Thalamic networks in the brain are responsible for strategically filtering sensory information subject to attentional demands. For example, one can gaze at a butterfly and completely be unaware of the flowers and bushes that surround it, even though these surroundings are entirely within the subject’s visual field. This occurs because visual thalamic neurons only relay the information in the visual field that the subject is paying attention to back to visual cortex for perception. How and when this relay occurs has never been precisely quantified.

In this talk, we utilize a biophysical-based model to quantify relay of a thalamic cell as a function of its input parameters and electrophysiological properties. Specifically, we compute bounds on relay reliability and show how these bounds can explain experimentally observed patterns of neural activity in the basal ganglia in (i) health where reliability is high, (ii) in Parkinson’s disease (PD) where reliability is low, and (iii) in PD during therapeutic deep brain stimulation where reliability is restored. Our bounds also predict different rhythms that emerge in the lateral geniculate nucleus in the thalamus during different attentional states of a cat.

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