

Increased Use of EEG in the Clinic



**The University Club, University of Pittsburgh
Pittsburgh, Pennsylvania, USA**

September 5 - 9, 2018

2018 International Joint Conference ECNS, ISNIP, ISBET, & ISFSI

Local Organizing Committee:

Dean F Salisbury
Brian Coffman
Mark Curtis
Justin Leiter
Tim Murphy
Natasha Torrence
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Scientific Committee:

Chair: Dean F Salisbury	ECNS
Armida Mucci	ECNS
Derek Fisher	ECNS
Thomas Koenig	ISBET, ECNS
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Sebastian Walther	ISNIP
Bin He	ISFSI
Jens Haueisen	ISFSI
Brian Coffman	ECNS
Agnieszka Chrobok	ECNS
Wolfgang Skrandies	ISBET
Newton Agrawal	ECNS

All events will occur in the **University Club**, 123 University Place, Pittsburgh, PA 15260.

The **Preconference EEGLab Workshop** will occur Tuesday and Wednesday in the University Club 3rd Floor Conference Room A.

The conference will begin with an **Opening Lecture and Reception Wednesday** evening in the University Club, 2nd Floor Ballroom B.

The **Conference sessions on Thursday and Friday** will occur in the University Club, 2nd Floor meeting rooms (Ballroom B, Ivy Room, Gold Room) and 3rd Floor Conference Room A.

On **Saturday, Conference sessions** will occur in the University Club, 1st Floor Ballroom A and 3rd Floor Conference Room A.

Saturday's Conference Banquet will be held at The Porch, Schenley Plaza, 221 Schenley Drive, Pittsburgh, PA 15213, within walking distance of the University Club.

Sunday's EEG in Psychiatry tutorial will be held in the University Club 3rd Floor Conference Room A.

Wifi is available. The PW code is **PittConferenceGuest**

Cortech Solutions has provided support for the meeting. Please visit the exhibit on Thursday and Friday.



ANT Neuro has provided support for the meeting. Please visit their exhibit throughout the conference.



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Tuesday September 4th

8:00 am - 8:30 am Continental breakfast & coffee provided

8:30 am - 12:30 pm **Pre-Conference EEGLab Workshop Morning Session**
Conference Room A, 3rd floor



Course Directors: Scott Makeig & Arnaud Delorme

Pre-registration is required

For the complete syllabus and materials please visit
https://sccn.ucsd.edu/wiki/EEGLAB_2018_Pittsburgh

[10:15 am - 10:30 am Coffee Break]

12:30 pm - 2 pm Workshop Lunch Break on your own

2 pm - 5:30 pm **Pre-Conference EEGLab Workshop Afternoon Session**

For a complete syllabus and materials please visit
https://sccn.ucsd.edu/wiki/EEGLAB_2018_Pittsburgh

[3:15 pm - 3:30 pm Coffee Break]

Wednesday September 5th

8:00 am - 8:30 am Continental breakfast & coffee provided

8:30 am - 12:30 pm **Pre-Conference EEGLab Workshop Morning Session**
Conference room A, 3rd floor
Course Directors: Scott Makeig & Arnaud Delorme

Pre-registration is required

For a complete syllabus and materials please visit
https://sccn.ucsd.edu/wiki/EEGLAB_2018_Pittsburgh

[10:15 am - 10:30 am Coffee Break]

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2018 International Joint Conference ECNS, ISNIP, ISBET, & ISFSI

2:00 pm - 5:30 pm

Pre-Conference EEGLab Workshop Afternoon Session

For a complete syllabus and materials please visit
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[3:15 pm - 3:30 pm

Coffee Break]

12:30 pm - 5 pm

ECNS Board Meeting

Ivy Room, 2nd Floor
Lunch Provided

2018 International Joint Conference begins

7:00 pm - 8:00 pm

Opening Lecture

Ballroom B, 2nd Floor



Lawrence J Hirsch, Yale University

The expanding use of continuous video-EEG monitoring in the critically ill

Continuous video-EEG monitoring is being used more and more widely for patients with impaired mental status, primarily for detection of nonconvulsive seizures, but also for ischemia detection and prognostication. The majority of seizures in critically ill patients are nonconvulsive and can only be diagnosed with EEG. The main risk factors are coma and prior seizures (recent or remote), but also sepsis and any acute supratentorial brain injury with impaired alertness. Nonconvulsive seizures, especially with a high seizure burden, are associated with adverse physiological effects and independently associated with worse short and long-term outcomes, including based on imaging, long term functional scales, cognition, and later epilepsy. There are many interesting rhythmic and periodic EEG patterns that are seen in these patients. There are now published criteria/guidelines/etc for naming these patterns (including separately for neonates), for performing continuous EEG in all age groups, and for determining whether a pattern represents nonconvulsive seizures or not. Quantitative EEG methods are very helpful for reviewing these studies. When specific patterns are causing neuronal injury and how aggressively to treat are active areas of research and lively debate.

8 pm - 10 pm

Opening Reception

Ballroom B, 2nd Floor

Music by the Ryan Salisbury Quartet

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Thursday September 6th

8:00 am - 8:30 am

Continental breakfast & coffee provided

8:30 am - 9:25 pm

Plenary Lecture

Ballroom B, 2nd Floor



Oliver Pogarell, Ludwig Maximilian's University Munich

Reasonable and efficient use of EEG in Psychiatry

Electroencephalography (EEG) is a traditional neuropsychiatric tool with relevance in both clinical and basic research. It is a functional tool covering brain electric activity offering a temporal resolution within the range of milliseconds. It allows the investigation of brain states at rest, during cognitive processing, emotional challenges or in different states of vigilance. Sophisticated techniques of analysis enable the investigation of functional connectivity, phase synchronization and phase shifts, further contributing to the knowledge of brain function and regulation. Standard EEG, though underutilized, is the method of choice for assessing organic factors influencing psychiatric presentations and should not be ignored in clinical practice. Quantitative techniques in combination with brain activation (cognitive stimuli) can be used to probe specific brain regions and are useful approaches to non-invasively study brain dysfunction, but also to monitor these changes, to indirectly assess neurochemical functions or even to predict subjects' prognoses or responses to treatment. The reasonable and efficient use of EEG will be emphasized with a focus on its clinical applications.

9:30 - 10:25

ECNS Invited Plenary Lecture

Ballroom B, 2nd Floor



Alan Anticevic, Yale University

Computational Psychiatry: Linking Neuropharmacology, Neuroimaging and Biophysical Modeling to Inform Circuit Mechanisms

The functioning and balance of excitatory (E) and inhibitory (I) neural circuit computations plays a pivotal role in supporting all aspects of human thought and behavior. The pattern and timing of alterations in E/I balance across neural circuits has been hypothesized as a parsimonious mechanism that could cut across neuropsychiatric diagnoses such as psychosis spectrum disorders. This presentation outlines method and results in humans that combine the multi-disciplinary approaches of computational modeling, pharmacological manipulations and non-invasive functional neuroimaging to help understand the mechanism underlying altered E/I balance in neuropsychiatric disease. The goal is to provide a roadmap for iteratively closing the gap across levels of analysis, from cells and circuits to neural systems and ultimately altered behavior. Such a roadmap could in turn drive rational development of neurobiological therapies for disrupted neural circuits across the psychiatric spectrum.

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10:30 am - 10:55 am	Coffee Break
11:00 am - 12:25 pm	Symposium 1 Ballroom B, 2 nd Floor

Use of Clinical Neurophysiology in Clinical Setting: Experience from the Field

Chairs: Lukasz Konopka, David Cantor

In research and clinical practice, neurophysiology and quantitative EEG are gaining significant momentum, particularly since the availability of technology and marketing have increased and equipment costs have significantly decreased. In addition, today's patients, who are frustrated by therapeutic failures, are seeking new approaches to diagnosis, treatment, and management of behavioral difficulties. Also, with the improvements in data availability, today's patients have a greater understanding of brain function and the importance of more directive and data-driven therapies, such as neuro- feedback, transcranial magnetic stimulation, transcranial electrical stimulation, deep brain stimulation, etc. In addition, insurance companies are now more willing to reimburse for neurophysiological evaluations provided by non-MDs. Moreover, as the field advances, we will face problems of translation, which will be directly related to how well we train practitioners in clinical neurophysiology, and particularly, in quantitative EEG. It would be prudent for our researchers and clinicians to join forces and provide systematic, organized training and develop practice standards. In an attempt to facilitate this process, the International Board of Quantitative Electrophysiology (IBQE) was conceived for providing qualified individuals with certification in electrophysiological methods as clinicians and/or researchers. To illustrate the utility of clinical neurophysiology in assessing and treating patients, we will focus on three topics: quantitative EEG in forensic evaluations; clinical neurophysiology in mental health, including psychology; and clinical neurophysiology in psychiatric practice.

QEEG Utilization in Forensic Settings

David Cantor CEO, Clinical MH Director Mind and Motion Developmental Centers of Georgia, LLC

Often the acceptance of new techniques and technology in diagnostics and assessments in general are the result of referencing its acceptance in courts of law. Actuarial methods for confirming and delineating a patient's given functional status has generally been preferred over arguments which are solely "clinical judgement" based on behavioral observations in forensic matters since having simple opposing clinical experts often leaves confusions for judges and juries. With the increasing advent of quantitative neurophysiological measures and neuroimaging, there has been a growing concern for the legitimacy of such measures for providing statements regarding CNS integrity and weighing this in the context of their reported symptoms and/or other clinical evidence of functional or adaptive compromise. This is no less true for methods of quantitative EEG (qEEG). More specifically, queries are made with regard to the specific methodology used in such cases including the qualifications of the equipment used, databases employed, and indeed the professional ultimately making interpretation of the qEEG in these cases. This presentation will review many of the issues that confront providers using qEEG in forensic circumstances using some of the cases that have appeared in both civil and criminal cases as illustrations. The potential more widespread acceptance of qEEG findings in forensics resides on the integrity of its used with well qualified professionals in the field.

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Clinical Electrophysiology as a biomarker diagnostic and treatment in Psychiatric setting

Tanju Surmali President of Biofeedback, Neurofeedback, use of QEEG and ERP in Psychiatry Association

Psychiatric disorders interfere with daily-life activities and treated with psychological and pharmacological treatments. For Psychopharmacology and Psychotherapy to meaningfully improve outcomes, it's time to figure out how to develop "the next generation of interventions." A new route map has been drawn for the diagnosis and treatment of psychiatric diseases. The National Institute of Mental Health (NIMH) has called for a more rigorous and evidence-driven approach to mental healthcare. It is time that psychiatry moves away from its present focus on diagnosing subjectively and takes a new direction that uses other modalities of care; evidence-based diagnosis and treatments. Psychiatry is the only specialty that doesn't actually look at the organ it treats. Patients deserves better. We need to devote our selves to efficient evidence-based diagnosis of disorders and personalized treatments. Implementing biological markers for psychiatric disorders into laboratory-based electrophysiological diagnostic tests can significantly improve diagnosis and management of these disorders. Diagnostic electrophysiological techniques are non-invasive and relatively inexpensive. Psychiatric electrophysiology currently under utilizes such methods and plays a limited role in the diagnosis and treatment in psychiatric disorders. This status is not supported by the existing literature. I am going to talk about evidence supporting diagnostic electrophysiological biomarkers and their effectiveness in the treatment of psychiatric disorders.

Brain to behavior approach-use of objective data in clinical work

Lukasz M Konopka Institute of Personal Development, Romeoville Illinois, Adjunct Professor Psychiatry and Neuroscience, Loyola University Medical Center

Within the clinical setting, the trajectory of patient assessment should be guided by how the patient's brain drives their behavior. The "Brain to Behavior Approach" uses objective and subjective assessment tools to provide the clinician with data that focus on a patient's key clinical features and assist in targeting the best individualized therapies for their unique mental health condition. The "Brain to Behavior Approach" incorporates objective neurophysiological tools that include auditory and visual cognitive evoked potentials, and IVA, a continuous performance task for assessment of auditory and visual processing, as well as a prolonged EEG recording that includes activation. On the day of the EEG, we perform a toxicology screen and genetic mapping, and if indicated, we add an acute medication challenge study. A challenge study involves two sequential EEG evaluations: one before and one after the administration of psychotropic medications. Moreover, patients routinely participate in face-to-face assessments, such as the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and computer-based tests such as the Cambridge Neuropsychological Test Automated Battery (CANTAB). Finally, after the analysis and integration of all the above-mentioned data, what emerges is a unique and comprehensive plan for individualized therapeutics. Clinical cases will be used to illustrate the utility of this approach.

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11:00 am - 12:25 pm

Symposium 2

Conference Room A, 3rd Floor

MMN impairment in psychosis: influence of course and outcome

Chair: Armida Mucci

Reduced amplitude of mismatch negativity (MMN) to auditory deviant stimuli is a well replicated finding in subjects with schizophrenia (SCZ), reflecting deficits in pre-attentive processing. Recent interest has grown about the characterization of the MMN impairment across a range of clinical presentations, from the high-risk state to the onset of psychosis and, finally, to the chronic phase of the disease. Some results indicated that pervasive MMN deficits are associated with chronic course and poor functional outcome. However, inconsistent findings and lack of adequate control of possible confounds call for further investigation of these associations. The aim of our symposium is to illustrate recent results of different research groups suggesting that MMN might be related to the disease course and be a marker of poor functional outcome. In particular, Derek Fisher will present data showing that a deficit in MMN to phonetic deviants is not present in the first 5 years of illness and appears later on, while Armida Mucci will show that MMN to pitch-(p-MMN) and duration-(d-MMN) deviant tones is impaired across illness stages (from the first 5 to over 30 years), independently of cognitive impairment and severity of psychopathology. Dean Salisbury and Giulia M. Giordano will highlight that results from two independent studies demonstrate that prior to the first contact for psychosis, as well as in the chronic phase, MMN is related to poor functional outcome. These studies suggest that standardization of MMN paradigms and systematic investigation of relationships with outcome will translate MMN research into clinical practice.

Phonetic MMN and chronic course in schizophrenia

Derek Fisher^{1,2,3}, Erica Rudolph^{1,2}, Emma Ells¹, Verner Knott^{4,5,6}, Alain Labelle^{4,5}, & Philip Tibbo³

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²Department of Psychology, Saint Mary's University, Halifax, Nova Scotia, Canada

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⁶Department of Cellular and Molecular Medicine, University of Ottawa, Ottawa, Ontario, Canada.

Auditory change detection, as indexed by the EEG-derived mismatch negativity, has been demonstrated to be dysfunctional in chronic schizophrenia using both pure-tone and speech (phoneme) sounds. It is unclear, however, whether reduced MMN amplitudes to speech sound deviants are observed within the first 5 years of the illness as no study to date has reported findings in this population. The present study investigated MMNs elicited by across-vowel (phoneme) change in early schizophrenia (ESZ; Experiment 1) as well as chronic schizophrenia (CSZ; Experiment 2). In both experiments, clinical and control participants were presented the Finnish phoneme /e/ (standard; $P = .85$) and the Finnish phoneme /ö/ (deviant; $P = .15$) within an oddball paradigm. In experiment 2 we report significantly reduced MMN amplitudes in CSZ relative to HCs, but no differences were found when comparing ESZ and HC in experiment 1. Follow-up of these findings showed smaller MMN amplitudes in CSZ participants compared to ESZ participants. These findings suggest that early detection of phonetic change is impaired in chronic populations, but not in populations early in the progression of the illness. That MMN reductions only emerged in patients with a longer course of illness suggests a dynamic change in the early auditory processing of language over time in schizophrenia.

MMN impairment in schizophrenia and disease stages

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Armida Mucci¹, Giulia Maria Giordano¹, Annarita Vignapiano¹, Giorgio Di Lorenzo², Fabiola Ferrentino², Antonello Bellomo³, Mario Altamura³, Silvana Galderisi¹

¹Department of Psychiatry, University of Campania "Luigi Vanvitelli", Largo Madonna delle Grazie 1, Naples, 80138

²Department of Systems Medicine, University of Rome "Tor Vergata", Rome, Italy

³Department of Clinical and Experimental Medicine, Psychiatry Unit, University of Foggia, Foggia, Italy

Reduced amplitude of the mismatch negativity (MMN), an event-related potential (ERP) associated with pre-attentive processing, is a well replicated finding in people with schizophrenia (SCZs), either in first-episode or chronic patients. However, it is unclear whether this impairment reflects a feature of the illness or of disease progression and if other variables, such as demographic characteristics, psychopathology and cognitive deficits, have an impact on this ERP.

The aim of our study was to investigate the influence of illness duration on MMN impairment in SCZs. MMNs to pitch- (p-MMN) and duration- (d-MMN) deviants were analyzed in 117 SCZs and 61 HCs, recruited within the add-on EEG study of the Italian Network for Research on Psychoses. SCZs were divided into four groups based on illness duration (ID): SCZ-A, ID \leq 5 years (N=23); SCZ-B, ID 6 to 13 years (N=38); SCZ-C, ID 14 to 18 years (N=27) and SCZ-D, ID 19 to 32 years (N=29). We also assessed psychopathology and neurocognition. Multivariate analyses were used to test group differences. We found that SCZ-D showed more positive symptoms than SCZ-A and higher global neurocognitive deficit than SCZ-A and SCZ-B. All groups of SCZs showed reduced p-MMN ($p < .001$) and d-MMN ($p < .001$) amplitudes as compared to HCs, using age and gender as covariates. There was no difference in MMN among the four SCZ subgroups (controlling for age, gender, positive symptoms and neurocognition). Our results suggest that MMN impairment is not related to illness duration and is independent of psychopathology severity or cognitive deficits.

Mismatch Negativity and Social Functioning Prior to the First Clinical Contact for Psychosis

Dean Salisbury Clinical Neurophysiology Research Laboratory, Western Psychiatric Institute & Clinic, Department of Psychiatry, University of Pittsburgh School of Medicine, United States.

Mismatch negativity (MMN) is sensitive to infrequent physical parameter changes in sounds such as pitch or duration. Both pitch-deviant MMN (pMMN) and duration-deviant MMN (dMMN) are reduced in long-term schizophrenia (Sz). Symptom factors (positive, negative, cognitive) are inconsistently associated with MMN amplitude in Sz, but smaller dMMN is associated with impaired social functioning. At the first psychotic episode in the schizophrenia spectrum (FESz), pMMN is not reduced, while dMMN shows moderate reduction. Associations between pMMN and dMMN and symptom clusters in FESz are also inconsistent, and associations with social functioning have never been reported. Forty FESz and forty matched controls were assessed for cognition, psychiatric symptoms, and social functioning (present and during the last year prior to first clinical contact), and underwent pMMN and dMMN testing. Neither pMMN ($p = 0.27$) nor dMMN ($p = 0.84$) were reduced in FESz. However, FESz showed associations between pMMN and dMMN and social functioning. More impaired MMNs in FESz were associated with impaired current social functioning. Intriguingly, social functioning in the year prior to the emergence of psychosis was also associated with smaller MMNs at first clinical contact. These data suggest compromised social behavior prior to first break is indexed by pMMN and dMMN. Thus, MMN may be sensitive to the degree of pathological process occurring prior to the emergence of first psychosis and serve as putative biomarkers of disease progression sensitive to functional impairment.

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MMN and real-life functioning in a sample of chronic schizophrenia subjects

Giulia Maria Giordano¹, Armida Mucci¹, Annarita Vignapiano¹, Giorgio Di Lorenzo², Fabiola Ferrentino², Antonello Bellomo³, Mario Altamura³, Silvana Galderisi¹

¹Department of Psychiatry, University of Campania "Luigi Vanvitelli", Largo Madonna delle Grazie 1, Naples, 80138

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Despite the development of innovative treatments, the impairment in real-life functioning in subjects with schizophrenia (SCZs) remains an unmet need in the care of these patients. Recently, functional outcome of SCZs was associated with deficits in mismatch negativity (MMN), an event-related potential reflecting pre-attentive processing. However, it is not clear whether this relationship is a direct one or reflects a cross-correlation with other variables. Our aim was to investigate group differences between SCZs and healthy controls (HCs) on MMN and relationships with real-life functioning domains in SCZs. Pitch- (p-MMN) and duration-deviant (d-MMN) MMNs were recorded in 125 chronic SCZs and in 61 HCs, recruited within the add-on EEG study of the Italian Network for Research on Psychoses. The Specific Level of Functioning Scale (SLOF) measured functioning. Psychopathology and neurocognition were also assessed. Multiple regression was used to predict functioning with MMN, age, gender, duration of illness, neurocognitive composite score of the MATRICS Consensus Cognitive Battery, Calgary Depression Scale for Schizophrenia total score, negative symptom domains of the Brief Negative Symptom Scale, positive and disorganization dimensions of the Positive and Negative Syndrome Scale (PANSS) as independent variables. SCZs, in comparison to HCs, showed a significant reduction of both p-MMN and d-MMN amplitudes. Within SCZs, we found that PANSS Positive ($\beta = -.421$, $p < .001$) and d-MMN amplitude ($\beta = -.219$, $p < .011$) predicted SLOF work skills domain, independently from other symptoms, demographic features and neurocognitive impairment.

Our results suggest that deficits in the pre-attentive processing in SCZs might represent a putative biomarker of poor functional outcome.

12:30 pm - 2 pm Lunch Break on your own

[1:30 pm - 2 pm **ECNS Membership Meeting]**
Conference Room A, 3rd Floor

2 pm - 3:25 pm **Symposium 3**
Ballroom B, 2nd Floor

Functional and Structural Abnormalities Associated with Auditory Verbal Hallucinations in Psychosis

Chair: Dean F Salisbury

Auditory verbal hallucinations (AVH) remain one of the most common and most debilitating symptoms in psychosis. Recent neurophysiological and functional and structural connectivity measures have begun to elucidate the underlying pathology and pathophysiology related to AVH. This session will describe recent advances in understanding the alterations in distributed systems within the brain that contribute to AVH, including possible differential patterns of underlying pathology related to the phenomenology of AVH using EEG measures (Fisher) and basal blood perfusion measures (Stegmayer), patterns of resting functional

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connectivity (Shinn), and white matter diffusion measures of abnormal structural connectivity (Kubicki, Salisbury). These data begin to reveal distributed circuits related to AVH at the systems-level, and may provide insight into pathophysiology for targeted interventions, including non-invasive brain stimulation.

Alterations of Mismatch Negativity (MMN) in Schizophrenia Patients Differing on Perceived Spatial Location of Auditory Hallucinations

Derek J. Fisher^{1,2,3}, Dylan M. Smith^{3,4}, Alain Labelle^{3,5}, Verner J. Knott^{2,3,4,5}

¹Department of Psychology, Mount Saint Vincent University, Halifax, Nova Scotia, Canada

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⁵Royal Ottawa Mental Health Centre, Ottawa, Ontario, Canada

Auditory verbal hallucinations (AHs), or hearing 'voices', are one of the hallmark symptoms of patients with schizophrenia (SZ). The primary objective of this study was to examine whether SZs with differing perceived locations of AHs also differ in the processing of auditory deviance, as indexed by the auditory mismatch negativity (MMN). MMNs to duration, frequency, gap, intensity and location were recorded in 21 SZ patients with persistent AHs and 15 healthy controls (HC). Patients were divided into those who experienced AHs as being inside the head only (SZI) and those with AHs outside the head (SZO). MMN amplitudes and latencies for each deviant were compared between groups. Duration-MMN was reduced in both patient groups relative to HCs. SZOs were found to have reduced right frontal location-MMN amplitudes compared to SZIs and HCs. Overall, we report differences in auditory change detection for location deviants between schizophrenia patient groups that differ in the perceived location of auditory hallucinations. Whether these differences are due to structural abnormalities and/or functional differences between the groups remains unanswered.

Abnormal Functional Connectivity Associated with Auditory Hallucinations Across the Psychosis Spectrum

Ann K. Shinn^{1,2}, Melissa Hwang¹, Sophie Roh¹, Jessica N. Talero¹, Bruce M. Cohen^{1,2}, Justin T. Baker^{1,2}, Dost Öngür^{1,2}

¹Psychotic Disorders Division, McLean Hospital, Belmont, MA

²Department of Psychiatry, Harvard Medical School, Boston, MA

Auditory hallucinations (AH) are most commonly associated with schizophrenia (SZ), but they are non-specific, also occurring in bipolar disorder (BP). In this transdiagnostic investigation, we sought to identify functional connectivity (FC) abnormalities associated with AH across SZ and BP. Participants were 95 individuals with lifetime AH (71 SZ, 24 BP) and 62 without (NAH) (16 SZ, 46 BP), categorized using item B16 in the Structured Clinical Interview for DSM-IV-TR (SCID). We acquired high-resolution structural scans and resting state blood oxygenation level dependent (BOLD) images (124 volumes, TR/TE 3000ms/30ms)

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on a 3T Siemens Tim Trio scanner at McLean Hospital. We used CONN v17e for resting state FC analysis. In addition to standard preprocessing, we used the ARTifact detection Tool (ART) to identify outlier time points, included only individuals with < 20 motion outliers, and performed rigorous denoising. For group-level analysis, we compared AH to NAH, adjusting for motion and other symptom dimensions. We performed ROI-to-ROI analysis, looking at BOLD time-course correlations across the 48 cortical and 21 subcortical regions of the Harvard-Oxford atlas and 26 cerebellar regions from the Automated Anatomical Labeling (AAL) atlas, using a significance threshold of $p < 0.05$, FDR-corrected. We found multiple brain region pairs showing hyperconnectivity (either from reduced anti-correlations or increased positive correlations) in AH relative to NAH. Regions of the cerebellum, pre- and post-central gyri, and auditory cortices featured prominently among the FC abnormalities. These results, highlighting cerebellar abnormalities, are particularly intriguing in light of growing evidence for the cerebellum's role in integrating higher-level brain processes.

Associations of Resting State Cerebral Blood Flow with Auditory Verbal Hallucinations with and Without Emotional Content in Schizophrenia

Katharina Stegmayer and Sebastian Walther Translational Research Center, University Hospital of Psychiatry, Bern, Switzerland

Auditory verbal hallucinations (AVH) are a core symptom in schizophrenia. Here we focus on resting state cerebral blood flow (rCBF) linked to AVH and explored rCBF in patients with AVH with and without emotional content. We included 48 schizophrenia spectrum patients and 40 age and gender matched healthy controls. We assessed AVH with the comprehensive assessment of schizophrenia history and the hallucination change scale as well as imaging on a 3T MRI scanner.

AVH were currently present in 33 patients and 18 patients had AVH with emotional content. Patients did not differ in antipsychotic medication or positive symptoms. We compared whole brain perfusion using arterial spin labeling (ASL) over all, and between the groups using one-way ANCOVAs (F-test and T-tests). We applied threshold-free cluster enhancement (TFCE) and a statistical threshold of $p < 0.05$ family wise error corrected for multiple testing (FWE-corr). We found a group effect (F-test) within the superior temporal gyrus and T-tests revealed that patients with AVH had increased perfusion most prominently within the left superior temporal gyrus compared to healthy controls and patients without AVH. Furthermore, T-tests indicated perfusion within the limbic system to be specific to AVH with emotional content. The STG has been suggested to play a key role in AVH in patients with schizophrenia. Thus, our results are highly compatible with increased superior temporal perfusion as a marker of AVH. Furthermore, distinguishable associations of rCBF with AVH with and without emotional content point to distinct underlying pathophysiology.

Microstructural White Matter Abnormalities Associated with Auditory Verbal Hallucinations

Marek Kubicki, Maria A Di Biase, Thomas Whitford, Johanna Seitz, Rene CW Mandl, Martha E Shenton, Iris E Sommer, Ofer Pasternak Psychiatry Neuroimaging Laboratory, Brigham and Women's Hospital, Harvard Medical School

Auditory verbal hallucinations (AVH) are one of the hallmarks of psychosis, but they also appear in 5-10 % of healthy individuals. Structural and functional imaging studies implicate the superior temporal gyrus and

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inferior frontal language areas in generation of AVH. Here, we examined white matter in tracts interconnecting these regions with advanced diffusion imaging methods. We aimed to reveal pathophysiologic substrates for AVH across several datasets, consisting of first episode and chronic schizophrenia patients as well as healthy individuals with and without AVH. Diffusion MRI data were analyzed using voxel-wise analyses, as well as stochastic and deterministic tractography to extract fiber connections forming language networks: arcuate fasciculus, inferior occipito-frontal fasciculus, and the genu and isthmus of the corpus callosum. Several measures of white matter microstructure were examined, including extracellular free water (FW) and tissue-specific fractional anisotropy (FAt), axial and radial diffusivity (Rdt). We identified significant microstructural abnormalities in language connections across patients with established schizophrenia and healthy individuals with AVH, albeit to lesser degree. These changes were characterized by increased extracellular FW and Rdt, as well as decreased FAt. Notably, microstructural variability was associated with positive symptoms and AVH, independent of diagnostic status and illness stage (first episode and chronic schizophrenia). Our data point to shared neural substrates for auditory verbal hallucinations across heterogeneous schizophrenia populations and healthy individuals; compatible with dimensional models of psychosis.

Auditory and Language System White Matter Connectivity Abnormalities and Auditory Hallucinations in the First Episode Schizophrenia Spectrum

Dean F. Salisbury¹, Yiming Wang¹, Frank Yeh², Brian A Coffman¹

¹Clinical Neurophysiology Research Laboratory, Department of Psychiatry, University of Pittsburgh School of Medicine

²High Definition Fiber Tracking Laboratory, Department of Neurological Surgery, University of Pittsburgh School of Medicine

Auditory verbal hallucinations (AVH) are common in schizophrenia and may be related to impaired cortical connectivity between left language centers via the arcuate fasciculus, and between the left and right the auditory cortices across the corpus callosum. We examined white matter auditory cortex connectivity using diffusion spectrum imaging (DSI) in 40 first-episode psychosis (FEP) and 32 matched healthy comparison subjects (HC). Our primary measure was generalized fractional anisotropy (gFA), the DSI analogue of FA reported in studies using diffusion tensor imaging (DTI). Across the auditory transcallosal (ATC) fibers, groups did not differ in gFA. However, AVH+ FEP (n =23) had reduced gFA within the ATC compared to AVH- FEP (n =17, p =.009). For bilateral arcuate fasciculus (AF) fibers, there were no significant group differences in gFA and no asymmetry between hemispheres in either group. AVH+ FEP had reduced gFA within the left hemisphere AF compared to AVH- FEP (p =.040). By contrast, AVH+ FEP and AVH- FEP did not differ in right hemisphere AF gFA. FEP showed white matter structural connectivity abnormalities in the left hemisphere language circuit and inter-hemispheric auditory fibers that were associated with AVH. Although the precise microstructural abnormality giving rise to gFA reductions is unknown, it is thought to indicate more “leaky” axons, and is likely manifest in slowed conduction times. Thus, at the first psychotic episode, AVH are associated with impaired left-language system and inter-hemispheric auditory communication, likely reflecting mistiming of information flow between language-related cortical centers.

Funding Sources: NIH R01 MH108568, NIH P50 MH103204

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2:00 pm - 3:25

Symposium 4

Conference Room A, 3rd Floor

Gamma oscillations as a biomarker in psychiatric disease

Chairs: Nevzat Tarhan, Kemal Arikan

Gamma oscillations are the fastest waves in EEG and represent the oscillations faster than 25 Hz. They have been related to several cognitive processes such as attention and memory. From a biological point of view, they arise as a result of interplay between inhibitory and excitatory cortical neurons and alterations in GABA, NMDA and dopamine pathways may effect gamma power. Recent studies indicate that gamma alterations are found in several psychiatric disorders and thus they have the potential to be used as biomarkers. For instance, we have showed that in depressed patients the response to paroxetine is inversely related to the power of gamma oscillations. Again, in a large population of patients with depression, gamma power was significantly greater in suicide attempters as compared to patients only with suicidal ideation. In schizophrenia, we also showed that insight levels are inversely correlated to gamma power. In this symposium, we will aim to discuss the biomarker value of gamma oscillations in depression, schizophrenia and suicidality and to propose new research directions.

Gamma Oscillations: Types, Neuronal Mechanisms and Functional Correlates

Tamer Demiralp^{1,2}, Elif Kurt^{2,3}, Cigdem Ulasoglu-Yildiz^{2,3}, Ani Kicik^{2,3}, Emel Erdogdu^{1,2}, Kardelen Eryürek^{2,3}, Ali Bayram^{2,3}

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Gamma oscillations build the faster range of brain electrical oscillations between ~25 and 90 Hz that can be observed in the local field potentials (LFPs) of various cortical and subcortical brain structures of several species and can be measured by intracranial EEG or ECoG, but also non-invasively through scalp EEG or MEG. While gamma frequency range constitutes a spectral part of the ongoing brain electrical activity, gamma oscillations can also be evoked phase-locked to a transient event, induced in non-phase-locked manner in the peri-event period or can be driven by rhythmic stimuli around 40 Hz. Although the precise mechanisms of these different gamma phenomena are not conclusively explored, they plausibly rely on similar neuronal circuits. The cellular origins of the gamma oscillations seem to depend on the connectivity of inhibitory interneurons with other interneurons (I-I) or with pyramidal cells (E-I). Significant associations of the gamma rhythm with several cognitive functions and with a number of neuropsychiatric conditions point to a fundamental role of the gamma oscillations as a universal operator of the brain function. The correlations of the gamma oscillations with fMRI-BOLD signal and its coupling with slower rhythms of the brain will be included in this overview.

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Gamma Frequency Entrainment and Metacognition in Early State Psychosis

Bethany L Leonhardt¹, Jenifer L Vohs^{1,2}, Paul H Lysaker¹, Andrew Visco¹, William P Hetrick², Alan Breier¹, Lisa Bartolomeo², Brian F O'Donnell²

¹Department of Psychiatry, Indiana University School of Medicine, Indiana, USA

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Metacognition, the process of thinking about one's own thinking, involves a range of faculties that allow an individual to form representations of mental states of the self and others. Persons with schizophrenia usually show impaired metacognition, but the neurocognitive basis for this impairment is not well characterized. We hypothesized that metacognitive capacity might depend on capacity of neural circuits to synchronize at gamma frequencies. In the present study, metacognition, insight and the 40 Hz auditory steady state response (ASSR) were assessed in eighteen adults with first episode psychosis. Metacognition was assessed with the Metacognition Assessment Scale Abbreviated, and insight was assessed with the Scale of Unawareness of Illness-Abbreviated. The electroencephalographic auditory steady state response to gamma range stimulation (40 Hz) was used to assess neural synchronization. Pearson correlation coefficients revealed that increases in 40 Hz ASSR power were associated with poorer metacognition and insight. These results suggest that altered neural synchronization may contribute to impairments in metacognitive processes required for insight into mental processes in one's own self and others.

Biomarkers for predicting suicide risk

Mehmet Kemal Arıkan Department of Psychology, Faculty of Humanities and Social Sciences, Uskudar University, Istanbul, Turkey

Previous studies have indicated that the abnormalities of brain activity are associated with suicidal behavior. However, few studies have investigated neurophysiologic biomarkers of suicide attempt (SA) and suicidal ideation (SI) in depressed patients. Here, we examined alterations of quantitative EEG (QEEG) in brain regions associated with SA and SI in patients with depression. Resting QEEG data were recorded from 533 patients with depression. According to this, there were a non-suicidal group (n = 218), a suicidal group (n = 211), a suicide attempters group (n = 74) and a healthy control group (n = 30). We found a significant correlation with absolute power in high gamma band at F4, Fz, C4, Cz, O2, F8, T5 and T6 electrode sites of suicide attempter group. Results showed that suicide attempted group elicited significantly higher gamma absolute power at all these electrode sites compared to the other groups. In the light of these results, it can be said that high gamma absolute power could be seen as a predictor of suicide attempt in patients with depression. EEG activity in high gamma absolute power in given regions has clinical potential as a biomarker for preventing suicide.

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Gamma oscillations in depression

Bariş Metin Department of Psychology, Faculty of Humanities and Social Sciences, Uskudar University, Istanbul, Turkey

Gamma oscillations represent oscillations faster than 25Hz in EEG frequency spectrum. Although gamma oscillations are commonly linked to cognitive and intellectual processing, their clinical significance was not explored extensively. Studies indicated that gamma oscillations could be related to cognitive functions in depressed patients as well as their suppression could be associated with clinical improvement. In addition, gamma oscillations may also be used as a biomarker. In the study that I will present, we explored prognostic value of gamma oscillations in patients with depression. The results showed that the patients with increased pre-treatment gamma power responded worse to treatment as compared to patients with lower gamma power. As Prof. Arikan will present in his talk, we also found that elevated gamma is associated with greater risk of suicide. These results show that EEG data of patients with depression should also be examined for gamma power, as elevated gamma is associated with worse antidepressant response, lower cognitive functioning and greater suicide risk.

3:30 pm

Coffee Break

3:45 pm - 4:25 pm

ECNS Presidential Lecture

Ballroom B, 2nd Floor



Armida Mucci, Second University of Naples

Are we ready for a neuroscience-informed psychopathology?

Psychopathological syndromes demonstrated clinical heterogeneity and affected subjects have different psychopathological manifestations, course and functional outcome. Electrophysiological (EEG) and brain imaging studies produced inconsistent findings for most of the syndromes and demonstrated a large overlap of measures between affected and control subjects at the individual level. These observations suggest that a neurobiological heterogeneity parallels the clinical heterogeneity of mental disorders. According to some findings, the study of psychopathological dimensions is a valuable approach to reduce heterogeneity for the investigation of biomarkers. Furthermore, psychopathological dimensions, unlike diagnostic categories, are predictive of the short- and long-term course and help defining the earliest clinical stages, for early interventions. The investigation of neuroimaging and electrophysiological correlates of dimensions produced testable hypotheses, but discrepancy of findings paralleled uncertainty in the definition and boundaries of each dimension. Attempts to integrate neuroscience and clinical research, as in the Research Domain Criteria, has partially contributed to the dissection and refinement of psychopathological dimensions. As an example of this process, the reconceptualization of some domains of negative symptom as disorders of the reward processing will be illustrated. Brain imaging and electrophysiological data will be presented to highlight the latest achievements in negative symptom research. The integration of longitudinal data in the definition of psychopathological dimensions represents a further challenge for this process of cross-fertilization between clinical and neuroscience research.

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4:30 pm - 6:00 pm

Society Awards & Awardee Lectures

Ballroom B, 2nd Floor

4:30 pm - 4:45 pm



Presidential Service Award This award is for outstanding service to ECNS. Any member of ECNS may be nominated by any of its members.

Derek Fisher, MSc, Ph.D., Associate Professor at Mount Saint Vincent University since 2015. He earned his doctorate degree in Psychology (Specialization in Neuroscience) at Carleton University Ottawa, Canada.

His research interests focus on auditory hallucinations and their impact on early information processing within schizophrenia and on the role of common drugs in the impairment of brain function. He organized the ECNS conference in Halifax, Nova Scotia, Canada on 2014. In 2015, he won the Early Career Award – of EEG & Clinical Neuroscience Society. He is the Chair of Membership Committee and Assistant Treasurer of the Society and Associate Editor for Clinical EEG & Neuroscience.

4:45 pm - 5:30 pm



Career Contribution Award This award is for senior scientists whose work has been influential in the field of Electrophysiology and Neuroimaging and has had high impact on research and clinical applications. Any scientist may be nominated by any member of ECNS. This award is considered the highest honor bestowed by the ECNS.

Oliver Pogarell, MD, Ph.D., Professor of Psychiatry, Medical Faculty, Ludwig-Maximilians-University of Munich. Head of the Department of Neurophysiology and Functional Neuroimaging, and also Head of the Department. of Addiction/Outpatient Clinic for Opioid Maintenance Therapy within the Department of Psychiatry and Psychotherapy, Ludwig-Maximilians-University of Munich. His research focuses on Neurophysiology and Functional Neuroimaging, Molecular Imaging, Brainstimulation and Neurofeedback. Chair of the Psychophysiology Section of the World Psychiatric Association (WPA) President-elect of the International Society for NeuroImaging in Psychiatry (ISNIP).

As is the tradition of ECNS, the lecture describing Dr Pogarell's body of work will be given by his mentee. His lecture **A modern neurophysiologist in a house of long tradition** will be presented by Agnieszka Chrobok.

5:30 pm - 6:00 pm

Young Investigator Awards

This award is reserved for young researchers who demonstrated significant contributions to translational research in the field of Electrophysiology and Neuroimaging.

5:30 pm - 5:45 pm

Bariş Metin, MD, MSc, PhD, Associate Professor of Neurology at the Uskudar University, Istanbul since 2016.



Neuroimaging in ADHD: Localizing symptoms to brain networks

5:45 pm - 6:00 pm

Brian Coffman, PhD, Instructor, Clinical Neurophysiology Research Laboratory in the Department of Psychiatry at the University of Pittsburgh School of Medicine, Pittsburgh, PA.



Can you feel the beat? Rhythm perception deficits are related to motor system impairment in first-episode schizophrenia

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The E Roy John Award, named after a pioneer in qEEG applications in psychiatry, is for a scientist who has produced more than 50 articles that are indexed in the SCI. Any scientist may be nominated by any member of ECNS.

This year's Awardee is Dezhong Yao, Ph.D., Professor, Director of Center for information in medicine at University of Electronic Science and Technology of China in Chengdu since 2014 and is Dean of School of Life Science and Technology at the same University since 2001. He earned his first doctorate degree in Applied Geophysics at Chengdu University of Technology in China and the second one in Biomedical Science at Aalborg University in Denmark. In 2017, he was nominated fellow of American Institute for Medical and Biological Engineering. He is Vice-president of Chinese Society of BioMedical Engineering. Since 2015, he is Member of the International Society for Brain Electromagnetic Topography. He is the author and coauthor of more than 600 scientific papers with 41 as H-index. His research interests include Human EEG and ERP, Brain-Computer interface and Brain-music interaction and EEG-MRI integration and its application in epilepsy.

It is traditional for the awardee to give the E. Roy John Memorial Lecture but Prof Yao cannot be present in Pittsburgh, so will give the lecture in 2019 at the next ECNS Joint Conference BACI, in Chengdu, China.

6:00pm - 7:00 pm

Poster Session I
Gold Room, 2nd Floor

7:30 pm – 10:00 pm

Young Investigator Social Event
Escape the Room PA
Pre-registration is required

Poster Abstracts:

1. New gambling paradigm: electrophysiological correlates of non-predictable gains and losses

Agnieszka I. Chrobok, Daniela Krause, Shari Langemak, Andrea Jobst, Daniel Keeser, Maximilian Maywald, Kristina Adorjan, Oliver Pogarell, Susanne Karch

Department of Psychiatry and Psychotherapy, University Hospital, LMU Munich, Germany

The aim of the present study was to investigate feedback processing regarding gains (reward) and losses (punishment) in healthy individuals. Twenty-nine healthy participants used a new gambling task with feedback given in pseudo-randomised order irrespective of the participants' choice. Subsequently event related potentials (ERPs) and event related oscillations (EROs) were analysed. Left-sided parietal potentials for high gains/losses compared to neutral and small gains/losses were significantly increased. Higher negativity for both gain and loss compared to a neutral condition in fronto-centro-parietal electrodes related to the feedback given was registered. Significantly reduced theta and alpha power for gains and only theta power for losses were recorded. Moreover, increased gamma and beta power in neutral condition and their significantly higher amplitudes in Fz compared to Cz and Pz have been observed. The results suggest that event-related potentials evoked through the new gambling paradigm could be helpful in analysing the reward system patterns in different diseases. Furthermore, EEG frequency variations can be registered depending on the amount of gains/losses, as the wavelet analysis showed.

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2. Low frequency magnetic stimulation of prefrontal cortex improves Autism Spectrum Disorder symptoms

Baris Metin, Muammer Aydogdu, Sinem Metin, Bernis Sutclubasi, Nevzat Tarhan

Uskudar University

Autism spectrum disorder (ASD) is characterized by impairments in social communication and behavior. Current treatments in ASD include medications to treat behavioral problems, behavioral therapy and sensory integration therapies. Transcranial magnetic stimulation (TMS) has been used in a number of psychiatric disorders. It offers the advantage of stimulating cortical activity non-invasively. In this open-label study we aimed to test the effect of low frequency stimulation of bilateral dorsolateral prefrontal cortices in children with ASD. Eight children with ASD (age 7-18) were recruited and TMS was applied over 20 sessions. ABC autism checklist were completed before and after TMS treatment by parents. In addition resting EEG was obtained at baseline and after treatment. The results show that, after TMS the children improved in sensory, relating, body and object use, language, and social and self-help skills subscale scores. EEG findings are not yet analyzed but will be presented in the conference. None of the children stopped the treatment due to adverse effects. Although preliminary, our findings indicate that bilateral frontal low frequency stimulation could be used as a safe and effective treatment in Autism Spectrum Disorder.

3. Low Field Magnetic Stimulation Is Associated With Immediate Changes In Brain Function In Healthy Controls Observed With fMRI And EEG

Michael L. Rohan¹, Rinah T. Yamamoto¹, Alexis E. Whitton², Clara B. Wellons¹, Bruce M. Cohen³

¹Imaging Center, McLean Hospital, Belmont, MA

²CSDAR, McLean Hospital, Belmont, MA

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LFMS is a treatment for depression that uses an induced electric field (1V/m, 1kHz) to produce short-term improvement in mood. Here we report observations of immediate changes in brain network activity made with fMRI and EEG in healthy control subjects. Two 5 min acquisitions of resting fMRI (singleband and multiband) were acquired before and after 20 min of active or sham LFMS in two sessions each in 3 healthy subjects (24 total acquisitions). rACC and bilateral DLPFC regions were used for a seed-based connectivity analysis. Subject results used the sham controlled change contrast (active_post - active_pre) - (sham_post - sham_pre) and a group mean effect is reported. Five-minute acquisitions of resting EEG data were using the same paradigm. EEG data were analyzed using LORETA methods to produce maps of change in power in the gamma band. Group effects were based on the same subject-wise contrast and used permutation methods for inference (sLORETA). Increased fMRI connectivity was observed between the mPFC and insulae along with a decreased connectivity between the mPFC and PCC/PCu. This is consistent with a stronger link between the Salience and Default Mode networks. A reduction in EEG gamma band power in the PCC/PCu region along with an increase in the dmPFC were observed and are consistent with the fMRI results. This response in healthy controls occur in brain regions that are implicated in the response to antidepressant treatment. This could indicate a physical response that leads to a selective antidepressant effect.

Funding: Hospital funds

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4. Patients with schizophrenia examined by paradigms of visual, auditory and a bimodal ERP oddball design. Does the use of a bimodal paradigm compared to an unimodal has an impact on the P300 component?

Hendrik Kajosch, Georgios Persefonis, Geerke Steegen, Pierre Fossion, Charles Kornreich, Salvatore Campanella

The P300 is one of the most investigated event-related potentials (ERPs) in the study of psychiatric disorders. Nevertheless it suffers from a lack of specificity and sensitivity. In previous studies (Campanella et al., 2010; 2012), the application of a more ecological bimodal oddball design has shown an increased sensitivity of the P300 component. In the present ongoing study we compare the results of a classic oddball with those of a more ecological bimodal design in a group of patients presenting schizophrenia. Patients were examined at two times: T0: admission: state of psychotic decompensation; T1: discharge: state of partial clinical remission. Patients were assessed through a structured clinical interview, and a completion of different clinical evaluation scales. Patients were confronted to an EEG recording during successive oddball tasks using visual, auditory, and bimodal stimuli. The objectives of this study are twofold: (1) investigate whether the use of a specific oddball task (visual vs. auditory vs. cross-modal) allowed to enhance the discriminative power of the P300; and (2) investigate the correlations between the evolution from T0 to T1 of the P300 and the evolution of the clinical situation of the patient. Indeed, we would like to investigate whether the fact that P300 is considered as a marker of trait of SZ (Mathalon et al. 2000) is not due to a lack of sensitivity of unimodal oddball tasks. Here we would like to present the results of this clinical study represented by a first group of 13 patients with the diagnosis of schizophrenia.

5. Stereo-motion Perception Research Based on Steady-state Visual Motion Evoked Potential

Chengcheng Han¹, Guhua Xu^{1,2}, Yiming Jiang¹, Sicong Zhang¹, Haochong Wang¹

¹School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an, China

²State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, Xi'an, China

The combination of EEG technology and stereoscopic 3D display technology has gradually become a trend, while EEG-BCI systems based on stereo vision have been used in rehabilitation training and visual medical testing. However, the current EEG-BCI research based on stereo vision mainly stays in the static stereo environment, there are few studies on dynamic stereo vision, which does not effectively utilize the characteristic of the stereoscopic display technology. Therefore, we propose a novel stimulation paradigm based on stereo-motion. It utilized a stereoscopic 3D display presented an image with binocular parallax, and a stereoscopic reciprocating motion stimulation was generated by the periodic changes of binocular parallax and image size. The SSMVEPs (steady-state visual motion evoked potentials) was elicited when gazing at the stereo-motion stimulation. Eight healthy subjects (with normal or corrected-to-normal vision) participated in the experiments. The motion inversion frequency was set at 3.3 Hz, 4.3 Hz, 5.3 Hz or 6.3 Hz. The results showed that the CCA (canonical correlation analysis) coefficients of fundamental frequency response of the SSMVEPs signal elicited by stereo-motion stimulation (3.3 Hz, 4.3 Hz and 5.3 Hz) was significantly higher than that elicited by the stimulation without parallax change (T test, $P < 0.01$), the average increased percent was 28.6%. This demonstrated that the stereo-motion stimulation can induce a stronger EEG response, which is significantly different from non-stereo-motion stimulation response. This technology both has a positive effect on improving EEG-BCI performance in virtual stereoscopic environment, and potential for the application of medical stereo vision detection.

Funding: National Natural Science Foundation of China (51475360); Key research and development plan of Shaanxi Provincial (2018ZDCXL-GY-06-01)

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6. The Combined Effects of Caffeine and Menstrual Phase on Visual Selective Attention: A Pilot Study

Kaitlyn Napier, Bronwen Schryver, Krista Hull, Derek J. Fisher

Department of Psychology, Mount Saint Vincent University, Halifax, Nova Scotia, Canada

Selective attention involves enhanced processing of relevant information while inhibiting the processing of irrelevant information. Both caffeine and menstrual phase have been shown to affect visual selective attention abilities; caffeine has been shown to improve accuracy and reaction times on selective attention tasks, while lower levels of progesterone (characteristic of the menstrual phase) have been associated with worsened selective attention and visuospatial abilities. Employing a double-blind, placebo-controlled design, nine women in their menstrual phase and six women in their luteal phase performed a visual search task in two separate sessions approximately 28 days apart following the administration of caffeine (200mg) or placebo. Behavioural performance measures (% correct, reaction time) were examined along with EEG-derived event related potentials (ERPs), including the P100 (early visual processing), P300 (target detection) and N2pc (attentional orientation). While there were no significant differences in behavioural performance on the visual search task, significantly larger amplitudes of the target P100 following caffeine administration in the menstrual phase. We also report caffeine-associated decreases in N2pc latency during the menstrual phase. These findings suggest caffeine speeds up target classification and enhances early selective attention to target-related information during the menstrual phase.

Funding: Natural Sciences and Engineering Research Council of Canada

7. Potential utility of a multivariate ERP battery in psychosis and bipolar spectrum: some preliminary data

Florence Hanard, Elisa Schröder, Hendrik Kajosch, Salvatore Campanella

CHU Brugmann, Psychiatry Department Université Libre de Bruxelles: Laboratory of Medical Psychology

Actual treatments in psychiatry are mainly based on pharmacological and psychotherapy treatments. However, relapse rate in many psychiatric disorder remains tremendously high. It is therefore of the highest relevance trying to find new add-on tools to enhance the quality of psychiatric care. As many psychiatric diseases are also characterized by cognitive difficulties, our main goal is to propose a complementary approach of treatment based on the identification of these cognitive difficulties to favor their reeducation. Such cognitive rehabilitations are expected to allow better life quality and, maybe, even reduce relapse rate. Such a plan emphasized the need to use an efficient and precise way to evaluate cognitive function in a psychiatric population, in which this evaluation could be difficult. Therefore, we propose that using a multivariate event-related potentials (ERPs) battery could be an appropriate solution to evaluate various cognitive functions in a timely manner. Our objective, as a first step in this process, was to evaluate the applicability of such an ERP battery in psychiatric patients. The ERP battery contained different tasks allowing us to simultaneously evaluate 6 well-studied electrophysiological components: P3a, P3b, NogoN2, NogoP3, MMN and P50. These components are well-known to index specific cognitive functions (from inhibition to memory updating or sensory gating). Here, we would like to present ERP data from 15 patients with psychotic and/or bipolar disorders in order to highlight specific patterns of differences when compared with healthy matched controls. Methodological properties of the ERP battery as well as potential clinical implications will be discussed.

8. Signs of depression in non-clinical states: evidence from brain oscillatory activity

Jaroslav Slobodskoy-Plusnin

Moscow School of Management SKOLKOVO

According to the World Health Organization (WHO), depression is the leading cause of disability worldwide and is a major contributor to the overall global burden of disease. With more than 350 million people affected worldwide, it becomes crucially important to reveal mechanisms underlying the disease. Twenty-seven healthy volunteers (11 males, 16 females, aged 19–51 years) have participated in the study. None of them have had a history of mental illness, brain injury, neurological disorders, history of substance abuse, or other serious medical conditions. 22-channel EEG (referenced to the ear tips) was recorded in the resting state and during the presentation of affective sounds (Achievement, Amusement, Anger, Disgust, Fear, Sadness and Neutral) that participants had to assess by valence (positive – negative) and arousal (low – high), both scales ranging from 1 to 9. Beck Depression Inventory–II (BDI-II) was used to estimate depressive symptoms. Based on the median value (8.0) the sample was split in two groups with scores below median (low BDI scorers, LB) and above median (high BDI scorers, HB). LB scores ranged within “minimal depression” scores, while HB scores landed within or on the borderline of “mild depression”, according to the BDI-II manual. Both behavioral and electrocortical “markers” of clinical depression were apparent at subclinical level. A resting-state EEG of HB revealed increased power in low frequencies (Cohen’s $d = 0.72$), predominantly in the frontal cortical areas, that is in accordance with a “spatio-temporal dysfunction” model of depression. Relatedly, transition from an eyes-closed to eyes-open condition was associated

9. Cerebral correlates of autobiographical memory in MCI and AD: Evidence from a Positron-Emission Tomography study

C. Frankenberg¹, J. Schröder¹, U. Haberkorn², Ch. Degen¹, M.S. Buchsbaum³

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² Department of Nuclear Medicine School, University Hospital Heidelberg, Heidelberg, Germany

³ Department of Psychiatry, University of California, San Diego, United States

Background: Autobiographical memory (AM) changes are the hallmark of Alzheimer’s disease (AD) and Mild Cognitive Impairment (MCI). In recent neuroimaging studies, AM changes were associated with numerous cerebral sites, such as the frontal cortices, the mesial temporal lobe, or the cingulum. Factor analysis provides statistical methods for evaluating patterns of cerebral changes in regional glucose uptake. Methods: In 115 patients with MCI or mild AD cerebral metabolic rates were determined using positron-emission tomography with [18F] deoxyglucose. According to the analyses of the scree plot factor analysis with VARIMAX rotation was used to identify underlying dimensions in 34 cerebral sites involved in AM deterioration. Subsequently, the respective factor scores were correlated with AM performance of 23 patients, which was measured with a structured inventory assessing memories from primary school, early adulthood, and recent years. Results: Factor analysis identified seven factors explaining 69% of the variance (“frontal cortex,” “mesial temporal substructures,” “cingulum,” “occipital cortex,” “left temporoprefrontal areas,” “anterior cingulum,” “right temporal cortex”). Relative to controls, AD patients showed significantly lower values on the factors “frontal cortex,” “cingulum,” and “left temporal cortex”. The factor “mesial temporal substructures” was significantly correlated with both, episodic memories ($r = 0.612$, $p < 0.05$) and semantic knowledge ($r = 0.646$, $p \leq 0.01$) from primary school, as well as semantic knowledge ($r = 0.616$, $p < 0.05$) from early adulthood. Conclusions: Interestingly, changes of the mesial temporal substructures were correlated with both semantic and episodic AM. These findings don’t necessarily contradict the multiple trace hypothesis as our sample only comprised patients with MCI or very mild AD

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for whom the relative preservation of semantic relative to episodic AM may not apply. In conclusion, our findings underline the importance of functional mesial temporal lobe changes in AD associated AM deficits.

10. High-density electroencephalographic recordings during NREM and REM sleep: An independent component analysis (ICA) based approach

Kathryn M Gill¹, Fabio Ferrarelli²

¹University of Pittsburgh Medical Center

²University of Pittsburgh School of Medicine, Department of Psychiatry

Background: We employed within-sleep stage independent components analysis (ICA) to more efficiently remove noise contamination from high density electroencephalographic (hd-EEG) data acquired during NREM, tonic and phasic REM sleep. Subsequently, power spectral density analysis was conducted, with emphasis on the average spectral power observed in distinct frequency bands as well as the associated topography.

Methods: All night hd-EEG sleep recordings (64 channels), along with simultaneous sleep polysomnography, were conducted in 10 healthy control subjects. Sleep staging was performed using standard criteria to identify NREM, and tonic and phasic REM epochs. EEG data within each sleep stage was independently de-noised using the extended infomax ICA algorithm (EEGLAB). Subsequently, spectral power density was computed for each channel, and global average power and topographical pattern within specific frequency bands, including delta (1-4Hz), theta (4-8Hz), alpha (8-12Hz), sigma (12-16), beta (15-25 Hz), and gamma (25-40Hz), were compared across NREM and REM sleep.

Results: NREM sleep was characterized by distinct spectral power peaks occurring at the delta and sigma frequency ranges. In contrast, both tonic and phasic REM exhibited greatest activation occurring at the delta and alpha frequency ranges. NREM activity in the sigma range occurred in primarily frontal-central electrodes. In contrast, tonic and phasic REM activity in the alpha range occurred predominately in posterior-central locations.

Conclusion: Within-sleep stage ICA analysis provides an effective means of identifying and removing artifact activity from overnight hd-EEG data, which could be used to establish topographic differences in NREM and REM activity in healthy subjects and psychiatric patients.

11. Emotion Regulation Ability and Levels of Life Stress in Adolescents at High and Low Familial Risk for Depression: Evidence from the Late Positive Potential

Mary L Woody, Cecile D Ladouceur, Lauren M Bylsma
University of Pittsburgh, Department of Psychiatry

There is a well-known reciprocal relation between depression and life stress. Emotion regulation (ER) strategies such as cognitive reappraisal or savoring may play an essential role in managing life stress, especially among those at risk for and/or currently experiencing depression. However, most past research has probed these relations using self-report measures of ER rather than measuring ER ability in the laboratory. Thus, we examined the relation between a laboratory-based measure of ER ability and self-reported stress among adolescents (ages 9-13; 48% female) at high (n = 41) and low (n = 44) familial risk for depression. Adolescents' ability to cognitively reappraise negative images or savor positive images was measured using the late positive potential (LPP), which can index changes in the intensity of emotional response to affective images. We found that adolescents who exhibited more savoring (i.e., greater LPP enhancement when asked to savor positive images) reported lower levels of life stress (p=.001). Notably, this effect was strongest among adolescents with high familial risk for depression who were already exhibiting depressive symptoms (p=.01), suggesting that savoring may disrupt the reciprocal cycle between stress and depression. In contrast, adolescents who exhibited more cognitive reappraisal (i.e., greater LPP reductions in response to negative images) reported higher levels of life stress (p=.01), an effect that was

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not moderated by familial risk or depressive symptoms. These findings suggest adolescents' ability to savor positive emotional responses is related to reduced life stress, particularly among high-risk adolescents reporting higher depressive symptoms.

12. Effect of Toluene Chronic Exposure on the Structure of the Hippocampus and Recognition Memory in Adult and Adolescent Rats

Nino Pochkhidze, Mzia Zhvania, Nana Japaridze

Iliia State Univesity, I. Beritashvili Center of Experimental Biomedicine

Toluene and toluene-containing volatile substances are the most widely abused solvents with demonstrative addictive potential in humans. Clinical and experimental studies have demonstrated that the exposure to toluene vapor leads to diverse consequences at the level ranging from the cell to the whole organism. The present study has been undertaken to determine whether toluene chronic exposure provokes immediate and/or persistent effect on the structure of hippocampus, learning and memory in adolescent and adult rats. We exposed male Wistar rats at ages P 28-32 (adolescents) and P 150-160 (adults) to 2000 ppm inhaled toluene for 40 days. The immediate and persisting effects of toluene misuse (immediately after the end of toluene chronic inhalation and 90-day after the end of toluene chronic inhalation, correspondingly) on pyramidal cell loss in the CA1 and CA3 of the hippocampus and exploratory behavior and recognition memory in the open field were evaluated. The results reveal that toluene chronic exposure affects the structure of the hippocampus, exploratory activity and recognition memory in the open field in adolescent and adult rats. In all cases the effect is age-dependent. In particular: in adolescent rats the more significant structural and behavioral alterations were observed immediately after toluene chronic exposure, while in adult rats the most considerable was persisting effect (90 days after withdrawal). Such data indicate that character of alterations depends upon the postnatal age of testing of the animals.

13. High-density EEG during NREM sleep in veterans with and without PTSD

Joanne Chiu¹, Rachel E Kaskie², Fabio Ferrarelli¹, Anne Germain¹

¹University of Pittsburgh School of Medicine, Department of Psychiatry

²University of Pittsburgh Medical Center

Sleep disturbances are a prominent feature of PTSD and likely exacerbate other symptoms observed in the disorder. Nearly all veterans diagnosed with PTSD suffer from sleep disturbances, but the physiological nature of these disturbances is not yet fully understood. In the present study, we used high-density electroencephalography (hd-EEG) to characterize sleep abnormalities in veterans with PTSD. Methods: Veterans of the Global War on Terrorism (n=34) spent two consecutive nights in a sleep laboratory, during which hd-EEG recordings were collected during sleep from 23:00 to 07:00. Participants were divided into a PTSD subgroup (n=17) and a control subgroup (n=17) based on scores from the PTSD Checklist (PCL-5). Sleep architecture and non-rapid eye movement (NREM) power spectra and power topography were calculated. Unpaired t-tests were calculated to assess differences between the PTSD and control groups. Results: No significant differences were found in sleep architecture between the two groups. Average power spectra also were not significantly different during the night. When examining NREM sleep only, we found a statistically significant decrease in EEG delta (1-4.5 Hz), sigma (12-15 Hz), and beta (15-25 Hz) power in a posterior parietal location in the PTSD group compared to controls. NREM sleep alpha (8-12 Hz) and gamma (25-40 Hz) power did not differ significantly between the groups. Conclusions: These findings indicate that there are unique NREM power deficits in individuals with PTSD. Treatments that specifically target these physiological sleep deficits in individuals with PTSD should be developed and may provide a way to improve treatment outcomes.

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Funding: US DoD Defense Health Program managed by the US Army Military Operational Medicine Research Program (MOMRP) Fort Detrick, MD, Log # 112293006 (PI: Reifman), and CSTI NTR001857 (PI: Reis).

14. Entropy Based EEG Biomarker for Major Depression based on Multivariate Empirical Mode Decomposition

R Murat Demirer, Selahattin Gultekin, K Nevzat Tarhan

Uskudar University, Istanbul 34662-TURKEY

Decomposing nonstationary multichannel EEG signals into distinct amplitude and frequency-modulated components lead to represent inherent stationary oscillatory modes upon Nyquist frequency. The Multivariate Empirical Mode Decomposition (MEMD) describes an EEG signal as a linear combination of an equal number of finite set of intrinsic mode functions (IMFs) with estimating the joint information of IMF functions utilizing 10-20 channels of EEG measurements. In our method, multivariate (EMD) method was applied to EEG signals with a normal group and major depression patients and entropic values are associated with Fourier Spectra of mean of IMF components. For EEG paradigms, 10-20 electrodes standard system regarding ear lobes were recorded with removing eye-blinks artifacts through visual inspections. Additionally, EEG signals are analog filtered with an analog band pass filter at 0.5-70 Hz with 12-bit resolution to account for noise of very low frequencies and rejecting 50 Hz power line frequency (notch filter). The sampling frequency is set to 125 Hz. The results showed that inter electrode (common) variance of entropic values of IMF signals are significantly lower in major depression and those values are in the range of narrow range (0.145-0.165) with higher offset across all electrodes for 7 subjects. However normal group showed higher inter electrode variance over electrodes and the entropic values are in the range of (0.090-0.13) for 10 subjects. The mean frequency of instantaneous IMF signals over different bands for all electrodes are significantly lower in major depression patients when compared to normal subjects.

15. Priming rTMS with Lamotrigine: A Case Study Using EEG Markers

Shelly Menolascino, Mitch Belgin, Genevieve Izzo, Austin Conery

Washington Square Psychiatry & TMS

Lamotrigine is FDA-approved for maintenance treatment in Bipolar I, a highly recurrent mood disorder. It protects against recurrence in other highly recurrent neuropsychiatric disorders. With treatment-resistant depression, co-morbid anxiety disorders are the rule, rather than exception. Such comorbidity leads to worse treatment response, as well as less durable recovery, with notable higher risk of relapse and recurrence. Many TMS psychiatrists use lamotrigine as a potential adjunct, often at lower than standard anti-epileptic dosages. Yet some TMS researchers have exclusion criteria which include anticonvulsant medications, due to the potential to limit rTMS efficacy. We present a case study, following EEG changes, documenting "priming" of TMS with lamotrigine. PreTMS (MADRS 34) resting state EEG showed elevated alpha peak frequency (ALF=11.5), reflecting cortical overarousal and hypervigilance. QEEG showed excess slow alpha left-frontally, sourced from rostral ACC, a marker of depression. Prior to rTMS, lamotrigine was initiated, as a potential "primer", aimed at durable recovery if there was TMS response, given comorbid chronic, persistent PTSD. Six weeks later, on lamotrigine 100 mg, there was no clinical change. She had excellent response to a 4-week course of daily TMS, using HRV state-training. A repeat EEG showed marked diminishment and normalization of APF, a marker of cognitive flexibility and resilience. On QEEG, excess left frontal alpha was gone, and sLoreta showed normalization in the rostral ACC. CONCLUSION We argue lamotrigine, often at lower than anti-epileptic dosages, might target hyperarousal

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in individuals with comorbid depression and chronic PTSD, and thus prime TMS response, rather than hinder such.

16. Complex Mismatch Negativity in Pitch Pattern Tasks is Reduced in the First Episode Schizophrenia-Spectrum

Stormy D Green, Sarah M Haigh, Timothy K Murphy, Dean F Salisbury

University of Pittsburgh Department of Psychiatry

Mismatch negativity (MMN) is an event-related potential elicited by deviant auditory stimuli. In long-term schizophrenia (Sz), MMN to simple sound alterations (simple mismatch: sMMN) like duration or pitch are drastically reduced. Similar reductions do not occur in first-episode schizophrenia participants (FESz). MMN can also be elicited by deviant stimuli that violate complex patterns (complex mismatch: cMMN). cMMN was examined on an ascending tone pattern in FESz participants. Groups of 3 tones were presented to 16 FESz and 17 matched healthy individuals while they watched a silent film. The standard sequence ascended in pitch (50 ms, 330 ms SOA, 90%) while the last tone of the deviant group (10%) descended in pitch, violating the ascending pattern. Patterns were separated by 1000 ms. cMMN was visualized by subtracting the “standard” from the “deviant” ending tone waveforms. FESz showed significant reductions in early cMMN ($p=.03$, effect size $d=0.8$) and late cMMN ($p=.037$, effect size $d=0.76$). In conclusion, early and late demonstrate cMMN reduction among FESz with a large effect size. Whereas sMMN appears to be a biomarker of disease progression (relatively healthy at first episode, becoming progressively worse with disease duration), cMMN appears to be robustly abnormal at first psychosis. Because it is abnormal at first psychosis, it is possible that cMMN reflects the pathology developing before the emergence of psychosis. Thus, cMMN could potentially serve as a biomarker of disease presence prior to the onset of psychosis. We are currently testing cMMN in clinical high risk individuals.

Funding: NIH MH094328

17. Effects of task duration on EEG indexed sensory gating

T-Jay A Anderson¹, Katie McKearney¹, Phillip Tibbo², Derek Fisher³

¹Dalhousie University

²Nova Scotia Early Psychosis Program

³Mount Saint Vincent University

Sensory gating refers to the ability to filter out extraneous stimuli and represents an extremely early, automatic attentional process. The sensory gating process is a crucial element in the ability to focus attention and has been shown to have deep connections to neurological functioning. However, tasks that probe sensory gating processes vary greatly between studies ranging from 34 to 192 trials per session. During these sessions a participant is either passively listening to clicks or is engaged in another task while clicks are playing while recording neural activity. At the neurophysiological level, sensory gating is typically indexed by the P50 event-related potential, as well as the N100-P200 complex. The test-retest reliability of these measures differs across time as fatigue effects have been observed in the N100 but not the P50. Method: 15 healthy participants reporting no psychiatric diagnoses had EEG recording while passively listening to repeated auditory click pairs for two 64-trial (10-minute) blocks, which were analyzed and compared separately. Results: Participants showed a significant reduction in P50 and N100 sensory gating measures during the last 64 trials compared to the first 64 trials. Conclusions: Sensory gating appears to be influenced by fatigue effects. This should be taken into consideration when using common sensory gating methodologies.

18. EEG for Early Detection of Autism and Neurodevelopmental Monitoring in Primary Care

William J Bos^{1,2,3}

¹University of San Francisco

²Harvard Medical School

³Boston Children's Hospital

Autism spectrum disorder (ASD) is a complex and heterogeneous disorder, diagnosed on the basis of behavioral symptoms during the second year of life or later. Finding scalable biomarkers for early detection is challenging because of the variability in presentation of the disorder and the need for simple measurements that could be implemented routinely during well-baby checkups. EEG is a relatively easy-to-use, low cost brain measurement tool that is being increasingly explored as a potential clinical tool for monitoring atypical brain development. EEG measurements were collected from 99 infants with an older sibling diagnosed with ASD, and 89 low risk controls, beginning at 3 months of age and continuing until 36 months of age. Nonlinear features were computed from EEG signals and used as input to statistical learning methods. Prediction of the clinical diagnostic outcome of ASD or not ASD was highly accurate when using EEG measurements from as early as 3 months of age. Specificity, sensitivity and PPV were high, exceeding 95% at some ages. Prediction of ADOS calibrated severity scores for all infants in the study using only EEG data taken as early as 3 months of age was strongly correlated with the actual measured scores. This suggests that useful digital biomarkers might be extracted from EEG measurements. These results will be reported, with additional discussion of the potential for EEG as a neurodevelopmental monitoring tool for use in primary care, well-baby checkups.

Funding: NIH, Simons Foundation

19. EEG for Accommodating Thick and Curly Hair

Arnelle Etienne, Harper Weigle, Momi Afelin, Ashwati Krishnan, Shawn Kelly, Pulkit Grover
Carnegie Mellon University, Electrical and Computer Engineering

EEG systems are extensively used to diagnose neurological disorders such as epilepsy, detect head injuries, and interface machines with the brain. EEG is the gold standard in epilepsy diagnosis. We first observe that the current systems do not work well with thick and curly hair types, e.g. of individuals of African descent, because these hairtypes result in increased electrode-skin impedance and, consequently, poorer signal-to-noise ratios (SNRs). In clinical settings, those with curlier and coarser hair are often recommended to shave their heads, or wear their hair in a way that can be embarrassing, so that EEG's SNR is not compromised. However, we observe that even these techniques have limited efficacy. This paper aims at improving how we accommodate different types of hair while maintaining the SNR. We propose a novel system that incorporates a braiding technique called cornrowing to carefully expose the desired scalp locations to the electrodes, consistent with the standard 10-20 configuration of EEG electrodes. We demonstrate that cornrowing the hair according to our specifications results in substantially reduced electrode-skin impedance (up to 4x reduction). Further, the rate of increase of impedance over time is also reduced, likely because cornrowing tames the natural springiness of coarse, curly hair. Further results establish utility of jointly designing electrodes and hairstyles for improved EEG recordings.

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20. Impairments in Visual Selective Attention Among First-Episode Schizophrenia Spectrum Patients

Alfredo L Sklar, Brian A Coffman, Timothy K Murphy, Gretchen Haas, Dean F Salisbury

Clinical Neurophysiology Research Laboratory, Western Psychiatric Institute and Clinic, Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh PA, USA.

Background: While a large literature has examined attentional deficits in schizophrenia, little is known about the biological mechanisms related to attentional modulation of sensory processing underlying such deficits nor their pathophysiology early in disease course. To that end, we examined the N2pc, an electrophysiological marker related to visual selective attention, at first psychotic episode. Methods: Thirty-nine first-episode schizophrenia spectrum (FESz) and 34 healthy control (HC) individuals completed two target detection tasks that required varying degrees of top-down attentional control, pop-out and serial visual search. The N2pc was measured at a grouping of occipito-parietal electrodes (i.e. O1/2, PO3/4, and PO7/8). Results: FESz exhibited reduced N2pc ($p = .04$), lower accuracy ($p = .03$), and marginally slower reaction times ($p = .051$) across tasks. In HC, larger visual search N2pc was associated with better accuracy ($r = -.38$, $p = .03$). By contrast, in FESz larger pop-out N2pc was marginally associated with better accuracy ($r = -.30$, $p = .07$). There were no associations with reaction time and N2pc in either group. Conclusion: Reductions in FESz N2pc indicate an impaired ability to modulate sensory input via selective attention, whether largely bottom-up or top-down. Although the ability to modulate visual signals was associated with faster RT for the bottom-up task and improved accuracy for the top-down task in HC, N2pc was only associated with pop-out accuracy among FESz. These findings suggest that task performance that relies on bottom-up processes among healthy individuals necessitates greater top-down control even at first break, limiting available resources for tasks requiring greater cognitive control.

Supported by P50MH103204

Friday September 7th

8:00 am - 8:30 am

Continental breakfast & coffee provided

8:30 am - 9:25 pm

Plenary Lecture

Ballroom B, 2nd Floor



Maria Baldwin, University of Pittsburgh

Use of EEG in the Cardiac ICU

With the advent of digital EEG, continuous EEG monitoring of ICU patients could more readily be performed. Post cardiac arrest patients have been a particular population of great interest for EEG monitoring. In this session, we will look at the role of EEG in the post cardiac arrest patient. We will explore its use for detection of ictal activity, technical challenges and role in prognosis.

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9:30 - 10:25

ISNIP Invited Plenary Lecture

Ballroom B, 2nd Floor



Mary Phillips, University of Pittsburgh

Mechanisms of mood disorder in the human brain: multimodal neuroimaging to identify neural targets for new treatments

The overarching goal of my research is to increase understanding of the neural circuitry underlying mood disorders to: 1) identify neural biomarkers to aid diagnosis; 2) identify objective markers of risk for future development of these disorders in youth and young adults; and 3) identify neural targets that may play an important role in the discovery of new and more effective treatments for mood and anxiety disorders. My presentation will focus on the use of multimodal neuroimaging techniques to elucidate functional and structural abnormalities in reward processing and emotional regulation circuitries that are associated with dimensions of reward-related psychopathology in youth and adults. I will focus in particular on recent studies in my laboratory that have used these techniques to elucidate the neural bases of impulsivity and sensation seeking in youth and young adults. I will also present data from our studies in at-risk youth that have identified neurodevelopmental abnormalities in reward and emotional regulation circuitries that are associated with worsening affective pathology and aberrant, impulsive sensation seeking-related behaviors in these youth; and from studies in infants elucidating relationships between large-scale neural circuitry function and emerging emotional behaviors. Finally, I will present findings from ongoing studies in my laboratory that seek to determine the extent to which novel neuromodulation interventions, including transcranial direct current stimulation, targeted on specific neural biomarkers of impulsive sensation seeking in young-mid-life adults can ameliorate abnormalities in reward and emotional regulation neural circuitries and, in turn, reduce propensity for risky decision making and behaviors and future affective pathology.

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10:30 am - 10:55 am

Coffee Break

11:00 am - 11:55 pm

ISFSI Invited Plenary Lecture

Ballroom B, 2nd Floor



Bin He, Carnegie Mellon University

Electrophysiological Source Imaging and Brain-Computer Interface using EEG

Brain activity is distributed over the 3-dimensional volume and evolves in time. Mapping spatio-temporal distribution of brain activation with high spatial resolution and high temporal resolution is of great importance for understanding the brain and aiding in the clinical diagnosis and management of brain disorders. Electrophysiological source imaging from noninvasively recorded high density electroencephalogram (EEG) has played a significant role in advancing our ability to image brain function and dysfunction. We will discuss current state of EEG-based electrophysiological source imaging in localizing and imaging epileptogenic zone for guiding epilepsy surgery. Our work demonstrated the precision and robustness of high density EEG based source imaging of both the origin and extent of epileptic seizures, as validated by intracranial EEG recordings and surgical resection. We will also discuss the co-localization of hemodynamic and electrophysiological signals associated with motor imagery tasks, and our recent progress in EEG based brain-computer interface, demonstrating that humans can control a robotic arm by "thought".

12:00 pm - 1:45 pm

Lunch Break on your own

[1:00 pm - 1:30 pm

ISNIP Board Meeting]

Conference Room A, 3rd Floor

[1:30 pm - 1:55 pm

ISNIP Membership Meeting]

Conference Room A, 3rd Floor

2 pm - 3:25 pm

Pittsburgh City Bus Tour

Included with registration

Meet in front of University Club

3:30 pm

Coffee Break

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3:45 pm - 4:25 pm



ISNIP Presidential Lecture

Ballroom B, 2nd Floor

Sebastian Walther, University Clinic Bern

Imaging of the motor system in psychosis: On connectivity and behavior

Motor abnormalities are inherent features of psychotic disorders. These motor signs persist throughout the course of the illness and may even present before the onset of the full-blown psychosis. For decades, these symptoms have been exclusively attributed to antipsychotic medication, but historical evidence and studies in medication naïve subjects suggest that motor abnormalities are intrinsic to psychosis. Motor abnormalities could inform on pathobiology and psychosis staging. Instrumental assessments of motor function allow for objective measurements. Renewed interest in the field has stimulated neuroimaging studies on motor abnormalities in psychoses. Indeed, structural and functional alterations in the cerebral motor system are associated with the different abnormal motor behaviors. Particularly, the interaction between cortical motor areas and basal ganglia is of interest in this regard. Catatonia, parkinsonism, dyskinesia and neurological soft signs appear to have distinct associations within the motor network. Cortical motor areas further serve as excellent entry nodes to tackle the motor system by noninvasive brain stimulation. Finally, distinct alterations of motor networks were found in subjects with different risk for psychoses, potentially informing on prodromal pathways. Thus, the motor system in psychosis could become an excellent example of successful integration of neuroimaging techniques into psychiatric practice.

4:30 pm - 5:55 pm

Symposium 5

Ballroom B, 2nd Floor

Auditory processing in older adults: Exploring the potential of EEG to quantify age-related auditory neurocognitive decline and to evaluate training outcome

Chairs: Nathalie Giroud, Stefan Elmer

Age-related hearing loss (presbycusis) is highly prevalent in old age with about 25% of 70 years old individuals experiencing at least mild presbycusis. Moreover, presbycusis is one of the top three leading causes of disability in older adults, surpassing diabetes and dementia. An age-related decline in auditory functions represents a strong load on speech comprehension and cognitive functions and thereafter on communication, the fundamental principle for social interaction. Nevertheless, the diagnoses and/or quantification of hearing functions (i.e., central hearing loss, speech-in-noise perception, tinnitus, distress during hearing) in older adults is by no means straightforward. On the contrary, up to date there is no standardized procedure available to probe these auditory functions in older adults. Furthermore, age-related changes in the role of cognitive functions such as attention, executive functions, and working memory need to be emphasized when investigating auditory processing across the lifespan. In this symposium we will evaluate the possibility of EEG to quantify auditory functions in older adults, while the role of cognitive factors will be emphasized. Moreover, we will explore the potential of different EEG parameters (ERPs, time-frequency, source localization, functional connectivity) as outcome variables when

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evaluating rehabilitation strategies to counteract auditory neurocognitive decline in older adults for example by using word learning or lip-reading training. This symposium will therefore make an important contribution to help better understand how hearing functions in older adults may be evaluated in the clinic and how they may be better maintained in the normal aging brain.

Exploring relationships between speech understanding and auditory ERPs

Tess K. Koerner, Leslie Grush, Brandon M. Madsen, Curtis J. Billings VA RR&D National Center for Rehabilitative Auditory Research, VA Portland Healthcare System, Portland, OR

Understanding speech in background noise is difficult for many individuals. Factors such as age, hearing sensitivity, and cognitive processing abilities likely contribute to the variability in performance often observed across individuals. Electrophysiological measures are ideal for assessing speech perception in complex listening environments as they allow for an examination of the effects of various factors on neural response timing and magnitude along the auditory pathway. Examining relationships between various neural and behavioral measures can provide valuable information about neural mechanisms underlying speech-in-noise perception. This work used auditory event-related potentials and behavioral measures to explore relationships between electrophysiological responses, cognitive processing abilities, and speech-in-noise perception across a group of 10 older, hearing impaired participants. Speech-evoked P3 responses were elicited to consonant-vowel syllables in a complex oddball paradigm. The P3 auditory event-related potential is thought to reflect attentional and cognitive processes related to auditory perception, and therefore serves as a useful measure for exploring variability in speech-in-noise perception in older, hearing impaired listeners. Participants also completed several speech perception tests and cognitive measures. Relationships between the P3 response and these behavioral measures were analyzed. Data from work examining the effects of age and hearing impairment on various neural and behavioral measures of speech perception in noise will also be discussed. This work has strong practical implications for the use of electrophysiological responses in the assessment of communication abilities in clinical populations by confirming that auditory event-related potentials are possible predictors of speech-in-noise perception across individuals with hearing impairment.

Funding Sources: VA Advanced Fellowship to TKK; United States (U.S.) National Institutes of Health (NIHNIDCD: DC15240) to CJB; Department of Veterans Affairs (VA-RR&D: 5IK2RX000714) to CJB.

Measuring Distress in Hearing

Lars Rogenmoser Laboratory of Integrative Neuroscience and Cognition Georgetown University Medical Center, Washington, DC, USA

Among many things, hearing is essential for making music. Life-long professional musicians becoming impaired in playing music (e.g., due to hearing loss, tinnitus) experience a severe loss of quality of life which is of high public importance. Quantifying impairment-related issues using EEG can be straightforward to some degree (e.g., ABR), whereas capturing the affective perspective is not. In my talk, I will focus on this aspect, discussing an N400 paradigm to measure distress in hearing. In particular, I will present findings from a special population representing a bend point in auditory performance, namely musicians with absolute pitch.

Funding source: Swiss National Science Foundation

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Does lip reading make speech comprehension easier for everyone? Electrophysiological evidence on inter-individual differences in younger and older adults

Nathalie Giroud^{1,2,3} & Natalie A. Phillips^{1,2,3,4}

¹ Centre for Research in Human Development, Department of Psychology, Concordia University, Montréal, Québec, Canada

² Centre for Research on Brain, Language, and Music, Montréal, Québec, Canada

³ Canadian Consortium on Neurodegeneration in Aging, Team 17, Canada

⁴ Lady Davis Institute for Medical Research, Jewish General Hospital, Montréal, Québec, Canada

For older adults, speech comprehension represents a strong load on working memory (WM) because of the need to rapidly process auditory cues while maintaining relevant information. The presence of visual cues (i.e., lip movements) during speech processing has been shown to enhance speech comprehension. However, the relation between audiovisual speech processing and WM remains unclear. In this EEG study, we investigated the extent to which interindividual differences in audiovisual speech processing may be explained by WM in younger (N=32) and older adults (N=16). The N400 was recorded time-locked to the last word of high and low predictable sentences. The semantic context (SC) effect was quantified as the difference in the N400 magnitude evoked by low minus high predictable sentences and assessed separately for an auditory-only (AO) and an audiovisual condition (AV). Furthermore, cortical sources of the SC effect were estimated using sLORETA. All individuals showed an earlier SC effect in the AV compared to the AO condition, highlighting faster integration of unpredictable words. Additionally, we found a stronger SE effect in the AV compared to the AO condition, but only in individuals with high WM. In low WM individuals, we found stronger right precuneus activity in the AV condition reflecting higher processing load during multisensory integration. Our data suggest that only a high WM allows to use visual speech cues to create predictions about the end of a sentence. We therefore argue that individual differences in WM may relate to qualitatively different aspects of the audiovisual benefit during speech comprehension.

Funding sources: NG: Early Postdoc Mobility Swiss National Science Foundation, NP: Canadian Institutes of Health Research (Grant MOP-97808)

Word learning as a promising tool for assessing auditory-related disorders and cognitive dysfunctions

Stefan Elmer Division Neuropsychology (Auditory Research Group Zurich, ARGZ), Institute of Psychology, University of Zurich, Switzerland

Word learning constitutes a multifaceted task that requires the dynamic interplay between perceptual and cognitive functions. In my talk, I will propose different word learning tasks as promising tools for assessing auditory-related disorders, learning disabilities, and mnemonic dysfunctions across the lifespan. In particular, I will present EEG data on word segmentation and word-meaning learning in different populations, including children, adults, elderly as well as musicians. Furthermore, I will emphasize how different EEG parameters (i.e., event-related potentials, frequency-based analyses, and source-based functional connectivity) can be used in a fruitful manner for diagnostic purposes and for predicting training outcome.

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4:30 pm - 5:55 pm

Symposium 6

Conference Room A, 3rd Floor

The Application of EEG in Psychiatry

Chair: Salvatore Campanella

This symposium will discuss the usefulness of different electrophysiological tools in psychiatric daily clinical practice. Concerning the detection of schizophrenia, Dean Salisbury (USA) will debate about the potential role of neurophysiological biomarkers such as the MMN, while Nash Boutros (USA) will focus on the utility of resting state vs. evoked EEG/MEG responses. Two talks will be also devoted to addictions. Oliver Pogarell (Germany) will present and discuss data from a neurophysiology-based therapeutic strategy using a real-time neurofeedback paradigm in patients with substance use disorders. Finally, Salvatore Campanella (Belgium) will focus on the impact of anti-craving medication on specific cognitive ERPs biomarkers in recently detoxified alcoholic patients.

Complex Mismatch Negativity to Extra Tone Gestalt Pattern Deviance may be a Putative Biomarker for Schizophrenia

Dean F Salisbury & Sarah M Haigh Clinical Neurophysiology Research Laboratory, Western Psychiatric Institute and Clinic, Department of Psychiatry, University of Pittsburgh School of Medicine

Presently there is no biological marker that can detect incipient psychosis. We measured complex mismatch negativity to deviant tones that violate the Gestalt perceptual principle of grouping by proximity in the first-episode schizophrenia spectrum, individuals early in the course of psychosis, to validate potential biomarkers of disease presence. Participants attended a silent video and repeated series of 3 identical tones were presented with short gaps in between. Occasional tone series that included a deviant extra 4th tone identical to the others were pseudo-randomly interspersed. Participants also were presented a simple physical parameter mismatch negativity task, where rare pitch- and duration-deviants were presented among standard repetitive tones). Twenty-two individuals at their first psychotic episode were compared to 22 volunteer healthy controls. First episode individuals did not show reductions of pitch-deviant MMN ($d = 0.08$) or duration-deviant MMN ($d = -0.02$). Importantly, first psychotic episode individuals showed reductions of the complex mismatch negativity ($d = 0.83$). Reduction in complex mismatch negativity but not in simple mismatch negativity in the first-episode schizophrenia-spectrum suggests impairments in late perceptual pattern processing that are sensitive to subtle pathology early in disease course whereas simple detection of stimulus change is unaffected. Thus, the extra tone Gestalt complex mismatch negativity displays the properties of a biomarker of disease presence at the first psychotic episode. Future studies in clinical high risk individuals are needed to determine whether this putative biomarker of disease presence is sensitive to the true prodromal state prior to the emergence of psychosis.

Resting state and ERPs in Deficit and non-deficit schizophrenia patients

Nash Boutros, Klevest Gjini, Susan Bowyer Clinical Electrophysiology Laboratory, Saint Luke's Marion Bloch Neuroscience Institute. Department of Psychiatry, University of Missouri-Kansas City.

Heterogeneity of schizophrenia is a major obstacle towards understanding the disorder. One likely subtype is the deficit syndrome (DS) where patients suffer from predominantly primary negative symptoms. This study investigated the EEG/MEG during resting state and evoked EEG/MEG responses. Ten subjects were

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recruited for each group (Control, DS and Non-Deficit Schizophrenia [NDS]). Resting state was recorded for 10 minutes, then an odd-ball paradigm (P300) and mid-latency evoked responses in a sensory gating paradigm were administered. MEG Coherence Source imaging (CSI) in source space and spectral analysis of the EEG and MEG waveforms in sensor space were performed. For resting state: (1) Significantly higher relative power at low frequencies (delta band) at sensor space in DS compared to NDS patients (MEG); (2) Source analysis revealed larger delta and theta power in the DS compared to NDS group in the frontal region; and (3) NDS patients showed significantly higher resting-state MEG signal relative power in beta bands in sensor space compared to DS patients. For evoked responses; 1) CSI during P300 task revealed a significantly higher average coherence value in DS than NDS subjects in the gamma band (30-80 Hz), when listening to standard stimuli; 2) only NDS subjects had a higher average coherence level in the gamma band than controls when listening to the novel sounds; and 3) P50, N100 and P3a amplitudes were significantly decreased in NDS compared to DS subjects. The data suggest that the two syndromes may not be representing different levels of severity but may be qualitatively different.

Neurophysiology tools as diagnostic and therapeutic applications in substance use disorders

Oliver Pogarell, Daniel Keeser, Susanne Karch Dept. of Psychiatry and Psychotherapy, University Hospital Munich, LMU, Munich, Germany

Neurophysiology techniques, i.e. the assessment of brain activity at rest (EEG) or upon stimulation (ERP) allow brain functional characterizations of psychiatric disorders with diagnostic, predictive and therapeutic implications. Neuropsychiatric disorders are often associated with deficits of executive functions, including response inhibition, voluntary decisions or reward related responses. The processing of these functions is modulated by brain regions, which can be assessed by EEG and or ERP studies. In substance use disorder (SUD) studies have shown that the craving is associated with increased responses predominantly in frontal and striatal brain regions. Based on EEG/ERP data in patients with SUD, a neurophysiology-based therapeutic strategy using a real-time neurofeedback paradigm has been developed. Patients were trained to voluntarily modulate craving-associated neuronal responses. Both biological and clinical effects of neurophysiology-based treatments will be presented and the feasibility of their implementation in a psychiatric context will be discussed.

What is the impact of anti-craving medication on cue reactivity in alcoholic patients?

Salvatore Campanella Laboratoire de Psychologie Médicale et d'Addictologie, ULB Neuroscience Institute (UNI), CHU Brugmann-Université Libre de Bruxelles (U.L.B.), Belgium

Alcohol-cue reactivity has been tagged as a principal mechanism of addictive behaviour, as repeated alcohol consumption leads to dopaminergic neurological changes and meso-cortico-limbic sensitization resulting in heightened incentive salience of stimuli associated with drinking. However, to our knowledge, no study has up to now tested the impact of anti-craving medications on this cognitive process. We performed an ERP study with recordings both at the beginning (T0) and at the end (T1) of a three-week detoxification cure. Fifty-eight patients were confronted at both moments with a visual oddball task, in which patients have to detect among a series of neutral stimuli target deviant stimuli, related or unrelated to alcohol. Our objective was to verify whether anti-craving medication (placebo, acamprosate, naltrexone or baclofen) would have an impact on the evolution of the oddball P300 (between T0 and T1), recorded in response to (non)alcohol-related targets. These results will also be correlated with the number of days of complete abstinence (post-detoxification cure). Preliminary data will be presented and clinical implications will be discussed.

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6:00pm - 7:00 pm

Poster Session II
Gold Room, 2nd Floor

Poster Abstracts:

1. Case study: epileptic spike and wave discharges monitored in EEG in course of cannabis withdrawal

Agnieszka I. Chrobok*, Kristina Adorjan*, Oliver Pogarell

During the last few decades, cannabis use has increased to become the most widely used illicit drug in the world. According to the World Drug Report of the United Nations Office on Drugs and Crime 3.8 % of the global population used cannabis in the past year. Typical patterns of consumption range from moderate to problematic, excessive use is associated with cannabis dependence. Repeated use of cannabis often leads to mental illnesses such as depression and psychosis, health problems in the physical sphere and impairments in the quality of life. Any abrupt interruption of more or less daily consumption can lead to withdrawal symptoms. These are often accompanied by vegetative effects, sleep disorders, anxiety and agitation, while seizures can also occur. Changes in the EEG in the context of cannabis use have been repeatedly described in the literature. However, there are only few reports describing the use of cannabis together with the occurrence of epileptic spikes in patients without epilepsy in patient history. The routine EEG in psychiatry is often abnormal, but not very specific with the resulting question of clinical relevance and consequences of potential anomalies like e.g. Should patients with detected epileptic discharges in EEG, but without any clinical correlates, be treated with anticonvulsants or not? With regard to this question, we present a case study where epileptic spikes could be observed in an otherwise clinically unremarkable patient with cannabis addiction. We present a 34-year-old female patient with a 14-year history of cannabis abuse in the course of withdrawal, showing abnormal EEG-patterns without any corresponding clinical symptoms. This case study is in line with the latest DSM-V diagnostic tool, including the diagnosis of cannabis withdrawal for the first time.

2. Predictive value of depression and neurocognitive impairment on auditory N100 latency in schizophrenia

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Numerous studies have found N100 amplitude deficits in schizophrenia, which are thought to reflect impairment in early auditory sensory processing and initial selective attention, and several authors investigated its relationship with positive symptoms. Instead, on latency of N100, few data have been reported and the findings are not robust. Until now, no investigation focused on N100 latency and its relations with psychopathology and cognitive deficits in schizophrenia. In the context of a multicentre study of the Italian Network for Research on Psychoses, we attempt to disambiguate the contribution of psychopathology and cognitive impairment on N100 latency in schizophrenia. ERPs were recorded, during an auditory odd-ball task, in 115 chronic stabilized subjects with schizophrenia (SCZ) and 63 healthy controls (HC). Psychopathology, neurocognitive functions and extrapyramidal side effects were measured by state of art instruments. Multiple stepwise linear regression analyses were used to determine the variables that predicted N100 latency for standard and target stimuli. Depression, parkinsonism, positive and disorganization dimensions, neurocognitive composite score and negative symptom domains were used as independent variables. SCZ did not differ from HC with respect to the latency of N100 for both stimuli. Regression models revealed that independent predictors of N100 latency were depression for

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standard tones ($B=0.256$, $p=0.010$) and neurocognitive composite for target tones ($B=-0.211$, $p=0.026$). Our results showed that speed of early processing was differently affected by depression and global cognitive impairment in SCZ, suggesting their involvement in poor activation of complex networks of the auditory cortical areas.

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3. Corticolimbic functional connectivity mediates the relation among early-life stress and suicidality in 5-HTTLPR s-carriers bipolar patients

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The relationship between early-life stress (ELS) and suicide in Bipolar Disorder (BD) has been widely investigated. The serotonin transporter genotype moderates this relation, indeed SLC6A4 (5-HTTLPR) S-carriers, compared to LL, present higher stress sensitivity that increase their suicide risk (Benedetti et al., 2014). Disregulation of corticolimbic functional connectivity (FC) is involved in pathophysiology of depression and BD, also related to suicidality and affected by ELS (Vai et al., 2014). Here we investigate the effect of 5HTTLPR on corticolimbic FC in BD-depressed patients, deepen a possible role of FC in mediating the detected relationship between ELS and suicidality in S-carriers. By using 3.0 T fMRI we found a significant interaction of 5HTTLPR and task condition (faces vs controlcondition) on FC between left-Amygdala and dorsolateral prefrontal cortex and anterior cingulate cortex in 64 BDpatients (CONN toolbox, cluster-size $pFDR<0.05$): S-carriers showed higher positive FC, compared to LL, during emotional processing, suggesting a reduced prefrontal control on Amygdala activity. Mediation and moderation analysis on extracted Z-scores of FC were performed (5000 bootstrapped-samples, 95%-CI), showing that the relationship between ELS (Social-Readjustment-Rating-Scale) and FC, and this latter and suicide (item-3, HDRS-21) were moderated by genotype: in S-carrier, ELS increase FC, which subsequently increase suicidality. A significant mediation of FC between ELS and suicidality was confirmed in s-carrier, but not in LL. This results suggest that the S-carrier proneness to stress could be accounted by the interaction between gene and ELS on brain. Imaging-genetics of early stress could improve our understandings and treatments of BD.

4. Relationship between P3a and real-life functioning in subjects with chronic schizophrenia

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The impairment in different areas of real-life functioning represents a key aspect of schizophrenia. Different studies reported a relationship between functioning and P3a, an event-related potential associated with the automatic engagement of attention and novelty processing. However, the nature of this association is not very clear, as literature findings were not controlled for possible confounds, such as cognitive impairment

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which might be crosscorrelated with both functioning and P3a. P3a for pitch- (p-P3a) and duration-(d-P3a) deviants stimuli were recorded in 125 chronic subjects with schizophrenia (SCZs) and in 61 healthy controls (HCs), recruited within the add-on EEG study of the Italian Network for Research on Psychoses. Within SCZs, we assessed functioning (using the Specific Level of Functioning Scale, SLOF), psychopathology and neurocognition. Multiple regression was used to investigate relationships between SLOF and P3a, age, gender, duration of illness, neurocognitive composite score of the MATRICS Consensus Cognitive Battery, Calgary Depression Scale for Schizophrenia total score, negative symptom domains of the Brief Negative Symptom Scale, positive and disorganization dimensions of the Positive and Negative Syndrome Scale (PANSS). Compared to HCs, SCZs showed a reduced amplitude of p-P3a and d-P3a. Linear regression demonstrated that p-P3a amplitude ($\beta=.329$, $p<.001$), avolition-apathy domain ($\beta=-.207$, $p=.019$) and PANSS positive dimension ($\beta=-.183$, $p=.038$) predicted the SLOF social acceptability domain, controlling for cognitive impairment and severity of the other psychopathological dimensions. Our results suggested that dysfunctions in the attention-mediated auditory processing are associated with social acceptability but not with other aspect of functioning such as instrumental and interpersonal skills.

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5. Non-Negative Matrix Factorization Reveals Resting-State Cortical Alpha Network Abnormalities in the First Episode Schizophrenia-Spectrum

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Background: Although subtle structural gray and white matter abnormalities are present in first episode psychosis, little is known about neural oscillatory dynamics during early illness. Pathophysiology of functional connectivity, thought to be a central factor in the emergence of psychosis, can be measured through network activity of alpha oscillations which may facilitate long-range communication between distal brain regions. Methods: Five minutes of resting Magnetoencephalography (MEG) were collected from 31 individuals with first-episode schizophrenia-spectrum psychosis (FESz) and 22 healthy controls (HC). Source activity was computed for the cortical surface and parcellated into 40 Brodmann areas per hemisphere. The first principal component for each region was Hilbert-transformed within the alpha range, and non-negative matrix factorization was applied to determine network architecture based on single-trial phase-locking values. Within networks, energy and entropy were calculated and compared between groups to identify regional network pathophysiology in FESz. Results: Four of the 17 cortical alpha networks identified were pathological in FESz. The networks involved areas thought to be pathological in psychosis including left temporal lobe, right inferior frontal cortex, right posterior parietal cortex, and bilateral cingulate cortex. The energy and entropy of network activations were compared between FESz and HC using the Wilcoxon rank sum test. Conclusion: Network analysis of resting alpha-band neural activity identified several aberrant networks in potentially pathologically-relevant areas in FESz, suggesting abnormal long-range system-level communication is evident at the first presentation for psychosis. Identification of pathophysiology in these networks may provide clues about mechanisms of disconnectivity and novel targets for non-invasive stimulation.

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6. Positive Psychology Course and Its effect on Well-Being, Social, and Emotional intelligence

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Objective. The present study examines whether the Positive Psychology course, which is given for 14 week and 3 hours per week to students at a university in Istanbul. Materials and Methods. 417 students participated. The study assessed pre- to post-test modifications in personal and mental well-being, happiness, satisfaction of life, emotional and social intelligence, emotional expressions and attachment styles factors. Results. The findings showed that significant differences between male and female gender in emotional and social intelligence. Interestingly, Results of paired sample t-test for females have significant difference on Positive Subscale of Emotional Expressivity Scale ($t=-2,047$: $p=0,042<0,05$), Negative Subscale of Emotional Expressivity Scale ($t=-2,052$: $p=0,041<0,05$), Personal Well- being Index ($t=4,65$: $p=0,00<0,05$), Social Information Processing Subscale of Tromso Social Intelligence Scale ($t=-1,997$: $p=0,047<0,05$), Social Skills Subscale of Tromso Social Intelligence Scale ($t=2,792$: $p=0,006<0,05$), Social Awareness Subscale of Tromso Social Intelligence Scale ($t=5,624$: $p=0,00<0,05$), Oxford Happiness Questionnaire ($t=2,112$: $p=0,036<0,05$), Total of Tromso Social Intelligence Scale ($t=-3,329$: $p=0,001<0,05$), Management Own Emotions Subscale of Bar-on Emotional Quotient Inventory ($t=-3,576$: $p=0,00<0,05$). Females reported significantly greater levels of positive emotional expressiveness, negative emotional expressiveness, social information processing and kendi duygularını yönetme on posttest compared to pretest. Discussion. It was necessary to discuss these results in a new perspective. The point reached at the end of the Positive Psychology course was not a happier life. Also, if the increase in awareness causes someone to find a deeper meaning, then happiness and well-being will be decreased at the beginning.

7. Correlation of EEG with Intracranial Pressure and Cerebral Hemodynamics during Burst-Suppression

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The physiological relationship between electroencephalography (EEG), intracranial pressure (ICP), and cerebral hemodynamics is poorly understood. Here we demonstrate work in correlating EEG with hemodynamic responses during burst-suppression states in non-human primates. Data were collected through acute experiments on non-human primates. All experiments and procedures were approved by the University of Pittsburgh and Carnegie Mellon University Institutional Animal Care and Use Committees. ICP and ABP was measured through invasive pressure probes in the parenchyma and external carotis, respectively. EEG was measured using 4 cup electrodes placed directly onto exposed skull using screws above the occipital and parietal cortices. Our preliminary results show that ICP and HbT change as a function of burst activity in the brain. Burst onset corresponded to a rise in ICP by 40%; a change of approximately 3mmHg. HbT simultaneously dropped by 0.2-0.3uM followed by a 0.5uM increase. ABP showed no significant change due to burst onset when compared to ICP changes. More work is needed to quantify the neurovascular relationship, specifically as a function of ICP baselines. Correlation of the hemodynamics with EEG may allow for quantifying intact neurovascular coupling in acute brain injury.

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8. Cerebral correlates of neurological soft signs in chronic schizophrenia

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Recent structural neuroimaging studies on the cerebral correlates of NSS focused on patients with first episode or recent onset schizophrenia. These findings may not apply to patients with chronic schizophrenia as longitudinal studies since NSS were found to increase with chronicity of the disease. 49 middle-aged patients with chronic schizophrenia (mean age: $42.3 \pm 14a$, duration of illness: $20.3 \pm 14a$) and 29 healthy subjects (mean age: $48.2 \pm 14a$) matched for age and sex were included. NSS were examined on the Heidelberg Scale and correlated to grey matter density by using whole brain high resolution magnetic resonance imaging (3 Tesla) with SPM12 analyses (FDR corrected). As expected, NSS were significantly ($p < 0.001$) higher in patients than controls. Patients showed significantly reduced gray matter volumes in the right inferior frontal gyrus and left parahippocampal gyrus, respectively. Within the patient group, NSS total scores were significantly correlated to reduced grey matter in the right occipital lobe, the left parahippocampal and superior temporal gyrus, the left thalamus (medial dorsal nucleus) and the left posterior lobe of the cerebellum (declive). These results were confirmed when chlorpromazine (CPZ)-equivalents were introduced as additional covariate; moreover, no significant correlates arose between NSS and CPZ-equivalents. In the healthy controls, solely NSS total scores were significantly ($p < 0.05$) correlated with the volume of right lentiform nucleus (medial globus pallidus). This pattern of cerebral changes in chronic schizophrenia differs from that typically found in patients with recent onset schizophrenia.

9. Parahippocampal Gyrus Thickness is Reduced and Associated with Hallucinatory Behavior and Verbal Fluency in the First Episode Schizophrenia Spectrum

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The early course of schizophrenia is associated with a progressive decrease in gray matter; however, it is unclear which structures decline first and how gray matter decline relates with cognition and symptoms. We examined these relationships in first episode schizophrenia-spectrum (FESz) individuals at their first contact with psychiatric services. T1-weighted MRI scans were acquired on 33 first-episode (FESz) and 32 matched healthy control (HC) individuals. Cortical thickness was estimated for 35 bilateral ROIs (Desikan-Killiany atlas) using Freesurfer. A cluster-based permutation test was used to determine significant group differences. Symptoms were rated with the Positive and Negative Syndrome Scale. Participants completed a category fluency task, naming as many animals as they could in one minute. FESz displayed a significant decrease in left fusiform gyrus, right insula, and right parahippocampal gyrus thickness ($p < .05$). Decreased parahippocampal gyrus thickness in left ($r = .37$, $p < .05$) and right ($r = .41$, $p < .05$) hemispheres were associated with worse verbal fluency. Increased right parahippocampal gyrus thickness was significantly associated with increased hallucinations ($r = .46$, $p < .05$). Right parahippocampal, right insula, and left fusiform gyrus thickness are reduced in FESz. Parahippocampal gyrus thickness is associated with verbal fluency and hallucinatory behavior in FESz. This may reflect the role of the parahippocampal gyrus in verbal memory, and abnormalities in verbal memory may impact hallucinations in schizophrenia. This likely occurs very early in disease course, as parahippocampal volume is also reduced in high-risk patients who convert to psychosis.

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10. Anterior Temporal Naming Area: a Patch Near the Anterior Tip of the Fusiform Causally Linked to Reading and Language

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The role of the ventral anterior temporal lobe in language processing remains unclear. In particular, electrical disruption of regions stretching along much of the ventral temporal cortex has been shown to affect naming. Here, we present intracranial electrophysiology, direct cortical stimulation, and 7T fMRI results that describe a new Word sensitive region near the anterior tip of the fusiform gyrus, which we dub the anterior temporal naming area. In 5 neurosurgical epilepsy patients undergoing intracranial electroencephalography, electrodes near the left anterior fusiform exhibited word sensitivity over five other categories of visual stimuli (faces, bodies, houses, hammers, and phase-scrambled images). For 2 patients, those same electrodes also displayed sensitivity to non-words, such as letter strings and pseudo words. Direct cortical stimulation was administered to 2 patients (P1 and P2), disrupting word and picture naming when applied to the word sensitive electrodes in both individuals and resulting in item circumlocution for P1. Additionally, the word selectivity demonstrated in our intracranial and stimulation studies is consistent with 7T fMRI findings in healthy controls, which display preferential orthographic sensitivity versus line drawings of objects anterior to the visual word form area, near the anterior fusiform. Taken together, our results strongly suggest the presence of a word sensitive patch near the anterior tip of the fusiform gyrus that is critical for naming and language, but not conceptual knowledge per se.

11. Major Depressive and Bipolar Disorder Differentiation based on Hilbert Transform

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The purpose of the study is to recognize multivariate synchronization differences in the major depression and bipolar disorders based on empirical mode decomposition of multi-channel EEG signals. This approach will enable for better individualized treatment approach based on pre- and post-assessment of mental diseases. This paper focuses on an application to the multivariate empirical mode decomposition (MEMD). EMD will be based on time–frequency analysis of EEG records. In the proposed method, Multivariate EMD-Phase synchronization analysis associated with Hilbert Transform has demonstrated successfully understanding phase synchronization behavior of the brain function. The synchronization index is one of the most important tools for phase synchronization analysis. We then classified discriminative synchronization indices for two different mental disorders (i.e. Bipolar and Major Depression). The results obtained indicate that there is strong relation between Bipolar Disorders and Major Depressions. When compared to normal subjects, there is relevance to the loss of synchronization for beta-gamma bands. EEG signals are digitized by a sampling rate of 125 Hz and recorded between 0.1 and 70 Hz with 12-bit resolution on 10–20 international system by 14 channels. A notch filter of 50 Hz were utilized to remove the noise and

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power line interference. 18 depression patients and 17 bipolar patients have been implemented. We concluded that the local separation of fast and slow mean frequencies is unique when compared to normal subjects in smooth manner.

12. Deficits in Attentional Modulation of Auditory Stimuli in First Episode Schizophrenia

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The late perceptual N100 auditory evoked potential is reduced in long-term schizophrenia and in the first episode schizophrenia spectrum (FE). It is not known whether the deficits are purely sensory in nature or reflect the inability of executive control cognitive centers to modulate sensory processing by selective attention. The N100 is increased in healthy individuals when sounds are attended, providing an objective measure of selective attention effects. Eighteen FE individuals and 17 matched healthy controls (HC) were compared on two auditory attention tasks. In the single tone task, participants ignored the tones in one block and pressed a button to every 7th tone in another block. In the twotone "oddball" task, participants ignored tones in one block and pressed to the oddball tone (infrequent higher frequency tone) in another. Attentional modulation of the N100 was marginally impaired in FE (Group x Attention, $p = 0.06$). The increase in N100 was greater for the oddball task ($p = 0.04$) and follow up analyses revealed that FE did not modulate N100 during the oddball task with attention to the same extent as HC ($p = 0.05$). This deficit may reflect a long-range functional disconnection between cognitive control cortical areas and sensory cortex early in disease course. This difference in N100 modulation between groups may be useful in learning more about the neurophysiology of the disease and could be utilized as a potential biomarker for diagnosis among clinically high-risk individuals.

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13. QEEG-Power of Spectral Dencity of brain regions correlated with risk and resistance for bipolar disorder: Comparing with first degree relatives and unrelated healthy subjects

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Background: Temperament originates in the brain structure, and hereditary individual differences are attributable to neural and physiological function differences. Affective temperament is a suggested endophenotype for BD as well. qEEGPower of Spectral Dencity are considered as an index of the brain's general affective and cognitive activity. The relationship between these two may help to identify brain functional endophenotypes associated with predisposition for bipolar disorder. Methods: TEMPS-A and resting state QEEG were acquired for 25 euthymic patients, their healthy first degree relatives ($n = 25$) and 25 unrelated healthy controls. All of patients were used lithium for maintenance treatment. Results: Cyclothymic and hyperthymic temperaments scores were found to be similar between patients and their relatives ($F = 18.43$, $p < 0.005$). F4 and T4 delta activity were similar between patients and their relatives, whereas Pz alpha activity in relatives and unrelated healthy subjects ($F = 20.08$, $p < 0.05$ and $F = 14.85$, $p < 0.05$). F7 beta and F7-O2 high beta power were correlated with hyperthymic and irritable temperament in bipolar patients, respectively ($r = 0.387$, 0.439 , 0.364). T3-F4-T4 delta power were correlated with cyclothymic temperament in patients and healthy relatives ($r = 0.420$, 0.443 , 0.505 and 0.334 , 0.258 , 0.372). There was found an inverse correlation between Pz alpha power and hyperthymic temperament in healty relatives and unrelated healthy subjects ($r = 0.256$ and 0.311). Conclusion: Medial temporal network seems to be associated with the heritability of bipolar disorders. However, left dorsolateral prefrontal beta and high beta activity may be a neural marker of a resistance factor for the disorder.

14. Dynamic Source Imaging of Ictal Activities in Focal Epilepsy Patients

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Scalp EEG is the only established non-invasive electrophysiological mapping tool that provides reliable seizure recording for pre-surgical evaluation of epilepsy. However, electrical source imaging (ESI) of ictal scalp EEG to localize the seizure onset zone (SOZ) remains challenging. Using a long-term dense-array EEG monitoring protocol along with a dynamic seizure imaging (DSI) algorithm, we were able to localize the ictal activity in concordance with surgically resected zones and ictal intracranial EEG recordings in the cohort of patients. 6 patients with focal epilepsy who had acquired T1 weighted MRI imaging with long-term 76-channel EEG recording were included in this study. All 6 patients had intracranial EEG recording and underwent resective surgery with at least 6-month follow-up. Seizures were visually inspected and the electrophysiological onset were identified by experienced clinicians. The recordings were also down-sampled to explore the effect of different montages. The localization results at the seizure onset were then compared with the SOZ electrodes, extracted from CT images and based on physician's reports. The mean localization error between the estimation and the SOZ electrodes is approximately 1.19 cm. In the subset of patients who became seizure-free, the localization error is smaller. Our results demonstrate the capability of imaging spatiotemporal seizure sources noninvasively, which nowadays can only be achieved by invasive procedures in clinical practice. It was also shown that the localization accuracy improves when electrode numbers are increased, which suggests the benefit of using high resolution EEG recording system.

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15. Prediction of Drug Resistance in Obsessive Compulsive Disorder Using EEG Complexity

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Obsessive Compulsive Disorder (OCD) is a common disorder with a life-time prevalence of 2.3 percent. The disorder is characterized by recurrent intrusive thoughts (obsessions) and repetitive behaviors (compulsions (DSM-5)). The mainstay of the pharmacological treatment of OCD are selective serotonin reuptake inhibitor (SSRIs) and cognitive-behavioral therapy (CBT), producing a response in only 50% of patients. Accordingly, clinicians frequently encounter "treatment-resistant" cases of OCD, who do not respond adequately to conventional treatment modalities. Identifying treatment resistant patients early in the treatment course is an important goal in clinical practice. In this study, we have examined quantitative EEG recordings for predicting drug resistance in OCD patients. Thirty-seven patients responding to SSRIs and 28 resistant cases were identified retrospectively. Approximate Entropy (APEN), which is a well-known complexity measure, was used as a potential biomarker for extracting EEG features. APEN features were extracted from raw EEG data (0-50 Hz) after data filtered according to four common frequency bands namely delta (0.5-4 Hz), theta (4-8 Hz), alpha (8-12 Hz) and beta (12-24 Hz) bands. The classification performance of feature vectors corresponding to five frequency bands were tested using a Random Forests classifier. The results indicated that it is possible to identify drug resistance with a classification accuracy of 75.28%, 68.99%, 89.95%, 63.91% and 64.78% with APEN features extracted from raw data, alpha, beta,

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delta and theta bands respectively. These results suggest that APEN could be a promising measure for identifying patients who would not respond to medications.

16. Electrophysiological Correlates of Learning and Emotion in Parkinson's Disease

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The dopaminergic reward system is the focus of intensive research because of its relevance to disorders such as addiction, obesity, Parkinson's disease (PD), schizophrenia, and depression. The current study was aimed to test whether learning effects on a measure of reward expectancy, the stimulus-preceding negativity (SPN), were dopamine mediated. A secondary goal was to test whether dopamine involved in processing of emotions triggered by positive and negative feedback displays. Parkinson's disease patients and healthy controls were tested via a probabilistic categorization task, in which they required to find out which of two doors was usually followed by a pleasant Picture and which by an unpleasant one. During the task procedure measurements for learning (i.e., changes in SPN) and emotion (i.e., late positive potential, startle blink reflex, and self-report) were recorded. Spontaneous eyeblink rate, an index of striatal dopamine level, of each participant was also recorded. Results showed that SPN learning effects seen in the control group were reduced in the patient group. Post-experimental questioning and SPN topography suggested that patients might have compensated for impairments in their dopamine-dependent reinforcement learning system by switching to declarative memory. Consistent with prior findings, participants with Parkinson's disease were less responsive to negative feedback as indicated by late positive potential. Patients with low spontaneous blink rate tended to exhibit reduced affective modulation of startle blink. Dopamine plays an important role in both anticipation and receipt of task feedback.

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17. Corticomuscular functional coupling assessment based on multifractal asymmetry cross-correlation analysis of EEG and EMG

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A large number of studies on animal cerebral cortex have demonstrated the presence of scale-affine dynamics in the patterns of neuronal avalanches. The scaling behavior between EEG and EMG signals can elucidate the dynamical mechanism of corticomuscular coupling function. To investigate the functional coupling between M1 and muscles, the multifractal asymmetric cross-correlation analysis (MF-ADCCA) method is adopted to analyze the time series of EEG and EMG in different coupling forces. The M1 and EMG signals during steady-state isometric contraction of right wrist flexor were recorded simultaneously from 12 right hand healthy subjects. In order to obtain homogenous EEG and EMG signals without motion artifacts and noise interference, a segmentation algorithm based on Jensen-Shannon entropic divergence and time irreversibility analysis is used to find common segments which have same boundaries. The processed EEG and EMG signals are analyzed by MF-ADCCA. The experimental results show that all the generalized fractal dimensions are greater than 0.5, which means that there is long-range persistent between EEG and EMG. Also, the cross-correlation between EEG and EMG are asymmetric and the asymmetric is obvious in the small fluctuation. With the increase of coupling force, the generalized hurst index of small fluctuation shows an increasing trend and the range of change from EEG to EMG is larger than EMG to EEG.

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18. Noninvasive Imaging Inter-Ictal Activity from Scalp EEG by Means of an Iterative Reweighted Edge Sparsity (IRES) Algorithm

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About one third of epilepsy patients do not respond to any medication, and surgical removal of the epileptogenic tissue is a viable option to stop seizures. The precise determination of the seizure onset zone (SOZ) is critical for presurgical guidance or intracranial grid placement. In this study, we aim to image the epileptic activity of the brain noninvasively from scalp EEG with an objective and computationally efficient technique. We have collected and analyzed pre-surgical MRI and high-density EEG recordings from 10 medically intractable epilepsy patients, from which an individual and realistic head model was made for each patient and inter-ictal spikes were extracted. More specifically, the EEG recordings were first pre-processed and then passed through a semi-automated detector to label out all potential candidates of the inter-ictal spikes, which were averaged to improve the signal-to-noise ratio. Solving the inverse problem using our recently proposed IRES method, we estimated the spatial location and extent of the interictal activity for each patient. The estimated results match well with the location and extent of the clinical findings defined by surgical resection and/or SOZ from intra-cranial studies. The results indicate a localization error of about 5 mm for resection and 10 mm for SOZ electrodes. The estimated source patch falls well inside the surgical resection volume and covers around 80% of the volume size. The capability of this algorithm to accurately localize and objectively determine the extent of the underlying epileptic brain sources is of crucial interest in studying epileptic brain and pre-surgical planning.

Funding: NIH R01 NS096761 and EB021027

19. Electrophysiological correlates of antidepressant response to sleep deprivation: preliminary findings by using a 1-ch EEG device

Takuya Yoshiike^{*1,2}, Masahiro Suzuki^{1,3}, Sara Dallaspezia¹, Kaori Kashiwagi⁴, Kenichi Kuriyama², Makoto Uchiyama³, Cristina Colombo¹, Francesco Benedetti¹

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Developing a new portable EEG device that properly works with a single channel may give us new opportunities in the clinic to identify cortical properties related to a psychiatric disorder and its treatment, while minimizing potential burden of measurements. Although evidence could suggest that therapeutic sleep deprivation (SD), a promising rapid-acting antidepressant treatment, may primarily influence the homeostatic process and eventually restore cortico-limbic connectivity, EEG correlates of antidepressant response to SD have been poorly characterized. Twenty-four depressed inpatients with Bipolar Disorder (BD), who were administered repeated SD, underwent overnight sleep EEG recordings at baseline, the 1st recovery night, and after treatment, using a single-channel EEG device that has modest concordance rates for sleep staging with a standard multi-channel one. The rate of REM sleep increased following SD and

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remained at a higher level after treatment than at baseline, with its lower rate in responder than in non-responder. By contrast, the amount of slow wave sleep showed a rebound following SD and then returned to a baseline level after treatment, regardless of treatment response. Additionally, patients who achieved remission showed a higher rate of N2 but a lower rate of N1 over time, compared to those who did not. Our findings suggest that SD may introduce synaptic downscaling, while in parallel facilitating REM-related pathways to restore higher cortical mechanisms underlying the pathophysiology of BD. Although the validity of the 1-ch EEG variables need further investigation, clinical utility of the 1-ch EEG device appears to open new fields in psychiatry.

This work was supported by the SENSHIN Medical Research Foundation and the Nihon University Overseas Researchers Fund.

Saturday September 8th

8:00 am - 8:30 am

Continental breakfast & coffee provided

8:30 am - 9:25 pm

Plenary Lecture

Ballroom A, 1st Floor



Nash Boutros, University of Missouri Kansas City

The Standard EEG in Childhood Psychiatric Disorders

The electroencephalogram (EEG) is an inexpensive non-invasive method for assessing brain function. The EEG remains hugely under-utilized in the assessment of childhood psychiatric disorders. Possible factors contributing to this underutilization will be discussed. The rate of EEG abnormalities is higher in children than in adults with psychiatric problems. That the brain heals itself has been advocated as the explanation for the decrease in the rate of abnormalities with moving from childhood through adolescence to adulthood. In this presentation we will argue that it is the growing thickness of the skull that may be a better explanation of this observation. Abnormalities in childhood psychiatric disorders will be reviewed with a focus on autism spectrum disorder (ASD), attention deficit/hyperactivity disorder (AD/HD) and repeated aggression. The presentation will conclude with providing examples of the ideal design for prospective studies to address the efficacy of treatment based on EEG findings (specifically isolated epileptiform discharges) in children with psychiatric disorders.

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9:30 - 10:25

ISBET Invited Plenary Lecture

Ballroom A, 1st Floor



Werner Strik, University Clinic Bern

Carving Nature by its Joints – The Bern SyNoPsis project

Despite important advances in clinical treatment of Schizophrenia, there is a disappointing deadlock regarding long-term disease management, biological heterogeneity, and the variety of theories about its etiology and pathophysiology. A methodological pitfall in contemporary neurobiological research may contribute to the failure to find mechanistic links between mental phenomena and the brain. Consequently, the Bern SyNoPsis project claims that the time-honored phenomenological method to define mental symptoms should not be contaminated with the naturalistic approach of modern neuroscience. Starting point was to shift the essence of psychotic disorders from reality distortion to a fundamental communication breakdown which lead to the development of a novel, neurobiologically informed semiotics of psychotic disorders. The respective operational rating scale (Bern Psychopathology scale, BPS) allows disentangling the clinical manifestations of schizophrenia into behavioral domains matching the functions of three well-described corticobasal brain loops including their corticocortical sensorimotor connections. The results of several empirical studies support the hypothesis that the tripartite symptom structure, segregated into the affective, the language, and the motor domain, can be mapped onto abnormalities of the respective brain systems. Pathophysiological hypotheses derived from this brain systems-oriented approach have contributed to develop and improve novel treatment strategies with noninvasive brain stimulation, clinical parameters and communication strategies. We expect important future advantages for therapeutic alliances, personalized treatment, and de-escalation strategies.

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10:30 am - 10:55 am	Coffee Break
11:00 am - 12:25 pm	Symposium 7 Ballroom A, 1 st Floor

Electrophysiological correlates of cognitive impairment and negative symptoms in schizophrenia

Chairs: Armida Mucci, Nash Boutros

Negative symptoms (NS) and cognitive deficits represent core features of schizophrenia with a strong impact on real life functioning. Their pathophysiological mechanisms are poorly understood, preventing the development of advanced treatments. Over the years, research about electrophysiological correlates of NS and cognitive deficits has increased, but only few studies attempted to disentangle ERPs abnormalities associated with NS or neurocognitive domains. Heterogeneity of NS is a major obstacle to research progress. Several studies observed the validity of a categorical approach, subgrouping people with primary and persistent NS, termed as deficit syndrome (DS) and those without them (NDS). Recently, there is a broad consensus on a dimensional approach, as NS load into two factors - avolition/apathy (AA) and expressive deficit (ED). Since NS and cognitive deficits in schizophrenia are partially related, understanding their neurobiological underpinnings could be helpful to identify subgroups of schizophrenia with different prognosis. Nash Boutros will present data on qualitative difference in ERPs abnormalities in subjects with DS and NDS, suggesting that the two subgroups have different pathophysiological mechanisms. Annarita Vignapiano will illustrate the findings of a study in which ERPs analysis during an oddball task revealed a specific pattern of association between N100 abnormalities and ED. Giorgio Di Lorenzo will present a study on the relations between P300 latency and cognitive impairment in the working memory domain in chronic schizophrenia. Brian Coffman will show findings about impairment in the modulation of contralateral delay activity amplitude, a neurophysiological index of visual short-term memory, in subjects at first episode of schizophrenia.

ERPs in schizophrenia subtypes: qualitative differences between subjects with deficit and nondeficit subtypes

Nash Boutros, Klevest Gjini, Susan Bowyer Clinical Electrophysiology Laboratory, Saint Luke's Marion Bloch Neuroscience Institute, Department of Psychiatry, University of Missouri-Kansas City.

The deficit syndrome (DS) is characterized by the presence of primary negative symptoms and is associated with poor outcome. A recent study from our group investigated the EEG/MEG during resting state and evoked EEG/MEG responses. Ten subjects were recruited for each group (Control, DS and Non-Deficit Schizophrenia [NDS]). Subjects were first recorded for 10 minutes eyes open (no task), then underwent an odd-ball paradigm (P300) and mid-latency evoked responses in a sensory gating paradigm. Significant differences were found between deficit and non-deficit patient groups: P50, N100 and P3a amplitudes were significantly decreased in NDS compared to DS subjects. NDS patients had abnormalities of both early (gating) and late processes (P300), and an increased response to novelty. The main deviance in the DS group was an increased response to ongoing irrelevant stimuli. These data suggest that subjects with primary negative symptoms have qualitative difference in ERP abnormalities, with respect to subjects with other forms of schizophrenia. These subjects might specifically present difficulties in the assessment of the relevance of stimuli to the ongoing task, in line with recent models of negative symptoms.

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Neural correlates of negative symptoms domains: evidences of their heterogeneity from an auditory oddball task

Vignapiano A.¹, Mucci A.¹, Giordano G.M.¹, Di Lorenzo G.², Ferrentino F.², Altamura M.³, Bellomo A.³, Galderisi S.¹

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Negative symptoms represent a heterogeneous psychopathological dimension, associated to poor outcome in subjects with schizophrenia (SCZ). A large consensus was reached on the inclusion of 5 constructs in the negative symptom dimension: anhedonia, asociality, avolition, blunted affect and alogia. Factor analyses showed that these constructs cluster in two domains: avolition-apathy (AA; including avolition, asociality and anhedonia) and expressive deficit (ED; including alogia and blunted affect) associated to different neurobiological abnormalities and outcome indices. Few studies used event-related potentials (ERPs) to investigate the neurobiological basis of negative symptom domains with controversial findings. In the context of a multicenter study of the Italian Network for Research on Psychoses, our study investigated the relationship of N100 with AA and ED domains. ERPs were recorded, during an auditory odd-ball task, in 115 chronic stabilized SCZ and 63 healthy controls (HC). The BNSS was used to assess the negative symptoms and their domains in SCZ. Multiple stepwise linear regression analyses were used to determine the variables that predicted N100 amplitude for standard and target stimuli. Depression, parkinsonism, positive and disorganization dimensions, neurocognitive composite score, AA and ED domains, were used as independent variables. Our results showed highly significant N100 amplitude reductions in SCZ. Regression models revealed that only ED was an independent predictor of N100 amplitude for standard ($b=0.287$, $p=0.004$), and target stimuli ($b=0.290$, $p=0.005$). Our results showed a specific pattern of association between N100 abnormalities and ED, suggesting that only some negative symptoms are associated with early processing deficits in SCZ.

Relations between auditory P300 and cognitive impairment in Schizophrenia

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People with schizophrenia present abnormalities of event-related potentials (ERPs) and cognitive deficits. The P300 reflects global cognitive efficiency, measuring neural activations of attention and memory systems during information processing. Despite the consistent finding of impaired P300 and cognitive domains in subjects with schizophrenia (SCZ), the relation between these deficits was not fully investigated in Schizophrenia. As an add-on to the Italian Network for Research on Psychoses study, we investigated the relation between P300 and cognitive indices.

ERPs were recorded in 112 chronic, stabilized SCZ and 63 healthy controls (HC) during a standard auditory oddball task. P300 latency and amplitude were assessed at Pz. MATRICS Consensus Cognitive Battery (MCCB) was used for cognitive assessment. Two separate stepwise multiple linear regression analyses were used to investigate MCCB domains that predicted, respectively, P300 latency and amplitude,

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controlling for sociodemographic and clinical variables. SCZ showed significant longer latency ($p=0.001$; Cohen's $d=0.52$) and lower amplitude ($p<0.0001$; Cohen's $d=0.71$) of auditory P300 compared to HC. In SCZ, a significant regression model (adjusted $R^2=0.163$, $p<0.0001$) revealed that independent predictors of P300 latency were MCCB working memory (R^2 change=0.106, $b=-0.298$, $p=0.002$) and age (R^2 change=0.075, $b=0.275$, $p=0.004$). No variable entered in the regression model with the P300 amplitude as dependent variable. These findings showed an association in SCZ between slower neural processes during an attentive task (as measured by auditory P300 latency) and working memory impairment. We were able to confirm a substantial independence of P300 amplitude from other clinical variables.

Event-Related Potentials Index Visual Working Memory Deficits in First-Episode Schizophrenia

Brian A. Coffman¹, Tim K. Murphy¹, Justin Leiter-McBeth¹, Gretchen Haas², Carl Olson³, Raymond Cho^{2,4,5}, Avniel Singh Ghuman⁶, and Dean F. Salisbury¹

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Working memory dysfunction may be central to neurocognitive deficits observed in schizophrenia. Maintenance of visual information in working memory, or visual short-term memory, has been linked to general cognitive dysfunction and is predictive of functional outcome. Lateralized change detection tasks provide a useful mechanism for investigation of neurophysiological indices of visual short-term memory, such as the contralateral delay activity (CDA), which may provide insight into the underpinnings of working memory dysfunction in schizophrenia. We investigated CDA amplitude during lateralized visual short-term memory of one versus three items using sensor-level electroencephalography and source-level magnetoencephalography in 24 individuals at their first episode of psychosis within the schizophrenia spectrum (FESz) and 21 healthy controls matched for age, gender, IQ, and parental socioeconomic status. Individuals at their first episode of psychosis were unable to modulate CDA with increased memory load, and CDA at high load was reduced compared to controls ($p<0.05$). Further, source-level CDA was reduced in FESz within posterior parietal cortex, bilaterally ($p<0.05$), and behavioral and neurophysiological indices of working memory were correlated with neurocognitive deficits and symptom severity ($p's<0.05$). These results support theories that working memory dysfunction is a central and early component of the disorder. Targeted intervention focusing on working memory deficits may therefore be warranted to alleviate downstream effects of this disability.

Funding: NIH P50 MH103204

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11:00 am - 12:25 pm

Symposium 8

Conference Room A, 3rd Floor

Recent advances in white matter imaging in psychiatry

Chair: Sebastian Walther

Structural connectivity changes are frequently reported in affective and psychotic disorders and white matter microstructure properties have received much attention. The field is still making progress by applying new methods and more fine-grained research objectives. This symposium will demonstrate recent developments in white matter imaging in psychiatry. One talk will cover the longstanding debate on whether antipsychotic medication alters white matter in the short-term. Authors demonstrate the longitudinal effects of six weeks treatment with oral risperidone on white matter properties in previously unmedicated early psychosis patients. Another study will report on the effects of stress, immune factors and genes on white matter in bipolar disorder. The third talk will cover the association of white matter organization, resting state fMRI and cognition in psychosis, reporting distinct associations between structure/function and processing speed as well as working memory. The final talk combines multiple diffusion weighted imaging data sets in schizophrenia with a new meta-analytic method to disentangle effects of age and gender on white matter alterations in patients. Thus, the symposium will provide an excellent overview of the current issues in white matter imaging and the promises of these methods to understand psychiatric disorders.

White Matter Integrity and Antipsychotic Treatment in Schizophrenia

Nina V. Kraguljac, Anthony Thomas, Frank M. Skidmore, David M. White, and Adrienne C. Lahti

Decreased white matter integrity was reported in schizophrenia, but little is known about the relationship with antipsychotic medications. We enrolled 42 unmedicated patients with schizophrenia in a longitudinal trial with risperidone. Symptom severity was assessed with the Brief Psychiatric Rating Scale (BPRS). We obtained diffusion weighted images before medication was started, and after six weeks of treatment. Matched healthy controls were also scanned twice six weeks apart. 30 diffusion sampling directions spanning the whole sphere were acquired twice and concatenated. To assess whole brain voxel-wise group differences and changes over time in scalar indices used AFNI's 3dttest++ (age, sex, and RMSrel as covariates) with clustsim, a bootstrapping method used to correct for multiple comparisons. Mean age of patients was 26.62 years, 62% of subjects were male. Of the 42 patients included here, 33 completed the study. BPRS total scores decreased significantly during 6 weeks treatment, average risperidone dose was 3.73+/-1.72mg. Fractional anisotropy (FA) was significantly decreased in a small area of the medial temporal lobe and mean diffusivity (MD) was significantly increased in the hippocampal part of the cingulum in unmedicated patients (n=40) compared to healthy controls (n=41). Longitudinal analyses showed no changes in FA, MD, RD or white matter macrostructure in healthy controls over time, and no changes in patients after six weeks of treatment with risperidone. We found only small areas of white matter integrity deficits in our predominantly medication-naïve patients. Our data suggests that a short-term course of antipsychotic medication may not alter white matter microstructure.

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White matter integrity in bipolar disorder: effects of genes, stress, and immune factors.

Francesco Benedetti Psychiatry and Clinical Psychobiology Unit, Division of Neuroscience, San Raffaele Scientific Institute, Milan, Italy, C.E.R.M.A.C., Vita-Salute San Raffaele University, Milan, Italy

White matter (WM) microstructure and oligodendroglia have been associated with Bipolar Disorder (BD). In vivo, diffusion tensor imaging (DTI) studies consistently documented a pattern of higher mean diffusivity of water (MD), with higher diffusivity perpendicular to the main axis of brain WM tracts, although coated by myelin sheaths (radial diffusivity, RD), and lower diffusivity along the main axis of the WM fiber (axial diffusivity), altogether resulting in a lower preferential diffusivity along WM tracts, also reflected by decreased fractional anisotropy (FA). These measures reflect the myelination, orientational coherence, and microtubular axonal structure of fibers, and, in clinical settings, they associate with core clinical features of BD including impulsivity and suicide, cognitive performance, and response to antidepressant treatment. These differences have been associated both, with the genetic risk for BD, with specific gene polymorphisms influencing neurotransmission and the biological clock, and with environmental stressors increasing the risk for the disease, such as adverse childhood experiences. These differences are counteracted by lithium salts, the mainstay for the treatment of BD. They are worse in the presence of elevated biomarkers of cell-mediated immune activation and inflammation, and of elevated body mass index, both influencing, in turn, the outcome of the disorder. Altogether, DTI studies support the hypothesis that changes of WM microstructure in circuitries critical for emotional and cognitive processing could be linked with BD psychopathology, and that WM alterations in BD are a potential target both, for the development of new diagnostic techniques aiming at the definition of the biological underpinning of the disorder, and for drug discovery and development.

Developing big data neuroimaging approaches to understand the neurobiology of cognitive deficits in schizophrenia and other psychiatric disorders.

Peter Kochunov University of Maryland

Cognitive deficits in schizophrenia contribute to the functional and socioeconomic burden in the patients and may be related to functional and structural impairments of cerebral networks. We used Big Data approaches to clarify the functional and structural connectivity deficits and their independent and joint roles supporting two neurocognitive functions affected in schizophrenia: working memory and processing speed. A total of 261 patients (161M/100F; age=18-63 years) and 327 controls (146M/211F; age=18-65 years) were ascertained using ENIGMA rsfMRI and DTI analyses pipelines. ENIGMA mega-analytical aggregation was used to derive functional connectivity (FC) and structural fractional anisotropy (FA) measures. Canonical correlation analysis was used to study the association between cognitive deficits and functional and structural connectivity measures. Patients showed consistent cognitive, functional and structural deficits. Highest patient-control effect sizes were observed for cognitive deficits, followed by structural and functional connectivity measures (average Cohen's $d=0.72\pm 0.21$, 0.49 ± 0.14 and 0.31 ± 0.09). Functional and structural connectivity measures were uncorrelated and explained between 12 and 17% of individual variances in working memory and processing speed independently and up to 31% of the variance when combined, with relatively minimal overlaps. The regional functional and structural connectivity and their associations with neurocognitive deficits were proportional to the patient-control differences in regional connectivity. Functional and structural connectivity abnormalities both contribute to working memory and processing speed deficits in schizophrenia but largely independently, suggesting partially segregated mechanisms. The pattern of association suggested that schizophrenia specifically affected functional networks and white matter tracts that serve these cognitive domains. This association was replicated in normal controls and is likely independent of the diagnosis of schizophrenia.

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Harmonization of Multi-Site diffusion MRI Schizophrenia Datasets

Marek Kubicki^{1,9}, Suheyla Cetin Karayumak¹, Natalia Chunga¹, Amanda Lyall^{1,9}, Aristotle Voineskos², Jung Sun Lee³, Petra Viher⁴, Sebastian Walther⁴, Anthony James⁵, Tim Crow⁵, Philip R. Szeszko⁶, Sinead Kelly^{1,7}, Matcheri Keshavan⁷, Martha Shenton^{1,8,9}, Yogesh Rathj^{1,9}

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Diffusion MRI (dMRI), the only non-invasive modality that can map the white matter (WM) connections of the brain, has been used extensively to investigate abnormalities in schizophrenia. Massive amounts of dMRI data have been acquired as part of many, usually small and underpowered, research experiments. Recent years have brought about attempts to pool such datasets together to perform larger meta-analyses. Here, we present results of the first attempt to harmonize and analyze raw diffusion data across multiple schizophrenia datasets. DMRI data from 10 sites (ranging the spectrum of patients from early onset, first episode, early course and chronic schizophrenia, and as well as healthy controls) were pooled with a total of 509 healthy controls (234F, 274M: age 29.26+/-14.42) and 803 schizophrenia patients (363F, 439M: age 33.59+/-14.39). Pre-processing and data harmonization based on the rotation invariant spherical-harmonics (RISH) were used to remove the nonlinear scanner and sequence differences across sites. After all harmonized data was registered to the common template, global and regional WM integrity (FA and MD) across schizophrenia lifespan were computed using the tractography atlas, then statistically modeled across age. Significantly lower FA in patients were observed at all stages of schizophrenia, in majority of regions. The most significant differences in MD (predominantly higher in patients) were observed around the maturational peak. Differences between males and females were also observed in both groups. We will present the trajectories and quantitative parameters (peak age and effect sizes) of the whole-brain and specific regions for both genders in health and in schizophrenia.

Dopamine receptor density and white matter integrity: 18F-fallypride positron emission tomography and diffusion tensor imaging study in healthy and schizophrenia subjects

Monte S. Buchsbaum¹, Serge A. Mitelman², Bradley T. Christian³, Brian Merrill⁴, Bradley R. Buchsbaum⁵, Jogeshwar Mukherjee⁵, and Douglas S. Lehrer⁴

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⁵University of California Irvine

We used diffusion tensor imaging and 18F-fallypride positron emission tomography in 19 healthy and 25 never-medicated schizophrenia subjects to assess the relationship between gray matter dopamine D2/D3 receptor Binding Potential and white matter fractional anisotropy. Patients were unmedicated, neuroleptic

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naïve, and negative for drugs of abuse on urine screen on the scan day. Analysis of Functional NeuroImages (AFNI) regions of interest were acquired for 42 cortical Brodmann areas and subcortical gray matter structures, as well as stereotaxically placed in representative white matter areas implicated in schizophrenia neuroimaging literature. Split-half fallypride images confirmed highly significant reliability (0.8-0.9 correlations) for cortical and subcortical regions. Healthy subjects displayed predominantly negative correlations between 18F-fallypride binding across cortical and subcortical gray matter regions and fractional anisotropy in rostral white matter regions (internal capsule, frontal lobe, anterior corpus callosum). Positive correlations tended to cluster at the dorsal white matter regions closer to the cortex and predominated only in the temporal white matter. These patterns were disrupted in subjects with schizophrenia, who displayed significantly weaker overall correlations, as well as comparatively scant numbers of significant correlations with the internal capsule and frontal (but not temporal) white matter, especially for dopamine receptor density in thalamic nuclei. Dopamine D2/D3 receptor density and white matter integrity appear to be interrelated phenomena, and their decreases in schizophrenia may stem from dysregulation of dopaminergic impact on axonal myelination.

12:30 pm - 2 pm Lunch Break on your own

2 pm - 3:25 pm **Symposium 9**
Ballroom A, 1st Floor

Young Investigators Session

Chairs: Agnieszka Chrobok, Brian Coffman

This session will highlight work of 6 young investigators selected from the submitted abstracts.

Somatosensory Functional Connectivity Differences between Term and Preterm Infants Demonstrated using Coherence EEG Analysis

Hemang Shrivastava, Nathalie Maitre

This is the first study demonstrating resting state and tactile functional connectivity in hospitalized term and preterm infants using EEG coherence analysis. We have recorded EEG with 128 channel dense array system, during delivery of calibrated air puffs to the palm of the hand in 54 term and 61 preterm infants. We performed coherence analysis on the 200ms time window prior to stimulus (resting state) and the 171-240ms time window (onset of somatosensory response as defined previously). We focused on children Alpha (8-14Hz) as well as infants alpha oscillations (3-5Hz), associated with tactile processing. Each electrode served as a node in the connectivity matrix. A bootstrap significance test ($p=0.01$) was applied on the top 2% coherence values to search for the most significant connections. We calculated each infant's network Characteristic Path Length (CPL), Global efficiency (GE) and Average clustering coefficient (ACC). Both term and preterm infants' resting state connectivity was characterized by a dense cluster between central and centro-parietal locations. However, the tactile network in term infants displayed lateralization to the centro-parietal locations overlaying the somatosensory cortex, while preterm tactile network was dense between frontal and central locations. Overall, the tactile network CPL decreased, while GE and ACC increased with higher gestational age at birth, indicating increased efficiency. The increasing ACC of tactile networks across all infants was associated with increased behavioral reactivity to tactile stimuli at 1 year

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and improved fine motor function at 2 years. These measures may be useful as biomarkers of tactile-dependent functional outcomes in early childhood.

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Using the HCP-Derived Parcellation to Examine Relationships Between Gray Matter Volume and MMN in the First-Episode Schizophrenia Spectrum

Mark T Curtis^{1,2,3}, Timothy K Murphy^{1,2,3}, Justin R Leiter^{1,2,3}, Anna Shafer^{1,2}, Brian A Coffman^{1,2,3}, Dean F Salisbury^{1,2,3}

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Our laboratory showed correlations between gray matter (GM) volume in manually traced Heschl's gyrus (HG) and pitch and duration mismatch negativity (pMMN/dMMN) in first-episode schizophrenia (FESz). Here, we used the human connectome project (HCP) atlas to automatically yet precisely parcellate auditory and dorsolateral prefrontal cortex (dlPFC) and investigate relationships between GM and MMN in FESz. pMMN and dMMN were measured at Fz from 29 FESz and 27 matched healthy controls, and T1-weighted MRI scans were acquired. Using the HCP workbench, the HCP parcellation was applied to individuals. The parcellated A1 resided within the manually traced HG, validating the resampled parcellation. In FESz only, impaired pMMN correlated with reduced GM volume in left A1 ($r=-.43$), medial belt ($r=-.49$), and A4 ($r=-.41$). Impaired dMMN correlated with reduced left A1 ($r=-.37$), lateral belt ($r=-.50$), parabelt ($r=-.41$), and medial belt ($r=-.53$). In FESz dlPFC, impaired dMMN was associated with reduced GM in left area 46 ($r=-.40$), left area p9-46v ($r=-.41$), right posterior inferior frontal sulcus ($r=-.40$), and right anterior inferior frontal sulcus ($r=-.40$). The HCP parcellation showed similar correlations with pMMN and dMMN in FESz as manually traced HG. However, more extensive parcellation revealed overlapping and distinct associations for pMMN and dMMN. pMMN was associated with GM volume of left hemisphere A1 and anterior auditory areas, while dMMN correlated with GM in left A1, surrounding auditory areas, and prefrontal areas. This provides a more precise understanding of the spatial extent of gray matter reduction associated with impaired MMN in FESz.

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fMRI examination of the efficacy of group therapy in patients with anxiety disorder and functional dizziness

Agnieszka I. Chrobok, Department of psychiatry, Ludwig Maximilian's University Munich

Autism spectrum disorder (ASD) is characterized by impairments in social communication and behavior. Current treatments in ASD include medications to treat behavioral problems, behavioral therapy and sensory integration therapies. Transcranial magnetic stimulation (TMS) has been used in a number of psychiatric disorders. It offers the advantage of stimulating cortical activity non-invasively. In this open-label study we aimed to test the effect of low frequency stimulation of bilateral dorsolateral prefrontal cortices in children with ASD. Eight children with ASD (age 7-18) were recruited and TMS was applied over 20 sessions. ABC autism checklist were completed before and after TMS treatment by parents. In addition resting EEG was obtained at baseline and after treatment. The results show that, after TMS the children improved in sensory, relating, body and object use, language, and social and self-help skills subscale scores. EEG findings are not yet analyzed but will be presented in the conference. None of the children stopped the treatment due to adverse effects. Although preliminary, our findings indicate that bilateral frontal low frequency stimulation could be used as a safe and effective treatment in Autism Spectrum Disorder.

Proactive, but not reactive, inhibitory control is disrupted in hazardous drinkers: Evidences from ERPs in a Continuous Performance Task

Elisa Schroder, Salvatore Campanella Laboratory of Medical Psychology and Addictology, CHU Brugmann, ULB Neuroscience Institute (UNI), Université Libre de Bruxelles (ULB), Brussels, Belgium

Inhibitory control is thought to be altered in subjects with alcohol use disorders. However, inhibitory control is not a unitary construct, and the exact mechanisms involved in this deficiency remain poorly understood, with a lack of coherence in the results reported in the literature. In the last decade, the Dual Mechanisms of Control theory has increasingly received scientific attention. This theoretical framework divides cognitive control into two different strategies: proactive control (based on the active maintenance of contextual information in working memory in anticipation of the inhibition that has to come) and reactive control (based on the transient activation of inhibitory mechanisms due to an external stimulus). The impact of alcohol on proactive vs. reactive inhibitory control abuse has not been studied to date. To specifically study this impact, 30 light and 30 heavy drinkers underwent an AX version of the Continuous Performance Task concomitant with an EEG recording. ERP analysis revealed a specific reduction in the amplitude of the Contingent Negative Variation (CNV) in a context of uncertainty (i.e., when the next action could either be a "Go" or a "Nogo" task) in the group of heavy drinkers compared to the control group, while the CNV amplitudes in a context of certainty (i.e., when the next action is always a "Go" task) were equivalent between the two groups. These results suggests a specific impairment in the activation of a default proactive control mode in the context of uncertainty.

Funding: Fonds pour la Recherche en Sciences Humaines & Fonds pour la Recherche Scientifique (FRESH & FRS-FNRS)

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EEG Signature of Amygdala Activity during Real-Time fMRI Neurofeedback Training for Depression

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¹Department of Psychiatry, University of Pittsburgh, Pittsburgh PA

²Laureate Institute for Brain Research, Tulsa OK

Real-time fMRI neurofeedback (rtfMRI-nf) training to upregulate amygdala hemodynamic activity during positive autobiographical memory recall decreases depressive symptoms. The current analysis characterized the EEG signal correlated to the fMRI amygdala signal during rtfMRI-nf training in order to translate amygdala rtfMRI-nf into a more easily implemented EEG-only intervention. 33 depressed patients recalled positive memories while upregulating hemodynamic activity in an amygdala (n=18) or parietal (n=15) region during rtfMRI-nf training. 32-channel EEG recordings were collected simultaneously with fMRI. After removing MRI and cardioballistic artifacts, a continuous wavelet transform was applied to obtain EEG signal power for each channel in four frequency bands at each electrode, which were convolved to a canonical hemodynamic response function. The average positive memory related amygdala signal and EEG frequency band data was calculated for each participant. A Principle Component Analysis (PCA) was performed on the EEG data, and the top 7 factors were included in a linear regression analysis to predict the amygdala signal across participants. Using the 7 factors identified by the PCA, we were able to explain 56% of the variance in amygdala activity ($p=0.04$). The alpha band, particularly in the posterior regions, was driving the model significance and was negatively related to amygdala activity. Using concurrent EEG measured during amygdala rtfMRI-nf training, we identified EEG correlates of amygdala hemodynamic activity during positive memory recall. The alpha band was a particularly important predictor. As alpha suppression is associated with processing high-arousal positive stimuli, reducing alpha activity during positive memory recall may be an effective intervention for depression.

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Effect of acupuncture for frontal lobe α band asymmetry evoked by anger

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According to motivational direction, previous studies have shown that anger induces frontal lobe α (8–13Hz) band asymmetry (FAA) in electroencephalogram (EEG). This study aimed to explore the effects of acupuncture on declining the FAA caused by evoked anger statement. In the study, right-handed 34 subjects with lots of anger, over the criteria score of 75 points in Novaco Anger Scale were included. For the baseline, EEG signals were recorded by 32 channel cap, under comfortable condition for eight minutes. Emotions of anger was induced by Articulated Thoughts in Simulated Situations (ATSS) task sequence, for nine minutes. After that, participants received acupuncture at GB20, GB21 for 10 minutes. The fast fourier transform was done for frequency analysis. The results showed that in the emotion of anger, participants displayed higher FAA at FP1, FP2, F3, F4, F7, F8 especially in left hemisphere than right one, compared to the baseline. Interestingly, with acupuncture stimulation, greater left sided FAA declined and even altered to the opposite as the stimulation continues. After the removal of acupuncture, FAA returned to the value between the baseline and the evoked anger stage. In conclusion, this study confirmed that anger stimulation

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increase left sided FAA and acupuncture affects toward opposite direction. It suggests the potential of acupuncture treatment on reducing FAA induced by anger stimulation. Therefore, the study confirms the clinical possibility that acupuncture can immediately recover the brain change caused by anger.

Funding: Undergraduate Research Program (URP) grant funded by Kyung Hee University College of Korean Medicine

2:00 pm - 3:25

Symposium 10

Conference Room A, 3rd Floor

QEEG and Neurofeedback in Psychiatry/Neurology: ADHD, Autistic Spectrum Disorder, Anxiety, Epilepsy, Sleep and Head Injuries/Concussions/Dementia

Chair: Michael Linden

QEEG has been used in psychology and psychiatry since 1990. QEEG has its foundation in ADHD Theta/Beta ratios (Lubar, Monastra, Linden) and then identification of subtypes of ADHD. QEEG based subtypes of Autistic Spectrum Disorder were identified more recently (Linden, Coben). Utilization of QEEG for identification of head injuries began 20 years ago (Duff), and currently is being used to detect Dementia and studied in correlation with CTE (Rozelle). Neurofeedback (EEG Biofeedback) began in the area of seizure disorders and epilepsy (Serman). Neurofeedback has been most extensively researched and performed with ADHD (Lubar, Linden). Neurofeedback has recently been studied and used with Autistic Spectrum Disorder (Coben, Linden), anxiety and head injuries (Linden) and TBI related Dementia in retired NFL players (Rozelle).

QEEG Subtypes and Neurofeedback for ADHD and Autistic Spectrum Disorders

Michael Linden, Ph.D. Attention Learning Center, Laguna Hills, California

QEEG has its foundation in ADHD Theta/Beta ratios (Lubar, Monastra, Linden) and then identification of subtypes of ADHD. The Theta/Beta ratio was found to have 93% specificity and be more than 90% reliable in identification of ADHD in children through young adults. In 1996, researchers identified subtypes of ADHD that were correlated with differential treatment responses to medications and assisted in selecting more specific treatment protocols for Neurofeedback.

Neurofeedback has been most extensively researched and performed with ADHD (Lubar, Linden). Neurofeedback with ADHD students resulted in higher IQ scores and has been found to have increased effectiveness without side effects compared to medication (Monastra, AAPB). Neurofeedback can be individualized to specific locations and frequencies in order to improve success rates and minimize side effects.

QEEG research identified six subtypes of ASD, including abnormal EEG activity (seizures), fast high Beta and both hypo and hypercoherence patterns (Linden, Coben). This has led to improved identification of

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Autism and Aspergers and significant improvements in communication, behavior and socialization (Coben, Linden).

QEEG and Neurofeedback for Detection and Treatment of Concussions, TBI and Dementia

Lucas Kobera, M.D. Department of Neurology, Florida State University

Within the sport concussion literature, there has been a call for more precise and accurate methods for diagnosing an injured athlete who may have suffered a concussion during competition or in off-field activities. Thankfully, research on the use of qEEG (Quantitative Electroencephalography) with patients with head injuries has (Duff, 2004) demonstrated reliable and measurable physiological markers that are associated with sport-related concussion. The research has shown that the qEEG map is the most sensitive type of brain imaging test for identifying post-concussion syndrome, detecting a concussion with 96 percent accuracy up to four months after injury, and it can track the impact of repeated injuries over multiple years' time.

Recent studies have been showing Neurofeedback and direct Neurofeedback are successful for treating concussions and TBI.. Neurofeedback for concussions and TBI can be individualized for each person and each specific head injury based on brain location, imbalance (frequency [speed], amplitude [energy], and coherence [connectivity]).

QEEG and Neurofeedback for Addiction and PTSD

George Rozelle, Mind Spa, Sarasota, Florida

Neurofeedback treatment of addiction can be traced back to the 1970's started with Joe Kama, (Kama & Noels, 1970) who established that the alpha rhythm can be operantly conditioned. With the clinical observation that alcoholics tend to be deficient in alpha and that drinking temporarily increased alpha, researchers began to hypothesize that alpha training could be a treatment for alcoholism. In the late 1980's the seminal work by Penniston and Kulkosky (Penniston & Kulkosky, 1989) demonstrated that alpha-theta brainwave training combined with preconstructed visualizations could produce remarkable results. Single channel alpha-theta training remains a viable treatment option today, but now advanced technology has given us the ability to do multichannel training of the addiction network as well as other networks in the brain.

Post-Traumatic Stress Disorder can also be treated by alpha-theta training, but recent research offers promising rapid resolution results with combat veterans. In addition to neurofeedback, a form of acoustical neuromodulation called BAUD assisted RESET therapy can break up and reset trauma circuits in the brain. QEEG mapping shows dramatic differences between a resting baseline and when the patient focuses on trauma recall. Following RESET treatment there is no distinguishable difference between baseline and trauma focus. (Linenfold & Rozelle, 2015)

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QEEG, ERP and Neurofeedback for Epilepsy and Sleep Disorders

John LeMay, M.A. Saybrook University

AED and surgical options are the standard treatments for epilepsy. However, about one-third of patients with epilepsy do not respond to anti-epileptic drugs (AED). Of the patients who are prescribed AED a considerable percentage are left being drug resistant. The majority of these treatment resistant patients suffer from focal seizures. Especially for these seizure patients feedback of brain activity (EEG-feedback, mostly called neurofeedback) has been developed and evaluated over the past three decades. In addition, the research has been found in two independent research groups. A decrease of seizures after enhancement of the sensory motor rhythm in patients with poorly controlled epilepsies was reported in 1972 for the first time (Serman and Friar, 1972). It was concluded that SMR-training decreased seizure susceptibility. Protocols for increasing SMR-activity and in some studies decreasing slow rhythms (delta and theta) of EEG have been used in the following years for research and practice mainly in the United States (for a review see Tan et al., 2009). In parallel to this development, Rockstroh et al. (1993) were able to reduce seizures after feedback of slow cortical potentials (SCPs). Investigations of neurofeedback and sleep disorders have chiefly focused on combating insomnia. Studies demonstrate that neurofeedback reduced the amount of sleep onset latency and that it improves the quality of sleep. This is especially true for patients with Attention Deficit Hyperactivity Disorder (ADHD). The sleep improvements apparently lead to a corresponding reduction in the inattention common to people with ADHD.

3:30 pm

Coffee Break

3:45 pm - 4:25 pm

ISFSI Presidential Lecture

Ballroom A, 1st Floor



Geertjan Husikamp, University Medical Center Utrecht

Analysis of ripple activity (>80 Hz) in surface EEG of children during sleep

The traditional EEG bandwidth of 0-70 Hz has widened with the discovery of high frequency oscillations (HFOs) in intracranial macro-electrodes in epilepsy patients. In these patients so called ripples (80 -250 Hz) and fast ripples (250-500 Hz) have been associated with epileptogenic tissue. Later, these pathological ripples and fast ripples have also been identified in scalp EEG. In animal models ripples have been described that are associated with normal, physiological function in hippocampus, and later on also in neocortex. These ripples seem to play a role in memory consolidation. In this study we analyze ripples that were found in scalp EEG of children during sleep. EEGs were recorded because of suspicion of epilepsy but often were described as normal. We visually marked ripples following a clinical protocol for analysis of HFOs and for each marking we checked whether there was an ongoing sleep specific transient in the normal EEG band. For the ripple band we performed a time frequency decomposition and defined a corresponding time-dependent spectral entropy in order to characterize the ripple events. We then compared the timing of ripples with respect to co-occurring sleep transients. We found ripples without a co-

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occurring sleep transient, but also consistent phase relationships of the ripple timings when they did co-occur. This suggest that these ripples are not random events, but are part of a physiological mechanism.

4:30 pm - 5:55 pm

Symposium 11
Ballroom A, 1st Floor

Treatment of Auditory Verbal Hallucinations with Non-Invasive Brain Stimulation

Chairs: Brian A. Coffman, Sebastian Walther

Antipsychotics have been the preferred treatment in schizophrenia since the introduction of chlorpromazine in 1952, and these medications have allowed many people to avoid a lifetime of institutionalization. However, in about 25% of cases, auditory hallucinations (one of the most distressing symptoms of schizophrenia) respond only partially to antipsychotic medication, and treatment of cognitive symptoms associated with the disorder (which are most strongly related to global functioning) is modest at best. New noninvasive treatment approaches are therefore being investigated for improving cognition and reducing auditory verbal hallucinations in schizophrenia. In this symposium, speakers will present findings from recent studies of electrical and magnetic brain stimulation for treatment of auditory hallucinations. Dr. Flavio Fröhlich will describe findings from a randomized, double-blind, sham-controlled clinical trial of 10Hz transcranial alternating current stimulation (tACS) for reducing auditory hallucinations and enhancing auditory steady-state responses in schizophrenia. Stephanie Winkelbeiner will present preliminary findings from a comparison of the effectiveness of transcranial direct current stimulation (tDCS) vs. single- and multi-session transcranial magnetic stimulation (TMS) protocols for the treatment of auditory hallucinations. Dr. Robert Thoma will present the results of a multimodal study investigating the mechanisms of auditory hallucinations reduction with tDCS. Finally, Dr. Brian Coffman will present preliminary results from a study of single-session tDCS paired with cognitive remediation training for the enhancement of cognitive control and reduction of auditory hallucinations in schizophrenia.

Targeting Impaired Neural Oscillations in Patients with Schizophrenia by Transcranial Alternating Current Stimulation for the Treatment of Auditory Hallucinations

Sangtae Ahn^{1,2}, Juliann M. Mellin^{1,2}, Sankaraleengam Alagapan^{1,2}, Morgan L. Alexander^{1,2}, John H. Gilmore¹, L. Fredrik Jarskog^{1,3}, Flavio Fröhlich^{1,2,4,5,6,7,*}

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Neural oscillations are a fundamental mechanism in large-scale brain dynamics and many psychiatric disorders have been associated impaired neural oscillations. In particular, patients with schizophrenia

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exhibit impaired alpha oscillations and functional connectivity, thus targeting and modulating these dysfunctions may represent a novel target-specific therapeutic approach for schizophrenia. Transcranial alternating current stimulation (tACS) is a non-invasive brain stimulation modality that applies oscillating currents to the brain via scalp electrodes. A single session of tACS modulates posterior alpha oscillations in healthy humans but it has remained unknown if this strategy can modulate impaired neural oscillations in patients with schizophrenia. In this study, we performed a randomized, double-blind, sham-controlled clinical trial for evaluating target engagement and therapeutic efficacy of twice-daily 10Hz-tACS for five consecutive days for auditory hallucinations in schizophrenia. We added transcranial direct current stimulation (tDCS) and sham stimulation as control conditions. Twenty-two patients with schizophrenia who experience auditory hallucinations were recruited and high-density electroencephalography (EEG) data were recorded. We found that 10Hz-tACS enhanced alpha oscillations ($F_{6,57}=3.49$, $p=0.005$) on day 5 of stimulation and modulated the strength of global functional connectivity to 10Hz. In addition, 10Hz-tACS enhanced the 40Hz auditory steady-state response (ASSR, $F_{6,57}=4.20$, $p=0.001$), which is considered a hallmark of schizophrenia. Importantly, clinical improvement of auditory hallucinations assessed by the auditory hallucinations rating scale correlated with enhancement of alpha oscillations and the 40Hz-ASSR. Our findings suggest that a target-specific approach using 10Hz-tACS has the potential to reduce symptoms by modulating impaired neural oscillations in patients with schizophrenia.

This work was supported by the National Institute of Mental Health of the National Institutes of Health under Award Numbers R21MH105574, R01MH111889, and R01MH101547.

Muting the voices with brain stimulation

Stephanie Winkelbeiner^{1,2}, Philipp Homan², Daniela Hubl¹, Thomas Dierks¹

¹Translational Research Center, University Hospital of Psychiatry and Psychotherapy, University of Bern, 3000 Bern 60, Switzerland.

²Center for Psychiatric Neuroscience, The Feinstein Institute for Medical Research, Manhasset, NY, USA.

Auditory verbal hallucinations (AVH) affect 70% of patients with schizophrenia and are often resistant to antipsychotic medications. While transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) have shown some promising treatment results, no study has investigated their effects independently of potentially influencing effects of antipsychotics. Here, we investigate rTMS and tDCS for AVH in medication-free patients. Due to the challenges that come with medication-free patients, we additionally investigate an accelerated protocol of four rTMS sessions within one day. The few studies that implemented such a protocol used high-frequency rTMS and found it to be equally effective and safe. A total of 160 patients within the schizophrenia spectrum and AVH will be recruited from the University Hospital of Psychiatry and Psychotherapy, Bern, Switzerland, and the Zucker Hillside Hospital at Northwell Health, NYC, and randomly assigned to either the classic 10 days rTMS, the accelerated rTMS, or tDCS protocol. Preliminary data of a non-medicated patient receiving tDCS show reduced AVH severity (Auditory Hallucination Rating Scale: pre = 28, post = 22) and increased normalized regional cerebral blood flow in the left Broca's area (pre = 0.90, post = 1.07), right Heschl's gyrus (pre = 1.03, post = 1.30), and bilateral superior temporal gyrus, posterior part (left: pre = 1.05, post = 1.18; right = 1.02, post = 1.18). Understanding the effects of brain stimulation on a physiological and subjective level is crucial to assess its potential as treatment alternative.

Funding: Swiss National Science Foundation and Northwell BIOMEND.

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Transcranial Direct Current Stimulation for Auditory Verbal Hallucinations in Schizophrenia

Robert J Thoma

University of New Mexico, Department of Psychiatry and Behavioral Sciences, and the MIND Research Network, Albuquerque, NM

Auditory verbal hallucinations (AVH) involve the perception of voices in the absence of auditory stimuli, and occur in >70% of schizophrenia patients (SZ). AVH remain resistant to pharmacological treatment in 25-30% of SZ, driving development of neuromodulatory interventions for AVH treatment. A recent meta-analysis reported a 30% reduction in overall SZ AVH severity with tDCS (Lee et al., 2017; $d=1.2$). However, none of the trials investigated neural mechanisms of tDCS effects, and there was considerable unexplained variability in treatment response. To address this, finite element modeling (FEM) was used to compute tDCS current delivery in inferior prefrontal cortex (iPFC) and temporoparietal junction (TPJ) in SZ with frequent, treatment-resistant AVH (N=6). AVH severity was assessed with the Psychotic Symptom Rating scales (PSYRATS), and fMRI and magnetoencephalography (MEG) were used to measure resting iPFC and TPJ activation pre- and post-treatment. Five-day tDCS treatment resulted in 26% reduction in AVH ($sd=7.6$). FEM modeling indicated significant current delivery to left iPFC and TPJ for 5/6 participants ($p<.05$). MEG and fMRI analyses revealed significant reduction in resting left TPJ activation ($p<.05$). FEM-assessed current at TPJ (but not iPFC) predicted change in AVH severity scores. These results support the hyperexcitation model of schizophrenia AVH and the primacy of temporoparietal language regions in the genesis of AVH. They further suggest that neuromodulatory reduction of left TPJ hyperexcitation is critical for reducing the severity of AVH in schizophrenia. Lastly, results suggest that it may be possible to improve the effectiveness using individualized FEMs to target TPJ hyperexcitation.

Funding: P20RR021938

Schizophrenia Treatment with Single-Session tDCS and Cognitive Remediation Training: Preliminary Findings

Brian A. Coffman, Tim K. Murphy, Justin Leiter-McBeth, Natasha Torrence, & Dean F. Salisbury

Clinical Neurophysiology Research Laboratory, Western Psychiatric Institute and Clinic, Department of Psychiatry, University of Pittsburgh School of Medicine

Perceptual models of auditory verbal hallucinations (AVH) in schizophrenia (Sz) include hyper-excitability of auditory/verbal perception (in left temporoparietal junction; l-TPJ), and hypo-excitability of cognitive control which normally inhibits or reattributes perceptual misrepresentations (in right ventrolateral prefrontal cortex; r-VLPFC). We examined a single-session treatment to enhance cognitive control with Cognitive Remediation Training (CRT) plus anodal tDCS applied to r-VLPFC, and to reduce AVH with cathodal tDCS applied to l-TPJ. Participants were 12 Sz with persistent daily AVH despite stable antipsychotic medication for >2 months. tDCS (2mA, n=7) or sham (0.1mA, n=5) was delivered during CRT. We assessed AVH at baseline and 1-week later. Participants also completed the AX-CPT during electroencephalography (EEG) testing at baseline and immediately after CRT+tDCS. We analyzed beta-band event-related desynchronization (ERD) during the cue evaluation period (200-400ms after 'A' stimulus onset) in left central electrodes, which has been linked to cognitive control of attention, and accuracy and RT. AVH was

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reduced by CRT+tDCS (36% reduction) compared to CRT+sham (18% reduction; $d=0.82$). In the AX-CPT, RT improvement was greater for CRT+tDCS ($\Delta RT=73ms$) than CRT+sham ($\Delta RT=21ms$; $d=0.80$). Beta ERD in the evaluation period was increased more for CRT+tDCS ($\Delta ERD=0.49\mu V^2$) than CRT+sham ($\Delta ERD=0.00\mu V^2$; $d=0.89$). Accuracy did not change for either group. These preliminary results suggest that a single session of CRT+tDCS may reduce AVH severity and enhance cognitive control in treatment-refractory schizophrenia patients. These findings could lead to a new adjunct biomedical treatment for improving cognition and reducing auditory verbal hallucinations in schizophrenia.

4:30 pm - 5:55 pm

Symposium 12

Conference Room A, 3rd Floor

Non-ictal paroxysmal EEG discharges (NID): Reframing to reveal their clinical relevance

Chairs: Montserrat Gerez-Malo, Nash Boutros

The clinical significance of NID in non-convulsive patients remains controversial. Some authors consider it an epiphenomenon of the underlying condition that should be ignored, while others advocate treatment, based on direct evidence of transient effects on reaction time and cognitive processes, as well as indirect evidence suggesting persistent behavioral and cognitive impairments. Use of antiseizure medications (ASM) in psychiatry has increased exponentially, relying more on empirical than research evidence. The EEG, keystone in epilepsy research and management, is discouraged for psychiatric evaluation. Brief focal discharges cannot explain persistent pleomorphic symptoms. That perspective shuts down opportunities to understand the mechanisms of well documented relationships between epilepsy and psychiatric disorders. EEG source localization and network analysis offer a wider perspective. This symposium addresses current knowledge and research expectation on NID in clinical settings. Dr. Kaplan presents a multimodal integrative model of periodic discharges in non-convulsive patients, interrelations with metabolic changes and etiologic factors: prognostic and therapeutic implications. The impact of NID in AE response in psychiatry is addressed by Dr. Boutros, based on accumulated evidence from the literature, as well as from his human and animal research.

New technologies to assess network connectivity, presented by Dr. Thatcher, may lead a perspective shift from focal to complex network dysfunction, a more suitable framework to study NID impact on higher brain function. Dr. Gerez presents results on selected EEG networks as related to neuropsychological scores in normal EEG epochs and the connectivity disruption introduced by NID epochs, related to symptom type and treatment response.

The clinical and EEG spectrum of periodic discharges – diagnosis, association with seizures, approach to care and prognosis

Peter W Kaplan
Johns Hopkins University

The family of periodic EEG discharges first delineated by Chatrian included lateralized types and more recently generalized, bilateral independent, multiple lateralized, and stimulus-induced varieties. Each of these subtypes has been defined, and reported. A review of the aggregate of reports on each of these types

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has been reviewed as they investigated the most frequent causes, the relative association with seizures, morbidity and mortality. Severity increases from lateralized varieties to generalized synchronous types. These features along with a schema of the spectrum of periodic discharges along axes of morbidity and ictal tendencies, as well as approaches to investigation and respective treatment will be discussed.

Isolated Epileptic Discharges in Panic Disorder

Nashaat N Boutros

The Saint Luke's Marion Bloch Neuroscience Institute, University of Missouri-Kansas City

Isolated Epileptic Discharges (IEDs) are not uncommon in patients with panic attacks, repeated violent acts, dissociative episodes, and rapid cycling mood disorders. The value of detecting IEDs in a non-epileptic psychiatric patient in predicting favorable responses to anti-epileptic drugs (AEDs) remains undetermined. A number of reports have been published suggesting that in some treatment-refractory PD patients AEDs may be useful. Comparing AEDs use in PD patient with and without IEDs showed significant differences. Ten reports were identified for use of AEDs in PD patients with abnormal EEGs with a total of 20 patients (17 responders). None of the ten reports were controlled studies. Eighteen reports (3 controlled) were identified for use of AEDs in panic patients with either normal EEGs or unselected groups (no EEG work-up). Included in the 18 studies were 253 patients (137 responders). The response was significantly higher in patients with abnormal EEGs. These data suggest that an abnormal EEG may be indicative of a higher likelihood of a positive response to an AED. Behavioral effects of IEDs appear to be region-dependent. IEDs emanating from the amygdalar region would be expected to correlate with fear manifestations (like in panic attacks). We have also shown that experimentally induced IEDs in the somatosensory region induce hyperactive behaviors in rats. That is the same region where epileptic discharges may be found in individuals with ADHD. It should be stated here that the optimal number or duration of recordings for the maximal yield has not been established for any psychiatric condition.

Partial support from the The Saint Luke's Marion Bloch Neuroscience Institute

New Advances in Electrical NeuroImaging to Evaluate the Sources of Non-Ictal Proximal Discharges

Robert W Thatcher Applied Neuroscience, Inc.

The 3-dimensional evaluation of the sources of non-ictal discharges and focal gross pathologies has recently been enhanced using advanced technology called swLORETA (weighted sLORETA (Palmero-Soler et al, 2007)). swLORETA uses Single-Value-Decomposition (SVD) to weight the lead field in order to increase lead field homogeneity and hence improved localization of deep sources. This allows for estimates of EEG sources in different layers of the cortex. Also, swLORETA uses a real MRI and not an average MRI with 12,270 voxels and a Boundary-Element-Method (BEM) of source localization (Wroel and Aliahadi, 2002). Non-ictal events and gross pathologies are localized inside of 3-dimensional volumes with the aid of slice and volume cutting tools to allow one to navigate through the brain and identify dysregulated brain network hubs (Brodmann areas) and connections. Computations include Functional Connectivity (Coherence, Lagged Coherence and Phase Difference) and Effective Connectivity (Phase Slope Index) of

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the magnitude and direction of information flow between network hubs as well as integration with Diffusion Tensor Imaging (DTI). A useful method is to also view the EEG potentials on a transparent scalp while simultaneously viewing the deeper sources of the EEG from inside the brain. Both raw scores and Z scores are used as well as the Laplacian transform of the scalp EEG. Examples of source localization in patients with gross pathologies such as epileptic foci and stroke will be presented as well.

Electrical networks connectivity is modulated by personality traits and significantly altered during non-ictal (NID) and ictal discharges in psychiatric patients

Montserrat Gerez-Malo Hospital Español de Mexico

Epilepsy and mental disorder links have been debated for centuries. Current epidemiological studies show a direct relationship with anxiety disorders, and a polarized one with psychoses: ictal-related psychoses on one side, forced normalization and electroconvulsive therapy on the other. Links with affective, impulse control, attention deficit and neurodevelopmental disorders have had partial support. From the historical term “psychomotor variant” to plenary sessions in this meeting, the EEG keeps facing the challenge. Against common mechanisms is the incongruousness of time-limited discharges causing long-lasting pleomorphic symptoms. Yet, network analysis has shown enduring changes caused by non-ictal discharges (NID). To address the impact of NID we studied a set of networks presumably involved in psychiatric symptoms, first by looking at network behavior in “normal-at-visual-inspection” (NL) EEGs of healthy volunteers. Networks’ z-scores (Nz) were within normal and correlated with neuropsychological scores. Multiple correlation analysis was also performed in psychiatric patients, comparing the NL epochs against NID epochs for each subject. NID introduced significant alterations, the affected networks correlated with predominant symptoms. The next step was conducting the analysis retrospectively on a comprehensively studied sample of attention-deficit-disorder (ADD) with treatment response follow-up. Methylphenidate response was correlated to attention network alterations in NL epochs, antiepileptic response to alterations in NID epochs. Lastly, the impact of NID was compared to that of ictal discharges in 10 psychiatric patients who developed an electroclinical partial seizure during EEG recording. Results will be discussed focusing on the impact of NID on complex network behavior and their potential relevance for therapeutic interventions.

6:00 pm - 6:15 pm

Close of Scientific Conference & Thanks
Ballroom A, 1st Floor

8:00 pm - 11:00 pm

Conference Banquet
The Porch
<http://www.dineattheporch.com/schenley>

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Sunday September 9th

Basic EEG in the Psychiatric Clinic Workshop

Conference Room A, 3rd Floor

Course Director: Oliver Pogarell

Pre-registration is required

8:30 am - 9:00 am	Continental breakfast & coffee provided
9:00 am - 09:15 am	History and Background – Why EEG in Psychiatry?
9:15 am - 09:45 am	Technical background, normal and abnormal EEG patterns, clinical significance
9:45 am - 10:15 am	EEG in psychiatric emergencies (Delirium, Intoxication, Encephalopathies)
10:15 am - 10:30 am	BREAK
10:30 am - 11:00 am	Geriatric psychiatry, epileptic and non-epileptic syndromes
11:00 am - 11:15 am	Monitoring Pharmacotherapy and ECT
11:15 am - 11:45 am	Clinical case presentations with interactive discussions
11:45 am - 12:00 pm	Summary, Q&A