# Behavioral correlates of apical dendrite activity

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**Abstract**

Of the six layers of the neocortex, layer 1 (L1) remains the most mysterious. L1 has been physiologically inaccessible for most of neuroscience's history, being comprised almost entirely of apical dendrites from pyramidal neurons. The advent of *in vivo* imaging technologies has recently opened up investigation of this major component of cortical circuitry. Even in primary sensory cortex, L1 apical dendrites receive long-range synaptic connections from higher-order cortical and thalamic areas. These connections have the potential to influence sensory processing in the context of self-generated motion, higher-order stimulus features, behavioral state, and the behavioral relevance of particular stimuli. The feedback nature of L1 connections suggests that their main effects on apical dendrites transpire when animals are engaged in a task. My talk will focus on our efforts to image apical dendrite activity during behavior. We train transgenic mice on various head-fixed behavioral tasks involving whisker-mediated sensation. Genetically encoded calcium indicators are selectively expressed in the apical tufts of L2/3 or L5 pyramidal neurons, and mice are imaged by two-photon microscopy during task performance. I will discuss how the dendrites respond to various sensory, motor, and behavioral events. I will also present a swept light sheet technique for acquiring volumes at relatively high-speed using a single microscope objective.

**Keywords:** two, photon microscopy, cortical layers

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