

Workshop program, CNS meeting 2009, Berlin:

Title: **Activity-Dependent Structural Plasticity – from cell cultures to cortical networks**

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Abstract:

Recent trends in modelling activity-dependent network formation focus on the role of structural plasticity for homeostasis and self-organized criticality. Understanding the full range of principles guiding self-organization of neuronal networks is relevant for repair of brain lesions (i.e. due to stroke) as well as for reorganization associated with learning. Recent time-lapse imaging studies of the living brain reveal new insights into how the brain rewires its networks under physiological and pathological conditions. A main principle of this reorganization as shown by a wealth of experimental data is the mutual interdependency of neuronal activity, neurotransmission and neural morphogenesis. Here, we propose a one-day workshop for presenting theoretical approaches that complement concrete experimental studies as these raise further questions for experimental testing. Thus, the workshop consists of four blocks of talks each focussing on one particular aspect of structural plasticity. The discussion following each block of talks is to exchange ideas between modellers and experimentalists.

Workshop program: (1 day)

8:30am
Opening and welcome
(Markus Butz)

Block A: Neuronal morphology and network formation

8:45am
Modelling neuronal morphology and network formation
Arjen van Ooyen, Amsterdam – *confirmed*

9:05am
A simple role for axon outgrowth and synaptic competition generates realistic connection lengths and filling fraction
Markus Kaiser, Newcastle – *confirmed*

9:25am
From single cell morphology to global patterns of network connectivity
*Luciano da Fortuna Costa, Sao Paulo, Brazil – *invited*

9:45am *Time for discussion with the speakers*

Relevant literature:
Van Ooyen A (Ed) (2003) Modeling Neural Development (2003) The MIT Press, Cambridge, Massachusetts, 2003

Graham, B. P., and Van Ooyen, A. (2006). Mathematical modelling and numerical simulation of the morphological development of neurons. BMC Neuroscience 7 (Suppl 1): S9.

10:15am – 10:45am Break

Block B: Network formation and self-organized criticality

10:45am

Self-organizing criticality and homeostasis in a model for activity-dependent network formation and predictions for experimental studies

Christian Tetzlaff, Goettingen – *confirmed*

11:05am

Experimental data from dissociated cortical cell cultures on self-organized criticality

Samora Okujeni, Freiburg – *confirmed*

11:25am *Time for discussion with the speakers*

Relevant literature:

Beggs JM, Plenz D. (2004) Neuronal avalanches are diverse and precise activity patterns that are stable for many hours in cortical slice cultures. J Neurosci. 24(22):5216-29.

Abbott LF, Rohrkemper R. (2007) A simple growth model constructs critical avalanche networks. Prog Brain Res. 2007;165:13-9. Review.

12:00am Lunch Break

Block C: Structural plasticity of neuronal circuits

1:30pm

Structural plasticity of circuits in cortical neuropil – *confirmed*

Armen Stepanyants, Boston, Massachusetts, USA

1:50pm

Structural plasticity controlled by calcium based correlation detection

Moritz Helias / Stefan Rotter, Freiburg – *confirmed*

2:10pm *Time for discussion with the speakers*

Relevant literature:

Escobar G, Fares T, Stepanyants A (2008) Structural plasticity of circuits in cortical neuropil. J Neurosci. 28(34):8477-88.

Stepanyants A, Hof PR, Chklovskii DB (2008) Geometry and structural plasticity of synaptic connectivity. Neuron. 2002 Apr 11;34(2):275-88.

Helias M, Rotter S, Gewaltig MO, Diesmann M. (2008) Structural plasticity controlled by calcium based correlation detection. Front Comput Neurosci. doi: 10.3389/neuro.10.007.2008.

2:40pm – 3:10pm Break

Block D: Structural plasticity of cortical networks

3:10pm

Massive restructuring of neuronal circuits during functional reorganization of adult visual cortex

Tara Keck, Muenchen – *confirmed*

3:30pm

Modelling experience-dependent structural plasticity in cortical networks

Markus Butz, Amsterdam – *confirmed*

4:10pm *Time for discussion with the speakers*

Relevant literature:

Butz M, Wörgötter F, Van Ooyen A (2009) Activity-Dependent Structural Plasticity (Review). Brain Res Rev (in press)

Butz M, Teuchert-Noodt G, Grafen K, van Ooyen A. (2008) Inverse relationship between adult hippocampal cell proliferation and synaptic rewiring in the dentate gyrus. *Hippocampus* 18(9):879-98.

Keck T, Mrsic-Flogel TD, Vaz Afonso M, Eysel UT, Bonhoeffer T, Hübener M. (2008) Massive restructuring of neuronal circuits during functional reorganization of adult visual cortex. *Nat Neurosci.* 11(10):1162-7.

5:00pm *End of the workshop*