

Behavioural & biological analysis of dissociable aspects of reward processing.

Supervisory team:

Main supervisor: Prof Dominic M. Dwyer (Cardiff University)

Second supervisor: Prof Emma S. J. Robinson (University of Bristol)

Prof Mark Good (Cardiff University)

Host institution: Cardiff University

Project description:

It is essential for a healthy organism to respond appropriately to rewarding events (e.g. foods). Thus investigating the biological substrates of reward processing offers key insights into both normal behaviour and the deficits seen in psychiatric disorders. Appropriate responses to rewards include aspects of cognition (e.g. veridical representations of the distribution of rewards in the environment), affect (e.g. proportionate hedonic responses to different rewards), and motivation (e.g. sensitivity to the relationship between different rewards and current biological needs). Moreover, disturbances in these responses are key aspects of many psychological and psychiatric disorders and thus this work will have a broader impact.

This PhD will examine interacting cognitive, affective, and motivational mechanisms involved in reward processing and explore their biological underpinnings. Initially, it will focus on pharmacological manipulations. Subsequently, it will examine environmental changes (e.g. early life adversity), manipulation of the gut microbiome (e.g., administration of dietary probiotics), and the influence of genetic and age-related risk factors that have been linked to affective abnormalities (e.g. using Tg2576 & WT mice to examine aging and amyloid pathology). Thus the project will investigate the general cognitive, motivational and affective processing of rewards, and examine the common biological and behavioural outputs of different psychological and biological challenges.

The project takes a cross-disciplinary approach combining behaviour analysis with pharmacology and neuroscience. This will involve bespoke behaviour analysis methods for assessing cognitive, motivational and hedonic processes. This analysis will be followed up with targeted analysis of protein/receptor expression (e.g., 5-HT receptor subunit expression) using immunohistochemistry and/or western blot analyses. In addition it may also use magnetic resonance (MR) spectroscopy to evaluate the impact of the manipulations described above on brain metabolite profiles across theoretically relevant brain regions (e.g., hippocampus, cingulate/frontal cortex; supported by the Cardiff University Experimental MRI Centre). Acquisition of expertise in these cutting edge behavioural and neuroscientific tools will position the student who undertakes this project at the forefront of behavioural neuroscience as well as allowing them to develop widely applicable skills in in vivo biology and MRspectroscopy that are in great demand within the academic and industrial research sectors.

The project is offered through the SWBio Doctoral Training Partnership (<http://www.bristol.ac.uk/swbio/>) and involves outstanding training in multidisciplinary approaches to biological systems; mathematics and data handling skills, statistics and experimental design (including data visualization, next generation DNA sequencing and bioimaging). The research will largely be based at Cardiff University, with a rotation period at Bristol University, as well as an internship in a non-research environment.

The project will be co-supervised by: Professor Dominic Dwyer (<https://www.cardiff.ac.uk/people/view/356849-dwyer-dominic>), Dr Emma Robinson (<https://research-information.bris.ac.uk/en/persons/emma-s-j-robinson>), and Professor Mark Good (<https://www.cardiff.ac.uk/people/view/1156508-good-mark>).