

# Spontaneous Reverberation in Developing Neuronal Culture Networks

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Reverberations within a synchronized burst in rat cortex cultures are studied as a function of days in vitro (DIV) in developing cortical cultures. Spontaneous activities in neuronal cultures are recorded by a multi-electrode-array and calcium image systems. A synchronized burst is characterized by the histogram of spiking time averaged over the 60 electrodes. These histograms are studied as a function of DIV and pharmacology is used to understand the possible causes for the changes in histogram. We find that reverberation in form of oscillations in the observed histogram can only be observed when the DIV of the cultures are less than  $13 \pm 3$ . These reverberations are induced by the residual calcium in firing neurons in the network and therefore enhance re-firing and synchronization of the same group of neurons. This later mechanism is believed to be a form of working memory. Our results show that the observed changes in reverberation originate from the changes in network connectivity. Therefore, reverberations, if considered as a form of working memory, can only be implemented with some optimal network connectivity and topology.