Researchers discover the connection that enables bilateral visual coordination in mammals

March 25 2019

Credit: Asociación RUVID

The laboratory of researcher Eloísa Herrera has discovered that during the development of the brain's visual areas, the two retinas communicate

with each other temporarily through nervous projections. This connection is important for synchronizing and aligning the representation of the two images from the eyes in the visual cortex, which ensures they can merge coherently.

Furthermore, in the article published in the journal *Current Biology*, the researchers describe the molecular mechanisms that lead to the creation of the temporary projections between both retinas, which disappear once the visual circuits have developed, as they are no longer necessary for the processing of the visual information in the adult.

From the origins of cinema in the late 19th century, people have experimented with the possibility of creating films that emulate the human three-dimensional vision. To achieve this, it was necessary to record the movie simultaneously with two slightly separated cameras aligned in a very accurate way to minimize the unpleasant experience of double vision.

The technical issue the pioneers of cinema found to create 3-D images was, essentially, the same that animals with three-dimensional vision must solve to couple the images registered by the right eye and the left eye. The retina, located in the internal posterior part of the eyeball, has a sensitive surface composed of photoreceptors, which is similar to the pixel map of a digital camera. The retina is much more accurate, as the human eye has around 105 megapixels of resolution. The cells in charge of sending all this information to the brain are those called ganglion cells , each one of which only "sees" a minuscule fraction of the visual field—one pixel. Collectively, they create an organised map that represents an image composed of small fragments like a digital photograph.

These images have to be transmitted through the optical nerve to the visual cortex, located in the posterior part of the brain, where they

ultimately merge, creating a picture of the world around us. And until now, the mechanism through which this alignment took place was a mystery.

As well as providing evidence of the connection between the retinas to solve this technical problem, the group of doctor Herrera, located in the Sant Joan d'Alacant campus of the UMH, has observed that there is a correlation between the number of fibres that connect the retinas during the development of the visual areas of the brain and the degree of complexity of the visual system in different species.

Thus, small birds or mammals like mice have similar numbers of these projections. However, species such as ferrets have a much longer period of visual system maturation because their visual acuity and the visual representations in each hemisphere are much more accurate, and they have more projections to connect both retinas.

However, in species such as the zebrafish, there is no connection between the retinas of both eyes, as the representation of the visual maps in each side of the brain is much cruder and more independent, and an accurate synchronisation of the visual maps of both eyes is not necessary. According to these observations, it is probable that in species with great visual acuity, including humans, the number of connections between the retinas is even higher than in ferrets.

More information: Verónica Murcia-Belmonte et al. A Retino-retinal Projection Guided by Unc5c Emerged in Species with Retinal Waves, *Current Biology* (2019). DOI: 10.1016/j.cub.2019.02.052

Provided by Asociacion RUVID