NENS Stipend for Training Stay – report

Catherine Perrodin

Host laboratory:
Laboratory of Comparative Neuropsychology (Dr. Chris Petkov), Institute of Neuroscience, Newcastle University Medical School, UK.

Home laboratory:
Physiology of Cognitive Processes (Prof. Nikos Logothetis), Max Planck Institute for Biological Cybernetics, Tuebingen, Germany.

Thanks to the NENS stipend, I had the opportunity to visit the Institute of Neuroscience at Newcastle University from 1st of March to 14th of April 2011. I am currently in the 3rd year of my PhD project, in which I use extracellular electrophysiology to investigate the encoding of voices, and the influences of faces on the processing of voices, by single neurons in a specialized 'voice' area in the rhesus macaque. My goal for my visit to Newcastle was to learn about functional magnetic resonance imaging (fMRI) in awake nonhuman primate using auditory and audiovisual stimuli.

FMRI is a non-invasive measure of hemodynamic changes in neural activity, and provides a whole-brain overview of brain activation patterns in response to sensory stimulation. Electrophysiological recordings, which I've been using so far, are crucial for understanding function at the level of single neurons. In contrast, fMRI can reveal functional properties of global brain networks involved in processing complex stimuli, thus providing a complementary perspective on my research question.

During my stay in Dr Petkov's group I was familiarized with the specific requirements for fMRI data acquisition and analysis methods when using auditory stimulation while imaging awake animals. Beyond the necessary behavioral training of the animals, auditory fMRI data acquisition requires optimized stimulation procedures to overcome the inherent noise produced by MR acquisition itself and obtain robust auditory activity: specific "sparse-sampling" imaging paradigms are used to minimize influences of scanner noise on the auditory cortex fMRI activity, and allow sounds to be presented during silent periods between image acquisition. Various scanning parameters have to be optimized for imaging auditory cortex, due to its anatomical location. In particular, I assisted in setting up and scanning awake behaving monkeys, learning both about the specific requirements for hardware, software, scanner setting and experimental paradigm to optimize the animal's behavior as well as sound stimulation, BOLD signal strength and image resolution in auditory cortex. In combination with multiple readings, I was taught by Dr Petkov in numerous discussions about the rationale, applications, advantages and limits of various commonly used preprocessing steps and data analysis methods. Increasing my awareness of the limitations of fMRI data and its analyses with respect to electrophysiology was crucial in developing my critical understanding of the relevant literature in both humans and monkeys, and will allow me to work more flexibly in collaborations combining the two techniques in the future.

This introduction to auditory, awake monkey fMRI was a very valuable way to diversify my technical skills, and a provided a different perspective on my research questions. I also found it extremely productive to be integrated in the stimulating research environment at Newcastle University: I attended talks by visitors and lab members on a variety of research projects, and greatly benefited from many interactions with other students and scientists. Indeed, since the Institute for Neuroscience has a slightly different focus than my home laboratory, it was very enriching for me to be exposed to my coworkers' new perspectives while discussing various topics and getting feedback from them on my work. Finally, Dr Petkov and I plan to build on this training visit by continuing to collaborate on the project we started, which aims at complementing my previously acquired electrophysiological data on the visual influences of voices on the processing of faces with fMRI data.