University of Rochester School of Medicine and Dentistry

The Neuroscience Graduate Program

Presents:

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Regulation of synaptic integration and recurrent excitation in the auditory midbrain

The inferior colliculus (IC) is the midbrain hub of the central auditory system and an important site for computations related to speech processing and sound localization. With more than five times as many neurons as the lower auditory brainstem, the computational potential of the IC is immense, but the cellular and synaptic mechanisms underlying computations in the IC have remained largely unknown. Using a multifaceted approach, we recently identified VIP and NPY neurons as the first two molecularly identifiable neuron types in the IC. VIP neurons are glutamatergic, NPY neurons are GABAergic, and both project to long-range targets including the auditory thalamus. The discovery of VIP and NPY neurons has enabled us to identify fundamental new mechanisms that shape computations in the IC. This seminar will focus on two of these mechanisms. First, we will address how the expression of NR2D-containing NMDA receptors broadens the time window for synaptic integration in VIP neurons by enhancing the activation of NMDA receptors at resting membrane potential. These results have important implications for how VIP neurons and other IC neurons convert the temporal codes used extensively in the auditory brainstem to the rate codes that predominate in higher brain centers. Second, we will discuss how NPY neurons are poised to regulate network excitability in the IC through a combination of GABAergic and NPYergic signaling. Our data show that most glutamatergic neurons in the IC express NPY Y1 receptors and that activation of these receptors reduces recurrent excitation in local IC circuits. Together, these results provide important new insights into the varied ways that IC circuits can shape auditory processing.

Monday, March 20th 2023

4:00 PM

1-9576 Ryan Case Method Room