

Clinical Investigators' Workshops				
Year	Moderator(s)	Title	Description	Speakers
2020	Ellen J. Bubrick, MD; and John M. Stern, MD	Low Intensity Focused Ultrasound for Epilepsy: Early Investigations of Treating Animals and Humans with TLE.	This workshop will address the utility of low intensity focused ultrasound (LIFUS) for epilepsy treatment. LIFUS is a novel, non-invasive form of neuromodulation that has been shown to suppress EEG activity in rodents, and modulate neural tissue of varying locations in humans. One of its advantages lies in its ability to target deep epileptogenic tissue, as opposed to only lateral cortex. Preliminary findings from the two centers investigating LIFUS for temporal lobe epilepsy in adults, as well as data on efficacy and possible mechanisms of LIFUS in an epileptic rat model with TLE will be reported.	Ellen J. Bubrick, MD; John M. Stern, MD; and Martina Mustroph, MD, PhD
2020	Emily Johnson, MD; and Alice D. Lam, MD, PhD	Bi-Directional Relationship Between Late-Onset Epilepsy and Alzheimer's Disease	This workshop will address the increasingly recognized clinical and mechanistic overlap between late-onset epilepsy and Alzheimer's disease and related dementias. We will review recent population-based evidence of this important interaction from large, multi-center longitudinal cohort studies. We will also compare neurophysiologic studies in humans and animal models, across multiple modalities, to derive new insights. Finally, clinical cases highlighting the diversity of presentations and clinical trajectories, diagnostic uncertainties, and other challenges will provide a springboard for discussion on the knowledge gaps, treatment implications, and important directions for future high-impact research at the boundary between epilepsy and Alzheimer's disease.	Emily Johnson, MD; Rani Sarkis, MD, MSc; and Mouhsin Shafi, MD, PhD
2020	Colin Ellis, MD; and Samuel Berkovic, AM, MD, FAA, FRACP, FRS	Genetics in the Clinic: Beyond Monogenic Epilepsies	This workshop will address the clinical relevance of genetics for the broader population of patients with epilepsy. The tremendous progress in gene discovery and the increasing availability of genetic data are thus far largely applicable to subjects with monogenic epilepsies, particularly epileptic encephalopathies. For the vast majority of patients, especially adults, genetic findings do not presently inform diagnosis or management. In this workshop, leading experts will discuss individualized genetic risk assessments (polygenic risk scores), genetic predictors of treatment response (pharmacogenetics), and the role of epigenetics in epileptogenesis and its potential clinical applications.	Karen L. Oliver, MS; Katja Kobow, PhD; and Gianpiero Cavalleri, PhD
2020	Sudha K. Kessler MD, MSCE	Pediatric Epilepsy Clinical Trials: Current and Future Challenges	This workshop will address specific study design challenges in pediatric epilepsy clinical trials related to choosing and defining target populations, defining seizure outcome measures appropriate for a population and therapeutic agent, and integrating meaningful and reliable non-seizure outcome measures. The workshop will also address challenges related to the impending wave of clinical studies involving precision therapies for mutation-specific genetic epilepsies.	Dennis Dlugos, MD; Madison Berl, PhD; and Adam L. Numis, MD
2020	Jorge A. Gonzalez-Martinez, MD, PhD; and Guy M. McKhann II, MD	Functional Mapping in Invasive Brain Recording: Science and Practice	This workshop will address the topic of functional mapping using invasive brain electrodes. In this session, faculty and attendees will discuss, in an interactive and dynamic mode, how the intersection between network dynamic analyses and 3D cortical and subcortical anatomy are applied to map language, motor, and cognitive functions. With the recent rise of SEEG methodology, the workshop will particularly focus on how brain functions and seizure onsets are mapped with SEEG and how this information is utilized to define the margins of SEEG-guided safe resections in eloquent and near eloquent areas.	Catherine Liégeois-Chauvel, PhD; Vejay N. Vakharia, MRCS; and Kareem Zaghoul, MD, PhD
2020	Julia Jacobs, MD; and Gordon C. Teskey, BSc, MSc, PhD	The Postictal State: A Transient Phenomenon with Long-term Consequences?	Many patients suffer from extended recovery after seizure, which usually is referred to as the postictal period. While immediate postictal loss of function is directly clinically evident, long-term implication of postictal changes in brain function are less accessible. This workshop aims to define the length of postictal changes and possible measurements for it. It demonstrates evidence for mechanisms active after the seizures that result in prolonged recovery. It will be discussed whether postictal changes in oxygenation might lead to permanent functional impairment. Based on the observed oxygen changes new avenues to treat patients with prolonged postictal periods will be proposed.	Paolo Federico, BSc, MSc, PhD; Jordan Stewart Farrell, PhD; and Jan Schoenberger, MD
2020	Ross Shegog, PhD; and Barbara C. Jobst, MD, PhD	MEW Network 2.0: Evidence-based epilepsy self-management research and scaling up for broad-based public health impact.	The Managing Epilepsy Well Network (MEW) is a multisite initiative in support of the CDC Epilepsy Program's mission to improve the health and well-being of people with epilepsy. Since 2007 MEW has initiated the development and evaluation of advanced epilepsy self-management programs. RCT studies have demonstrated evidence for program efficacy to improve patient self-management and quality of life and to reduce co-morbidities (depression and memory). Building a robust evidence base for epilepsy self-management programs is important for future scale-up and dissemination. This workshop describes these programs and explores the challenges in bringing evidence-based self-management programs to scale.	Martha Sajatovic, MD; Robin McGee, PhD; Erica K. Johnson, PhD
2020	Jurriaan M. Peters, MD, PhD; and Floor Jansen, MD	Epilepsy Surgery in Tuberous Sclerosis Complex: Research Priorities and Study Design	This workshop will address research priorities and challenges in study design in epilepsy surgery in TSC. TSC is a multilesional and dynamic epileptic encephalopathy which limits surgical success by conventional outcome standards that aim for complete and sustained seizure freedom. Recent advances in surgical techniques, better localization tools, and improved developmental outcomes seen even with seizure reduction, are changing the surgical landscape in TSC. Our speakers will cover both clinical and technical aspects of epilepsy surgery in TSC, research priorities in the field, and challenges in the design of a multi-institutional study. Attendees are actively encouraged to engage in discussion.	Jamie Capal, MD; Jeffrey P. Blount, MD; and Brenda E. Porter, MD, PhD
2019	Daniel Friedman, MD	Wearable Devices: Beyond Seizure Detection	This workshop will address the application of available wearable devices to novel uses beyond simple seizure detection and alerting and discuss ongoing research to leverage available technology to better understand seizure risk, aid in epilepsy diagnosis and dynamically assess disease comorbidities.	Daniel M. Goldenholz, MD, PhD; W. Curt LaFrance Jr., MD, MPH; and Akane Sano, MEng, PhD
2019	Jean Gotman, PhD	Novel Approaches to the Treatment of Epilepsy Caused by Periventricular Nodular Heterotopia (PNH)	This workshop will address the treatment of refractory focal epilepsy caused by PNH, a neuronal migration disorder in which nodules of gray matter are often found in posterior head regions, near ventricles. Patients have been investigated with intracerebral electrodes and epileptogenic regions found in the nodules and in overlying or adjacent cortex. We will review recent EEG and MRI-based functional connectivity studies demonstrating that the nodules are interconnected and are connected to cortex. The selective destruction of some nodules may nevertheless provide a cure to epilepsy and we will discuss the possible impact of connectivity studies on treatment approaches.	Francois Dubeau, MD; Hui Ming Khoo, MD, PhD; and Laura Tassi, MD

2019	Brenda E. Porter, MD, PhD; and Eric Marsh, MD, PhD	Gene Therapy for Developmental Epileptic Encephalopathies	This workshop will address the number of unique genetic etiologies causing developmental epileptic encephalopathies continues to expand. Treatment with disease specific small molecule therapies is slowly improving seizure control but not treating the fundamental pathophysiology underlying these disorders. Gene therapy has moved into clinical practice in a few neurologic disorders and is poised to do so in multiple other disorders including the developmental epileptic encephalopathies. The workshop will focus on how to design animal model studies of gene therapy, clinical trial design and perspective of a company trying to bring gene therapies to patients.	Timothy Benke, MD, PhD; Rachel Bailey, PhD; and Barry Ticho, MD, PhD
2019	Carrie R. McDonald, PhD; and Leonardo Bonilha, MD, PhD	New Approaches and Challenges to Modeling Brain Networks Using Large Neuroimaging Databases: Experiences from ENIGMA-Epilepsy and the Epilepsy Connectome Project	This workshop will address unique challenges and opportunities related to using large imaging databases to identify common structural and functional brain network alterations in epilepsy. We will rationalize approaches to data harmonization, network modeling, and statistical approaches that have been employed in the two largest epilepsy imaging projects worldwide —the ENIGMA-Epilepsy Consortium and the Epilepsy Connectome Project, and demonstrate how these datasets can provide a new platform for mechanistic and clinical translational discoveries. Recent work from each group will be presented, covering large-scale meta-analyses to integration of raw data to identify imaging phenotypes and predict cognitive and clinical outcomes.	Carrie R. McDonald, PhD; Boris C. Bernhardt, PhD; and Jeffrey Binder, MD
2019	Aaron F. Struck, MD; and Jan Claassen, MD, PhD	Electrographic Seizures in Acute Brain Injury: Prediction, Significance, and Association with Epileptogenesis.	This workshop will address the emerging topic of continuous EEG monitoring after acute brain injury focusing on the detection and significance of electrographic seizures as well as the link between continuous EEG findings early in the course of brain injury and the eventual developed of post-injury epilepsy.	Aaron F. Struck, MD; Jan Claassen, MD, PhD; and Jennifer A. Kim, MD, PhD
2018	Kevin Staley, MD	Therapeutic trials for neonatal seizures	This workshop is designed to address what has been learned about neonatal seizure therapy and trial design based on three recently completed neonatal anticonvulsant trials. After summaries of key findings from the trials, the workshop will provide a forum for discussion regarding what needs to be done next.	Moderator: Kevin Staley, MD; Speakers: Janet Soul, MD, CM, FRCP, Cynthia Sharpe, MBChB, Geraldine Boylan, PhD
2018	Ellen Bublick, MD	7T MRI: A Translational Frontier in Epilepsy	Improved neuroimaging technologies have advanced the field of epilepsy in important ways over the past several decades. High quality brain MRI has become a cornerstone in the evaluation of epilepsy patients, both in understanding the epilepsy syndrome and in considering possible treatments including surgery. Contrast to noise increases with field strength, as was seen with the advent of 3T as compared to 1.5 T MRI many years ago, which resulted in significantly higher rates of lesion detection in epilepsy patients. We are now on the front of the next wave of neuroimaging advances in epilepsy. In this workshop, speakers will report on their findings using 7T MRI in epilepsy patients at their respective institutions. Dr. Gholipour will discuss functional MRI at 7T, including its use in identification of eloquent cortices and epileptogenic hubs and networks. The discussion will briefly review advantages and limitations of 7T MRI functional sequences, task-based versus resting-state methods, and ongoing clinical research applications. Dr. Guerrini will report on his experience using 7T in lesion detection, specifically of focal cortical dysplasias not visible at conventional field strength, as well as improved characterization of polymicrogyria and its potential implications for diagnosis, genetic studies, and surgical treatment of associated epilepsy. And finally, Dr. Stufflebeam will discuss how 7T MRI can be integrated into a multimodal imaging evaluation with magnetoencephalography (MEG), EEG, and PET data to allow for a more comprehensive investigation of epilepsy patients.	Moderator: Ellen Bublick, MD; Speakers: Taha Gholipour, MD, Renzo Guerrini, MD, Steven Stufflebeam, MD, PhD
2018	Lorenzo Caciagli, MD	Bridging imaging and genetics: focus on endophenotypes	A complex multifactorial etiology, involving the interplay between genetic and environmental factors, is maintained for the most common epilepsies, including temporal lobe epilepsy as well as genetic generalized syndromes. The specific genetic determinants, however, remain less thoroughly defined. To overcome the known limitations of both genome-wide association and case-control genetic studies, a promising approach, first devised by researchers in the field of psychiatry, entails the identification of intermediate phenotypes or endophenotypes, linking the underlying genetic architecture with the observable clinical and behavioral correlates. Endophenotypes are heritable, illness-associated quantitative traits which co-segregate in affected families, but are state-independent and present irrespective of whether the disorder is active or not, such as in unaffected relatives of index cases. By providing quantitative measures pointing to the neural systems affected by the underlying genetic risk, endophenotypes have the potential orient and increase the power of causative gene searches, while overcoming the abundant phenotypical heterogeneity seen in disorders with complex etiologies. In this workshop, we will highlight recent research seeking to identify imaging endophenotypes in focal and generalized epilepsies, and discuss the role of the endophenotype concept to advance the quest for causative genes in epilepsy and other neuropsychiatric disorders, with emphasis on promises, pitfalls and future directions. Graeme Jackson, MD, Professor of Neurology and Deputy Director of the Florey Institute of Neurosciences and Mental Health, Melbourne, Australia, has recently focused on quantitative structural imaging endophenotypes, and will detail studies on patients with temporal lobe epilepsy and their unaffected relatives; Lorenzo Caciagli, MD (Young Investigator Speaker), is a Clinical Research Fellow pursuing a PhD at the UCL Institute of Neurology, Queen Square, London, UK, and will discuss novel research on endophenotypes in genetic generalized epilepsies; Daniel Weinberger, MD, is Professor of Psychiatry, Neurology and Neuroscience at Johns Hopkins University as well as Director and Chief Executive Officer of the Lieber Institute for Brain Development in Baltimore, Maryland. He is one the pioneers of imaging genetics applied to psychiatric disorders, and is an internationally-recognized authority on schizophrenia research. He will critically discuss the applicability of endophenotypes to support gene mapping efforts in neuropsychiatry. An alternative third speaker would be Todd Gould, MD, Professor of Psychiatry and Anatomy Neurobiology at the University of Maryland School of Medicine. Professor Gould is an authority on mood disorder research, and was a close collaborator of the late Professor Irving I. Gottesman, with whom he conducted seminal studies on psychiatric endophenotypes and their potential to aid the development of valid animal models.	Moderator: Mathias Koepp, MD, PhD; Speakers: Lorenzo Caciagli, MD, Saur Alhusani, PhD, Gabriella Blokland, PhD
2018	Victoria Morgan, PhD and Dario Englot, MD, PhD	Neuroimaging Connectivity Studies in Temporal Lobe Epilepsy and Implications for Surgical Therapy	Approximately one-third of temporal lobe epilepsy (TLE) patients experience persistent seizures after surgery, suggesting significant room for improvement. Surgery may sometimes fail because TLE is a more heterogeneous disorder than previously suspected, involving disruption of complex brain networks beyond the mesial temporal	Moderator: Victoria Morgan, PhD; Speakers: Dario Englot, MD, PhD, Leonardo Bonilha, MD, PhD, Joseph Tracy, PhD, ABPP(CN)

2018	Shalini Narayana, PhD	Overcoming Obstacles of Pediatric Pre-surgical Functional Mapping: Is Transcranial Magnetic Stimulation (TMS) the new kid on the block?	Non-invasive functional neuroimaging is essential for pre-surgical planning in management of patients with intractable focal epilepsy and/or brain tumors. However access to some techniques for functional cortical mapping, without sedation, is limited in the pediatric population where many patients lack the capacity to cooperate	Moderator: James Wheless, MD; Speakers: Shalini Narayana, PhD
2017	Dang Nguyen	Structural and functional connectivity of the insula: toward a deeper understanding of insular epilepsy	A better understanding of insular connectivity observed at different spatial scales can improve our understanding of the clinical manifestations of insular epilepsy and increase its recognition. The first theme of this workshop will address the structural connectivity of the insula and the alterations of that connectivity as a consequence of the epileptic condition. The second theme will look at the aberrant functional connectivity of the insula during both spontaneous and electrically-induced epileptiform activity. The panel will explore links between alterations in structural/functional connectivity and clinical manifestations of insular epilepsy.	Moderator: Dang Nguyen, M.D.; Speakers: Jimmy Ghaziri, Ph.D., Younes Zerouali, Ph.D., Philippe Ryvlin, M.D.
2017	Page Pennell and Jaqueline A. French	Incorporating Sex and Gender into Epilepsy Research	This symposium will address both the underlying theory as well as the practical aspects of incorporating sex/gender into your research in a meaningful way. 1)Incorporating sex and gender issues in preclinical epilepsy research – Jaideep Kapur; 2)Lessons learned from recent clinical studies in women with epilepsy: gathering the best data - Lia Ernst; 3)Learning about gender-based issues from "big data"-promise and pitfalls- Alison Pack	Moderators: Page Pennell, M.D., Jacqueline A. French, M.D.; Speakers: Alison Pack, M.D., M.P.H., Lia Ernst, M.D., Jaideep Kapur, M.D., Ph.D.
2017	Cecil Hahn	Seizures among critically ill children: optimizing treatment strategies to improve outcomes	The growing use of continuous EEG monitoring in the pediatric ICU setting has led to growing awareness of the high prevalence of seizures among certain groups of critically ill children. Although higher seizure burdens have been associated with worse short- and long-term outcomes, it remains unclear whether more aggressive seizure management can improve outcomes. This Investigators' Workshop will provide a forum for discussion of the relationship seizures among critically ill children and outcome, and their optimal treatment. The presenters will highlight gaps in knowledge that require further study, and propose strategies for optimal study design. Discussion will be focused on setting research priorities and designing future collaborative studies.	Moderator: Cecil Hahn, M.D.; Speakers: Eric Payne, M.D., M.P.H., F.R.C.P.C., Tobias Loddenkemper, M.D., Nicholas Abend, M.D., M.S.C.E.
2017	Ali Asadi-Pooya	Psychogenic non-epileptic seizures: new developments and future directions	Psychogenic non-epileptic seizures (PNES) are relatively common occurrences in epilepsy centers. However, PNES is a unique condition in that it is largely defined in terms of what it is not rather than what it is. During this workshop, we will first discuss why PNES are important. Then, we will review the recent advances with respect to etiology and management. Finally, we will talk about directions for future research in the field.	Moderator: Ali Asadi-Pooya M.D.; Speakers: Ali A. Asadi-Pooya, M.D., W. Curt LaFrance Jr., M.D., M.P.H., Markus Reuber M.D., Ph.D., F.R.C.P.
2016	William Theodore	Natural Fluctuations Of Epilepsy – Lessons From A Million Seizures	Most approaches to seizure analysis fail to identify "big picture" patterns, because studies sizes are often quite small (<100 patients). Newer methods of applying Big Data to our understanding of seizures are now becoming available. Using the free online tool seizuretracker.com, over one million seizures have been documented by thousands of patients. A growing international collaboration of investigators are now studying this database for large patterns that emerge across hundreds or thousands of patients. What has been revealed has implications for clinical trial design, drug delivery timing, and even types of pharmacologic interventions. During this workshop, individual investigators will provide an overview of how patterns seen in this database can further our understanding of the placebo effect, "seizure clocks", and seizure cluster patterns.	Moderator: William Theodore, M.D. Speakers: Daniel Goldenholz, M.D., Ph.D., Tobias Loddenkemper, M.D., Victor Ferastroaru, M.D.
2016	Jean Gotman	New approaches to the interictal EEG challenge the need to record seizures	Recent advances in the analysis of the interictal EEG/MEG, combined with the increased sensitivity of imaging methods, lead us to ask the question: when is it necessary to record seizures and when can we rely on results from interictal data when considering surgery? Given the high costs of hospitalization and the frequent need to record for many days to obtain seizures, and the complexities associated with medication reduction it is important to review the localizing power of new analysis methods applied to the interictal EEG. We will particularly emphasize High Frequency Oscillations, as seen from scalp EEG or acute corticography, EEG source analysis applied to high density EEG and to MEG, combined EEG-fMRI, and acute corticography in the context of focal cortical dysplasia. These methods can sometimes be complemented by the home video recording of seizures to characterize clinical manifestations. The purpose of the workshop is to discuss if there are particular clinical contexts when analysis of interictal data is sufficiently reliable to avoid the necessity of recording seizures.	Moderator: Jean Gotman, Ph.D. Speakers: Maeike Zijlmans, M.D., Ph.D., Francois Dubeau, M.D., Andre Palmigni, M.D.

2016	Ravindra Arya	Electrocorticographic Language Mapping in Epilepsy Surgery: From Cortical Stimulation to Real-time Dynamic Networks	<p>Pre-surgical localization of language cortex is often necessary in people with drug-resistant epilepsy (DRE) to optimize the surgical resection plan. Electrical cortical stimulation (ECS) is the conventional method for language localization in people undergoing invasive evaluation with implanted subdural electrodes. Typically, this procedure involves sequential stimulation of pairs of subdural electrodes with increasing current to achieve functional inhibition. There is variability in the tasks used to assess functional inhibition, but commonly it includes visual naming. There have been long standing concerns about both the procedure and the choice of task(s). It is a time and resource intensive procedure, which requires sustained patient cooperation in the rather intimidating environment of an epilepsy monitoring unit (EMU), and can be associated with pain from stimulation of dura, or triggering of a seizure. The ecological validity of the tasks used for mapping has also been questioned. These challenges have motivated investigations of the safety and validity of electrocorticographic (ECoG) mapping based on task-related modulation of spectral power to determine language topography. ECoG studies have crystallized important knowledge that cognitive processes in the language network are localized by spectral power changes in high-gamma frequency band. This approach can also be used to study temporal dynamics of language networks. Recent innovations in ECoG mapping have been motivated by a desired to obviate the crucial dependence on patient co-operation for functional mapping, which may be very difficult to obtain in children or patients with intellectual disabilities, and to find a more 'ecologically valid' representation of language networks. As a result, investigators have studied the topography of ECoG spectral modulation associated with natural speech, rather than conventional task-response paradigms. Despite the exciting potential of ECoG mapping, ECS has stood the test of the time and despite many concerns, is still considered 'gold standard' for language localization. In this investigators' workshop, we will comprehensively review the existing state of the pre-surgical language localization with talks devoted to ECS, ECoG mapping and network dynamics both in adults and children, along with recent developments and future implications of the emerging techniques of real-time and natural speech mapping from both clinical and translational neuroscience aspects. We expect to generate rich audience interaction and discussion regarding safety and validity of existing ECoG mapping and outlook regarding the emerging technologies. Speakers: 1. Ravindra Arya, M.D., D.M. (Junior Investigator) Assistant Professor of Neurology and Pediatrics, Comprehensive Epilepsy Center, Division of Neurology, Cincinnati Children's Hospital Medical Center; Cincinnati, OH (Moderator) 2. Prasanna Jayakar, M.D., Ph.D. Chairman, Nicklaus Children's Brain Institute; Adjunct Professor, Florida International University; Miami, Florida 3. Nathan E. Crone, M.D. Co-Director, Clinical Neurophysiology Fellowship Program; Associate Professor of Neurology Epilepsy Center, Department of Neurology; Johns Hopkins University School of Medicine; Baltimore, MD</p>	<p>Moderators: Ravindra Arya, M.D., D.M. Speakers: Ravindra Arya, M.D., D.M., Nathan Crone, M.D., Prasanna Jayakar, M.D., Ph.D.</p>
2016	Matthias Koepp	Epilepsy - a tauopathy?	<p>The link between AD and epilepsy is best described as "shared risk factor association" originating from common underlying risk factors (depression, traumatic brain injury), which are predisposing to the development of both conditions. Classic pharmacological approaches to the treatment or prevention of cognitive decline, and/or epilepsy have failed to substantially reduce their medical and financial burden. In general, we do not know the exact mechanisms underlying epilepsy in AD, or vice-versa. Addressing common pathways and related comorbidities represents an innovative way to develop new, potentially preventative therapies, which has been stagnating for both neurodegeneration and epilepsy, partly due to a lack of clinically validated, sensitive and specific biomarkers to identify the relevant disease-mechanism in individual patients. Biomarkers for early detection and disease monitoring are the pre-requisite to develop innovative, mechanisms-based treatment strategies for both epilepsy and dementia within a personalised health care framework.</p>	<p>Moderator: Matthias Koepp, M.D., Ph.D. Speakers: Xin-You Tai, M.D., Jeffrey Noebels, M.D., Ph.D., Christophe Bernard, Ph.D.</p>
2015	Jeffrey Tenney, MD, PhD	Idiopathic Childhood Epilepsy Syndromes: Can we consider them benign?	<p>Although idiopathic childhood epilepsies such as Childhood Absence Epilepsy (CAE) and Benign Epilepsy with Central Temporal Spikes (BECTS) have been labeled as "benign" syndromes, the clinical course can be variable and prior research has highlighted a variety of cognitive and behavioral co-morbidities. This new, and at times conflicting, information directly impacts the care of children with epilepsy and potentially limits their quality of life. In this investigator workshop Drs. Glauser and Loring will explore the impact of cognitive and behavioral co-morbidities in idiopathic childhood epilepsies. Drs. Tenney and Vannest will discuss the evidence for potential pathophysiological causes of cognitive and behavioral co-morbidities in CAE and BECTS. A forum will be provided to discuss whether CAE and BECTS can be considered "benign" and if there are potential biomarkers to predict which patients are at risk for neuropsychological co-morbidities. The target audience includes neurologists, neuropsychologists, and basic scientists. Dr. Loring is a neuropsychologist with clinical research interests related to the cognitive and behavioral aspects of epilepsy. Dr. Glauser directs the NIH funded CAE clinical trial which has longitudinally followed treatment response and neurocognitive outcomes in this population. Dr. Vannest is a cognitive neuroscientist and neuroimaging researcher who is the PI of a R01 investigating the effect of centrotemporal spikes and seizures on neurocognitive function in patients with BECTS. Dr. Tenney is a junior clinician-researcher focused on understanding the spatiotemporal characteristics of absence seizures and how these relate to clinical characteristics.</p>	<p>Jeffrey Tenney, MD, PhD, Tracy Glauser, MD, David Loring, PhD - 4th Speaker: Jennifer Vannest, PhD</p>
2015	John W. Miller	MR-Guided Stereotactic Laser Ablation of the Hippocampus and Amygdala: Reducing Collateral Damage	<p>MR-guided stereotactic laser ablation is a minimally invasive technique that allows treatment of deeper brain structures with little injury to overlying brain areas that are not involved in the epileptic focus. This system delivers light energy to the target through a small needle introduced through a 3.2 mm hole in the skull, which is directed to the target under stereotactic guidance. The laser produces elevation of the temperature at the end of the needle, destroying the target. The procedure is done in the MR scanner so that the ablation size can be monitored and controlled in real-time. Anterior temporal lobectomy is an invaluable treatment for temporal lobe epilepsy, but is associated with cognitive morbidity, particularly naming and verbal memory problems when the resection is done on the language dominant temporal lobe. There has been disagreement as to whether this morbidity is related to damage to the hippocampus, or to nearby structures such as the temporal stem and other overlying white matter tracts, temporal neocortex or entorhinal cortex. A number of selective amygdalohippocampal operative procedures, and hippocampal radio surgery, reduce, but do not eliminate damage to structures adjacent to the hippocampus. However, laser amygdalohippocampal ablations are done with a posterior approach, which is designed to eliminate injury to all adjacent extrahippocampal temporal structures. This symposium reviews evidence that this approach greatly reduces the cognitive morbidity of surgical treatment of mesial temporal epilepsy, and discusses the theoretical implications of these findings for concepts of the functional anatomy of memory and language in the temporal lobe, and the practical implications for surgical decisions.</p>	<p>Daniel Drane, PhD, Robert Gross, MD, PhD, John W. Miller, MD, PhD</p>

2015	Bernard Chang	Using functional connectivity to target stimulation therapy for epilepsy and its comorbidities	Noninvasive brain modulation using repetitive transcranial magnetic stimulation (rTMS) has been shown in some studies to be effective in reducing seizures in patients with medically refractory epilepsy, but success appears to depend on the ability to target such stimulation properly. In epilepsy associated with deep inaccessible lesions, such as gray matter heterotopia, there is now evidence that resting-state functional connectivity imaging can successfully identify surface cortical regions that show physiological hyperexcitability and may be amenable to noninvasive rTMS. In addition, the efficacy of rTMS used as a clinically indicated treatment for depression, an important epilepsy comorbidity, appears to be linked to the connectivity of the prefrontal stimulation site to deep regions involved in mood regulation. Finally, there are exciting recent data showing that high-frequency rTMS applied to lateral parietal cortex with resting-state connectivity to the hippocampus can enhance associative memory in healthy individuals. The proposed workshop would be an interactive forum in which these data would be briefly presented, followed by a facilitated discussion of how connectivity-guided targeting could be used to optimize brain stimulation as a therapy for seizures and comorbidities of mood and cognition in patients with epilepsy.	Mouhsin Shafi, Michael Fox, Joel Voss
2015	Tobias Loddenkemper	Spikes and cognition: Should we treat spikes?	The role of spiking and non-convulsive status epilepticus on learning memory and cognition is unclear. While several studies indicate that spikes may interfere with learning and memory, EEG is usually not used as a treatment outcome parameter. In particular the pathophysiology of sleep potentiated spiking, and its impact on learning and memory is not completely understood, but involvement of the cortico-thalamic neuronal network as well as hippocampal circuitry have been described. Early developmental injury, specifically early strokes, and/or genetic predisposition may play a role in the potentiation of age-related hyperexcitability in the immature brain. A better understanding of the mechanisms leading to frequent spiking, non-convulsive status epilepticus, and cognitive implications may provide additional therapeutic targets that can improve the outcome of seizures, EEG pattern, and cognitive development in patients with frequent spiking.	Ivan Sanchez Fernandez, MD, David Loring, PhD, Kevin Chapman, MD
2014	Jean Gotman	Yes, focal epilepsy is a network, but does it matter?	There has been a lot of emphasis recently on the networks involved in focal epilepsy, in contrast to the earlier emphasis on the focus itself. Networks have been shown to be involved at the time of interictal discharges with EEG and MEG source analysis, as well as with intracerebral recordings. Networks are revealed when studying responses to intracerebral stimulation. Networks are shown to exist at the time of interictal discharges with fMRI studies and abnormal networks have been demonstrated even in the resting state (between interictal discharges). Of course networks are involved at the time of seizure spread. We would like to raise the question of the importance of these networks in the context of presurgical evaluation. In focal epilepsy, even when a network is involved, there is usually a primary focal area. In what situations should we pay attention to this network, and when should we ignore it?	Christophe Grova, Philippe Kahane, Michael Sperling
2014	Kimford J. Meador, MD	Teratogenesis of Antiepileptic Drugs	Over the last decade, there has been a marked increase in our information concerning differential anatomical and behavioral teratogenic across antiepileptic drugs. This new knowledge directly impacts the medical management of women with epilepsy prior to and during pregnancy. However, there remain large gaps in our knowledge. This investigator workshop will review current evidence from animal and human data on the anatomical and behavioral teratogenesis of different antiepileptic drugs. The presentations will discuss potential mechanisms and highlight the strengths and weaknesses of our present evidence. It will provide a forum for discussion of research priorities and strategies for the future investigations to reduce gaps in our knowledge and improve care for these women. Our target audience includes neurologists, neuropsychologists, epidemiologists and basic scientists.	Patrick Forcelli, PhD – Georgetown U., Page Pennell, MD – Harvard U., Kimford Meador, MD – Stanford U.
2014	Jeffrey Ojemann	Brain connectivity in health and epilepsy	Slow oscillations across brain regions have defined specific functional networks in the healthy brain. Though greatly studied by functional connectivity MRI, these patterns are also apparent in EEG and invasive EEG (electrocorticography). The clinical significance of these networks is not known, but they do seem to cluster in functionally related domains (vision, motor, attention, memory/default mode network). Emerging reports have focused on the disruption of these networks in different epilepsy types, including temporal lobe epilepsy, hemispheric disease, and generalized syndromes. As the field is quite new, the speakers will be relatively junior. An overview of functional networks will be given by the organizer, Dr. Chu-Shore is a junior investigator who is a leader in identification of EEG networks in children with epilepsy. She will present the significance of EEG-identified networks in identification and tracking of the impact of epilepsy on cortical function. Dr. Weaver will review the fcMRI and electrocorticography-measured functional networks and evidence for the significance of disruption of these networks. Dr. Maccotta will discuss his area of expertise in functional networks in the setting of focal epilepsy in adults. The discussion and debate of the workshop is expected to focus on whether the different tools reveal the same networks, whether the findings in epilepsy are consistent or specific and whether a network disruption has any clinical significance. The critical assessment of this rapidly expanding field will be a benefit to those interested in advanced imaging, biomarkers and clinical epilepsy.	Catherine Chu-Shore, Luigi Maccotta, Kurt Weaver
2014	Michael Privitera, MD	Stress and Seizures	Stress is the most commonly reported trigger of seizures in multiple surveys of people with epilepsy. Prior research has identified underlying depression and anxiety as risk factors. Dr. Baram has extensive experience in studying the effects of stress on animal models of epilepsy. Dr. Herman is a world recognized expert on translational stress models of psychiatric illness and funded research applying those models to epilepsy. Dr. Allendorfer is a junior researcher who will have completed a study of fMRI and physiologic measures of patients with stress triggered seizures. Dr. Haut is co-PI of the first RCT of stress management for seizure control in patients with medication resistant epilepsy.	Jane Allendorfer, PhD, Sheryl Haut, MD, Tallie Baram, MD, PhD; 4th speaker James Herman, PhD
2013	Jorge G Burneo	Neurocysticercosis-related Epilepsy	New advances in the pathogenesis of Neurocysticercosis (NCC)-related seizures have increased our knowledge (and have made us aware of our ignorance) about the role of this parasitic infection not only in seizure generation, but also in the possible genesis of MTS in a selected group of patients. Also, new imaging techniques have been found to play an important role in the identification of NCC-related seizure cases that evolve into intractable epilepsy. Finally, the increase of NCC cases reported in the medical literature that require epilepsy surgery to become seizure free, and the peculiar pathological findings in these cases, make a case to have a dedicated session at the AES on this topic. Particularly, since NCC is not only a disease of developing countries, but also a disease seen quite more frequently in North America and Europe.	Alejandro L Escalaya, Gagandeep Singh, Jorge G Burneo

2013	Jack J. Lin, MD	The big picture: How changes in global brain connectivity facilitate epileptic seizures and cognitive deficits	<p>Emerging evidence indicates that the epileptic brain undergoes large-scale changes in cortical and subcortical connectivity in addition to alterations within the epileptic foci. In concert with these diffuse network derangements, the varied epilepsy syndromes also impose cognitive impairments, some of which are broad in nature and shared with other epilepsy syndromes, while others appear specific to the type of epilepsy. The goal of this workshop is to provide an overview on how disrupted brain networks may contribute to the generation of epileptic seizures and cognitive deficits. The workshop will bring together researchers in brain connectivity with emphasis on graph theory, neuroimaging, and neurobehavioral comorbidities of epilepsy to integrate the overarching link between topological properties of brain networks, their modifications by the epilepsies, and the resulting impacts on cognitive functioning. Dr. Marcus Kaiser will first overview graph theory and other techniques for network analyses to characterize the topological and spatial properties of the human connectome, followed by a discussion of organizational changes in the epileptic brain. Dr. Jack Lin will further demonstrate the applicability of these techniques to clinical research and present new findings on the neurodevelopmental alterations of large-scale structural networks in children with new-onset epilepsy. Dr. Bruce Hermann will then present new findings regarding how alterations in large-scale network configurations in the epileptic brain may reduce the efficiency of information transfer, representing a new avenue to understand the disordered neurobiology of cognitive comorbidities in epilepsy. Dr. Leonardo Bonilha will summarize the findings and lead an audience discussion session on how improved understanding of global brain connectivity may provide insights on the underlying mechanism of the epileptic network and treatment strategies.</p>	Marcus Kaiser, PhD, Jack J. Lin, MD, Bruce Hermann, PhD
2013	Cecil Hahn	Seizures Among Critically Ill Children: Epidemiology, Treatment and Outcomes	<p>The growing use of continuous EEG monitoring in the pediatric ICU setting has led to growing awareness of the high prevalence of seizures among certain groups of critically ill children. Yet much remains to be learned about the epidemiology of seizures, their effective treatment, and their impact on outcomes. This Clinical Investigators' Workshop will provide a forum for discussion of the prevalence and risk factors for seizures among critically ill children, their optimal treatment, and emerging evidence regarding their impact on outcome. The presenters will highlight gaps in knowledge that require further study, and propose strategies for optimal study design. Discussion will be focused on setting research priorities and designing future collaborative studies. Speakers and Topics: Nicholas Abend: Seizures in the Pediatric ICU: Epidemiology and Impact Tobias Loddenkemper: Evidence-Based Seizure Management in the Pediatric ICU Cecil Hahn: Designing Clinical Research on Seizures Among Critically Ill Children Objectives 1. To review current evidence regarding the epidemiology of seizures among critically ill children, and their impact on outcomes 2. To review current evidence regarding seizure prophylaxis and treatment among critically ill children, and discuss optimal treatment strategies. 3. To identify gaps in our knowledge of seizures among critically ill children, and discuss strategies for optimal study design. 4. To provide a forum for discussion of research priorities and the planning of collaborative clinical investigation. Our target audience includes pediatric neurologists, clinical neurophysiologists, EEG technologists and neurocritical care physicians with an interest in seizures among critically ill children and the practice of ICU EEG monitoring in children.</p>	Nicholas Abend, Tobias Loddenkemper, Cecil Hahn
2013	Anne Berg, PhD & Brandy Fureman, PhD	"Translating Clinical Research into Clinical Practice and Back Again"	<p>• Substantial information that could improve the diagnosis, treatment, and management of epilepsy has resulted from the last many years of research. The implementation of this knowledge into clinical practice has not always been straightforward and its impact on patient care has not been evaluated. In this workshop, we will address a series of topics regarding the implementation and effectiveness of epilepsy care approaches and procedures. Speakers will discuss the evidence base for efficacy, the evidence base for effectiveness, the challenges to and successes in implementation, and the next series of research questions posed by these challenges. Speaker topics will address models for comprehensive epilepsy care (Lorie Hamiwka), development of clinical pathways to care (Tobias Loddenkemper), and the ways in which emerging genetic diagnostic techniques could revolutionize diagnosis and care (Russell Saneto) of epilepsy. From these perspectives, the next round of clinical research questions will become apparent and should form the focus for future research efforts in clinical epilepsy.</p>	Tobias Loddenkemper, Lorie Hamiwka, Russell Saneto
2012	Stephane Auvin	Comorbidity between epilepsy and autism spectrum disorder: challenges in the diagnosis	<p>There has been a growing interest in neuropsychiatric comorbidities of epilepsy. Autism and Epilepsy is an area of major concern and one of the hardest issues that pediatric specialists (epileptologists, neurologists, pediatricians, psychiatrists, and educators) have to deal with. Although there is a prevalent impression that autism is associated with epilepsy, there are many methodological and diagnostic issues that have not been adequately addressed. This workshop will advance participants understanding of the relation between autism and epilepsy by addressing three primary areas: 1) The definition and diagnostic criteria for autism, the errors in diagnosing autism, and the prevalent use of the diagnosis of autism to obtain services for children who, while having special needs often do not have autism per se. 2) The role of intellectual disability which may be the primary if not the sole factor linking autism and epilepsy. 3) The nature and appearance of autistic features and autism in genetically defined forms of epilepsy. The application for this proposal comes from the Junior Speaker (Stephane Auvin, MD, PhD, Child Epileptologist in Robert Debre Hospital in Paris). My role as the organizer of this CIW will be in stressing the lack of knowledge about the patients with epilepsy and autism. I will also emphasize the high level of misdiagnosis of autism among behavioral disorders and of epilepsy among autism patients (i.e. misinterpretation of behavioral and EEG abnormalities). The CIW faculty will provide the background for the audience discussion by presenting different aspects of Autism and Epilepsy: Rochelle Caplan, M.D., Professor, UCLA Semel Institute for Neuroscience and Human Behavior, will briefly review the diagnostic categories included in autism spectrum disorder (ASD), the criteria for diagnosis, and the differential diagnosis. In discussing the change over time in who is making this diagnosis and how it is being done, she will focus on the diagnostic pitfalls related to ASD in early onset intractable epilepsy and in Landau-Kieffner Syndrome, Electrical Status Epilepticus in Sleep, and Continuous Spikes and Waves during slow Sleep. She will conclude with the need to avoid both over-diagnosis and under-diagnosis of ASD in children with epilepsy. Anne T. Berg, PhD, Professor, Epilepsy Center Childrens Memorial Hospital, Northwestern University, will be the second speaker. She will first describe two common clinical scenarios: patients with epilepsy that develop autism and patients with autism that start epilepsy. She will then describe clinical data such as incidence, age of the onset, type(s) of seizure, risk factors in epilepsy which predispose to the development of autism, and risk factors in primary autism patients which predispose to the evolution of epilepsy. She will finish by discussing the data on EEG findings in patients with autism. Ingrid Scheffer, M.D. Ph.D., Professor at the Epilepsy Research Center, Melbourne will be the third speaker. She will discuss our knowledge about epilepsy syndromes observed in autism patients and epilepsy syndromes leading to autism behavior. She will describe the frequency of autistic features versus autism proper in several genetically homogeneous disorders (tuberous sclerosis, Dravet, EFMR, GLUT1 deficiency) and the relation to intellectual disability She will also stress how challenging it is to differentiate certain types of seizure from autistic behaviors. She will conclude by mentioning the treatment options for these patients.</p>	Rochelle Caplan, Anne Berg, Ingrid Scheffer

2012	Bernasconi, Neda	SEARCHING FOR LESIONS IN 'NONLESIONAL' EPILEPSY	<p>SEARCHING FOR LESIONS IN 'NONLESIONAL' EPILEPSY Moderator: Bernasconi, N (MD PhD) Montreal Neurological Institute Speakers and titles of presentations Speaker - 1: F. Cendes (MD,PhD) University of Campinas, Brazil Title: Strategies for MRI visual evaluation Speaker - 2: A. Bernasconi (MD) Montreal Neurological Institute, Montreal, Canada Title: Image processing: new prospects for structural MRI Speaker - 3: F. Chassoux (MD) Sainte-Anne Hospital, Paris, France Title: Diagnostic yield of metabolic imaging MOTIVATION. In up to 50% of patients with drug-resistant focal epilepsy, imaging techniques are unremarkable and thus unable to reveal the potential surgical target. In recent years, it has become increasingly clear that epilepsies that are considered cryptogenic are not necessarily nonlesional, the primary histopathological substrate being focal cortical dysplasia, as shown by surgical series. METHODS. MRI is a pivotal component in the pre-surgical investigation because of its unmatched ability in visualizing structural brain pathology. The evaluation of MR images of patients with epilepsy is generally more demanding than brain imaging in other neurological conditions because abnormalities can be subtle and not easily visualized on routine exams. Dr F. Cendes will discuss strategies to increase the sensitivity of MRI visual evaluation. Advances in computing power and algorithm development have enhanced the area of computational neuroanatomy research. The overall goal of these techniques, when applied to structural MRI, is to improve the detection of subtle abnormalities of brain tissue overlapping with the epileptogenic zone that might go unrecognized or are undetectable on visual inspection. Dr A. Bernasconi will discuss the contribution of image processing to unveil subtle cortical dysplasias. Dr Chassoux will discuss the contribution of FDG-PET to the understanding of metabolic characteristics related to dysplastic lesions, particularly in patients with negative MRI. OBJECTIVES. This workshop will provide participants with: a) strategies to optimize the evaluation of conventional MR images; b) principles of novel structural and metabolic image analysis methods; c) multidisciplinary discussion on new integrative approaches aimed at improving the understanding, diagnosis and management of cryptogenic epilepsy. SUMMARY. Patients with 'nonlesional' epilepsy represent one of the greatest clinical challenges in many tertiary epilepsy centers. This workshop is meant to bring together a panel of experts to discuss state-of-the-art evaluation methods aimed at unveiling epileptogenic lesions and propose new cohesive approaches to evaluate 'nonlesional' epilepsy.</p>	F. Cendes (MD PhD), A. Bernasconi (MD), F. Chassoux (MD)
2012	Prof John S Duncan	3D Multimodal neuroimaging to direct epilepsy surgery	<p>Successful epilepsy surgery depends on removing the epileptogenic zone and not causing damage to eloquent cortex or critical white matter tracts that will give rise to a new deficit. Neuronavigation is increasingly used to direct cranial neurosurgery. A recent development has been the ability to display multimodal data including structural MRI, angiography, venography, functional MRI of eloquent functions, tractographic representation of critical tracts, PET, ictal SPECT, electrical and magnetic source imaging in a common space. It is now possible to view these data in 3D with stereoscopic visualization combined with orthogonal slices and to interactively use these data to place intracranial electrodes and to plan resections. The data may also be uploaded into neurosurgical navigation systems and so be available in the operating room. We will present the techniques that are now becoming available, and their limitations, and will debate the utility of these in neurosurgical practice.</p>	Dr Christian Vollmar, Munchen, Germany, Dr Bill Bingaman, Cleveland OHIO, Prof John S Duncan, London, UK
2012	Madison Berl	fMRI task selection for presurgical mapping in children: goals and challenges	<p>fMRI is a staple in presurgical planning but conducting studies with children presents unique challenges. Moreover, although the aim of studies is to plan for surgical resection, clinical studies are also fundamental to advances in cognitive neuroscience and thus considering research aims as well as clinical aims adds another layer to the decision making process when deciding on paradigms. Language paradigms are used regularly; however, this workshop will discuss the challenges that occur including using overt/covert tasks, deciding the optimal scanning protocol when a child is not able to scan for very long or is cognitively delayed, and dealing with movement (Croft). Memory paradigms are not regularly used in children, but would be an important next step in reducing the need for invasive procedures (e.g., Wada). The final two talks will focus on what paradigms have been utilized in children thus far to target hippocampal functioning (Sepeta) and what we know from developmental cognitive neuroscientists regarding hippocampal functioning across development to inform task selection for clinical purposes (Ghetti). Ghetti is a cognitive neuroscientist that is NIH funded to examine memory development in children with multiple neuroimaging techniques. As an expert in her field, she is an outside speaker that will enhance the conversation as it applies to clinical epilepsy populations.</p>	Louise Croft, University College London, Leigh Sepeta, Childrens National Medical Center, Simona Ghetti, UC Davis
2011	Imad Najm	Clinical and Basic Mechanisms of Epilepsy Surgery Failure	<p>Objective: To describe the long-term seizure outcomes and discuss possible clinical and molecular mechanisms of recurrence following epilepsy surgery. Background: Despite various advances in neurophysiological, imaging and surgical evaluation techniques, a sizable number of patients with pharmacoresistant epilepsy exhibit seizure recurrence early (within 6 months) or late (6 months and up to 10 years) following epilepsy surgery. Regardless of the type/lobe of focal resection, half of all recurrences occurred within 4-6 months of surgery, with the rate of seizure recurrence slowing down beyond that point. Late recurrences were rare but not negligible: 10% of patients with recurrent seizures had their first relapse 5 years or later after surgery. Our proposal: We propose to review the recent long term follow up studies regarding the longitudinal seizure outcomes following various types of epilepsy surgeries, and to discuss the clinical and molecular mechanisms of failures. The workshop would consist of the following: 1) Patterns of seizure recurrence after epilepsy surgery: Lara Jehi (30-40 minutes) 2) Clinical predictors and mechanisms of surgical failures (neurophysiological, imaging, and surgical): Andre Palmiini (30-40 minutes) 3) Molecular and cellular mechanisms of surgical failures: the role of "pro-epileptic" cortex, second hits and molecular mechanisms that underlie these concepts will be discussed based on animal data and resected human tissue studies. Imad Najm (30-40 minutes)</p>	Lara Jehi, MD, Andre Palmiini, MD, PhD, Imad Najm, MD
2011	Dang Khoa Nguyen	Refractory insular cortex epilepsy	<p>A significant percentage of patients continue to have seizures after epilepsy surgery. Among the multiple causes, the most obvious ones include failure to remove all of the epileptogenic tissue or incorrect localization of the epileptogenic zone. Recent studies have shown that failure to recognize insular seizures may be responsible for some of these surgical failures. In this workshop, we will review the various clinical presentations of insular cortex epilepsy, the non-invasive and invasive investigation of suspected insular cortex epilepsy and treatment alternatives for this entity. Increased awareness and further understanding of insular cortex epilepsy will hopefully lead to improved recognition of this localization-related syndrome and translate into better epilepsy surgery outcomes.</p>	Dr. Francois Manguire, Dr. Dang Khoa Nguyen, Dr. Alain Bouthillier

2011	Charles Akos Szabo, M.D.	Photosensitive Epilepsy in Humans and Baboons: A Window to Networks Underlying IGE	<p>Photosensitive Epilepsy in Humans and Baboons: A Window to Networks Underlying IGE. Clinical Investigator Workshop Background: While our understanding of the mechanisms underlying focal epilepsies has been driven by epilepsy surgery, our knowledge of the circuits or networks underlying idiopathic generalized epilepsy (IGE) is still limited. Photosensitivity provides a window for the investigation of the mechanisms underlying IGE. Recent advances in the genetics and neuroimaging (fMRI, PET and MRS) in the research of photosensitive epilepsy in humans, complemented by functional neuroimaging and intracranial recordings in the photosensitive baboon, may provide new insights into IGE. Rationale: The goal of this clinical investigator workshop is to provide an update on recent advances in our understanding of mechanisms underlying photosensitive epilepsy and IGE. Furthermore, it will integrate human and animal data and provide a forum to discuss avenues for developing and testing treatments for IGE. Topics: The workshop will consist of three 20-25 minute presentations. The first presenter, Dr. Dorothee Kasteleijn-Nolst Trenite, Chairwoman of the European Consortium on Genetics of Photosensitivity and Visually Sensitive Epilepsies, will introduce the classification of photoparoxysmal and photoconvulsive responses and review clinical and genetic studies of photosensitivity and generalized epilepsies. The second presenter, Dr. Michael Siniatchkin, is an expert in human photosensitivity, using modern clinical neurophysiology- and neuroimaging tools, to unravel underlying networks. The third speaker, Dr. Charles Akos Szabo, Chief of Epilepsy at the University of Texas Health Science Center at San Antonio, and collaborator at the SFBR, will provide new neuroimaging and electrophysiological data from intracranial recordings in the photosensitive baboon. The panel, consisting of the three speakers, will integrate clinical, neuroimaging and electrophysiological data in humans and baboons to better understand the mechanisms underlying IGEs and impact development of therapies in the future.</p>	Charles Akos Szabo, M.D., Dorothee Kasteleijn-Nolst Trenite, M.D., Michael Siniatchkin, M.D.
2011	Barbara Jobst	Pathophysiology of memory dysfunction in epilepsy	<p>Memory impairment in epilepsy is a well described clinical entity but the underlying pathophysiology of the memory deficit associated with seizures remains largely unknown. The workshop is intended to discuss the underlying physiology of memory impairment with epilepsy and the current work that explores underlying mechanisms. Current data pertaining to animals and humans will be explored as well as evidence that is based on imaging as well as neurophysiologic data. There is still controversy whether the underlying disease is responsible for memory impairment in epileptic patients or whether seizures and epileptiform activity by itself is the culprit for memory impairment. The workshop will have four parts with following topics: Dr Jobst will discuss memory processing and impairment thereof during epileptic discharges as measured by intracranial recordings in humans. Dr Koepp will discuss imaging memory networks via f-MRI in frontal lobe epilepsy. Indre Viskontas will discuss dynamic and plastic memory processes in medial temporal lobe as it can be assessed with human microelectrode recordings in epileptic patients. The workshop should enhance the understanding of the pathophysiology of impaired memory processing in patients with epilepsy and should be of interest for all researcher who study memory in epilepsy.</p>	Indre Viscostas, PhD, Matthias Koepp, MD, PhD, Barbara Jobst, MD
2010	Sanjay Sisodiya	Copy number variation in the epilepsies	<p>More and more genetic changes are being identified in the epilepsies. Many of these changes are monogenic, a few oligogenic: these changes tend to segregate with disease, can often be modelled in vitro or engineered into mice, and disease mechanisms explored. The presumption, usually demonstrable, is that the mutation is responsible for disease. However, such Mendelian explanations for disease causation are still relatively uncommon. Genome-wide association studies for epilepsy causation are underway at many centres. Emerging results are tending to suggest that the common variant-common disease hypothesis is unlikely to be applicable to the epilepsies, presumably related to the diversity of conditions being considered. On the other hand, copy number variants are being reported more and more frequently, in both rare and common epilepsies. Whilst there are several reasons to believe these reported structural variants are pathogenic, much work remains to be done to interpret these basic genetic findings for clinical diagnosis, prognosis and broader implications. It is likely that many epilepsies will emerge as 'genomic diseases'. The significance for patients and clinicians treating 'everyday' epilepsies will be explored in this workshop. Dr Scheffer will set the context of genetics in the epilepsies in its broadest interpretation, considering the 'missing heritability' of the epilepsies, the gap between evidence that heritability can be high and the absence of identified causes of the heritability. Dr Helbig will survey the evidence that copy number structural variants are important in the common epilepsies. Dr Sisodiya will consider further genotype-phenotype correlation and how this can be pursued in individual patients to gain a better understanding, and thus clinical application, of these exciting new discoveries in epilepsy genetics. Each speaker has been individually involved directly in the relevant areas of research, and will speak from direct experience.</p>	Ingrid Scheffer, Ingo Helbig, Sanjay Sisodiya
2010	Cynthia L. Harden	De-standardizing antiepileptic therapy development	<p>The safety and efficacy of antiepileptic therapies (AETs) has been assessed using measures and trial designs that have become standardized. Unfortunately, although times have changed, trial designs have not. This has led to enormous difficulty with recruitment of patients as well as a narrow view of possible adverse effects. As a consequence, the standard approach of AET evaluation presents barriers in bringing novel therapies to the patients who need them. We have an urgent need for updated trial designs that are methodologically sound. Furthermore, in order to discover new aspects of how AETs affect people with epilepsy, new outcome measures are needed. For example, to reduce the time that patients are exposed to placebo, time to "n-th" seizure may be a more appropriate outcome than seizure frequency. In some circumstances, when initial efficacy of a drug has already been proven, shorter trials may be appropriate for new indications. Trial duration can (and should) be modeled from prior studies. The risks of AETs also need to be addressed through better methodology; the baseline rate of suicidality in the epilepsy clinical trial population has never been assessed, although the risk of suicide with starting AETs has acquired an FDA warning. The available suicidality scale and its use in the epilepsy population deserves exploration. It also is not clear which of the many available depression scales, is the most appropriate for use in epilepsy studies. Further, possible predictors of behavioral adverse events, such as baseline neuropsychiatric and hormonal status, while potentially accessible in clinical trials, have not been appropriately utilized to date. The clinical impact of inattention and psychomotor slowing that occurs with almost all AETs is also not accurately predicted with current methodology and updated assessment techniques could be employed and evaluated. This clinical workshop will put forth ideas and evidence for using new outcome measures for AET evaluation and provide a forum for discussion of the drawbacks and benefits for patients of de-standardizing AET development.</p>	Jackie French -Time to nth seizure , Birol Emir (from Pfizer)-Shorter trials-does modeling tell us how long?, Andy Kanner -Suicidality and depression scales , Cynthia Harden-Hormones, behavior and inattention affected by AEDs

2010	Andrea Bernasconi, MD - Montreal Neurological Institute and Gaillard W.D., Department of Neuroscience, Children's National Medical Center, Washington, DC	Mapping brain networks in epilepsy: insights from novel EEG, fMRI and morphometric MRI methods	Mapping brain networks in epilepsy: insights from novel EEG, fMRI and morphometric MRI analysis methods Speakers Title: From EEG signal to brain connectivity Name: Fabrice Bartolomei Speaker-2 Title: Mapping local and large scale cortical networks using structural MRI Name: Neda Bernasconi Speaker-3 Title: Functional connectivity in cognitive domains Name: Madison M Berl ABSTRACT Motivation. Studying the relationship between brain structures sustaining epileptogenic networks in epilepsy is crucial to understand consequences of the epileptic process, and its relationship to brain morphology and cognitive functions. This workshop is meant to bring together a panel of experts that have proposed novel frameworks based on EEG, fMRI and structural MRI to assess quantitatively structural and functional brain connectivity. The discussion will focus on the relationship between these independent modalities. Methods. Novel methods analyzing spatial properties of EEG signal in the time and frequency domain and resting state fMRI analyzing temporal correlations of blood-oxygen-level-dependent signals allow localizing areas that participate to epileptogenic networks (F. Bartolomei). fMRI activation studies have mapped functional networks associated with memory and language (M. Berl). Patterns of structural connectivity have been recently assessed using MRI-based morphometric correlational analysis. These methods have provided independent evidence for altered connectivity in epilepsy (N. Bernasconi). Objective. This workshop will provide participants with: a) principles of recent electrophysiological and imaging methods to analyze networks; b) a comprehensive review of data on in vivo mapping of temporo-limbic and language networks; c) multidisciplinary discussion on the pathophysiology of networks remodeling, with emphasis on temporal lobe epilepsy; d) interactions between a broad audience of clinicians and researchers interested in neuroimaging and electrophysiology.	Fabrice Bartolomei, Service de Neurophysiologie Clinique, CHU Timone-264, Marseille, France, Neda Bernasconi, Neuroimaging of Epilepsy Laboratory, Montreal Neurological Institute, Montreal, Canada, Madison M Berl, Department of Neuroscience, Children's National Medical Center, Washington, DC, USA
2010	Rochelle Caplan, M.D., Co-Chair: Bruce Hermann, Ph.D.	Insights from Neuroimaging on Brain Development in Children With "Epilepsy Only"	Children with epilepsy with average intelligence but without neurological handicaps and neuroradiological abnormalities have frequent cognitive, linguistic, and psychopathology comorbidities. However, the structure, function, and underlying neural mechanisms of brain development in the children with and without these comorbidities, an NINDS "comorbidity benchmark," remain unclear and a subject of both clinical and basic science research. This workshop will bring together researchers on comorbidities, neuroimaging, and basic science to integrate the comorbidity and multimodal neuroimaging findings in these children with cognitive and behavioral impairments evident in animal models of seizures. To do this, Bruce Hermann will describe prospective volumetric and morphometric findings and cognition in children with recent onset epilepsy with and without comorbidities. Rochelle Caplan will discuss volumetric, morphometric, and DTI data related to a broad range of psychopathology in children with epilepsy. Hal Blumenfeld will relate ictal fMRI, interictal DTI, and resting functional connectivity in childhood epilepsy, as well as fMRI network abnormalities to direct neuronal recordings in animal models of childhood epilepsy. Integrating the findings of the presenters, Raman Sankar, will start the general discussion on how to model comorbidities of epilepsy in animals to study the neurobiological connection.	Bruce Hermann, Ph.D., Rochelle Caplan, M.D., Hal Blumenfeld, M.D., Ph.D.
2009	Celine Dube	Magnetic Resonance Imaging changes after Prolonged Febrile Seizures and Temporal Lobe Epilepsy: what basic science can learn from clinical studies and vice versa?	The relationship between prolonged febrile seizures (febrile status epilepticus) and temporal lobe epilepsy, remains unclear. Whereas some children develop epilepsy and/ or cognitive deficits after febrile status epilepticus, it is not possible to predict these outcomes for an individual child. Magnetic Resonance Imaging, MRI, holds promise as a biomarker, because MRI changes have been found after seizures in children and in an animal model. However, three major questions remain in both human and animal research of this area: 1. Is MRI predictive of epileptogenesis and/ or cognitive deficits? 2. Which is the optimal imaging modality? 3. What do the MRI changes signify at a cellular and a molecular level? Information about the meaning of these alterations might permit intervention and prevention. The proposed session will bring together clinicians, imagers and scientists to discuss our current understanding of these issues, and provoke interchange and cross-talks. 1. Darrell V Lewis will discuss the MRI changes detected after febrile status epilepticus in humans (FEBSTAT study). 2. Celine Dube will discuss novel and unpublished findings from several modalities of MRI (T2, DTI) in an animal model of prolonged febrile seizures, as well as the underlying pathology of these MRI changes. 3. Olli Grohn will present innovative methodologies applicable to humans and animals for predicting both functional and structural reorganization in limbic circuits involved in epileptogenesis. 4. Devin Binder will discuss novel imaging methods, detecting changes in water content, which are applicable to both humans and rats, and may delineate circuit changes.	Darrell V. Lewis, Celine Dube, Olli Grohn
2009	Daniel Yoshor	Mapping Cortical Function with Intracranial Electrodes: Pushing Beyond Penfield	Dramatic advances in noninvasive methods for mapping cortical function have been rapidly incorporated into the clinical assessment of epilepsy surgery patients. While these techniques are valuable, direct electrical stimulation mapping is still routinely used and is considered the gold standard in the clinical arena. In recent years, a number of groups have refined methods for using electrodes implanted in patients undergoing invasive monitoring for epilepsy in order to carry out research on human cortical function. This workshop will explore how these studies can serve as a powerful adjunct to monkey invasive electrode studies and work with human fMRI, and then review examples of the application of some of the current research methods for studying higher cortical function in patients undergoing invasive monitoring, with an eye towards how the field has advanced beyond the classic methods of Penfield.	Michael Beauchamp - Strengths and limitations of BOLD fMRI: Can invasive human studies help fill some of the gaps?, Geoffrey Ghose - Invasive human recordings as a complement to studies, Itzhak Fried - Activity of individual human neurons as a gateway to understanding perception and memory, Robert Knight - Network properties and neural coding in the human neocortex
2009	Matthias Koepp	Imaging drug-resistance	Recent developments in radiochemistry now allow to image P-glycoprotein function in-vivo. This workshop will focus on the feasibility of non-invasive molecular imaging-methods to study multi-drug resistance in epilepsy. The proposed workshop will outline the development of PET tracers to image P-gp function and its role for the prediction of treatment response. Oliver Langer (or Robert Innis) will present recent developments of both P-gp substrates and blockers as potential radioligands. Heidrun Potschka will focus on Imaging P-gp function in animal models of epilepsy. Philippe Ryvlin will assess the potential of existing PET tracers (MPPF, Flumazenil) for imaging P-gp function in epilepsy, and Matthias Koepp will report on imaging P-gp function using 11C-verapamil in epilepsy in humans.	Oliver Langer (University of Vienna, Austria), Sanjay Sisodia (UCL Institute of Neurology, London, UK), Philippe Ryvlin (Cermep Lyon, Fr), Matthias Koepp (ION London, UK)
2009	Hitten Zaveri and Dennis Spencer	Sensing the brain in epilepsy	The direct measurement of electrical activity from the cortex and subcortical structures has helped define the concept of a seizure focus, helps locate the seizure onset area for epilepsy surgery, and is integral to brain implantable devices. Advances including active sensors, new materials such as thin films, silicon micromachined electrodes, wireless telemetry, solid state and remote power solutions and new fabrication technologies are creating new avenues for multimodal sensing of the brain. Speakers will address new methodologies to measure electrical and neu-rochemical activity and the separate and conjoint analysis of these sensor signals.	Bruce Lanning, PhD, ITN Energy Systems, Daryl Kipke, PhD, University of Michigan, Miguel Nicolelis, MD, PhD, Duke University
2008	Jean Gotman	Metabolic changes during epileptic discharges	Recent studies have demonstrated a variety of metabolic responses during epileptic discharges in humans and animals. This variety reflects the different methodologies used, including SPECT, BOLD-fMRI and intrinsic optical signals, as well as the mechanisms involved at the time of discharges, including normal neurovascular coupling and situations in which blood flow or blood volume do not seem able to keep up with metabolic demand. Intriguing pre-ictal blood flow changes have also been reported. This workshop will present the methods used as well as recent findings in this area.	Amir Schmel, Hal Blumenfeld, Theodore Schwartz, Jean Gotman

2008	Barbara Jobst	Brain stimulation for the treatment of epilepsy: What is the evidence in humans and animals?	Brain stimulation has been proposed as effective treatment for epilepsy. It is currently assessed in several large scale human clinical trials. There have been some animals studies assessing the efficacy of brain stimulation for epilepsy. The workshop is intended to discuss the proposed mechanisms and most effective mode of brain stimulation in humans and animals in epilepsy. Different types of brain stimulation namely deep brain stimulation, cortical and hippocampal continuous or responsive stimulation and their rationale and efficacy are the topic of discussion. The workshop also intends to enhance communication between basic animal research and clinical researchers and share their experience regarding therapeutic brain stimulation. Animal research supporting or not supporting the use of cortical or deep brain stimulation will be presented. Dr Jobst will begin the session by briefly summarizing the current state of the larger scale clinical trials in humans. Dr Boon will present evidence in animals and humans supporting continuous hippocampal stimulation. Dr Velasco will present his work on thalamic stimulation in humans. Dr Lado will expose his studies about the effect thalamic stimulations on seizure frequency in rats and finally, Dr. Mogul will present the advances in responsive stimulation in animal models of epilepsy.	P Boon, University of Gent, Belgium, FA Lado, Albert Einstein College of Medicine, New York , F Velasco, Mexico City, DJ Mogul, Illinois Institute of Technology
2008	Ronit Pressler	The relevance of interictal discharges in childhood epilepsy	Objectives: This workshop session will provide participants with knowledge of the pathophysiology of interictal discharges and the significance of epileptiform activity in neonates (effects on the immature brain) and in older children (effects on cognition and behaviour). Background: Epileptiform discharges not accompanied by obvious clinical events are regarded as subclinical or interictal. They are found in up to 80% of patients with epilepsy but are only weakly related to seizure frequency or seizure severity. Indeed their clinical relevance in highly controversial and a principle of treatment is to avoid over-interpretation of epileptiform activity. Experimental data shows that interictal spikes and ictal discharges are generated by different populations of neuron through different cellular and network mechanisms and may represent a condition that delays or prevents seizure onset. However, in the immature brain both ictal and interictal discharges may cause neuronal cell loss. In older children and adults interictal discharges can be accompanied by brief interruption of cognitive function even in the absence of overt seizures (transitory cognitive impairment). In children with Landau-Kleffner syndrome or epilepsy with continuous spike-waves during slow sleep prolonged nocturnal discharges can have devastating effects on language. Outcome: The multi-disciplinary nature of this workshop provides opportunities for interactions between participants and faculty with diverse backgrounds including basic science, neurology, paediatrics, epileptology, psychiatry and neurophysiology. By bringing together experimental and clinical experience this workshop tries to shed light on a highly controversial topic.	Massimo Avoli , Solomon Moshe, Shlomo Shinnar, Ronit Pressler
2008	Mary Lou Smith and Bill Gaillard	fMRI and memory: advances and promises	This workshop will examine the current evidence for the role of fMRI in understanding the integrity of the medial temporal lobes for memory, primarily in epilepsy but also with perspectives from other clinical populations. Are we ready to use fMRI memory procedures as a reliable clinical tool? There is keen interest in this techniques both to understand the role of different brain structures in aspects of memory (encoding, recall), and also to examine its reliability and validity for surgical planning. This topic was last addressed in a workshop at AES in 2002, but considerable work has been done since that time.	MP McAndrews, J Detre, M Richardson or Powell
2007	Eva Andermann	Pathways of brain development: Genetic and phenotypic characterization of malformations of cortical and cerebellar development	Malformations of cortical development (MCD) present clinically with developmental disabilities and mental retardation, epilepsy and behavioural and psychiatric disorders. MCD were previously believed to result from complex or multifactorial inheritance, and to be related to various extrinsic environmental factors during development. In the past decade, a number of single gene disorders particularly involving neuronal migration have been identified, and the genes have been mapped or cloned. These include lissencephaly, the Miller-Dieker syndrome, subcortical band heterotopia or double cortex syndrome, periventricular nodular heterotopia and schizencephaly. Many of these were found to be inherited as X-linked dominant traits with male lethality. This session will describe the clinical features and the genes and loci involved in the various forms of MCD as well as in Joubert syndrome and related cerebellar malformations. Studies of the inter-relationship of the various genes involved in developmental pathways related to neuronal migration will also be presented.	William B. Dobyns, MD, Christopher A. Walsh, MD, Ph.D, Eva Andermann, MD, Ph.D, FCCMG, James L. Kennedy, MD, FRCP
2007	Matthias Koepp	Imaging brain connectivity - not just pretty pictures	Human cognition is driven by rapidly changing and widely distributed patterns of neural activity, which involve numerous cortical and subcortical regions activated in different combinations and contexts. Functional imaging provides the location of functionally defined cortical regions, but offers rather less insight into how these regions are connected. The study of the anatomy of white matter connections is crucial to our understanding of both normal and abnormal brain function. Investigating the influence of brain circuitry on function and dysfunction has been hindered by the lack of techniques for exploring brain connectivity in vivo. With the advent of diffusion tensor MRI and tractography, we can study these connections in vivo for the first time. Furthermore, this technique can be employed synergistically with clinical, fMRI, PET, and electrophysiological data, in order to obtain insights into both the anatomy and function of these connections. With this knowledge a variety of clinical applications are possible, particularly with regard to epilepsy where the identification and surgical mapping of the relationship of eloquent cortical and subcortical areas to epileptogenic zones can be challenging. Anticipated tuition value for the audience: The multi-disciplinary nature of the proposed workshop provides opportunities for interactions between participants and faculty with diverse backgrounds including pediatric and adult neurology/epileptology, basic neuroscience, medical physics, neurophysiology and neuroradiology. This workshop will outline the evolution of white matter pathway mapping, the basic principles of tractography, its limitations and the role it may play in the treatment of epilepsy. It will provide participants with: a working knowledge of the complexities of diffusion tensor imaging (DTI) -insight into normal brain anatomy that can aid understanding of the cognitive, sensory and motor impairments resulting from localized pathology or damage, or guide interventions -evidence from DTI for the presence of quantitative comparisons of specific white matter pathways in epilepsy or following recovery from surgery -an understanding of the limitations of this technique and its potential to understand disease progression and planning surgical interventions	Peter Basser, Marco Catani, Matthias Koepp
2007	William H Theodore	Disparities of Health Care in Epilepsy Populations	Recent studies suggest substantial disparities in epilepsy treatment across US population subgroups. In some studies, these persist after control for insurance status. Additional reasons for poor treatment access and health care disparities for people with epilepsy may include rural isolation, gender, ethnicity, and lack of public and physician knowledge of modern approaches to epilepsy care. This workshop will present examples of disparities, discuss possible contributing factors, and potential remedies.	William Theodore MD. Introduction, Karen Parko MD. Native Americans and epilepsy, Jose Burneo MD .Disparities in epilepsy surgery, Elizabeth Waterhouse MD. Status epilepticus in an urban setting
2006	Paul Garcia, M.D.	Language localization in surgical planning: Methods and controversies		David Loring, Ph.D., Nathan Crone, M.D., William D. Gaillard, M.D.
2006	William H. Theodore, M.D.	Viruses in human epilepsy		Leon Epstein, M.D., Steven Jacobson, Ph.D., C.G. Bien, M.D.
2006	Andrea Bernasconi, M.D.	Defining hippocampal malformations in epilepsy: From histopathology to MRI		Michel Baulac, M.D., Neda Bernasconi, M.D., Maria Thom, M.D.
2006	Edwin Trevathan, M.D.,	Clinical trials of antiepileptic drugs: Do they answer pertinent clinical questions?		Tracy Glauser, M.D., Jackie French, M.D.
2005	Nicholas M. Barbaro, M.D.	Non-destructive surgical treatment of epilepsy		Robert. R. Goodman, M.D., Ph.D., Robert S. Fisher, M.D., Ph.D., Brian Litt, M.D.
2005	William H. Theodore, M.D.	Serotonin, depression and epilepsy		Csaba Juhasz, M.D., Ivanka Savic, M.D., Wayne Drevets, M.D.
2005	Guy M. McKhann II, M.D.	Hypothalamic hamartomas: Clinical features, treatment options and basic biology		Andre Palmigni, M.D., Jean Regis, M.D., Jack Kerrigan, M.D.

2005	Gregory D. Cascino, M.D.	Sudden unexpected death in epilepsy (SUDEP). Roundtable discussion.		Patricia A. Gibson, M.S.S.W., Vijay Thadani, M.D., Maromi Nei, M.D., Markus Reuber, M.D.
2004	David W. Loring, Ph.D.	Assessing cognitive effects and outcomes of AEDs		Kimford J. Meador, M.D., Gus Baker, Ph.D.
2004	Paul A. Garcia, M.D.	MEG and EEG: Advances and controversies in source localization-related epilepsy		John S. Ebersole, M.D., William Sutherling, M.D.
2004	William D. Gaillard, M.D.	Flumazenil PET in human epilepsy		Csaba Juhasz, M.D., Alexander Hammers, M.D.
2004	Terence J. O'Brien, M.D.	Mechanisms of pharmaco-resistance in epilepsy		Annamaria Vezzani, Ph.D., Heinz Beck, M.D.
2003	Steve Weinstein, M.D.	How do seizures stop?		Kevin Staley, M.D., Steve Rothman, M.D.
2003	Gary Mathern, M.D.	Seizure reoccurrence after medical and surgical therapy, and early post-surgery seizures as predictors of long-term seizure control		Shlomo Shinnar, M.D., Theodore Schwartz, M.D., Susan Koh, M.D.
2003	Elinor Ben-Menachem, M.D.,	Mechanisms of deep brain stimulation and peripheral nerve stimulation		Scott Krahl, Ph.D., Paul Boon, M.D., Ph.D., Libor Velisek, M.D., Ph.D.
2003	Lawrence J. Hirsch, M.D.	Nonconvulsive status epilepticus and ICU EEG monitoring		David M. Treiman, M.D., Frank W. Drislane, M.D.
2002	Sara J. Swanson, Ph.D.	Functional MRI and memory		Jeffrey Binder, M.D., John Detre, M.D., Marilyn Jones-Gotman, Ph.D.
2002	Nicholas Barbaro, M.D.	Gamma knife surgery in epilepsy		Kevin Lee, Ph.D., Ajay Niranjani, MBBS, M.S., M.Ch., Jean Regis, M.D., Nicholas Barbaro, M.D.
2001	William D. Gaillard, M.D.	Is epilepsy a progressive disease?		Gregory L. Holmes, M.D., Peter R. Camfield, M.D., FRCP, Fernando Cendes, M.D.
2001	Andreas Hufnagel, M.D.	Is there a clinical role for diffusion/perfusion MRI?		Alan Connelly, Ph.D., Udo Wieshman, M.D., John A. Detre, M.D.