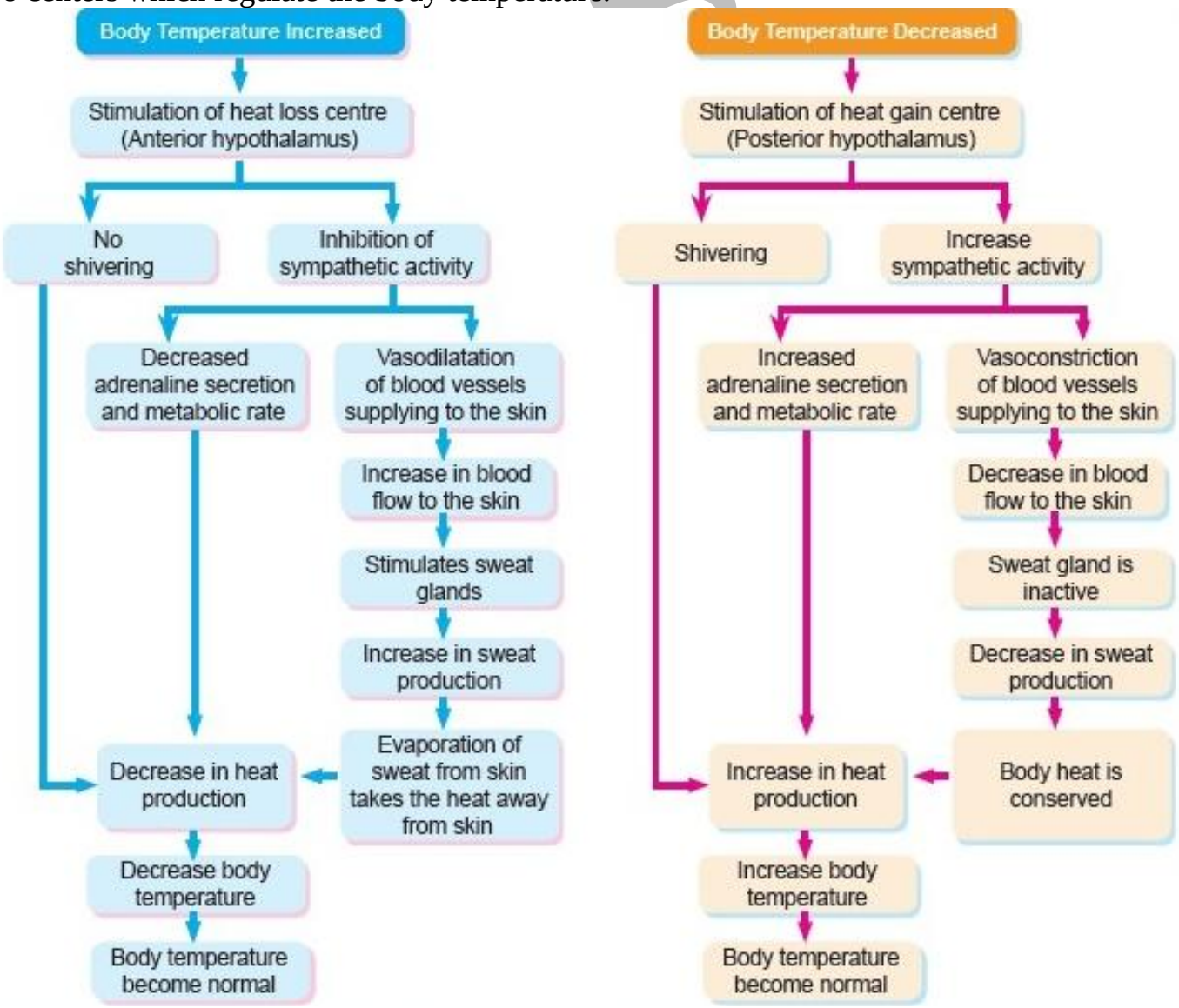
b. **Radiation:** The sixty percent (60%) of heat is lost by means of radiation, i.e. transfer of heat by infrared electromagnetic radiation from body to other objects through the surrounding air.

c. **Convection:** The fifteen percent (15%) of heat is lost from body to the air by convection. First the heat is conducted to the air surrounding the body and then carried away by air currents, i.e. convection.

d. **Evaporation (Excretion):** When water evaporates, heat is lost. Twenty two percent (20 %) of heat is lost through evaporation of water. Normally, a small quantity of water is continuously evaporated from skin and lungs.

MECHANISM OF REGULATION OF BODY TEMPERATURE

The body temperature is regulated by hypothalamus, which sets the normal range of body temperature. The set point under normal physiological conditions is 37°C. Hypothalamus has two centers which regulate the body temperature.



EYE

Eye is the hollow, spherical shaped photosensitive organ. It is also known as organ of sight. It is situated in the orbit of skull. Its diameter is about 2.5cm.

Structure of Eye

The wall of eye is composed of three layers:

- Outer/Fibrous layer: It is formed by sclera and cornea.
- Middle/Vascular layer: It is formed by choroid, ciliary body and iris.
- Inner/Nervous layer: It is formed by retina.

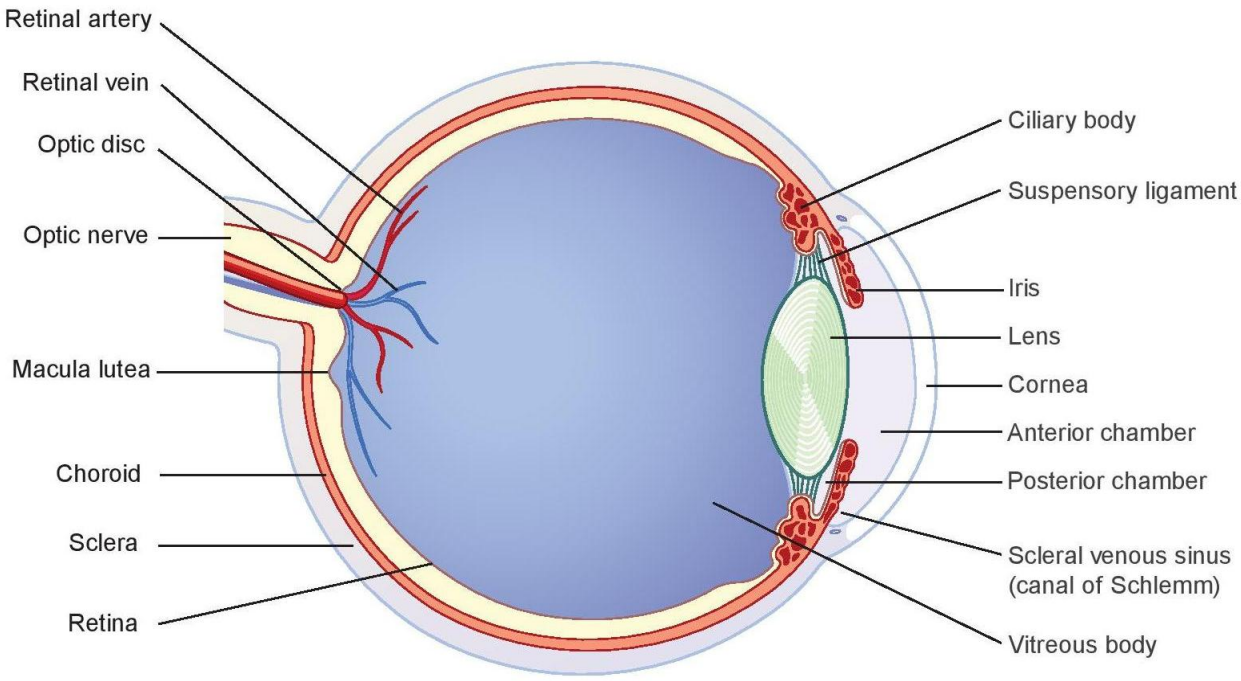


Fig: structure of eye

VISUAL PATHWAY (PHYSIOLOGY OF VISION)

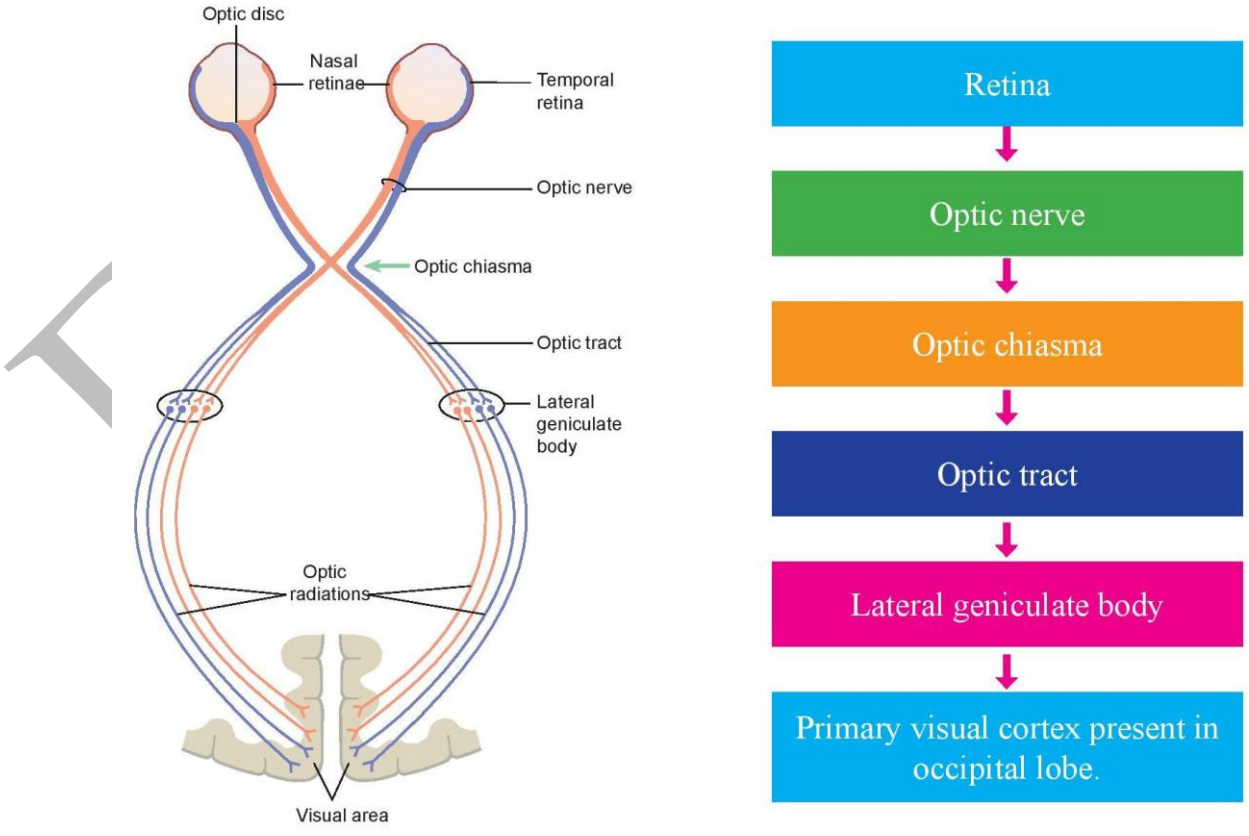


Fig. and Chart: visual pathway

ACCOMMODATION OF EYE

The accommodation is adjustment of the eye to see either near or distant objects clearly. It is the process, by which light rays from near objects or distant objects are brought to a focus on the sensitive part of the retina. This is achieved by various adjustments made in the eyeball.

BINOCULAR VISION

It is a type of vision in which both eyes are focused to see the same object at the same time. The images from the two eyes are fused in the cerebrum. So, that only one image is perceived. It provides better judgment over the distance, height and depth.

EAR

Ear is concerned with the functions of hearing and maintaining equilibrium of the body. It is also known as phonoreceptor organ. It is supplied by the 8th cranial nerve (vestibulocochlear nerve).

Structure of Ear

Ear is divided into three parts:

1. **External ear:** It is the external part of ear. It is formed of two parts:
   a. Auricle (Pinna) b. External acoustic meatus (auditory canal)
2. **Middle ear:** The middle ear consists of:
   a. Tympanic membrane b. Tympanic cavity with auditory ossicles.
3. **Inner ear**
   a. Bony labyrinth b. Membranous labyrinth

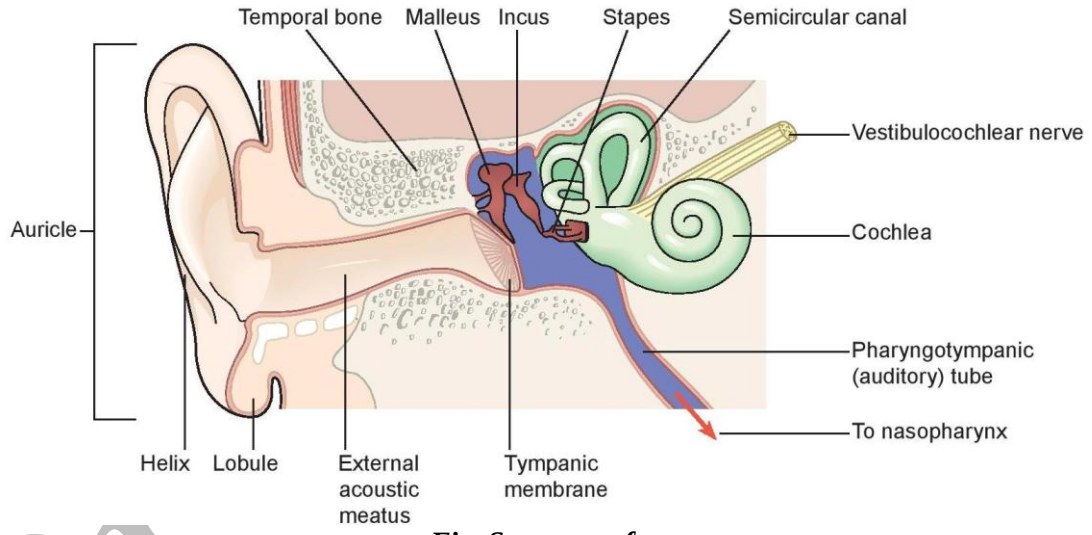


Fig. Structure of ear

MECHANISM OF HEARING

- Sound waves in air are collected by pinna.
- The external auditory meatus directs these waves to the tympanic membrane which then vibrates.
- The vibrations are transmitted by malleus, incus and stapes to the membrane covering fenestra ovalis.
- From the inner surface of this membrane, vibrations are transmitted to organ of corti through perilymph and endolymph.
- From the organ of corti, the impulses (Produced by vibrations) are carried to brain stem through cochlear portion of 8th cranial nerves.
- The fibers are then carried to auditory centre of brain which is present in the temporal lobe of the opposite side.
- The normal hearing range in man 20Hz to 20 KHz.

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