LIN Colloquium

out of turn

Who: **Prof. Dr. Chiara Cirelli**
Dept of Psychiatry, University Wisconsin-Madison, USA

What: **Sleep and synaptic down-selection**

Monday, July 1st, 2019, 15:00 h

Ebbinghaus Lecture Hall (ground floor)
Brenneckestr. 6, 39118 Magdeburg
Leibniz Institute for Neurobiology

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ABSTRACT

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Sleep and synaptic down-selection

The synaptic homeostasis hypothesis (SHY) proposes that sleep is an essential process needed by the brain to maintain the total amount of synaptic strength under control. SHY predicts that by the end of a waking day the synaptic connections of many neural circuits undergo a net increase in synaptic strength due to ongoing learning, which is mainly mediated by synaptic potentiation. Stronger synapses require more energy and supplies and are prone to saturation, creating the need for synaptic renormalization. Such renormalization should mainly occur during sleep when the brain is disconnected from the environment and neural circuits can be broadly reactivated off-line to undergo a systematic and yet specific synaptic down-selection. In short, according to SHY, sleep is the price to pay for waking plasticity to avoid runaway potentiation, decreased signal-to-noise ratio, and impaired learning due to saturation. I will discuss the rationale underlying this hypothesis and summarize electrophysiological, molecular and ultrastructural studies in flies, rodents and humans that confirmed SHY's main predictions, including the recent observation, obtained using serial block face scanning electron microscopy, that most synapses in mouse primary motor and sensory cortices grow after wake and shrink after sleep. I will then present unpublished ultrastructural data obtained in the hippocampus and in the cortex of mouse pups. Finally, I will examine recent studies by other groups showing the causal role of cortical slow waves and hippocampal ripples in sleep-dependent synaptic down-selection, and some of the molecular mechanisms that can mediate this process.