

Hubert H. Lim:

“Non-invasive and Integrative Neuromodulation Approaches Towards Treating Tinnitus”

Over the past decade, there has been growing excitement and opportunities for new invasive and noninvasive technologies for interfacing with the nervous system to treat various brain and health disorders. Multiple funding agencies and several high-profile companies (e.g., Google, GSK, Facebook, Neuralink, Kernel) have invested hundreds of millions of dollars into developing novel neural devices that can seamlessly integrate with the human body to restore or enhance function. These emerging technologies will open up new research and clinical opportunities for the tinnitus field. In my talk, I will introduce several existing neural technologies, some of which are being explored for tinnitus treatment, and provide a glimpse of what is envisioned for the future by several funding agencies and companies. I will then share my own journey to develop a tinnitus treatment, beginning with my early work in invasive brain stimulation approaches that expanded towards noninvasive stimulation methods of the brain and peripheral nerves. Ongoing research in my lab has revealed the benefits of combining multiple stimulation modalities (e.g., sound and electrical stimulation) and sensory inputs (e.g., auditory and somatosensory) to drive enhanced plasticity in the auditory brain that could be relevant for tinnitus treatment. In particular, the selection of stimulus patterns and timing between sensory inputs can systematically increase or decrease firing patterns in the auditory midbrain and cortex. Other factors such as stress and attention also significantly alter the type of plasticity elicited within the brain. These findings reveal the potential for multi-modal neuromodulation in stimulating multiple sensory inputs to treat tinnitus. Furthermore, incorporating methods to promote relaxation and active engagement by the patient together with multimodal stimulation could lead to a more personalized and greater therapeutic effect for each tinnitus patient