UNIT 5 PHYSIOLOGICAL DRAWING

UNIT STRUCTURE

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1.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- identify the needs and importance of various parts of the human body
- explain the structure and functions of the human brain
- describe the structure and functions of the human eye
- discuss the structure and functions of the human ear

1.2 INTRODUCTION

The human body is a combination of various parts like brain, ear, nose, eye, teeth, leg, hand, glands etc. The beauty of the body is made by the God or the super power. The present structure of the human body is seen after several processes of evolution. Apart from the various parts of the body, the human brain, eye and ear are related to both physiological and psychological functions like memory, recognition, perception, attention etc. As a learner of the subject like education, you should learn and understand the functions, activities and structure of each part of the human body. Here, in this unit, we are going to discuss the structure and functions of the human brain, ear and eye.

5.3 STRUCTURE AND FUNCTIONS OF THE HUMAN BRAIN

The human brain is considered the headquarter of all the organsims that operate the activities of the human being. The structure of the human brain is more complex than any parts of the human body, and it has varied functions that establish the human being as super among the animals of the existing world.

The nervous system is the most important system in the human brain which is an extensive network of billions of specialised cells that are interconnected and carry information to and from all parts of the body. It controls the behaviour of the human being. The brain and spinal cord make up the central nervous system (CNS). The brain is connected to the spinal cord, which runs from the neck to the hip area. The spinal cord carries nerve messages from the brain to the parts of the body.

The nerves that connect the CNS to the rest of the body are called the peripheral nervous system. The autonomic nervous system controls our life support systems-like breathing, digesting food, blood circulation, etc that we don't consciously control. The human brain is a complex organ that allows us to think, move, feel, see, hear, taste, and smell. It controls our body, receives information, analyses information, and stores information (in terms of our memories).

The brain produces electrical signals, which, together with the chemical reactions, let the other parts of the body communicate. Nerves send these signals throughout the body.

By doing an experiment, you can understand the structure and functions of human brain in a practial way. Let us do the experiment in the following way.

Experiment No: 1

Title: The Human Brain

Objective: To Study the Importance of Human Brain, its Functions and Structure

Materials: For doing the practice, you need some materials like paper, pencil, eraser, ruler for drawing.

Structure and functions of the Human Brain:

The brain has three main parts: the cerebrum, the cerebellum, and the brain stem (medulla). The brain is divided into regions that control specific functions. The human brain and nervous system together help in adapting to the world. Although nerve cells reside in certain regions of the brain, they are not fixed. With changing the biological structure of body and the environment, the capacity of adaptability of the brain is supposed to change.

The weight of the human brain is about 3 pounds (1300-1400 g). At birth, the human brain weighs less than a pound (0.78-0.88 pounds or 350-400 g). As a child grows, the number of cell remains relatively stable, but the cells grow in size and the number of connections increases. The human brain reaches its full size in the age of 6 years of a child.

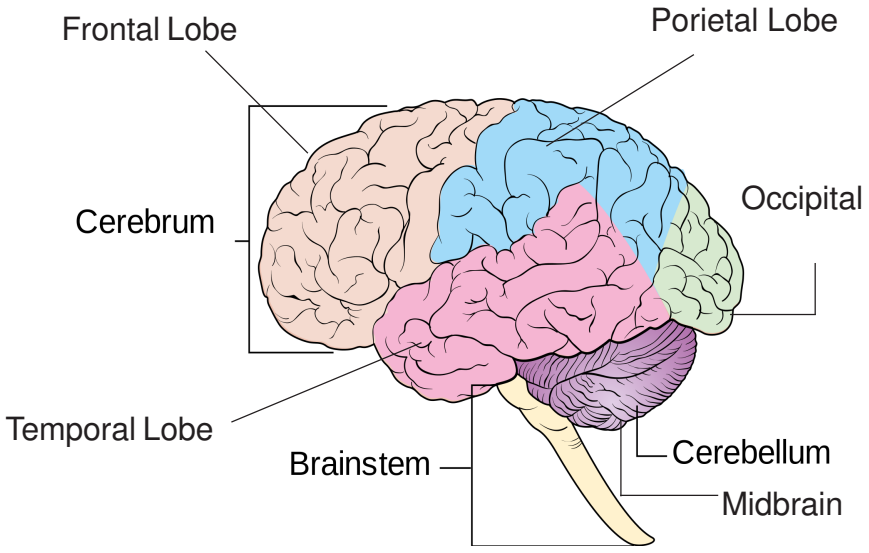
The compostition of the brain consists of gray matter (40%) and white matter (60%) contained within the skull. Brain cells include neurons and glial cells.

Brain stem: The midbrain, ***pons*** and ***medulla oblongata*** with the spinal cord together constitute the brain stem. The brain stem includes the functions like motor and sensory pathway to body and face, respiratory, vasomotor etc.

Pons: It recieves incoming impulses to the brain. It also connects the two parts of the cerebellum and connect the medulla oblongata with the cereburm.

Medulla oblongata: It transmits impulses to the muscles vis the spinal cord. It cooordinates the impulses like tasting, touching and hearing. The activities like heartbeat, circulation of the blood are controlled by the medulla oblongata.

Fig.1 Human Brain



Cerebrum: Cerebrum is the chief and the largest part of the brain and it occupies the upper and frontal two-thirds of the entire brain. It controls all the deliberate and voluntary actions of a human being. It conducts the functions like intelligence, co-ordination, memory, will, imagination etc.

Cerebellum: It controls the balance of the human body. It also controls the voluntary movements and skilled acts as well. The activities of the cerebellum are essential for the execution of posture, cardiac, respiratory and vasomotor cells of the human organism.

Midbrain: The midbrain regulates complex functions that are involved in locomotion. It plays the central role in terms of making conncetions between the fore brain and the mid brain.

Frontal Lobe: It is located superior to lateral sulcus and anterior to central sulcus.The Frontal Lobe is associated with the activities like reasoning, planning, parts of speech, movement, emotions and problem solving, abstract thought processes, attention, intellect, reflection, judgement, initiative, inhibition, eye movements, sense of smell, muscle movements, skilled movements etc.

Temporal Lobe: The temporal lobe is anatomically ventral to the lateral sulcus and is ovated behind the eyes. The temporal lboe is associated with perception and recognition of auditory stimuli, memory, sense of identity, music, fear, speech etc.

Parietal Lobe: The parietal lobe is bounded by the central from anterior side and the parieto-occipital sulcus from the ventral side. It is associated with visuo-spatial perception, recognition, interpretation of impressions, spatial and body orientation, ability to carry out learned voluntary movements, readm write and calculate. It fact, the parietal lobe is associated with movement, orientation, recognition and perception of stimuli.

Occipital Lobe: Occipital lobe occupies the posterior part of the cortex. The functions of the lobe is associated with visual processing; reception and integration of visual information. Hence, the occipital lobe is the seat of vision and transmit the visual response.

5.4 STRUCTURE AND FUNCTIONS OF HUMAN EYE

Apart from the brain, we can not deny the importance of eyes which is one of the most essential organs or parts of the human body. Our eyes are the organs through which we can see the world. Eyes detect both brightness and colour. Having two eyes separated on our face enables us to have depth perception.

A whole series of events happens in order to see something. First, light must reflect off an object. The light travels through the clear cornea of the eye, and then the lens, which focuses the light into the retina (the sensory tissue lining the back of the eye). In the retina, cells called rods detect light (they are photoreceptors) and cones detect colors. The rods and cones convert light rays into electrical impulses that are relayed to the brain along the optic nerve. The brain interprets the signals from the eyes and then "see" what we are looking at.

Let us have a look at the structure and functions of the Eye.

Experiment 2: Human Eye

Title: Human Eye

Objective: To draw the diagram of human eye and explain the functions of its different parts.

Materials: For doing the practice, you need some materials like paper, pencil, eraser, ruler for drawing.

Structure and functions of Human Eye:

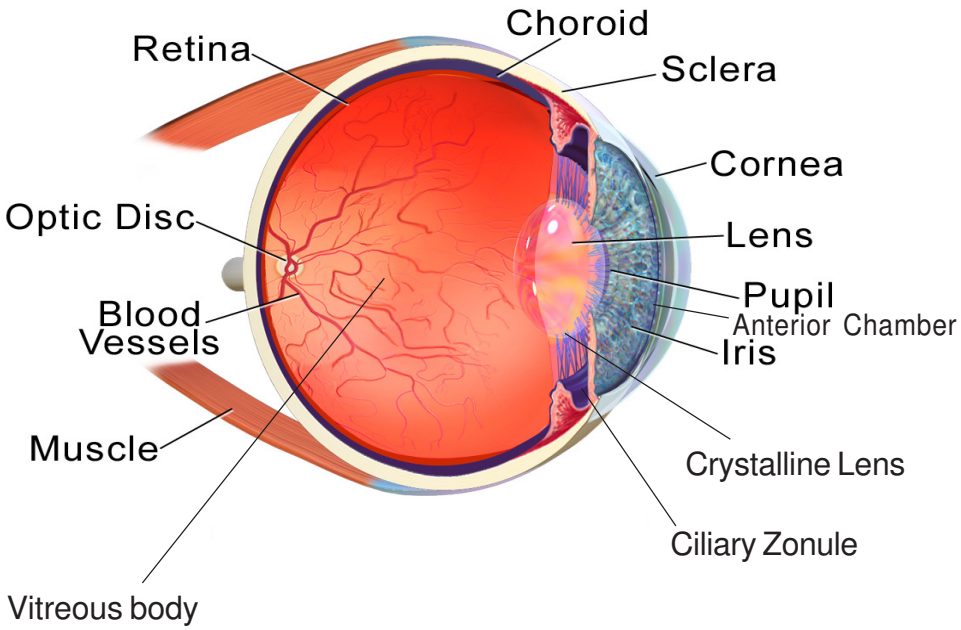


Fig No 2: Eye and its Major Parts

The ***eyeball*** is the peripherial organ of sight and it occupies the place in the cavity of the orbit, the walls of which serve to protect it from injury. The eyeball comprises three coats, which are Fibrous coat, Vascular Pigmented coat and Nervous coat which is also known as Retina. The Fibrous coat consists of sclera in behind and the cornea in the front. The Vascular pigmented coat comprises of choroid, ciliary and iris.

The Sclera: It is a firm membrane which serves to maintain the form of eyeball. The external surface of the sclera is white and its inner surface is brown. It keeps the eye shape, protects its delicate internal parts and maintains the internal fluid pressure.

Choriod: It is a thin highly vascular membrane of dark brown and chocolate colour. It is a layer of blood vessels between the retina and sclera and it also supplies blood to the retina.

Optic Nerve: The nerve fibres from the receptor cells i.e. rods and cones, pass across the front of the retina and all leave at one point to form the optic nerve. It carries stimuli from the eye to the brain. The nerve that transmits electrical impulses from the retina to the brain.

Retina: It is a light-sensitive tissue that lines the back of the eye. It contains millions of photoreceptors (rods and cones) that convert light rays into electrical impulses that are relayed to the brain via the optic nerve. Therefore, retina is known as the screen of the eye. The most sensitive part of the retina is a small area called the macula, which has millions of tightly packed photo receptors. The high density of cones in the macula makes the visual image detailed, just as a high-resolution digital camera has more megapixels.

Vitreous body: It is a solution of salt, sugar and protein in water. It is a thick, transparent liquid that fills the center of the eye. It is mostly water and gives the eye its form and shape. (It is also called the vitreous humor).

Ciliary zonule: Ciliary zonule is also known as ciliary body that comprises ciliary ring, ciliary processes and the ciliaris.

Crystalline lens: The crystalline lens of the eye is like an adjustable lens in a camera. It occupies the place just behind the cornea. It adjusts itself for distance and close vision. It focuses image on the retina.

Anterior chamber: The space between the cornea and iris filled is called Anterior chamber.

Pupil: The pupil is the hole in the center of the iris from which light passes through. It plays the role for opening in the center of the iris- it changes size as the amount of light changes (the more is the light, the smaller is the hole).

Iris: Iris is the coloured part of the eye - it controls the amount of light that enters the eye by changing the size of the pupil.

Cornea: The cornea is transparent, dome-shaped tissues covering the front of the eye. It can be damaged due to accidents, infections and other genetical defects, the clear, dome-shaped tissue covering the front of the eye.



LET US KNOW

Besides the various parts of the human eye mentioned above, the following are some other parts which are equally important:

Astimatism: It is a condition in which the lens is warped, causing images not to focus properly on the retina.
Aqueous humor: Aqueous provides nutrients to the eye.
Binocular vision - The coordinated use of two eyes which gives the ability to see the world in three dimensions - 3D.

Cones - The cells in the retina that sense colour. People have three types of cones, L cones that sense long wavelengths (reds, yellows), M cones that sense medium wavelengths (greens), and S cones that sense medium wavelengths (violets, blues).

Eyebrow - a patch of dense hair located above the eye.

Eyelash - one of the many hairs on the edge of the eyelids.

Eyelid - the flap of skin that can cover and protect the eye.

Farsighted - Farsighted is also called hyperopia, a condition in which distant objects are seen more clearly than nearby objects because light is focused behind the retina, not on it.

Lens - a crystalline structure located just behind the iris - it focuses light onto the retina.

Nearsighted - It is also called myopia, a condition in which nearby objects are seen more clearly than distant objects because light is focused in front of the the retina, not on it.

Rods - The cells in the retina that sense brightness (they are photoreceptors). Night vision involves mostly rods (not cones). There are many more rods than cones.

Tear - clear, salty liquid that is produced by glands in the eyes.
20/20 Vision - normal human vision, a condition in which a person can see a letter of a specific size from a distance of 20 feet.

5.5 STRUCTURE AND FUNCTIONS OF HUMAN EAR

With the help of ear, sounds are transmitted to the brain and ultimately, we are able to hear. It not only receives sound, but also aids in balance and body position. The ear is part of the auditory system. Ear is divided into three major parts i.e. external, middle, and inner portions. Sound is collected by the pinna (the visible part of the ear) and directed through the outer ear canal. The sound makes the eardrum vibrate, which in turn causes a series of three tiny bones (the hammer, the anvil, and the stirrup) in the middle ear to vibrate. The vibration is transferred to the snail-shaped cochlea in the inner ear; the cochlea is lined with sensitive hairs which trigger the generation of nerve signals that are sent to the brain. On average, people can hear sounds in the frequencies between 20 to 20,000 Hertz.

The ear canal stretches for a distance of about 1 inch, and consists of an inner portion surrounded by bone, and an outer portion surrounded by cartilage.

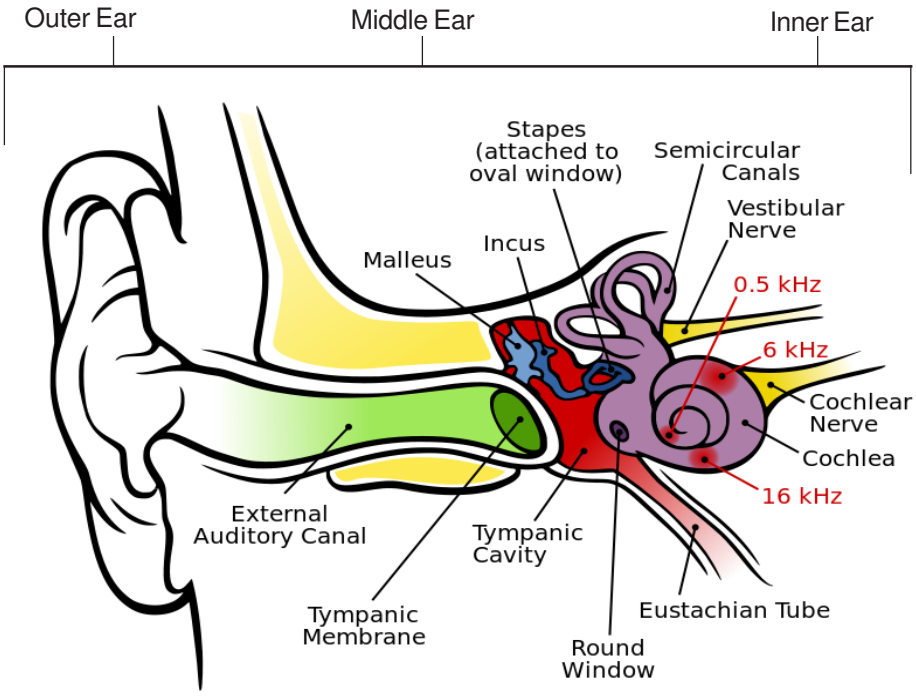


Fig.3: Human Ear

Experiment No 3: Parts of the Human Eye

Title: Human Ear

Objective: To draw the diagram of human ear and explain the functions of its different parts.

Materials: For doing the practice, you need some materials like paper, pencil, eraser, ruler for drawing.

Structure and functions of Human Ear:

The organ of hearing is divided into three parts: the external or outer ear, middle or tympanic ear and internal or labyrinth ear.

Outer Ear: It is divided into two parts i.e., the pinna and external auditory meatus (ear canal). Pinna is located on each side of our head and it is made up of cartilage and soft tissue. It is the visible part of the external ear. It is an irregular funnel shaped flap of cartilage covered with skin. The outer ear or external ear is the only visible portion of the ear in humans and almost all vertebrates, and consequently the word “ear” may be used to refer to the pinna alone. Pinna helps the human being by conducting the sound waves through the external auditory canal and making people to have concentration and direct the vibrations into the ear. It means, pinna passess the vibrations from our surroundings to the external auditory meatus (ear canal). The external or outer ear canal through which sound travells to the eardrum. The ear canal is covered with skin, hair and the cerumen or wax gland. The eardrum vibrates according to the frequency and the amplitude of sounds that strike it.

Middle Ear: The middle ear is an air-filled cavity behind the tympanic membrane, includes three bones which are known as ossicles. The three bones are: the malleus (or hammer), incus (or anvil), and stapes (or stirrup). The middle ear also connects to the upper throat via the Eustachian tube. The three ossicles transmit sound from the tympanic membrane to the secondary tympanic membrane which is situated within the oval window and is one of the two windows between the middle ear and the inner ear. The malleus bone is connected to the tympanic membrane, and transmits vibrations of the membrane produced by sound waves. The incus

bone is the bridge between the malleus and stapes. The stapes bone connects to the oval window, and is the smallest named bone in the human body. The three bones are arranged so that movement of the tympanic membrane causes movement of the malleus, which causes movement of the incus, and then, the stapes. When the stapes footplate pushes on the oval window, it causes movement of fluid within the cochlea (a portion of the inner ear). The ossicles help in the amplification of sound waves by nearly thirty times.

In humans and other animals on earth, the middle ear (like the ear canal) is normally filled with air. Unlike the open ear canal, however, the air of the middle ear is not in direct contact with the atmosphere outside the body. The Eustachian tube connects from the chamber of the middle ear to the back of the nasopharynx. The middle ear is very much like a specialised paranasal sinus, called the tympanic cavity. Like the paranasal sinuses, it is a hollow mucosa-lined cavity in the skull that is ventilated through the nose. The mastoid portion of the human temporal bone, which can be felt as a bump in the skull behind the pinna, also contains air which is ventilated through the middle ear. Hence, the middle ear is an air-filled cavity which lies beyond the ear drum and is surrounded by bone. The main function of the middle ear is to control the vibrations which are transmitted to the inner ear.

Inner Ear: The inner ear is also known as labyrinth. It contians liquid called the “Endolymph” and “Perilymph”. The labyrinth is a spirally coiled structure. The main function of the inner ear is to maintain equilibrium and hearing.

The bony structure, shaped like a snail is a part of inner ear known as cochela, is involved in the function of hearning. The sensory receptor called the organ of corti is located inside the cochlea. It has hair cells and nerve receptors, which are required for hearning. The hair cells translate sound signals into nerve impulses. The nerve impulses are transmitted to the brain.



LET US KNOW

Besides the various parts of the human ear and its functions which are mentioned above, the following are some other parts:

Anvil - Anvil is also called the incus, a tiny bone that passes vibrations from the hammer to the stirrup.

Cochlea - A spiral-shaped, fluid-filled inner ear structure; it is lined with cilia (tiny hairs) that move when vibrated and cause a nerve impulse to form.

Eardrum (also called the tympanic membrane)-- it is a thin membrane that vibrates when sound waves reach it.

Eustachian tube - A tube that connects the middle ear to the back of the nose and equalises the pressure between the middle ear and the air outside. When you “pop” your ears as you change altitude (going up a mountain or in an airplane), you are equalising the air pressure in your middle ear.

Hammer - It is also called the malleus, a tiny bone that passes vibrations from the eardrum to the anvil.

Nerves - Nerves carry electro-chemical signals from the inner ear (the cochlea) to the brain.

Pinna - It is also called the auricle, the visible part of the outer ear. It collects sound and directs it into the outer ear canal.

Semicircular canals -Refers to the three loops of fluid-filled tubes that are attached to the cochlea in the inner ear. They help us maintain our sense of balance.

Stirrup - It is also called the stapes, a tiny, U-shaped bone that passes vibrations from the stirrup to the cochlea. This is the smallest bone in the human body (it is 0.25 to 0.33 cm long).



5.6 LET US SUM UP

- The human body is a combination of various parts like brain, ear, nose, eye, teeth, leg, hand, glands etc.
- Apart from the various parts of the body, the human brain, eye and ear are related to both physiological and psychological functions like memory, recognition, perception, attention etc.
- The human brain is considered the headquarter of all the organsims that operate the activities of the human being.
- The structure of the human brain is more complex than the other parts of the human body and has varied functions that establish the human being as super among the animals of the existing world.
- The nervous system is the most important system in the human brain which is an extensive network of billions of specialised cells that are interconnected and carry information to and from all parts of the body. It controls the behaviour of the human being.
- The brain and spinal cord make up the central nervous system (CNS). The brain is connected to the spinal cord, which runs from the neck to the hip area. The spinal cord carries nerve messages between the brain and the body.
- In fact, human brain is a complex organ that allows us to think, move, feel, see, hear, taste, and smell. It controls our body, receives information, analyses information, and stores information (in our memories).
- The brain has three main parts: the cerebrum, the cerebellum, and the brain stem (medulla). The brain is divided into regions that control specific functions. Human brain and nervous system together help in adapting to the world.
- The eyes are organs through which we can see the world. Eyes detect both brightness and colour. Having two eyes separated on our face enables us to have in-depth perception.
- The light travels through the clear cornea of the eye, and then the lens, which focuses the light into the retina (the sensory tissue lining the back of the eye).