SFB 1372
Magnetoreception and Navigation in Vertebrates

Invitation to a SFB 1372

guest talk

Thursday, May 4th 2023, 4 pm

Room: W03 1-152

Link: https://elearning.uni-oldenburg.de/plugins.php/meetingplugin/room/index/3112833332ab0d9ad2173370e74c687b/531cbca026c63156234a1b7e0a6ae178?cancel_login=1

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Discovering novel feature-selective retinal circuits through model-guided search of natural stimulus space

The retina transforms patterns of light into visual feature representations supporting behaviour. These representations are carried by various types of retinal ganglion cells (RGCs), whose spatio-temporal tuning properties have been extensively studied in many model organisms, most prominently, in the mouse. However, little is known about how RGCs process chromatic information under natural visual stimulation conditions. This is because adding the chromatic dimension dramatically increases the size of the stimulus space to be explored when searching for novel stimulus selectivity patterns.

Here, we combined two-photon recordings of RGC responses to movies from the natural environment of mice with predictive modelling to investigate chromatic processing in the mouse retina. Using our model that captures spatial, temporal, and chromatic aspects of the visual input, we searched in silico for stimuli that maximally excite different types of RGCs. We identified one RGC type from the functional class of suppressed-by-contrast cells that differed substantially from all other cell types we studied by exhibiting colour-opponent (green-off, UV-on) selectivity. Going back to our set of natural scenes from the mouse environment, we found that ground-to-sky transitions in visual scenery are separated from other stimuli precisely along the colour-opponent axis that this cell type is sensitive to. With a decoding analysis, we show that the representation of visual input formed by this cell type could be used for detecting these presumably behaviourally relevant transitions.

Our work demonstrates how a combination of experiments with ecologically relevant natural stimuli and computational modelling approaches can enable the discovery of novel types of stimulus selectivity in neural systems.