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Non-invasive Neuromodulation for Reversible Modulation of Neural Activity

A method for targeted modulation of neural activity using transcranial low intensity focused ultrasound.

IP Status: Pending US Continuation; **Application #:** 19/202,430

Targeted suppression of neural activity

Non-invasive techniques to reversibly modulate neural activity can be valuable in research, diagnostic, and therapeutic applications. Researchers at the University of Minnesota recently discovered that transcranial low-intensity focused ultrasound (tFUS) can reversibly suppress evoked-responses and modulate functions within the nervous system. This technology uses a high-precision dual-mode, phased-array ultrasound system to deliver tFUS neuromodulation signals to target nervous tissues with high spatial resolution (voxel size: < 2 cubic mm). Using specific parameters, tFUS can reversibly modulate neural activity by non-invasively heating a spatially-restricted volume of neural tissue without histological damage. This technology has also been shown to have superior temporal and spatial resolution when compared to other neuromodulation platforms, such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tcDCS).
Professor Emad Ebbini's team has demonstrated suppression of somatosensory-evoked potentials using tFUS in rodents. Activity suppression is found to be highly correlated and temporally consistent with *in vivo* temperature changes. Noninvasive heating of spatially-restricted volume of neural tissue without damage may provide a method of temporarily suppressing specific neural pathways or controlling networks through multiple foci. This technology may also be useful in investigating the basis of disease and neural function. Focused thermal neuromodulation pairs a method of noninvasive investigation of the underlying locations and networks of diseases of the central nervous system with a monitored treatment platform.

Phase of Development

Prototype developed. *In vivo* study performed in rodents.

Features & Benefits

- Transcranial treatment: non-invasive neuromodulation alternative to drug-based therapy
- High spatial and temporal resolution enables precision target excitation
- Tunable ultrasound parameters for adjustable excitation on-the-fly
- Dual-mode system: simultaneous excitation and imaging for continuous monitoring
- No histological changes or tissue damages

Applications

Technology ID
20180087

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Life Sciences/Human Health
Life Sciences/Medical Devices
Life Sciences/Neuroscience
Software & IT/Algorithms

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- Neuromodulation
- Treatment alternative for drug-based therapy
- Research tool for investigation of functional neural activity
- Neuromodulation for reversible targeted suppression

Researchers

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Publications

Reversible neuroinhibition by focused ultrasound is mediated by a thermal mechanism
Brain stimulation (2019)

Ready for Licensing

This technology is now available for license! The university is excited to partner with industry to see this innovation reach its potential. Please contact us to share your business' needs and your licensing interests in this technology. The license is for the sale, manufacture or use of products claimed by the patents.