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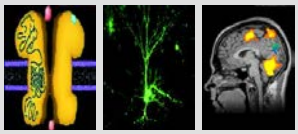

The Sense of Memory: Integration and representation of sensory processes

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**

PASCAL FRIES

Ernst Strüngmann Institute (ESI) for Neuroscience, Frankfurt/M., Germany

Rhythms for cognition: communication through coherence

I will show that free viewing induces gamma-band oscillations in early visual cortex. If the gamma rhythm in a lower visual area entrains a gamma rhythm in a higher visual area, this might establish an effective communication protocol: The lower area sends a representation of the visual stimulus rhythmically, and the higher area is most excitable precisely when this representation arrives. At other times, the higher area is inhibited, which excludes competing stimuli. I refer to this scenario as the Communication-through-Coherence (CTC) hypothesis. I will show that the gamma rhythm in awake macaque V4 modulates the gain of synaptic inputs. I will further show that constant optogenetic stimulation in anesthetized cat area 21a (homologue to V4) induces a local gamma rhythm, and that this isolated gamma is sufficient to produce similar gain modulation. These gain modulation effects would be ideal to lend enhanced effective connectivity to attended stimuli. I will show that this is indeed the case between macaque V1 and V4. When two visual stimuli induce two local gamma rhythms in V1, only the one induced by the attended stimulus entrains V4. I will then investigate how these changes in gamma synchronization between visual areas are controlled by influences from parietal cortex. I will show that posterior parietal cortex influences visual areas primarily via beta-band synchronization. I will show that generally, beta-band influences are stronger in the top-down direction, while gamma-band influences are stronger in the bottom-up direction. This holds across macaques and human subjects, and in both species it allows building a hierarchy of visual areas based on the directed influences. Finally, I will show that attentional selection occurs at a theta rhythm. When two objects are monitored simultaneously, attentional benefits alternate at 4 Hz, consistent with an 8 Hz sampling rhythm, sampling them in alternation.