

# **EEG and MEG Connectivity: Basic principles, state-of-the-art methods, and emerging vistas**

## **Organizers:**

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*Thomas Koenig*

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The human brain imaging community is increasingly adopting connectivistic views for many more complex psychobiological processes. Electroencephalographic (EEG) and Magnetoencephalographic (MEG) signals directly result from temporally coherent neural activity, and naturally distinguish processes organized in time and frequency. However, the physics of these signals can entail possible fallacies in the connectivity analysis, which must be avoided. This full-day educational course will give a comprehensive overview on the current state-of-the-art of analysis of EEG- and MEG-based connectivity. After introducing the physical background of EEG and MEG signals and the currently available models for source imaging and signal decomposition, we will present the established methods and emerging views to come to integral and multiscale accounts of brain functional connectivity within and across measurement modalities, such as cross-frequency interactions and scale-free dynamics. Particular care will be taken to make the audience aware of their possibilities to employ robust and state-of-the-art connectivity methods for basic and clinical applications.

## **Course Schedule:**

8:00-8:20

### **Introduction**

*Thomas Koenig, Department of Psychiatric Neurophysiology University Hospital of Psychiatry, Bern, Switzerland*

8:20-8:50

### **Temporal dynamics of EEG microstates**

*Christoph Michel, Neuroscience Department of the Medical Faculty and Center for Biomedical Imaging, University of Geneva, Geneva, Switzerland*

8:50-9:20

### **Electrophysiological Source Imaging – Solving the Inverse Problem**

*Bin He, Institute for Engineering in Medicine, Department of Biomedical Engineering, University of Minnesota, Minneapolis, United States*

8:20-9:50

**Noninvasive modeling of brain dynamic connectivity**

*Scott Makeig, Swartz Center for Computational Neuroscience Institute for Neural Computation  
University of California, San Diego, United States*

9:50-10:20

**Brain connectivity inference through multivariate time series: advances, pitfalls and applications**

*Laura Astolfi, Department of Computer, Control, and Management Engineering  
Rome, Italy*

10:20-10:40

**Break**

10:40-11:10

**Which tool should I use for connectivity in neuroelectrical imaging?**

*Daniele Marinazzo, University of Ghent, Ghent, Belgium*

11:10-11:40

**Fact and Fallacy EEG Source Connectivity**

*Pedro Valdes-Sosa, Joint Cuba/China Laboratory for Neurotechnology Cuban Neuroscience  
Center/University of Electronic, Chengdu, China*

11:40-12:00

**Question and Answer**

12:00-13:00

**Lunch**

13:00-13:30

**Connectivity in epilepsy: characterization of pathological networks on MEG and intracerebral EEG**

*Christian Benar, INSERM UMR1106, Marseille, France*

13:30-14:00

**Connectivity in ERP analyses**

*Daniel Brandeis, Child and Adolescent Psychiatry, Central Institute of Mental Health, University  
of Heidelberg, Mannheim, Germany*

14:00-14:30

**Large-scale network synchronization in ongoing brain activity: relation between non-invasive electrophysiological and hemodynamic data**

*Laura Marzetti, University of Chieti-Pescara, Chieti, Italy*

14:30-14:50

**Break**

14:50-15:20

**Understanding the prevalent arrhythmic brain activity and its implications for connectivity analyses**

*Biyu He, New York University Langone Medical Center, New York, NY, United States*

15:20-15:50

**Estimation of large-scale network synchronization and cross-frequency interactions from electrophysiological data**

*Satu Palva, Neuroscience Center, University of Helsinki, Helsinki, Finland*

15:50-16:20

**Mechanisms & dynamical structure of brain rhythms: from rest to perception**

*Sylvain Baillet, McGill University, Montreal, Quebec, Canada*

16:20-16:30

**Question and Answer**