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# IGOR TIMOFEEV

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PARTICIPANT AT:

## A DIALOGUE WITH THE CEREBRAL CORTEX: CORTICAL FUNCTION AND INTERFACING

**April, 29<sup>th</sup>-30<sup>th</sup>, 2015, Barcelona**

**Igor Timofeev**, Full professor, Department of **Psychiatrie et Neurosciences** at **Université Laval**, Québec, Canada

Dr. Timofeev received his PhD from Bogomolets Institute of Physiology (Kiev, Ukraine) in 1993. He was employed as Lecturer in the Department of Human and Animals Physiology at Odessa State University (Odessa, Ukraine). From 1994 till 2000 he was postdoctoral fellow in Dr. Mircea Steriade laboratory at Université Laval (Quebec, Canada), since then he holds independent position and now Igor Timofeev is a full professor in the department of Psychiatrie et Neurosciences at Université Laval. His current research activities are located in the Centre de recherche de l'Institut universitaire en santé mentale de Québec. His laboratory investigates cellular mechanisms of sleep and epilepsy within thalamocortical system. He authorized over 100 original papers, over 30 review paper/chapters and he edited a book.

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**ABSTRACT**

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### **Optogenetic Cortical Stimulation to Increase Sleep Slow Oscillation and to Improve Memory Consolidation in Mice**

Throughout life, brain generates multiple forms of activities. Multiple studies suggest that slow oscillation of slow wave sleep contributes to memory consolidation. Therefore, an increase in slow oscillatory activity should promote memory consolidation. Transcranial direct current stimulation with frequency of slow oscillation demonstrated some improvement of memory consolidation. This method of stimulation does not consider brain microstates. For more efficient interaction with brain, we propose to use optogenetic approach. Thy1 mice contain channelrhodopsin 2 in a large number of pyramidal neurons and a subset of interneurons enabling to use low intensity optical stimuli to activate a subset of neurons. Low intensity stimulation of frontal cortex was able to induce slow waves, which were propagating during quiet wakefulness and slow-wave sleep, but not active wakefulness. Low frequency stimulation in the first hours of light period was able to increase significantly power of EEG in slow-wave range and highly significantly increased memory consolidation in novel object recognition test.

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