

P10.02 Development and preclinical validation of a modular multimodal read-write neural interface

Klaudia Csikós^{1,2}, Domonkos Horváth^{1,2}, István Homolya¹, Dries Kil³, Julio Loera², Alan Urban³, Ábel Petik^{1,2}, Klaudia Spitzer¹, Attila B. Dobos¹, Zoltán Vidnyánszky¹, Daniel Hillier^{1,2,4}

¹ Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary

² Pázmány Péter Catholic University, Faculty of Information Technology and Bionics, Budapest, Hungary

³ Neuro-Electronics Research Flanders, Leuven, Belgium

⁴ German Primate Center, Visual Circuits and Repair Group, Gottingen, Germany

Understanding brain function represents the foundation of new therapies that target diseases of the central nervous system. During the past century, multiple technologies have been developed to record neuronal activity. Each brain activity access technology offers complementary advantages for investigating neural circuits at the microscale, mesoscale, and macroscale with different spatial and temporal resolutions. Since no single method offers access across these scales, probing the same population of neurons using different techniques is necessary to understand the integrated function of brain networks. Here, we present a novel modular chronic neural interface for monitoring and manipulating neural activity. The interface allowed us to perform mesoscale measurements with functional ultrasound technology in freely behaving animals, at an order of magnitude better spatiotemporal resolution compared to classical fMRI methods. Thus, we establish a new method that merges macroscopic (MRI), mesoscopic (fUSI), and microscopic (optical imaging) modalities providing the opportunity to understand brain function in large animal preclinical species that was not possible before.

This work was supported by icGEB grant CRP/HUN20-01, by the Lendület ("Momentum") Programme of the Hungarian Academy of Sciences to DH and New National Excellence Programme ÚNKP-21-2-II-PPKE-84 grant as well as by project no.129120 that has been implemented with the support provided by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the FK18 funding scheme.