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Study supports widespread use of brain research probes in epilepsy patients

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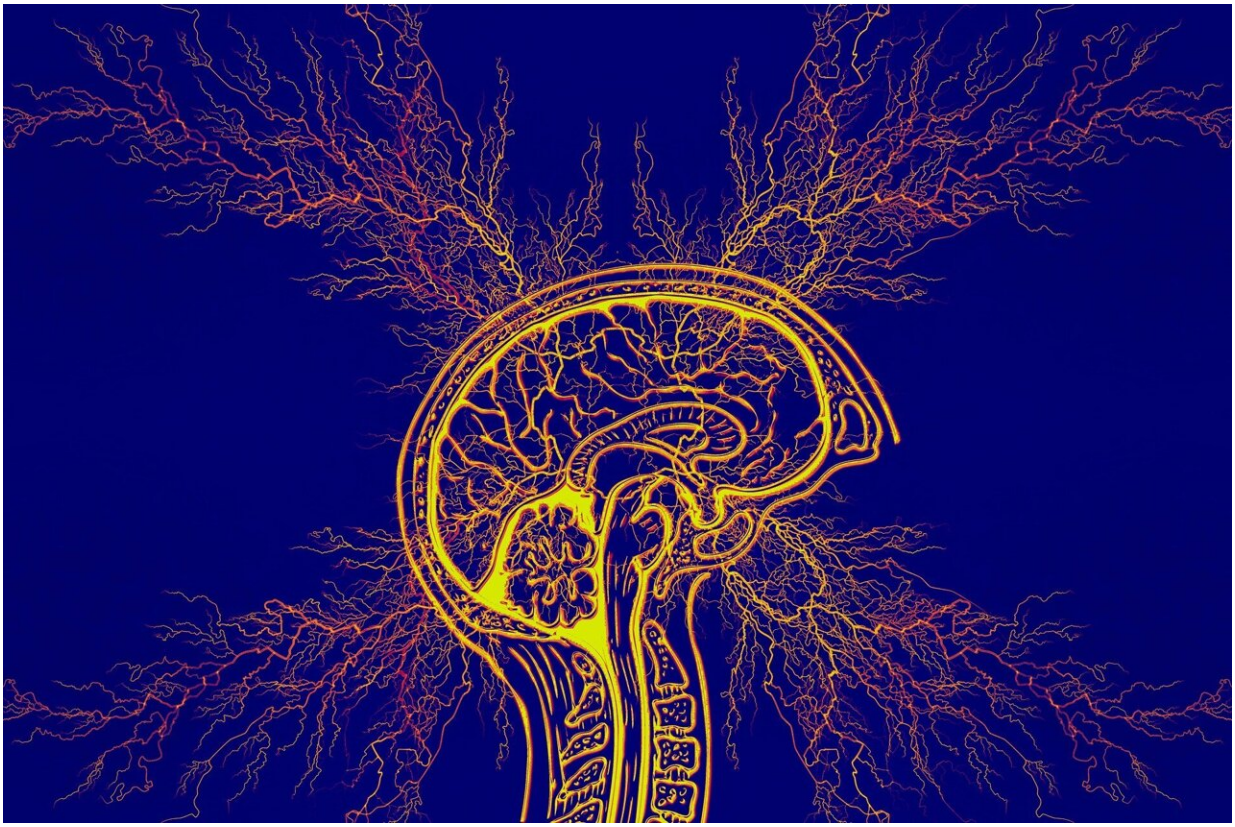

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Electrodes designed to collect research data while also locating epileptic seizures in the brain perform about as well as electrodes designed solely to locate seizures, according to Rutgers and UCLA researchers.

"The finding could increase the usage of these electrodes, which provide valuable information about how the brain works," said Yasunori Nagahama, director of pediatric epilepsy surgery at Robert Wood Johnson Medical School and lead author of a new study published in the *Journal of Neurosurgery*. "More information could improve treatment of epilepsy and other conditions."

According to the Centers for Disease Control and Prevention, some 3.4 million Americans have epilepsy (recurrent seizures), and about a third of them get little relief from medication. Surgery can reduce or eliminate seizures—if surgeons can determine precisely where the seizures originate.

Surgeons often seek the faulty tissue by placing electrodes into the brain and leaving them, often for weeks on end, to collect seizure data.

Behnke-Fried electrodes, named for the UCLA researchers who invented them nearly 30 years ago, combine an electrode with tiny wires that extend into the brain to collect additional information, either from groups of neurons or at the single-neuron level.

The new study examined outcomes for 218 patients after implantation with the Behnke-Fried electrodes. Surgeons installed an average of 10 electrodes into each patient and monitored feedback (in the hospital) for an average of 12 days.

All results were comparable with those from standard probes. The electrodes allowed doctors to find epilepsy networks in nearly 88 percent of patients. Nearly two-thirds of the patients who subsequently underwent surgical resection achieved freedom from seizures, and three-quarters of those who opted for neurostimulation saw seizure rates decline by 50 percent or more.

Only two significant complications arose from electrode implantation: one hemorrhage and one infection. The extra wires used to collect research data from patient brains showed no signs of damaging patients, researchers said.

"There was no expectation that the electrodes used in this study would outperform standard electrodes in locating seizure origins," said Nagahama, who trained under the electrode's co-inventor, Itzhak Fried, as a fellow at UCLA's neurosurgery program. "The intent was to discover whether they worked as well as standard probes and were thus suitable for widespread usage."

Nagahama said he believes their performance in this study was strong enough to support widespread usage and create a large and valuable source of information about how the brain functions.

Even with the limited use of Behnke-Fried electrodes to date, the research data they have collected has led to numerous significant discoveries, Nagahama said.

"Usage has already begun to spread, which should help future research," he said. "As neurosurgeons with unique access to the human brain, we must use these unique opportunities to advance our understanding of the human brain to help people suffering from brain conditions."

More information: Yasunori Nagahama et al, Outcome of stereo-electroencephalography with single-unit recording in drug-refractory epilepsy, *Journal of Neurosurgery* (2023). DOI: 10.3171/2023.4.JNS222633

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