Lipids and neuropeptides as modulators of O-LM interneurons activity

Salvatore Incontro, PhD
Unité de Neurobiologie des Canaux Ioniques et de la Synapse (UNIS)
Aix Marseille Université - INSERM U1266, Marseille, France

Interneurons are fundamental components of the cortical area sculpting the activity of principal neurons. The control of pyramidal cell activity by GABAergic interneurons is required for the execution of hippocampal functions during spatial memory formation. Oriens lacunosum moleculare (O-LM) are SOM-positive interneurons which form a very singular feedback inhibition circuit with principal neurons: receiving glutamatergic inputs from pyramidal neurons they not only inhibit the apical dendrites of CA1 pyramidal neurons in the lacunosum moleculare region but they also inhibit interneurons located in the stratum radiatum. In hippocampal neurons, synaptic and intrinsic plasticity are expressed in parallel. This synergy is functionally important as both forms of plasticity act to either promote or reduce excitation. The alteration of this balance is one of the consequences of many neurological diseases. In the first part of this talk I will introduce our findings on the synergy between synaptic and intrinsic plasticity in O-LM interneurons. Long-term potentiation of both synaptic transmission and intrinsic excitability is induced by presynaptic stimulations in the theta range while long-term depression of both synaptic transmission and intrinsic excitability is tuned by endocannabinoids.
Modulation of neuronal activity is fundamental for the maintenance of homeostasis in physiological conditions. Neurotransmitters like acetylcholine importantly regulates excitability of O-LM and pyramidal neurons through muscarinic and nicotinic receptors. However, the role of somatostatin and others neuropeptides as alternative modulators of intrinsic and synaptic activity is largely unknown. In the second part I will focus on the modulatory role of neuropeptides on the synaptic and intrinsic properties of hippocampal neurons and how this can regulate the O-LM to pyramidal neurons feedback circuit and the excitation/inhibition balance.