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Press Release

From mice to men – Lessons in colour vision.

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Our eyes are complicated organs, with the retina in the back of the eyeball comprising hundreds of millions of neurons that allow us to see and to do so in colour. Scientists have long known that some retinal ganglion cells – these are neurons that connect the retina with the rest of the brain – are tuned to specific wavelengths of light or “colours”. In humans and other primates they are excited by red and inhibited by green, for example. An important question is: how are these so-called colour-opponent cells “wired” to discriminate wavelengths so that we perceive colours?

Scientists in the lab of Thomas Euler, professor at the Werner Reichardt Centre for Integrative Neuroscience and the Institute for Ophthalmology at the University of Tübingen, have been working on the problem of retinal colour processing for several years. Their article in the journal Neuron show that whether or not ganglion cells becomes colour-opponent depends on the chromatic preference of the light-sensitive photoreceptor cells in the vicinity. Their research looked at mice, which have a striking distribution of photoreceptors across their retina, with a green-sensitive upper half and blue-sensitive lower half. This differs from most mammals, yet they turn out to be an excellent model system for studying important aspects of mammalian colour processing.

Researchers found that when stimulated with light, ganglion cells that have never before been implicated in colour vision become colour-opponent if they are located close to the border between the green- and the blue-dominated retina halves, but nowhere else. Their findings show that colour vision can arise from neural circuits in the retina that are not specifically “wired” for colour processing.

Although these findings were worked out in mice, they represent an important contribution to our understanding of colour processing in humans and other primates, which are considered the “colour specialists” among the mammals. Such random wiring has long been proposed for primate red-green colour vision, which resulted from a gene duplication event that occurred, on an evolutionary time scale, only “recently”, possibly leaving not enough time for a specific neural circuit to evolve. The new findings support this idea and suggest more similarities in the general principles of colour discrimination in

mice and primates than previously thought.

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The Werner Reichardt Centre for Integrative Neuroscience (CIN) is an interdisciplinary institution at the Eberhard Karls University Tübingen funded by the DFG’s German Excellence Initiative program. Its aim is to deepen our understanding of how the brain generates function and how brain diseases impair them, guided by the conviction that any progress in understanding can only be achieved through an integrative approach spanning multiple levels of organization.

Original Article:

Le Chang, Tobias Breuniger, Thoas Euler. ‘Chromatic Coding from Cone-type Unselective Circuits in the Mouse Retina’ Neuron Volume 77 Issue 3 6 February 2013.

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