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Bioengineering professor Dr. Leon Iasemidis, along with ASU collaborators, partner universities and medical entities, was among the first to prove that epileptic seizures are predictable.

Epilepsy in humans

Stopping seizures before they start

About one percent of the world's population develops epileptic seizures in a lifetime, due to genetic or acquired injuries to the brain. And another 1.1 million Americans suffer from heart attacks – 40,000 of them fatal.

While they are very different medical events, both of these pathological crises are caused by electrical and magnetic anomalies in the brain and heart.

Bioengineering professor Dr. Leon Iasemidis and electrical engineering professor Dr. Kostas Tsakalis have found a mathematical link to these electrical malfunctions that may make it possible to create brain pacemakers that issue warnings or interventions before a seizure begins.

"We were the first group to prove that epileptic seizures are predictable," explains Iasemidis of the mathematical algorithms the team developed to help detect the electromagnetic anomalies.

In the first phase of their research, the team analyzed changes in pre-recorded electrical activities of diseased brains, using actual patient EEGs (brainwave tests). They discovered that seizures always happened after a period of synchronized electromagnetic brain activity.

The team is creating devices that look for those specific electromagnetic patterns, which, when identified, will send an alert to a brain pacemaker (intelligent implanted deep-brain stimulator) that an episode will occur. One patent has been awarded and seven are pending on these discoveries. The goal, Iasemidis explains, is not to stop the seizures themselves, but to re-route the brain's electromagnetic activity back to its normal state – before the occurrence of a seizure.

"We intend to widen the target of our research to include other similarly devastating brain disorders like stroke and heart attacks. Parkinsonian tremors and even sleep apnea could be effectively treated with similar devices," says Iasemidis.

Dr. David Treiman of Phoenix-based Barrow Neurological Institute is also a member of the research team. The research is funded by the National Institutes of Health, the Epilepsy Research Foundation of America and the National Science Foundation.

Leon Iasemidis can be contacted at leon.iasemidis@asu.edu