



# Sensory Processes: From Molecules to Cognition

April 12 - 13, 2016, Veranstaltungszentrum, Ruhr University Bochum

Wednesday April 13, afternoon ( 13:10 – 16:00 )

## Session 4 Sensory Integration and Representation

### JAN BORN

Department of Medical Psychology and Behavioral Neurobiology, University of Tübingen

### Sleep, memory and perception

Whereas memories are encoded and retrieved optimally when the brain is awake, the consolidation of memory requires an offline mode of processing as established optimally only during sleep. Recent studies have elucidated some of the neurophysiological mechanism underlying the consolidation of memories during sleep, especially in the hippocampus-dependent declarative memory system. This system is capable of rapidly forming an initial memory representation for an episode upon its one-time occurrence, and is thus at the basis of the formation of any long-term memory. Consolidation of hippocampus-dependent memories represents an active system consolidation process that takes place mainly during slow wave sleep (SWS) rather than REM sleep. It critically relies on the neural reactivation of newly encoded memory representations which originate from hippocampal circuitry and likely stimulates a gradual redistribution of the representations towards extra-hippocampal, mainly neocortical networks serving as long-term store. The redistribution process thereby leads to a qualitative transformation of the memory representation which is thought to also entail the strengthening of low and high level sensory and perceptual representations contributing to the experienced episodes. Memory reactivations originating from the hippocampus are synchronized to the <math><1\text{Hz}</math> EEG slow oscillations that dominate SWS and are generated in neocortical networks, partly as a function of the prior use of these networks for encoding of information. By synchronizing hippocampal memory reactivations with specific activity from other brain areas, including thalamo-cortical spindles, slow oscillations enable persisting plastic changes underlying the long-term storage of memories in the neocortex.

