iCase Project / AY 2023 -2024

Developing an ethological system for studying spatial working memory in mice

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Department/Institute: Physiology, Development and Neuroscience

Industrial Partner: Cambridge Phenotyping Limited

Research area: Neuroscience

Project outline:

The hippocampal-parahippocampal formation plays a key role in spatial memory, learning and navigation. While the role of the hippocampal-parahippocampal formation is well studied in the context of spatial navigation, its role in spatial working memory is less well understood. For example, it is known that the T-maze forced-choice alternation task, where the animal has to remember its previous choice (called a sample trial) in order to fetch the reward on the next trial (called test trial) is one of the most sensitive hippocampal tasks and the degree of impairment highly depends on the inter-trial duration between the sample and the probe trials.

Currently, the underlying mechanism which supports this ability is completely unknown. To address this challenge, a new behavioural assay is required which would enable probing an animal's spatial working memory at various inter-trial intervals under ethological conditions coupled with neural recordings. Here, we propose to develop a novel fully automated system which will combine two-photon imaging and wireless electrophysiological recordings integrated with a 'smart' home cage environment (the smart Kage, UK Registered Designs: 6126197 - 6126198) recently developed by Krupic lab in collaboration with Dr Marius Bauza (UCL) for studying the underlying neural mechanisms of spatial working memory under ethological conditions. The smart Kage includes T-maze -like test with inter-trial periods spanning 20s to >3 hours and has been shown to be highly sensitive to the hippocampal lesions.

BBSRC DTP main strategic theme: Understanding the rules of life