Depression-enhanced Synchronization in Reverberatory Bursts

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Cortical neurons cultured on multi-electrode array can display spontaneous, synchronized, episodic activities called neuronal bursts. Some of these bursts show reverberations in their temporal profile, which are repeating rise-and-falls of spiking activity level. Typically, these bursts are initiated by wave-like propagation of spikes through the culture. However, the reverberations that follow are usually concurrent with a lower degree of synchronization, which improves over the course of the burst until the end of the burst. Simulations of geometrically constrained networks of spiking neurons are performed with both spike-triggered and noise-activated synaptic releases. The results suggest that the increase of synchronization can be caused by the depletion of neural resources. This reduces the excitability of neurons as well as the effect of noise making the role of synchronous, spike-triggered releases more prominent in later reverberations of a burst.