Project Title	Investigating the Effect of Temporal Interference Stimulation to induce brain wide plasticity
Supervisor(s)	Dr Samuel Barnes (Department of Brain Sciences)
Themes	Molecular and Cellular Bioengineering
Project Type	Lab based
Project Description	"Overview: The brain processes the dynamic sensory environment in the face of unpredictable 'noisy' neural activity 1,2. To meet this challenge, homeostatic plasticity mechanisms have evolved to regulate fluctuating neuronal activity and prevent extreme levels 1,3,4. One feature of Alzheimer's Disease (AD) is the destabilisation of spontaneous neural activity levels5, suggesting that homeostatic plasticity may be failing in early AD6,7. Destabilised activity is predicted to increase neural noise5,8 and trigger aberrant molecular cascades6,7 which can ultimately lead to synapse loss6,7. Recent research suggests that the emergence of destabilized spontaneous activity in mouse models of early AD is concomitant with a decline in the power of brain-wide neuronal network oscillations important for organizing neuronal activity across multiple spatial scales9,10,11,12. Interestingly, reinstating these brain rhythms restores spontaneous activity to physiological levels10,12 and alleviates amyloid load10,13, a central player in AD, thus highlighting the therapeutic potential of neuromodulation for treating AD. This project will characterize changes in neuronal activity following the application of a novel deep brain stimulation (DBS) technique, Temporal Interference14 (TI), in mouse models capturing key features of AD, including amyloidosis. Understanding the mechanisms through which TI can modify neuronal circuitry offers the opportunity to both tune TI stimulation parameters to target specific cell types affected in AD and reveal intrinsic deficits in homeostatic plasticity processes in the amyloidogenic brain. To do this the Barnes lab uses a combination of rodent models, in vivo widefield calcium imaging, immunofluorescence, TI stimulation and behavioural assessment of cognition. The successful student will employ these techniques and analysis in MatLab to test the hypothesis that patterned TI stimulation modulates neuronal activity through the induction of Hebbian or homeostatic modifications to synaptic connectivity."