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Visual detection: new neural circuits identified in the retina

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The detection of approaching objects, such as looming predators, is necessary for survival. Which neurons and nerve circuits mediate this function? A new type of nerve cell, sensitive to approaching motion, has recently been identified in mice. This new retinal function has been brought to light by Rava Azeredo da Silveira of the Laboratoire de Physique Statistique of the École Normale Supérieure (France) and a team of researchers from the Friedrich-Miescher Institute in Switzerland. Their work was published online on 6 September 2009 on the website of *Nature Neuroscience*.

The retina has traditionally been considered as a simple 'filter' through which the visual world is transmitted from the eye to the brain. However, several discoveries made over recent years have altered this image: the retina performs sophisticated processing of visual information and transmits a selective screening of this visual information to the brain.

The discovery of a new retinal function in mammals by Rava Azeredo da Silveira of the Laboratoire de Physique Statistique of the École Normale Supérieure (ENS / UPMC / Université Paris Diderot / CNRS) and the team of Botond Roska at the Friedrich-Miescher Institute in Switzerland illustrates this complexity of visual information being processed by the retina. The researchers have identified a new functional type of neuron in the retina of mice. These neurons are activated when an object is looming, but do not respond if the motion is lateral or receding. Thus, these nerve cells send a warning signal to the brain when, for example, a predator approaches its prey and could thus turn out to be essential for

survival.

The discovery of this new type of cell has been made possible experimentally by isolating the neuron in question as well as the relevant neural circuit. For its function of detecting approaching motion, the retinal neuron uses to its advantage a rapid inhibitory neural pathway in its circuit that ‘suppresses' any response to a stimulus other than approaching motion. However, although this inhibitory pathway has already been identified as being involved in nocturnal vision, here it involves diurnal vision.

This is therefore an example of efficient adaptation: as it evolves, the same circuit of neurons is capable of acquiring different functions depending on the physiological conditions to which it is subjected. In this study, various experimental methods combining genetic labeling of individual cell types, two-photon microscopy and electrophysiology were complemented by a theoretical modeling approach. This work thus illustrates the complementarity of experiment and theory, necessary for quantitative biology discoveries that employ statistical, mathematical and experimental methodological tools.

More information: Thomas A Münch, Rava Azeredo da Silveira, Sandra Siegert, Tim James Viney, Gautam B Awatramani & Botond Roska. “Approach sensitivity in the retina processed by a multifunctional neural circuit”. Published in *Nature Neuroscience* (DOI: 10.1038/nn.2389), September 2009.

Source: CNRS