Final report NENS Exchange Grants

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Host Institution: King's College, London, Juan Burrone's Lab, Department of Developmental Neurobiology
Project title: Functional characterization of control and Satb1-deficient neurons during synaptic plasticity.

I am Ioannis Maragkos, a final-year MSc student in Athens International Master's Programme in Neurosciences and I was selected for the NENS Exchange Grants in October 2020. Having this grant I had the great opportunity to spend three months at King's College London. The main goal of my training stay was focused on learning how to perform whole-cell patch-clamp recordings (voltage clamp and current clamp) from organotypic slices and dissociated cells (cell cultures) as well. My current project is based on the role of Satb1 in synaptic homeostasis, a project which we are trying to approach it mainly using molecular and -omics techniques. So we consider this training as a great opportunity for me to gain some knowledge of basic neuroelectrophysiological techniques which, having completed my training stay, I could apply to my project. During my training, I learned how to perform acute slices from mouse brain, prepare appropriate solutions for electrophysiological experiments, use electrophysiological equipment and softwares. The mini-project of my training was to study the possible effect of excess glutamate in the presynaptic area of hippocampal interneurons. From the main three types of glutamate receptors (AMPA-R, NMDA-R and Kainate Receptors) we focused on kainate receptors which can be found in the presynaptic area of interneurons indicating that this is probably a mechanism for keeping the balance between excitation and inhibition. For this experiment, I performed whole cell patch current clamp to record the action potentials of the patched interneuron. For the very first 5 minutes I applied standard aCSF (artificial CerebroSpinal Fluid), then for the next 4 minutes I applied aCSF 250nM kainate, and finally for the next 11 minutes I switched back to standard aCSF. As it was expected the firing of the patched interneuron was increased during the application of kainate. Although my training stay was focused on electrophysiological techniques I had the opportunity to study the principles of other techniques as well, like calcium imaging and preparation of rat hippocampal primary culture.Personally the biggest gain for me was not only the fact that I built the basic electrophysiological skills for my current project but also that I had the opportunity to work with excellent neuroscientists who willingly offered me useful information, new protocols, help and guidance during my stay and a lot of important advices for my next academic steps. It was truly delightful, and I would like to thank my host lab and NENS Commitee of Higher Education and Training for making this unique opportunity possible, by providing all the needed funding.

Yours sincerely
Ioannis Maragkos

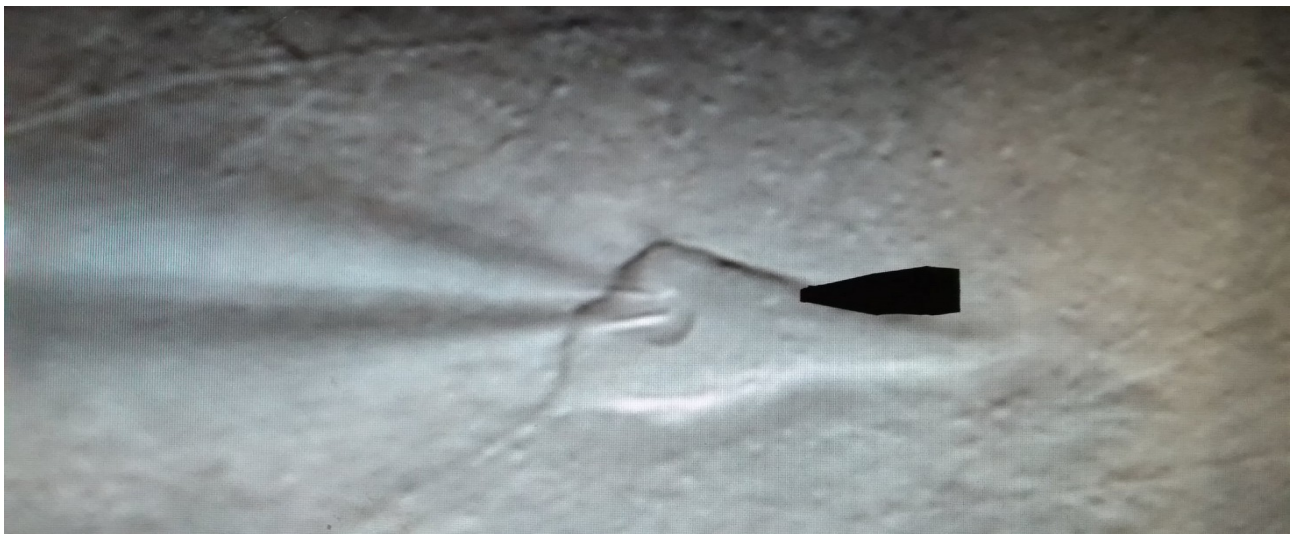

Figure 1. Approaching and patching of pyramidal neuron using a glass pipette.

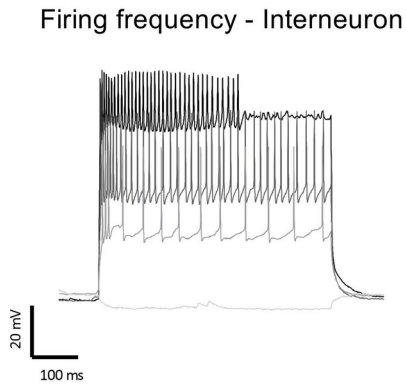

Figure 2. Firing Frequency of hippocampal interneuron.

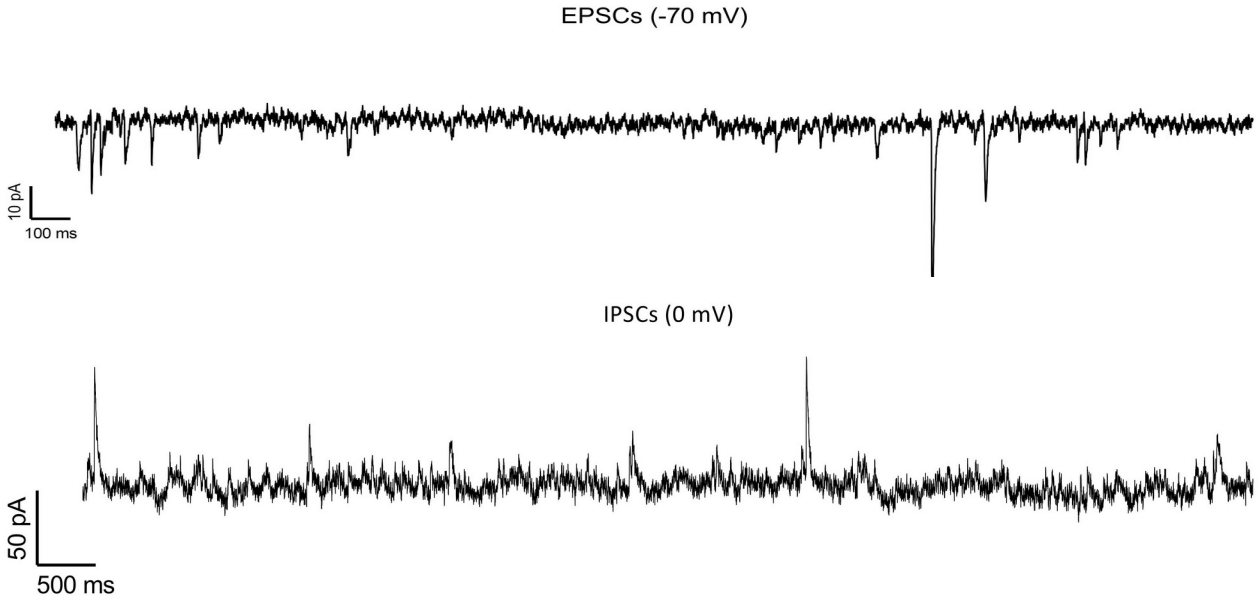

Figure3. spontaneous excitatory postsynaptic current from hippocampal interneuron.
Figure4. spontaneous inhibitory postsynaptic current from hippocampal pyramidal neuron.

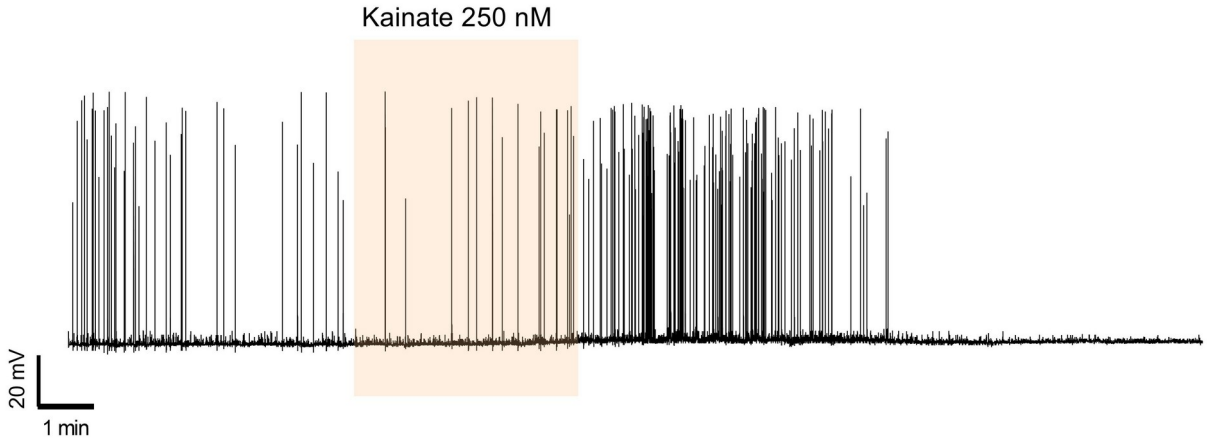

Figure 5. Action potentials recordind from hippocampal interneuron applying kainate (aCSF 250nM) for 4 minutes (from the 5th to the 9th)