Nature Biomedical Engineering Journal selects MSU research as a Top 10 highlight addressing health challenges

Medical advances in the use of brain implants are strengthening treatment possibilities for brain injuries and neurological diseases, such as Parkinson's and Alzheimer's. Unfortunately, using implants still has a major drawback - scar tissue that forms around the implant severely limits its function.

Research in the Michigan State University College of Engineering has uncovered an insight that may provide valuable design improvements for future devices.

Erin Purcell, assistant professor of biomedical engineering and electrical and computer engineering, and her PhD student Joseph Salatino, have revealed the complexity of interactions between brain implants and the cells that they interface, where the supporting cells have a more important role in determining device function than previously thought.

Their research has been published in Nature Biomedical Engineering Journal and was selected among its Top 10 articles addressing outstanding health challenges.

"Today's new implantable devices can read-out and write-in electrical and chemical signals to and from the nervous system," Purcell explained. "That has created unprecedented opportunities to understand brain function and treat neurological disease or injury, including Parkinson's and Alzheimer's diseases, depression, Tourette's Syndrome, deafness, blindness, stroke and tinnitus.

"Following implantation the brain mounts a foreign body response to the device and the subsequent 'scar' tissue
surrounding a device can severely limit its long-term function."

These support cells, called glia, play a primary role in encapsulating the implants, she continued.

In the *Nature* article, *Glial responses to implanted electrodes in the brain*, Purcell’s research team reframed the view of the support cells and suggested they should be considered “dynamic regulators” of neuron networks.

“As such, the article positions glia as an active determinant of the performance and therapeutic effects of devices implanted in the brain. We expect these findings to inform new device designs that can improve treatment outcomes for a broad spectrum of patients suffering from neurological diseases.”

Purcell’s research team works in the MSU Regenerative Electrode Interface Laboratory and is collaborating with Kip Ludwig from the Mayo Clinic and TK Kozai from the University of Pittsburgh. Her efforts are currently supported by two National Institutes of Health grants.

**MSU Regenerative Electrode Interface Laboratory**

Research in the Regenerative Electrode Interface Laboratory is focused on improving and redefining the connectivity of electrode arrays implanted in the brain with the neural circuitry that they are intended to interface.
In a lab setting, these devices are used to understand the role of neural activity in a variety of neuroscience research applications. In the clinic, they can be used to restore sensory and motor function for patients suffering from the debilitating effects of neurological injury and disease.

“Our research goals are to characterize the integration of implanted electrodes with the neural tissue they record or stimulate and develop approaches to improve the fidelity and patency of the interface. We envision connecting individual electrode sites and specific neuronal subtypes using a combination of genetic reprogramming, optogenetics, histology, and electrophysiology,” she added.

Related Website: Communications contact: Patricia Mroczek

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