EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

CIN
Werner Reichardt
Centrum für Integrative
Neurowissenschaften

bccn
tübingen

Press Release

No Blue Skies for Mice

Scientists at the University of Tübingen study the differential distribution of photoreceptors in the retina of mice

Universität Tübingen
Hochschulkommunikation

Dr. Karl Guido Rijkhoek
Director

Janna Eberhardt
Phone +49 7071 29-76788
+49 7071 29-76789
Fax +49 7071 29-5566
karl.rijkhoek[at]uni-tuebingen.de
antje.karbe[at]uni-tuebingen.de

www.uni-tuebingen.de/aktuell

Tübingen, 4 December 2013

Guppies, hyenas and mice share one particular retinal specialization in their eye: Photoreceptors (“cones”) sensitive to ‘green’ light are largely located in the top half of the eye, whereas cones sensitive to ‘blue’ light dominate the bottom half. Since the lens inverts the image as it enters the eye this arrangement seems to make intuitive sense: blue light from the sky is detected by the blue cones, while the greenish light from the ground falls onto the green cones. Scientists led by Thomas Euler at the Werner Reichardt Centre for Integrative Neuroscience at the University of Tübingen have investigated this retinal specialization in mice. In their study, just published in the journal *Neuron*, they show that this arrangement is not an adaptation to the predominating ‘colors’ of the sky and the ground, as was previously thought. Their experiments showed that the apparent match between ‘color’ and differential cone distribution brings the animals no advantage. “The green cones would ‘see’ the light in the sky just like the blue cones”, explains Thomas Euler. Instead, this specialized distribution of cones appears to subserve a much more fundamental aspect of vision: the detection of dark-light contrasts.

As photographers will know, there is a very substantial difference between the sky and the ground in terms of brightness and contrast. On the ground average brightness is rather low in comparison with the sky, and light is reflected from things such as leaves and the earth, so that contrasts of bright and dark are roughly equally frequent. Light from the sky, however, is usually direct, with objects appearing as dark silhouettes against a bright background. So it would make sense for different parts of the eye to be adapted to the predominant distribution of contrast below and above the horizon.

“Indeed, this is the case: Green cones in the mouse retina respond similarly to dark and light stimuli, but blue cones respond more strongly to dark ones”, clarifies the scientist. The ‘blue’-sensitive, sky-oriented lower

half of the mouse retina is tuned to spot dark objects against a bright background. These objects can be, for example, birds of prey. The results match very well with two recent studies in which it was shown that mice either freeze or run and hide as soon as something dark appears above them. This instinctive reaction occurs within less than 200 milliseconds, which is too short a time to allow for a thorough 'assessment' of the situation. Therefore, the researchers think that this behavior is based on very fast visual processing, as it might be provided by a signal path specializing in dark contrasts that begins at the first synapse, with the cones.

Publication:

Tom Baden, Timm Schubert, Le Chang, Tao Wei, Mariana Zaichuk, Bernd Wissinger, Thomas Euler: A Tale of Two Retinal Domains: Near-Optimal Sampling of Achromatic Contrasts in Natural Scenes through Asymmetric Photoreceptor Distribution. *Neuron 80,* 1–12, December 4, 2013
http://dx.doi.org/10.1016/j.neuron.2013.09.030

Contact:

Prof. Dr. Thomas Euler
University of Tübingen
Werner Reichardt Centre for Integrative Neuroscience (CIN)/Institute for Ophthalmic Research
Bernstein Center Tübingen
Phone +49 7071 29-85028
thomas.euler[at]cin.uni-tuebingen.de

The University of Tübingen

Innovative. Interdisciplinary. International. Since 1477. These have always been the University of Tübingen's guiding principles in research and teaching. With its long tradition, Tübingen is one of Germany's most respected universities. Tübingen's Neuroscience Excellence Cluster, Empirical Education Research Graduate School and institutional strategy are backed by the German government's Excellence Initiative, making Tübingen one of eleven German universities with the title of excellence. Tübingen is also home to five Collaborative Research Centers, participates in six Transregional Collaborative Research Centers, and hosts six Graduate Schools.

Our core research areas include: integrative neuroscience, clinical imaging, translational immunology and cancer research, microbiology and infection research, biochemistry and pharmaceuticals research, the molecular biology of plants, geo-environment research, astro- and elementary particle physics, quantum physics and nanotechnology, archeology and prehistory, history, religion and culture, language and cognition, media and education research.

The excellence of our research provides optimal conditions for students and academics from all over the world. Nearly 28,000 students are currently enrolled at the University of Tübingen. As a comprehensive research University, we offer more than 250 subjects. Our courses combine teaching and research, promoting a deeper understanding of the material while encouraging students to share their own knowledge and ideas. This philosophy gives Tübingen students strength and confidence in their fields and a solid foundation for interdisciplinary research.

The Werner Reichardt Centre for Integrative Neuroscience (CIN)

The Werner Reichardt Centre for Integrative Neuroscience (CIN) is an interdisciplinary institution at the University of Tübingen funded by the DFG's German Excellence Initiative program. Its aim is to deepen our understanding of how the brain generates functions 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.

The Bernstein Center Tübingen

The Bernstein Center Tübingen is part of the National Bernstein Network Computational Neuroscience in Germany. With this funding initiative, the German Federal Ministry of Education and Research (BMBF) has supported the new discipline of Computational Neuroscience since 2004 with over 170 million euros. The network is named after the German physiologist Julius Bernstein (1835-1017).