Introductory Remarks to Symposium 33

The Multiple Neural Codes of the Retina

Martin Greschner and Tim Gollisch, Oldenburg and Göttingen

The retina is an ideal system to study how neurons encode sensory information. Its inputs – the light patterns that impinge on the photoreceptors – can be rigorously controlled in the lab. Moreover, it is now possible to simultaneously monitor the activity of large fractions of retinal ganglion cells, the retina's output neurons.
Yet, we are still far from a complete understanding of visual stimulus encoding by the retina. Among the prevailing mysteries is the puzzling diversity of output channels that emerge from the retinal network. Recent progress in calcium imaging, electrophysiology, and genetic or morphological cell type identification has indicated that the output of the retina consists of more than 30 parallel channels, each based on a different type of retinal ganglion cell and carrying its own specialized representation of the visual world. While some of these channels appear well described by classical, text-book-like center-surround filters, many others display much more intricate and nonlinear response properties, carrying out information processing tasks that had previously been thought to emerge only in higher visual centers. Furthermore, much of the current knowledge about neural coding in the retina has been obtained with artificial, simplistic laboratory stimuli. Yet, little is known about how the diversity of ganglion cell response features contributes to the encoding of natural visual stimuli, where strong spatio-temporal correlations, the presence of objects and objects boundaries, and the temporal dynamics of eye movements provide specific challenges.
This symposium will address the challenges of understanding stimulus encoding in the retina from different perspectives. We will start by exploring the large functional diversity of ganglion cell types (T. Euler). From there, we will turn to nonlinear signal processing in the retinal network and how this shapes the response features of different ganglion cell types and contributes to the encoding of visual images (T. Gollisch). Next, we will address the question of how ensembles of ganglion cells jointly represent visual stimuli in a population code (O. Marre). Finally, we will examine the area of natural stimuli and, in particular, the challenges that ever-present eye movements impose on retinal stimulus encoding (R. Segev). Combined progress in these general directions will be necessary to improve our understanding of the diversity of retinal ganglion cell types and of the many neural codes that jointly represent what the eye tells the brain.

Symposium 33

Saturday, March 25, 2017
8:30 – 10:30, Lecture Hall 104

Chair: *Martin Greschner and Tim Gollisch, Oldenburg and Göttingen*

08:30 **Opening Remarks**

08:35 Thomas Euler, Tübingen
FUNCTIONAL DIVERSITY IN THE MOUSE RETINA (S33-1)

09:00 Tim Gollisch, Göttingen
SIGNAL GATING AND NEURAL CODING IN THE RETINA UNDER SACCADIC SCENE CHANGES (S33-2)

09:20 Katrin Franke, Tübingen
INTERPLAY OF EXCITATION AND INHIBITION DECORRELATES VISUAL FEATURE REPRESENTATION IN THE MAMMALIAN INNER RETINA (S33-3)

09:30 Olivier Marre, Paris, France
READING THE POPULATION CODE OF THE RETINA (S33-4)

09:55 Ronen Segev, Beer Sheva, Israel
DECORRELATION OF RETINAL RESPONSE TO NATURAL SCENES BY EYE MOVEMENTS (S33-5)

10:20 Florian Jetter, Reutlingen
TOWARDS THE ACTIVATION OF PHYSIOLOGICAL RETINAL GANGLION CELL SPIKING BY ELECTRICAL STIMULATION (S33-6)

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