Introductory Remarks to Symposium 35

Use it or lose it - cellular and molecular mechanisms of synapse remodeling in developmental plasticity

Siegrid Löwel and Oliver Schlüter, Göttingen and Pittsburgh (USA)

The plasticity and maturation of neural networks is a fundamental process to shape a functional brain. If gone awry, it may lead to neurodevelopmental disorders, which still lack causal treatment strategies. After genetic programs have instructed initial brain wiring, all cortical neural circuits are refined to optimize their functional properties in restricted time windows of heightened plasticity. During these "critical periods", synaptic connections are shaped by experience. Importantly, while some plasticity remains and can be reactivated after critical periods, optimal functionality of the respective cortical network is only achieved by experience-driven remodeling during critical periods. Thus, reinstating critical period plasticity could be a promising mechanism to restore functionality in damaged or diseased brains. An essential step to achieve this goal is the understanding of the cellular mechanisms and their molecular underpinnings. While critical period plasticity is regulated by the strength of local inhibitory networks, the refinements of connectivity occur primarily at glutamatergic synapses onto excitatory pyramidal neurons. Recent studies report that this refinement is based on the maturation of silent synapses, glutamatergic synapses expressing NMDA-receptors but no AMPA-receptors, and the pruning of unfavored synapses. The instructive role of silent synapses for neural network refinement is further substantiated by the observation that silent synapse maturation terminates critical periods.

Our symposium will focus on recent advances in understanding the molecular and cellular basis of how glutamatergic synapses on principal neurons are consolidated or eliminated for functional optimization of neural networks. It will cover intrinsic mechanisms of synaptic plasticity for synapse strengthening and weakening (Christian Lohmann), the elimination of synapses by interactions with glial cells (Ania Majewska), and molecular mechanisms of the postsynapse to regulate the maturation versus elimination of synapses (Weifeng Xu and Oliver Schlüter).

Supported by the DFG/CRC 889 ''Cellular Mechanisms of Sensory Processing'' and the BCCN Göttingen.

Symposium 35

Saturday, March 25, 2017
8:30 - 10:30, Lecture Hall 10

Chairs: Siegrid Löwel and Oliver Schlüter, Göttingen and Pittsburgh (USA)

08:30 Oliver Schlüter, Pittsburgh, USA
MOLECULES OF THE EXCITATORY POST-SYNAPSE GOVERN THE DURATION OF PLASTIC PHASES DURING BRAIN DEVELOPMENT (S35-1)

08:55 Weifeng Xu, Cambridge, USA
EXPERIENCE-DEPENDENT EQUILIBRATION OF AMPAR-MEDIATED SYNAPTIC TRANSMISSION DURING THE CRITICAL PERIOD (S35-2)

09:20 Juliane Jäpel, Martinsried
LATERAL GENICULATE NEURONS PROJECTING TO MOUSE VISUAL CORTEX SHOW ROBUST OCULAR DOMINANCE PLASTICITY (S35-3)

09:30 Christian Lohmann, Amsterdam, The Netherlands
PLASTICITY FOR FINE-TUNING DEVELOPING CORTICAL CIRCUITS WITH SINGLE SYNAPSE PRECISION (S35-4)

09:55 Ania K. Majewska, Rochester, USA
MICROGLIA – A CRITICAL ELEMENT OF CORTICAL PLASTICITY
(S35-5)

10:20 Oriane Blanquie, Mainz
ACTIVITY-DEPENDENT APOPTOSIS SHAPES THE STRUCTURAL MATURATION OF THE CEREBRAL CORTEX IN AN AREA-DEPENDENT MANNER (S35-6)