

Thalamo-cortical Modelling to Advance Treatments of Tourette Syndrome

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Tourette syndrome is a neurological disorder characterised by motor and vocal tics, and it is particularly prevalent among children. Although tic severity often decreases with age, many adults continue to experience significant symptoms. Recent advances have shown that median nerve stimulation can effectively reduce the frequency and severity of tics, and a mechanistic understanding of its effectiveness can improve neurostimulation protocols. The thalamus is a body of neural cells that relays impulses from the sensory pathways to the cerebral cortex. Feedback from the cortex gives rise to thalamo-cortical loops that generate emergent brain rhythms from the interplay of single-cell ionic currents and network mechanisms; this circuit is believed to be dysfunctional in people with Tourette's. This work presents a mathematical model of the thalamo-cortical circuit built from neural mass models of the cortex coupled to mean-field models of the thalamus. Analysis to treat the system's response to external sensory drive in the form of median nerve stimulation can be performed, and its understanding will pave the way for the design of improved healthcare treatments utilising wearable devices.