# Improved Brain-Computer Interface Technology for Long-Term Cortical Stimulation or Recording

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## Technology description

Brain-computer interface (BCI) technology has the potential to create new treatments for severe motor impairment. Devices to acquire signals from the brain are essential components of BCI systems. For example, clinical cortical monitoring devices are used routinely for monitoring and mapping epilepsy activity. Recording and interpreting electrical signals from the cortex has been used for BCIs that can enhance communication for individuals with conditions such as spinal cord injury or amyotrophic lateral sclerosis (ALS). And therapeutic stimulation of the brain has been used to rehabilitate stroke patients, alleviate chronic pain and control seizures.

Current devices for these applications include invasive penetrating microelectrodes and electrocorticographic (ECoG) electrodes that lay on the cortical surface. However, these devices are much larger than necessary, often are made with sub-optimal materials and may not be compatible with physiological environments. UW-Madison researchers have developed a thin-film microelectrode array that is tailored specifically for long-term, minimally invasive cortical recording or stimulation. The array includes a new type of electrode, called a "micro-electrocorticographic (μECoG) electrode," which is significantly smaller, more flexible and less invasive than existing brain recording or stimulating electrodes.

The microelectrode array is implanted in the cranium of an individual in a contracted configuration. Then a predetermined stimulus, such as voltage, causes a flexible element to unfurl the electrode structure to its expanded configuration. An array of contacts, which is linked to a control module, is included on the flexible element. These contacts engage the cortical surface to record or stimulate brain signals when the microelectrodes are in the expanded position.
The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a thin-film microelectrode array designed for long-term, minimally-invasive cortical recording or stimulation.

## Application area

Long-term, minimally invasive cortical recording or stimulation for applications including ALS, epilepsy, stroke rehabilitation, obesity control and smoking cessation

## Advantages

Electrode diameters and inter-electrode distances are on the order of 100s of μms, resulting in improved signal-to-noise ratio and higher spatial resolution as compared to current electrodes.
Electrodes are flexible and have a small footprint, making them amenable to minimally invasive surgical implantation procedures, including endoscopic approaches.
Three-dimensional shape is less invasive and aids in the delivery of the device to the surface of the brain.
Bioactive organic compounds may be included on the array to provide an optimal implant environment and increase the amount of time the array can be maintained in the cranium without inducing an excessive immune response.
Microelectrodes also may include chemicals or drugs to treat neurological disorders.
Array is simple and inexpensive to fabricate.

## Institution

Wisconsin Alumni Research Foundation

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