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Tunable Neural Electrodes for MRI-Compatible Brain Signal Recordings

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MRI-Compatible Electrode Array Records Brain Signals

An MRI-compatible electrode array records brain physiological signals in animals and humans. The array is manufactured with carbon nanotubes or other nano-structured materials and will be tuned to have a magnetic susceptibility very close to that of brain tissue. Matching the magnetic susceptibilities of the electrode array and brain tissue will highly reduce—or even eliminate—magnetic imaging artifacts. In addition, it will enable simultaneous acquisition of functional MRI (fMRI) images and neural physiological signals at the same spatial location in the brain. The electrodes can be used for MRI after deep brain stimulation (DBS) to determine the effects of treatments for brain disorders such as Parkinson's disease, dystonia, essential tremor, depression, epilepsy, and obsessive compulsive disorder.

Eliminates MRI Artifacts

Normally, electrodes in the brain create a significant artifact that restricts the ability to obtain fMRI data at and near the electrode location. Obtaining co-located and simultaneous fMRI and neural signals will help improve understanding of brain function and its treatment. These novel electrodes can overcome such challenges that currently prevent the use of MRI/fMRI/MRS for investigating the mechanisms underlying DBS treatment and for improving treatment efficacy. No electrode arrays tuned to match brain magnetic susceptibility currently exist. A combination of paramagnetic and diamagnetic materials in the appropriate volume ratios achieves a tuned magnetic susceptibility equal to that of brain tissue, and doing so can eliminate magnetic image artifacts that hinder current technologies.

BENEFITS AND FEATURES:

- Tuned electrodes for MRI; magnetic susceptibility close to brain tissue
- MR imaging artifacts highly reduced or even eliminated
- Simultaneous acquisition of functional MRI (fMRI) images and neural physiological signals at the same spatial location in the brain
- Carbon nanotubes (films) or nano-structured materials offer increased surface area in contact with the brain with good signal and high conductivity
- Improved neural signal acquisition

APPLICATIONS:

- Deep brain stimulation (DBS)
- Treating brain disorders (e.g., Parkinson’s disease, dystonia, essential tremor, depression, epilepsy and obsessive-compulsive disorder)

Phase of Development - Prototype development

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