

## **How thalamic circuits change visual signals en route from retina to cortex**

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The lateral geniculate nucleus of the thalamus is in many ways the underdog of early visual pathway, taking a back seat to the retina and the cortex. Even the name of its principal neurons, “relay cells” seems to diminish its relevance by suggesting a passive role. Yet there is mounting evidence to suggest that the thalamus makes unique contributions to early visual processing. For example, past anatomical and cross-correlation analyses have shown that retinogeniculate wiring is complex and that some relay cells receive input from multiple ganglion cells. As well, nearly a third of neurons in the geniculate never leave the thalamus, but rather make inhibitory connections with local relay cells and with each other. Further, relay cells use dual modes of firing to transmit visual information downstream; they fire either rapid bursts or tonic trains of spikes depending on the level of membrane polarization.

Such findings compelled us to explore the physiology and anatomy of thalamic circuits directly by combing intracellular recording and staining in vivo with various computational approaches. We used many different types of visual stimulus, but focused on natural movies in order to evoke ecologically relevant patterns of activity. The talk will introduce three main projects that address how thalamic circuits operate. For the first project we map patterns of retinogeniculate convergence by analyzing the total pool of excitatory synaptic potentials that individual relay cells receive. In the second, we investigate local inhibitory circuitry by recording visually evoked inhibition in relay cells and by recording directly from interneurons. Last, we ask if patterns of synaptic excitation and inhibition evoked by naturalistic stimuli are able engage both burst and tonic modes of firing. A particular goal of this talk is to present empirical findings to theorists in order to foster discussion about thalamic function.