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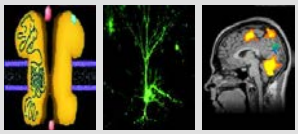

The Sense of Memory: Integration and representation of sensory processes

April 25 - 26, 2016 Veranstaltungszentrum, Ruhr University Bochum

Tuesday April 26, 13:10 – 16:00

Session 4 **Higher order representations of memory and sensory experiences**

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Network and behavioral dynamics of sensory integration in the rodent hippocampal system.

What are the systems-level mechanisms allowing for formation of memories? The conceptual picture that emerges is that the representation of a novel object or event is incorporated into representation of the spatio-temporal context in the hippocampus, a structure critical for memory. The accepted broad mechanistic framework for this process is that perceived information about the world is transferred from multimodal neocortical areas to the hippocampal region where it is actively encoded. Both transfer of information to and encoding in the hippocampus relies on active sampling of the external sensory inputs and internal network dynamics. However the quantitative link between diverse exploratory behaviour that rodents use to actively sample external sensory inputs during learning, oscillatory network dynamics that controls information flow and hippocampal population code for space and memory is not established. We use marker-based high-resolution tracking of rat biological motion to quantitatively and objectively segment and classify its exploratory behaviour. We combine behaviour analysis with multichannel extracellular recording of populations of neurons and oscillatory dynamics in entorhino-hippocampal circuits. In the talk I will present our recent advances in these project along several directions. First, I will show how high-resolution tracking gives rise to quantification of known behaviours and discovery of new behavioural motifs. Second, how population activity of hippocampal neurons is changing dynamically with changes of exploratory states. Third, I give comprehensive overview of the oscillatory synchronization dynamics across entorhinal-hippocampal circuits. Taken together the constraints imposed by spontaneous exploratory behaviour and network dynamics on activity of hippocampal neurons give rise to a novel temporal framework for the analysis of the mechanisms of memory encoding.