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Study reveals how the eye is formed

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A human eye

(PhysOrg.com) -- Scientists at King's College London have discovered specific cells responsible for ensuring that different parts of the eye come together during development, according to a paper published in *Nature Communications*.

These findings significantly enhance understanding of how the different components of the eye are organised into a functional organ, and therefore reveal clues as to the possible causes of congenital malformations that lead to life-long visual impairment. The study was funded jointly by the BBSRC, Wellcome Trust and Fight for Sight.

The vertebrate eye contains many different components and has a complex anatomy. At the back of the eye is the retina, which contains neurons and photoreceptors that capture the light and convert it into electrical pulses transmitted to the brain, as well as the pigment epithelium that helps to nourish the retina. In the front of the eye, behind

the cornea and iris, lies the lens, which is responsible for focusing the light onto the retina.

The correct arrangement of the different parts is critical for normal vision. During development the lens and the retina come from completely different tissues, the surface ectoderm and central nervous system, respectively, which raises the question of how they are aligned to form a functional eye.

This study, carried out using chicken embryos, shows that neural crest cells, a migratory cell population in the embryo, play an important role in this process. They send out a signal, called TGF-ß, to the surface ectoderm, which in turn activates a second pathway, the Wnt pathway.

Together both signals act to stop the lens being established in the wrong position and ensure that the lens only develops next to the future retina.

Dr. Andrea Streit from the Department of Craniofacial Development in the Dental Institute at King's, said: "Neural crest cells give rise to many tissues in the head, including bones and sensory neurons, however their role in organising the eye was previously unknown.

"This finding opens up the exciting possibility that they not only integrate eye formation, but also different components of other sense organs and sensory circuits in the head.

"Identifying the signals was a long journey, because of the complex interactions of the TGF-ß and Wnt pathways. But we are now in a position to ask more pointed questions about how different structures in the head are formed and how this relates to developmental abnormalities in humans."

Provided by King's College London