

NENS stipend stay at Universtiy of Oxford, UK;
Technique: Optogenetic mapping of cortical circuits
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From January till March 2012 I have trained in the lab of Professor Gero Miesenböck at the Centre for Neural Circuits and Behaviour, University of Oxford.

Here, I have learned two techniques. First, I was taught whole-cell patch clamping, a widely used technique to measure either potentials or currents across the membrane of a single neuron. Second, I learned how to map cortical circuits in slices using optogenetics. For this technique, mice that express Channelrhodopsin (ChR2) in only a certain cell type (e.g. PV⁺ interneurons) are used. ChR2 is an ion channel that can be activated by light. Thus, in these mice, laser light can be used to activate PV⁺ interneurons specifically and in a precise manner. In order to map neuronal circuits, a single pyramidal neuron is patched. Laser light is then shined at certain points along a grid that surrounds the patched neuron in order to specifically activate interneurons is activated. If it projects to the patched cell, the IPSC that results from it is measured. Because the responses are very temporally precise, spontaneous interneuron firing can be filtered out by repeating the protocol several times. This way, an accurate map of inputs onto a single neuron can be constructed. Due to the ever increasing number of mouse lines available, this technique can be implemented to map many other cell types, beside PV⁺ interneurons. By patching multiple cells simultaneously, network connectivity can be investigated further.

I will use this technique during my PhD research to look at changes in network connectivity during early development, both in wild-type and a mouse model for mental retardation. My stay in Oxford has provided me with the skills and knowledge to independently implement the technique, which was previously not available in my lab. Furthermore, it has allowed me to be in an invigorating scientific environment and meet new friends, and has given me a possibility for future collaboration. I therefore feel strongly that my NENS stipend training stay in Oxford was a success.