Project Details	
Project Code	MRC18NMHCa Rossiter
Project Title	Investigation of Motor Adaptation using Translational Neurophysiology
Research Theme	Neuroscience & Mental Health
Summary of Project	The sensorimotor system is adept at planning and executing dextrous movements including correcting errors on line. The brain mechanisms behind this process are poorly understood, especially in relation to ageing. This project will utilise both animal and human techniques to understand the neural network basis of age-related motor adaptation.
Project Description	Imagine reaching to pick up a glass of water – this is far from the simple task it appears to be. You need to calculate the appropriate action that will reach the glass, estimate the weight of it and how to hold it in order not to spill the water. This process involves correction for errors during the movement in order to reach the desired goal. To do this it is thought that the brain creates an internal model of the on-going movement which it then compares to the sensory feedback it is receiving in order to decide what corrections need to be made. This is achieved through a process of motor adaptation (MA) which is the process by which we learn new motor skills and adjust for any perturbations in the external environment. This process is affected by healthy ageing and also in disease. There are a number of different brain areas involved in this process e.g. primary motor cortex, prefrontal cortex and cerebellum. We are interested in how these brain areas communicate with each other during the process of MA and how the predictions and prediction errors may be encoded within neuronal firing and oscillatory patterns as well as how this may change with age (MRC strategic plan Priority 2 – life course perspective). We will integrate findings from in vivo recordings from rats with non-invasive imaging results from human subjects. This is highly novel and will foster a new collaboration between groups at Cardiff University and University of Bristol. We will use a very similar paradigm in both setups: a manual reaching task to which we will then add a force perturbation (e.g. using weights or magnetic force) or a visual perturbation (e.g. using prism glasses) which they will have to correct for in order to reach their target. In the rodent experiments we will record from electrodes chronically implanted into the primary motor cortex as well as prefrontal cortex and/or cerebellum during these MA tasks. The measures recorded in these experiments will allow us to understand neural dynamics in these key nodes of the motor network at a cellular level of characterization. In the human imaging experiments we will record magnetoencephalography (MEG) and functional magnetic resonance imaging (fMRI) during the same MA tasks. These techniques offer both excellent spatial (fMRI) and temporal (MEG) resolution. Complementary to the rat work the imaging experiments will reveal at a global level how different areas of the brain communicate over time during the process of MA. For example, based on previous work (Rossiter et al 2014 NeuroImage) we will investigate changes in beta oscillations (15-30Hz) during MA. We will record both young and older participants in order to investigate the changes in the brain's MA response as part of healthy ageing. We propose that MA could potentially be used clinically with these techniques as an early warning sign of potential pathologies for example in Parkinson's disease (MRC strategic plan Priority 1 - tissue disease and degeneration).

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