CENTER FOR **COGNITIVE** AND
BEHAVIORAL BRAIN IMAGING

THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

DECEMBER 8TH, 2022

9:30am to 5:00pm

Psychology Building Room 35

Or Attend via Zoom

KEYNOTE SPEAKER

Dr. Bharat Biswal

Professor of Bio-Medical Engineering

New Jersey Institute of Technology

Center for Cognitive and Behavioral Brain Imaging

The Center for Cognitive and Behavioral Brain Imaging (CCBBI) is dedicated to pursuing structural and functional magnetic resonance studies using state-of-the-art techniques, contributing to the development of future brain imaging modalities, and to disseminating knowledge about brain, mind, and imaging to students and the public. In our work, we value our commitment to the uniqueness of each individual. This includes, but is not limited to, valuing individuals with differences in race, ethnicity, country of origin, age, sex, gender, sexual orientation, religion, physical and mental abilities, immigration status, and socioeconomic status.

In pursuit of its goal to disseminate knowledge about brain, mind, and neuroimaging research, the Center for Cognitive and Behavioral Brain Imaging (CCBBI) invites the OSU Imaging community, including faculty, postdoctoral scientists, graduate students and research staff to its first annual CCBBI Research Day.

The 2022 CCBBI Research Day is the world-class neuroimaging research being completed at The Ohio State University. It will feature a keynote address by Dr. Bharat Biswal, a professor of Bio-Medical Engineering at New Jersey Institute of Technology; featured faculty presentations; and poster and short oral presentations by undergraduate and graduate students, research staff, and postdoctoral scientists.

Keynote Address: Dr. Bharat Biswal

Dr. Bharat Biswal obtained his PhD in Biophysics under the mentorship of Dr James Hyde at the Medical College of Wisconsin. His PhD topic was investigating the noise sources in fMRI. Upon completion of his PhD, he continued working at MCW, first as a Postdoc and then as a faculty. He has been in the Department of Radiology at the New Jersey Medical School from 2001. Since 2012, he is the Professor of Biomedical Engineering at NJIT. His research interests include fMRI data analysis and methods development.

Title: Toward Brain Connectomics: Examining Whole-Brain Modulated Connectivity in Different Task Domains and Rest

Abstract

Human brain anatomical and resting-state functional connectivity have been comprehensively portrayed using MRI, which are termed anatomical and functional connectomes. In this talk, we will provide an overview of the different analysis methods, and applications of resting state. We will also examine effect of tasks on whole brain functional connectivity, which we term as task connectome. Also, most of resting state (and task activation) studies in fMRI have primarily focused on the gray-matter BOLD signals. The signals from the white-matter have usually been considered to be noise dominated and rarely reported in the literature. To address this hypothesis, we evaluated the WM-FNs by performing a clustering analysis to the voxel-based white-matter functional connectivity matrix, and studied the relationships between WM- and GM-FNs.

Featured Faculty Presenters

Dr. Jay Fournier
Associate Professor, Psychiatry

Building Better Phenotypes: Parsing Individual Differences in Negative Affectivity and Emotion Regulation in the Internalizing Disorders

Dr. Jasmeet Hayes
Associate Professor, Psychology

Biomarkers of Accelerated Aging & Dementia in the Context of Neurotrauma

Dr. Ian Krajbich
Associate Professor, Psychology

Neural mechanisms underlying gaze-driven decision-making

Dr. Jessica Turner
Professor, Psychiatry

Imaging genetics of cognition in schizophrenia

CCBBI Research Day Agenda – December 8, 2022

9:00 - 9:45 am	**Registration/Breakfast**
9:45 - 10:00 am	**Opening Remarks: Dr. Peter Mohler**
10:00 - 11:00 am	**Keynote Talk: Dr. Bharat Biswal**
11:00 am - 12:30 pm	**Featured Faculty Presentations** *See Page 4 for talk titles* *Dr. Jay Fournier, Associate Professor, Psychiatry* *Dr. Jasmeet Hayes, Associate Professor, Psychology* *Dr. Ian Krajbich, Associate Professor, Psychology* *Dr. Jessica Turner, Professor, Psychiatry*
12:30 - 1:45 pm	**Lunch**
1:45 - 3:15 pm	**Graduate Student/Research Staff Oral Presentations** *See Pages 6 to 9 for abstracts* *Anita Shankar* *Fiona Molloy* *Blaire Dube* *Heather Hansen*
3:15 - 4:45 pm	**Poster Presentations and Refreshments** *See Pages 10 to 28 for abstracts*
4:45 - 5:00 pm	**Closing Remarks**

Oral Presentation Abstract 1

Temporal Network Desegregation as a Neural Correlate of Aging and Moderator of Cognitive Decline

Anita Shankar, Iris Mao, Richard Betzel, Ruchika S. Prakash
Department of Psychology

Introduction: Networks of the brain reliably desegregate with age, however, there is little work deriving dynamic task-based metrics of network desegregation and examining their relationship to cognitive performance across the lifespan. Here, we utilized an edge-centric network neuroscience approach to derive nodal entropy, which measures the diversity of temporal dynamics during a functional MRI scan. We hypothesized that entropy will be positively correlated with age, reflecting an increase in temporal network desegregation, and will moderate the negative association between age and fluid cognition.

Methods: Participants (n = 720) were individuals aged 36 to 100+ (Mage = 59.7; SD=14.9 years; 55.7% women) with three cognitive task-fMRI runs from the Human Connectome Project Lifespan Release, including an attentional task, a processing speed task, and an episodic memory task. We correlated task-averaged whole-brain entropy with age, and examined it as a potential moderator of the relationship between age and fluid cognition as measured by the NIH toolbox.

Results: As hypothesized, entropy significantly increased with age, $R(713) = .53$, $p < .001$, and moderated the relationship between age and fluid cognition ($B = -.10855$, $t(603) = -2.7949$, $p < .01$) such that individuals with lower entropy demonstrated better cognitive performance.

Discussion: The current analysis demonstrated temporal patterns of neuronal firing become more diverse with increasing age across the lifespan and moderate cognitive performance across the lifespan. Future longitudinal work is recommended to further examine entropy as a potential marker of cognitive health.

Keywords: graph theory, aging, cognitive health

Oral Presentation Abstract 2

Identifying visual brain regions in the absence of task fMRI

M. Fiona Molloy, Zeynep M. Saygin, David E. Osher
Department of Psychology

The ventral visual stream is comprised of numerous regions selective for specific high-level visual categories. While generating an areal map of the brain is a century-long endeavor, no approach is yet able to accurately identify functionally-selective high level visual regions on an individual subject basis in the absence of a task-based fMRI localizer. Previous work has demonstrated a tight link between brain circuitry and function, at the fine-grain of single voxels from individual subjects and reflecting individual variation therein. Can connectivity reliably identify high-level visual functional regions of interest (fROIs), in place of well-established functional localizers? If so, a single 10-minute resting state scan could be used in lieu of myriad localizers, saving researchers an enormous amount of scanning time, effort, and funding. Further, these models illuminate the neural circuitry that best define each brain region, and are strong candidates of the underlying mechanisms that govern visual selectivity. We scanned 40 participants with functional localizers for visually-selective regions involved in the perception of faces (FFA, OFA, STS), scenes (PPA, RSC, TOS), bodies (EBA), and objects (LOC, PFS). We designed linear models to predict the location of each ROI using resting state (functional connectivity, FC). These models were able to accurately identify face, scene, body, and object selective voxels in all cases, and could reliably localize each fROI for any given participant. These FC-ROIs were selective to the expected category of interest, similar to the fROIs identified with the functional localizer task. They also outperformed probabilistic parcels, as well as the closest matching region from other areal maps/atlases purported to reflect functional subdivisions of the brain, e.g. Glasser atlas. Thus, a single resting-state scan can efficiently replace an entire set of functional localizers for high-level vision, offering practical and scientific advantages.

Keywords: fMRI, functional connectivity, high-level vision, functional regions of interest

Oral Presentation Abstract 3

Spatial Distraction Reverses Category-Tuned Attentional Filters by Disrupting Both Facilitation and Suppression

Blaire Dube, Lasyapriya Pidaparthi, & Julie D Golomb
Department of Psychology

Attentional filters ensure that relevant information is processed and irrelevant information is filtered out. It is well known that a distractor appearing outside the focus of attention disrupts spatial attention, but what are the consequences for non-spatial attentional filters? In two fMRI experiments, participants attended different object categories while viewing hybrid image arrays (superimposed face/house [E1] or face/house/shoe [E2] pairs). On distractor-absent trials, we observed the standard signature of category-tuned attentional filtering: greater FFA activation when attending faces, PPA when attending scenes, and LOC when attending shoes. When a salient distractor appeared, however, category-tuned filtering was dramatically disrupted. Strikingly, the neural filters were not simply reset, but briefly inverted, such that to-be-ignored categories were incidentally prioritized. To further quantify attentional facilitation and suppression, in E2, single-category image conditions (faces only, houses only, shoes only) were also included as benchmarks. On distractor-absent trials, activation in FFA when attending faces in hybrids was comparable to viewing faces-only, and activation when ignoring-faces in hybrids was comparable to faces-absent; the same was true for the other ROIs, suggesting effective facilitation of the target category and suppression of the nontarget category. Interestingly, on distractor-present trials, facilitation and suppression were both disrupted. Thus, when there is attentional competition (hybrid images), spatial distraction can be so disruptive as to actually invert these filters; processing of the task-relevant object category is reduced, while processing of the task-irrelevant category is boosted. Extending the Filter Disruption Theory (Dube & Golomb, 2022), the current results reveal that in addition to disrupting spatial attention, distraction disrupts category-tuned attentional filters, via temporary disruptions to mechanisms of both facilitation and suppression.

Keywords: Attentional filtering, Distraction

Oral Presentation Abstract 4

Neural Evidence for Non-orofacial Triggers in Mild Misophonia

Heather A. Hansen, Patricia Stefancin, Andrew B. Leber, Zeynep M. Saygin
Department of Psychology

Misophonia, an extreme aversion to certain sounds, is a highly prevalent yet understudied condition plaguing 20% of the population. Although neuroimaging research on misophonia is scant, recent work showing higher resting-state functional connectivity (rs-fMRI) between auditory cortex and orofacial motor cortex in misophonia vs. controls has led researchers to speculate that misophonia is caused by orofacial mirror neurons. Since orofacial cortex was defined using rs-fMRI, we attempted to replicate these findings using regions defined by task-based fMRI instead. Further, given our recent work showing that a plethora of sounds (i.e., not just oral/nasal) can be triggering, we investigated neural evidence for misophonic aversion to non-orofacial stimuli. Sampling 19 adults with varying misophonia levels, we collected resting-state data and an fMRI task involving phoneme articulation and finger-tapping. We first defined “orofacial” cortex in each participant using rs-fMRI as done previously, producing what we call resting-state regions of interest (rsROIs). Additionally, we functionally-defined regions (fROIs) representing “orofacial” or “finger” cortex using corresponding task activation. To investigate the motor specificity of connectivity differences, we subdivided the rsROIs and fROIs into both motor and sensory regions. We then calculated rs-fMRI between each rsROI/fROI and a priori non-sensorimotor ROIs. We found increased connectivity in mild misophonia between rsROIs and both auditory cortex and insula, replicating previous results, with differences extending across sensorimotor cortex. However, the orofacial task-based fROIs did not show this pattern, suggesting the “orofacial” cortex described previously was not capturing true orofacial cortex; in fact, we find no task-based selectivity to orofacial action in these so-called “orofacial” regions. Instead, we observed higher connectivity between finger fROIs and insula in mild misophonia, demonstrating neural evidence for non-orofacial triggers. These results provide support for a neural representation of misophonia beyond merely an orofacial/motor origin, leading to important implications for the conceptualization and treatment of misophonia.

Keywords: misophonia, resting-state connectivity, fMRI, sensorimotor cortex, orofacial, finger-tapping

Poster Abstract 1

Effects of a Physical Activity Intervention on Working Memory Connectome in People with Multiple Sclerosis

Madhura Phansikar*, Elizabeth Duraney*, Heena Manglani, Anita Shankar, Christine Roberts, Rebecca Andridge, Jacqueline Nicholas, Rick Petosa, & Ruchika Shaurya Prakash
Department of Psychology

Introduction: Multiple sclerosis (MS), a neurodegenerative condition, is marked with significant declines in working memory, which may be ameliorated by physical activity. Using connectome-based predictive modeling, studies have identified whole brain changes in connectivity associated with working memory task performance among healthy adults, which predicted variance in working memory among people with MS. However, no study has examined the effects of a physical activity intervention on improving network strength of a cognitive connectome.

Methods: Individuals between 30-59 years, ambulatory, and with relapsing-remitting MS were randomized to a 6-month step-track or water-track intervention (active control). Step-count was measured using a GT3X+ accelerometer. At baseline and post-intervention, functional magnetic resonance imaging data was collected during the n-back task (n = 68). Preprocessed data was parcellated using the 268-node Shen atlas. We computed the average blood-oxygen level-dependent signal across time in each node and the Pearson correlation between the mean time course of each node pair. Each participant's working memory network strength was determined using the working memory connectome from a previous study (Avery et al., 2020). A combined network strength score (difference between the high and low working memory network) was computed.

Results: A linear mixed model with Group, Time, and Group X Time showed no significant effect of Time $F(1, 61) = .06$, $p = .80$, Group $F(1, 118) = .14$, $p = .70$, or interaction effect $F(1, 61) = .16$, $p = .68$, on the combined network strength. A Group X Time interaction effect for step-count showed a maintenance of step-count in the Step-track group and a significant reduction in the Water-track group.

Discussion: To our knowledge, this is the first study to assess changes in a whole brain connectome from a longitudinal behavioral intervention. Results suggest the need for investigating intervention factors that may result in meaningful changes in a cognitive connectome.

Poster Abstract 2

An Age-Invariant Whole-Brain Neuromarker of Sustained Attention

Nathan McPherson, James Teng, Courtney Blau, Ruchika S. Prakash
Department of Psychology

Introduction: Attention is one of a set of cognitive abilities which often decline from early adulthood into old age, resulting from normal age-related alterations in brain function and connectivity. Furthermore, attention serves as a foundational mechanism for the proper functioning of multiple cognitive and perceptual processes, such that deficits in attention often result in poorer performance on assessments of other cognitive functions (*Rosenberg et al., 2017*; Burgoyne & Engle, 2020). Because of its nearly ubiquitous role in a broad variety of processes, it is commonly thought that attention is not localized to a single region or network. Rather, it may be the result of a set of functional connections which occur across the entire brain. Recent studies using Connectome Based Predictive Modeling (CPM) – a machine-learning algorithm which predicts task performance using whole-brain functional connectivity (Shen et al., 2017) – have generated whole-brain models of attention in young adults which successfully predict performance on tasks of sustained attention (Rosenberg et al., 2017). However, we currently lack a similar model of attention which is applicable across the entire adult lifespan due to a high degree of heterogeneity in age-related cognitive changes.

Methods: Here, our aim is to derive a CPM of attention consisting of edges which are resistant to age related change using 594 subjects across the adult lifespan (36-105 years old) from the Human Connectome Project Aging dataset (Van Essen et al., 2013).

Results: Convergent with previous literature, our whole-brain models of attention demonstrate significant predictive accuracy despite heterogenous aging-effects. The High attention network consisted of high within-network contribution primarily from the Visual and Dorsal Attention Networks, with between-network contributions primarily coming from the Visual, SomatoMotor, and Dorsal Attention networks. Comparatively, the low attention network shows stronger within-network contribution from the Control, and especially SomatoMotor network, and weaker within-network contributions from the Visual network.

Discussion: Future studies might test the predictive accuracy of this model on a novel set of subjects to determine generalizability, or use this model as a reference to detect age related changes in this brain-wide neuromarker of attention.

Keywords: Sustained Attention, Connectome-Based Predictive Modeling (CPM), Lifespan Neuromarker, functional connectivity

Poster Abstract 3

Modulating the Activation of Motor and Reward Centers with Light

Emily J. Yu, M. Fiona Molloy, Sanjay Krishna, K. Luan Phan, Kevin Reeves, Zeynep M. Saygin
Department of Psychology

Researchers have made advancements in brain stimulation techniques, such as nonpharmacological neuromodulation of specific neural pathways. However, current stimulation techniques such as deep brain stimulation (DBS) and transmagnetic stimulation (TMS) are either invasive or imprecise (and unable to penetrate deep subcortical structures). A newer noninvasive method that may potentially reach subcortical structures is photobiomodulation (PBM), which uses red to near-infrared light to stimulate neurons. This project aims to utilize PBM to alter neural and behavioral responses by stimulating the primary motor cortex and dorsal and ventral striatum. These neural pathways are believed to be pathways shared in Parkinson's Disease and Major Depressive Disorder. In this pilot study, we built a head-mounted apparatus to achieve better PBM precision and acquired fMRI data from subjects before and after PBM. Stimulation was conducted using a 1064-nm continuous wave laser at 0.6 W/cm2 for 10 minutes at the Cz location (10-20 system), targeting motor cortex. Subjects participate in two tasks while fMRI data is collected. The first task involves alternating blocks in which the participant taps a button with their right index finger vs. rest (evokes motor activation). The second task is a monetary reward-guessing game (previously shown to evoke striatal activation) in which the participant chooses one of two identical doors resulting in a win or loss of money. Preliminary analyses showed effective manipulation of motor cortex, where the left precentral gyrus (location of primary motor cortex) showed an average positive PSC prior to stimulation and a negative PSC after stimulation during the motor task. Ongoing investigations include analyzing functional connectivity changes with stimulation, exploring how reward processing is impacted with stimulation of subcortex, replicating these observations in more subjects, and comparing these effects to those achieved with TMS.

Keywords: photobiomodulation, fMRI, reward, precentral cortex, motor cortex

Poster Abstract 4

Predicting Alzheimer's Disease Pathology Through Mind Wandering

James Teng, Michael R McKenna, Oyetunde Gbadeyan, Ruchika S Prakash
Department of Psychology

Introduction: Prior work on mind wandering in aging have proven inconclusive, but have shown hints as to its relationship with disease symptomology, especially in Alzheimer's disease (AD), which could potentially have predictive utility in identifying AD pathophysiology.

Methods: Utilising the connectome-based predictive modeling (CPM), we previously identified a unique set of network connectomics that are hallmarks of mind wandering. We applied this mind wandering CPM (mwCPM) to an independent sample of mixed pathology patients from the Alzheimer's Disease Neuroimaging Initiative (ADNI). We hypothesise that the mwCPM will successfully predict AD pathophysiology.

Results: We found that the model associated with high mind-wandering successfully predicted the ratiometric p-tau/ Aβ levels of the independent ADNI sample. However, the combined model and low mind-wandering model failed to predict pathophysiology. We further confirmed the predictive utility of the mwCPM by examining the correspondence between the high mwCPM with three cognitive measures: a generalised AD cognitive composite, a composite measuring memory, and a composite measuring executive function. In light of these findings, we attempted to elucidate the precise mechanism of the mwCPM by performing a lesion study of the models: The high mwCPM model remained significantly predictive of AD pathophysiology even after the removal of nodes in the default mode network, the ventral attention network, the dorsal attention network, and the frontoparietal network.

Discussion: Our results are the first to demonstrate the predictive utility of behaviourally measured mind-wandering in predicting such physiological constructs serum biomarkers of AD. These functional networks appear to be robust, and seem to work in concert across all identified networks; not just in networks previously found to be important to mind wandering alone. We show that the relationship between mind wandering and AD is not clear-cut, and warrants further investigations.

Keywords: Alzheimer's disease, mind wandering, fMRI, connectome-based predictive modeling

Poster Abstract 5

Lesion-Symptom Mapping of Semantics and Phonology in People with Aphasia

Jessica Timog[1], Victoria Diedrichs, M.A., CCC-SLP,[1] David Osher, Ph. D.,[2] and Stacy Harnish, Ph. D., CCC-SLP[1]
[1]Department of Speech and Hearing Science & [2]Department of Psychology

People who have had a left hemispheric stroke will commonly experience chronic aphasia which is a language disorder that impacts expression, understanding, reading, and writing of language. Word recall and activation are used in language processing skills which relies on short term (STM) and working memory (WM) but are impaired in people with aphasia. By assessing and targeting STM and WM in speech therapy, it has been shown to improve language in people with aphasia (Baddeley, 2003; Silkes, 2021; Shallice, 1977). The Temple Assessment of Language and Verbal Short-Term Memory in Aphasia (TALSA) can quantify a person with aphasia's STM and WM and how to customize speech therapy when focusing on these skills (Martin, 2021).

Neuroimaging and MRI scans provide information on the size and location of the brain lesions caused by the stroke. Depending on the location of the lesions, symptoms in language impairments can be predicted (Crinion, 2013). However, it is unknown how phonological and semantic STM and WM deficits relate to lesion location.

We used a region of interest-based approach (ROI; Poldrack, 2007; Zhao 2017) to localize the brain regions most associated with phonological and semantic WM deficits. We ran a partial correlations analysis of lesion load comparison to TALSA scores, respective to sematic and phonological areas and results. We found that lower semantic WM scores were associated with lesions in the supramarginal gyrus and intraparietal sulcus (aIFG), which are recruited during semantic processing and WM, respectively. By contrast, lower phonological WM scores were associated with lesions in Heschl's gyrus (auditory cortex), posterior inferior frontal gyrus (pIFG), and the inferior precentral gyrus (motor cortex of cranial muscles involved in speech production). The phonological correlation did not reach significance, possibly due to lack of power. More data must be collected to draw further conclusions.

Keywords: Aphasia, ROI, Semantics, Phonology, Short Term Memory

Poster Abstract 6

Assessing the Feasibility of Implementing a Cardiorespiratory Exercise Stimulus during Functional MRI

Cloud, J.A.[1], Hiersche, K.J.[1], Hasselbach, A.N.[1], Shin, A.N.[1], Williams, V.J.[2,3], Salat, D.[4,5], Hayes, S.M.[1]

[1]The Ohio State University, Department of Psychology
[2]Division of Geriatrics and Gerontology, Department of Medicine, University of Wisconsin at Madison School of Medicine and Public Health
[3]Wisconsin Alzheimer's Disease Research Center, University of Wisconsin at Madison, School of Medicine and Public Health
[4]Neuroimaging Research for Veterans Center, VA Boston Healthcare System
[5]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard University

The primary goal of the current study was to examine the feasibility of implementing a cardiorespiratory exercise stimulus during functional MRI. 9 young adults (age: 18-22 years) completed three, 8-minute runs of fMRI (volumes=619; TR=800 ms; multiband=4; voxel size=3 mm3). During fMRI, participants used an MRI-compatible cardiostepper (similar to a Stairmaster) to complete an exercise challenge consisting of alternating blocks of exercise and rest. Participants stepped at a rate of 60 Hz with pedal resistance determined by participants' fitness level and exercise intensity evaluated using heart rate and respiration data. fMRI data were processed and analyzed using FMRIB Software Library (FSL). Volumes with significant artifact were identified using the ARtifact Detection Toolbox (ART), and motion-related artifacts were removed from BOLD signal components using ICA-AROMA. During exercise, heart rate increased (mean=131 bpm) compared to rest (mean=87 bpm; $t(34)=4.3$; $p<.001$), corresponding to light to moderate exercise intensity for this age group. As expected, motion (median framewise displacement) was significantly higher during exercise (mean=.53 mm) than rest (mean=.36 mm), with 69% of brain volumes classified by ART as artifact-containing outliers occurring during exercise blocks. The use of ICA-AROMA reduced the impact of motion considerably, recovering an additional 25% of the task-related signal. Preliminary comparisons of fMRI activity during exercise versus rest revealed significant associations with primary and supplementary motor cortices, hippocampus, and the insula, among other regions. Our data suggest that it is feasible to elicit light to moderate intensity cardiorespiratory exercise during functional MRI. Although increased head motion was observed during exercise compared to rest, the degree of motion was approximate to values published in previous fMRI studies. Post image acquisition processing improved task-related signal. During exercise, preliminary results showed increased brain activation in regions associated with the central command network, which regulates autonomic nervous system and musculoskeletal function during exercise.

Keywords: fMRI; exercise; physical activity; central command

Poster Abstract 7

White Matter Hyperintensities and Plasma Neurofilament Light are Associated with Cognition in Aging and Mild Cognitive Impairment

Ann J. Lee[1] and Scott M. Hayes[1, 2]
[1] Department of Psychology, The Ohio State University
[2] Chronic Brain Injury Initiative, The Ohio State University

Introduction: White matter hyperintensities (WMH) are a common feature of aging and Alzheimer's disease and contribute to cognitive decline. Elevated plasma neurofilament light chain (NfL) reflects neuro-axonal damage in white matter. Although previous studies have examined relationships between WMH and cognitive domains and NfL and global cognition, few have simultaneously associated these variables with performance in specific cognitive domains, such as executive function and episodic memory. The present study aims to examine the relationships between WMH, NfL, and specific cognitive functions in a cohort of non-demented older adults.

Methods: 284 older adult participants ages 55 to 85 years (mean age = 72; SD = 6.96) classified as cognitively normal or mild cognitive impairment were selected from the Alzheimer's Disease Neuroimaging Initiative based on the availability of baseline executive function and episodic memory composite scores, total WMH volume, and plasma NfL. Multiple regression models examined associations between NfL, WMH, and executive function and episodic memory performance. Mediation analyses explored the relationship between NfL and cognition with WMH as the mediator.

Results: NfL was associated with greater total WMH volume ($\beta = 0.18$, $p < 0.01$) and lower episodic memory performance ($\beta = -0.17$, $p < 0.001$), but not executive function performance. WMH volume was associated with lower executive function ($\beta = -0.17$, $p = 0.001$) but not episodic memory performance. Mediation models showed a significant indirect effect of WMH on NfL and executive function performance ($\beta = -0.03$, 95% CI [-0.06, -0.01]).

Discussion: Results support total WMH volume as a risk-factor that mediates the link between axonal degeneration and executive function performance. These findings suggest the importance of considering WMH volume when examining NfL as a prognostic marker of executive function performance in aging and those at risk for Alzheimer's disease.

Keywords: Aging; Executive function; Mild cognitive impairment; Neurofilament light; White matter hyperintensities

Poster Abstract 8

A Whole-Brain Functional Connectivity Model of Alzheimer's Disease Pathology

Michael R. McKenna, Oyetunde Gbadeyan, Anita R. Shankar, Rebecca Andridge, Douglas W. Scharre, Ruchika S. Prakash
Department of Psychology

Introduction: Detection of Alzheimer's disease (AD) in its early stages is a necessity as symptom onset is too late for meaningful intervention. As blood-based assays which estimate neural accumulation of protein-based biomarkers further develop, existing longitudinal datasets lag behind this new technology. Thus, blood-based markers are several years away from being in included in large AD databases. Current methodology which uses lumbar punctures or Positron Emission Tomography is rather invasive or involves exposure to radioactive tracers. Functional magnetic resonance imaging (fMRI)-based neuromarkers offer a possible complementary method in quantifying neural protein accumulation.

Methods: In this project, we employed connectome-based predictive modeling (CPM), a whole-brain machine learning connectome approach, to predict individualized concentrations of p-tau/Aβ42, a ratio of proteinaupathies associated with future decline in cognitive functioning, on a sample of 289 individuals drawn from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database.

Results: Our model, which we call PATH-fc, was successful in predicting concentrations of proteinaupathies associated with AD pathology in cognitively normal, mild individuals with cognitive impairment, and individuals with AD dementia ($rs=0.25$, $p < 0.001$, 1000 interaction permutation testing). This model, primarily characterized through intra-network edges, also strongly predicted current performance on measures of global functioning (Preclinical Alzheimer's Cognitive Composite: $rs = 0.50$, $p < 0.001$), executive functioning (ADNI-EF: $rs = 0.39$, $p < 0.001$), and episodic memory (ADNI-MEM: $rs = 0.41$, $p < 0.001$).

Discussion: Therefore PATH-fc demonstrates fMRI-based neuromarkers can predict both concentrations of AD proteinaupathies and cognitive functioning. Future work validating this model in other external datasets, and to midlife adults will critically extend this fMRI neuromarker.

Keywords: Alzheimer's disease, cognition, biomarkers, executive functioning, episodic memory

Poster Abstract 9

Increased Posterior Cingulate Connectivity with Dorsolateral PFC Following Mindfulness-Based Cognitive Therapy (MBCT) in PTSD Patients Linked to Treatment Response: A Randomized Controlled Replication Study

Garrett R. Hosterman, Alexis M. Berry, Anthony P. King
College of Medicine

Posttraumatic Stress Disorder (PTSD) is common and can be chronic and debilitating. Our research group previously reported that mindfulness based cognitive therapy (MBCT) decreased symptoms of anxiety, depression, and PTSD with clinical significance in US military veterans and first responders. Findings also demonstrated increased neural connectivity between the posterior cingulate cortex (PCC), a key node of the Default Mode Network (DMN), and the dorsal lateral prefrontal cortex (DLPFC), a key node of Frontoparietal Network (FPN) in fMRI measures. To test the efficacy of MBCT and attempt to replicate our PCC-DLPFC fMRI findings in a broader population, we performed a randomized control trial (RCT) comparing MBCT to an active comparison intervention called progressive muscle relaxation (PMR), a similarly structured 8-week treatment group, with people with PTSD from the community. 41 participants completed the RCT with both pre- and post-therapy fMRI scans. Due to COVID restrictions, MBCT and PMR were delivered via virtual Zoom groups. Both MBCT and PMR led to clinically meaningful improvements in PTSD (MBCT mean 22-point PCL-5 reduction, Hedge's g=1.0, p<.001, PMR 24-point CAPS-5 reduction, g=1.0, p<.001). In the PCC-seed rsFC ANOVA interaction Z-map we found a cluster in the right DLPFC/ BA10 MNI: (30,48,12), F=20.91, Z=3.90, k=94 voxels, SVC pFWE=0.021, with greater (p=.002) increase in extracted resting state functional connectivity (rsFC) in MBCT compared to the PMR control (Hedges g = 1.03). Furthermore, the increase in PCC-DLPFC rsFC was greater in MBCT responders than non-responders (p<.05, g=0.57). Our results indicate support for our registered hypothesis (R61 "Go-criteria") that MBCT, but not PMR, lead to an increase in PCC-DLPFC rsFC (altered DMN-FPN cross-network connectivity). This increased rsFC was significantly related to clinical improvement (blinded CGI-I scores for PTSD) in the MBCT group only. This data further supports PCC-DLPFC FC as a potential treatment target mechanism of mindfulness interventions.

Poster Abstract 10

Shifting Ability and Links with White Matter Microstructure in Children with Pediatric TBI

Florencia Ontiveros,[1] Katherine Billetdeaux,[1] Kathryn Vannatta, PhD,[1,2] Elisabeth A. Wilde, PhD,[3] Keith O. Yeates, PhD,[4] Kristen R. Hoskinson, PhD[1,2]
[1]Center for Biobehavioral Health, The Research Institute at Nationwide Children's Hospital
[2]Section of Pediatrics, The Ohio State University College of Medicine, Columbus, OH
[3]Department of Neurology, University of Utah School of Medicine, Salt Take City, UT;
[4]Department of Psychology, University of Calgary College of Medicine, Calgary, AB, Canada

Traumatic brain injury (TBI) puts children at increased risk for deficits in executive function, possibly due to disrupted white matter microstructure of tracts associated with executive function. This study explored variations in white matter microstructure in children with complicated-mild TBI (cmTBI), moderate to severe TBI (msTBI), or orthopedic injury (OI) and its relationship with executive function. Participants included 56 children: 13 with cmTBI (M_{age}=12.4), 19 with msTBI (M_{age}=11.5), and 26 with OI (M_{age}=11.6). Parents completed the Behavior Rating Inventory of Executive Function (BRIEF). Children underwent MRI in a 3T Siemens scanner with 64-direction DTI. We obtained fractional anisotropy (FA) values of white matter tracts linked with executive function, including the corpus callosum (CC), external capsule (EC), superior longitudinal fasciculus (SLF), uncinate fasciculus (UNC), and fornix using FSL's (v6.0.4) Tract-Based Spatial Statistics. One-way ANOVA shows a group difference in the Shift subscale; children with msTBI were rated as having less ability to shift from one activity or situation to another compared to children with cmTBI (p=.050) and OI (p=.013). ANOVA also revealed significant group differences in FA of the CC, genu of the CC, EC, fornix, and left UNC, indicating degradation of white matter microstructure in msTBI (ps<.05). Within groups, we found significant negative correlations among Shift scores and FA in the EC, fornix, UNC, right UNC, SLF, and left SLF. We found that those with msTBI are at risk of poor shifting ability, and that this important executive function ability is associated with white matter microstructure in anterior and subcortical tracts. Specifically, higher FA values, purported to reflect greater microstructural integrity, was linked with better parent-rated shifting ability. Increases in injury severity were associated with lower FA values, suggesting a possible neural substrate underlying weaknesses in shifting in this vulnerable population.

Keywords: TBI, white matter, executive function, shifting.

Poster Abstract 11

Episodic Memory Differences Following a Single Season of Youth Tackle Football

Patricia Stefancin-Resnick, Jaclyn B. Caccese, Zeynep M. Saygin
Department of Psychology
School of Health and Rehabilitation Sciences

Introduction: Youth tackle football players sustain a median of 378 subconcussive head impacts over the course of a single season, or roughly 14 times the amount as flag football players, raising concerns about the effect of football on the developing brain2. Studies of adolescent and collegiate athletes have shown reduced memory function in collegiate football athletes. However, few studies have investigated memory function within the medial temporal lobe in a child population.

Methods: 7 football players and 6 control subjects were scanned before the start of the football season and following the season. Subjects underwent a 3D MPRAGE T1 weighted anatomical scan and an episodic memory encoding fMRI paradigm. This task consisted of an encoding phase inside the scanner and a memory test following the scan to record encoded vs forgotten trials. Whole brain block wise analysis and percent signal change (PSC) calculations were performed to determine differences in memory encoding. Independent samples T-test were performed on the difference between timepoints. Results were corrected for multiple comparisons using a cluster-wise correction.

Results: Football players showed reduced activation within the left parahippocampal gyrus ($T= -5.17$, $p<0.005$), the right entorhinal cortex ($T= -3.59$, $p<0.005$) and the left hippocampus ($T= -3.18$, $p<0.005$) between timepoints compared to controls across the season during the episodic memory task. Football players also showed reduced PSC for Hits-Misses within the bilateral hippocampus, bilateral entorhinal, and bilateral amygdala across the season compared to controls.

Conclusions: Football players also showed a loss of activation following the season compared to controls. The players also showed reduced PSC for Hits-Misses compared to controls across the season. This is perhaps showing an effect of football on memory function in young participants.

Poster Abstract 12

Reduced Prefrontal Cortical Volume Associated with Marijuana Exposure Predicts Future Marijuana Use

Ferris , C. S., Boettner, B., Bai, P., Wilson, K. L., Browning, C. R., Wagner, D. D., & Way, B. M.

Department of Psychology

Marijuana use among adolescents is very common, with 15% of 8th graders and 44% of 12th grade students reporting any lifetime use in 2019. Adolescence is a sensitive period of neural development during which the prefrontal cortex matures as individuals enter adulthood. Prior work investigating structural differences in the brains of adolescent marijuana users have reported mixed results, though there is some consensus that reductions in prefrontal cortical volume is associated with marijuana use. Herein, we performed high-resolution structural MRI scans on a large sample of adolescents (N=247; age M =16.1 years, SD = 2.1) to address two questions. First, we examined to what extent differences in brain volume between marijuana using and non-using adolescents are specific to the prefrontal cortex. Second, we examined whether prefrontal brain volume can predict future substance use in non-using adolescents. Marijuana use was self-reported at the time of the scan as whether the individual had previously tried marijuana (n = 64 users), and a subset of participants completed follow up assessments 2-3 years after scanning (n = 146; 70 new users). Regional brain volume at baseline was measured using the FreeSurfer recon-all pipeline and standardized to control for head size (raw ROI volume divided by total intracranial volume). To determine the specificity of the association between marijuana use and grey matter volume throughout the brain, we correlated lifetime exposure to marijuana with brain volume in 41 brain regions and corrected for multiple comparisons (FDR corrected). We observed significant negative correlations between lifetime marijuana use and brain volume in eight regions, five prefrontal (rostral middle frontal, pars orbitalis, pars triangularis, superior frontal gyrus, and frontal pole), as well as the posterior cingulate cortex, insula, and transverse temporal cortex when controlling for other substance (alcohol and cigarette) use, race, sex and socioeconomic status. Due to our a priori interest in the relationship between marijuana use and frontal cortical volume we utilized these prefrontal regions as predictor variables in a series of multiple regressions predicting future marijuana exposure in non-using participants. Independently, lower volume of the rostral middle frontal gyrus, frontal pole, and superior frontal gyrus significantly predicted future marijuana exposure (FDR corrected). Together, this pattern of results supports the hypothesis that marijuana use is associated with reduced frontal volume, and that reduced frontal volume in key regions may be influencing future marijuana exposure rates.

Keywords: marijuana, structural MRI, rostral middle frontal gyrus, superior frontal gyrus, frontal pole

Poster Abstract 13

The Relation between a Heritage Language and the Neurobiological Correlates of Emergent English Reading

Ye Shen, PhD
College of Education and Human Ecology

Functional communication between brain regions plays a key role in reading and is influenced by individual differences in language experiences. Yet, to date, no study has investigated how heritage language learners' (HLLs) L2 reading reflects their spoken first language (L1) at the neurobiological level. Here, I examined the differences in the reading networks of HLLs and monolingual children between 9 and 10 years old. Additionally, I investigated whether differences in their neurobiological reading networks could be accounted for by English (L2) reading ability. To examine this difference, I randomly selected 60 HLLs from the Adolescent Brain Cognitive Development (ABCD) Study and matched HLLs to monolinguals in terms of age, sex, performance intelligence, and working memory. I found that HLLs built a wider and more distributed reading network than monolinguals. This more distributed network included connections to regions known to be involved in motor control, verbal memory, speech production, and language control. This suggests that reading may be a more demanding task for HLLs, compared to monolingual children. HLLs may need to borrow resources from other cognitive and control regions to assist with reading in their L2. It is also possible that HLLs may form different networks to deal with interactions between two languages. When L2 reading scores were included in my neuroimaging analysis, better L2 reading scores were positively associated with stronger functional connectivity between reading and cognitive control regions for HLLs and monolinguals as a whole group. In addition, even though no significant difference in L2 reading was found, HLLs continued to show differentiated intrinsic connectivity. Specifically, for HLLs only, better L2 reading scores were positively related to stronger functional connectivity between reading and language control areas. This suggests that HLLs are more likely to recruit brain regions involved in executive control to achieve advanced English word reading.

Keywords: heritage language learners; reading network, intrinsic functional connectivity

Poster Abstract 14

Neurophysiological Correlates of the Sensory Gating Inventory in Autistic Adults

Nicole D. Singer, BS, S/OT & Jewel E. Crasta, PhD, OTR/L
Department: Health and Rehabilitation Sciences- Occupational Therapy

Objective: A common sensory difference seen in autistic adults includes filtering out redundant sensory information, referred to as sensory gating. This study examined perceptual abnormalities associated with sensory gating using the Sensory Gating Inventory (SGI) and its relationship to event-related potential (ERP) measures from the paired-click electroencephalography (EEG) paradigm in young adults with and without autism.

Methods: Twenty-four autistic young adults (18 – 30 years) and 24 age-matched neurotypical adults completed the SGI. The SGI is a self-report questionnaire of perceptual anomalies related to sensory gating. The questionnaire yields 4 factors: Perceptual Modulation, Distractibility, OverInclusion, and Fatigue-Stress Vulnerability. EEG data were recorded during the auditory paired-click paradigm wherein participants heard repeated presentations of 80 pairs of click sounds. The study's primary ERP measures included the P50 and N1 amplitude and latency and difference score (Click 2 – Click 1).

Results: Compared to controls, autistic adults had significantly higher scores on all 4 factors of the SGI, as well as the SGI total score. On the paired-click EEG paradigm, there was no significant group difference on P50 and N1 amplitudes of Click 1 or 2, and difference scores. There were no group differences on the P50 latencies of either click. However, the autism group showed significantly delayed N1 latencies of click 1 and 2 compared to controls. Across all participants, there was a positive relationship between click 2 N1 latency and SGI total score.

Conclusion: Our results indicate that autistic young adults show significant perceptual anomalies related to sensory gating. While these individuals show robust neural sensory gating at the P50 and N1 components, they show delayed processing of simple auditory sounds. Delayed auditory processing has been proposed as a biomarker for autism, and our results show that longer N1 latencies are associated with greater behavioral sensory gating differences.

Keywords: autism, sensory gating, Sensory Gating Inventory, electroencephalography (EEG), adults

Poster Abstract 15

The Effect of Repetitive Neurotrauma on Development

Brenden K. Dalton[1], Kelly J. Hiersche[1], Elana Schettini[1], Jaclyn B. Caccese[2], Zeynep M. Saygin[1]
1. Department of Psychology
2. School of Health and Rehabilitation Sciences

According to recent studies, the chance of developing Chronic Traumatic Encephalopathy doubles every 2.6 years of football play. Current research continues to show that repeated head impacts seriously threaten the brain, but how specifically do head impacts affect development? Without collecting data before the brain is impacted, it is difficult to determine if development is directly affected by football-related trauma. This study effectively creates a true baseline by collecting data before a child's inaugural season of contact football. We scanned a group of football players before and after their first season of tackle football and a group of matched controls who did not participate in contact sport on both structural and fMRI experiments. Prior analyses in this sample have shown significant differences between groups for working memory (WM) activation and white matter microstructure of related tracts (namely fractional anisotropy (FA) in the arcuate fasciculus (SLFT) and Inferior longitudinal fasciculus (ILF)). Here, we relate these neuroimaging measures to measures of head impact (assessed through instrumented mouthguards) in a preliminary evaluation of the dose-response relationship between football-related neurotrauma exposure and changes in neurodevelopment. We found a positive correlation between the increase in WM activation across the season within subject-specific brain regions (right precentral gyrus and inferior frontal sulcus) and head impact as measured by the magnitude of impact and by risk-weighted exposure (RWE; a measure that incorporates both peak linear acceleration and peak rotational velocity). Further, the change of FA in the right SLFT and ILF was positively correlated with RWE. The SLFT is one of the last white matter pathways to mature, so they may be susceptible to blunted development due to pediatric neurotrauma. Blunted development of these tracts and the nodes of the WM network may be the underlying neural substrates of cognitive deficits in this population.

Keywords: football, development, white matter, working memory

Poster Abstract 16

The Development of Language and Social Cognition in Young Children

Kelly J. Hiersche, Zeynep M. Saygin
Department of Psychology

Language, as well as the ability to understand others' thoughts, feelings, and emotions (theory of mind, ToM) are vital skills for effective communication and interaction in a social world. Are these networks distinct in early childhood, or do they develop from a common 'social communication' or even a domain-general attentional network sensitive to both verbal and nonverbal communication? In this project, we examined the development of high-level language and ToM using task-based fMRI in children ages 4-12 (N=23). Children completed two runs of an auditory language task, watched a non-linguistic short movie to localize ToM, and completed two runs of a spatial working memory task with conditions of varying attentional load. We defined subject-specific functional regions of interest (bilateral language, ToM, and attentional regions) and explored the domain-specificity of each region. We show that left hemisphere temporal and prefrontal high-level language regions are developed and distinct from social cognition, showing language selectivity, but little to no modulation by either attention or mentalizing. Bilateral temporal and parietal ToM regions are responsive to mentalizing, while the prefrontal regions do not yet show this selectivity. Temporal ToM regions (distinct from temporal language regions) also show language selectivity but are not modulated by attention. Finally, the attention network shows no selectivity to language or ToM. Overall, we find that the ToM and language networks are for the large part distinct, just like in adults, and we find no evidence that these networks emerge from domain-general cortex. However, we also show that while certain parts of superior temporal cortex are distinctly language-selective, other parts respond to social communication that is common to both language and nonverbal mentalizing. Longitudinal data will further investigate the co-development of this overlapping response and how language may facilitate development of ToM.

Keywords: Language, Theory of Mind, development, fMRI

Poster Abstract 17

The Left Inferior Frontal Gyrus and Language in Healthy Adults and Post-Stroke Aphasia

Victoria A. Diedrichs, MA, CCC-SLP; David E. Osher, PhD; Stacy M. Harnish, PhD, CCC-SLP
Department of Speech and Hearing Science
Department of Psychology

It has been suggested that the left hemisphere inferior frontal gyrus (LIFG) is functionally organized, such that the anterior portion (aLIFG) is involved in processing the meaning of language (i.e., semantics; Devlin et al., 2003) and the posterior portion (pLIFG) is involved in processing the sounds of language (i.e., phonology; Lorca-Puls et al., 2017). However, patterns of intrinsic connectivity associated with these regions have not been fully explored in relation to semantic and phonological abilities. Therefore, the present analysis will utilize data collected from six healthy neurotypical adults as part of an ongoing study to conduct resting state functional MRI (rsfMRI) connectivity analyses of a bilateral semantic network including the anterior LIFG and a bilateral phonological network including the pLIFG, using parcels by Glasser et al. (2016). We expect performance on semantic and phonological behavioral tasks to positively correlate with rsfMRI connectivity within the semantic and phonological networks, respectively. Moreover, recent evidence using virtual lesions created by transcranial magnetic stimulation suggests that damage to the aLIFG vs. pLIFG leads to differences in short-term reorganization (Hartwigsen et al., 2016). Considering the LIFG is often damaged in individuals with aphasia, a language impairment impacting approximately one third of stroke survivors (Flowers et al., 2016), patterns of rsfMRI connectivity will be explored in a small cohort of individuals with post-stroke aphasia as well. In individuals with lesions including greater damage to the pLIFG than aLIFG, rsfMRI connectivity between regions in the phonological network (particularly in the intact right hemisphere) is expected to exceed that of the neurotypical group, potentially suggestive of reorganization resulting from pLIFG damage.

Devlin, J. T., Matthews, P. M., & Rushworth, M. F. S. (2003). Semantic processing in the left inferior prefrontal cortex: A combined functional magnetic resonance imaging and transcranial magnetic stimulation study. Journal of Cognitive Neuroscience, 15(1), 71–84. https://doi.org/10.1162/089892903321107837

Flowers, H. L., Skoretz, S. A., Silver, F. L., Rochon, E., Fang, J., Flamand-Roze, C., & Martino, R. (2016). Poststroke aphasia frequency, recovery, and outcomes: A systematic review and meta-analysis. Archives of Physical Medicine and Rehabilitation, 97(12), 2188–2201. https://doi.org/10.1016/j.apmr.2016.03.006

Glasser, M. F., Coalson, T. S., Robinson, E. C., Hacker, C. D., Harwell, J., Yacoub, E., Ugurbil, K., Andersson, J., Beckmann, C. F., Jenkinson, M., Smith, S. M., & Van Essen, D. C. (2016). A multi-modal parcellation of human cerebral cortex. Nature 2016 536:7615, 536(7615), 171–178. https://doi.org/10.1038/nature18933

Hartwigsen, G., Weigel, A., Schuschan, P., Siebner, H. R., Weise, D., Classen, J., & Saur, D. (2016). Dissociating Parieto-Frontal Networks for Phonological and Semantic Word Decisions: A Condition-and-Perturb TMS Study. Cerebral Cortex, 26(6), 2590–2601. https://doi.org/10.1093/cercor/bhv092

Lorca-Puls, D. L., Gajardo-Vidal, A., Seghier, M. L., Leff, A. P., Sethi, V., Prejawa, S., Hope, T. M. H., Devlin, J. T., & Price, C. J. (2017). Using transcranial magnetic stimulation of the undamaged brain to identify lesion sites that predict language outcome after stroke. Brain, 140(6), 1729–1742. https://doi.org/10.1093/brain/awx087

Poster Abstract 18

Investigating Color Representation in Area V4

William Narhi-Martinez, Zitong Lu, Angela M. Brown, Julie D. Golomb, Delwin T. Lindsey
Department of Psychology

The highly-influential opponent process theory of Ewald Hering states that color vision operates on a system consisting of two opponent chromatic dimensions (red – green and blue – yellow). While evidence for spectral opponency has been measured in retinal cells (e.g., red-preferring cell activity becoming inhibited when viewing green), no one has found neurophysiological evidence for Hering-style color opponency in the brain. The present study investigates this in a novel way. We asked whether representations of stimulus color in area V4, a cortical region known for preferential activation to colored stimuli, varies according to Hering's theory when participants are asked to evaluate colors along different criteria in a Hering-like manner (i.e., opposing color axes). Twelve adults conducted hue scaling judgements while in the fMRI scanner. At the beginning of each block of trials, participants were instructed to judge "What proportion of each upcoming color has…", with the options: "redness", "greenness", "blueness", or "yellowness", depending on the block. Within each block, participants viewed colored spirals (red, orange, yellow, lime, green, cyan, blue, or purple, plus intermittent gray) that each appeared in isolation for 2-second durations, and indicated their judgement via button-press, ranging from 1 ("none") to 4 ("all"). Across multiple sessions, each participant viewed 16 trials for each of the 8 colors in each of the 4 tasks. Left and right area V4 were individually localized by retinotopic mapping and a functional color localizer. A Representational Similarity Analysis (RSA) compared the pattern similarity of fMRI voxel activation in V4 with different theoretical model similarity matrices based on the stimuli, task, and Hering's theory. The results suggest that V4 activity most highly reflected individual response selections to the hue scaling rather than color, task, or Hering's theory. These findings indicate, once again, a lack of evidence for the opponent process theory in the brain.

Keywords: color, perception, fMRI, V4, RSA

Poster Abstract 19

Untangling the Relationship Between Alpha Power and Sensory Behaviors in Autism

JoJo A. Martis, MA, Jewel E. Crasta, PhD, OTR/L
Occupational Therapy Division

Autism is a neurodevelopmental condition characterized by sensory hypo and or hyper-sensitivities. The majority of research examining neurophysiological basis of sensory symptoms in autism focuses on pediatric populations. However, there is growing consensus that autistic adults show significant and persistent sensory symptoms. Emerging evidence suggests that atypicalities in alpha power may be linked to underlying sensory symptoms in autism. There is a need for research examining alpha power in autistic adults and its relationship with sensory behaviors. In this study, we examined average alpha power and its relationship with sensory behaviors in young adults with and without autism.

Participants included 81 young adults, ages 18 – 30 years; 57 neurotypical and 24 autistic adults. Electroencephalography (EEG) data were recorded during 3 minutes of an eyes-open resting state session. Participants completed the self-report Adolescent/Adult Sensory Profile (AASP). Average alpha power was calculated and analyzed from 4 central scalp channels in the alpha frequency band (8-12 Hz).

Independent samples t-test showed that the autism group had significantly lower alpha power compared to the neurotypical group at POz, $t_{(77)} = 2.69$, $p = .009$, Pz, $t_{(78)} = 2.76$, $p = .007$, CPz, $t_{(79)} = 2.45$, $p = .016$, and Cz, $t_{(77)} = 2.15$, $p = .034$. Within the autism group, higher alpha power at channels Cz and CPz correlated with greater sensory quadrants Sensory Avoidant ($p = 0.03$; $p = 0.03$) and Sensory Sensitive ($p = 0.029$; $p = 0.027$). Further analysis will incorporate Bayesian models to determine the best fit model considering AASP scores and alpha power as parameters predicting autistic or neurotypical group membership.

Adults with autism showed significantly lower alpha power during resting state compared to neurotypical adults. Within the autism group, alpha power and sensory scores were positively correlated. Further research examining the clinical correlates of atypical alpha power is warranted.

Keywords: Autism, EEG, Sensory Processing, Alpha Power

CCBBI Research Day Committees

Research Day Organizers:

Adam Sharp, Office Associate

Jin Li, Graduate Research Assistant

Xiangrui Li, CCBBI Assistant Director

Deron Foltz, MRI Technologist

Ruchika Prakash, CCBBI Director

CCBBI Student Committee:

William Narhi-Martinez

Minhee Yoo

Kelly Hiersche

Yong Min Choi

Jin Li

Oral & Poster Presentation Judging Committee:

Jewel Crasta, School of Health and Rehabilitation Sciences

Blaire Dube, Department of Psychiatry

Jay Fournier, Department of Psychiatry

Julie Golomb, Department of Psychology

Jasmeet Hayes, Department of Psychology

Kristen Hoskinson, Psychiatry and Behavioral Health, Nationwide Children's Hospital

Anthony King, Department of Psychiatry

Ian Krajbich, Department of Psychology

Andy Leber, Department of Psychology

David Osher, Department of Psychology

Ruchika Prakash, Department of Psychology

Zeynep Saygin, Department of Psychology

Dylan Wagner, Department of Psychology

Lei Wang, Department of Psychiatry

Agenda at a glance

9:00 - 9:45 am	**Registration/Breakfast**
9:45 - 10:00 am	**Opening Remarks: Dr. Peter Mohler**
10:00 - 11:00 am	**Keynote Talk: Dr. Bharat Biswal**
11:00 am - 12:30 pm	**Featured Faculty Presentations**
12:30 - 1:45 pm	**Lunch**
1:45 - 3:15 pm	**Graduate Student/Research Staff Oral Presentations**
3:15 - 4:45 pm	**Poster Presentations and Refreshments**
4:45 - 5:00 pm	**Closing Remarks**

Thanks to all the organizers to make this happen.

Thank you for attending Annual Research Day!