

# Fourth International Workshop on Seizure Prediction

Kansas City, Missouri – June 4-7, 2009

## Scientific Program

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#### Wednesday June 3, 2009

Registration (18:00-20:00) – Hyatt Regency Crown Center Lobby

#### Day 1: Thursday June 4, 2009

Registration and Continental Breakfast (06:30–07:50) – Empire Foyer

Introductory Remarks and Orientation (07:50-08:00)

#### Epilepsy for Non-MDs Didactic Course (08:00-15:15)

##### Chateau Room, Mezzanine Level

Chairs for Lectures 1-3: John Jefferys (*Univ. of Birmingham, Birmingham, United Kingdom*), Andreas Schulze-Bonhage (*Univ. Hospital Freiburg, Freiburg, Germany*)

1. Neuroanatomy as Applicable to Epilepsy (Gross and Microscopic Anatomy/Histology), (08:00-09:00)

Speaker: Taufik Valiante (*Toronto Western Hospital, Toronto, Canada*)

2. EEG Generation: under normal and epileptic conditions, (09:00-10:00)

Speaker: Fernando Lopes da Silva (*Univ. of Amsterdam, Amsterdam, Netherlands*)

Break (10:00-10:15)

3. Introduction to EEG (10:15-11:15)

Speaker: Richard Wennberg (*Univ. of Toronto, Toronto, Canada*)

Chairs for lectures 4-6: Fernando Lopes da Silva (*Univ. of Amsterdam, Amsterdam, Netherlands*), Richard Wennberg (*Univ. of Toronto, Toronto, Canada*)

4. Basic Mechanisms of Seizure Generation (11:15-12:15)

Speaker: John Jefferys (*Univ. of Birmingham, Birmingham, United Kingdom*)

Lunch provided (12:15-13:15)

5. An Atlas of Epileptiform Activities and Seizures Patterns: Scalp and Invasive (13:15-14:15)

Speaker: Andreas Schulze-Bonhage (*Univ. Hospital Freiburg, Freiburg, Germany*)

6. Classification of Epilepsy and Seizures: A Video Presentation (14:15-15:15)

Speaker: Steven Weinstein (*Weill Cornell Medical College, New York Presbyterian Hospitals, New York, NY, US*)

Break (15:15-15:30)

#### Engineering, Math, Physics for MDs Didactic Course (08:00-15:15)

##### New York Ballroom A, Ballroom Level

Chairs for lectures 1-3: Klaus Lehnertz (*Univ. of Bonn, Bonn, Germany*), Bjoern Schelter (*Univ. Freiburg, Freiburg, Germany*)

1. Signal Amplification, Conditioning, Sampling Rate and Digitization, Analog Signals (08:00-09:00)

Speaker: Brian Litt (*Univ. of Pennsylvania, Philadelphia, PA, US*)

2. Time-Frequency-Energy Analysis (09:00-10:00)

Speaker: Piotr Franaszczuk (*Johns Hopkins Univ., Baltimore, MD, US*)

Break (10:00-10:15)

3. An Introduction to Dynamical Systems (10:15-11:15)

Speaker: John Milton (*Claremont Colleges, Claremont, CA, US*)

## Day 1, Thursday – continued

Chairs for lectures 4-6: Brian Litt (*Univ. of Pennsylvania, Philadelphia, PA, US*), Steven Schiff (*Pennsylvania State Univ., University Park, PA, US*)

4. Non-linear Dynamical Tools (11:15-12:15)

Speaker: Ralph Andrzejak (*Univ. Pompeu Fabra, Barcelona, Spain*)

*Lunch provided (12:15-13:15)*

5. Seizure Time Series Analysis I: Automated Detection, Quantification, and Assessment of Seizure Detection Algorithms (13:15-14:15)

Speaker: Sridhar Sunderam (*Pennsylvania State Univ., University Park, PA, US*)

6. Seizure Time Series Analysis II: Automated Prediction and Assessment of Seizure Prediction Algorithms (14:15-15:15)

Speaker: Florian Mormann (*California Institute of Technology, Pasadena, CA, US*)

*Break (15:15-15:30)*

### **Joint Didactic Course: (15:30-18:30)**

#### **New York Ballroom A/B, Ballroom Level**

Chairs: Paul Carney (*Univ. of Florida, Gainesville, FL, US*), Gregory Worrell (*Mayo Clinic, Rochester, MN, US*)

1. Epilepsy Models and their relevance to humans (15:30-16:20)

Speaker: Ivan Soltesz (*Univ. of California, Irvine, CA, US*)

2. State transitions in the epileptic brain (16:20-17:10)

Speaker: Stiliyan Kalitzin (*SEIN, Heemstede, Netherlands*)

3. Applications of control theory to epilepsy (17:10-18:00)

Speaker: Steven Schiff (*Pennsylvania State Univ., University Park, PA, US*)

Discussion of the three talks and wrap-up (18:00-18:30)

*Dinner on your own, possible informal gathering*

## **Day 2: Friday June 5, 2009 – Atlanta Ballroom, Ballroom Level**

Continental Breakfast (06:30-07:50)

Opening Remarks for Scientific Sessions (07:50-08:00)

### **The Challenge of Prediction I: (08:00-11:30, includes 15-minute break)**

Chairs: John Milton (*Claremont Colleges, Claremont, CA, US*), Walter Freeman (*Univ. of California, Berkeley, CA, US*)

Speaker: Didier Sornette (*ETH Swiss Federal Institute of Technology, Zurich, Switzerland*)

a. A Dynamical Perspective

What Makes the Behavior of a System Predictable?

From Predictability to Prediction: What are the Necessary Steps?

b. Prediction in Finance and Material Failure

c. Seismic Prediction: Its Relevance to Epilepsy

Panel discussion (11:00-11:30) Panel:

Ralph Andrzejak (*Univ. Pompeu Fabra, Barcelona, Spain*)

Stiliyan Kalitzin (*SEIN, Heemstede, Netherlands*)

Andreas Schulze-Bonhage (*Univ. Hospital Freiburg, Freiburg, Germany*)

John Milton (*Claremont Colleges, Claremont, CA, US*)

Walter Freeman (*Univ. of California, Berkeley, CA, US*)

Lunch on your own (11:30-12:30)

### **The State of Seizure Prediction: Seizure Prediction & Detection I**

(12:30-14:30) Chairs: Florian Mormann (*California Institute of Technology, Pasadena, CA, US*), Bjoern Schelter (*Univ. Freiburg, Freiburg, Germany*)

Topics and Speakers:

1. Testing null hypotheses about seizure prediction algorithms. Ralph Andrzejak (*Univ. Pompeu Fabra, Barcelona, Spain*) (12:30-12:50)
2. Statistical assessment of event predictors. Bjoern Schelter (*Univ. of Freiburg, Freiburg, Germany*) (12:50-13:10)
3. Seizure prediction by spectral power in nine bands using weighted SVM. Yun Park (*Univ. of Minnesota, Minneapolis, MN, US*) (13:10-13:30)
4. Seizure prediction and monitoring. J. Chris Sackellares, M.D. (*Optima Neuroscience, Inc. Gainesville, FL, US*) (13:30-13:50)
5. Stimulation-based state monitoring – new developments. Stiliyan Kalitzin (*SEIN, Heemstede, Netherlands*) (13:50-14:10)
6. Recent approaches to seizure prediction at U Bonn. Klaus Lehnertz (*Univ. of Bonn, Bonn, Germany*) (14:10-14:30)

Break (14:30-14:45)

### **The State of Seizure Prediction: Seizure Prediction & Detection II**

(14:45-16:45) Chairs: Levin Kuhlman (*Univ. of Melbourne, Parkville, VIC, Australia*), Stiliyan Kalitzin (*SEIN, Heemstede, Netherlands*)

Topics and Speakers:

1. How probable is seizure occurrence: a time-scale and time-frequency analysis of SEEG. Jean-Marc Lina (*Ecole de Technologie Supérieure, Montréal, Canada*) (14:45-15:05)
2. Seizure prediction and observability of EEG Sources. Levin Kuhlmann, (*Univ. of Melbourne, Parkville, VIC, Australia*) (15:05-15:25)
3. Early seizure detection in animal models of temporal lobe epilepsy. Paul Carney (*University of Florida, Gainesville, FL, US*) (15:25-15:45)
4. Synchronization for seizure prediction. Piotr Mirowski (*New York University, New York, NY, US*) (15:45-16:05)
5. Meaning of spikes. Shivkumar Sabesan, (*Arizona State Univ., Tempe, AZ, US*) (16:05-16:25)
6. Two algorithms for real-time seizure prediction and detection, from an implanted, closed-loop, epilepsy prosthesis in vivo. Pooja Rajdev and Shriram Raghunathan (*Purdue University, W. Lafayette, IN, US*) (16:25-16:45)

*Dinner and Entertainment provided (17:00-22:00) – Buses depart hotel starting at 17:00*

Kansas City Barbecue and Jazz –

The "New Jazz Order" big band led by Clint Ashlock, with singer Megan Birdsall will entertain at the IWSP4 banquet at the American Jazz Museum. For more information go to: [www.clintashlock.com](http://www.clintashlock.com).

Authentic Kansas City barbecue will be provided by Oklahoma Joe's, one of Kansas City's premier barbecue restaurants. Check out their story at [www.oklahomajoesbbq.com](http://www.oklahomajoesbbq.com)

The history of Kansas City barbecue will be shared by Rich Davis, MD, creator of KC Masterpiece Barbecue Sauce.

The American Jazz Museum and the Negro Leagues Baseball Museum will be open for tours.

### Day 3: Saturday June 6, 2009 – Atlanta Ballroom, Ballroom Level

Continental Breakfast (06:30-08:00)

#### The Challenge of Prediction II: Prediction in Finance (08:00-09:00)

Chair: Leon Iasemidis (*Arizona State Univ., Tempe, AZ, US*)

Speaker: Shane Haas

#### The State of Seizure Prediction: Seizure Generation (09:00-11:00)

Chairs: John Jefferys (*Univ. of Birmingham, Birmingham, United Kingdom*), Anatol Bragin (*Univ. of California, Los Angeles, CA, US*)

Topics and Speakers:

1. Interictal fast ripples recorded from a dense microelectrode array in human epileptic neocortex. Catherine Schevon (*Columbia Univ., New York, NY, US*) (09:00-09:20)
2. Large-scale electrophysiology: acquisition, storage and analysis. Greg Worrell, MD, PhD (*Mayo Clinic, Rochester, MN, US*) (09:20-09:40)
3. High-frequency oscillations in the epileptic brain: What is good and what is bad? Michel Le Van Quyen (*LENA-CNRS, Paris, France*) (09:40-10:00)
4. Complexity of early ictal onset patterns. Christophe Jouny (*Johns Hopkins Univ., Baltimore, MD, US*) (10:00-10:20)
5. Synergy of cellular dynamics and network structure in spatio-temporal pattern formation in excitatory networks. Andrew Bogaard (*Univ. of Michigan, Ann Arbor, MI, US*) (10:20-10:40)
6. Large scale brain networks in epilepsy: nodes and pathways. Hitten Zaveri (*Yale University, New Haven, CT, US*) (10:40-11:00)

Break (11:00-11:15)

#### The State of Seizure Prediction: Seizure Control (11:15-12:15, 13:15-14:15)

Chairs: Bruce Gluckman (*Pennsylvania State Univ., University Park, PA, US*), Gregory Bergey (*Johns Hopkins Univ., Baltimore, MD, US*)

Topics and Speakers:

1. Seizure evolution and control in animal models. Bruce J. Gluckman (*Pennsylvania State Univ., University Park, PA, US*) (11:15-11:35)
2. Modulating seizure-permissive states with weak electric fields. Marom Bikson, (*The City College of New York, New York, NY, US*) (11:35-11:55)
3. Vagus nerve stimulation triggered by patient-specific detection of seizure onset: initial clinical implementation and evaluation. Ali Shoeb, (*Massachusetts Institute of Technology, Boston, MA, US*) (11:55-12:15)

Lunch on your own (12:15-13:15)

4. Low frequency sine wave stimulation as a therapy for epilepsy, Jeff Goodman (*NYS Institute for Basic Research, Staten Island, NY, US*) (13:15-13:35)
5. A SVM assembly classifier for epileptic seizure detection, Yuang Tang and Dominique Durand (*Case Western Reserve Univ., Cleveland, OH, US*) (13:35-13:55)
6. The State of Seizure Prediction, Brian Litt (*Univ. of Pennsylvania, Philadelphia, PA, US*)
7. Novel insights into the dynamics of intractable human epilepsy, and Seizure abatement with single DC pulses: is phase resetting at play? Ivan Osorio (*Univ. of Kansas, Kansas City, KS, US*) (13:55-14:15)

## Day 3, Saturday – continued

### Technology for Implantable Devices in Epilepsy (14:15-15:15)

Chairs: Michel Le Van Quyen (*LENA-CNRS, Paris, France*), Andreas Schulze-Bonhage (*Univ. Hospital Freiburg, Freiburg, Germany*)

Topics and Speakers:

1. Overcoming technical challenges in wireless power delivery and data telemetry, en route to a closed-loop prosthesis for seizure suppression – Pedro Irazoqui (*Purdue Univ., W. Lafayette, IN, US*) (14:15-14:45)
2. Enabling technologies for Wireless Multimodal Brain Monitoring (and Intervention) – Bruce Lanning (*ITN energy Systems, Littleton, CO, US*) (14:45-15:15)

Break (15:15-15:30)

### EEG databases/data sharing (15:30-16:00)

Chair: Brian Litt (*Univ. of Pennsylvania, Philadelphia, PA, US*)

### Industry Session (16:00-17:00)

Chairs: Chris Sackellares (*Optima Neuroscience, Inc., Gainesville, FL US*), Mark Frei (*Flint Hills Scientific, LLC, Lawrence, KS, US*)

Topics and Presenters:

1. When to Approach Industry – Milton Morris (*Cyberonics, Houston, TX, US*)
2. Intellectual Property Issues – John Harris (*NeuroVista, Seattle, WA, US*)
3. Product Development: Timelines and Other Considerations – Nina Graves (*Medtronic, Minneapolis, MN, US*)
4. Custom Devices and Prototyping – David Putz (*AdTech, Racine, WI, US*)
5. Academia - Industry Relationships and Tech Transfer – James Baxendale (*KU Center for Technology Commercialization, Lawrence, KS, US*)

Dinner on your own (17:00-19:00)

### Poster Session and Seizure Prediction/Detection Competition Results and Awards (19:00-21:30) – Atlanta Ballroom

Competition Chairs:

Andreas Schulze-Bonhage (*Univ. Hospital Freiburg, Freiburg, Germany*)

Bjoern Schelter (*Univ. Freiburg, Freiburg, Germany*)

Jean Gotman (*Montreal Neurological Institute, Montreal, Canada*)

Poster Session Judges:

Ralph Andrzejak (*Univ. Pompeu Fabra, Barcelona, Spain*)

Gregory Worrell (*Mayo Clinic, Rochester, MN, US*)

Piotr Franaszczuk (*Johns Hopkins Univ., Baltimore, MD, US*)

Anatol Bragin (*Univ. of California, Los Angeles, CA, US*)

Paul Carney (*Univ. of Florida, Gainesville, FL, US*)

Michel Le Van Quyen (*LENA-CNRS, Paris, France*)

## **Day 4: Sunday June 7, 2009 – Atlanta Ballroom, Ballroom Level**

Continental Breakfast (06:30-08:00)

### **The Challenge of Prediction III (08:00-10:00)**

Chair: Klaus Lehnertz (*Univ. of Bonn, Bonn, Germany*)

1. Lessons from Nonlinear Brain Dynamics on Complex Partial Seizures (8:00-9:00)  
Speaker: Walter Freeman (*Univ. of California, Berkeley, CA, US*)
2. Complex Networks and Synchronization (9:00-10:00)  
Speaker: Juergen Kurths (*Potsdam Institute for Climate Impact Research, Potsdam, Germany*)

Break (10:00-10:15)

### **Debates on Dynamical Issues (10:15 -12:15)**

Chairs: Ivan Osorio (*Univ. of Kansas, Kansas City, KS, US*), Hitten

Zaveri (*Yale University, New Haven, CT, US*), Mark Frei (*Flint Hills Scientific, LLC, Lawrence, KS, US*)

1. Ictogenesis: Focus vs Network?

Debaters:

“Focus” – Gregory Bergey (*Johns Hopkins Univ., Baltimore, MD, US*)

“Network” – Klaus Lehnertz (*Univ. of Bonn, Bonn, Germany*)

2. Spikes and seizures: step-relatives or siblings?

Debaters:

“Step-relatives” – Jean Gotman (*Montreal Neurological Institute, Montreal, Canada*)

“Siblings” – Ivan Osorio (*Univ. of Kansas, Kansas City, KS, US*)

3. Ictogenesis: A result of hyposynchrony?

Debaters:

“Yes” – Tay Netoff (*Univ. of Minnesota, Minneapolis, MN, US*)

“No” – Hitten Zaveri (*Yale University, New Haven, CT, US*)

4. Can focal seizures be caused by excessive inhibition?

Debaters:

“Yes” – Walter Freeman (*Univ. of California, Berkeley, CA, US*)

“No” – John Jefferys (*Univ. of Birmingham, Birmingham, United Kingdom*)

5. Do HFOs provide relevant independent information?

Debaters:

“Yes” – Gregory Worrell (*Mayo Clinic, Rochester, MN, US*)

“No” – Michel Le Van Quyen (*LENA-CNRS, Paris, France*)

6. Phase synchronization – is it worthwhile as measured?

Debaters:

“No” – Steven Schiff (*Pennsylvania State Univ., University Park, PA, US*)

“Yes” – Florian Mormann (*California Institute of Technology, Pasadena, CA, US*)

Rules:

Each issue will be devoted 20 minutes, 5 minutes for each side, opening with the first person listed, then open up to floor for up to 10 min.

Lunch provided (12:15-12:45)

### **Patient Perspectives (12:45-13:15)**

Chair: Susan Arthurs (*Alliance for Epilepsy Research, Dexter, MI, US*)

### **Consensus Session, Concluding Remarks and Klaus Lehnertz’s Invitation to the 5<sup>th</sup> International Workshop on Seizure Prediction (13:15-14:00)**

Chairs: Ivan Osorio (*Univ. of Kansas, Kansas City, KS, US*), Hitten

Zaveri (*Yale University, New Haven, CT, US*), Mark Frei (*Flint Hills Scientific, LLC, Lawrence, KS, US*), Susan Arthurs (*Alliance for Epilepsy Research, Dexter, MI, US*)

**Adjourn – 14:00**