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Diploma in Pharmacy 1st Year
Human Anatomy and Physiology
Important Questions
Chapter 12 : Sensory Organ

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Chapter 12
Sensory Organ
IMPORTANT Questions

Q1. Write a note on sensory organs.

Ans. SENSORY ORGANS

- Sense organs have highly specialised nerve cells, which receive stimuli and convert them into appropriate nerve impulses.
- These nerve impulses are carried to the CNS by afferent or sensory nerve fibres.
- sense organs (eyes, ears, tongue, skin, and nose) contain receptors that relay information through sensory neurons to appropriate places within the nervous system.

Following organs are known as sense organs:

1) Tongue (Taste Bud of Tongue): To sense the taste.
2) Nose: For perceiving sense of smell.
3) Ear: For maintaining equilibrium and sense of hearing.
4) Eye: To perceive vision/sight.
5) Skin: To sense touch, pressure, temperature, as well as for thermoregulation.

Organ of Taste (Tongue)

- Tongue is a muscular organ situated on the floor of the mouth, which helps in chewing and swallowing of food (deglutition).
- Since the surface of tongue is covered with the papillae and taste buds, it is considered as the chief organ for taste perception.
- Speech is another function supported by tongue.
- Tongue is a very sensitive organ which remains moistened with the saliva.
- A large amount of nerves and blood vessels innervates the tongue, there by helping in its movement.
- Separated by a V-shaped groove Which makes the terminal sulcus, the dorsal layer (upper Surface) of the tongue has two parts:
- An oral part, lying in the mouth (anterior two-thirds of the tongue), and
- A pharyngeal part, facing backward to the oropharynx (posterior third part of the tongue)

Anatomy and Physiology

- Supporting Cells: Taste buds contain about 40 supporting cells. Similar to the gustato-receptors, these cells are also spindle in shape but are non-sensory and hold the taste cells at their position.
- Papillae: Lingual papillae (papilla, a nipple-shaped mound) are epithelial projections present on the upper surface of the tongue.

Three types of lingual papillae distributed variably in the specified regions of the human tongue are :

i) Filiform Papillae (Filum, Thread-like): Tongue allows the movement of objects within the mouth due to the friction produced by the filiform papillae. These papillae do not contain any taste buds.

ii) Fungiform Papillae (Fungus, Mushroom-like): These are small in size and contain around 5 taste buds.

iii) Circumvallate Papillae (Circum means Around and Vallum means Wall): These are large sized cells and possess about 100 taste buds. They form a V-shape structure at the posterior margin of the tongue.

Foliate Papillae: These are present on each side of the tongue as short (4 to 5) vertical folds. Their size and shape is variable. The foliate papillae appear as a series or red coloured, leaf-like ridges of mucosa.

Functions

Tongue performs three main functions:

1) The taste buds cover the surface of the tongue and inform the brain regarding the nature of the eaten food. Tongue not only acts as a sense organ of taste for recognising the delightful taste of food but also acts as a protective guard for rejecting the unpalatable food.

2) It also assists in digestion as it allows the eaten food to move inside the mouth and reach a position where it can easily be crushed by the molar teeth. After this process, when the food is ready for swallowing, the tongue converts the crushed food into a ball (bolus) and directs it towards the pharynx in order to swallow the bolus.

3) It also promotes speech by attaining different positions within the mouth. This change in position, changes the shape of the air passage; thereby, producing variations in sound (by vibrating the vocal cords).

Organ of Smell (Nose)

- The nose is centrally located in human beings whereas it is on the upper snout tip, in most of the mammals.
- Anatomically, the nose consists of nostrils or nares that expel and admit the respired air along with the mouth.
- The sinuses and the olfactory mucosa are present behind the nose.
- The air passes from the nasal cavity to the pharynx (shared with the digestive system) which then moves into the rest of the respiratory system.

Anatomy and Physiology

- The two small and oblong bones which vary in size and forms, in all individuals, are termed as nasal bones.
- These are located at the middle and upper part of the face, side by side, and form the bridge of the nose at their junction.
- Each nasal bone consists of four borders and two surfaces.
- About 10-100 million receptors are present in the nose for olfaction carried in an area, known as olfactory epithelium.

Functions

Nose performs the following functions:

1) Smell: The smell sense is accommodated by the nose due to the presence of special neuro-epithelium.)

(2) Respiration: It is the primary function of nose.)

(3) Air-Conditioning: Nose helps in the moistening of dry and cold air inhaled by the human beings even on the coldest day of winters. This air is transformed into the 'tropical' air before reaching the lungs.)

(4) Detoxification: The nasal mucous membrane secretes the viscous mucous layer that helps to intercept and exclude the solid matter such as dust, bacteria, pollen, viruses, etc. present in the air inhaled by human beings. The membrane surface is covered with the countless tiny hair-like ilia.) structures known as cilia."

Ear

- Human beings have a pair of ears, each present laterally on either side of the head.
- The primary function of ears is to maintain body equilibrium as well as they are also responsible for hearing.
- Thus, ears not only help in perceiving sound but also play a pivotal role in balancing different positions of the body.
- The auditory nerve (8th cranial nerve) is divided into two parts, namely vestibular nerve, responsible for equilibrium of the body and cochlear nerve, responsible for hearing, which detects vibrations of the sound wave.

Anatomy and Physiology

The three distinct parts of ear are

1) Outer ear or pinna,

2) Middle ear (tympanic cavity), and

3) Inner ear

Functions

Functions of ear include:

1) Motor and Reflex Effects: Position of the eyes and head, and maintain balance.

2) Effects on Higher Functions: Thought, memory, language, body language, and emotions.
3) Sensory Effects: Position and movement of the head.
4) Sensorial Effects: Perception of sound.
5) Effects on State of Consciousness and Vigilance: Triggering of sleep and waking phases. Maintaining alertness

Eye

- Eyes are almost spherical in shape having a diameter of about 2.5cm.
- They are situated in the orbital cavity, receive sense of sight, and are supplied by the optic nerve (llnd cranial nerves).
- Adipose tissue is present in the space between the eye and orbital cavity.
- Bony wall of the eye orbit protects the eyes from injury.
- Activities of both the eyes are coordinated in such a manner that they function as a pair.
- It is possible to see only through one eye but in this case three dimensional vision is impaired, especially in the case of judgement of distance.

Functions

Eye performs two major functions:

1) Vision: It is one of the most complex functions of the human body. It requires the cooperation of many small and intricate parts. The functioning of human eye and a camera is similar.
Both devices gather, focus, and transmit light through a lens to create an image of the surrounding environment.
i) Light enters the eye through the cornea, the clear front surface of the eye, which acts like a camera lens.
ii) The iris of the eye functions like the diaphragm of a camera, controlling the amount of light reaching the back of the eye by automatically adjusting the size of the pupil, which acts like an aperture. In dark conditions, the pupil widens, while in bright conditions, it constricts.
iii) The eye's crystalline lens, located directly behind the pupil, helps the eye automatically focus on near and approaching objects, like an autofocus camera lens.
iv) The light then travels through the vitreous. humor, a clear gel-like substance that fills the middle of the eye.
v) Light then reaches the retina, a sensitive inner lining of the back of the eye. The retina acts like a camera film, converting optical images into electronic signals.
vi) The image reflected on the retina is upside down. The optic nerve transmits signals to the visual cortex in the brain, which flips the image right side up and creates one composite image.
Production of Tears: Tears form an important component for maintenance of vision, as the tears nourish and lubricate the surface of the eye and wash away debris as well.

Skin

- Skin is the largest organ of human body.
- It is also known as the integument.
- It has a surface area of 1.8m^2 and comprises of 16% of the total body weight.
- Skin performs various functions out of which, the most important one is its action as a barrier to the external environment during selective inward and outward movement of water, electrolytes, etc.
- It also provides protection by restricting the entry of microbes, UV rays, harmful chemicals, and mechanical wear and tear.
- Skin is made up of three distinct structural layers, viz., epidermis, dermis, and hypodermis.

Anatomy and Physiology

Skin is the thick, protective covering of body which comprises of the following layers:
1) Epidermis: It is the outermost covering of stratified squamous epithelial tissue, lacking blood vessels. The major portion of epidermis is made up of keratinocytes cells, which synthesise a protein called keratin.

Function

Skin plays numerous vital roles in the physiology of the body:

1) Sensation: For the detection of stimuli of temperature, touch, pressure, and pain there are numerous receptors and nerve endings present on the skin.
2) Protection: The skin acts as a physical barrier which helps in protecting the deep-seated organs and tissues from microbial invasion; dehydration, UV radiation, and physical absorption.
3) Thermoregulation: An increase in body temperature results in sweating and when this sweat gets evaporated from the skin surface, it cools the body (lowers the body temperature). On the other hand, in case of decreased body temperature, sweat production gets reduced which helps in the conservation of heat in the body.)
4) Immunity: It provides immunologic information obtained during antigen processing to the appropriate effector cells in the lymphatic tissues.
5) Excretion: The sweat released from skin excretes out the toxic substances, ions, and several other compounds.
6) Blood Reservoir: The dermis is highly vascularised. In resting stage, the blood vessels in the skin of an adult carry about 8-10% of the total blood volume. At the time of vigorous activity, the rate of blood flow increases, thus leading to dissipation of extra body heat.
7) Drug Delivery Route: Skin acts as a route for delivery of drugs (transdermal patches). The transdermal drug delivery system involves the absorption of drug through systemic circulation by transdermal patches. The lipid soluble drugs and substances with low molecular weight, e.g., nitroglycerin, hormones, scopolamine, nicotine, etc., easily permeate through the skin.
8) Endocrine Function: Skin helps in biosynthesis of Vitamin D. Ultraviolet light is essential for the first stage of Vitamin D formation.