

Cortical Microcircuit Models of Information Processing and Plasticity

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Workshop website: <http://www.cs.stir.ac.uk/~vcu/CNS2009.htm>

Workshop duration: one day, Thursday July 23

Abstract: The brain, from the neocortex to the spinal cord, consists of various parts that are built of repetitive microcircuits. These circuits adapt to the specific functions they have to perform by means of synaptic plasticity. Understanding what constitutes microcircuits and how they learn and interact is fundamental in the neurosciences, because they form the interface from cell biophysics to higher cognitive functions. The goal of this workshop is to provide a resume of the current state-of-the-art of the ongoing computational research avenues concerning cortical microcircuits with particular emphasis on the functional roles of the various inhibitory interneurons in information processing and synaptic plasticity. Computational network models that are tightly grounded on experimental data are particularly welcome.

Specific aims:

- What is a microcircuit? What circuits have been identified?
- What elementary functions do microcircuits perform?
- What types of synaptic plasticity rules are used?
- How do microcircuits interact? How do they form larger functional networks?
- How do perception, action, attention, or learning and memory arise from local microcircuits and their global interaction?
- How does the activation of a microcircuit show up in brain-signals on a larger scale like local field potentials, surface EEG, or fMRI?

Tentative Schedule:

All talks will be held in **July 23rd in Conference Room 3 (WS7)**

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| 09:00 - 09:05 | Vassilis Cutsuridis, University of Stirling, U.K.
Welcome notes |
| 09:05 - 09:45 | Phil Ulinski, University of Chicago, U.S.A.
A dynamical systems approach to understanding cortical microcircuits |
| 09:50 - 10:30 | Mark van Rossum, School of Informatics, University of Edinburgh, U.K.
Models of cortical dynamics and the role of recurrent connections |

10:30 - 10:45	Coffee/Tea Break
10:45 - 11:25	Peter Erdi, Center for Complex Studies, Kalamazoo, Michigan, USA Synaptic theory of working memory: some further analysis
11:30 - 12:10	Jan Schnupp, Genoa, Italy Laminar processing of sound in auditory cortex: an information theoretical analysis
12:15 - 13:30	Lunch Break
13:30 - 14:10	Clemens Boucsein, University of Freiburg, Germany Intermediate-range projections in non-columnar circuits of rat neocortex
14:15 - 14:55	Gleb Basalyga, University of Plymouth, U.K. Response properties of cells in the laminar cortical architecture
15:00 - 15:15	Coffee/Tea Break
15:15 - 15:55	Russell Hunter, University of Stirling, Stirling, U.K. Improving associative memory in a spiking neural network
16:00 - 16:40	Vassilis Cutsuridis, University of Stirling, Stirling, U.K. Hippocampal CA1 microcircuits of associative memory: A tale of two models
16:45 - 17:30	Thomas Wennekers General discussion with the audience

Bibliography

1. Cutsuridis, V and Wennekers T. Hippocampus, microcircuits and associative memory. Neural Networks, in press
2. Thomson AM, Lamy C. Functional maps of neocortical local circuitry (2007) Frontiers in Neuroscience 1: 19-42
3. Cortical microcircuits, Special issue in Neural Networks journal, <http://helen.pion.ac.uk/microcircuits08/>