Ralitsa Todorova

Address: 57 boulevard Jourdan, CIUP, Maison d'Arménie, Chambre 210, Paris, 75014
Telephone Number: 06 52 52 85 95
E-mail: ralitsa.todorova@college-de-france.fr
Date and place of birth: 16 Aug 1990 in Sofia, Bulgaria

Education

PhD (01/10/2014 – present)
PhD student in the lab of Michaël Zugaro, Collège de France.
Inscription à l'École Normale Superieure de Paris en Doctorat 1 Sciences, Technilogies, Sante mention Cerveau-Cognition-Comportement, specialité Cerveau-Cognition-Comportement.
Project: The role of recurring neuronal activity patterns during oscillatory events in the formation and consolidation of hippocampus-dependent memories.
Funded by Labex MemoLife and École des Neurosciences de Paris.

Master of Science (01/09/2013 – 24/06/2014)
Université Paris Descartes, 12 rue de l'Ecole de Médecine, 75270 Paris Cedex 06
Qualification: M2: Cogmaster (Master Recherche en Sciences cognitives).
Final grade: 16.71 out of 20.

Masters Project:
Coupling of hippocampo-cortical rhythms in rats and their implications in memory.
Description: There is evidence that memory consolidation might depend on a hippocampo-cortical dialogue that takes place during sleep. Experiments by Nicolas Maingret in Michaël Zugaro's lab addressed the causal link between the coupling of hippocampal and cortical rhythms (namely, hippocampal ripples and thalamo-cortical delta waves and spindles) and memory consolidation by enhancing the coupling in electrically stimulated rats, which resulted in improved learning. In this data-mining project, I analysed the data collected in this experiment in Matlab, and investigated the role of the coupled oscillatory events to network reactivation. I was intrigued by the response of some cortical cells to the fast (140 – 220 Hz) hippocampal ripple oscillation. This impelled me to contact Vincent Hakim at the ENS to do a summer internship in theoretical neuroscience, which aimed to address a potential mechanism for this inter-regional phase-locking by the means of neuronal model simulations.

Bachelor of Science (01/09/2009 – 30/06/2013)
University of Edinburgh, Old College, South Bridge, Edinburgh, EH8 9YL
Qualification: BSc Honours, Biological Sciences (Neuroscience).
Class: 1st; Best Science Student and Best Dissertation in the 2013 Neuroscience class.

Bachelors Honours Project:
The role of attention in perceptual learning (82%, Best Dissertation in class of 78 students).
Description: Perceptual learning is thought to occur at the primary visual cortex at the region of the retinotopic map corresponding to the quadrants of training. This project assessed whether the

presence of an attention-drawing cue before the stimulus introduces a quantitative change in perceptual learning, speeding up the process, or a qualitative change, involving learning on a wider scale across quadrants where training has not occurred. Supervised by Dr David Carmel, I recruited participants, ran the psychomotor experiment on Matlab, and analysed the perceptual improvements after prolonged training. Prolonged training without exogenous attention-inducing cue yielded improvements in all quadrants, including ones that were not trained. This supported the notion that attention speeds up a transfer of perceptual learning, but, with sufficiently long training paradigm, attention is not necessary for such a transfer.

Internships

Simulating the prefrontal response to hippocampal ripple inputs (01/07/2014 – 01/09/2014)
Supervisor: Dr Vincent Hakim
The goal of this project was to theoretically explore the possible responses of a network to oscillatory inputs by the use of simulations executed in Matlab. I developed code computing a theoretical network response average by implementing a rate model network. Next, I simulated a physically more accurate leaky integrate-and-fire (LIF) neuronal model wit a stochastic equation. The project lead to some insight into the possible responses of prefrontal neurons to hippocampal inputs, and it has resulted in the creation of an extensive simulation toolbox, which implements the LIF model for single cells and networks, as well as a rate model network model that takes into account excitatory and inhibitory within-network connections. As the programs can be used to predict the expected network response to any input, they will be a powerful tool for testing hypotheses about network behaviour, answering questions such as: are the recorded inputs alone sufficient to predict the recorded responses, and if so, under which conditions?

The role of HCN1 channels in synaptic integration (20/05/2011 – 20/07/2011)
Supervisor: Dr Matt Nolan
Participating in lab research has been an invaluable experience for me. I was introduced to the Cre-loxP-mediated DNA flip-flop and to the methodology behind electrophysiological recordings of the mouse entorhinal cortex. I learned to independently perform a number of techniques such as analytical PCRs, vectors preparation, plasmid purification, freezing microtome brain dissection, biocytin staining, cytochrome oxidase staining, software-aided neuron tracing. Observing researchers at work, I have developed an understanding about the efforts behind a paper, and I have gained confidence in my potential and enthusiasm to discover.

References

Dr Michaël Zugaro
(PhD Supervisor)
Center for Interdisciplinary Research in Biology
Collège de France
11 place Marcelin Berthelot
75231 Paris Cedex 05 - France
01 44 27 12 93
michael.zugaro@college-de-france.fr

Dr Vincent Hakim
(Summer 2014 Internship Supervisor)
Laboratoire de Physique Statistique
Physique – École Normale Supérieure
24, rue Lhomond
75231 Paris Cedex 05 - France
01 44 32 37 68
hakim@lps.ens.fr