



The Visual System ^[1]

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The visual system is a remarkable part of the central nervous system. It acts as a receiver of information about visual images and a processor of visual sensory input. This system is comprised of the eye, optic nerve, optic chiasm, optic tract, lateral geniculate nucleus (LGN), optic radiation, visual cortex and visual association cortex.

Parts of the Eye

The sclera is the white part of the eye that is readily visible when you face the mirror or look at another person's eye. The sclera of the eye functions as a structure where the eye muscles for movement are attached. This white membrane is made up of collagen fibers that measure up to 150 nm in diameter, giving its opaque appearance.

The cornea and the lens are like a tag-team as they bend light together, focusing it on the retina. This bending of light, known as refraction, is measured in dioptres. Aging causes the refractive power of the lens to decrease, whereas aging does not affect the refractive power of the cornea. Unlike the sclera, the cornea is comprised of is made up of thin collagen fibers that measure 30 nm in diameter. Thus, the cornea is clear as compared to the opaque sclera.

The iris is the colored part of the eye. In its middle lies an opening called the pupil, where light enters. The pupil is able to dilate (open wide) in a dim light environment or constrict (narrow) in bright light due to its Whytt's reflex. This reflex is elicited through the contraction of the iris' muscles- the spincter muscles for pupil constriction and the dilator muscle for pupil dilation.

If the pupil functions as the light moderator, the lens acts as an accommodator. The lens is able to change shape when the eye is focused on an object depending on its distance from the person. The lens flattens when the eye is concentrated on a distant object. On the other hand, it thickens when one looks on a nearby object.

Situated at the back of the eye, the retina is the part where electromagnetic energy is turned into neural energy. This process of transduction is made possible by photoreceptors. There are two kinds of photoreceptors – (1) the rods that help us see in black, white and grey, and (2) the cones that let us see in color. Although comprised of ten layers, the retina is transparent for better light passage. Within the retina is the yellow area called macula, and in it is the fovea which is the center for the best visual acuity.

Optic Nerve and Optic Chiasm

The optic nerve carries the visual sensory input from the eye to the brain. Most axons in the optic nerve are connected to the lateral geniculate nucleus of the thalamus for processing to perception, while the others transmit information to the superior colliculus of the midbrain, which helps control eye movements.

Each eye has an optic nerve, and they meet (and cross) at a point called optic chiasm, which is located at the hypothalamus' base. In the optic chiasm, the information from both eyes are joined. Then, it is split depending on the visual field [3].

Optic Tract and LGN

The visual input on the right visual field goes in the left optic tract, while that from the left visual field is transmitted to the right optic tract. The two optic tracts end at the thalamus, particularly in the lateral geniculate nucleus (LGN). The LGN is responsible for relaying information to the primary visual cortex in the occipital lobe (back of the brain).

Visual Cortex

The visual cortex is a system comprised of five areas that serve as processors of visual input. It is located above the cerebellum. V1 is called the primary visual cortex, where the image is initially processed. Then, the information proceeds to V2, V3, V4 and V5 accordingly for the recognition, identification and categorization of the image, as well as the spatial attention for eye movement responses.

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Links

[1] <https://explorable.com/visual-system-en>

[2] <https://explorable.com/users/sarah>

[3] <http://www.skidmore.edu/~hfoley/Perc3.htm>