EEG and Clinical Neuroscience Society (ECNS)
International Society for Neuroimaging in Psychiatry (ISNIP)
International Society for Brain Electromagnetic Topography (ISBET)

COMBINING EEG AND NOVEL TECHNOLOGIES

Hosted by ECNS

October 15 - 18, 2024

Toronto, Ontario, Canada

Program 2024

Conference Webpage

http://www.ecnsweb.org/ecns-conferences

Contact Michael Kiang (Conference Host)

Michael.kiang@camh.ca

ECNS

Electroencephalography and Clinical Neuroscience Society

ECNS 2024

Program

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2024 Joint Meeting ECNS, ISNIP, ISBET, & ISFSI
Theme: Combining EEG and Novel Technologies

Schedule at a Glance

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	Tues. Oct. 15	Wed. Oct. 16	Thurs. Oct. 17	Fri. Oct. 18
8:00		continental breakfast 0800-0830	continental breakfast 0800-0830	continental breakfast 0800-0830
8:30		Plenary Lecture Ben Brinkmann Mayo Clinic Improving seizure forecasting with novel devices 0830-0930	Plenary Lecture Margaret Niznikiewicz Harvard University Real-time fMRI neurofeedbacks for auditory hallucinations in schizophrenia 0830-0930	Plenary Lecture Björn Herrmann University of Toronto Auditory cortical plasticity in older adults: The hyperactivity phenomenon 0830-0930
9:00				
9:30		Symposium 1 The utility of EEG tools in psychiatry - I Chair: Salvatore Campanella 0930-1045	Plenary Lecture Sophie Molholm Albert Einstein College of Medicine 0930-1030	Plenary Lecture Jeff Daskalakis University of California, San Diego Brain stimulation for treatment of refractory symptoms in psychiatric disorders 1030-1130
10:00				
10:30			coffee provided 1030-1045	coffee provided 1030-1045
10:45		coffee provided 1045-1100	Symposium 4 Electrophysiological traits in depression Chair: Mehmet Kemal Arikan 1045-1215	Symposium 6 EEG/MEG and Cognition in Children and Adolescents Chair: Jennifer Lepock 1045-1215
11:00		Symposium 2 The utility of EEG tools in psychiatry - II Chair: Salvatore Campanella 1100-1145		
11:15				
12:15		buffet lunch provided (Main Lounge) / ECNS Membership Mtg. (Upper Dining Room) 1145-1300	buffet lunch provided 1215-1245	buffet lunch provided 1215-1300
12:30	ECNS Board Meeting 1230-1500		Poster Session 1245-1415	
13:00		Symposium 3 Computational Neuropsychiatry Chair: Nevzat Tarhan 1300-1430		Plenary Lecture Michael Kiang University of Toronto The N400 ERP as a window on meaning in psychotic and mood states 1300-1400
13:30				
13:45				
14:00			coffee provided 1400-1430	
14:30		coffee provided 1430-1445	Plenary Lecture Greg Light University of California, San Diego EEG biomarkers in global CNS trials 1430-1530	
14:45		Special Presentation Ronald Swatzyna, Lorrianne Morrow Evidentiary Significance of Routine EEG in Refractory Cases: A Paradigm Shift in Psychiatry 1445-1545		
15:00				
15:15				
15:30		ECNS Presidential Lecture Derek Fisher 1545-1645	Symposium 5 Neuroimaging Markers of Drug Use, Dependence and Treatment Chair: Derek Fisher 1530-1700	
16:00				
16:15				
16:45		Society Awards 1645-1700		
17:00	Opening Lecture John Foxe Univ. of Rochester The Hunt for Translatable Cross-Species Electrophysiological Endophenotypes (Neuromarkers) in Rare Diseases of Neurodevelopment 1700-1800			
17:15				
18:00	Reception (Main Lounge + Wedgwood Main Dining Room) 1800-2100	Society Dinner 1830-2100		
18:15				
19:00				
19:30				
20:00				
21:00				
22:00				
	Registration/Exhibitor Main Lounge (all afternoon)	Registration/Exhibitor Main Lounge (all day)	Registration/Exhibitor Main Lounge (all day)	

Fairley Lounge
Main Lounge
Wedgwood Main Dining Room
Foulds Room
Upper Dining Room

Welcome Letter

Dear Attendees,
It is my great pleasure to welcome you to the 2024 joint meeting of the EEG & Clinical Neuroscience Society (ECNS), International Society for Neuroimaging in Psychiatry (ISNIP), and International Society for Brain Electromagnetic Tomography (ISBET) in Toronto, Ontario, Canada.
While this joint meeting is always informative and inspiring, I believe this year's meeting is especially so. First, our conference schedule is particularly excellent with interesting symposia and plenary lectures from some of the leaders in the field. Additionally, this 2024 conference takes place during the centenary of the first EEG recordings by Hans Berger in 1924. What better way to commemorate 100 years of EEG research than in the presence of great colleagues? I can't think of any.
We hope that you enjoy the conference sessions, but also take time to explore the world class city of Toronto. This beautiful, cosmopolitan city is a wonderful venue to hold our meeting. Thank you for joining us this year, and we hope to reconnect next year in Munich!

Cheers,
Derek Fisher,
President, EEG & Clinical Neuroscience Society

About the Society

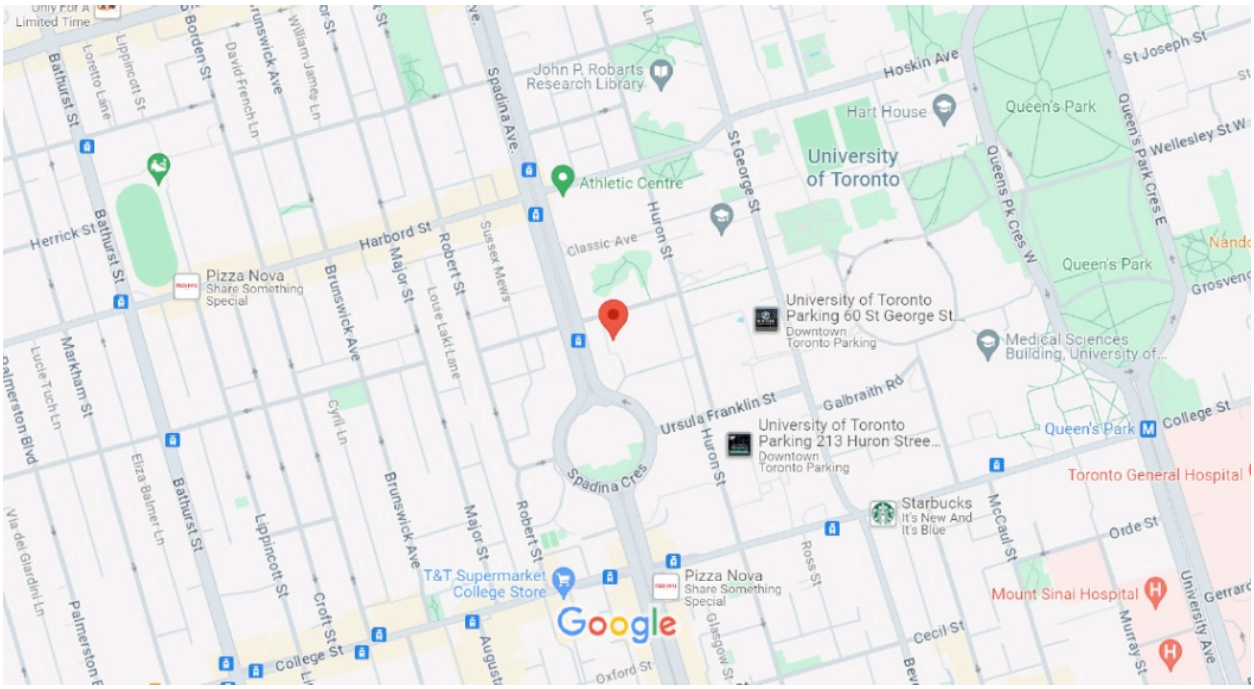
Electroencephalography and Clinical Neuroscience Society (ECNS) presents the annual joint meeting of four Societies – including ECNS, which promotes the use of neurophysiological methods in psychiatry and neurology; the International Society for Neuroimaging in Psychiatry (ISNIP), which promotes MRI and other imaging methods in psychiatry; the International Society for Functional Source Imaging (ISFSI), dedicated to developing advanced methods for source analysis; and the International Society for Brain Electromagnetic Topography (ISBET), dedicated to developing state-of-the-art methods for EEG and MEG analyses. Members of these Societies come together from across the globe for our annual joint meeting to discuss methods and advances in cognitive and clinical neuroimaging.
This year's meeting will have the theme of "Combining EEG and Novel Technologies." The meeting will bring clinicians and researchers from all over the world together for 3 days of intense scientific presentations and clinical demonstrations. Lectures and symposia will be presented by a slate of internationally known speakers. The joint meeting focuses on innovative research with an applied clinical focus, and is attended by neurologists, psychiatrists, psychologists, and other scientists and clinicians interested in novel findings and treatments for epilepsy, sleep disorders, neurological disorders, and psychiatric disorders.

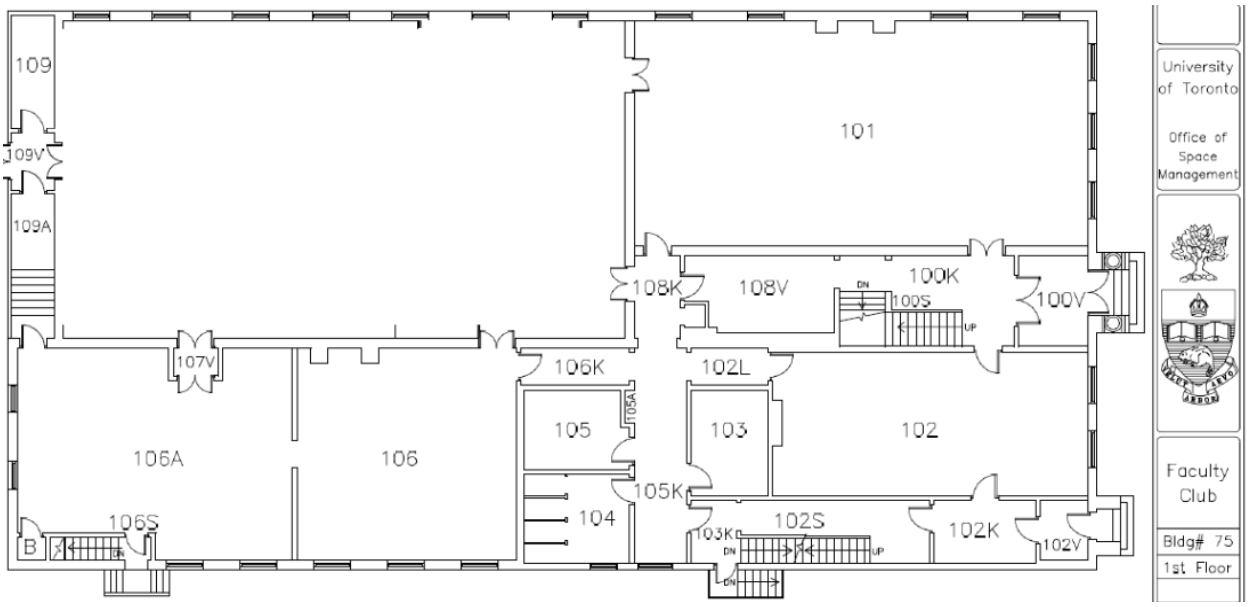
General Conference Information

Directions

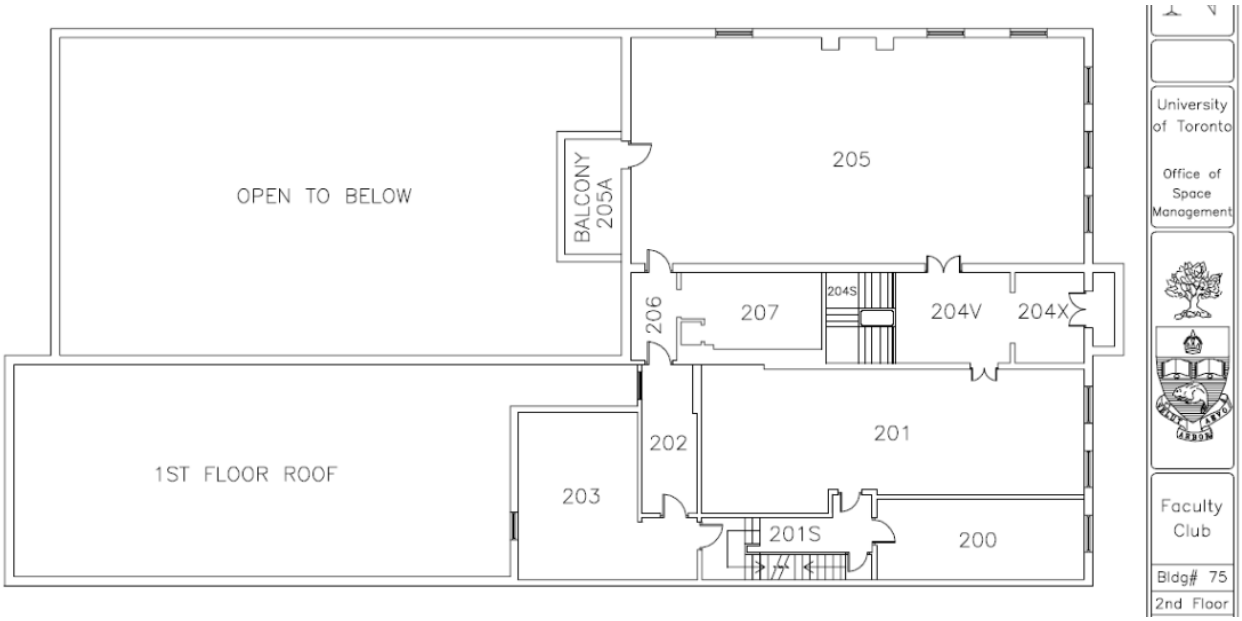
From YYZ airport
Uber/Taxi – approx. $40- $50 one way
UP express train – airport to union station – adult $12.35 one way – from Union take Line 1 University to Queen's Park Station. Walk through campus to 41 Wilcocks St.
TTC – 900 airport express bus to Kipling station on line 2 Bloor- Danforth subway line – take Line 2 to Spadina station. Take 510 south to Wilcocks (or walk 10 mins south on Spadina). Faculty club is 41 Willcocks St.

Map of Venue





Room 101 – Main Lounge
Room 102 – Fairley Lounge
Room 107 – Wedgewood Main Dining Room



Room 204 - Primrose room
Room 205 - Upper Dining room

ECNS 2024 Program

Day 1 – Tuesday October 15, 2024

12:30 - 15:00 **ECNS Board Meeting -** ***Fairley Lounge***

17:00 - 18:00 **Lecture 1. Opening Lecture - The Hunt for Translatable Cross-Species Electrophysiological Endophenotypes (Neuromarkers) in Rare Diseases of Neurodevelopment -** ***Wedgwood Main Dining Room***
John Foxe, University of Rochester, New York

18:00 - 21:00 **Reception -** ***Main Lounge Ground Floor***

Day 2 – Wednesday October 16, 2024

8:30 - 9:30 **Lecture 2. Improving Seizure Forecasting with Novel Devices - *Wedgwood Main Dining Room***
Ben Brinkmann, Mayo Clinic

9:30 - 10:45 **Symposium 1. The Utility of EEG Tools in Psychiatry -** *Wedgwood Main Dining Room*
Chair: Salvatore Campanella (University of Brussels, Belgium).

Speakers:
Brian Coffman (University of Pittsburgh, USA): Event-Related Synchronization of Frontostriatal Reward Systems Indexes Sensation Seeking and Reward Sensitivity
Jenny Lepock (Centre for Addiction and Mental Health, University of Toronto, Canada): Event-Related Brain Potentials as Biomarkers of Clinical Outcomes in Persons at High Risk for Psychosis
Anais Ingels (University of Brussels, Belgium): Cognitive Event-Related Potentials as Biomarkers of addictive mechanisms in polydrug users
Derek Fisher (Mount Saint Vincent University, Canada): The MMN and P3a as markers of function in schizophrenia

Despite decades of research, the utility of EEG tools in psychiatric clinical care units is still matter of debate. In the present symposium, we will present last empirical findings highlighting (1) the utility of various eeg tools to better understand the pathophysiological mechanisms underlying various psychiatric diseases; and (2) their potential contribution in the clinical care of these disorders.

11:00 - 11:45 **Symposium 2. The Utility of EEG Tools in Psychiatry II -** *Wedgwood Main Dining Room*
Chair: Salvatore Campanella (University of Brussels, Belgium).

Speakers:

Gary Hasey (McMaster University) Machine Learning and Deep Learning methods of EEG analysis to assist with diagnosis, treatment planning and suicide risk assessment
Victoria Popov (University of Rochester School of Medicine and Dentistry) An acute exercise intervention to ameliorate behavioral and neurophysiological indices of inhibitory control deficits in schizophrenia: a mobile brain/body imaging (MoBI) study
Background: Inhibitory control deficits are a core feature of schizophrenia and autism spectrum disorders (SSDs, ASDs), with clear manifestations seen in both psychophysiological and electrophysiological measures of these processes. Addressing these symptoms is of critical clinical relevance since they are a main predictor of negative vocational and psychosocial outcomes. An intriguing set of findings has suggested exercise can have a positive effect on SSD and ASD symptomatology, but the exercise-linked neural changes that may result in improved inhibitory control are unknown.
Methods: Male and female individuals with SSDs or ASDs and neurotypical, age-matched healthy controls (HCs) completed the Go/NoGo response inhibition (RI) task while sitting and walking. The emergence of Mobile Brain/Body Imaging (MoBI) technologies allowed for the successful assessment of

cognitive control processes through high density electroencephalography (hd-EEG), behavioral performance on the RI task, and motoric function through motion capture technologies while participants were engaged in treadmill walking or were sitting. Here, we leveraged MoBI to ask whether a single acute exercise intervention, particularly treadmill walking in this study, would lead to improved performance on a canonical RI task, and if previously well-characterized deficits in the generation of inhibition-related event- related-potential (ERP) components can be ameliorated in individuals with SSDs or ASDs.
Results: A two-way repeated measures ANOVA was performed to compare the effect of groups (HCs, SSDs or ASDs) or motion state (sitting, walking) on d' scores (RI task performance). Preliminary data suggest, overall, HCs had better inhibitory control than SSDs or ASDs, and walking did not improve inhibitory control performance to be like those of HCs. The cluster- based permutation approach allowed for exploring the existence of walking-related effects on ERPs in the entire electrode set and at all the epoch timepoints. The effects this approach revealed were significant ERP amplitude increases during walking over frontal and frontocentral scalp regions and reductions over parietal and occipital scalp regions during the RI related ERP component intervals for HCs and SSDs or ASDs. Additionally, in HCs there was substantial reconfiguration over RI related scalp regions when walking relative to sitting that happened earlier than SSDs or ASDs.
Discussion: Preliminary findings suggest a single intervention of treadmill walking showed no improvement in inhibitory control performance but normalization of neurophysiological processes in SSDs or ASDs to those of HCs. To our knowledge, this is the first study of its kind to date to examine inhibitory control in real time during an acute exercise intervention. A longer- term fitness intervention trial could assess whether these positive outcomes can be established more durably.

Paige Nicklas (University of Rochester School of Medicine and Dentistry) Cognitive-motor interactions in those with and without Autism Spectrum Disorder show differences in neurophysiology and task performance: A mobile brain-body imaging (MoBI) study
Cognitive-motor (C-M) interference occurs when the demands of concurrent cognitive and motor tasks compete for the available neural resources, potentially leading to performance decrements in one or both tasks. Research commonly investigates this phenomenon by employing dual-task designs to compare performance under single-task and dual-task conditions, which require both motor and cognitive engagement. However, recent findings challenge the concept of C-M interference, as approximately half of young adults (YAs) demonstrated improvement on a response inhibition (RI) task while walking. Those who showed improvement exhibited significant differences in neurophysiological and gait profiles compared to non-improvers. This suggests that while some individuals experience C-M interference, others demonstrate a more integrated response, adapting better to multi-modal demands. Yet, the factors that determine the direction of C-M interactions and their developmental trajectory remains unclear, especially regarding autism. Previous work suggests inhibition becomes more focused with age, shown through improved performances, and more frontal and concentrated distributions of neural topographies, but its dual-task dynamics remain unexplored. Further, one of the most common developmental disabilities, Autism Spectrum Disorder (ASD), is under-explored from dual-task perspectives despite known motor, cognitive, and sensory differences in individuals within this population. Specifically, how different deficits in these single-modal domains interact in multi-modal contexts warrants investigation. To address these questions, we utilize Mobile Brain-Body Imaging (MoBI), enabling simultaneous recording of neurophysiological (electroencephalography/EEG), kinematic (motion-tracking), and behavioral (task performance) data. Notably, this is the first study to use these methods in individuals under 18 years old. Participants aged 8-30 years engage in a Go/NoGo RI task while seated and walking on a treadmill, and data collection includes cognitive assessments, physical activity surveys, and biometric measurements. Preliminary results show motion-state related difference within each group in gait variability, task performance, but only in the neurotypical group for ERP amplitudes. Currently,

individual factors are not significantly correlated with the change in ERP amplitudes, gait, or task performance from sitting to walking in either group, suggesting that the dual-task C-M interactions are not due to any single-modal ability or metric. Data collection is ongoing to properly power all analyses.

13:00 - 14:30 **Symposium 3. Computational Neuropsychiatry - *Wedgwood Main Dining Room***
Chair: Prof Dr Nevzat Tarhan, MD - Uskudar University

Speakers:
Prof Dr Baris Metin (NP Istanbul Brain Hospital)
Prof Dr Turker Erguzel (Uskudar University)
Dr Elvan Ciftci (NP Istanbul Brain Hospital)
Firat Tarhan

In-Silico Neuroscience, a relatively recent discipline within the broader field of neuroscience, has emerged as crucially important for furthering our understanding of brain function and translating this knowledge into technological applications. Since both the resolution and size of medical data are increasing with the performance of data processing software and hardware, it is valuable to bring those two together for better medical diagnosis and treatment processes. With in-silico applications in neuroscience, it is easier to explain the biophysical mechanisms of computation in neurons, computer simulations of neural circuits, and models of learning. In order to contribute to the innovative, collaborative structure of neuroscience the interdisciplinary studies contribute to the charting the future of mental health. As uskudar university with computational Neuropsychiatry, recent studies covering data collection, processing and clinical interpretation steps of the studies conducted to support diagnostic, prognostic, predictive, and therapeutic applications in the clinic priotizing the following titles.

- QEEG Cordance calculation of what promises in treatment-resistant depression
- Computational Neuropsychiatry Applications in Np Brain Hospital: Np Model
- Biomarkers versus deep learning for identification of patients with neuropsychiatric disorders
In-silico-based innovative collaboration of genetics, neuroscience and AI for the future of mental health

With the NeuroPsychiatry Brain Hospital model, a unique and patented model, the data collection, processing analysis, and application to healthcare systems will be presented to the audience, which will inspire the clinicians to apply to broaden their perspective and clinical vision.

14:45 – 15:45 **Special Presentation Lecture 3. Evidentiary Significance of Routine EEG in Refractory Cases: A Paradigm Shift in Psychiatry** - ***Wedgwood Main Dining Room***

Ronald Swatzyna, Houston Neuroscience Brain Center
Lorrianne M. Morrow

Over the past decade, the Diagnostic and Statistical Manual's method of prescribing medications based on presenting symptoms has been challenged. The shift toward precision medicine began with the National Institute of Mental Health and culminated with the World Psychiatric Association's posit that a paradigm shift is needed. This study supports that shift by providing evidence explaining the high rate of psychiatric medication failure and suggests a possible first step toward precision medicine. A large psychiatric practice began collecting electroencephalograms (EEGs) for this study in 2012. The EEGs were analyzed by the same neurophysiologist (board certified in electroencephalography) on 1,233 patients. This study

identified 4 EEG biomarkers accounting for medication failure in refractory patients: focal slowing, spindling excessive beta, encephalopathy, and isolated epileptiform discharges. Each EEG biomarker suggests underlying brain dysregulation, which may explain why prior medication attempts have failed. The EEG biomarkers cannot be identified based on current psychiatric assessment methods, and depending upon the localization, intensity, and duration, can all present as complex behavioral or psychiatric issues. The study highlights that the EEG biomarker identification approach can be a positive step toward personalized medicine in psychiatry, furthering the clinical thinking of "testing the organ we are trying to treat."

15:45 - 16:45 **Lecture 4. ECNS Presidential Lecture -** ***Wedgwood Main Dining Room***
Derek Fisher, Mount Saint Vincent University

16:45 - 17:00 **Society Awards** - ***Wedgwood Main Dining Room***

18:30 - 21:00 **Society Dinner** - ***Wedgwood Main Dining Room***

Day 3 – Thursday October 17, 2024

8:30 - 9:30 **Lecture 5. Real-time fMRI Neurofeedbacks For Auditory Hallucinations in Schizophrenia - *Wedgwood Main Dining Room***
Margaret Niznikiewicz, Harvard University

9:30 - 10:30 **Lecture 6. Probing Neural Unreliability Accounts in Autism and Rett Syndrome - *Wedgwood Main Dining Room***
Sophie Molholm, Albert Einstein College of Medicine

10:45 - 12:15 **Symposium 3. Electrophysiological Traits in Depression: From the Beginning to the End - *Wedgwood Main Dining Room***
Chair: Mehmet Kemal Arıkan

Speakers:
Prof. Dr. Med. Oliver Pogarell (Dept. of Psychiatry and Psychotherapy, Ludwig-MaximiliansUniversity of Munich - Germany)
Prof. Dr. Med. Giorgio Di Lorenzo (Dept. of Systems Medicine, University of Rome Tor Vergata - Italy)
Prof. Dr. Mehmet Kemal Arıkan (Kemal Arıkan Psychiatry Clinic, Istanbul - Turkey)
Prof. Dr. Barış Metin (Kemal Arıkan Psychiatry Clinic, Istanbul - Turkey)

In this symposia, the electrophysiological parameters in depression will be discussed from several perspectives. Prof. Pogarell will present new neurofeedback data in depression. Then, Prof. Lorenzo will make a presentation about EEG features in treatment resistant depression. Miss Ilhan will speak about the value of QEEG in the treatment of depression. Finally, Prof. Arıkan will discuss the electrophysiological parameters of treatment cessation in depression.

12:45 - 14:15 **Poster Session - *Main Lounge***

P1. The effect of using template head models on ERP source estimation
Emma Depuydt[a], Yana Criel[b], Miet De Letter[b], Pieter van Mierlo[a]
[a]*MEDISIP, Department of Electronics and Information Systems, Ghent University, Ghent, Belgium*
[b]*BrainComm, Department of Rehabilitation Sciences, Ghent University, Ghent, Belgium*

Introduction: Event-Related Potentials (ERP) are an important tool for analyzing brain activity, enabling the examination of neuronal mechanisms involved in task execution at a millisecond scale. EEG source imaging, which combines EEG signals with structural MRI images, facilitates the identification of the generators of electrophysiological activity recorded at the scalp. EEG source imaging has significantly advanced various research domains, including epilepsy and sleep studies. However, precise localization of neural activity remains challenging, and the spatial resolution is still uncertain. The accuracy of source analysis of EEG/ERP data is heavily dependent on modeling parameters. The most accurate reconstruction of neural activity requires a realistic head model, created using the individual's MRI and accurate electrical properties of

various tissue types (Conte & Richards, 2021). Despite this, acquiring MRI data in many ERP studies is often difficult. The goal of this study is to investigate and quantify the localization errors associated with average head models in ERP reconstructions.

Methods: This study used the open-source multimodal neuroimaging dataset VEPCON (Pascucci et al., 2022). For each individual, a three-layer head model was created, employing a distributed dipole source space with orientations fixed orthogonally to the cortical surface. The boundary element method (BEM) was used to calculate the EEG leadfield matrix. The same approach was applied to the average subject data, fsaverage (Fischl, 2012), to derive the leadfield matrix for the average head model. Simplified ERP waveforms were simulated to quantify the localization error associated with subject-specific and average head models. Four brain regions were considered 'active': the left and right occipital poles, and the left and right inferior temporal cortices. Dipoles within a 10 mm radius of the center of these regions were selected as the regions of interest (ROIs). ERP activity in these dipoles was simulated as a 5 Hz half-cycle sinusoidal waveform with a 10 ms delay for the different ROIs, with pink noise added. Additionally, epochs containing only pink noise were created for comparison. The simulated source space activity was projected to the scalp using the individual head models, resulting in simulated EEG data in both ERP and noise conditions. For the reconstruction of the brain activity, the MNE-python implementation of eLORETA was used. Evaluation of source reconstruction considered several factors: the number of obtained sources, localization error, spatial dispersion of correctly reconstructed sources, and the correlation between simulated and reconstructed activity.

Results: The reconstructed activity averaged over all subjects using both individual head models (averaged after morphing to the average head model) and the average head model shows that temporal sources were not reconstructed using the average head models, and a clear localization error was observed for occipital sources. Looking at the number of false negatives and true positives, localization error, the correlation between original and reconstructed activity as a function of simulated SNR and other measures, it is clear that the subject-specific head model outperformed the average model on all measures, with higher SNRs yielding more accurate results.

Discussion: The findings indicate that source reconstructions of ERPs using average head models should be interpreted cautiously due to significant localization errors observed in this simulation. However, this study simulated a temporo-occipital network, regions known for larger localization errors. Future simulations should include additional networks to further evaluate these findings.

P2. How does Body Mass affect the Neural Mechanisms of Inhibitory Control? An ERP study

Sonia Sistiaga[1], Clémence Dousset[1], Anaïs Ingels[1], Hendrik Kajosch[2], Salvatore Campanella[1]
[1]Laboratory of Medical Psychology and Addiction, University of Brussels
[2]Department of Psychiatry, CHU Brugmann, Brussels

Background: The impairment of inhibitory control is pivotal in both the development and maintenance of obesity. Elevated body mass index (BMI) can induce metabolic alterations leading

to compromised inhibitory functions. Despite the importance of inhibitory control in shaping eating behaviors and weight management, the neural substrates underlying this process remain elusive.
Objective: This study aims to explore the influence of BMI on inhibitory control through a multi-faceted approach incorporating electrophysiological measures (event-related potentials), and behavioral assessments.
Methodology: In the present study, 63 participants (*M*age = 23.03, *SD* = 4.66, 66,67% female) were divided in two groups based on their BMI (26 normal-weight, 37 overweight). They completed a modified Go/NoGo task encompassing two contextual domains (food-related and neutral). Electrophysiological components N2 and P3 were recorded simultaneously.
Results: During the Go/NoGo task, no significant differences in reaction time, omission errors, or commissions errors were observed between the overweight and normal-weight groups. However, in the food-related context, the overweight group exhibited a significantly greater P3 amplitude compared to the normal-weight group (p = .036). No significant differences in P3 amplitude were found between the two groups in the neutral context.
Conclusion: With equal performance, overweight individuals recruit more neural resources than normal-weight individuals to perform inhibitory control in a food-related context, as indicated by the larger amplitude of the P3 component.

P3. Comparison of Resting EEG Frequency Bands in Cannabis Users and Non-Users

Jenna N. Bissonnette[1], Ashley M. Francis[2], Sarah MacNeil[3], Hayley Reil[3], Candice E. Crocker[2], Sherry Stewart[2], Phil G. Tibbo[2], Derek J. Fisher[1,3]
[1]*Dalhousie University, Department of Psychology and Neuroscience*
[2]*Dalhousie University, Department of Psychiatry*
[3]*Mount Saint Vincent University, Department of Psychology*

Introduction: Approximately 10% of adults in Canada reported using cannabis daily or almost daily in 2023. Despite its widespread use, much remains unknown about the effects of chronic cannabis use on cortical function. Chronic cannabis use has been associated with abnormal functional connectivity and poorer cognitive performance. Abnormal EEG-derived spectral band power is hypothesized as a potential biomarker of the neurotoxic effects of chronic cannabis use.
Methods: To add to the literature investigating cannabis' effects on spectral band power, the current study examined frequency bands of interest (delta, theta, alpha, beta, gamma) in 20 cannabis users (CU) and 24 non-users (NU) during an eyes-closed resting task. EEG power measures for each band were separately analyzed using a repeated-measures general linear model (GLM) and alpha asymmetry values were compared between groups using independent samples t-tests. Alpha asymmetry values. Additionally, as an exploratory analysis, subjective measures of motivations for cannabis use were correlated with spectral band power.
Results: Results showed that theta power was significantly lower in CU in the frontal region (p = 0.039). Frontal theta power in the CU group was not significantly associated with any specific motivations for cannabis use. Finally, alpha asymmetry values were not significantly different between groups.
Conclusion: The observed changes in theta activity may reflect potential disruptions in cognitive and neural processes associated with cannabis use (such as attention and memory). These

findings enhance our understanding of cannabis' effects on the cortex and may inform future interventions for cannabis misuse.

P4. Cannabis Use in Males and Females: An ERP Study

Sydney Slaunwhite-Hay[1], Ashley Francis[2], Jenna Bissonnette, Sarah MacNeil[3], Candice Crocker[2], Sherry Stewart[2], Philip Tibbo[2], Derek Fisher[1,3]
[1]Saint Mary's University, Halifax, Nova Scotia, Canada
[2]Departments of Psychiatry, Dalhousie University, Halifax, Nova Scotia, Canada
[3]Mount Saint Vincent University, Halifax, Nova Scotia, Canada

Introduction: Cannabis use normally begins between ages 13-15 and is associated with structural and functional changes in the brain. Adolescence is a critical period for development and differs based on biological sex. Therefore, cannabis use may affect the brains of males and females in different ways. Auditory stimulus paradigms can be used to elicit EEG-derived event-related potentials (ERPs). The mismatch negativity (MMN) and the novelty P300 (NP3) represent different stages of the cognitive processes involved with the detection and encoding of a deviance within an auditory paradigm. The present study aimed to explore the MMN and NP3 in cannabis-using (CU) and non-using (NU) males and females.

Methods: Fifty-two (N=52) volunteers aged 18-30 participated in the study (N=26 NU, N=26 CU; N=30 Male, N=22 Female). Participants were invited to complete two sessions. For females, one session took place during the menstrual phase and one during the luteal phase. EEG data was collected from an auditory paradigm.

Results: It is expected that there will be differences in ERP amplitude between groups that are greatest when comparing cannabis-using and non-using participants.

P5. The Potential Signature of the Placebo Effect in Brain Oscillations in Neurorehabilitation: A systematic review and meta-analysis

Ortega-Márquez J.[1], Gonzalez-Gonzalez L[1], Sosa W.[1], Fregni F[1], Pacheco-Barrios K[1]
[1]Neuromodulation Center and Center for Clinical Research Learning, Spaulding Rehabilitation Hospital, Harvard Medical School

Background: Brain oscillatory activity and its role as a biomarker in human behavioral mechanisms stands as an unexplored tool to explain the effect of placebo therapeutics in neurological disorders. This systematic review and meta-analysis characterize, for the first time, the neural mechanistic biomarkers of placebo effect in neurorehabilitation.

Methodology: A systematic literature search based on PRISMA guidelines was conducted in PubMed, Embase, and Cochrane Library including randomized controlled trials (RCTs), and cross-over trials up to August 2023. The review included studies reporting brain oscillations in resting state as outcome in placebo-controlled neurorehabilitation trials. A qualitative, semi-quantitative, quantitative analysis was performed using minimal statistical information from each

study and calculating effect sizes of absolute power differences between placebo and active intervention groups using Hedges's g statistic method.

Results: In total, the analysis included 63 studies: 5 studies (180 healthy subjects) and 58 studies (1758 patients with neurological disorders). In healthy subjects, placebo interventions showed an increase in alpha power when comparing placebo intervention versus no intervention (g = 0.45, 95% CI [0.09; 0.8]). Within placebo groups in subjects with neurological disorders showed after the sham intervention increase in alpha frontal (g = 0.08, 95% CI [0.07; 0.08]), alpha central (g = 0.55, 95% CI [0.47; 0.65]), alpha parietal (g = 0.28, 95% CI [0.18; 0.44]), beta central (g = 1.31, 95% CI [1.06; 1.63]), and theta central (g = 0.58, 95% CI [0.46; 0.72]). Interestingly, these effects became non-significant when comparing with the active interventions.

Conclusion: In both types of populations, the increment of alpha oscillations in fronto-central regions was identified as the primary neural biomarker of the placebo effect. Additionally, the increase of beta and theta bands in the same brain regions were observed as potential biomarkers primarily in non-healthy subjects. Interestingly, these effects were pulled in the opposite direction when compared to active rehabilitation interventions, suggesting a masking effect by active rehabilitation techniques.

P6. Measuring brain network states in individuals with psychosis: a novel approach to investigate resting-state EEG alpha dynamic connectivity

Romain Aubonnet[1], Mahmoud Hassan[2,3], Paolo Gargiulo[2], Stefano Seri[4.5], Giorgio Di Lorenzo[1,6]
[1]Laboratory of Psychophysiology and Cognitive Neuroscience, Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy
[2]Institute of Biomedical and Neural Engineering, Reykjavik University, Reykjavik, Iceland
[3]MINDIG, F-35000, Rennes, France
[4]College of Health and Life Sciences, Institute of Health and Neurodevelopment, Aston University, Birmingham, United Kingdom
[5]Department of Clinical Neurophysiology, Birmingham Women's and Children's NHS FT, Birmingham, UK
[6]IRCCS Fondazione Santa Lucia, Rome, Italy

Introduction: Large and complex brain functional dysconnections characterize psychosis. However, traditional static connectivity measures may not adequately capture brain activity's complex and rapidly changing nature. This study investigates brain dynamic connectivity patterns in psychosis and their relationship with psychopathological profile and cognitive functioning using a novel dynamic connectivity pipeline on resting-state EEG.

Methods: Data from seventy-eight individuals with first-episode psychosis (FEP) and sixty control subjects (CTR) were analyzed. Source estimation was performed using eLORETA, and connectivity matrices in the alpha band were computed with the weighted phase-lag index. A modified k-means algorithm was employed to cluster connectivity matrices into distinct brain network states (BNS), from which metrics were extracted. A multivariate permutation approach was employed for the statistical analysis.

Results: The segmentation revealed five distinct BNSs. FEP exhibited significantly lower connectivity power in BNS 2 and 5 and a greater duration dispersion in BNS 1 than CTR. Significant negative correlations were identified between BNS metrics and negative symptoms in FEP. Associations between BNS metrics and cognitive domains were significant only in CTR.

Conclusion: This novel analysis method highlights the variability of neural dynamics in FEP and their relationship with negative symptoms. This association suggest that disruptions in particular brain states may underlie specific negative domains, providing a potential pathophysiology and target for therapeutic interventions. Furthermore, the relationship between cognitive efficiency and BNS features in CTR suggests that BNS may serve as potential proxies for general brain functioning and could be a viable candidate for characterizing the physiological processes underlying certain cognitive domains.

P7. Cognitive functioning and resting-state EEG microstates in first-episode of psychosis: an exploratory study

Giorgio Di Lorenzo[1,2], Romain Aubonnet[1], Carmine Gelormini[3], Paolo Gargiulo[3], Stefano Seri[4,5]
[1]Laboratory of Psychophysiology and Cognitive Neuroscience, Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy
[2]IRCCS Fondazione Santa Lucia, Rome, Italy
[3]Institute of Biomedical and Neural Engineering, Reykjavik University, Reykjavik, Iceland
[4]College of Health and Life Sciences, Institute of Health and Neurodevelopment, Aston University, Birmingham, United Kingdom
[5]Department of Clinical Neurophysiology, Birmingham Women's and Children's NHS FT, Birmingham, UK

Introduction: Cognitive impairment is evident in psychosis from the onset of the illness. Alterations of brain dynamics in psychosis have been investigated using resting-state EEG microstates (rsEEGms). However, the relationship between cognition and rsEEGms in psychosis has not been systematically explored.

Methods: We identified four rsEEGms maps in 78 patients with first-episode psychosis (FEP) and 60 healthy controls (CTR). Cognitive function was assessed using the MATRICS™ Consensus Cognitive Battery (MCCB™). A multivariate permutation approach was employed for the statistical analysis.

Results: Results showed that the mean duration and standard deviation (SD) of map D were lower in FEP than in CTR. Additionally, FEP had lower global field power means and SDs across all four maps, except for map B. MCCB™ domains were significantly lower in FEP than in CTR. In FEP, visual learning was positively correlated with the explained variance of map D, and reasoning and problem-solving were associated with the mean duration of map B. In CTR, social cognition was positively correlated with the coverage and explained variance of map C, and verbal learning was correlated with the mean duration of map C.

Conclusion: This exploratory study confirms that FEP exhibits alterations in brain dynamics, particularly those related to rsEEGms map D, which is more associated with cognitive

functioning. Furthermore, this study suggested a specific relationship in FEP between map D and visual learning, map B (related to visual performance) and reasoning and problem-solving, and in CTR between map C (related to self-oriented and interoceptive processes) and social cognition and verbal learning.

P8. Predicting the personal and social functioning in first-episode of schizophrenia: an exploratory study with resting-state EEG microstates

Giorgio Di Lorenzo[1,2], Romain Aubonnet[1], Carmine Gelormini[3], Diego Cichetti[1], Cherubino Di Lorenzo[4], Paolo Gargiulo[3], Stefano Seri[5,6]
[1]Laboratory of Psychophysiology and Cognitive Neuroscience, Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy
[2]IRCCS Fondazione Santa Lucia, Rome, Italy
[3]Institute of Biomedical and Neural Engineering, Reykjavik University, Reykjavik, Iceland (CG, PG); [4]Department of Medico-Surgical Sciences and Biotechnologies, Polo Pontino, Sapienza University of Rome, Latina, Italy
[5]College of Health and Life Sciences, Institute of Health and Neurodevelopment, Aston University, Birmingham, United Kingdom
[6]Department of Clinical Neurophysiology, Birmingham Women's and Children's NHS FT, Birmingham, UK

Introduction: Functional outcome in schizophrenia is mainly predicted by negative and cognitive symptoms. Brain dynamics in schizophrenia have been investigated using resting-state EEG microstates (rsEEGms), but the relationship between functioning and rsEEGms remains largely underexplored in schizophrenia.

Methods: We identified four rsEEGms maps in 31 patients with first-episode of schizophrenia (FES). Functioning was assessed using the Personal and Social Performance (PSP) scale. Models of stepwise linear regression were carried out to explore if PSP was predicted by rsEEGms features, controlling for cognition (measured with the total score of MATRICS™ Consensus Cognitive Battery, MCCB™), negative symptoms (assessed with the Brief Negative Symptom Scale, BNSS), and thought disorders (evaluated with the scale for the assessment of Thought, Language, and Communication, TLC). In regression models, we entered only independent variables significant to correlation analysis.

Results: After controlling for MCCB™ and TLC total score and BNSS Emotion Expressivity Deficit, regression models revealed that PSP in FES was independently predicted by mean global field power (GFP) of B, C, and D map and by GFP standard deviations of B and C map, with values of the standardized coefficient (b), ranging from 0.273 to 0.288.

Conclusion: This exploratory study reveals that measures of brain dynamics, particularly those related to rsEEGms map B (related to visual performance), C (associated with self-oriented and interoceptive processes), and D (related to cognitive functioning), could be useful in predicting the personal and social functioning in schizophrenia.

P9. Behavioural and Neural Responses to Cognitive Distractibility in High Sensory Sensitivity Children and Adolescents: An ERP Study

Lauren Stepien[1], Zihang Bu[1], Pratik Nath, Veronica Panchyshyn[1], Alicia Miller[1], Tyler Collins, Sid Segalowitz[2,3], Erin Panda[1,2], Ayda Tekok-Kilic[1,2]
[1]Department of Child and Youth Studies,[2] Centre for Neuroscience, [3]Department of Psychology, Brock University

Introduction: Sensory processing sensitivity (SPS) is a temperamental trait characterized by heightened sensitivity to internal and external stimuli. Individuals with high SPS have been likened to orchids, those with medium sensitivity to tulips, and low sensitivity to dandelions. This flower metaphor emphasizes the distinct ways these groups respond to and thrive within the appropriate environments. The purpose of this study is to examine the effects of SPS and cognitive distractibility (operationalized by introducing distracting noise) on attention and late processing in children and adolescents without clinical diagnoses.

Methods: Thirty-three children aged 8-17 completed a 4-stimulus visual oddball (VO) task with 50 target (requiring a button response), 50 nontarget, 200 standard, and 50 novel stimuli. Participants repeated this task while speakers played distracting background noise of five voices speaking at once to create a distracting visual oddball (DVO) task, analogous to classroom chatter. Reaction times (RTs) and event-related potentials (ERPs) from 128-channel EEG recordings were analyzed.

Results: Behavioural results indicated a significant main effect of sensitivity group on mean RT, with longer mean RTs for the high sensitivity group. A main effect of task condition was revealed, with longer RTs in DVO than VO. No significant main effects or interactions were found for RT variability, though a trend suggested higher variability in DVO for the high sensitivity group. Bootstrapping analyses (all p's <.001) conducted on ERPs revealed significant differences between sensitivity groups in parietal electrodes. For difference waves of targets minus standards, peaking at approximately 475 ms, the high sensitivity group had larger difference waves in VO. Additionally, the high sensitivity group showed a more positive difference wave for standards in VO minus standards in DVO at 350ms. For target conditions, group comparisons showed no significant differences in ERPs at these time points (350ms or 475ms). For standards in VO, the high sensitivity group had greater positivity around 350-375ms, while the low sensitivity group had greater positivity around 450-525ms. In DVO, the low sensitivity group showed greater positivity around 400-550ms.

Conclusions: These findings suggest that children and adolescents with reportedly high SPS exhibit distinct neural and behavioural responses to cognitive distractibility. The significant ERP differences show that high SPS children allocate more attentional resources to a task in non-distracting environments, suggesting increased difficulty with distractibility. These insights may have implications for our knowledge of how SPS affects cognitive processing and attention allocation in distracting environments.

14:30 - 15:30 **Lecture 7. EEG Biomarkers in Global CNS Trials** - ***Wedgwood Main Dining Room***

Greg Light, University of California, San Diego

15:30 - 17:00 **Symposium 4. Neuroimaging Markers of Drug Use, Dependence and Treatment -** ***Wedgwood Main Dining Room***
Chair: Derek Fisher (Department of Psychology, Mount Saint Vincent University)

Speakers:

Ashley M. Francis (Department of Psychiatry, Dalhousie University, Halifax, NS, Canada):
Impact of cannabis use on ERP-indexed markers of behavioural inhibition
Charlotte Caswell (Department of Psychiatry, McGill University, Montreal, QC, Canada):
A Three-Factor Model of Commonly Comorbid Early Onset Psychiatric Disorders: Replication in a Large Sample
Salvatore Campanella (ULB Neuroscience Institute (UNI), CHU Brugmann-Université Libre de Bruxelle, Brussels, Belgium):
The utility of cognitive ERPs in the management of addictive disorders
Benjamin Davidson (Harquail Centre for Neuromodulation, Sunnybrook Research Institute, Toronto, ON, Canada):
Deep Brain Stimulation for the Treatment of Alcohol Use Disorder

Given the impact of drug use and abuse within the general population, there is an increased need for characterization of the underlying neural bases of drug use and objective markers of treatment response. EEG and neuroimaging methodologies such as MRI can provide such information. In this symposium, data on EEG-based markers of cannabis use and alcohol use will be provided, as well as neuroimaging findings relating to the co-occurrence of substance abuse and psychiatric disorders. From the perspective of treatment, a report on the utility of EEG-derived ERPs in the treatment of substance dependence, as well as the utility of EEG to guide deep-brain stimulation in alcohol use disorder, will be presented.

Day 4 – Friday October 18, 2024

8:30 - 9:30 **Lecture 8. Auditory Cortical Plasticity in Older Adults: The Hyperactivity Phenomenon - *Wedgwood Main Dining Room***
Björn Herrmann, University of Toronto

9:30 – 10:30 **Lecture 9. Brain Stimulation for Treatment of Refractory Symptoms in Psychiatric Disorders - *Wedgwood Main Dining Room***
Jeff Daskalakis, University of California, San Diego

10:45 - 12:15 Symposium 5. EEG in Child and Adolescents - *Wedgwood Main Dining Room*
Chair: *Jenny Lepock* (Centre for Addiction and Mental Health)

Speakers:

Alfredo L Sklar (University of Pittsburgh School of Medicine): Visual Cortex Response Amplification and Modulation by Spatial Attention in First-Episode Psychosis

Introduction: While visual contrast amplification is diminished in chronic psychosis, its integrity at disease onset remains understudied. Modulation of the contrast response function (CRF) by attention, a process reliant on long-range cortical communication, may reveal even greater disruptions given impaired cortical connectivity in schizophrenia. The present study utilized magnetoencephalography (MEG) to examine attentional modulation of the CRF within visual cortex (VC) during first-episode psychosis (FEP).
Methods: MEG was recorded from 16 healthy controls (HC) and 10 FEP participants. Lateralized gabor patches of varying contrast were presented during valid and neutral cue conditions. MRIs were obtained to localize cortical sources. Peak activity levels were calculated within each VC division. CRF parameters (baseline (R0), response maximum (Rmax), slope (n), and mid-saturation contrast (C50)) were modeled using peak responses averaged across VC divisions.
Results: HC exhibited lower C50 relative to FEP across task condition (p=.04). Attention had a differential effect on Rmax between groups (p=.007). While attention increased Rmax in HC (p=.01), no effect was observed among FEP (p=.11). There was no effect of group, attention, or their interaction on either R0 (p's>.6) or n (p's>.3).
Conclusion: In addition to reduced contrast sensitivity relative to HC, FEP exhibited an impaired ability to modulate VC responses via attention. Effects were not driven by a baseline shift, indicating response gain by attention in HC rather than an additive model suggested by previous neuroimaging studies. Future analyses will examine neural synchronization between fronto-parietal cortices and VC as a potential mediator of impaired perceptual modulation in FEP.

Erin Panda (Brock University): ERPs to target and novel stimuli in quiet versus noisy environments relate to attention allocation control in children

Attention Deficit Hyperactivity Disorder (ADHD) is increasingly one of the most common neurodevelopmental conditions, with diagnostic rates at 5-10% of children and youth. However, ADHD-like traits (inattention, hyperactivity/impulsivity) are continuous in the population, and likely affect more children to some degree. The purpose of this study is to better understand the relationship between

ADHD-like traits and the electrophysiological correlates of attention allocation in children to target/novel stimuli and quiet/noisy conditions. While 128 channel EEG was recorded, 89 children (45 females, 8-17 years; approx. 50% referred for mental health services) participated in a 4-stimulus visual oddball task in which they viewed frequent "standard" stimuli and 3 kinds of infrequent stimuli ("targets", to which they responded), and "non-targets" and "novels" (images that differed on each trial), where no response was required. This was conducted twice: during silence and noise (multiple voices talking simultaneously, analogous to a noisy classroom environment). Parents also completed the Conners' Comprehensive Behavior Rating Scale (3rd Edition). ERPs from children with high (n=30; Conners' inattention T scores: 62-90) versus low difficulties with inattention (n=31; T scores: 40-48) were examined for this report. Bootstrapping analyses (all ps <.001) of event-related brain potentials (ERPs) at midline frontal and posterior electrodes showed, in both quiet and noise, a sustained frontal negativity (250-700ms) that was larger for novels than the other conditions (novelty effect) and a large midline posterior positivity (300-700 ms) that was largest for targets (P3b target effect). Results showed differences in both novelty and target processing as a function of background noise and children's inattention scores. Whereas children with low inattention scores responded in the same way to novels and targets in quiet and noise conditions, those with high inattention scores showed an exaggerated response to novels in quiet and a reduced response to targets in noise conditions. Together these results suggest that parent-report ADHD-like traits may relate to differences in attention allocation to both target (response required) and novel (no response required) stimuli, as a function of environmental noise. Inattentive children may be more distracted by novel stimuli in quiet and more distracted by noise during target processing than their peers without attention difficulties. These results may have implications for our understanding of children's attention processing in quiet and noisy classroom situations.

Erika Wauthi (University of Mons): Threatening stimuli interfere with attentional control and response inhibition in children with social anxiety: evidences from an emotional antisaccade paradigm

Introduction : Attentional biases (AB) of vigilance and threat avoidance are well-known markers of social anxiety, from its onset in childhood. These biases could be due to difficulties in inhibiting the automatic processing of stimuli perceived as threatening, involving the processes of cognitive control. However, AB are not always detectable by behavioural measures, possibly because of a dissociation between processing efficiency and processing effectiveness, as suggested by the theory of attentional control of Eysenck and colleagues. Accordingly, this study aimed to investigate the electrophysiological correlates of cognitive control and inhibition processes in children with social anxiety, using an antisaccade task.
Methods : 20 children with high levels of social anxiety (HSA - mean age=10.08; SD=1.01) and to 22 children with low levels of social anxiety (LSA - mean age=10.31; SD=1.31) performed a modified emotional antisaccade task with pictures of faces displaying neutral or angry expressions as peripheral stimuli. Faces were presented for 600ms and followed by a target to detect. Participants performed two prosaccade and two antisaccade blocks. EEG data was recorded from 64 electrodes and ERPs were analyzed by means of two separated spatio-temporal principal component analyses (PCA) locked on the onset of the faces or the targets.
Results : Compared to low socially anxious children, HSA children displayed increased N2pc for angry faces compared to neutral faces in the antisaccade condition and larger P2 amplitudes for targets following angry faces in the prosaccade condition. They also showed enhanced P3b amplitudes for targets following neutral faces in both pro- and antisaccade conditions, and and source analyses show increased brain activity in the parietal (precuneus) and frontal lobes. However, LSA and HSA children did not differ in terms of their behavioural performance on the task.
Conclusions : These results suggest that social anxiety leads to increased attentional engagement towards threatening faces, possibly due to a top-down attentional control deficit. However, additional cognitive resources are recruited to compensate for these AB, resulting in a lack of behavioural effect. To sum up, threatening expressions impair attentional control in social anxiety from childhood onwards. Moreover,

social anxiety has an impact on processing efficiency but not on processing effectiveness, and evoked potentials can help to clarify this discrepancy.

Minarose Ismail (The Hospital for Sick Children): Exploring Mechanisms of Language Lateralization in Developing Brains: A Personalized Multi-Modal Computational Modelling Approach

Understanding how language develops, and is represented in the brain is essential for addressing language disorders in childhood. Progressive hemispheric specialization is well-documented - lateralization not only reflects normal development but also plays a vital role in the network's resilience and its response to perturbations (e.g., brain injury).

Recent advances in neuroimaging and neurophysiology, particularly fMRI and magnetoencephalography (MEG), have allowed us to non-invasively study language lateralization. Our previous research has shown that expressive language tasks are supported by left-hemisphere decreases in beta-band oscillations (termed event-related desynchronization, or ERD) and right-lateralized increases (ERS) This pattern becomes more pronounced in later childhood and adolescence, and persist through adulthood. Despite technological advancements, a critical question remains: What drives the lateralization of beta rhythms, and how does the brain transition from a relatively bilateral language network in early childhood to a predominantly left-lateralized one in adulthood?

To address this question, we employ MEG and diffusion MRI (dMRI) data from 43 children and adolescents, ages 4-18 years. We construct personalized brain network models that simulate neural oscillations observed during auditory verb generation. Using biologically-inspired neurocomputational models, we explore the emergence of macro-scale activity from underlying brain structure and micro- and meso-scale neuronal dynamics.

Our findings reveal two key insights:

1. Models of early auditory evoked dynamics can predict later beta lateralization patterns, suggesting that initial auditory processing of nouns provides an early indicator of language laterality.
2. Lateralization of beta ERD and ERS is driven by interhemispheric inhibitory signaling, specifically among pyramidal and inhibitory interneurons. Importantly, we find that adolescents exhibit greater left-to-right inhibition, a pattern not observed in young children.

We present the first personalized whole-brain models of expressive language representation in a developmental cohort. Our models provide key insights that not only deepen our understanding of language lateralization in development, but may contribute to a mechanistic understanding of plasticity in the context of early insult, and detection and intervention strategies for language disorders of childhood.

13:00 – 14:00 **Lecture 8. The N400 ERP: A Window on Cognition and Prognosis in the Clinical High Risk State for Schizophrenia-** ***Wedgwood Main Dining Room***
Michael Kiang, University of Toronto