GABAergic neurones – the cellular substrate for local and long-range synchrony

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Abstract

Over the past decade we used genetic manipulations to study the contribution of GABAergic interneurones for rhythmic synchronous activity. We focused on the hippocampus on the medial entorhinal cortex, two brain structures that are crucially involved in spatial coding and spatial memory. Genetic manipulations included ablations of glutamate receptors or electrical coupling in GABAergic interneurones in the whole forebrain, or locally in the hippocampal-entohinal formation. Our studies underline the functional role of local GABAergic interneurones for spatial or temporal coding in the hippocampus. The genetic manipulations were always associated with distinct spatial memory deficits. In addition I will present data demonstrating the presence of long-range GABAergic cells that connect the hippocampus and entorhinal cortex reciprocally. Also these data will be discussed in a larger context, since there is good reason to believe that long-range GABAergic neurones are more abundant in the forebrain as previously thought. I will present data on two GABAergic projections that project from the septum to the medial entorhinal cortex where they differentially inhibit specific interneurons and modulate the activity of spatially tuned cells. Most recent studies in the lab focus on long-range GABA that connect several cortical areas involved in pain perception. By virtue of their connectivity – the target cells are most often local interneurones - this class of cells is ideally suited to synchronize brain regions over long distance.

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