

## The Adaptive Brain in Action: Cellular correlates of learning, memory and forgetting

Changes in the connectivity of neurons - activity-dependent synaptic plasticity - regulate the fine-tuning of neuronal networks during development and during adult learning. Synaptic plasticity includes functional and structural modifications at neurons. Both changes occur in a 'positive' (synapse strengthening, dendritic spine growth) and in a 'negative' way (synapse weakening, dendritic spine loss). On the other hand, *in vivo* imaging studies show that the large-scale organization of axons and dendrites as well as the majority of synaptic structures in several areas of the mature, intact brain shows a remarkable stability. These observations implicate the existence of a set of molecules regulating the stability of mature neuronal networks at the end of development. Dendritic spine number and dendritic arbor complexity can change during activity-dependent plastic processes. The underlying mechanisms and molecules are largely unknown. Neurotrophins modulate neuronal morphology as well as support functional changes at synapses. So far mainly the role of BDNF and its TrkB receptor has been studied by us and others in order to study elucidate processes of positive synaptic plasticity, synaptic scaling and synaptic tagging. In addition we are interested in the process of negative synaptic plasticity (weakening of synapses and loss of synaptic structures) and we study mechanisms and molecules that mediate stability of neuronal networks. In search for factors restricting functional as well as structural plasticity processes, we investigated the role of the myelin-associated protein Nogo-A, whose function as negative regulator of structural changes in the CNS is well known. We analysed synaptic transmission as well as long-term synaptic plasticity (LTP/LTD) in the presence of function blocking anti-NogoA or anti Nogo receptor (NgR) antibodies and in the mature hippocampus of NogoA KO mice.

Finally the talk will address our current research on the origin and progression of the Alzheimer Disease - which is foremost a disease of forgetting.