Review Article

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Is it what we See with the Eyes?

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ABSTRACT

Keywords: Optic Nerve; Retina; Chiasm; Visual Pathway; Visual Cerebral Cortex

Introduction

Euglena is a single-celled organism that represents the first organism with a light-sensitive structure with numerous chloroplasts, which is truly the first step in history towards the human eye. Transduction is the mechanism in which photoreceptors transform the optical energy of light into electrical energy as part of the evolution of the eye. In such a way that the human eye captures shapes and images, converts them into an electrical signal, which passes to the optic nerve and from there to the brain in the visual cortex, in this way the image is processed and thus allows its interpretation in the medium [1].

Radiological Anatomy

Only 25% of the content of the bony orbit corresponds to the eye, the eyeball on average measures 23 mm while its wall is 2 mm thick, it is made up of three layers from the outside in, the outermost layer is the cornea and the sclera, the middle layer or uvea, are composed of the ciliary body and the choroid. This choroid is the layer that is enhanced with the injection of intravenous contrast given its constitution with abundant blood vessels and the deepest or inner layer. formed by the retina, which in turn is the composite portion of the neuroepithelial type. Inside the eyeball there are also three chambers: the most superficial chamber, the anterior chamber that is located between the cornea and the iris where the anterior angle is located for the drainage of the aqueous humor, the posterior chamber that is located between the iris and the iris. anterior part of the vitreous body that contains the lens and the ciliary body that are producers of the aqueous humor and the vitreous chamber, a segment that is occupied by the vitreous humor, of gelatinous consistency with approximately 99% water content. From a functional ophthalmological point of view, it can be considered only the anterior segment that includes the cornea, the anterior chamber, the iris, the ciliary body and the lens. Posterior segment that includes sclera, choroid, retina and vitreous body [2-4].

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The retinal axons travel backwards through the orbit, entering the brain through the optic canal to form the chiasm, where the temporal retina is ipsilateral and the nasal retina is contralateral, from there it goes to the optic tracts until it synapses with the cells of the retina. lateral geniculate body and finally to the occipital visual cortex Images 1A- 1E. For anatomical and didactic purposes, the retina can be divided into four retinas: the nasal retina, which receives information from the temporal field, the temporal retina, which receives information from the nasal visual field, the upper and lower retina, so that the upper visual field Its information is processed by the lower retina and the information from the lower visual field by the upper retina Images 2A & 2B. The cones and rods are photoreceptors located in the retina, responsible for the synapse with the bipolar cells, which in turn form the second synapse with the ganglion cells, the axons of these cells form the fibers of the optic nerve. The optic nerve is covered by the meninge, cerebral extension and instilled by cerebrospinal fluid [3-5,6]. Light enters the eye and crosses the optically active components until it reaches the retina. These components pass through all layers of the retina to stimulate the photoreceptors in its outermost layer. Here the impulses are modified by the accessory cells of the retina that are before passing to the proximal external of the ganglion cells. Once activated, the ganglion cells transmit the action potential of their distal axons that go from there to the nerve fiber layer of the retina, then the axons converge to form the optic nerve. The optic nerves go from the posterior pole of the eye, run intraconally towards the superior orbital fissure in the chiasm, join the contralateral optic nerve, only the nasal retina crosses, while the temporal retina continues ipsilateral in the chiasm the ganglion cells that arise from the nasal retina join the axons of temporal ganglion cells [7,6].

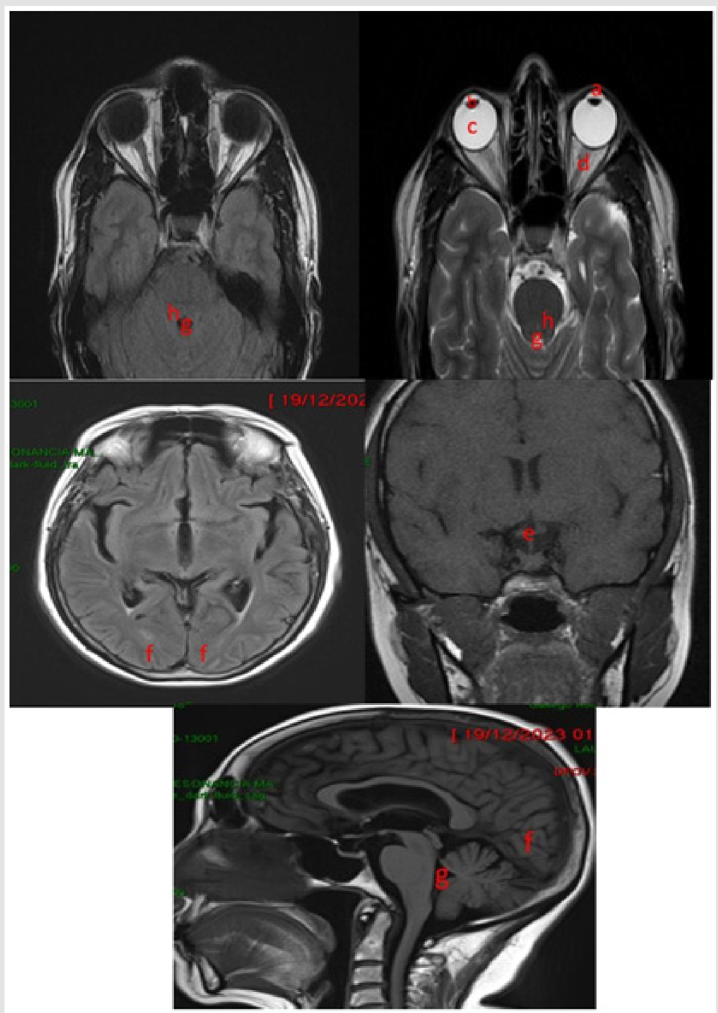

Image 1: A and B MRI of the orbits showing the eyeballs and optic nerves on T1 and T2, C and D Optic chiasm in coronal and sagittal, D and E visual area in axial and sagittal to anterior chamber, bcrystalline, cvitreous, doptic nerveandoptic chiasmaF occipital primary visual association area,gIV ventricle ,hperiaqueductal gray matter.

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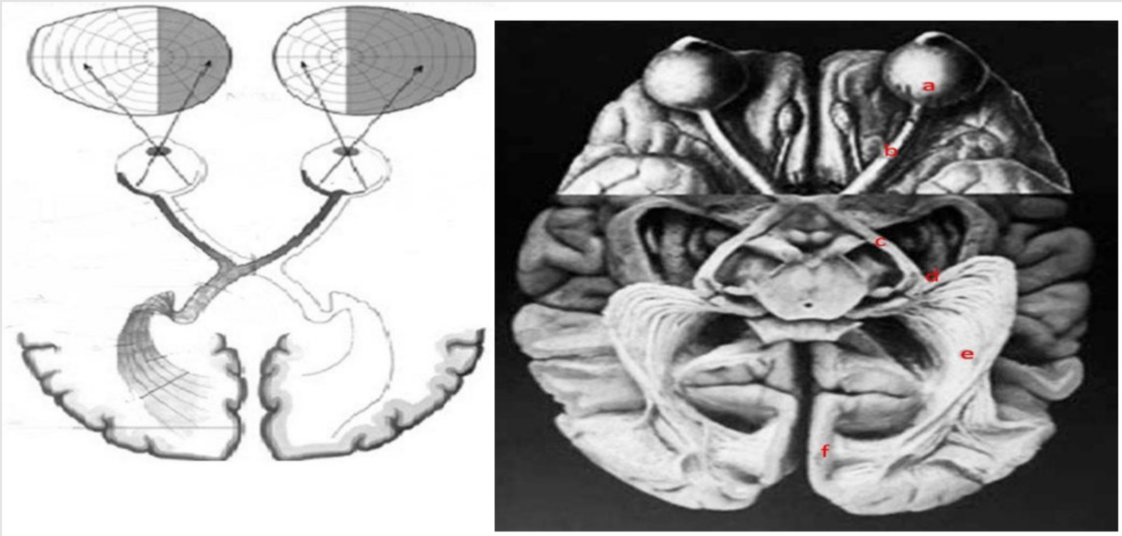

Image 2: A and B characterization of the visual pathway of the right temporal retina, left nasal, chiasm, visual radiations and occipital association area.

The optic tracts arise from the chiasm and pass posterolaterally around the brain stem. Each of the optic tracts contains axons from the contralateral nasal hemiretina and the ipsilateral temporal hemiretina. Most of the fibers end up synapsing in the lateral geniculate body. Lateral geniculate body constitutes a small oval thickening of the pulvinar of the thalamus, consists of six layers of cells in which the axons of the optic tracts synapse. Each layer of the lateral geniculate body contains a complete and ordered representation of the contralateral visual field, here the information of luminosity and colors of the retina is processed, the axons of the nerve cells of the lateral geniculate body exit to form the optic radiation. The superior quadrigeminal tubercle located on the posterior surface of the midbrain. part of the fibers that do not end in the lateral geniculate body, pass through the brachia pontis and go to the superior colligeminal tubercle, its circuits generate movements of the head and eyes or movements to objects of visual interest, it connects with the spinal nerves, the trigeminal nerve, the visual cortex, the periaqueductal gray matter, and the inferior quadrigeminal tubercle [8]. The Nucleus of Edinger Westphal is a parasympathetic nucleus located at the level of the periaqueductal gray matter. Its preganglionic axons run next to the third cranial nerve and at the orbital level they synapse in the ciliary ganglion. Through the short ciliary nerves, they innervate the ciliary muscle for accommodation of the lens and the sphincter of the iris for pupillary contraction Images 1A-1E.

Optical Radiation

The fibers of the optic radiation are the axons of the nerve cells of the lateral geniculate body. The beam subsequently passes through the retrolenticular part of the internal capsule and terminates in the visual cortex.

Primary Visual Cortex

The primary visual cortex is located at the level of the calcarine fissure on the medial surface of the brain, which corresponds to Brodman's area 17. Higher-order visual areas are located in Brodmann areas 18 and 19 that surround area 17. Retino is organized topically. It emits projections to higher-order visual areas of the occipital, parietal, and temporal lobes. These functional pathways are intended for the perception of the shape of the stimulus, the color and the movement of the stimulus [7].

"I see you with my eyes!".

It is a common phrase, but false. The function of seeing is a global function of the nervous system and only neurons intervene in it. Other types of structures participate in seeing well. To see is to be aware of the information that the visual pathways collect, conduct and deliver, interpret it, recognize it, be able to store it in memory and call it when you want or when you need it, with the possibility that the latter may occasionally occur. that we neither want it nor need it. An individual, who has lost his eyes, does not see

But another person with healthy eyes, but with damage to very precisely defined structures and regions in the brain, does not see either. If this damage is not total, it is possible that you receive light and images, but you cannot interpret or recognize them, which does not allow a cerebral visual function, it is not seeing, in the final and complete sense of the term [9-11]. Let's see what this is like. The optic pathways run from the retina, inside the eye, to the back of the brain, the occipital lobes. Images 2A & 2B Optical images are analog when received on the retina(to), which is a nervous structure. There they are encoded to convert light energy into electrical energy, that is, a stream of electrons (digital images) that travel at high speed through the optic nerves [12-15]. (b)And Optical Tapes (c) Until reaching the thalamus (d), Where they make a neuronal relay to arrive, through optical radiation(and), to the primary visual area in the cortex of the occipital lobe(F). Image 3 But digital images are not visible. To do this, once we reach the primary visual cortex. (F) are analyzed, identified, decoded and retransformed to analog through two synaptic steps to neighboring secondary visual areas. (g) and tertiary (h) and then they see each other. That means we see with the brain and not with the eyes. (scheme 3).

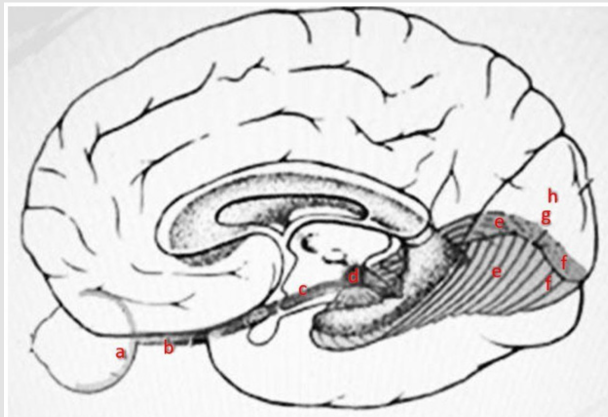

Image 3.

The image above shows the similarities between viewing with optical pathways and viewing images captured by a video camera on a television screen. The camera receives analog images that its computer systems encode and transform into digital (electron flow). In that format they travel to the VCR where they are analyzed, identified and encoded to continue to the television where they are finally decoded and transformed into analogue, that is when we see them. There are some problems left to solve, not for us, but for our entire vision system. [14,15] The first is the inversion of images, a problem known for a long time in so-called dark cameras. Images 4A & 4B. A closed box that allows the passage of light Images only through a small perforation on one of its faces will project, on the opposite face, the image of the object presented, but inverted: from top to bottom and from left to right. That's a camera obscura. If we place a plate of sensitive photographic film on the back of that camera obscura, the image presented is fixed on it, with the inversion already described. This is a camera. Images 5A-5C Human eyes are dark chambers with the characteristics we already described.

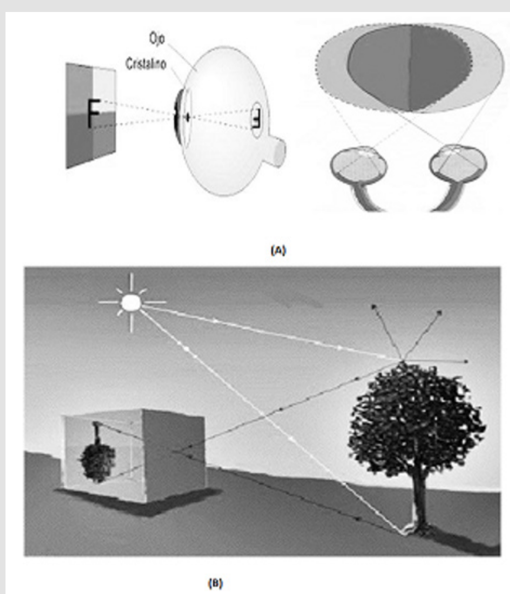

Image 4.

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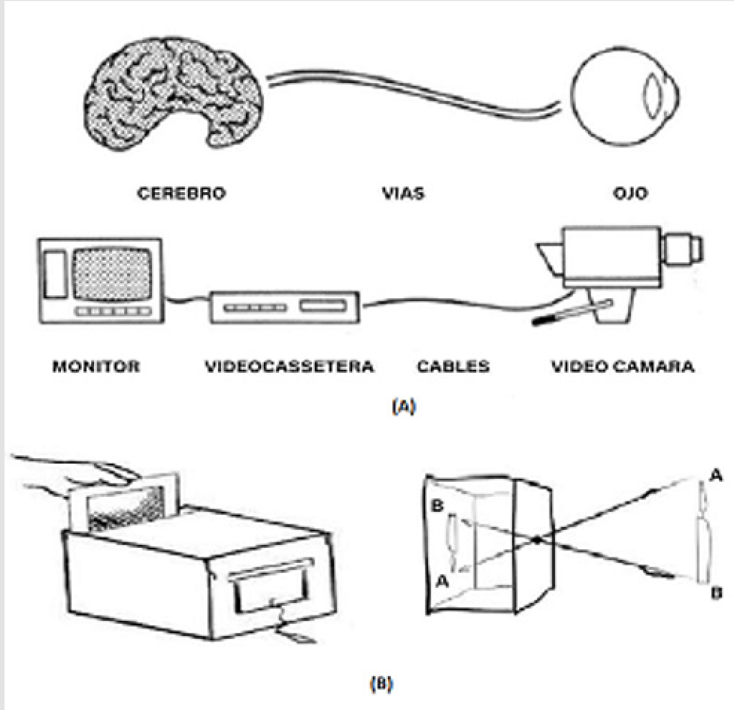

Image 5.

The image shows the inversion of the letterFand the inversion of the place of the colors also occurs, horizontally and vertically. Humans have two eyes in front, which allows us to have stereoscopy, to see in third dimension, to know the depth of the different objects that are offered to us. A single, large central image, which occupies the entirety of our visual field, is received by each eye almost completely, excluding the lateral extreme portions, each of which is only perceived by the eye on the same side. But the single image is received in each eye inverted horizontally and vertically. Images 5A-5C If we see them from above, the same thing finally happens, but with a different strategy. At the level of the optic chiasm, the fibers that go externally in the optic nerves thus continue through the optic tracts and to the occipital cortex. Those that come from the inside are crossed in the chiasm and are placed inside in the bands and up to the occipital cortex, but on the opposite side. The final result is that, to the visual areas of the brain, the occipital lobes, inverted images arrive horizontally and vertically and in separate quadrants, since there is no physical communication, at that level, between the cerebral hemispheres and the visual areas. cortices above and below the calcarine fissure From all this it turns out that the image of this dancer, image 6, when it reaches its final destination to be seen and recognized (gnosia), does so divided into quadrants and inverted in the horizontal and vertical planes (Image 6).

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Image 6.

Conclusion

From here and from this moment, how do you do it, what are the steps and pathways that the brain takes to reconstruct the images so that we see them well? I don't know, but I also know that no one knows for sure. I won't have to know anymore.

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