Learning and memory:
mechanisms, functional correlates, control and extinction

4th - 5th of March 2013
Veranstaltungszentrum, Ruhr Universität Bochum

Learning and Memory -
Molecular and cellular mechanisms of learning and memory

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Synapse-specific Compartmentalization of Signaling Cascades for LTP Induction in CA3 Interneurons

We have previously demonstrated that LTP induction at mossy fiber (MF) synapses on CA3 interneurons with somata located in the Stratum Lacunosum Moleculare (SLM; Galván et al. 2008; 2010) is independent of NMDAR activation but dependent on postsynaptic depolarization and calcium influx. SLM interneurons also receive strong input from CA3 pyramidal cells via recurrent collaterals (RC) synapses. The purpose of this study was to assess whether the initial steps in LTP induction at RC synapses vs. MF synapses on SLM interneurons share common calcium dependent signaling cascades. Whole cell recordings from visually identified SLM interneurons were used to measure RC and MF EPSPs evoked in the same cell by low intensity stimulation delivered to the s. radiatum and the dentate gyrus, respectively. We found that RC LTP induction is NMDAR dependent, and also relies on postsynaptic depolarization and calcium influx. However, unlike MF LTP the induction of LTP at RC synapses depends on CaMKII but not PKA activation. On the other hand, both forms of LTP require PKC activation for the induction. Together these data show that the spineless dendrites of SLM interneurons have the capability to compartmentalize the initial Ca2+ dependent signaling cascades leading to LTP induction in two different types of converging synaptic inputs.