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**W e l c o m e**

On behalf of the Undergraduate Neuroscience Program. We welcome you to this very special day, our 27th Annual Student Virtual Research Symposium. It has been the goal of the program since its inception 43 years ago, to provide our majors with the opportunity to work with faculty committed to multi-disciplinary teaching and research. Such a commitment is clearly evident in the research accomplishments of our majors showcased today. Whether you spend the entire day with us or just a portion of it, we are sure you will be impressed.

Dr. Marc Schmidt, Co-Director

Dr. Lori Flannagan-Cato, Co-Director



**Zoom Instructions for BBB Annual Symposium 2021**

There are two zoom rooms for the live presentations. Room 1 and Room 2. Room 3 is for Poster Presentations

Check the schedule to see your assigned room and presentation time.

Everyone should join the zoom room 15 minutes before the talks start to make sure everything is working.

Everyone will remain in the zoom room for their entire assigned session

Feel free to notify your PIs, lab members, family and friends with the zoom link

Here are the links for zoom rooms:

Room 1 (9 am – 2 pm)

https://upenn.zoom.us/j/96783205724?pwd=anlqL3FMTXdJbXhraXlJRndBL0k2QT09

Meeting ID: 967 8320 5724

Passcode: 917121

Room 2 (9 am – 1:45 pm)

https://upenn.zoom.us/j/96912780410?pwd=MGFONUhCVS9pNGVMMlIxL1piVWU1dz09

Meeting ID: 969 1278 0410

Passcode: 161639

Room 3 Posters (11:45-12:30)

https://upenn.zoom.us/j/92091243495?pwd=citROUViSnp0all3cDM5UENaMm5Pdz09

Meeting ID: 920 9124 3495

Passcode: 050704

Prepare your PC to be viewed publicly. Close out of any unnecessary applications. If you are sharing your

screen all participants will be able to see everything that you can.

Open up any material (Powerpoints, Videos) that you want to share. Navigate to Canvas, go to Announcements

and click on the link for the date and room (Room 1 or Room 2) that the symposium is scheduled in.

Click ‘Joinwith Computer Audio’ if using a PC connected headset or dial in on a phone using the Meeting ID

and Participant ID

**Undergraduate Neuroscience Program**

**Student research Symposium**

**Friday April 9th, 2021**

8:50 Call into zoom rooms to set up

**Zoom Room 1 Zoom Room 2**

**Session 1**

9:00 Jessica Reiner 9:00 Anthony Russo

9:15 Rachel Villari 9:15 Raena Greenbaum

9:30 Christina Recto 9:30 Mary Webb

9:45 Andrew Kim 9:45 Brendan Yoo

10:00 Dani Bergman Chudnow 10:00 Allison Dreier

10:15 BREAK

10:20 Call into zoom rooms to set up

**Session 2**

10:30 Daniel Kargilis 10:30 Julia Noreck

10:45 Christina Miranda 10:45 Claire Pince

11:00 Daria Zaitseva 11:00 Amanda Moreno

11:15 Katie MacVittie 11:15 Riley Merkel

11:30 Brian Johnson 11:30 Catherine Gotz

**Zoom Room 3**

11:45 LUNCH/Posters

**Zoom Room 1 Zoom Room 2**

12:20 Call into zoom rooms to set up

**Session 3**

12:30 Thomas Auslander 12:30 Deena Elul

12:45 Dhanya Mahesh 12:45 Sophie Kim

1:00 Rusty Fields 1:00 Janvi Shukla

1:15 Navpreet Reehal 1:15 Zoe Griffiths

1:30 David Isaacs 1:30 Max Wragan

1:45 Abigail Abramson

**Research Symposium Room Assignments for Evaluators**

**Room 1** **Room 2**

Lori Flanagan-Cato Marc Schmidt

Jennifer Heerding Judith McLean

Mike Kane Mike Kaplan

**Poster Presenters**

**BBB399 BBB499**

Kristen Barboza Reena Greenbaum Amanda Moreno

 Zoe Griffiths Navpreet Reehal

 David Isaacs Jessica Reiner

 Dhanya Mahesh

**Room 1**

9:00

**Jessica Reiner**

Title: Analysis of Reported Restfulness, Sleep-Related Impairment, Sleep Disturbance and Measured Sleep in Adolescents with Type 2 Diabetes

**Supervisor:** Dr. Lorraine Katz **Additional Support:** Dr. Talia Hitt and Dr. Jonathan Mitchell

Adolescents with Type 2 Diabetes (T2D) may have altered sleep patterns, but little is known about their perceived quality of sleep. This study examines the association between (1) measured sleep compared to reported sleep characteristics and (2) reported restfulness compared to reported sleep-related impairment (sri) and sleep disturbance (sd). Adolescents with T2D completed Patient-Reported Outcomes Measurement Information System (PROMIS) SRI 8a (n=16), PROMIS SD 8a (n=16), and Child Depression Inventory (CDI) surveys (n=7). Patient sleep was measured for 2 weeks using wrist actigraphy and sleep diaries. Participants with T2D reported higher sri and sd compared to the general population. Total sleep duration, efficiency, and disturbance measured by actigraphy did not correlate to average feeling of restfulness, PROMIS sri or sd t-scores. Reported average feeling of restfulness negatively correlated to PROMIS sri (p=.001) and sd t-scores (p=.005). Further, CDI scores negatively correlated to average feeling of restfulness (p=.014) and positively correlated to PROMIS sri t-scores (p=.004), but not sd t-scores (p=.072). Total sleep duration, sleep efficiency, and sleep disturbances may not affect the perceived quality of sleep in adolescents with T2D. Depression may play a role in reported sri, sd, and perceived restfulness.

9:15

**Rachael Villari**

Title: The Effects of Exercise and Hunger-Suppressant Drugs on Dopamine

**Supervisor:** Dr. John Nicholas Betley

Diseases like obesity have been tied to modulations of dopamine (DA) within the mesolimbic pathway. DA is an important neurotransmitter for motivation and reward, two factors that play critical roles in the development of obesity. Thus, understanding how DA functions in response to various forms of motivation and reward can enable the creation of effective pharmacological interventions for this disease. To explore DA’s response to different stimuli, we conducted a two-part study: part 1 examines how DA in the nucleus accumbens (NAc) responds to voluntary versus forced exercise; part 2 investigates how DA in the NAc responds to numerous hunger-suppressant drugs. Both segments of this experiment were analyzed using single-wave fiber photometry and MATLAB data analytics. We believe that this data will provide valuable insights into how to best target the mesolimbic pathway to treat obesity.

9:30

**Christina Recto**

Title: Associations between Age, Socioeconomic Status, and Brain Network Connectivity in Childhood

**Supervisor:** Dr. Allyson Mackey

As children age, brain network architecture becomes increasingly refined, manifested by increased within-system and decreased between-system resting-state functional connectivity. Recent literature has suggested that lower childhood socioeconomic status (SES) is associated with faster adolescent brain maturation. We examined associations between SES and brain network connectivity in children ages 9-11 (n = 699), using a common adult partitioning approach and two community detection approaches to estimate functional brain network structure in middle childhood. Across all three partitions, higher neighborhood SES was associated with greater between-system connectivity and lower within-system connectivity, results which were in a direction consistent with accelerated maturation in children from lower SES neighborhoods. No significant associations were found between individual SES and global measures of brain network connectivity, and replication analysis across different sites (n = 543) did not yield any significant associations. Ongoing work is incorporating longitudinal data to examine how associations with SES change over development.

9:45

**Andrew Kim**

Microhemorrhage Pathology in Traumatic Brain Injury (TBI): Clinical and Radiologic Features

**Supervisor:** Ramon Diaz-Arrastia

Traumatic Brain Injury (TBI) is a form of acquired brain injury caused by sudden physical trauma to the head, ranging from traffic accidents to sports injuries. In the case of severe TBI, the deficits in regional brain structures are often visible in the traditional CT and MRI scans. However, over 80% of TBI cases fall into the mild TBI category, a setting in which it is much more difficult to discern neuroimaging deficits, especially with standard clinical neuroimaging techniques. Thus, early mild TBI diagnosis and prognosis continues to pose a challenge. Prior literature have implicated traumatic microbleeds (TMBs) as predictors of dysfunction in TBI. Susceptibility Weighted Imaging (SWI), a modified form of T2 weighted gradient recalled echo MRI, has been shown to be particularly sensitive in detecting TMBs. In this study, we sought to characterize the prevalence, regional distribution, and clinical correlations of TMBs in patients hospitalized for TBI.

10:00

**Dani Bergman Chudnow**

Abstract Title: Designing a Cognitive Touch-Screen Task to Investigate the Influence of TBI on Learning and Memory Dysfunctionn

**Supervisor:** Dr. John A. Wolf

Traumatic Brain Injury (TBI) is caused by a physical injury to the head and often results in prolonged (and potentially life-long) brain dysfunction, including loss of sensory, motor, and/or cognitive function. This study analyzes available literature on functional cognitive testing using touch screens that can be scaled up or down to be used on the Wolf Lab’s swine model of TBI. The research reviewed indicates that the Conditional Associative Memory and Delayed Nonmatching to Location Tasks would be most useful for investigating the role of TBI in learning and memory dysfunction. Based on this, we developed a new touch-screen paradigm to test for cognitive impairment of pigs following TBI. The Wolf Lab is currently trying to implement the aforementioned touch screen cognitive test to evaluate TBI-induced changes in learning and memory in an animal model.

10:15-10:30 -BREAK-

10:30

**Daniel C. Kargilis**

Title: Genotype at Parkinson’s Disease Risk SNPs Associates with Lysosomal Protein Concentrations in CSF

**Supervisor**: Dr. Alice Chen-Plotkin **Co-Sponsor**: Dr. Thomas F. Tropea

Lysosomes play an important role in Parkinson’s disease (PD) pathogenesis. Genome-wide association studies have identified genetic loci associated with PD risk. However, the effect of variation at PD risk genetic loci on lysosomal protein concentrations is unknown. Here we evaluated whether genotypic variation at PD risk-associated single nucleotide polymorphisms (SNP) associated with concentrations of a panel of lysosomal proteins in cerebrospinal fluid (CSF) from 176 people with PD. Genotype was determined for 19 SNPs selected based on (1) association with PD, (2) effects on mRNA expression, and (3) experimental evidence of roles in PD progression. The concentrations of 17 lysosomal proteins were analyzed using parallel-reaction monitoring mass-spectrometry. Linear regression models showed that PD-risk genotype at SNP rs7910668 (intergenic near *ITGA8*) was associated with a lower concentration of Cathepsin-B in CSF, and PD-risk genotype at rs12657663 (*CAMLG* missense) was associated with elevated levels of Cathepsin-F, Cathepsin-L, Beta-hexosaminidase, and Tripeptidyl-peptidase-I in CSF.

10:45

**Christina Miranda**

Title: Neuron-Glia Interactions in Regulating the Autophagy-Lysosomal Pathway

**Supervisor:** Dr. Sandra Maday

Autophagy is a lysosomal degradation pathway that recycles aged and damaged cellular components to maintain homeostasis. Autophagy is integral to neuronal development, function, and viability; yet how it is regulated is largely unknown. Furthermore, how glia, key regulators of neuronal health, impact neuronal autophagy is also unknown. Thus, we developed a system to coculture neurons and astrocytes that recapitulates in-vivo intercellular connections. We found that, compared to neurons in monoculture, neurons in coculture have decreased autophagic flux. These effects are not due to a global dampening of degradative pathways because we observed an increase in lysosome-mediated proteolytic activity. Thus, astrocytes may regulate autophagy-lysosomal pathways in neurons. We also observed reciprocal effects on autophagy in astrocytes. Preliminary data shows that autophagy peaks as astrocytes transition from polygonal to star-like morphologies during development in coculture. These findings shed insights into how quality-control pathways are coordinated in the brain to maintain homeostasis.

11:00

**­­Daria Zaitseva**

Title: Behavioral CDG Phenotypes in a Novel Pan-Neuronal CDG Knockout Mouse Model

**Supervisor**: Zhaolan Zhou

Patients affected by **congenital disorders of glycosylation (CDG)** exhibit deficits in a variety of neurological processes including motor coordination. The majority of CDG patients carry biallelic mutations in the gene *PMM2,* encoding the **phosphomannomutase 2** (**PMM2**) enzyme. The molecular bases of PMM2 deficiency remain poorly understood and not treatment options are available. In the Zhou laboratory, mouse models carrying selective loss of PMM2 in neurons in the brain have recently been generated. This project continues to characterize behavioral phenotypes in two PMM2-CDG mouse models and the extent to which motor coordination deficits are recapitulated in these mice. Various mouse models of CDKL5 deficiency disorder are also characterized in the process of creating a reliable system for scoring repetitive behavior phenotypes. The overarching objective is to establish a PMM2-CDG mouse model that recapitulates human CDG phenotypes.

11:15

**Katie MacVittie**

Abstract Title: Investigating TRPC3 in Mouse Models of Chronic Itch

**Supervisor:** Dr. Wenqin Luo

This study investigated the underlying mechanisms behind the uncomfortable sensation of itch. TRPC3, a calcium activated cation channel, is expressed throughout the central and peripheral nervous system and may be implicated in the itch transduction pathway. In a mouse model of Allergic Contact Dermatitis, it was found that *TrpC3* KO mice exhibit a significant increase in scratching behavior compared to WT mice. The first aim of this study was to investigate if this phenotype is translatable to another chronic itch model named dry-skin induced pruritus. The second aim was to return to the mouse model of Allergic Contact Dermatitis and investigate MRGPRD+ nociceptors in DRG, as the percentage of TRPC3+ DRG that also express *Mrgprd* is very high. Using GFP and IHC, we were able to investigate if there are any morphological changes in these MRGPRD+ nociceptors that could cause the increase in scratching behavior seen in *TrpC3* KO mice.

11:30

**Brian Johnson**

Title: Transient mTORC1 Pathway Activation Enhances Maturation of Stem Cell-Derived Interneurons

**Supervisors:** William Manley, PhD & Stewart A. Anderson, MD

Inhibitory interneurons establish and maintain a balance of excitation and inhibition in the brain by synchronizing excitatory output through cortical circuitry. Accordingly, developmental abnormalities in interneuron populations have been associated with various neuropsychiatric disease states. To more accurately characterize, model, and design relevant treatments for these diseases, researchers have begun differentiating interneurons from human pluripotent stem cells. However, progress in this field is currently limited by the protracted timeline of cellular maturation. We found that transient activation of the mTORC1 pathway for cell growth in postmitotic interneuron precursors was sufficient to speed up their morphological maturation *in vitro*. Using a lentiviral vector, we infected postmitotic interneuron precursors with an inducible construct encoding AKT, an upstream activator of mTORC1. Infected cells exhibited markedly more robust neurite outgrowth than GFP-infected controls. To corroborate the evidence presented here, the transcriptional profiles of infected cells will be further analyzed downstream by single-cell RNA sequencing.

11:45 LUNCH/POSTERS in Room 3

12:30

**Thomas Auslander**

Title: Body Mass Index and Lumbar Bone Mineral Density, but not Cancer Treatment, are Positive Predictors of Intracranial Calcification Assessed by 18F Sodium Fluoride PET/CT

**Supervisor:** Dr. Chamith Rajapakse

18F-sodium fluoride (18F-NaF) PET/CT is a common radioimaging tool, used to measure bone metabolism and calcification. In the brain, calcification is implicated in various pathologies but also presents idiopathically. To better understand this phenomenon and its correlates, the brains of prostate cancer patients were manually segmented using ImageJ software. Though a preliminary study showed treatment-mediated attenuation of correlation between age and NaF uptake, a larger patient group did not. Patients were then divided into groups based on radiotracer dosage. In the “high” group radiation treatment predicted higher SUVmean; there was also positive correlation between SUVmean and body mass index (BMI). In the “low” group, SUVmax was positively correlated with lumbar bone mineral density (BMD). These results are difficult to synthesize, but further study surrounding calcification’s potential causes and effects in the brain is still warranted. Future research should perform more involved patient matching to ensure patients only received one treatment.

12:45

**Dhanya Mahesh**

Title: Characterizing Gray Matter and White Matter SEEG Recordings: A Signals and Network Based Approach

**Supervisor**: Dr. Kathryn Davis

Stereo-encephalography (SEEG) is an increasingly popular procedure wherein electrodes record activity from both white matter (WM) and gray matter (GM) regions. Previous SEEG studies have focused on GM recordings, often excluding WM tissue. Yet there is evidence that WM tissue reflects valuable seizure activity transmitted across the brain. This study aims to provide an analysis of WM recordings to inform current understanding of epilepsy disorders. Through a univariate signals approach, we show that seizure activity captured in WM tissue is comparable to that of GM tissue. Through a bivariate approach, we then show that during seizures, WM-WM functional connectivity is higher than that of GM-GM regions, which may reflect how seizures spread along white matter tracts. Finally, through a multivariate approach, we show how WM-GM signals relate to the structural connectivity of the brain. These initial findings offer insight into the role of WM in seizure biology.

1:00

**Rusty Fields**

Title: Can Diffusion Tensor Imaging predict HIE severity: A Connectomic Approach

**Supervisor**: Dr. Hao Huang

Human brain structural and functional development undergoes dynamic changes across the lifespan, accompanied by both microstructural and macrostructural modifications that facilitate the transition from the first few neurons to the fully functioning adult human brain. Elucidating the precise mechanisms through which this dramatic reorganization occurs is critical to understanding the formation of typical brain networks and may shed light on aberrant processes that result in neurodevelopmental disorders. The advent of advanced neuroimaging techniques has created unprecedented opportunities to investigate patterns of structural and functional connectivity within and between brain regions, facilitating further exploration into the organization and function of the human brain. Indeed, these non-invasive imaging techniques have enabled examination of brain structure and function in pediatric populations as well as in some of the earliest stages of development during the human gestational period, which has revealed precisely regulated developmental trajectories, such as the development of primary brain regions before higher-order association cortex.

1:15

**Navpreet Reehal**
Title: Differentiating Dynamic Cerebral Autoregulation Across Vascular Territories
**Supervisor:** Dr. Christopher Favilla

Cerebral autoregulation (CA) describes the brain’s intrinsic capacity to maintain stable cerebral blood flow (CBF) despite fluctuations in blood pressure. CA is impaired in the context of some types of brain injury, most notably acute stroke. This project aimed to characterize and compare CA in all six major cerebral arteries in 40 healthy individuals and subsequently in 32 acute stroke patients to test the hypothesis that CA is focally impaired in the territory of the stroke but preserved elsewhere in the brain. CA was assessed by simultaneously measuring Cerebral blood flow velocity (CBFv) and arterial blood pressure (ABP). A transfer function analysis was conducted on the waveforms from each vessel to calculate characteristics of autoregulation: phase, gain, normalized gain, and coherence. Our results suggest there may be stronger absolute CBF regulation in posterior circulation of healthy individuals, but when accounting for differences in absolute flow, regulation appears consistent throughout the brain. Importantly, CA is preserved in vascular territories unaffected by the stroke. These results not only inform our understanding of cerebral hemodynamics after stroke but have implications for future studies aimed personalizing blood pressure goals for stroke patients.

1:30

**David Isaacs**

Title: Microglial Immune Checkpoint Proteins in Comorbid Alzheimer’s and Seizures

**Supervisor:** Dr. Delia Talos

Alzheimer’s Disease (AD) is a neurodegenerative disease characterized by Aβ plaques and hyperphosphorylated tau (phosphor-tau), along with overactivated microglia that can cause neuroinflammation. Recent avenues into AD research suggest an intersection with seizures, both of which lead to an overactivated microglial phenotype. We hypothesized that seizures accelerate AD progression, partially through seizure-induced neuroinflammation. In order to investigate this relationship, we used quantitative multiplex assays and immunohistochemistry to evaluate the expression of Aβ and phospho-tau (Ser396/404 and Thr181), as well as microglial cytokines and chemokines (IL-1b, IL-1Ra, IL-18, Fractalkine/CX3CL1, RANTES/CCL5) in temporal lobe cortex tissue samples from AD patients with seizures, AD patients without seizures, and controls. We found a trend of increasing AD pathology in AD cases with seizures compared to those without, especially with amyloid load in the white matter. However, the cytokines and chemokines studied did not appear to be the main mechanism by which seizures worsen AD.

1:45

**Abigail Abramson**

Seizure Treatment of Neonates with Congenital Diaphragmatic Hernia on ECMO

**Supervisor:** Shavonne Massey, MD, MSCE

Neonates with congenital diaphragmatic hernia (CDH) have a hole in their diaphragm which leads to pulmonary hypoplasia and often requires the use of extracorporeal membrane oxygenation (ECMO) for respiratory and cardiac support. ECMO exposure increases the risk of brain injury and seizures. The aim of this study is to describe seizure management of neonates with CDH on ECMO at CHOP. We performed a retrospective review of a prospectively acquired cohort of 18 consecutive neonates with CDH on ECMO treated for seizures between 1/2011 to 12/2019. We found that 100% of these neonates were treated acutely with phenobarbital initially, with levetiracetam used as the second line treatment if needed. Despite consistent medication selections, the median time from seizure identification to medication administration was 1.95 hours and a significant proportion of neonates failed treatment. Our findings demonstrate a need for improved, novel seizure management strategies for this vulnerable population.

**Room 2**

9:00

**Anthony G. Russo**

Title: Analyzing the effects of space radiation on social stress-mediated murine conflict resolution

**Supervisor:** Dr. Amelia J. Eisch

Social dominance can be measured in rodents via the tube test. When placed into opposite sides of a clear tube, two mice will push, retreat, and resist until the “dominant” mouse forces the “subordinate” mouse to exit the tube. Manual scoring of the tube test is limited by human error, lack of accuracy and precision, and its time-consuming nature. Using a manipulation that changes mouse behavior - exposure to space radiation - we set out to develop an automatic way to measure conflict duration and aggression in the tube test. Specifically, we applied a pre-existing workflow of deep-learning tools to automatically detect treatment-based differences in individual mouse behaviors in tube-mediated social hierarchy measures. Thus far we have established reproducible scoring criteria for the tube test and successful pose estimation using deep learning. We are now implementing automated behavioral detection to elucidate radiation and sex-differences in tube behaviors.

9:15

**Raena Greenbaum**

Title: The Memory Trace of Addiction: How Drug-linked Memories Impact Emotionality and Drug-seeking in an Experimental Model of Opioid Abuse

**Supervisor:** Dr. Amelia J. Eisch

Animal models are vital in the development of novel therapies to manage opioid use disorders (OUDs), and there is currently a gap in research on the subjective experiences typified in opioid addiction in animal models. We used different frequency ranges of ultrasonic vocalizations (USVs) from the drug-taking rat to measure emotional changes during acquisition and extinction of oxycodone self-administration behavior. First, Rats (n=66) were trained to press a lever for intravenous drug infusions in a distinct context. An analysis of emotionality was conducted over the course of the acquisition phase to characterize affective states associated with the development of addiction. Then, a single extinction probe test with different levels of drug-memory linkage was used to assess whether context and new action-outcome learning impact emotionality. These analyses hold important insights for understanding the neurobiology of drug-linked memory retrieval and directions for future research surrounding diminishing opioid dependence and protecting against relapse.

9:30

**Mary Webb**

Title: Investigating the Co-use of Nicotine and Opioids

**Supervisor:**Mariella De Biasi, PhD

With the current opioid epidemic, the concurrent rise in e-cigarette popularity, and the fact that ~85% of opioid-dependent people also use nicotine, further investigation into the relationship between the drug classes is critical. Though historically neglected in literature, the medial habenula-interpeduncular nucleus (MHb-IPN) axis has received recent attention for its proposed role in addiction to almost all drug classes, including nicotine and opioids. This project aimed to further establish a paradigm for co-drug dependence that will be used for future calcium imaging studies of the MHb-IPN axis. Mice were exposed to either nicotine or vehicle vapor via e-cigarette delivery once daily. After a week of vapor pre-exposure, mice were given continuous access to morphine via the 2-bottle choice paradigm for 2 weeks while vapor exposure continued. Following this, vapor exposure was discontinued while morphine remained available for an additional 2 weeks. At the conclusion of drug treatment, physical signs of spontaneous withdrawal will be quantified.

9:45

**Brendan Yoo**

Title: Perception of Morality and Decision Making

**Supervisor:** Joseph Kable

The literature suggests that the dimensions of warmth and competence can be used to predict behavior in economic games. There is also evidence that warmth can be split into morality and sociability. Data was collected from the UPenn SONA population. Factor analysis (FA) supported a 3 factor model with mortality sociability and competence. Results from factor analysis were used to predict belief and behavior in the trust game (TG), ultimatum game (UG) and the dictator game (DG). In single linear regression, the factor associated with morality was a consistent predictor of both belief and choice, while the other two factors were not significant in any of the conditions.

10:00

**Allison Dreier**

Title: Development of a mouse model to study the effects of adolescent vaping of ∆-9-tetrahydrocannabinol (THC)

**Supervisor**: Dr. Mariella De Biasi

The present study utilized an e-cig vapor machine to deliver vaporized e-liquid containing THC dissolved in Propylene Glycol (PG) to adolescent mice. Subcutaneous body temperature was measured before and after an acute exposure to either 100 or 200 mg/ml THC vapor or to vehicle control vapor (100% PG). The same animals were tested in the open field arena for locomotor activity after the acute e-cig vapor exposure. 24-h after acute exposure, tissue punches were collected and analyzed with qPCR. A subset of mice was allowed to mature into adulthood, and spatial memory was assessed using a spontaneous T-Maze apparatus. Mice showed a biphasic response in locomotion and a dose-dependent decrease in body temperature compared to controls. THC was detectable in the serum via ELISA assay and molecular analyses detected the gene expression changes in the PFC. We also find a sex-specific deficit in adult female mice only in spatial memory.

10:15-10:30 -BREAK-

10:30

**Julia Noreck**

Consequences of Morphine Administration on Neural Activation and Sociability

**Supervisor**: Dr. Julie Blendy

Opioid use has many detrimental effects on the body, including a disruption of sleep patterns and social behavior deficits. This study worked to evaluate the molecular mechanisms, which are less well-understood, underlying the changes in sleep patterns in each stage of morphine use and withdrawal. We examined mouse brains with immunohistochemistry for the protein c-FOS to look for activation in specific regions that are related to sleep and opioid addiction. Using the same morphine exposure paradigm, a separate group of mice was tested in a three-chamber social interaction test to determine the effects of morphine use and withdrawal on sociability. Results showed significant differences in c-FOS expression in the lateral hypothalamus, paraventricular nucleus of the thalamus, and locus coeruleus. No significant effects were seen in the sociability test. Further analysis of these results can lead to future interventions in an attempt to fix sleep disturbances and reduce withdrawal symptoms.

10:45

**Claire Pince**

Title: Assessing the Effects of Prenatal Opioid Exposure on Neural Correlates of Social Behavior

**Supervisor**: Dr. Julie Blendy

In the midst of the opioid epidemic, increasing numbers of pregnant women have been using opioids, and their infants show characteristics of neonatal opioid withdrawal syndrome. We have developed a murine model of neonatal opioid withdrawal syndrome and observed a variety of long-term effects, including deficits in social behavior. We have also developed a method for quantifying neuronal activation through the visualization of the marker c-FOS. This study first attempts to evaluate the inter-rater reliability of the c-FOS quantification protocol developed in Brynildsen et al. (2020). To this end, we re-analyzed a subset of mouse brain images according to the protocol, and subsequent statistical analyses suggested that the protocol is reliable across raters. We then used this protocol to investigate brain regions associated with social behavior following 5 minutes of social interaction, as well as evaluate changes in activation in these regions for mice exposed to opioids in utero.

11:00

**Amanda Moreno**

Title: Cell Type-Specific Effects of Amylin Receptors in the Nucleus Accumbens Shell on Oxycodone Reinforcement

**Supervisor**: Dr. Heath D. Schmidt

Current pharmacotherapies used to treat opioid use disorder have modest efficacy in promoting long-term abstinence. Thus, there is a critical need for novel pharmacotherapies that reduce opioid abuse liability. Emerging studies from our lab suggest that amylin, a neuropeptide, reduces oxycodone taking and seeking in rats. Consistent with these effects, amylin administered directly into the nucleus accumbens (NAc) shell attenuates oxycodone taking and seeking. The present study sought to characterize the cell type-specific mechanisms mediating these suppressive effects of amylin on opioid-mediated behaviors. Using a novel Cre-dependent knockdown virus in transgenic rats, we showed that amylin receptors expressed on D1R-MSNs and D2R-MSNs in the NAc play differential roles in the acquisition of oxycodone taking, the motivation to consume oxycodone, and the reinstatement of oxycodone seeking. Notably, endogenous and exogenous amylin signaling were implicated in different phases of addiction. Together, these findings suggest that amylin receptors may serve as molecular targets to reduce opioid abuse liability.

11:15

**Riley Merkel**

Unraveling the Complexity of Amygdalar GLP-1 Signaling in Cocaine-Seeking Behavior

**Supervisor**: Dr. H.D. Schmidt

Preventing relapse and promoting long-term abstinence remain the greatest challenges for successfully treating cocaine use disorder. Unfortunately, there are currently no FDA-approved pharmacotherapies to reduce the rate of cocaine relapse. Previously we established that activation of central glucagon-like peptide-1 receptors (GLP-1Rs) attenuates drug-seeking behavior during abstinence. Here, we extend these results the amygdala and show that selective activation of GLP-1Rs in the central nucleus of the amygdala (CeA) dose-dependently attenuates the reinstatement of cocaine-seeking during withdrawal. We also used neural tracing and fluorescent *in situ* hybridization techniques to show that GLP-1Rs are expressed on the subset of neurons that project from the CeA to bed nucleus of the stria terminalis (BNST). These findings establish a functional role of CeA GLP-1R signaling in the reinstatement of cocaine seeking and identify a novel circuit for future investigation, while making strides in the development of an innovative pharmacotherapy to treat cocaine use disorder.

11:30

**Catherine Gotz**

Title: Ketamine for the treatment of Alcohol Use Disorder: a review and recommendation for further study

**Supervisor:** John Dani, PhD

Alcohol use disorder (AUD) is a pervasive, chronic disorder with profound individual and societal effects. The NMDA receptor antagonist ketamine is under investigation for the treatment of AUD. Ketamine has been used as an anesthetic in humans and animals for decades and was recently approved use in treatment resistant depression (TRD). Ketamine is thought to assert its effects on addicted individuals by fixing imbalance caused by hyperglutamatergic levels in the brain. Studies using animal models have shown that ketamine disrupts the intake of ethanol, and that these effects depend on mTOR levels in the brain and modulation of the bed nucleus of the stria terminalis (BNST). Clinical studies have shown that ketamine decreases cue-induced craving and increases motivation to quit in addicted individuals, and that it is able to produce abstinence for weeks after a single infusion. Further studies are needed to identify the underlying mechanisms of ketamine’s effect in addicted individuals.

11:45 LUNCH/POSTERS in Room 3

12:30

**Deena Elul**
Title: Identifying Individual Cone Fundamentals Using Rayleigh Matching
**Supervisor**: Dr. David Brainard

Human color perception is affected by individual differences in cone photopigment peak spectral sensitivity and optical density. These differences can be studied using Rayleigh matching (a technique used to characterize red-green color vision), but changes in peak sensitivity and optical density are confounded when matches are made with a single reference wavelength. This project used enhanced Rayleigh matching, where observers make matches at multiple reference wavelengths, to estimate L and M cone individual difference parameters. We first tested this method using simulated observers, which led to successful recovery of individual difference parameters and cone fundamentals in the noiseless case. While adding noise to observer judgements reduced accuracy, increasing the number of matches for each reference wavelength helped mitigate this. Our results suggest that enhanced Rayleigh matching is a potential noninvasive method for estimating L and M individual difference parameters. Currently, we are collecting pilot human data to validate our approach.

12:45

**Seung (Sophia) Kim**

Title**:** Modulatory role of α5-containing nAChR in nicotine and ethanol interactions

**Supervisor:** Mariella De Biasi, PhD

Alcohol and nicotine addiction are commonly abused drugs with preventable disease and death, yet there is still much unknown about their combined pharmacological mechanisms. There is significant evidence of the cholinergic system, particularly the *CHRNA5* gene encoding the α5 subunit of nicotinic acetylcholine receptors (nAChRs), being implicated in both types of drug addiction by altering addiction behaviors. The present study aims to investigate how decreased functioning of α5 nAChRs affects nicotine-induced changes in ethanol-related drinking by treating α5 KO and WT mice with nicotine in adolescence, then expose them to ethanol using a two-bottle choice DID binge drinking paradigm in adulthood. Statistical analyses of ethanol drinking microstructure demonstrate sex-, α5 genotype-, nicotine treatment-, and ethanol concentration-specific effects on drinking behaviors. These preliminary results offer a novel perspective in understanding the role of the α5 subunit mediating aversive effects of substances and how that reflects in drug addiction.

1:00

**Janvi Shukla**

Title: Individual differences in exendin-4 sensitivity predict obesity susceptibility

**Supervisor**: Dr. Harvey Grill

Obesity is an epidemic in the United States; however, current treatments are minimally effective. This could result from administering treatment uniformly to all patients. New research highlights the possibility of different subtypes of obesity that will require individual treatment, including one identified through variability in satiation hormone sensitivity. Here we investigated whether sensitivity to the intake inhibitory effects of one hormone, glucagon-like peptide-1 (GLP-1), predicts body weight (BW) gain on a high-fat high-sugar diet (HFHSD). GLP-1 sensitivity was measured as chow or Ensure intake suppression in response to the long-acting GLP-1 receptor (GLP-1R) agonist, exendin-4 and rats were subsequently maintained on HFHSD for 5 weeks. 399 results did not show a significant correlation between GLP-1 sensitivity and HFHSD-induced BW gain using chow. 499 results showed that Ensure intake suppression at a low exendin-4 dose significantly correlated with HFHSD-induced BW gain, identifying GLP-1 sensitivity as a predictor of diet-induced obesity.

1:15

**Zoe Griffiths**

Title: Autistic Traits and Resiliency in Autism without Intellectual Disability

**Supervisor:** Edward Brodkin

Autism Spectrum Disorder (ASD) is neurodevelopmental condition made up of multiple quantitative traits in different behavioral domains. Understanding relationships between them is important to the field. Additionally, resilience has emerged as an important construct during the COVID-19 pandemic. In a genetic family study of autistic adults we collected data on social interaction, restricted and repetitive behavior, and executive function using self- and informant-report measures. In this sample and in two independent cohorts, resiliency data was also collected. We found moderate to high correlations between behavioral domains within method (i.e. self-report, informant-report) and that severity of both anxiety and depression were predicted by severity of ASD traits. The effect of ASD traits on resiliency was moderated by both anxiety and depression in a sample-dependent manner. These results reinforce the idea that autistic traits may be understood through a constellation of measures and underlines the complex interrelatedness of autistic and other psychological characteristics.

1:30

**Max Wragan**

Title: Density of Microglia in the Hippocampus of the Developing Mouse: Does Sex Matter?

**Supervisor:** Amelia J. Eisch

Microglia, the brain’s resident macrophages, play critical roles in both the maintenance of the healthy brain and its response to disease and injury. Microglia play an important role in learning and memory, functions for which the hippocampus is critical. Additionally, microglia are different in males and females. There is conflicting literature on the developmental time course of microglia in male and female hippocampus in early stages of development, and therefore there is a need for further research on the developmental patterns of microglia in hippocampal subregions between sexes. To address this need, here we quantify microglial densities in male and female mice in the four most microglial-dense hippocampal subregions at three time points: postnatal days 3, 7, and 10. Preliminary results show no sex-based differences at postnatal day 7, but do

**Posters Room 3 (11:45-12:30)**

**Kirsten Barboza**

Title: Associations Between Brain Network Segregation, Parental SES, Neighborhood Food Access, and Percent of Neighborhood in Poverty

**Supervisor**: Dr. Allyson Mackey

Brain network segregation is a process consisting of increased within network connectivity and decreased between network connectivity. Two quite complicated factors that influence a child’s environment are parental and neighborhood SES. Generally, research shows that children with higher parental and neighborhood SES show greater system segregation than children with lower parental and neighborhood SES. While there is a considerable amount of literature separately analyzing the associations between parental and neighborhood SES with system segregation, there is not much literature comparing them. In order to determine whether parental or neighborhood SES has greater associations with brain network segregation among children ages 4-10 years, we will perform multiple linear regression analyses in R to the CBPD data collected in the Mackey Lab. Specifically, we will analyze the associations between system segregation, within network connectivity, between network connectivity, age, gender, parental education, parental income, SES composite (consisting of both parent education and income), neighborhood percent access to fresh food, and percent of the neighborhood in poverty (our proxy for neighborhood SES).

**Raena Greenbaum**

Title: The Memory Trace of Addiction: How Drug-linked Memories Impact Emotionality and Drug-seeking in an Experimental Model of Opioid Abuse

**Supervisor:** Dr. Amelia J. Eisch

Animal models are vital in the development of novel therapies to manage opioid use disorders (OUDs), and there is currently a gap in research on the subjective experiences typified in opioid addiction in animal models. We used different frequency ranges of ultrasonic vocalizations (USVs) from the drug-taking rat to measure emotional changes during acquisition and extinction of oxycodone self-administration behavior. First, Rats (n=66) were trained to press a lever for intravenous drug infusions in a distinct context. An analysis of emotionality was conducted over the course of the acquisition phase to characterize affective states associated with the development of addiction. Then, a single extinction probe test with different levels of drug-memory linkage was used to assess whether context and new action-outcome learning impact emotionality. These analyses hold important insights for understanding the neurobiology of drug-linked memory retrieval and directions for future research surrounding diminishing opioid dependence and protecting against relapse.

**Zoe Griffiths**

Title: Autistic Traits and Resiliency in Autism without Intellectual Disability

**Supervisor:** Edward Brodkin

Autism Spectrum Disorder (ASD) is neurodevelopmental condition made up of multiple quantitative traits in different behavioral domains. Understanding relationships between them is important to the field. Additionally, resilience has emerged as an important construct during the COVID-19 pandemic. In a genetic family study of autistic adults we collected data on social interaction, restricted and repetitive behavior, and executive function using self- and informant-report measures. In this sample and in two independent cohorts, resiliency data was also collected. We found moderate to high correlations between behavioral domains within method (i.e. self-report, informant-report) and that severity of both anxiety and depression were predicted by severity of ASD traits. The effect of ASD traits on resiliency was moderated by both anxiety and depression in a sample-dependent manner. These results reinforce the idea that autistic traits may be understood through a constellation of measures and underlines the complex interrelatedness of autistic and other psychological characteristics.

**David Isaacs**

Title: Microglial Immune Checkpoint Proteins in Comorbid Alzheimer’s and Seizures

**Supervisor:** Dr. Delia Talos

Alzheimer’s Disease (AD) is a neurodegenerative disease characterized by Aβ plaques and hyperphosphorylated tau (phosphor-tau), along with overactivated microglia that can cause neuroinflammation. Recent avenues into AD research suggest an intersection with seizures, both of which lead to an overactivated microglial phenotype. We hypothesized that seizures accelerate AD progression, partially through seizure-induced neuroinflammation. In order to investigate this relationship, we used quantitative multiplex assays and immunohistochemistry to evaluate the expression of Aβ and phospho-tau (Ser396/404 and Thr181), as well as microglial cytokines and chemokines (IL-1b, IL-1Ra, IL-18, Fractalkine/CX3CL1, RANTES/CCL5) in temporal lobe cortex tissue samples from AD patients with seizures, AD patients without seizures, and controls. We found a trend of increasing AD pathology in AD cases with seizures compared to those without, especially with amyloid load in the white matter. However, the cytokines and chemokines studied did not appear to be the main mechanism by which seizures worsen AD.

**Dhanya Mahesh**

Title: Characterizing Gray Matter and White Matter SEEG Recordings: A Signals and Network Based Approach

**Supervisor**: Dr. Kathryn Davis

Stereo-encephalography (SEEG) is an increasingly popular procedure wherein electrodes record activity from both white matter (WM) and gray matter (GM) regions. Previous SEEG studies have focused on GM recordings, often excluding WM tissue. Yet there is evidence that WM tissue reflects valuable seizure activity transmitted across the brain. This study aims to provide an analysis of WM recordings to inform current understanding of epilepsy disorders. Through a univariate signals approach, we show that seizure activity captured in WM tissue is comparable to that of GM tissue. Through a bivariate approach, we then show that during seizures, WM-WM functional connectivity is higher than that of GM-GM regions, which may reflect how seizures spread along white matter tracts. Finally, through a multivariate approach, we show how WM-GM signals relate to the structural connectivity of the brain. These initial findings offer insight into the role of WM in seizure biology.

**Amanda Moreno**

Title: Cell Type-Specific Effects of Amylin Receptors in the Nucleus Accumbens Shell on Oxycodone Reinforcement

**Supervisor**: Dr. Heath D. Schmidt

Current pharmacotherapies used to treat opioid use disorder have modest efficacy in promoting long-term abstinence. Thus, there is a critical need for novel pharmacotherapies that reduce opioid abuse liability. Emerging studies from our lab suggest that amylin, a neuropeptide, reduces oxycodone taking and seeking in rats. Consistent with these effects, amylin administered directly into the nucleus accumbens (NAc) shell attenuates oxycodone taking and seeking. The present study sought to characterize the cell type-specific mechanisms mediating these suppressive effects of amylin on opioid-mediated behaviors. Using a novel Cre-dependent knockdown virus in transgenic rats, we showed that amylin receptors expressed on D1R-MSNs and D2R-MSNs in the NAc play differential roles in the acquisition of oxycodone taking, the motivation to consume oxycodone, and the reinstatement of oxycodone seeking. Notably, endogenous and exogenous amylin signaling were implicated in different phases of addiction. Together, these findings suggest that amylin receptors may serve as molecular targets to reduce opioid abuse liability.

**Navpreet Reehal**
Title: Differentiating Dynamic Cerebral Autoregulation Across Vascular Territories
**Supervisor:** Dr. Christopher Favilla

Cerebral autoregulation (CA) describes the brain’s intrinsic capacity to maintain stable cerebral blood flow (CBF) despite fluctuations in blood pressure. CA is impaired in the context of some types of brain injury, most notably acute stroke. This project aimed to characterize and compare CA in all six major cerebral arteries in 40 healthy individuals and subsequently in 32 acute stroke patients to test the hypothesis that CA is focally impaired in the territory of the stroke but preserved elsewhere in the brain. CA was assessed by simultaneously measuring Cerebral blood flow velocity (CBFv) and arterial blood pressure (ABP). A transfer function analysis was conducted on the waveforms from each vessel to calculate characteristics of autoregulation: phase, gain, normalized gain, and coherence. Our results suggest there may be stronger absolute CBF regulation in posterior circulation of healthy individuals, but when accounting for differences in absolute flow, regulation appears consistent throughout the brain. Importantly, CA is preserved in vascular territories unaffected by the stroke. These results not only inform our understanding of cerebral hemodynamics after stroke but have implications for future studies aimed personalizing blood pressure goals for stroke patients.

**Jessica Reiner**

Title: Analysis of Reported Restfulness, Sleep-Related Impairment, Sleep Disturbance and Measured Sleep in Adolescents with Type 2 Diabetes

**Supervisor:** Dr. Lorraine Katz **Additional Support:** Dr. Talia Hitt and Dr. Jonathan Mitchell

Adolescents with Type 2 Diabetes (T2D) may have altered sleep patterns, but little is known about their perceived quality of sleep. This study examines the association between (1) measured sleep compared to reported sleep characteristics and (2) reported restfulness compared to reported sleep-related impairment (sri) and sleep disturbance (sd). Adolescents with T2D completed Patient-Reported Outcomes Measurement Information System (PROMIS) SRI 8a (n=16), PROMIS SD 8a (n=16), and Child Depression Inventory (CDI) surveys (n=7). Patient sleep was measured for 2 weeks using wrist actigraphy and sleep diaries. Participants with T2D reported higher sri and sd compared to the general population. Total sleep duration, efficiency, and disturbance measured by actigraphy did not correlate to average feeling of restfulness, PROMIS sri or sd t-scores. Reported average feeling of restfulness negatively correlated to PROMIS sri (p=.001) and sd t-scores (p=.005). Further, CDI scores negatively correlated to average feeling of restfulness (p=.014) and positively correlated to PROMIS sri t-scores (p=.004), but not sd t-scores (p=.072). Total sleep duration, sleep efficiency, and sleep disturbances may not affect the perceived quality of sleep in adolescents with T2D. Depression may play a role in reported sri, sd, and perceived restfulness.