



Precision Imaging Beacon of Excellence

Studentship Form

First supervisor	Daniele Avitabile School of Mathematical Sciences		
Co supervisors	Peter Liddle Faculty of Medicine and Health Science Stephen Coombes School of Mathematical Sciences		
Start date	September 2018	Duration	3 years
Project Title	Mathematical modelling and uncertainty quantification of distributed brain circuits to inform development of neuromodulation therapies.		
Project Abstract	<p>In treating mental disorders current pharmacological treatment provides transient relief of symptoms but enduring benefit is likely to require re-modelling of the relevant cerebral circuits by targeted modulation of neural activity in these circuits. It is possible to produce appropriate modulation of neural activity by non-invasive stimulation techniques such Transcranial Magnetic Stimulation (TMS). TMS is of proven benefit in treating depression but only achieves substantial therapeutic effects in some cases. The challenge is to optimise the timing and location of stimulation to promote the desired healthy pattern of activity in an individual person, taking account of the unique structure and function of each individual's brain.</p> <p>The object of this project is to develop mathematical models of the effects of stimulation on the brain circuits involved in mental symptoms, such as depression, that will facilitate the adjustment of stimulation taking account of the specific structure and function of the individual brain. In our ongoing studies of the treatment of depression using TMS we are acquiring detailed information about brain structure, function and chemistry using structural and functional MRI and also Magnetic Resonance Spectroscopy.</p> <p>The interplay between data and models is a central theme of this project. Firstly, data will be used to inform and validate models of spatially distributed brain networks. Secondly, we aim to build a mathematical and numerical toolkit to perform Uncertainty Quantification and Data Assimilation tasks on generic neural networks. These techniques allow to quantify how uncertainty in model inputs are propagated forward to the outputs, and they constrain model outputs to observed data, thereby sharpening model predictions and tailoring them to the individual.</p> <p>We are looking for a postgraduate student with a strong background in numerical methods and mathematical modelling, willing to specialise in random/stochastic simulations and to interface with clinicians at Nottingham's Centre for Translational Neuroimaging.</p>		
Queries	Please contact PI-Beacon@nottingham.ac.uk		
To apply	Please apply online via the University of Nottingham application page		