Celebrating 40 years
1978-2018

Biological Basis of Behavior
24th Annual
Student Research Symposium

Thursday, April 26, 2018

Levin Building

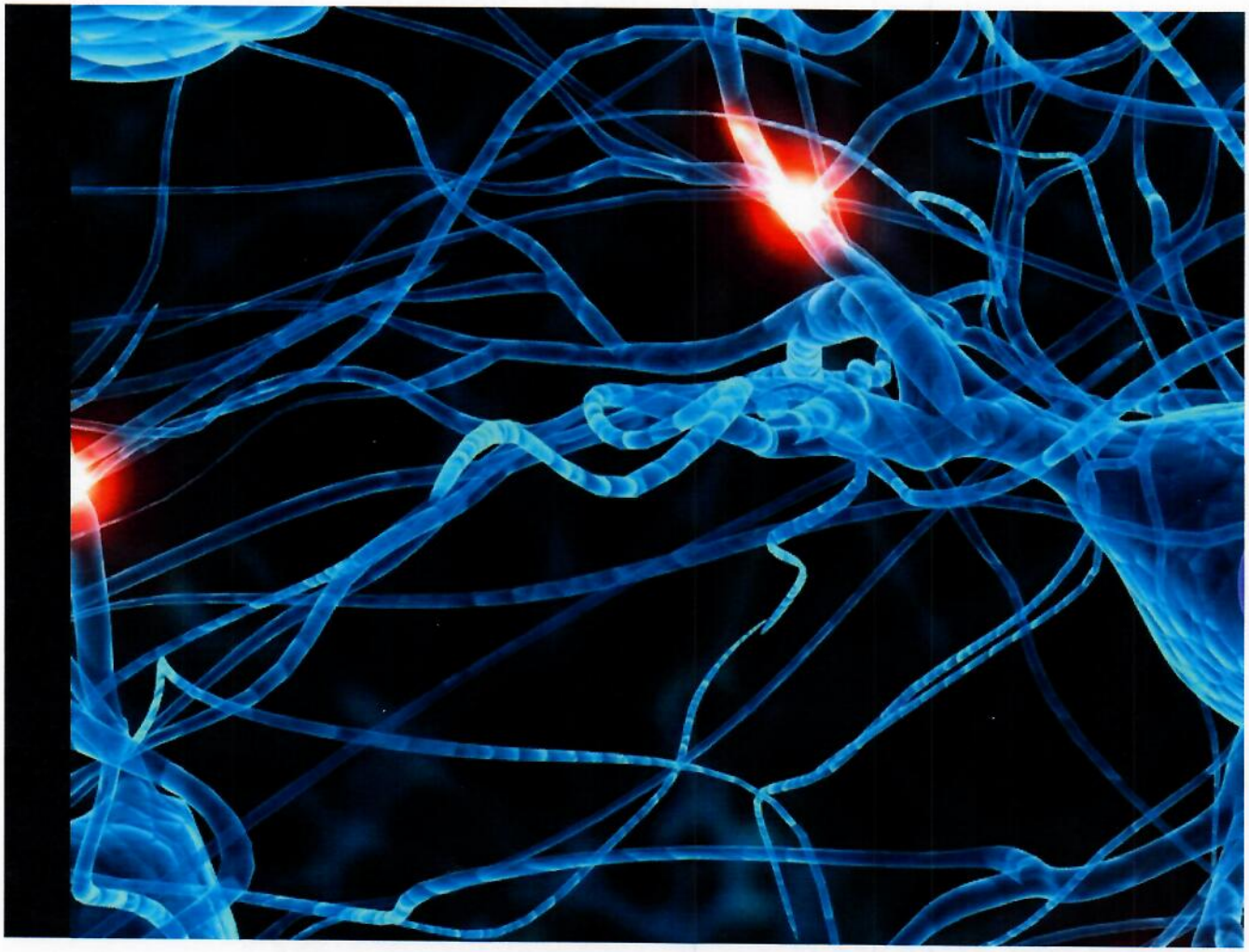
425 S. University Avenue

SCHOOL OF ARTS AND SCIENCES
UNIVERSITY OF PENNSYLVANIA

W e l c o m e

On behalf of the Biological Basis of Behavior Program. We welcome you to this very special day, our 24th Annual Student Research Symposium. It has been the goal of the program since its inception 40 years ago, to provide our BBB majors with the opportunity to work with faculty committed to multidisciplinary 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



Schedule of Activities

8:45 a.m.	Continental Breakfast
9:15 - 11:45 a.m.	Honor Thesis Presentations Levin Conference Room 250 & 450
12:00 Noon	Poster Session and Lunch Levin Sail Room
1:30 - 3:30 p.m.	Honor Thesis Presentations Levin Conference Room 250 & 450

Biological Basis of Behavior Graduation Awards Reception

Class of 2018

Saturday, May 12, 2018

11am-1pm

Levin Building

425 S. University Avenue

RSVP to mhobson@sas.upenn.edu by

Wednesday, May 3rd.

LEVIN 250

Timothy Delaney

Title: Migratory Interneurons Potential as Targeted Therapy for Glioblastoma
Supervisor: Stewart Anderson

Glioblastomas are one of the deadliest tumors. However, their treatment is limited due to their invasive and heterogeneous nature. This experiment sought to determine if the tumor margins of glioblastoma could be more precisely identified in order to create more targeted therapies. Mice were introduced human glioblastoma known to express stromal cell derived factor-1 (SDF-1), a common protein secreted by glioblastoma cells. Then, migratory interneurons differentiated to express high levels of cytokine receptor-4 (CXCR4), which has a high affinity for SDF-1, were injected into the mice. The mouse brains were then sectioned and stained to see if the tumor margins were surrounded by the injected migratory interneurons. According to staining, none of the cells appeared to be alive one-week post-transplantation. Future directions will include methods to promote longer survival of cells after transplantation to determine if cells show potential to migrate, as well as testing different mouse models of glioblastoma.

Jiasi Vicky Zhang

Title: Neurofilament light chain, Neurogranin, and their relationships with demographic/analyte/cognitive measures in patients with likely Tau or likely TDP pathology
Supervisor: Dr. Murray Grossman

Two pathological subtypes of frontotemporal lobar degeneration are FTLD-Tau and FTLD-TDP. Two new potential biomarkers, neurofilament light chain (NfL) and neurogranin (Ng), may lead to more precise diagnostic/prognostic information for FTLD with respect to these two pathological subtypes. Cerebrospinal fluid NfL and Ng levels were compared between Tau-likely, TDP-likely, and Normal control patient groups, including subgroups for autopsy confirmed/genetically determined cases. Correlation and regression analyses were performed between NfL and Ng levels of patients and various cross-sectional/longitudinal demographic, analyte, and cognitive measures. From cross-sectional data, NfL was related to episodic memory difficulty in the Tau group. In the TDP group, NfL was related to naming difficulty. From longitudinal data of the TDP group, NfL was related to executive difficulty. Ng was related to short-term memory decline from longitudinal data of the Tau group. These results suggest that NfL and Ng can be used as biomarkers for cognitive decline in FTLD.

Meera Kohli

Title: Variable Accumulation of TDP-43 between Cortical Regions of ALS Patients
Supervisor: Dr. David Irwin

Amyotrophic lateral sclerosis (ALS) is a devastating neurodegenerative disease that primarily effects motor function and leads to respiratory failure and/or malnutrition and ultimately death. TAR DNA-binding protein 43 (TDP-43) is the primary associated pathology and is seen in cytoplasmic ubiquitinated aggregates in glial cells and neurons in both ALS and FTLD patients. Quantifying and comparing the accumulation of TDP-43 protein between brain regions and layers of cortex can help us understand the relationship of protein aggregation and the progression of clinical symptoms. This study aims to quantify and compare the percentage area occupied (%AO) of TDP-43 within the Medial Frontal Cortex, Entorhinal Cortex, and Motor Cortex. The study examines brain tissue of clinically diagnosed FTLD/ALS patients using the color recognition technology of Halo Software (IndicaLabs;Albuquerque, NM). The results of this study can be compared to the typical clinical symptom progression to better understand the pathological determinants of disease.

Hannah Deutsch

Title: Whole body ^{12}C radiation: influence on neurogenesis and neural stem cells

Supervisor: Dr. Amelia J. Eisch

Carbon (^{12}C) is a high energy and charge (HZE) particle present in space radiation. Radiation leads to cognitive deficits, partly due to suppressed neurogenesis in the dentate gyrus. While ^{12}C is among the most under-investigated ions, we hypothesized that like other space radiation particle exposure, ^{12}C also targets neurogenesis. We defined the effects of whole-body ^{12}C radiation exposure to either 0 cGy (Sham) or 100 cGy (IRR) (1000 MeV/n; 8 kEV/μm). Mice were sacrificed either 24 hours (Short-Term) or 3 months (Long-Term) after irradiation. Our data show ^{12}C radiation decreases both proliferation (BrdU and Ki67-immunoreactive cells) and differentiation (DCX-immunoreactive cells) in the short-term, while in the long-term proliferation and differentiation parameters are restored, indicating that ^{12}C radiation has a transient effect on neurogenesis. ^{12}C radiation decreases cell survival (BrdU-immunoreactive cells) in the long term. Our data are pivotal for future comparisons across HZE particles and their influence on neurogenesis.

Mariya Bershad

Title: Prediction of AD pathology with an Android-based memory task

Supervisors: Drs. David A. Wolk and Dawn Mechanic-Hamilton

There is great interest in the diagnosis of Alzheimer's disease (AD) in its prodromal (i.e., mild cognitive impairment) and preclinical stages, given that disease-modifying medicines are likely to be the most effective before significant presence of neuropathology. Current challenges in standard cognitive testing procedures include in-person variability, the artificial nature of laboratory conditions, poor sensitivity to early stages (i.e. preclinical) of AD, and discrimination between AD and normal cognitive aging. This project looks at the possibility of a mobile ambulatory assessment to tackle some of these challenges. To determine the effectiveness of an Android-based game as a memory-assessment tool, we collect game-performance data (average number of levels achieved, average number of guesses completed) from cognitively normal adults and compare it to scores on standardized psychometric assessments. We will use this data to determine whether memory-game performance better tracks with evidence of AD-specific neurodegeneration than standardized psychometric measures.

Melissa Mendez

Title: Social Motivation Deficits in Autism Spectrum Disorder: Toward a Precision Medicine Approach to Treatment

Supervisor: Dr. Edward Brodkin

Autism spectrum disorder (ASD) is characterized by impaired social functioning and restricted and repetitive behaviors. We hypothesized that ASD-related difficulties with social functioning may be related to low motivation for social interaction. In a sample of adults recruited for participation in a pilot treatment study, TUNE-In (Training to Understand and Navigate Emotions and Interactions), we assessed correlations among measures of social functioning, social motivation, and other relevant behavioral domains. We found that reduced social motivation is a key phenotype, correlated with overall measures of social functioning in ASD, as well as social anxiety, social skills, and community functioning. The 29 participants who completed TUNE-In showed improvements in measures of overall social functioning. To gain a better understanding of the biological mechanisms underlying social motivation and social functioning, we are recruiting participants with ASD and their family members and testing the effects of neurexin1 gene variants on those behavioral phenotypes.

Maria Pomponio

Title: Acute treatment of Pcdh10 +/- mice with a glycine transporter inhibitor: Testing a potential treatment for social deficits in autism spectrum disorder

Supervisor: Dr. Ted Brodkin

Autism Spectrum Disorder (ASD) is a heterogeneous group of disorders that is usually diagnosed in childhood, characterized by a wide range of developmental symptoms, including impairments in social interaction, restricted or repetitive behaviors, and increased comorbidity with many mental health disorders. In this study, we looked at a mouse model relevant to ASD, protocadherin 10 gene haploinsufficient mice (Pcdh10 +/- mice), which show reduced social approach behaviors, anomalies of amygdala structure and function, and alterations in glutamate NMDA receptor subunit in amygdala. Glycine is an important co-agonist with glutamate at NMDA receptors. We tested the hypothesis that a glycine transporter inhibitor (GTI) would rescue social approach behaviors in Pcdh10 +/- mice. We found that acute treatment with the GTI PF-3463275 rescued social approach behavior in Pcdh10 +/- mice. In future studies, the lab will further dissect the neural circuits underlying this behavior and pharmacologic rescue.

Kate Oksas

Title: Towards a Precision Medicine Approach to the Treatment of Autism Spectrum Disorder

Supervisor: Dr. Ted Brodkin

Autism spectrum disorder (ASD) comprises a biologically heterogeneous set of neurodevelopmental disorders, but current treatments are not guided by a biological understanding of ASD. In an effort to begin to develop a precision medicine approach to treating ASD, we are seeking to determine whether sequence information on the ASD susceptibility gene *NEUREXIN1* (*NRXN1*) is useful in guiding treatment choices. We have developed a behavioral treatment program called TUNE In (Training to Understand and Navigate Emotions and Interactions), and found that TUNE In treatment significantly improves social functioning as measured by the Social Responsiveness Scale–2 (SRS-2) in a pilot study of adults with ASD, whose genotypes were not determined. As our next step, we are testing the effects of various types of *NRXN1* mutations on SRS-2 scores in a family-based genomics study, and we then plan to test whether TUNE In treatment effectiveness varies based on *NRXN1* genotype.

Margaret Heller

Title: Inhibition of Src-PSD-95 interaction to enhance NMDA receptor function in Schizophrenia

Supervisor: Chang-Gyu Hahn

Reduced Src kinase phosphorylation at NMDA receptors is implicated in receptor hypofunction in schizophrenia. The scaffolding protein PSD-95 inhibits Src activity and has increased association with NMDARs in schizophrenia. Inhibiting the Src and PSD-95 interaction is hypothesized to recover deficits in NMDA receptor functioning by increasing recptor phosphorylation. SAPIP mimics the inhibited Src SH2 domain and competes with Src for binding to PSD-95. Previously, SAPIP has been shown to increase Src activity in human DLPFC fractions. In this study, SAPIP was tagged with HIV-1 Tat to facilitate membrane transduction. Tat-SAPIP disrupted Src-PSD-95 interactions in primary rat cortical neurons. Intracellular application of tat-SAPIP to mouse hippocampal neurons increased NMDAR EPSCs selectively through Src. These results suggest that tat-SAPIP has the potential to alter protein-protein interactions at the NMDAR complex. By preventing the inhibitory effects of PSD-95 on Src activity, tat-SAPIP is a prospective strategy to increase NMDA receptor activity in Schizophrenia.

Olivia M. Hess

Title: Ophthalmic outcomes of children with type SS sickle cell disease following vitamin A supplementation

Supervisor: Dr. Virginia Stallings

Suboptimal vitamin A status has been linked to decreased ocular health, including functional deficits in dark adaptation and structural changes in the retina. Previous work has shown that children with type SS sickle cell disease (SCD-SS) present with reduced serum retinol levels compared to healthy children. We evaluated ocular changes in 19 children (ages 9-19) with SCD-SS following two months of daily, high-dose vitamin A supplementation (3000 and 6000IU/d). We examined changes in scotopic thresholds using Diagnosys Full-Field Stimulus Testing (D-FST) and retinal thickness changes as determined by spectral domain optical coherence tomography (SD-OCT). Subjects indicating scotopic thresholds below the 50th percentile at baseline experienced improvement post-supplementation. Vitamin A dose group did not significantly affect retinal thickness changes from baseline to post-supplementation time points, but we observed trends of thickening or thinning in subsections. Vitamin A supplementation may maintain ophthalmic health or improve retinal abnormalities in children with SCD-SS.

Madeline Moore

Title: Effects of Chronic Short Sleep on TIA1 in Stress Granules

Supervisor: Dr. Sigrid Veasey

Chronic short sleep, otherwise known as CSS, is a problem that pervades much of modern human society. Although the effects of CSS have been studied, few have been established for certain. In mice, hyperphosphorylated tau is upregulated by CSS, and TIA1 (an intracellular T-antigen) in stress granules could potentially function as a template for tau dimers to form and aggregate. Using wild-type mice, this study examines the effect of CSS on stress granules in locus coeruleus neurons using immunohistochemistry (double-label immunofluorescence and confocal imaging) to determine the stress granule response to sleep loss. The results indicate that a lower percentage of LC neurons in rested mice contain TIA1 in stress granules versus those of sleep-deprived mice. These results corroborate prior studies indicating that TIA1 is involved in stress granule formation as a consequence of short sleep.

Denice Arnold

Title: Circadian Regulation of Blood-Brain Barrier Efflux Transporter Rhythms

Supervisor: Dr. Amita Sehgal

The blood-brain barrier (BBB) is a highly selective, semi-permeable barrier that plays an indispensable role in the protection of the brain from the blood. Circadian rhythms endogenously regulate physiological processes in a roughly 24-hour cycle. Recently, we have shown that efflux transporters in the BBB exhibit circadian rhythmicity, causing time-of-day-dependent oscillations in levels of drug efflux. For this work, we used both a mouse and tissue culture model to elucidate the mechanisms behind the BBB rhythmicity. Chromatin immunoprecipitation assays, qPCR, and RNA sequencing techniques were used to address whether circadian transcription factors, particularly Bmal1, mediate the observed cycling. Our results suggest that efflux transporters do not operate under the control of circadian transcription factors within the BBB; however, there are a number of genes that do. Further insight into the mechanism by which neurotoxic substances interact with the BBB has potential therapeutic advantages, particularly in regard to optimizing drug efficacy.

Wanming Teng

Title: Rev-erb Deletion in Hypothalamus: Behavioral and Molecular Characterization
Supervisor: Mitchell A. Lazar
Mentor: Marine Adlanmerini

The master clock is located in the Supra-Chiasmatic Nucleus (SCN) of the hypothalamus, which integrates time givers and synchronizes circadian physiology. The nuclear receptors Rev-erbα/β play crucial roles in the mammalian clock system and metabolic processes. However, the functions of hypothalamic Rev-erbs are poorly understood, due to the lack of a true conditional knockout mouse model. We characterized the circadian profile of Rev-erbα in the SCN, VMH/DMH and ARC by immunofluorescent staining using HA-epitope tagged-Rev-erbα mice model. Remarkably, while HA-Rev-erbα expression in individual cells was highly synchronized within the SCN, this was less true for other hypothalamic nuclei. To delineate the functions of Reverbs in the hypothalamus, we developed two hypothalamic cre-driver lines that allow nuclei-specific deletion of Rev-erbα in the SCN and non-SCN hypothalamic nuclei. After validation of the conditional knockout by micro-punch, the roles of hypothalamic Rev-erbs in circadian behavior and metabolism are currently being evaluated.

Karbi Choudhury

Title: Glial-Guided Modification of Synapses in Human TSC Brain Lesions
Supervisor: Dr. Delia Talos

Tuberous Sclerosis Complex (TSC) is a genetic disorder characterized by epilepsy, cognitive impairment, and autistic behaviors. Previous studies in human tissue and mouse models of TSC have highlighted significant defects in synaptic structure and function. Astrocyte-derived proteins such as Thrombospondin-1 (TSP-1), Glypican 4, and SPARC-like 1 (SPARCL1) can promote synapse formation, and their expression is dysregulated in several neurological disorders. I hypothesized that altered expression of these astrocytic factors may contribute to abnormal development of excitatory synapses in TSC. The expression of TSP-1, Glypican 4 and SPARCL1, together with the post-synaptic density protein PSD-95, the pre-synaptic protein synaptophysin, and the vesicular glutamate transporter 1 (VGLUT1) were assessed by Western blotting and immunohistochemistry. All these proteins showed altered expression patterns in human TSC tissue, which suggests a potential role for altered glial function in TSC-associated neurological deficits. A better understanding of these mechanisms may assist in the development of new therapies for this disorder.

Evan Honig

Title: Effects of early-life seizures on GABA inhibitory signaling during auditory cortex development
Supervisor: Frances E. Jensen, M.D., FACP

Early-life seizures are associated with developmental disorders such as autism and intellectual disability. Previous research in our lab has shown that pentylenetetrazol (PTZ)-induced seizures at an early age prematurely unsilence glutamatergic synapses and cause disruption of thalamocortical critical period plasticity within the auditory cortex, indicative of excitatory-inhibitory imbalance. Here, we aim to examine whether neonatal PTZ-induced seizures further contribute to excitatory-inhibitory imbalance in the primary auditory cortex (A1) by disrupting GABAergic signaling during development. At birth, inhibitory GABAergic circuitry is underdeveloped and matures postnatally, regulated by both development of inhibitory parvalbumin maturation and relative expression of the chloride transporters, NKCC1 and KCC2. PTZ-treated mice demonstrated an overall reduction in parvalbumin expression in A1 in both a layer- and region-specific manner along the rostral-caudal axis, suggestive of altered GABAergic inhibitory function in A1 following neonatal seizures.

Yoon Ji Moon

Title: The roles of *sema3fa, kirrela, fat2,* and *lingo2b* mutants in protoglomerular targeting of OMP and TRPC olfactory sensory neurons in the zebrafish olfactory system

Supervisors: Jonathan Raper, PhD (PI)

Puneet Dang, PhD (research mentor)

Axon guidance in the olfactory system is a good model to study the development of complex neuronal circuitry. Two classes of olfactory sensory neurons (OSNs) that express either OMP or TRPC sort into distinct fascicles in the olfactory nerve and project to mutually exclusive protoglomeruli in the olfactory bulb. We hypothesized that the differential targeting of the two OSN classes is mediated in part by the activity of guidance and adhesion molecules. Based on previous RNA sequencing data, *sema3fa, kirrela, fat2*, and *lingo2b* were identified and selected for mutation by CRISPR for further analysis. Mutants of *sema3fa, kirrela,* and *fat2* showed significant targeting errors in the TRPC axons. On the other hand, both wild-type and mutants of *lingo2b* displayed high rates of ectopic OMP axon errors. These findings suggest that *sema3fa, kirrela,* and *fat2* play a role in the axon guidance of OMP and TRCP neurons.

Alexander Zhang

Title: An Intronic Variant in *OPRD1* Regulates Expression in Neuroblastoma Cells

Supervisors: Wade Berrettini, Richard Crist

Addiction phenotypes and treatment outcomes are greatly influenced by genetic factors. A major target of research is the δ-opioid receptor, encoded by the *OPRD1* gene. The intronic single nucleotide polymorphism rs678849 of *OPRD1* has been associated with several addiction phenotypes within African Americans, but its proximal effects on *OPRD1* are not well understood. Current research aims to discover the mechanism by which rs678849 affects the expression of *OPRD1* in two ways: (1) luciferase assays with vectors containing the rs678849 C or T-allele regions downstream of the luciferase gene, and (2) chromatin immunoprecipitation of the region surrounding rs678849. Luciferase assay analysis revealed that transfection of the major C-allele of rs678849 in neuroblastoma cells resulted in reduced luciferase activity compared to the minor T-allele or the empty vector control. These findings indicate that carriers of the major C-allele of rs678849 may have reduced expression of the δ-opioid receptor in their neuronal cells.

Chiara Bettale

Title: Investigating indomethacin efficacy in normalizing expression levels of known Cornelia de Lange Syndrome dysregulated genes in human-derived fibroblasts

Supervisor: Dr. Ian Krantz

Individuals with CdLS present with significant cognitive and behavioral issues including verbal, social, and emotional deficits as well as autism spectrum disorder. Psychotropic medications are currently used to ameliorate behavioral complications in children with CdLS, but response to treatments are very individualized and few studies have reported on the clinical management of these behaviors. Results from our clinical survey were used to quantify the overall prevalence of medication use in this patient population and evaluate the effectiveness of current psychotropic treatments. Previous studies in individuals with CdLS and *NIPBL* mutations have identified conserved patterns of significantly dysregulated genes (Liu et al., 2009), suggesting a role for *NIPBL* in regulating several key developmental and neural pathways. In this study we used CdLS fibroblast cell lines to test the efficacy of the drug indomethacin in normalizing expression patterns of 11 genes that were previously shown to be dysregulated in *NIPBL* individuals (2009).

POSTER ABSTRACTS

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Valeryia Aksianiuk

Title: Analyzing the Olfactory Breathing Signal and its Behavioral Implications

Supervisor: Dr. Minghong Ma

The relationship between breathing and emotion is one that has anecdotal and clinical relevance, yet is not understood neurally. Because the olfactory system represents not only odorants, but also the respiratory breathing signal, olfactory processing can be used to explore the link between breathing and emotion. To explore whether respiratory signals originating from the olfactory system are capable of influencing emotion, I employ a series of mouse behavioral assays that aim to access both olfactory and limbic circuitry. I first look to see if disrupting the olfactory breathing signal alters fear behavior during the retrieval stage of fear conditioning. This is done with optogenetic activation of olfactory receptor neurons (ORNs) at 10 Hz. I also use the tube test for social hierarchy to access the medial prefrontal cortex (mPFC), with the goal of identifying olfactory manipulations potentially relevant to emotion.

Gregory Boyek

Title: Biomarkers of Consciousness in Human Neurosurgical Patients

Supervisor: Dr. Timothy H. Lucas

Anesthetics are used in a wide variety of medical procedures in order to induce sedated states of consciousness and unconsciousness. However, there remains no reliable way to distinguish a conscious state from an unconscious state based upon brain activity alone. In order to further the study of the modulations caused by consciousness on brain electrophysiology, we have developed a paradigm for the measurement of evoked potentials caused by an auditory stimulus during anesthesia induction and emergence. Using intraoperative recordings of patients receiving electrode implants for the clinical monitoring of epilepsy, this study provides proof-of-concept of the recording paradigm.

Jessica Burke

Title: State-dependency of viscerosensory input to song motor system of passerine songbirds

Supervisor: Marc Schmidt

Motor performance is evaluated continuously by specialized brain circuits and used adaptively to modify behavior moment-to-moment as well as over longer time periods. During vocal behaviors, motor performance is evaluated by auditory feedback and likely also by sensory feedback from the vocal-respiratory periphery (viscerosensory). Although work has been performed on auditory feedback, little is known about how viscerosensory feedback is evaluated. In the avian song circuit, premotor nucleus HVC responds to auditory stimuli but it is not known whether it also responds to viscerosensory stimulation. My investigations involved stimulating this viscerosensory pathway to test for response in HVC. Using air puffs into the posterior air sacs, I found HVC responses only consistent when the bird was slightly sedated with diazepam and not when fully anesthetized, suggesting HVC response to viscerosensory information is likely state-dependent. My results provide evidence for state-dependency of HVC responsiveness, which has been shown in response to auditory stimulation.

Mack S. Finkel

Title: Neural Correlates of Impulsive Choice Behavior and Decision Optimization

Supervisor: Theodore D. Satterthwaite

Abstract: The tendency to make impulsive choices that overvalue immediate reward with respect to later reward is associated with many maladaptive behaviors and disorders, such as engagement in substance abuse, depression, and schizophrenia. Impulsive choice behavior is often measured using delay discounting, a behavioral task that involves making repeated decisions between a varying smaller amount of money that is immediately available and a larger amount of money that is given later. However, this task is limited in the assumption that delayed choices are always optimal, and has limited environmental applicability. Willingness to wait, a behavioral task that measures the ability to dynamically adapt impulsive choice behavior to different environments with the goal of optimizing reward, is less well studied than delay discounting yet offers a more nuanced approach by understanding that a certain degree of impulsive choice behavior as optimal when necessitated by a subject's environment. Both tasks are known to engage the reward network, although neither has been studied using arterial spin labeling perfusion MRI. This study utilizes data from a subset of the Philadelphia Neurodevelopmental Cohort to examine the relationship between delay discounting and willingness to wait, and examines their neural correlates as measured by cerebral blood flow in the reward network.

Claire Fishman

Title: Visual Attention in Delivery Room Neonatal Resuscitation

Supervisor: Elizabeth E. Foglia, MD, MA, MSCE

Neonatal resuscitation is a dynamic and unpredictable process requiring integration of information from many sources. However, the gaze and attentional behavior of neonatal practitioners during resuscitation have not been previously investigated in depth. This study aimed to characterize where neonatal providers focus their visual attention during resuscitations through the utilization of eye tracking glasses technology. Neonatal providers wore the eye tracking glasses for the duration of resuscitations in the delivery room while performing the team leader role. The visual attention parameters total fixation duration, average visit duration, and visit count per ten seconds were measured for ten areas of interest and compared between attending physicians and fellows. Gaze patterns during the administration of continuous positive airway pressure for attending physicians and fellows were also compared. The results indicate that level of training is associated with the visual attention of a neonatal provider during neonatal resuscitation in the delivery room.

Misgana Ghidewon

Title: Maternal and Early-Life High Fat Diet Increase Astrogliogenesis in Dorsal Vagal Complex (DVC) and Alter Energy Balance

Supervisor: Matthew Hayes (PI), Claudia Liberini (post-Doc)

Previous studies have shown that exposure to a high-fat diet (HFD) during early-life significantly alters metabolic phenotype and predisposes offspring to obesity. While there has been some investigation of the neurological changes in response to maternal HFD in the hypothalamus, less is known about maternal and early-life diet on the dorsal vagal complex (DVC), an area known to regulate energy balance. Using a cross-fostering paradigm, our data shows that pre- and postnatal HFD increases astrogliogenesis that may underlie the increase in body weight in the DVC. There is also indication that prenatal diet can partially attenuate the effects of postnatal diet. In addition, to explore whether current drug therapies can prevent the development of diet-induced obesity, juvenile rats maintained on HFD or chow (pre- and postnatally) were chronically injected daily with liraglutide, a glucagon-like peptide-1 (GLP-1) agonist. Our data shows that liraglutide administration effectively impedes weight gain in males but not females.

Trevor Glenn

Title: Associations between Subjective and Objective Memory and Medial Temporal Lobe Subfield Volumes in Healthy Controls and Patients with Mild Cognitive Impairment

Supervisors: David Wolk, MD, Center for Cognitive Neuroscience and Laura Wisse, PhD, Penn Image and Computing Science Lab

Aim: We examined associations of subjective memory assessments with objective memory tests and medial temporal lobe (MTL) subregion volumes in 83 cognitively normal and 27 mild cognitive impairment (MCI) subjects. Methods: In all subjects, self- and proxy-ratings on the Prospective Retrospective Memory Questionnaire were obtained to assess subjective memory. Results from an objective memory test evaluating recall ability and MTL volumes using T2-MRI scans were also acquired. Results: Both groups rated themselves as performing worse than their proxies scored them, but MCI subjects were more similar to their proxy's scores. Comparing objective with subjective assessments, MCI patients believed they did better than they actually were able to do. Additionally, proxy reports correlated better with subfield volumes than self-reports in both groups. Discussion: Cognitively normal individuals were harder on themselves than MCI subjects. Proxy assessments, since they correlate well with MTL atrophy, could provide valuable information about potential future prognoses.

Margaret Heller

Title: Inhibition of Src-PSD-95 interaction to enhance NMDA receptor function in Schizophrenia

Supervisor: Chang-Gyu Hahn

Reduced Src kinase phosphorylation at NMDA receptors is implicated in receptor hypofunction in schizophrenia. The scaffolding protein PSD-95 inhibits Src activity and has increased association with NMDARs in schizophrenia. Inhibiting the Src and PSD-95 interaction is hypothesized to recover deficits in NMDA receptor functioning by increasing receptor phosphorylation. SAPIP mimics the inhibited Src SH2 domain and competes with Src for binding to PSD-95. Previously, SAPIP has been shown to increase Src activity in human DLPFC fractions. In this study, SAPIP was tagged with HIV-1 Tat to facilitate membrane transduction. Tat-SAPIP disrupted Src-PSD-95 interactions in primary rat cortical neurons. Intracellular application of tat-SAPIP to mouse hippocampal neurons increased NMDAR EPSCs selectively through Src. These results suggest that tat-SAPIP has the potential to alter protein-protein interactions at the NMDAR complex. By preventing the inhibitory effects of PSD-95 on Src activity, tat-SAPIP is a prospective strategy to increase NMDA receptor activity in Schizophrenia.

Phillip J. Huffman

Title: Optogenetic Stimulation of Nucleus Accumbens Shell D2-containing Medium Spiny Neurons Attenuates Cocaine-Primed Reinstatement of Cocaine-Seeking Behavior

Supervisor: R. Christopher Pierce, Ph.D. and Sarah Swinford-Jackson, Ph.D.

Cocaine use disorder is characterized by cycles of abstinence and relapse. In a preclinical model of relapse, modulation of nucleus accumbens shell (NAcSh) activity by deep brain stimulation (DBS) attenuates cocaine-primed reinstatement of cocaine-seeking. The NAcSh contains medium spiny neurons (MSNs) that express either D1 or D2 dopaminergic receptors. High frequency optogenetic stimulation delivered to specific subpopulations of NAcSh MSNs may further elucidate the mechanisms through which DBS suppresses cocaine-seeking. We hypothesized that optogenetic stimulation of NAcSh D2-MSNs which expressed channelrhodopsin (ChR2) would attenuate cocaine-primed reinstatement. Rats acquired and extinguished cocaine self-administration, and cocaine-seeking was measured in cocaine-primed reinstatement sessions. Intra-NAcSh high frequency optogenetic stimulation or no stimulation was administered throughout the session in a within-subjects counterbalanced design. Our results suggest that DBS-like optogenetic stimulation of ChR2-expressing D2-MSNs may attenuate reinstatement of cocaine-seeking. Additional studies to increase the sample size and modulate other neuron populations, including D1-MSNs, are ongoing.

Olivia M. Hess

Title: Ophthalmic outcomes of children with type SS sickle cell disease following vitamin A supplementation

Supervisor: Dr. Virginia Stallings

Suboptimal vitamin A status has been linked to decreased ocular health, including functional deficits in dark adaptation and structural changes in the retina. Previous work has shown that children with type SS sickle cell disease (SCD-SS) present with reduced serum retinol levels compared to healthy children. We evaluated ocular changes in 19 children (ages 9-19) with SCD-SS following two months of daily, high-dose vitamin A supplementation (3000 and 6000IU/d). We examined changes in scotopic thresholds using Diagnosys Full-Field Stimulus Testing (D-FST) and retinal thickness changes as determined by

spectral domain optical coherence tomography (SD-OCT). Subjects indicating scotopic thresholds below the 50th percentile at baseline experienced improvement post-supplementation. Vitamin A dose group did not significantly affect retinal thickness changes from baseline to post-supplementation time points, but we observed trends of thickening or thinning in subsections. Vitamin A supplementation may maintain ophthalmic health or improve retinal abnormalities in children with SCD-SS.

Sai Kodukula

Title: Role of Netrin 1a and 1b in Olfactory Axon Guidance

Supervisor: Dr. Jonathan Raper

Olfactory sensory neurons are guided from the olfactory epithelium to their final destinations in the olfactory bulb via crucial interactions between guidance receptors and ligands. These interactions could be either attractive or repulsive. Here, I assess the roles of two such ligands netrin1a and netrin1b in olfactory guidance and the development of zebrafish embryos. netrin1a and netrin1b loss of function mutants were generated and their effects were determined for the fluorescently labeled olfactory sensory neuron subpopulations expressing OR111-7: IRES: Gal4. Analysis of double mutants of netrin1a/1b embryos showed increased misprojections to the DZ compared to single ntn 1a knockouts and ntn 1b knockouts, indicating that both the ligands work together to guide sensory axons, possibly via different receptors and that the ntn1b phenotype is diminished by a compensatory or redundant role played by ntn1a. Netrin1a/1b trans-heterozygotes are expected to provide vital clues as to whether ntn1a and ntn1b operate together on the same pathway by either showing a phenotype similar to ntn1a mutants or no misprojections at all.

Iris Kwak

Title: Longer Wake and More Frequency Microarousals in Mouse Models for Autism

Supervisor: Dr. Franz Weber and Dr. Shinjae Chung

Many neurodevelopmental disorder patients, including Autism Spectrum Disorder or Attention Deficit Hyperactivity Disorder patients, often report having sleep problems. We will be looking at the 16p11.2 del/+ and SYNGAP1 models for autism in male mice, both of which are genetic variations linked to ASD and ADHD in humans. We will be looking at sleep-wake patterns and microarousals during NREM sleep in these mice and compare them to controls. We predicted that the experimental mice would exhibit longer wake durations and more wake overall, as well as more frequent microarousals. The data was both automatically analyzed by a sleep annotation program and manually reviewed to ensure accuracy, then was run through data analysis programs in MATLAB to find that both the 16p11.2 del/+ and SYNGAP1 mice exhibit significantly longer periods of wake time as well as more frequent microarousals during NREM sleep. These can be paralleled to the sleep difficulties and disturbances often seen in human ASD and ADHD patients.

Tyler Ling

Title: Amylin and GLP-1R Analogs as a combination therapy for Obesity Treatment

Supervisor: Matthew Hayes

Obesity affects more than one-third of individuals in the world, creating an enormous health and economic burden, yet effective non-invasive treatments are limited. Liraglutide (Glucagon-like-peptide1 [GLP-1] receptor agonist) and Pramlintide (amylin analog) are currently FDA-approved therapies for obesity and diabetes. However, as monotherapies are only effective in the long-term treatment of obesity, there is a critical need to identify unique combination therapies that will yield meaningful and sustained weight loss. Here, diet-induced obese animals were maintained on a free-choice diet of chow and 60% high fat diet. Rats received daily systemic injections of vehicle, salmon calcitonin (sCT; 3 μg/kg), Liraglutide (50 μg/kg) or sCT+Liraglutide administered as a combination or in a stepwise manner for 32-days. Our results demonstrate that a combination treatment of GLP-1 and amylin analogs significantly reduced energy intake and bodyweight gain compared to monotherapies. Future studies should investigate the underlying neuroendocrine mechanisms of sCT and Liraglutide.

Kristen Miller

Title: Combining auditory and viscerosensory feedback perturbations causes rapid song destabilization without recovery in the adult male zebra finch

Supervisor: Marc Schmidt

The avian song system is an established model for studying learned vocal behavior. Juvenile songbirds crystallize their song using auditory feedback, and disruption of this feedback by deafening causes song degradation over an age-dependent time period. Feedback from vocal musculature, air sacs, and lungs, is hypothesized to play an important role in song maintenance. Song degradation caused by transection of the vagus nerve, which carries sensory information from the vocal-respiratory periphery, has been modest. If both types of feedback are necessary for song maintenance, then combining deafening with unilateral vagotomy should result in a profound and rapid degradation of song. Preliminary findings show rapid acoustic and temporal song degradation that does not recover. Most significantly, we observe syllable omissions and variability in syllable duration 1-2 weeks after nerve transection in deafened birds. Our findings suggest that perturbing both sensory feedback systems causes an accumulation of error that is greater than for each perturbation alone.

Hillary Nguyen

Title: My Transgender Brain Study (MyT "Mighty" Brain)

Supervisor: Dr. C. Neill Epperson

Although increasing numbers of transgender and gender non-binary individuals are presenting for care, clinically useful information about the impact of gender-affirming hormone therapy on brain health is lacking. The present study addresses this gap by seeking to understand how testosterone affects executive function, mood, and behavior over 3-4 months in individuals on the female-to-male (FTM) spectrum. Mental and physical health history data are collected, and individuals submit blood samples for genetic and hormonal analyses on each scan day. They also complete behavioral assessments,

computerized cognitive testing, and tasks in functional magnetic resonance imaging (fMRI) sessions to measure structural volumes, resting state activity, working memory, impulsivity, and attention. Previous findings in cisgender individuals lead us to believe that premature loss of estrogen and elevated androgen levels may be concerning in this population. Data from this study would expand the existing literature on LGBTQ+ health and provide valuable information for transmasculine patients.

Caroline O'Rourke

Title: Characterization of Neurodegenerative Tau Pathology Associated with a Novel VCP Mutation
Supervisor: Dr. Edward Lee

Neurodegenerative diseases are characterized by protein aggregation and intercellular spread. This process may cause neurodegeneration and associated symptomatology. Tauopathies are a set of neurodegenerative diseases featuring tau protein aggregation. The patterns and morphology of tau aggregation vary among the tauopathies. Frontotemporal dementia (FTD) is a neurodegenerative disease that can consist of either tau or TAR DNA-binding protein 43 (TDP-43) pathology. Mutations in valosin-containing protein (VCP) cause FTD associated with TDP-43 pathology. We have identified a novel VCP mutation associated with tau pathology and cytoplasmic vacuolization. We aim to characterize this pathology via immunohistochemistry and immunofluorescence. We will also compare tau lysates from this novel mutation or Alzheimer's disease through intracerebral injections in wildtype mice. This will enable us to understand the histopathologic differences of these tauopathies. Our studies will help us understand the pathological features between these tauopathies.

Darsol Seok

Title: Gaze impacts decision-making: a process model of loss aversion
Supervisor: Dr. Michael Louis Platt

Loss aversion is a commonly observed psychological phenomenon in which people preferentially avoid losses over equivalent gains. One's degree of loss aversiveness is typically inferred through behavioral output, but it remains unclear how loss aversion arises as a result of cognitive processes. For example, loss aversion may be a result of (1) preconceived biases in decision making, (2) greater attentional allocation to negative stimuli or (3) faster information integration of negative stimuli. By applying a common computational model of decision making called the drift diffusion model to an eye-tracking paradigm in which participants performed a gambling task, we determined the extent to which loss aversion is a result of these (3) different factors. Our findings have implications for loss aversion as a behavioral biomarker for mood disorders like depression and anxiety, which were correlated with the extent of attentional allocation to negative stimuli.

Sandy Samuel

Title: Dietary Branched Chain Amino Acids Improve Spatial Memory Deficits After Mild Traumatic Brain Injury
Supervisor: Dr. Akiva Cohen

Traumatic Brain injury (TBI) results in cognitive impairment for which there is currently no approved treatment. Mild to moderate TBI can be represented via a lateral fluid percussion injury model (LFPI) which mimics the effects of clinical TBI in brain regions including the cortex and the hippocampus. We have previously demonstrated that LFPI mice exhibited impaired spatial memory when performing a modified spatial object recognition task (SOR) that involves the hippocampus. Dietary consumption of branched chain amino acids (BCAAs) has been shown to restore TBI-induced shifts in synaptic excitability in the hippocampus. Thus, we wanted to examine if dietary BCAAs can improve LFPI mice performance in the SOR task. The second half of the project aimed to assess LFPI mice performance in a new behavioral task (pattern separation task) that is known to specifically implicate the dentate gyrus- a region that was shown to increase in excitability after injury.

Rudrajit Sinha

Title: Compulsive Exercise and Disordered Eating in College Athletes
Supervisor: Rebecka Peebles, MD

While compulsive exercise (CE) is common in patients exhibiting disordered eating, extant literature has done little to characterize its prevalence in athletes. The first study examines self-reported data from a college student population in which competitive athletes were intentionally oversampled. Secondary data analyses of this dataset found the most at-risk groups for CE markers were recreational exercisers and competitive athletes who engage in regular recreational exercise in addition to their sport. CE markers were associated with higher Eating Disorder Examination Questionnaire scores. The second study aimed to collect and analyze data on these same CE markers at different levels of athleticism in a clinical population of adolescents with eating disorders. These data will contribute to a better understanding of maladaptive exercise in patients seen at CHOP's Eating Disorder Assessment and Treatment Program.

LEVIN 450

Victoria Siu

Title: Adult and Adolescent Sex Differences in Orexin 1 and 2 Receptor Expression in Locus Coeruleus and Paraventricular Thalamic Nucleus

Supervisor: Seema Bhatnagar

Susceptibility to stress and anxiety disorders is higher among females than males. Furthermore, these sex differences are known to arise during adolescence, a period of life represented by the maturation of cognitive, reproductive and social characteristics. Previous studies have shown that orexin neuropeptides with a role in acute stress response mediate sex differences in stress response and cognitive flexibility. By examining the differences in orexin 1 and orexin 2 receptors (HCRTR1 and HCRTR2) expression in the locus coeruleus (LC) and paraventricular nucleus of the thalamus (PVT) across adult and adolescent rats, the quantity and distribution of HCRTR1 and HCRTR2 could point to a mechanism for the differing susceptibility in stress and anxiety disorders. In-situ radiolabeling and ImageJ analysis was used to analyze heavily orexin innervated and stress related regions of the LC and PVT. The adult rats used were 70 days old and adolescent rats were 30 days old.

Shreya Ganguly

Title: Sweet Flavorants in E-Cigarettes Increase Nicotine Reward in Adolescent Mice

Supervisor: Mariella de Biasi

Adolescents have predominantly consumed nicotine through e-cigarettes, including flavored e-cigarettes, in recent years. However, few studies show the potential neurochemical and behavioral risks of chemical constituents in flavored e-cigarette vapor. It is possible that flavorings uniquely affect brain activity relating to drug reward during development. Therefore, a conditioned place preference (CPP) model was used to determine whether a strawberry flavoring enhances nicotine reward in adolescent mice. It was found that strawberry flavoring does not produce a synergistic or additive effect on nicotine reward, but that flavor itself is rewarding. These results have begun to unveil the role that flavorants may play in adolescent e-cigarette reward. However, future studies will be necessary to better understand the dose-response relationship between nicotine and sweet flavorants, as well as the role of sweet flavorants on other measures of nicotine addiction (e.g. nicotine consumption).

Isaac Dayan

Title: The Task Dependence of Neural Activation in the Approximate Number System

Supervisor: Dr. Elizabeth Brannon

The approximate representation of number is an ability seen in early human development and is shared with non-human animals. This ability has been attributed to processing in the intraparietal sulcus and early visual cortex. Here we tested whether number is automatically processed when viewing a group of objects or only processed when performing a number comparison task. We used fMRI to measure the brain activity of healthy adults while they performed two tasks. Subjects viewed an array of dots in both tasks but only had to perform a number comparison in one of the tasks. The results showed that we could decode number in our regions of interest during both tasks with a significant increase in decoding during the number comparison task. This suggests that number processing occurs automatically when viewing a group of objects, but is enhanced when one attends to the numerical aspect of the objects.

Heba H. Arshad

Title: Context Alters Embedded Levels of Anger & Disgust in Moral Outrage Response

Supervisor: Dr. Joe Kable

According to sociofunctional theory, emotions shape the behavior of an organism within its environment. Moral outrage is an emotional response to moral violations that prior work has linked to the basic emotions of anger and disgust. It is not clear to what extent moral outrage may be a distinct emotion, which may have implications for behavioral outcomes. We tested how moral outrage compares to anger and disgust, per self-report and facial electromyography (muscle movements), across first vs. third person contexts and violations of the five major moral foundations (care, fairness, loyalty, authority, sanctity). Participants read scenarios designed to elicit anger, disgust, and moral outrage, then answered questions regarding their emotional responses. This study adds to previous work by conducting facial electromyography analysis as a physiological marker to supplement self-report data. The results of this study may better clarify the sociofunctional role of moral outrage in society.

Phillip J. Huffman

Title: Optogenetic Stimulation of Nucleus Accumbens Shell D2-containing Medium Spiny Neurons Attenuates Cocaine-Primed Reinstatement of Cocaine-Seeking Behavior

Supervisors: R. Christopher Pierce, Ph.D. and Sarah Swinford-Jackson, Ph.D.

Cocaine use disorder is characterized by cycles of abstinence and relapse. In a preclinical model of relapse, modulation of nucleus accumbens shell (NAcSh) activity by deep brain stimulation (DBS) attenuates cocaine-primed reinstatement of cocaine-seeking. The NAcSh contains medium spiny neurons (MSNs) that express either D1 or D2 dopaminergic receptors. High frequency optogenetic stimulation delivered to specific subpopulations of NAcSh MSNs may further elucidate the mechanisms through which DBS suppresses cocaine-seeking. We hypothesized that optogenetic stimulation of NAcSh D2-MSNs which expressed channelrhodopsin (ChR2) would attenuate cocaine-primed reinstatement. Rats acquired and extinguished cocaine self-administration, and cocaine-seeking was measured in cocaine-primed reinstatement sessions. Intra-NAcSh high frequency optogenetic stimulation or no stimulation was administered throughout the session in a within-subjects counterbalanced design. Our results suggest that DBS-like optogenetic stimulation of ChR2-expressing D2-MSNs may attenuate reinstatement of cocaine-seeking. Additional studies to increase the sample size and modulate other neuron populations, including D1-MSNs, are ongoing.

Darsol Seok

Title: Gaze impacts decision-making: a process model of loss aversion

Supervisor: Dr. Michael Louis Platt

Loss aversion is a commonly observed psychological phenomenon in which people preferentially avoid losses over equivalent gains. One's degree of loss aversiveness is typically inferred through behavioral output, but it remains unclear how loss aversion arises as a result of cognitive processes. For example, loss aversion may be a result of (1) preconceived biases in decision making, (2) greater attentional allocation to negative stimuli or (3) faster information integration of negative stimuli. By applying a common computational model of decision making called the drift diffusion model to an eye-tracking paradigm in which participants performed a gambling task, we determined the extent to which loss aversion is a result of these (3) different factors. Our findings have implications for loss aversion as a behavioral biomarker for mood disorders like depression and anxiety, which were correlated with the extent of attentional allocation to negative stimuli.

Leah Sorcher

Title: The Effects of Age and Socioeconomic Status on the Development of Creativity in Early Childhood

Supervisor: Dr. Allyson Mackey

Creativity is a complex neural process thought to rely on dynamic interactions between the default mode network and the cognitive control network. As these networks segregate over development, cognitive control increases, but perhaps at the cost of creativity. However, declines in creativity are difficult to document because standardized measures of creativity rely heavily on verbal ability. In this study, 110 children between the ages of 4 and 7 completed two measures of creativity: the creative foraging game (CFG), a recently developed automated test for creativity that does not depend on verbal ability, and the alternate uses test (AUT), a standardized creativity task. Data will be presented on links between the two creativity measures, and the effects of age and socioeconomic status on creativity. The CFG has been incorporated into ongoing studies of neurodevelopment to elucidate the neural mechanisms underlying the developmental trajectory of creativity in early childhood.

Jessica Burke

Title: State-dependency of viscerosensory input to song motor system of passerine songbirds

Supervisor: Marc Schmidt

Motor performance is evaluated continuously by specialized brain circuits and used adaptively to modify behavior moment-to-moment as well as over longer time periods. During vocal behaviors, motor performance is evaluated by auditory feedback and likely also by sensory feedback from the vocal-respiratory periphery (viscerosensory). Although work has been performed on auditory feedback, little is known about how viscerosensory feedback is evaluated. In the avian song circuit, premotor nucleus HVC responds to auditory stimuli but it is not known whether it also responds to viscerosensory stimulation. My investigations involved stimulating this viscerosensory pathway to test for response in HVC. Using air puffs into the posterior air sacs, I found HVC responses only consistent when the bird was slightly sedated with diazepam and not when fully anesthetized, suggesting HVC response to viserosensory information is likely state-dependent. My results provide evidence for state-dependency of HVC responsiveness, which has been shown in response to auditory stimulation.

Kristen Miller

Title: Combining auditory and viscerosensory feedback perturbations causes rapid song destabilization without recovery in the adult male zebra finch

Supervisor: Marc Schmidt

The avian song system is an established model for studying learned vocal behavior. Juvenile songbirds crystallize their song using auditory feedback, and disruption of this feedback by deafening causes song degradation over an age-dependent time period. Feedback from vocal musculature, air sacs, and lungs, is hypothesized to play an important role in song maintenance. Song degradation caused by transection of the vagus nerve, which carries sensory information from the vocal-respiratory periphery, has been modest. If both types of feedback are necessary for song maintenance, then combining deafening with unilateral vagotomy should result in a profound and rapid degradation of song. Preliminary findings show rapid acoustic and temporal song degradation that does not recover. Most significantly, we observe syllable omissions and variability in syllable duration 1-2 weeks after nerve transection in deafened birds. Our findings suggest that perturbing both sensory feedback systems causes an accumulation of error that is greater than for each perturbation alone.

Amber Chen

Title: Developing a mouse model to study the effects of cannabis vapor exposure in adolescent mice on reward and addiction behavior.

Supervisor: Mariella De Biasi

Cannabis is one of the most highly abused illicit drugs in the world, and is increasingly used by adolescents. Given the changing legislation on cannabinoids in many states and abroad, it is important to develop a reliable research model to examine the effects and biological basis of long-term cannabis vapor exposure in adolescents on reward and addiction behaviors. To validate our route of cannabis delivery, we evaluated both physiological and behavioral outcomes typical of cannabis exposure (i.e. plasma THC concentrations, hypothermic response, locomotor response, etc.). Ultimately, this model can be used to assess behavioral and molecular adaptations that might occur during or following adolescent exposure to cannabinoids.

Devin Murphy

Title: Can Aspects of Adolescent Executive Functioning Predict Driving Behavior?

Supervisor: Flaura K. Winston

Motor vehicle crashes are the leading cause of death for teens in the United States. Although the implications of inexperience due to age in these crashes has been studied, little has been done to understand how the unique development of the brain during adolescent years may impose risk factors that contribute to more dangerous driving behaviors and higher likelihood of crashes in this population. This study aims to investigate a comprehensive model for the role of adolescent executive function (EF) in predicting driving behaviors and outcomes. Participants' EF capabilities, assessed with a battery of cognitive assessments in the domains of EF deemed most relevant to driving, and the BREIF, will be compared with driving variables measured both by a driving simulator and a driving behavior questionnaire. This correlational model including both objective and subjective measures will have the potential to advise future directions in this critical area of safety research.

Hillary Nguyen

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Although increasing numbers of transgender and gender non-binary individuals are presenting for care, clinically useful information about the impact of gender-affirming hormone therapy on brain health is lacking. The present study addresses this gap by seeking to understand how testosterone affects executive function, mood, and behavior over 3-4 months in individuals on the female-to-male (FTM) spectrum. Mental and physical health history data are collected, and individuals submit blood samples for genetic and hormonal analyses on each scan day. They also complete behavioral assessments, computerized cognitive testing, and tasks in functional magnetic resonance imaging (fMRI) sessions to measure structural volumes, resting state activity, working memory, impulsivity, and attention. Previous findings in cisgender individuals lead us to believe that premature loss of estrogen and elevated androgen levels may be concerning in this population. Data from this study would expand the existing literature on LGBTQ+ health and provide valuable information for transmasculine patients.

Trevor Glenn

Title: Associations between Subjective and Objective Memory and Medial Temporal Lobe Subfield Volumes in Healthy Controls and Patients with Mild Cognitive Impairment

Supervisors: David Wolk, MD, Center for Cognitive Neuroscience and Laura Wisse, PhD, Penn Image and Computing Science Lab

We examined associations of subjective memory assessments with objective memory tests and medial temporal lobe (MTL) subregion volumes in 83 cognitively normal and 27 mild cognitive impairment (MCI) subjects. *Methods:* In all subjects, self- and proxy-ratings on the Prospective Retrospective Memory Questionnaire were obtained to assess subjective memory. Results from an objective memory test evaluating recall ability and MTL volumes using T2-MRI scans were also acquired. *Results:* Both groups rated themselves as performing worse than their proxies scored them, but MCI subjects were more similar to their proxy's scores. Comparing objective with subjective assessments, MCI patients believed they did better than they actually were able to do. Additionally, proxy reports correlated better with subfield volumes than self-reports in both groups. *Discussion:* Cognitively normal individuals were harder on themselves than MCI subjects. Proxy assessments, since they correlate well with MTL atrophy, could provide valuable information about potential future prognoses.

Nikitha Kosaraju

Title: Hippocampal Subfield Volumetrics as a Function of Cognitive Ability in Epilepsy

Supervisor: Dr. Kathryn Davis

Epilepsy is a disabling neurological disorder that affects 3 million Americans, but recent advances in imaging techniques have assisted in achieving seizure-free outcomes following resective surgery. The Defense Advanced Research Projects Agency (DARPA) Restoring Active Memory (RAM) project is a multi-center study investigating the potential to improve memory through electrical stimulation. From 9 clinical sites, the RAM team has gathered imaging, clinical demographics, intracranial electrophysiological recordings, and neuropsychological testing on >400 patients. We are using MRI brain volumetric analyses and neuropsychological testing results to assess the relationship between hippocampal subfield volumetrics and cognitive dysfunction. Results are pending. However, we expect that the hippocampal subfield pattern of volume loss as a function of cognitive ability will differ between mesial temporal epilepsy and neocortical epilepsy patients. These patterns may prove useful for diagnostic purposes in patients undergoing presurgical evaluation for epilepsy.

Claire Fishman

Title: Visual Attention in Delivery Room Neonatal Resuscitation

Supervisor: Elizabeth E. Foglia, MD, MA, MSCE

Neonatal resuscitation is a dynamic and unpredictable process requiring integration of information from many sources. However, the gaze and attentional behavior of neonatal practitioners during resuscitation have not been previously investigated in depth. This study aimed to characterize where neonatal providers focus their visual attention during resuscitations through the utilization of eye tracking glasses technology. Neonatal providers wore the eye tracking glasses for the duration of resuscitations in the delivery room while performing the team leader role. The visual attention parameters total fixation duration, average visit duration, and visit count per ten seconds were measured for ten areas of interest and compared between attending physicians and fellows. Gaze patterns during the administration of continuous positive airway pressure for attending physicians and fellows were also compared. The results indicate that level of training is associated with the visual attention of a neonatal provider during neonatal resuscitation in the delivery room.

Caroline O'Rourke

Title: Characterization of Neurodegenerative Tau Pathology Associated with a Novel VCP Mutation

Supervisor: Dr. Edward Lee

Neurodegenerative diseases are characterized by protein aggregation and intercellular spread. This process may cause neurodegeneration and associated symptomatology. Tauopathies are a set of neurodegenerative diseases featuring tau protein aggregation. The patterns and morphology of tau aggregation vary among the tauopathies. Frontotemporal dementia (FTD) is a neurodegenerative disease that can consist of either tau or TAR DNA-binding protein 43 (TDP-43) pathology. Mutations in valosin-containing protein (VCP) cause FTD associated with TDP-43 pathology. We have identified a novel VCP mutation associated with tau pathology and cytoplasmic vacuolization. We aim to characterize this pathology via immunohistochemistry and immunofluorescence. We will also compare tau lysates from this novel mutation or Alzheimer's disease through intracerebral injections in wildtype mice. This

will enable us to understand the histopathologic differences of these tauopathies. Our studies will help us understand the pathological features between these tauopathies.

Misgana Ghidewon

Title: Maternal and Early-Life High Fat Diet Increase Astrogliogenesis in Dorsal Vagal Complex (DVC) and Alter Energy Balance

Supervisors: Matthew Hayes (PI), Claudia Liberini (post-Doc)

Previous studies have shown that exposure to a high-fat diet (HFD) during early-life significantly alters metabolic phenotype and predisposes offspring to obesity. While there has been some investigation of the neurological changes in response to maternal HFD in the hypothalamus, less is known about maternal and early-life diet on the dorsal vagal complex (DVC), an area known to regulate energy balance. Using a cross-fostering paradigm, our data shows that pre- and postnatal HFD increases astrogliogenesis that may underlie the increase in body weight in the DVC. There is also indication that prenatal diet can partially attenuate the effects of postnatal diet. In addition, to explore whether current drug therapies can prevent the development of diet-induced obesity, juvenile rats maintained on HFD or chow (pre- and postnatally) were chronically injected daily with liraglutide, a glucagon-like peptide-1 (GLP-1) agonist. Our data shows that liraglutide administration effectively impedes weight gain in males but not females.

Jenna Harowitz

Title: The Effects of Positive Autobiographical Retrieval on Motivation in Depression and Schizophrenia

Supervisor: Dr. Daniel Wolf

Patients who suffer from major depression or schizophrenia often show deficits in the ability to feel pleasure. This phenomenon, known as anhedonia, contributes to many related symptoms of the disorders such as reduced reward sensitivity and amotivation. The potential to increase motivation by inducing one's anticipation of pleasure derived from expending effort to obtain a reward presents as a possible intervention in unmotivated psychiatric populations. Here, I investigate recalling and describing in detail positive life events as a mechanism of increasing predicted pleasure and motivation to achieve monetary reward in an effort-discounting task. Results may help inform future therapeutic development designed to reduce amotivation stemming from the inability to anticipate the positive results of effort and reward.


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