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Long-term relationships between network activity, synaptic tenacity
and synaptic remodeling in networks of cortical neurons

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ABSTRACT OF THE TALK

The human brain consists of a vast number of neurons interconnected by specialized communication devices known as synapses. It is widely believed that activity-dependent modifications to synaptic connections - synaptic plasticity - represents a fundamental mechanism for altering network function, giving rise to emergent phenomena commonly referred to as learning and memory. This belief also implies, however, that synapses, when not driven to change their properties by physiologically relevant stimuli, should retain these properties over time. Otherwise, physiologically relevant modifications would be gradually lost amidst spurious changes and spontaneous drift. We refer to the expected default tendency of synapses to hold onto their properties as "synaptic tenacity".

We have begun to examine the degree to which synaptic structures are indeed tenacious. To that end we have developed unique, long-term imaging technologies that allow us to record the remodeling of individual synaptic specializations in networks of dissociated cortical neurons over many days and even weeks at temporal resolutions of 10-30 minutes, and at the same time record and manipulate the levels of activity in the same networks. These approaches have allowed us to uncover intriguing relationships between network activity, synaptic tenacity and synaptic remodeling.

These experiments and the insights they have provided will be described.