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Towards an Investigational Platform for a Multimodal Neuromodulation Approach

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Over the past decades, neuromodulation has been proven to be an effective treatment for several neurological disorders. Moreover, it continues to be a rapidly evolving field with a wide-ranging potential for biomedical applications. However, efficient and patient-specific targeted neuromodulation remains one of the biggest challenges for implantable devices.

Current studies explore the possibility of using multimodal neuromodulation techniques by combining electrical, thermal, optical, ultrasonic, and/or pharmacological methods to increase the specificity of therapies.[1] Moreover, it is hypothesized that the safety profiles and spatiotemporal resolution could potentially increase by combining electrical and ultrasonic methods into a hybrid neuromodulation technique.[2] Low-intensity focused ultrasound has the potential to alter the neural response in a wide range of neuronal targets, with an improved spatial resolution.[3,4] However, the most effective, reliable, and safe acoustic parameters are currently unknown, especially for the peripheral nervous system, due to the little understanding of the mechanisms that govern this method.[5]

In this study, we propose an investigational platform that will allow us to explore a variety of ultrasound parameters for a multimodal neuromodulation approach. The platform integrates a custom-adapted system for stimulation and neural recording, commercially available components for the ultrasound stimulation system, and an experimental control unit with a PC interface. The proposed setup facilitates the evaluation of the tested parameters during experiments on explanted nerve models. Here we will describe potential implementations of such a system and discuss challenges that can be faced during experiments on explanted nerves.

This work can be useful to increase our understanding of ultrasound neuromodulation on peripheral nerves and its benefits when integrated into a hybrid platform dedicated to multimodal neuromodulation

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