Background

Understanding the function of a brain region requires manipulation of that region. Noninvasive, temporary and reversible manipulation of the brain, such as transcranial magnetic stimulation (TMS), is needed to study the brain in healthy and disease.

When single pulses or short bursts of TMS are used on the cortex, they can cause temporary and reversible perturbations on neuronal activities or create "virtual lesions", making TMS ideally suited for causal study of the human brain.

Current TMS coils are not optimal for such studies as:

i) a standard figure-8 TMS coil has a large size (10cm) difficult to fit into a head coil;

ii) it experiences a large force that causes vibration making it difficult to hold and induces serious imaging artifacts during the 100 msec immediately following a TMS stimulation pulse;

iii) it has a large stimulation focality (2cmx2cm at the cortical surface), making it difficult to resolve a column region in the mm scale for studying brain network dynamics.

Technology Summary

This invention provides systems and methods for focal transcranial magnetic stimulation (fTMS). Methods include generating a high focality localized current and applying the high focality localized current to a cortex of a subject.

Fig. 1 a) Cross sections of various wires. The plate of rectangular cross section (right), an extreme case to the classic I-beam (mid), is advantageous over the standard circular wire (left) in stress tolerance, heat convection and skin effect. b) An effective current plate (blue) in flat U shape generates a focal field in the brain below (cone).

c) An I-beam shape design.

Fig. 2. Induced electric current density at cortex 2 cm away from the figure-8 coil (left) and a U-shape fTMS coil (right). U-coil has 1/173 of figure8-coil scalp footprint, delivers 20% higher peak stimulation, and reduces focal area by half.

Technology Advantages

- Noninvasive, temporary and reversible intervention of the brain
- Allows stimulation within an MRI machine
- Reducing the stimulation focality at the cortex by 100 fold, enabling stimulation resolution of brain circuit elements at mm size

Licensing Contact

Vibhu Sachdev, JD
Technology Licensing Officer
(212) 746-6187, sachdev@cornell.edu