PhD student: Frederike Winkel

Period of stay: 13th April – 15th June

Home laboratory: Eero Castrén, Neuroscience Center, Helsinki University

Host laboratory: Claudio Rivera, INMED Aix-Marseille

The NENS exchange grant supported my 2-months lab visit at the INMED institute at Aix-Marseille University from 13th of April to 15th of June. The lab visit was part of my doctoral training and its purpose was to learn and acquire 2-photon Calcium imaging in acute slices, to be introduced to in vivo Calcium imaging experiments and to transfer these skills and knowledge to my home laboratory where we recently purchased a new 2-photon microscope.

The project in which I was involved in focuses on interneuron migration during early postnatal age and how it is regulated by pyramidal neuron activity. To address this question we used a chemogenic approach in which we inhibited pyramidal neuron activity during a specific time window and examined the effect on interneuron migration and network activity using 2-photon calcium imaging in acute cortical slices of early postnatal pups. The acute slices were loaded with the calcium indicator Fura-2AM, which penetrates the cells, binds calcium and a decrease in its fluorescent signal indicates cell activity. We recorded spontaneous activity at different time points during development: right after inhibiting pyramidal cell activity and 5 days later. We will analyze the data with MatLab using a custom written code from the institute. We specifically look at the percentage of active vs. inactive cells and the type of activity (Spontaneous cell activity can involve different patterns: SPAs (synchronous plateau assemblies), GDPs (giant depolarizing potentials) and ENOs (early network oscillations)). Therefore, we can estimate whether the type of activity is shifted towards a certain pattern resulting from pyramidal neuron inhibition.

In addition to the above mentioned project, I had the chance to learn and watch in vivo 2-photon calcium imaging experiments. Members of a collaborating lab showed me how to perform cranial windows for imaging the somatosensory cortex in P10 pups and in adults, targeting the CA3 area of the hippocampus. For the first, a window was created above the somatosensory cortex by removing a piece of skull without damaging the dura. In the second experiment, a window was applied at the coordinates of the CA3 region of the hippocampus and a piece of cortex was removed to allow direct exposure of the hippocampus. While P10 pups can be recorded awake without training, adult mice need training to run on a wheel during the recordings to allow imaging in freely moving mice. In

both cases, the animal is fixed with the help of an attached holding bar. The imaging session takes usually about 20 min and can be repeated for long-term measurements. After the recording, the data needs to be processed by removing moving artifacts, such as breathing, and convolution, which can be done in MatLab.

My visit in Marseille has been extremely useful not only for my professional but also personal development. The INMED institute provides top-notch knowledge and an ideal environment to learn any physiological methods in vitro and in vivo. I had the possibility to broaden my network and established collaborations, which will be very beneficial for my future. Moreover, the environment is very friendly and especially helpful; whenever a problem occurred, people were around to help.

Due to the lab visit, I am now able to perform 2-photon calcium imaging in acute slices independently, analyze the data with MatLab and understand the results I obtain. I feel very confident to transfer this knowledge to my home laboratory and teach students and other researchers how to perform this technique. Moreover, I collaborate in a project where I will perform cranial windows in pups (as mentioned above) and in vivo 2-photon calcium imaging in combination with the optogenetic tools of my home laboratory to further investigate the impact of pyramidal neuron silencing on interneuron migration.

I want to thank the NENS committee for supporting me to achieve these skills and experiences by granting me the NENS exchange grant and encourage everyone to apply for this opportunity.