P1.10.

Modeling the transition between gamma and sharp wave – ripple network states in the hippocampus

Káli, S.[2*]; Karlócai, R.[2]; Hájos, N.[2]; Freund, T.[2]; Gulyás, A.[1]

1: HAS - PPCU - SU Neurobionics Research Group, Budapest, Hungary
2: Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest, Hungary

In different behavioral states cortical networks show distinct dynamics, which may implement distinct computations. Switching between network states may be effected by subcortical modulatory inputs, which affect both single cell and synaptic properties, but the actual mechanisms are currently unknown. We take advantage of the recent development of an in vitro preparation where controlled transitions between gamma rhythmic activity and repetitive (sharp-wave-ripple) bursting can be induced by the application of cholinergic drugs, to investigate, via the combination of electrophysiological and modeling tools, the link between changes in neuronal characteristics and the resulting switches in emergent network behavior. We developed a large-scale model of the CA3 area of a hippocampal slice, consisting of integrate-and-fire models of pyramidal cells and interneurons. Single cell and synaptic properties were determined experimentally in both network states. Our model confirmed that the measured cellular and synaptic changes are sufficient to explain the observed switching between the two types of network dynamics, and also suggested possible mechanisms for the initiation and termination of sharp wave events.

Supported by OTKA 77793, NNF78917.