

## History in the Making: Cook Children's Secures Large NIH Grant to Enhance Pediatric Epilepsy Diagnosis

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Fort Worth, Texas (Feb. 12, 2024) - For the first time in its 105-year history, Cook Children's Medical Center is the recipient of and primary institution for a \$2.3 million research project grant, known as an R01, by the National Institute of Neurological Disorders and Stroke of the National Institutes of Health (NIH).

Awarded for a study initiated and led by Christos Papadelis, Ph.D, director of the Neurosciences Research Center at Cook Children's, the grant (R01NS134944) will fund research using a combination of cutting-edge imaging techniques to better identify the location of seizure origin in children with drug-resistant epilepsy. The R01 is the most prestigious and competitive award given by the NIH and is a marker of academic success.

Nearly 500,000 children nationwide have epilepsy. For 70% of them, medication successfully controls their seizures. But for 30% of children with epilepsy, medications fail to control seizure activity, making them candidates for surgical intervention.

"For kids whose seizures can't be controlled with anti-seizure medication, this is a huge burden for the family and the children," Dr. Papadelis said. "Sometimes these kids have several seizures per day. Often, the best available treatment for them is brain surgery where the neurosurgeon dissects the area of the brain where the seizures originate. If we successfully disable this area, either with laser ablation or with resective or disconnective surgery, we are able to control the seizures and the child can become seizure-free."

For successful brain surgery with minimal complications, precise brain and seizure mapping is crucial to interrupting seizures while also preserving crucial physiological functions of the brain, such as language and movement. In many cases, current techniques in brain mapping for seizure localization can precisely pinpoint where seizure activity originates in the brain, known as the epileptogenic zone. These techniques include electroencephalography (EEG), computed tomography (CT) and magnetic resonance imaging (MRI), as well as other modalities.

But not all seizures have a single point of origin. Some seizures originate from a synchronized network of abnormal electrical activity in the brain. In these cases, one test may point to one location for seizure origin, while another localizes a different area of the brain as the culprit.

"There are several new studies, including ones published by my research teams, that show in these cases it's not a single area of the brain which is involved in the generation of the seizures but, rather, is the whole brain network that is somehow synchronized during seizures," Dr. Papadelis explained.

Neurosurgeons can use intracranial-EEG (iEEG) to help identify epileptogenic networks within a patient, but this test also has limitations, one of them being its invasiveness.

"Many children with epilepsy require an invasive surgery in which we implant electrodes directly into the brain to help us better understand where their seizure activity is starting, prior to us offering a more definitive surgery intending to stop the seizures," said Daniel Hansen, M.D., a Cook Children's pediatric neurosurgeon and medical director of Neuro-Trauma. "Dr. Papadelis' research may potentially lead to not needing this step for some children."

In addition to being invasive, an iEEG only records activity within the area of the brain where the electrodes are placed rather than throughout the entire structure. These testing variations and limitations make it difficult for surgeons to pinpoint the entire zone within the brain where surgery should be performed in order to interrupt the whole of an epileptogenic network.

Dr. Papadelis aims to give neurosurgeons and epileptologists a new method to localize seizure onset more completely.

"A more detailed understanding of seizure networks will allow us to better counsel patients on their true chance of being seizure free after surgery, while also allowing us to be more precise and targeted with our surgeries," Dr. Hansen said.

Dr. Papadelis' study will explore the effectiveness and accuracy of combining the outputs of two types of non-invasive imaging and brain mapping techniques as they're performed simultaneously — magnetoencephalography (MEG) and high-density EEG (HD-EEG). The MEG test measures the magnetic fields produced by the brain's electrical activity, while the HD-EEG records brain activity using more than 500 closely spaced electrodes placed all over a patient's head. Such a setup is unique in the country.

In addition to improved seizure mapping and surgical precision, this new technique may also open the door for children whose cases were previously considered inoperable.

"This type of work potentially helps not only the many difficult cases we currently encounter, but could uncover other cases that would be good surgical candidates, whereas previously they would not have been considered," said M. Scott Perry, M.D.,

epileptologist and head of the Jane and John Justin Institute for Mind Health at Cook Children's. "Take cases of apparent generalized epilepsy, which is essentially epilepsy coming from the whole brain, as an example. In some instances, this is just a more diffuse network that may still be eligible for treatment if we locate the primary hubs."

The study will begin in March 2024 and continue for five years. Dr. Papadelis and his colleagues believe this new seizure mapping technique will give physicians a better read on the scope of their patient's epilepsy, giving more children the chance for a seizure-free future.

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**About Cook Children's Health Care System:** Cook Children's is more than a health care system: we strive to be an extension of your family, growing with your child from their first steps to adulthood. By collaborating to deliver on our Promise—to improve the well-being of every child in our care and our communities, we connect the dots for our patients. Between primary and specialty. Between home and medical home. Between short-term care and long-term health. Based in Fort Worth, Texas, we're 8,000+ dedicated team members strong, passionately caring for over 1.5 million patient encounters each year. Our integrated, not-for-profit organization spans two medical centers (including our new, state-of-the-art location in Prosper), two surgery centers, a physician network, home health services and a health plan. It also includes Child Study Center at Cook Children's, Cook Children's Health Services Inc., and Cook Children's Health Foundation. And our impact extends beyond the borders of Texas. We proudly treat children from virtually every state in the nation and 32 countries. By seeing the world through the eyes of children and their families from all backgrounds, we're able to shape health care suited to them: connected by kindness, imagination and respect—with an extra dose of magical wonder. Discover more at [cookchildrens.org](https://www.cookchildrens.org)