University of Basel

Departement Biomedizin Basel

MASTER THESIS RESEARCH PROJECT IN SYSTEMS NEUROSCIENCE:

How does the perception of time enfold through the auditory system

The sensation of time on a scale from milliseconds to seconds is necessary for learning and behavior, such as communication, sensory-motor processing etc. Time perception has an intimate connection to the sensory features of the event. Stimulus intensity, as well as optogenetic manipulation of primary somatosensory cortex alters perceived duration of a tactile stimulus (Reinartz et al., The sensory code within sense of time | bioRxiv), suggesting a direct non-linear read-out of primary sensory cortices as a mechanism underlying the perception of the passage of time. How can this be transferred to duration coding in the auditory modality, especially given its further differentiation and complexity in processing of the temporal domain? What are the neuronal activity dynamics underlying the read-out of primary sensory areas with coupled stimulus representation (intensity and duration), in order to generate perceptual decisions?

To this end, we designed a single-stimulus auditory categorization task, where mice are trained to classify naturalistic sound textures according to their duration. Applying multi-channel electrophysiology (potentially 2-photon and wide field calcium imaging), we intend to record neuronal activity in primary auditory cortices, and probe the behavioral relevance of underlying neuronal correlates optogenetically.

Methods applied and experience obtained during the apprenticeship

Mouse behavioral training in a highly controlled psychophysical setup, learning and application of psychometric analysis, introduction to electrophysiological & optogenetic methodology, potentially insights to 2-photon calcium imaging.

Specific Requirements

Strong interest in understanding the brain and its relation to behavior. Motivation and patience to train mice in a behavioral task. Experience with Matlab analysis is desirable, motivation to learn it is necessary.

Supervision & Contact

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Prof. Tania Rinaldi Barkat,
tania.barkat@unibas.ch, Brain & Sound Lab (www.brainsoundlab.com)

Location

The project will take place in the Brain and Sound Lab directed by Prof. Tania Rinaldi Barkat at Basel University, Switzerland. The aim of the lab is to understand the role of neuronal circuits in making sense of sounds. We use a systems neuroscience approach and combine optogenetics, in vivo electrophysiology, functional imaging, behavioral assays, cochlear implants and computer modeling to explore the functions of neuronal circuits in the mouse central auditory system.