

## CIMeC Seminars Red Series 2013

18 December 2013 10 am

Palazzo Fedrigotti, Sala conferenze affrescata, 1° floor, Rovereto

*Speaker:*

- Prof. Jonas Hauser, Honorary Senior Researcher at University College London

**Title: The navigation network: Interactions between grid cells and head direction cells**

*Abstract:*

Spatial navigation is a complex function that is found in all animals and requires integration of internally generated idiothetic cues (e.g. vestibular and proprioceptive inputs) as well as the relative positions of geographic landmarks. The first step in understanding the brain substrate for spatial navigation was the discovery of place cells (PC) in rats by O'Keefe and Dostrovsky. PCs are neurons of the hippocampus which increase their firing rate when the rat is in a specific location of a familiar environment, referred to as place field. More recently, two additional classes of spatial responsive neurons have been described in the hippocampal formation: head direction cells (HDC) and grid cells (GC). HDCs code for the orientation of the head of the animal in a world-centered reference frame, whereby their firing rate increases when the head of the animal is facing a specific direction. HDCs have been reported in several interconnected brain areas, including the anterior thalamus, presubiculum and the lateral mammillary nuclei. The GC provide a metric system, they are neurons exhibiting regularly spaced place fields across the environment following a triangular pattern, the grid fields. GCs are found in dorso-medial entorhinal cortex, a region of cortex which projects and receives afferents from the hippocampus, where PCs are found. In this project, we evaluate the possible interaction between these three neuronal populations using two methods, a developmental approach and a causal approach. The developmental approach evaluates the appearance and functionality of these neuronal populations. The causal approach will focus on the impact of optogenetic inactivation of the HDC on the GC function. We found that the PC rely more on boundaries of the environment in pre-weanling pups. We established the optogenetic inactivation of hippocampal PC and anterior dorsal thalamic HDC.

*Hosted by:* Giorgio Vallortigara

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16 October 2013 11 am

Palazzo Fedrigotti, Sala conferenze affrescata, 1° floor, Rovereto

*Speaker:*

- Moritz von Heimendahl, Bernstein Center for Computational Neuroscience - Humboldt University, Berlin Germany

**Title: Dopamine and place field remapping: What makes new places feel new?**

*Abstract:*

The phenomenon of hippocampal remapping has received sustained attention ever since its discovery. Remapping is striking because usually, most place cells in the rodent hippocampus show stable response properties over weeks and more. However, strong changes in the environment lead to global remapping, whereby most place cells change their firing fields drastically or shut down altogether, while new, previously silent cells become active. While the kind of environmental cues that elicit remapping have been studied in detail, it is still unclear what kind of internal signal prompts the otherwise so stable place representations to change all at once. Dopamine is often discussed as a potential novelty signal and here we investigated the effects of dopamine agonists on place cell activity. To this end, we recorded the spatial response properties of pyramidal cells in the dorsal hippocampus of rats while they freely explored an environment. Systemic injection of the nonspecific dopamine agonist apomorphine, but not of saline, led to changes in place field locations of many cells, similar to changes observed in global remapping. In further experiments, the dose-dependence, role of the specific receptor subtypes, and the effect of dopamine antagonists were examined. The finding that dopaminergic action induces remapping-like place field changes shows that global remapping can occur in the absence of environmental changes.

Pharmacological manipulation opens up new avenues to analyze the mechanisms underlying global remapping.

*Hosted by:* Giorgio Vallortigara