

Title: Elucidating the theoretical and physiological basis of anti-correlated slow oscillation activity

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Summary (300 words max)

Spontaneous slow oscillations (0.01-0.1Hz) occur in the human brain during rest. Slow oscillations have been detected mainly in the cortex of all mammals, including rodents. However, the function and the mechanisms that drive slow oscillations remain unclear. The evolutionarily conserved habenulo-interpeduncular nucleus pathway has emerged as a crucial circuit that mediates fear and stress-related behaviors. By carrying out volumetric functional imaging of thousands of habenular neurons during spontaneous activity in zebrafish larvae, preliminary data show slow oscillations that are anti-correlated between distinct neuronal populations. The first aim of this project is to model the anti-correlated slow oscillation activity using Firing Rate models such as the Wilson-Cowan model. The second aim is to identify neurotransmission parameters that regulate anti-correlated slow oscillation activity. This will be carried out by recording and analysing habenular neurons in zebrafish larvae carrying mutations for genes necessary for excitatory or inhibitory neuromodulation in the habenula. This project will uncover the theoretical and physiological basis for how slow oscillation activity is encoded in the brain.