

Brain Blueprint

Le Bonheur utilizes cutting-edge technology and world-class talent for brain mapping

In the fall of 2018, Le Bonheur Children's became the first hospital in the world to install the MEGIN's TRIUX™ neo MEG (magnetoencephalography) system. Staying on the forefront of mapping technology is key to the program's success, said Chief Pediatric Neurologist James Wheless, MD, who also serves as co-director of the Neuroscience Institute.

"We know this has the capability to really benefit children and their families," Wheless said. "If we can do that early on, we can change their entire lives."

TRIUX™ neo MEG provides the capability to map the brain's language, sensory and movement centers with 248 sensors that non-invasively detect the miniscule magnetic fields created by electrical signaling in neurons. MEG recordings can subsequently be superimposed over the patient's CT or structural MRI scan to provide a complete picture of the brain's functional architecture in real-time.

"MEG imaging works by reconstructing activation inside



Le Bonheur is the first hospital in the world to install the newest magnetoencephalography (MEG) technology, the MEGIN's Triux™ neo MEG system.

the brain based on magnetic fields outside of the head that are associated with the electrical activity that goes on in neurons," says Roozbeh Rezaie, PhD, Director of Le Bonheur's Magnetoencephalography (MEG) Laboratory. "MEG often completes the picture and provides a complementary approach to other imaging modalities to provide the

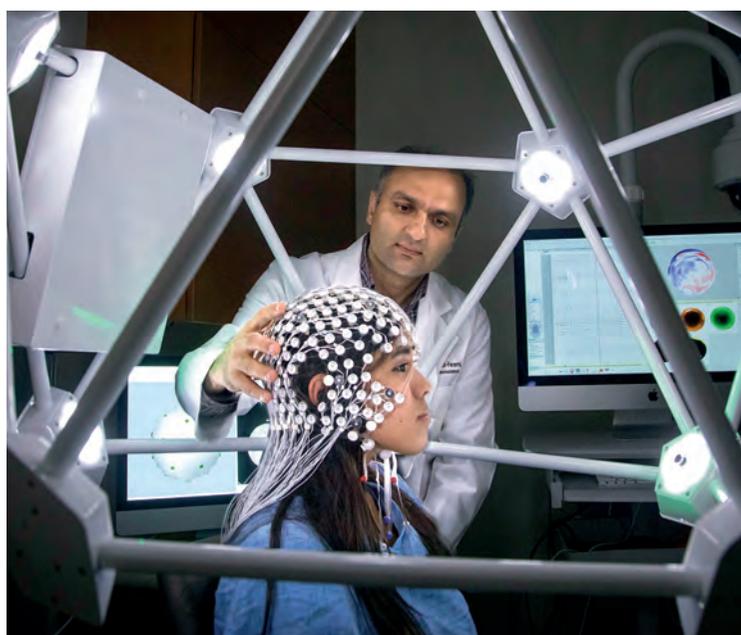
surgeon with an accurate picture of the brain areas responsible for language, sensory and motor functions."

The new MEG provides multiple advantages for neurologists and neurosurgeons. In addition to the large number of sensors and advanced electronic aspects that improve accuracy, mitigate operating costs and suppress noise, the TRIUX™ neo MEG can be utilized to scan patients

who were previously unable undergo testing with MEG due to implanted medical devices.

For children with epilepsy or brain tumors, Le Bonheur's imaging modalities for mapping the brain play a crucial role in determining whether surgery is a good option for a patient.

Even when surgery is the best



Abbas Babajani-Feremi, PhD, uses hd-EEG to locate epileptiform discharges and language function.

"MEG often completes the picture and provides a complementary approach to other imaging modalities to provide the surgeon with an accurate picture of the brain areas responsible for language, sensory and motor functions."

Roozbeh Rezaie, PhD, Director of Le Bonheur's Magnetoencephalography (MEG) Laboratory

Referrals: 866-870-5570

www.lebonheur.org/neuroscience

A pediatric partner with The University of Tennessee Health Science Center/College of Medicine and St. Jude Children's Research Hospital



2018 Le Bonheur Neurosurgery Volumes

**Epilepsy
Surgery Volume**

99*

**Tumor
Surgery Volume**

209*

* Patients, according to Le Bonheur Children's Neuroscience Institute

Continued on page 2

choice, it still carries the risk of removing or injuring a part of the brain that controls functionality – whether it is motor, sensory or language. Brain imaging helps to dictate the options for surgery and predict consequences to functionality of the brain after surgery.

“The different imaging modalities come together to show how aggressive we can be with our brain surgery,” says Frederick Boop, MD, co-director of the Neuroscience Institute and chairman of the Department of Neurosurgery for the University of Tennessee Health Science Center. “For example, if a tumor is near a speech area, we use imaging to prevent injury to that patient’s speech area to preserve speech post-surgery.”

Epilepsy and brain tumors add another level of complexity to brain imaging. The beauty of the brain is its flexibility and ability to restructure its pathways and reorganize the functional areas, said Shalini Narayana, MBBS, PhD, director transcranial magnetic stimulation (TMS) laboratory.

“With imaging we can find the reorganization of the brain due to epilepsy,” Narayana said. The TRIUX™ neo MEG is only one piece of the imaging puzzle. In addition to structural imaging such as MRI and CT, the functional imaging suite is able to utilize multiple functional modalities. Functional MRI (fMRI) is run by the radiology department while magnetoencephalography (MEG), transcranial magnetic stimulation (TMS),



Narayana conducts TMS tests at Le Bonheur to track changes in motor and language systems.

high-density electroencephalogram (hd-EEG) and high-gamma electrocorticography (hgECoG) are run by the pediatric neurology department. All of these modalities work in different ways to provide mapping information about brain function.

Using multiple imaging modalities for surgery is crucial to confirm that mapping is correct — as the adage says, “measure twice, cut once.” The types of imaging that the Neuroscience Institute uses for a patient depend on a variety of factors including age, cognitive ability as well as what functionality needs to be localized.

Brain imaging technology is only as effective as the people who operate it and interpret the results. It’s a big reason why Institute Co-directors Wheless and Boop insisted on recruiting a depth of expertise across the board to improve patient outcomes.

“Most importantly, we have the talent to use the equipment to its maximum potential,” says Boop. “This group has been working together for more than a decade and has more experience than anyone in the country.”

Le Bonheur’s three imaging experts in pediatric neurology — Babajani-Feremi, Narayana and Rezaie — each have their area of expertise.

“We have the manpower here for fast turnaround of brain imaging results,” says Rezaie. “We have access to all resources under one roof. Le Bonheur is a one stop shop with all imaging modalities along one hallway.”

Case Study: Tristan Sudduth *Tuberous sclerosis complex, tonic-clonic seizures*

Bree Sudduth was a new mom, but her gut told her jerks she saw from her son, Tristan, weren’t infantile spasms. With months of no answers and failed treatments, Bree woke up to a shaking bed as Tristan had a tonic-clonic seizure. After months of failing to find adequate care for Tristan, she turned to Le Bonheur.

There Le Bonheur neuroscientists agreed resective surgery would be the best option for Tristan. “Tristan’s seizures failed to respond to numerous medications,” said Tristan’s Neurologist, Stephen Fulton, MD. “His likelihood of responding positively to surgery was much greater than our chances of success with further medical therapy. Our non-invasive imaging and brain mapping of his areas of seizure onset and brain function were critical in planning his surgical resection.”

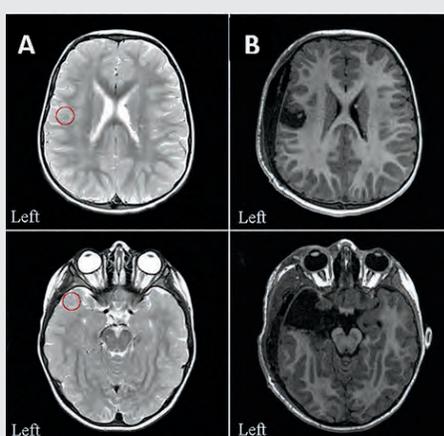
Tristan underwent magnetoencephalography (MEG) testing to determine if seizures were located in the left frontal gyrus - an important area of the brain for language function. Because of the seizure location, neuroscientists wanted to be sure to preserve language function after the resection.

Tristan underwent high-gamma electrocorticography (hgECoG) testing to determine the location of his language cortex, and testing concluded that there was no language cortex close to the tubers which needed to be resected. Abbas Babajani-Feremi, PhD, who conducted Tristan’s brain mapping, speculates that the cortical tuber caused the reorganization of Tristan’s brain.

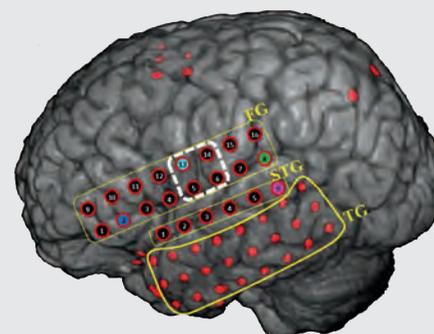
Post-surgery, Tristan has been seizure free for two months – the longest amount of time in his life. He has no language deficit and is making rapid progress in his development. In addition, Tristan is the youngest person ever to undergo successful presurgical language mapping using hgECoG.



Tristan Sudduth, 18 months
Diagnosis: tuberous sclerosis complex, tonic-clonic seizures
Imaging: MEG and hgECoG
Treatment: resective surgery
Result: seizure-free for two months



Pre-surgical MRI (A) shows the locations of two cortical tubers noted by the red circles. Post-surgical MRI (B) shows the areas of resection of two cortical tubers in inferior frontal gyrus and anterior temporal lobe.



This image shows the locations of the subdural grid and strip electrodes. The cortical tuber was underneath four electrodes (FG-5, 6, 13 and 14) marked by a white rectangle. The only electrodes to show high gamma activity during the object naming task were FG-2, FG-8 and STG-6 all of which were far from the tuber. Therefore, surgeons could confidently perform the resective surgery without damage to Tristan’s language.



Le Bonheur neurologists give 16 presentations at AES Annual Meeting

Recently the Neuroscience Institute attended the American Epilepsy Society (AES) Annual Meeting where they gave 16 presentations about the latest research and trials taking place at Le Bonheur's Neuroscience Institute.

Some of the highlights included the "Comprehensive approach to intractable epilepsy" symposium led by James Wheless, MD, "Predicting postoperative language outcome using DWI, fMRI, and MEG" presented by Abbas Babajani-Feremi, PhD, and "Infantile Spasms: Combination Therapy with High Dose ACTH and Vigabatrin" presented by Sarah Weatherspoon, MD.



ABRET grants EEG laboratory a second five-year accreditation

The EEG laboratory at Le Bonheur's Neuroscience Institute recently became the only EEG lab in Tennessee to ever receive a second five-year accreditation from the Laboratory Accreditation Board of ABRET. In order to receive this accreditation, the EEG lab must meet technical standards and demonstrate quality output. Evaluation focuses on the technical component of recordings and lab management issues.

ABRET is a national credentialing board that encourages and promotes quality technical and clinical standards world-wide for neurodiagnostic technologists and laboratories through certification and accreditation.

IN BRIEF

Neuroscience Institute welcomes new neuropsychologists



Billy Holcombe, PhD

Billy Holcombe, PhD, and Jessica Pliego, PhD, recently joined Le Bonheur's Neuroscience Institute.

Holcombe completed a fellowship at Akron Children's Hospital in Pediatric Neuropsychology. He also completed an internship at Children's Hospital of Michigan, Wayne State University School of Medicine.

Pliego completed her postdoctoral pediatric neuropsychology fellowship at University of Colorado School of Medicine and Children's Hospital Colorado. She also has a doctor of Philosophy in School Psychology from Texas A&M University with a specialization in Pediatric Neuropsychology.



Jessica Pliego, PhD

Klimo awarded Pediatrics Paper of the Year

Le Bonheur neurosurgeon Paul Klimo, Jr., MD, MPH, recently won Pediatrics Paper of the Year from the Congress of Neurological Surgeons (CNS) for his paper "Pineoblastoma – The Experience at St. Jude Children's Research Hospital." Klimo studied the treatment of rare pineoblastoma tumors in adolescent patients and documented the outcomes with multimodal therapy and evaluated the impact surgical resection had on survival.



Paul Klimo, MD

Brain Waves is a quarterly publication of the Neuroscience Institute at Le Bonheur Children's Hospital. The institute is a nationally recognized center for evaluation and treatment of nervous system disorders in children and adolescents, ranging from birth defects and learning and behavioral disorders to brain tumors, epilepsy and traumatic injuries.

Institute Co-Directors

Frederick A. Boop, MD
James W. Wheless, MD

Adam Arthur, MD
Abbas Babajani-Feremi, PhD
Elena Caron, MD
Asim F. Choudhri, MD
Michael DeCuyper, MD
Lauren Ditta, MD
Stephanie Einhaus, MD
Lucas Eljovich, MD
Stephen Fulton, MD
Billy D. Holcombe, PhD
Christen Holder, PhD
Masanori Igarashi, MD
Robin Jack, MD
Paul Klimo, MD
Amy McGregor, MD

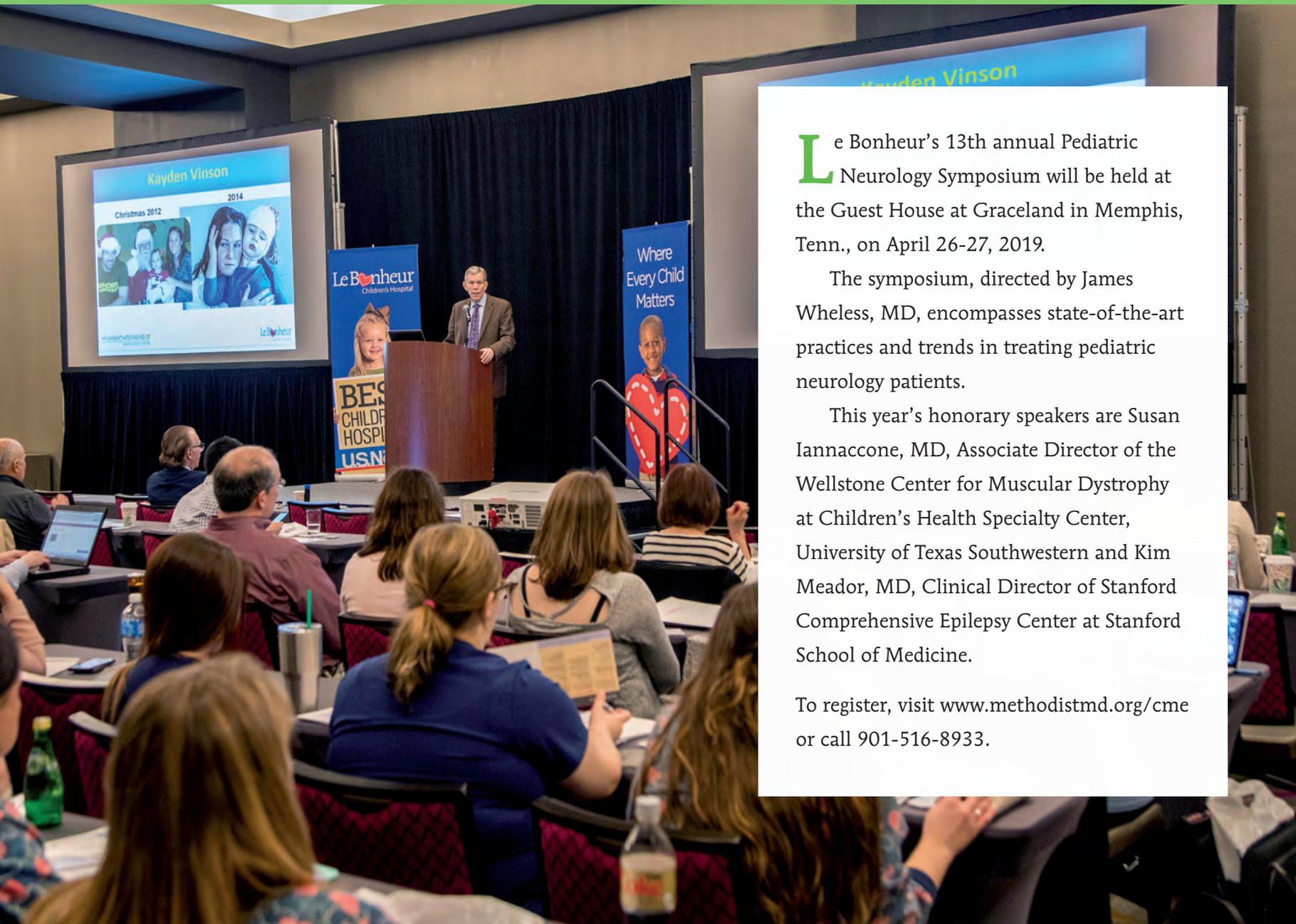
Basan Mudigoudar, MD
Michael S. Muhlbauer, MD
Shalini Narayana, MBBS, PhD
Amy Patterson, MD
Jessica Pliego, PhD
Roozbeh Rezaie, PhD
Mari Rivas-Coppola, MD
Namrata Shah, MD
Adeel Siddiqui, MD
Sarah Weatherspoon, MD

Scan to learn
more about our
Neuroscience Institute.



Registration now open for Pediatric Neurology Symposium

April 26-27, 2019 | The Guest House at Graceland



Le Bonheur's 13th annual Pediatric Neurology Symposium will be held at the Guest House at Graceland in Memphis, Tenn., on April 26-27, 2019.

The symposium, directed by James Wheless, MD, encompasses state-of-the-art practices and trends in treating pediatric neurology patients.

This year's honorary speakers are Susan Iannaccone, MD, Associate Director of the Wellstone Center for Muscular Dystrophy at Children's Health Specialty Center, University of Texas Southwestern and Kim Meador, MD, Clinical Director of Stanford Comprehensive Epilepsy Center at Stanford School of Medicine.

To register, visit www.methodistmd.org/cme or call 901-516-8933.