iCase Project / AY 2024 -2025

Characterizing the effects of protein intake on long-term spatial memory and learning

Project Code: ICS-IMS-CB

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Industrial Partner: Cambridge Phenotyping Ltd

Research area: Nutrition and cognitive functions

BBSRC DTP main strategic theme: Bioscience for an integrated understanding of health

BBSRC DTP secondary strategic theme: Transformative technologies

Project outline:

Caloric restriction produces significant health benefits, including improved cognitive performance, but is difficult to maintain long-term, highlighting the need to better understand the direct contribution of individual dietary components. Protein restriction (PR) is emerging as a more sustainable alternative to caloric restriction producing similar health benefits, but the effects of PR on cognitive functions are unclear.

PR is associated with a wide range of behavioural consequences, including protein preference, protein-induced conditioned taste preference and increased motivation to obtain proteins. Collectively these adaptations promote dietary protein intake to sustain growth and reproductive function. However, little is known about how memory functions also adapt to PR. For example, central remodelling of memory circuits might enhance the memory of feeding events that successfully provided proteins and the associated food localization.

In this project, we propose to characterize the cognitive adaptations occurring during PR in healthy young adult mice through a collaboration between the laboratories of Dr Blouet, an expert in central protein sensing and the control of feeding behaviour, the laboratory of Dr Krupic, an expert in the biology of spatial memory, and Cambridge Phenotyping, a start-up developing AI-driven home-cage monitoring systems for in-depth behavioural phenotyping (Smart-Kage). The project will contribute to the development and integration of a pellet dispenser module into Smart-Kage, allowing precise quantitative, qualitative, and temporal dietary manipulations. Using activity-dependant neural circuit labelling in PR mice and a multi-disciplinary approach combining molecular, electrophysiological and histological assessments, we will decipher the central pathways mediating the cognitive adaptations to PR.