Targeted Project / AY 2023 -2024

Circuit-dissection of visually-guided spatial navigation

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Research area: Neuroscience of sensory processing

Project outline:

A critical requirement for survival is the ability to navigate in the environment. This skill is believed to rely on internal spatial representations of the surroundings, such as the "spatial maps" found in the hippocampus and entorhinal cortices.

Sensory inputs are fundamental for shaping these internal spatial representations. In particular, visual cues are considered essential factors that guide navigation. However, how visual input is converted into spatial maps is still poorly understood.

Spatial navigation is based on a fine integration of self-motion cues and the perceived position of external landmarks. Measuring the distance that the animal has travelled from previously occupied locations (i.e., "path integration") requires external cues to correct the positional errors that accumulate over time. It is believed that internal representations of visual landmarks, such as "cue cells" in the medial entorhinal cortex, play a crucial role in correcting path integration errors.

However, the circuits mechanisms that transform visual information into the invariant representations of external cues that guide spatial navigation are largely unknown.

Combining electrophysiological, 2photon imaging, virtual reality, and opto/chemogenetic approaches in a mouse model, we will study the interactions between distinct visual pathways and spatial navigation. By capitalising on the expertise of Beltramo's and Krupic's labs in visual processing and hippocampal/entorhinal circuits, this joint targeted studentship aims to determine the roles that the visual system plays in spatial navigation.

BBSRC DTP main strategic theme: Understanding the rules of life