Research Results of the BCF presented at the ENCODS 2013

Juggling with Molecules Circuits and Computation

1st EUROPEAN NEUROSCIENCE CONFERENCE

by DOCTORAL STUDENTS for DOCTORAL STUDENTS

ABSTRACT BOOK

Bordeaux, April 18th - 19th 2013

encods.eu

encods

European Neuroscience Conference
by Doctoral Students

ABSTRACT BOOK

Program

ARRIVAL DAY

Open Day in the Neuroscience Institutes of Bordeaux
19.00 Welcome Buffet and Drinks at the City Hall of Bordeaux

DAY 1

08.00 – 08.20 Coffee and Opening

08.20 – 09.20 Opening Lecture: **STEN GRILLNER**

Bridging the gap from ion channels to behaviour – a challenge today and a requirement for tomorrow

09.20 – 10.20 Keynote lecture: **ALCINO SILVA**
Molecular traps for inactivating and activating memories: implications to memory allocation

10.20 – 11.00 Student Session I: *Molecules & Synapses*
Chaired by Charlotte Madore and Sílvia Viana Silva

10.20 – 10.40 **JOANA FERREIRA**
Changes in the proteome of the postsynaptic densities of cortical neurons from mice lacking the GluN2B subunit of NMDA receptors

10.40 – 11.00 **AGNÈS VILLERS**
L-LTP can be induced in CA1 pyramidal cells in the absence of alpha-CaMKII autophosphorylation

11.00 – 11.20 Coffee Break

11.20 – 12.20 Keynote lecture: **CHRISTOPHE MULLE**
Lipid-mediated retrograde signalling and synaptic plasticity

12.20 – 13.00 Student Session II: *Molecules & Synapses*
Chaired by Charlotte Madore and Sílvia Viana Silva

12.20 – 12.40 **YOAV BEN SIMON**
Optogenetic activation of hippocampal mossy fiber synapses reveals major role for tomosyn in short-term plasticity

12.40 – 13.00 **GABRIELE DEIDDA**
Early depolarizing GABA controls critical period plasticity in the rat visual cortex

13.00 – 13.30 Lunch

13.30 – 15.00 Coffee and **Poster Session**

15.00 – 16.00 Keynote Lecture: **ED CALLAWAY**
Molecular, genetic and viral approaches for linking neural circuit structure and function

16.00 – 17.00 Student Session III: *Circuits & Systems*
Chaired by Audrey Bonnan and Stefano Zucca

16.00 – 16.20 **JOHANNES KOHL**
A sexually dimorphic circuit switch in higher olfactory centres

16.20 – 16.40 **ULRIKE PECH**
Analysis of contacts between intrinsic and exrtrinsic mushroom body neurons in Drosophila using split-GFP

16.40 – 17.00 **MORGANE ROTH**
Pattern integration in mouse primary visual cortex

17.00 – 17.20 Coffee Break

17.20 – 18.00 Student Session IV: *Circuits & Systems*
Chaired by Audrey Bonnan and Stefano Zucca

17.20 – 17.40 **BENJAMIN SCHOLL**
Emergence of orientation selectivity in the mammalian visual pathway

17.40 – 18.00 **MICHAL BOLA**
Transorbital alternating current stimulation strengthens oscillatory activity and functional connectivity in patients with visual system damage: a resting-state EEG study.

18.00 – 19.00 Keynote Lecture: **TROY MARGRIE**
Intrinsic biophysical diversity and connectivity of neuronal circuits

20.00 Gala Dinner at *Cap Sciences*

DAY 2

09.00 – 10.00 Keynote lecture: **ZACHARY MAINEN**

Neural circuits for spontaneous action timing in the frontal cortex

10.00 – 10.40 Student Session V: *Modeling Synapses & Circuits*
Chaired by Matthias Haberl and Maria Szlapczynska

10.00 – 10.20 **SADRA SADEH**
Common-mode attenuation leads to contrast invariant feature selectivity in inhibition-dominated random networks

10.20 – 10.40 **FEDERICO STELLA**
A model for grid cells in 3-D environments

10.40 – 11.00 Coffee Break

11.00 – 12.00 Keynote lecture: **MARK VAN ROSSUM**
Modelling synaptic plasticity and memory retention

12.00 – 12.40 Student Session VI: *Modeling Synapses & Circuits*
Chaired by Matthias Haberl and Maria Szlapczynska

12.00 – 12.20 **MERAV STERN**
Dynamics of clustered networks

12.20 – 12.40 **YAIR LAKRETZ**
A neuronal-based model for the process of reading

12.40 – 13.30 Lunch

13.30 – 15.00 Coffee and **Poster Session**

15.00 – 16.00 Keynote Lecture: **WINFRIED DENK**
The tools we need – advances in imaging

16.00 – 17.00 Student Session VII: *Novel Tools in Neuroscience*
Chaired by Elisabetta Aloisi and Jean-Christophe Delpech

16.00 – 16.20 **PHILIPP BETHGE**
Title two-photon excitation STED Microscopy in two colors in acute brain slices

16.20 – 16.40 **HENRIK BOIJE**
The prospects of a multi-coloured transgenic Zebrafish retina

16.40 – 17.00 **JOANNA SZCZURKOWSKA**
High-performance, site-directed, and reliable in utero electroporation in rodent by a triple-electrode probe

17.00 – 17.30	Special Lecture: **ALESSIO ATTARDO** ***Instability of dendritic spines in live adult CA1 hippocampus***
17.30 – 18.00	Coffee Break
18.00 – 19.00	Scientific Communication: **MIN CHO** ***Publishing 101 in Nature Neuroscience***
19.00 – 20.00	Closing Lecture: **TOBIAS BONHOEFFER** ***How activity changes synapses in the mammalian brain***
20.00	Wine tasting followed by the Farewell Buffet

Sadra Sadeh

Common-mode Attenuation Leads to Contrast Invariant Feature Selectivity in Inhibition-Dominated Random Networks

Sadra Sadeh, Stefano Cardanobile and Stefan Rotter
Bernstein Center Freiburg & Faculty of Biology, University of Freiburg, Germany

Neurons in the primary visual cortex (V1) of mammals are highly selective for the orientation of a light bar [1, 2, 3], while they receive afferent connections from neurons in lateral geniculate nucleus (LGN) which are themselves not selective. The emergence of this property in cortex has been subject of debate since decades, and served as a paradigm to unravel the key mechanisms of information processing in the brain. We investigate the problem from a network point of view, by focusing on random recurrent networks with no specific pattern of connectivity.

By exploring a large-scale network model of spiking neurons through simulations and theoretical analysis, we show how a purely random network operating in the inhibition dominated regime contributes to feature selectivity. In particular, we demonstrate how tuning amplification can happen in these networks as a consequence of 'selective attenuation', a general mechanism which selectively suppresses the common mode. By systematically investigating the relevant parameter space, we pinpoint different regimes of orientation selectivity, which yields testable predictions for the biological cortex.

The 'selective attenuation' mechanism also yields contrast invariance [4, 3] of feature selectivity, which ensures feature detection for a wide range of input scales. Therefore, we suggest that the basic mechanism of contrast invariance is a consequence of intracortical interactions, and neither a single cell property, nor a purely feedforward mechanism. We argue in favor of 'tuning amplification' as the key process of the recurrent processing stage, for which no specific structure is needed. This mechanism could, in principle, also work for other sensory features and other sensory modalities as well, since the neural hardware necessary to achieve it is readily available in the cortex.

References:
[1] D H Hubel and T N Wiesel. Receptive fields, binocular interaction and functional architecture in the cat's visual cortex. The Journal of Physiology, 160:106–54, 1962.
[2] D H Hubel and T N Wiesel. Receptive fields and functional architecture of monkey striate cortex. The Journal of Physiology, 195(1):215–243, 1968.
[3] C M Niell and M P Stryker. Highly selective receptive fields in mouse visual cortex. The Journal of Neuroscience, 28(30):7520–36, 2008.
[4] G Sclar and R D Freeman. Orientation selectivity in the cat's striate cortex is invariant with stimulus contrast. Experimental Brain Research, 46(3):457–461, 1982.

Notes