Opening Lecture (Lecture Hall)

From algorithms to artificial antelligence: progress of electrophysiological markers in psychiatry
Sebastian Olbrich, Zürich

Key Note Lectures (Lecture Hall)

On-going and Task-Related Dynamics of Brain's Intrinsic Connectivity Networks
Tamer Demiralp, Istanbul Faculty of Medicine, Department of Physiology & Hulusi Behçet Life Sciences Research Laboratory-Neuroimaging Unit, Istanbul University, Istanbul, Turkey
The study of brain functional organization often relies on key dichotomies, one of the most fundamental being ongoing versus task-related dynamics. In electroencephalography (EEG), early approaches treated task-related event-related potentials (ERPs) as separate from the "noisy" background brain oscillations. However, research in the 1970s–80s demonstrated that these signals are not exclusive but interconnected. This shift gave rise to concepts such as event-related oscillations, synchronizations, desynchronizations, and spectral perturbations, which together advanced EEG research and deepened understanding of brain dynamics.
On the other hand, studies in the other more recent, non-invasive functional measurement modality, the functional magnetic resonance imaging (fMRI), was initially dominated by the neo-phrenological question about the localization of task-related activations, but the field expanded with the discovery of the default mode network (DMN), which highlighted the role of intrinsically connected brain regions. Strong temporal correlations within the DMN led to functional connectivity analyses of resting-state fMRI, revealing a set of intrinsic connectivity networks (ICNs), which map onto major cognitive domains—perception, motor control, attention, executive function, or language. The on-going patterns in fMRI are mostly represented by these ICNs, which seem to be the counterparts of the on-going rhythms or oscillations in EEG. Despite this progress, an integrated analytic framework directly associating ICN modulations and task-related activations, akin to event-related oscillations in EEG, remains underdeveloped.
Our recent studies addressed this gap using spatial independent component analysis (sICA), which decomposes fMRI signals into ICN spatial patterns and their temporal dynamics. This approach allowed us to systematically investigate how intrinsic networks are dynamically modulated and integrated during tasks, yielding insights not captured by analyzing fMRI activations and connectivity separately. In a separate study, inspired by EEG methods, we applied a phase-based connectivity metric in the frequency domain rather than wide-band correlation coefficients conventionally used in estimating ICNs in fMRI. Unlike correlations, which are dominated by large-amplitude signal components, phase-consistency detects subtler covariances, similar to EEG coherence analyses. These results revealed frequency-dependent network participation, showing that nodes of the attention networks cluster within a cognitive module at low frequencies while at the same time they participate in visual or motor modules at higher frequencies.
Together, these approaches highlight how segregated ongoing fMRI network patterns can integrate into unified states during task processing. Our findings suggest that drawing analogies between time-resolved EEG and space-resolved fMRI phenomena, and translating insights across modalities, may offer a powerful path forward. By integrating these complementary perspectives, we can achieve a more comprehensive understanding of the functional organization of the human brain.

Neural correlates of threat and paranoia
Katharina Stegmayer, Bern, Switzerland

Brain stimulation and EEG-related topics.
Keiichiro Nishida, Osaka, Japan

From simple to complex and back again: Nonlinear, higher order, and topological signatures of (dys)functional brain connectivity
Jaroslav Hlinka, Czech Academy of Sciences, Czech Republic

Lectures (Lecture Hall)

Stability and variability of pain-related gamma oscillations
Enrico Schulz, LMU Munich, Germany

Electrical fingerprints as a new tool for neurofeedback treatment
Christoph Mulert, Giessen, Germany

Oral Presentations (Lecture Hall)

Heterogeneity of Z-Scored EEG Features: Towards Universal Translational Biomarkers in Psychiatry
Vahid Asayesh, NPCindex Research Company, Tabriz, Iran, Asayesh Psychiatric Clinic, Tabriz, Iran
This study aimed to evaluate the heterogeneity of z-scored EEG spectral features in 1243 participants, including depression, anxiety, BMD, OCD, adult ADHD. We extracted relative powers and z-scored them using a control group. EEG z-scoring identified extreme deviations ($|z|>1.5$) that varied widely across individuals. A certain spatial consistency was observed among individuals within the BMD and OCD groups across the high-beta band positive deviations, and within BMD group across alpha band negative deviations. The locations of extremely deviated channels were not unique to any clinical group; similar patterns of deviation within the same frequency bands were present across all groups. Permutation tests revealed limited significant differences in any pathological group from controls. Findings indicate high within-group heterogeneity and notable between-group homogeneity, challenging the diagnostic specificity and clinical reliability of frequency-based z-scored EEG markers.

Modeling Cortical Information Geometry in Psychiatric Disorders
R Murat Demirer, Üsküdar University, Istabul, Turkey
Cognitive functions such as memory, decision-making, and attention are governed by the dynamic structure of neural representations. The prefrontal cortex (PFC) encodes cognitive variables through spatially organized population activity. Recent studies in representational geometry suggest that sparse, low-dimensional manifolds support executive function. In psychiatric disorders, these structures may degrade, yet current models often lack a noninvasive geometric characterization.This study proposes a theoretical framework using EEG to investigate representational disintegration in psychiatric illness. We hypothesize that spatial EEG patterns encode signatures of disrupted cortical geometry, particularly in prefrontal regions. Findings reveal that psychiatric EEG manifolds are higher-

dimensional and less segregated, reflecting geometric disintegration. This approach enables geometry-based biomarkers of cognitive dysfunction.

Using EEG to Predict Dementia Risk and Cognitive Resilience in Elderly Patients Undergoing Surgery
Yessica Martinez-Serrato, Centre for Human Brain Health (CHBH), University of Birmingham, UK
This study investigates whether alpha modulation in the alerting network, measured via pre-surgical EEG during the Attention Network Task (ANT), can predict post-operative cognitive resilience or vulnerability in elderly patients undergoing surgery. We hypothesise that efficient alpha modulation reflects cognitive resilience, while disrupted modulation may signal increased risk of cognitive decline. Inflammatory markers will also be assessed to explore their association with EEG activity and cognitive outcomes. These EEG and biomarker profiles will be analysed alongside clinical data to identify predictors of cognitive impairment. Our goal is to develop a pre-surgical tool to improve decision-making and recovery outcomes. The study is conducted in collaboration with the University of Birmingham and NHS Trusts.

qEEG and Gamma Asymmetry in Forensic Neuroscience: Emotional Valence in a Murder Case Analysis
David S. Cantor, Mind and Motion Centers, Suwanee, Georgia
This presentation explores the use of qEEG and frontal gamma asymmetry to assess emotional valence in a homicide case. The defendant, accused of killing his uncle, had a history of trauma and emotional instability. EEG was recorded while he viewed emotionally charged, personalized stimuli. Right-dominant gamma activity (linked to avoidance/negative affect) emerged in response to threatening family cues, while left-dominant gamma (approach/positive affect) appeared with loyalty-related cues. These patterns aligned with psychological testing and sLORETA findings of prefrontal dysregulation, supporting a theory of emotionally reactive—not premeditated—behavior.

Effects of QEEG-Based Neurofeedback on IQ in Patients with Intellectual Disabilities.
Tanju Surmeli, Living Health Center for Research and Education, Istanbul, Turkey

Harmonizing Clinical QEEG Practice: IQCB Guidelines for Acquisition and Reporting
David S. Cantor, Mind and Motion Centers, Suwanee, Georgia
This presentation summarizes the International QEEG Certification Board's 2025 guidelines for clinical quantitative EEG (QEEG), integrating technical acquisition standards with best practices for report writing. The guidelines establish minimum EEG recording requirements, including 19-channel systems, proper artifact management, and normative database use. Emphasis is placed on clinician-led interpretation and the differentiation between dysregulation and compensation. Report guidelines outline structured sections—history, methods, findings, and recommendations—tailored to the reader's needs and clinical context. Examples of AI tools may assist, but clinical judgment, for now, remains essential. Together, these guidelines promote accuracy, clarity, and consistency in QEEG practice.

Oral Presentations (Alzheimer's Lab)

Bimodal P300 for Psychotic Disorders: A New Paradigm for Diagnosis & Follow-up
Hendrik Kajosch, CHU Brugmann Institut de Psychiatrie, Brussels, Belgium
The P300, a psychiatric ERP biomarker, lacks specificity. Previous work (Campanella et al., 2010; 2012; Kajosch et al. 2016) indicated a bimodal oddball design increased its sensitivity. This study directly

compares classic unimodal (visual, auditory) and synchronized audio-visual bimodal oddball designs. We aim to enhance P300's discriminative power between psychotic patients (schizophrenia, bipolar, psychotic disorder NAO) and healthy controls, all carefully matched, as a first-onset schizophrenia case report demonstrates the advantage of combining unimodal and bimodal paradigms for illness stage follow-up. Patients underwent SCID and clinical scales; both groups completed 20-channel EEG recordings during successive visual, auditory, and bimodal oddball tasks. Our data investigated if specific oddball tasks improve P300's ability to distinguish these groups, and results confirmed bimodal P300 specificities in these groups. Clinical implications will be discussed.

Oscillatory Dynamics of Rhythm: Timing Systems in First Episode Psychosis.
Brian A Coffman, University of Pittsburgh, USA

Biomarkers in Psychiatry, looking at a complex phenomenon from a neurophysiological perspective.
Montserrat Gerez
Biomarkers have become central across medical fields, yet Psychiatry lags—mainly due to biological heterogeneity within symptom-based diagnostic categories. Since finding the best treatment for each case is the ultimate goal, we sought biomarkers of physiopathogenic mechanisms underlying each patient's set of symptoms. Our results from studies using EEG, ERP and eBN in five psychiatric disorders (OCD, ADHD, AD, ASD, SUAD), revealed different mechanisms within a diagnostic category and recurring patterns across diagnoses. Targeted interventions based on these patterns outperformed standard guidelines. eBNs deepened the understanding—network hyperactivity, dopaminergic imbalances, even psychotherapy-relevant signatures. Our findings advocate transitioning from diagnosis-centered to mechanism-driven biomarkers. Until big-data and RDoC mature, this approach may offer a more precise path for personalized psychiatric care. Methods, limitations and future perspectives will be discussed.

Assessing neuronal network changes in the brain in neurodegenerative diseases using EEG microstates.
Hannes Opperman, TU Ilmenau, Germany
Neurodegenerative diseases, e.g. Parkinson's disease (PD), have been found to be associated with alterations in whole-brain neuronal networks. Hence, analyzing these networks reliably and efficiently is a key challenge. EEG microstates are an easy-to-apply method for studying networks and semi-stable patterns of the brain. We compared microstates from 19-channel EEG recordings between 132 PD patients and 32 healthy controls (HC). We extracted four most prominent microstate maps from 3-minute resting state segments for each individual. PD and HC group averages were calculated. A visual comparison of the microstate maps revealed a high degree of similarity between the PD and HC groups for both maps A and B. Differences between the groups were observed for maps C and D. Our preliminary results show that EEG microstates can be used to investigate neuronal network disruptions in the brain and represent a potential marker for the detection and classification of such diseases in the future.

Improved source reconstruction of auditory evoked fields with high resolution BEM-FMM models
Guillermo Núñez Ponasso, Worcester Polytechnic Institute
Most freely available MEG source localization pipelines are constrained to low-resolution, three-layer head models and source spaces of ~20,000 sources. We introduce a novel forward modeling framework based on the Boundary Element Fast Multipole Method (BEM-FMM), enabling high-resolution head models with multiple tissue layers and dense source spaces of up to 4 million sources. We do so by integrating BEM-FMM with Lorentz reciprocity, which establishes a connection between the MEG forward problem and the forward transcranial magnetic stimulation (TMS) problem. Our

approach provides a significant improvement in the quality of source localization of auditory evoked fields.

EEG Based ISPC Analysis of Default Mode Network Synchronization in Depression

Mehmet Akif Özçoban, Gaziantep University, Gaziantep, Turkey

Major Depressive Disorder (MDD) involves abnormal DMN connectivity (1–4). We analyzed EEG from 63 MDD patients and 87 controls (eyes closed), focusing on DMN-related electrode pairs (6). ISPC (7) quantified phase synchronization across delta–gamma bands. MDD showed higher ISPC in several frontoparietal and frontopolar–posterior pairs, mainly in delta. Using LDA, KNN, and Random Forest, top accuracies were F8–F3, F7–F4, and Fp1–F4 in delta. Findings suggest robust low-frequency DMN hyperconnectivity in MDD, supporting ISPC as a biomarker (8,9)