

CHAMPMouse: CHArting Multi-areal Visual Perception in the Mouse

Main area: Targeted Mapping of the Mouse Brain

Keywords: mouse;vision;mapping;perception;imaging;electrophysiology

Duration (months): 36

Total project funding: € 570 000

Abstract

An important task of the visual system of an animal is to segregate and recognize objects and other animals in the continuous stream of inputs to the eye. This process is crucial. Is the other animal valuable or does it pose a risk? What are these landmarks and can they be used for navigation? We will develop a task for mice that allows us to study the brain processes that segregate an object from the background. The animal will report whether it perceives an object in a visually cluttered scene. Using a combination of wide-field calcium imaging and electrophysiology, we will map the neuronal correlates of visual perception and image segmentation across the visual areas in the brain, including the visual cortex, the visual thalamus and the superior colliculus, at a mesoscopic and microscopic single cell level. When we have created an atlas of the strength and latencies of these figure-ground segregation signals, we will

select areas which show diverse correlates to the segregation at a single cell level to study the cell type specificity of the responses using two-photon calcium imaging. We will also interfere with processing in a selected number of areas using optogenetic tools to determine which areas merely correlate with the figure-ground segregation and which areas are essential for performing the task. Finally, using the public anatomical maps that are constantly increasing in resolution and extent, and the maps being constructed by the HBP, we will use all the neural activity from the mesoscopic and microscopic scales during task performance and from resting periods to construct a detailed model of the functional connectivity between the mapped visual areas. This will result in a wiring diagram of the brain areas involved in mouse visual perception and texture segregation.

Consortium

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