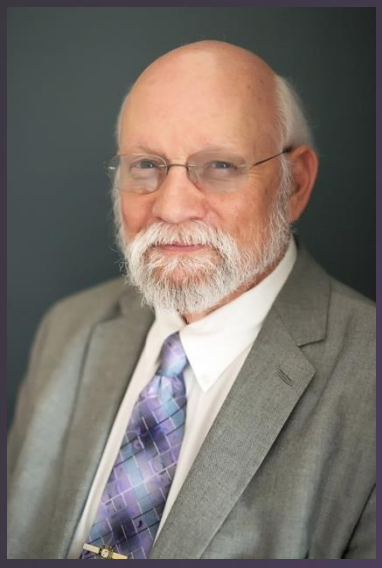
Baton Rouge Chapter of the Society for Neuroscience Presents:

2nd Neuroscience Symposium

Bringing Minds Together!



Featuring:

Nicholas E. Goeders, Ph.D.

Professor and Head
Department of Pharmacology,
Toxicology & Neuroscience
LSU Health – Shreveport

"Stress and Addiction – My 40-year journey!"

Friday, April 11, 2025

LSU School of Veterinary Medicine,

Skip Bertman Drive, Baton Rouge, Louisiana

Funding for this event was made possible by contributions from:

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LSU Department of Comparative Biomedical Sciences

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2nd Annual Neuroscience Symposium

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10:15 am – 11:15 pm | 12:30 pm – 2:00 pm

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Visitors from outside LSU Baton Rouge may park in designated spaces across the street from the LSU Vet School. Parking will be available in the area outlined in red on the map below. All LSU Baton Rouge campus employees and students can park in their usual spots using university parking passes.

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Parking Map:

2nd Neuroscience Symposium

Bringing Minds Together!

Society for Neuroscience (SfN) Baton Rouge Chapter

LSU School of Veterinary Medicine, Skip Bertman Drive, Baton Rouge, LA 70803

Program

8:30-9:00 **Registration /Breakfast** 

9:00-10:15 **Oral presentations (trainees)**

9:00-9:15	Keyla N. Pruett, Biological Sciences, LSU, Baton Rouge
9:15-9:30	Melanie Wilson, CBS, LSU Vet School, Baton Rouge
9:30-9:45	Laura Kaiser, Central Leptin Signaling, PBRC, Baton Rouge
9:45-10:00	Qianru Zhao, PhD, PBRC, LSU, Baton Rouge
10:00-10:15	Alexander Lawriw, Psychology, LSU, Baton Rouge

10:15-11:15 **Vendor Show/Poster Viewing**

11:15-11:20 **Welcome from Chapter President:** Alexander K. Murashov, MD, PhD

11:20-11:25 **Opening Remarks from Dr. Oliver Garden**, Dean and Kenneth Burns Endowed Chair, LSU School of Veterinary Medicine.

11:25-11:30 **Welcome from Dr. John Nauright,** Karen Wax Schmitt & Family Endowed Professor Director, LSU School of Kinesiology

11:30-12:30 **Keynote Address:** Nick Goeders, PhD, Professor and Head of Pharmacology, Toxicology, and Neuroscience at LSU Health Shreveport

12:30 -13:00 **Lunch/Networking** 

13:00-14:00 **Vendor Show/Poster Viewing**

14:00-15:40 **Oral Presentations (faculty)**

14:00-14:20	Ethan M. Anderson, PhD, CBS, LSU Vet School, Baton Rouge
14:20-14:40	Elizabeth M. Avegno, PhD, Physiology, LSUHSC, New Orleans
14:40-15:00	Ryoichi Teruyama, PhD, Biological Sciences, LSU, Baton Rouge
15:00-15:20	Ezgi Özcan, PhD, Nutrition and Food Sciences, LSU AgCenter, Baton Rouge
15:20-15:40	Carmen Canavier, PhD, Cell Biology and Anatomy, LSUHSC, New Orleans

15:40-15:50- **Coffee break**

15:50-16:10 **Closing Remarks and Awards:** Alexander K. Murashov, MD, PhD

16:10-16:15 **Group Photo**

16:45-8:00 **Social at the Vet School** 

Keynote Speaker:

Nicholas E Goeders, Ph.D.
Professor and Head
Department of Pharmacology, Toxicology & Neuroscience LSU Health – Shreveport

Dr. Nicholas Goeders was born and raised in Louisiana. He attended the Louisiana State University (LSU) in Baton Rouge and graduated with a BS in Psychology, with a minor in Chemistry from LSU-Shreveport in 1978. Dr. Goeders received his Ph.D. in Pharmacology from the School of Graduate Studies at the LSU Medical Center in Shreveport in 1984. He was awarded the Chancellor's Award for his dissertation research on the role for the prefrontal cortex in cocaine reward. His first scientific publication, in 1983, was in the premiere scientific publication in the world, Science, and was titled "Cortical dopaminergic involvement in cocaine reinforcement." This publication focused on his dissertation research.

Dr. Goeders left Louisiana for a postdoctoral fellowship in the Department of Neuroscience at The Johns Hopkins University School of Medicine in Baltimore in 1984 in the laboratories of Dr. Michael Kuhar. This is one of the top Neuroscience departments in the country and was under the leadership of Dr. Solomon Snyder at the time. Dr. Goeders was also a staff fellow at the Addiction Research Center at the National Institute on Drug Abuse (NIDA) of the National Institutes of Health (NIH).

Dr. Goeders returned to the LSU Health Sciences Center in Shreveport (LSUHSC-S) in the fall of 1985 as an Assistant Professor in the Department of Pharmacology & Therapeutics. Dr. Goeders has been very successful over the past 35+ years as he rose through the ranks to Professor, and he was named Head of the Department of Pharmacology, Toxicology & Neuroscience at LSU Health Shreveport (https://schoolofgradstudies.lsuhs.edu/academics/pharmacology-toxicology-and-neuroscience)

Dr. Goeders has led a very successful research program, and he is considered one of the world's leaders on the role for stress in drug addiction. While anecdotal reports have suggested that stress influences relapse to drug use for many years, Dr. Goeders' research has helped to determine the mechanisms responsible for this phenomenon. Dr. Goeders has been invited to speak on his research more than 300 times at Universities and Scientific Societies across the United States as well as in Europe, Asia and South America. He has published over 130

manuscripts in major pharmacological and neurobiological journals and has written 15 book chapters. Dr. Goeders holds 7 patents based on his research, 5,869,474; 9,078,886; 9,415,107; 9,987,286; 10,022,383; 10,561,668; and 10,702,537. He received the distinguished "Excellence in Innovation" award from the Office of Research, LSU Health Shreveport, in 2021.

Dr. Goeders was named Executive Director of the Louisiana Addiction Research Center (LARC) in 2019 (https://www.lsuhs.edu/centers/louisiana-addiction-research-center). Approved by the Louisiana Board of Regents, the mission of LARC is to provide addiction research and education in an integrated environment, pursuing the latest in innovative approaches and learning, with a goal of radically improving models of care and intervention for those with Substance Use Disorders.

Although the majority of his research has been preclinical, Dr. Goeders has also translated his basic research findings. He co-founded a venture capital-funded company in 2005 to develop a novel pharmacotherapy for the treatment substance use disorders based on the results from his research on stress and addiction. Embera NeuroTherapeutics, Inc., (https://emberaneuro.com/) was initially founded to test a novel combinational drug treatment in individuals with cocaine and methamphetamine substance use disorder and in cigarette smokers, and this pharmacotherapy may also prove to be effective in the treatment of drug and other addictions, including gambling. Embera funded a pilot clinical trial on the effectiveness of this pharmacotherapy on cocaine relapse in association with the Psychopharmacology Research Clinic through the Department of Psychiatry at LSU Health in Shreveport. Positive significant results were found, and in 2010, Dr. Goeders was awarded a $3.9 M R01 grant for his lab and Embera to conduct FDA-required toxicology tests and manufacture and formulate the compound. This was the largest individual grant of this type ever awarded to LSU Health in Shreveport at the time. In 2016, Embera was awarded an $11 M grant to take the compound into Phase II clinical trials for cocaine use disorder.

Dr. Goeders was elected to the Board of Directors for the Council on Alcoholism and Drug Abuse (CADA; https://www.cadanwla.org/) for Northwest Louisiana in 2012, served as Secretary in 2013, and he was elected President in 2015. After serving three full terms, Dr. Goeders was reelected and still serves on CADA's Board of Directors. He received the Wayne Drewry Award for Outstanding and Distinguished Contributions in the Field of Addiction from CADA in 2020.

Dr. Goeders has been the major advisor for 12 Ph.D. and 3 MS students and has served on the graduate advisory committees for over 40 students. He has also trained 10 postdoctoral fellows, 14 medical students and hosted 2 sabbaticals. He has taught autonomic pharmacology, psychopharmacology, and addiction pharmacology to medical students and graduate students for

over 35 years, and his lectures are always well received by the students. He was twice nominated for the Allan A. Copping award for excellence in teaching.

Dr. Goeders received research funding from the Pharmaceutical Manufacturers Association and the National Institute on Drug Abuse (NIDA) for his doctoral research and an individual NRSA grant from the National Institute of Mental Health (NIMH) to support his postdoctoral research. He received his first R01 grant from NIH in 1986, and his research has been continually funded by NIH ever since (https://reporter.nih.gov/search/jT65VWbmxk2uqC-S-2_9SA/projects). He was also the Director of an Institutional Training Grant for predoctoral students and postdoctoral fellows from the National Institute on Drug Abuse, and this was the only grant of its kind in the state of Louisiana at the time.

Dr. Goeders was on the Board of Directors of the College on Problems of Drug Dependence (https://cpdd.org/) and was also the Chair of their Publications Committee. Dr. Goeders is also a member of several other scientific societies, including the American Society for Pharmacology and Experimental Therapeutics, the Society for Neuroscience, and the American College of Neuropsychopharmacology. He was a charter member of the Integrative, Functional, Cognitive and Neuroscience (IFCN-1) study section at NIH and has been an ad hoc member of many other NIH study sections, center reviews, concept reviews and other panel reviews. He has also served on study sections for the Veterans Administration, the Department of Defense and various Primate Research Centers. He is also an ad hoc reviewer of manuscripts for several scientific journals. Dr. Goeders served on the LSU Health Shreveport Institutional Review Board (IRB) for human research for 12 years and spent 4 years as Chair, with an additional 2 years as Chair of two IRB committees in 2008-2009. He is a past President of the General Faculty and was the Senate Representative to the LSU Board of Supervisors. He has also served on the Promotion & Tenure Committee, the Scientific Misconduct Review Board, the Scientific Advisory Review for Technology Transfer, the Graduate Advisory Council, the Conflict of Interest Committee, the Institutional Research Advisory Committee and a vast number of other Institutional Committees at LSU Health Shreveport.

Dr. Goeders founded the 501(c)(3) nonprofit “Loving Solutions” (https://lovingsolutions.org/), a faith-based home for veterans healing from methamphetamine and other substance use disorder in 2016. Dr. Goeders continues to raise funding for Loving Solutions, which began accepting men into the home in late 2024.

ORAL PRESENTATIONS

Investigating the role of nr2f2 in the establishment of the dorsal and ventral retina territories in the four-eyed fish, Anableps anableps.

Keyla N. Pruett, Dr. Louise Perez, Gabriela Lima, Iyana Oliviel, Dr. Patricia N. Schneider

Louisiana State University; Except for Iyana Oliviel who is now at Ohio State University

The four-eyed fish, Anableps anableps, possesses a remarkable evolutionary innovation to the visual system through partially duplicated ocular structures allowing simultaneous vision from above and below the waterline. The Anableps eye comprises duplicated corneas, a single pyriform lens, and a sub-functionalized retina. Aerial light stimuli travel through the dorsal cornea and reach the ventral retina, while light stimuli from below the waterline cross the ventral cornea and reach the dorsal retina. As the eye develops, the retina is divided into two distinct dorsal and ventral regions. The establishment of dorsal-ventral retina territories is well characterized, and it seems highly conserved across vertebrates but the exact molecular mechanisms (e.g., cis-regulatory elements or CREs) underpinning the regionalization of the retina are poorly understood. Remarkably, the Anableps ventral retina is expanded compared to the zebrafish (Danio rerio). We combined bulk RNA seq and ATAC-seq to begin assessing the gene regulatory network behind the establishment of D-V retina. Our data shows nr2f2 expression restricted to the dorsal Anableps retina; furthermore, ATAC-seq on dorsal and ventral retina tissue identified nine regions of open chromatin that were differentially represented in D-V retinas, presenting these regions as an excellent candidate to test for CRE activity. We are in the process of testing these regions using zebrafish transgenesis. This work will provide unprecedented mechanistic insights into the morphological innovations of the visual system of the iconic four-eyed fish, while revealing mechanisms of gene expression and regulation potentially translatable to vertebrates in general.

Effects of Developmental Lead (Pb) Exposure on the Structural Development and Activity of Locus Coeruleus Noradrenergic Neurons: Implications for Stress-Related Disorders

M. Wilson, A. Abdelmoneim

Department of Comparative Biomedical Sciences, School of Veterinary Medicine, Louisiana State University, Baton Rouge, Louisiana

Environmental contributors to stress-related disorders represent a largely understudied area in toxicology. Among these, the environmentally ubiquitous heavy metal lead (Pb) is a known developmental neurotoxin, frequently highlighted in public health discussions across the United States. Exposure to Pb has been linked to neurological and psychological conditions, including anxiety disorders and depression. Despite this awareness, the specific effects of Pb on the brain, the mechanisms driving these conditions, and safe exposure thresholds during neurodevelopment remain unclear.

This study builds on prior research done by our lab demonstrating Pb-induced changes in behavioral stress responses in larval zebrafish. We investigated how developmental exposure to environmentally relevant Pb concentrations affects noradrenergic (NA) neurons in the locus coeruleus (LC)-a brain region producing norepinephrine, a key stress-response neurotransmitter. Zebrafish embryos from transgenic lines labeling NA neurons with fluorophores and calcium indicators were exposed to Pb (II) acetate from 6 to 120 hours post-fertilization (hpf). Pb concentrations reflecting the US EPA's drinking water action level were tested (15 ?g/L), as well as 75, 150, 375, and 750 ?g/L, with daily 50% media changes. At 120 hpf, confocal microscopy and calcium imaging assessed Pb effects on LC/NA neuronal numbers, organization, axonal projections to the dorsal telencephalon, and neuronal activity.

Exposures to 150, 375, and 750 ?g/L Pb significantly reduced the projection area within the dorsal telencephalon, with 375 ?g/L Pb or higher also decreasing total projection length and volume. At 750 ?g/L Pb, axonal projection numbers and LC/NA neuronal activity were significantly decreased. These findings align with prior behavioral and molecular data showing reduced stress responses and altered regulation of genes linked to neural development, neurodegeneration, and anxiety-like behaviors.

This research provides insights into early-life Pb exposure's effects on NA axonal projections and LC/NA neuronal activity, key components in stress regulation. Further research is necessary to elucidate the molecular and cellular changes within the stress circuitry underlying these neurobehavioral alterations.

Integration of exteroceptive temperature sensing and interoceptive leptin-sensing in preoptic area neurons POA-Lepr) modulates food intake via melanocortin pathways.

Laura Kaiser, Sean Swetledge, Nathan Lee, Allie Peever, Rob Noland, Sangho Yu, Christopher D. Morrison, Hans-Rudolf Berthoud, Heike Münzberg

Pennington Biomedical Research Center

Ambient temperature is a robust modulator of food intake (FI), yet the hypothalamic mechanisms underlying this phenomenon remain elusive. We previously showed that glutamatergic preoptic area leptin receptor (POA-Lepr) neurons are activated by warm ambient temperatures, leading to decreased energy expenditure (EE) in a temperature-dependent manner and also suppresses FI. However, the exact circuits mediating this suppression remain unclear. The melanocortin pathway, involving the antagonistic actions of Pro-opiomelanocortin (POMC) and Agouti-Related Protein (AgRP) at melanocortin-4 receptor (MC4R) expressing neurons, is central to maintaining body weight homeostasis. Recent studies suggest thermoregulatory POA circuits interact with the melanocortin pathway to influence FI, but these studies primarily examined cold-activated circuits.

Here, we first verified the physiological adaptations of FI and BW following exposure to warm (30°C) or cold (10°C) ambient temperatures. Both acute and chronic exposure to warm temperatures suppressed FI, and chronic exposure (4 weeks) highlighted that warm temperature is obesogenic. We combined synthetic and physiological POA-Lepr activation via chemogenetics and ambient temperature changes to demonstrate that chemogenetic activation robustly suppressed FI at 10°C (when POA-Lepr neurons are physiologically inactive) but not at 30°C (when POA-Lepr neurons are physiologically already activated). These demonstrate that glutamatergic POA-Lepr neurons mediate warm-suppressed feeding and block cold-induced FI. Anterograde tracing revealed POA-Lepr innervation of key regions in the melanocortin pathway, and MC4R activation with melanotan-II recapitulated temperature-dependent FI suppression. Also, chemogenetic POA-Lepr stimulation at 10°C increased POMC activation in the rostral arcuate nucleus but cold-activated feeding neurons (e.g. AgRP neurons) were not directly affected. Instead, activation of POA-Lepr fibers in the dorsomedial hypothalamus (DMH) strongly suppressed FI suggesting that POA-Lepr neurons may directly suppress FI via POMC neurons, while cold-induced feeding is blocked by downstream circuits in the DMH. These hypothalamic circuits potentially represent novel targets for the modulation of appetite.

Mechanisms of Excitatory Neurons in Piriform Cortex Responding to Odor and Regulating Feeding

Qianru Zhao

Yanlin He

Background: Sensation of food such as smell and taste could affect appetite and regulate feeding behavior. It has been reported that population with high body mass index (BMI) showed higher odor sensitivity for high-energy-dense food compared with low BMI group. Olfactory system including piriform cortex could sense and transduce metabolic signals. The neuronal circuits and mechanisms how piriform cortex responds to food odor and regulates feeding behavior are not clear. In this study, we aim to explore the function of excitatory neurons in piriform cortex and build a link between odor sensory and feeding behavior.

Methods: Ca2+ signals in anterior piriform cortex (APC) were recorded to study the neuronal excitabilities during odor detection. Adeno-associated virus were stereotaxically injected to trace the nucleus innervated by excitatory neurons in APC. Optogenetics and chemogenetics were applied to selectively activated the neural circuits related to APC and observe the changes of feeding behaviors of mice.

Results: We discovered that odor stimuli before food intake could significantly increase the amounts of high fat diet taken by mice. Virus vectors expressing fluorescence tracer illustrate that excitatory neurons in APC could project to the brain areas related to feeding such as paraventricular nucleus of the thalamus (PVT) and substantia nigra pars reticulata (SNr). Activation of neuron fibre from APC to PVT could significantly increase high fat diet intake of mice. Retrograde adeno-associated virus injected in PVT expressing Designer Receptors Exclusively Activated by Designer Drugs (DREADD) in APC could also significantly increase the food intake when mice were injected with Deschloroclozapine (DCZ).

Conclusions: In summary, excitatory neurons in APC could innervate PVT and activation of this circuit could increase the food intake of mice. This novel discovery would further contribute to the development of anti-obesity drug by targeting the neurons in piriform cortex.

Key words: excitatory neurons, piriform cortex, paraventricular nucleus of the thalamus, feeding

Timing is Everything: Temporal Community Structure Shapes is Sufficient for Categorical Inference

Alexander Lawriw, Dr. Christopher Cox

Louisiana State University

Sequences are parsed into events by tracking transitional probabilities. How well such structure has been learned correlates with activity in the hippocampus. Recent work has raised the possibility that the hippocampus has some capacity to learn categorical representations and may even support categorical inference. We critically evaluated this interpretation in two experiments where participants were exposed to sequences of stimuli that were, unbeknownst to the participant, generated by random walks on a 15-node graph with three 5-node "communities" and one path between each community. Learning this structure is understood to involve the hippocampus. In experiment 1, following sequence exposure, participants responded to a series of 2AFC trials consisting of a reference stimulus paired with an attribute that was either distinctive of its community or generic (shared by all stimuli). During these trials, participants were asked to choose which of two alternative stimuli was most likely to share that attribute with the reference stimulus. Behavior was similar regardless of whether the attribute was distinctive or generic. In experiment 2, participants were explicitly taught to associate a community-distinctive attribute with a single member from each community before being exposed to the structured sequence. Following sequence exposure, participants selected which of two alternatives were more likely to have a particular community-distinctive attribute on each 2AFC trial. Analysis of 58 participants in experiment 2 indicates a significant category inference bias, $t(57) = 2.064$, $p = .04$, $d = .3$, suggesting that hippocampus-mediated representation of temporal community structure is sufficient for categorical inference.

Cell-Type Specific Epigenetic Signaling Reduces Stress-Potentiated Alcohol Drinking in Mice.

Ethan Michael Anderson, Ph.D.

Louisiana State University, Department of Comparative Biomedical Sciences, Baton Rouge, LA, 70803

A common mechanism that regulates both stress-sensitivity and alcohol use is epigenetic regulation of gene transcription. One epigenetic modifier that is implicated in models of alcohol use disorder (AUD) and addiction is G9a, a histone methyltransferase. Alcohol reduces G9a protein levels in the nucleus accumbens (NAc) and mimicking this reduction with an AAV-mediated shRNA knockdown blocks stress-potentiated alcohol drinking in mice; however, the mechanism is not fully understood. Here we show that G9a acts selectively through NAc dynorphin (NAcDyn+) neurons - but not NAc enkephalin-containing (NAcEnk+) neurons - to alter stress-potentiated drinking by injecting a novel cre-dependent AAV virus (AAV-DIO-shG9a) into the NAc of both dyn-cre and enk-cre mice. Next, a transcriptomic analysis revealed that NAc G9a alters genes associated with excitability including a potassium channel subunit called KCNk1, so we then used ex vivo slice physiology and found that our G9a knockdown increases NAc intrinsic excitability. We next selectively targeted NAc KCNk1 in Dyn-positive neurons and found that this also blocked stress-potentiated alcohol drinking and recapitulated G9a's effects on intrinsic excitability. Combined, these results suggest that the epigenetic effects of NAc G9a on stress-potentiated drinking are mediated by altering the excitability of NAcDyn+ neurons, and reveal a potential novel therapeutic target for AUD: KCNk1.

Mesoamygdala circuit activity and VTA orexin receptor expression are associated with anxiety-like behavior in rats

E M Avegno, L Johnson, S Klinefelter, S C Cruise, N W Gilpin

LSUHSC-NO Department of Physiology

Humans with alcohol use disorder often experience negative affect during withdrawal (WD), and depressed mood and anxiety are positively correlated with relapse during abstinence. The neural adaptations that occur during the transition to dependence are not entirely understood, but may include interactions between mesolimbic reward circuits and brain stress circuits. Previously, we showed alcohol WD-induced activation of ventral tegmental area (VTA) neurons that project to the central amygdala (CeA), raising the possibility that these cells play a role in the development of WD-associated behavior. The mechanism by which these cells become activated is unknown, but may involve orexin-mediated disinhibition. Here, we explored (1) the role of VTA-CeA circuitry in anxiety-like behavior during alcohol WD and (2) the role of intra-VTA orexin signaling in influencing anxiety-like behavior, as well as VTA Hcrtr1 (orexin 1 receptor) expression following chronic alcohol exposure, in male and female Wistar rats. Using a dual virus approach to transfect CeA-projecting VTA neurons with excitatory or inhibitory DREADDs, we demonstrate that VTA-CeA circuit activation produces increased anxiety-like behavior in otherwise experimentally naïve rats, and VTA-CeA inhibition rescues increased anxiety-like behavior during WD from chronic alcohol, indicating a role for the VTA-CeA circuit in increased anxiety-like behavior that manifests during alcohol WD. Additionally, in situ hybridization data show increased Hcrtr1 expression in the VTA of female Wistar rats following alcohol exposure, which is significantly correlated with anxiety-like behavior during WD (i.e., higher Hcrtr1 expression associated with reduced time spent in the open arm of an elevated plus maze in alcohol-exposed rats). We further demonstrate that intra-VTA orexin A (50 nM) administration is sufficient to produce an anxiety-like phenotype in otherwise experimentally naïve rats. Collectively, the results of these experiments contribute to our understanding regarding the potential role that orexin signaling and VTA-CeA circuitry may play in alcohol WD-induced behavior. Ongoing work is focused on combining these lines of research, by investigating orexin-mediated modulation of VTA-CeA neurons specifically during WD.

Sexually Dimorphic Expression of Oxytocin Receptor in the Central Nervous System

Ryoichi Teruyama, Armita Abdollahi Govar, Bandana Ghimire

Dept. of Biological Sciences, LSU

The neurohypophysial hormone, oxytocin, is known for its critical role in female reproductive physiology, such as uterine contraction during labor and milk ejection while nursing. Oxytocin is also released in the brain and modulates many aspects of social behaviors, including social recognition, maternal behavior, and pair bonding. Oxytocin influences social behaviors by binding to the oxytocin receptor (OXTR) located in various parts of the central nervous system (CNS). In recent years, the oxytocin system in the brain has received tremendous attention as a potential pharmacological target for the treatment of many psychiatric disorders, such as anxiety, autism spectrum disorders, and postpartum depression. Clinical trials for intranasal application of oxytocin are currently underway to investigate its effects on these psychiatric disorders. An important problem and a critical barrier to progress in the field is that despite the importance, the cellular characterization of many cell types that express OXTR in the CNS are still largely unknown. This is especially true in females where OXTR expression may change significantly in various brain areas during reproductive states. Using OXTR reporter (OXTR-Venus) mice, we recently discovered a few groups of neurons that are expressing OXTR exclusively in females, but not in males. These sexually dimorphic expressions of OXTR were found in the preoptic area, hypothalamus, and retina. We use an integrative, multidisciplinary approach combining, immunohistochemistry, molecular biology, neural tracing, electrophysiology, behavior analysis, and chemogenetics to study these neurons. Our study suggests the presence of the sex-specific oxytocin neural circuitry system that regulates sex-specific behaviors. The findings from our project will provide useful insight into sex-specific pharmacological interventions that may likely treat sex specific disorders, such as postpartum depression and preterm birth. I will discuss the cellular characterizations, connectivity, regulatory mechanisms, and functional significances of the sexually dimorphic OXTR expressing cells in the CNS.

Microbiota-Targeted Therapeutics in Neurological Diseases

Ezgi Özcan

School of Nutrition and Food Sciences, LSU AgCenter

Interactions between diet and the gut microbiome play a critical role in host physiology, including neurological and psychiatric diseases. Understanding these interactions enables the development of microbiota-targeted therapeutics to modulate brain function and behavior. Several strategies have emerged for leveraging the gut microbiome in neurological disease treatment: (i) dietary interventions, such as specialized fibers, to alter microbiome composition and metabolic output to impact the behavior; (ii) administration of microbiota-derived metabolites, such as short-chain fatty acids, to influence neural pathways; and (iii) probiotic or engineered microbial therapies that exert targeted effects on behavior. These approaches highlight the therapeutic potential of microbiome-based interventions in managing neurological disorders and improving mental health outcomes.

Mechanistic Insights provided by computational modeling of midbrain dopamine neurons

Carmen Canavier

Department of Cell Biology and Anatomy, LSU Health Sciences Center New Orleans

We summarize the basic insights that mathematical and computational modeling has provided so far into how the intrinsic properties of midbrain dopamine neurons might contribute to their electrical activity in vivo, particularly with respect to the integration of their synaptic inputs. We emphasize modeling subpopulations with different responses to noise, depolarization and hyperpolarization. Topics include conductance based single compartment models with Hodgkin-Huxley type equivalent circuits and mass balances, bifurcation theory and fast/slow analyses, pacemaking, degeneracy, bursting, dynamic clamp, Markov models of ion channels, linking electrical and metabolic activity, synaptic integration in the balanced state in vivo, and multi-compartmental models with spatially extended morphologies.

POSTER PRESENTATIONS

Poster #1

Electrophysiological profile of oxytocin receptor-expressing neurons in the anteroventral periventricular nucleus (AVPV) of female mice.

Armita Abdollahi Govar, Ryoichi Teruyama

Department of Biological Sciences, Louisiana State University, Louisiana

Oxytocin (OT) is a neuropeptide hormone mainly synthesized in the paraventricular and supraoptic nuclei of the hypothalamus. OT exerts a wide spectrum of central and peripheral actions by binding to oxytocin receptor (OXTR). Previously, we identified a group of sexually dimorphic OXTRs in the anteroventral periventricular nucleus (AVPV) of female mice. Moreover, our previous experiments revealed that inactivation of these neurons in the postpartum female mouse disrupts maternal behavior, especially pup retrieval. In the present study, we aim to extend our study further to evaluate the intrinsic electrophysiological characteristics of these neurons in virgin female mice. Therefore, whole-cell patch clamp recordings were accomplished to observe the electrophysiological properties of AVPV-OXTR neurons. Results from immunohistochemistry of patched neurons revealed two distinct groups of OXTR-TH+ and OXTR-TH- neurons in the AVPV. Electrophysiological experiments revealed heterogeneity in the morphological profile, electrophysiological properties, and diverse responses to oxytocin receptor agonists (TGOT). Notably, a single spike from OXTR-TH+ neurons showed strong depolarizing after potential (DAP), followed by bursting firing patterns combined with membrane oscillation. Results from OXTR-TH- neurons revealed a more diverse population of neurons, exhibiting distinct patterns of DAP and after-hyperpolarization (AHP). These neurons demonstrate a wider range of patterns with more regular (tonic) to burst (phasic) firing. Our findings suggest the electrophysiologically distinct population of AVPV-OXTR neurons likely regulates different aspects of maternal behavior. This study paves the way for a better understanding of the complexity of the electrophysiological properties of these neurons and their response to TGOT stimulation.

Poster #2

Role of Nucleus Accumbens Shell Ubiquitin Specific Protease 5 on Heroin Seeking

Armah C, Ayanshina OA, Simmons M, Bradford T, Eagleton AC, & Anderson EM

Louisiana State University

The nucleus accumbens shell (NAcSh) is a part of the brain's limbic system that is implicated in addiction and reward. The addictive drug heroin can alter synaptic plasticity mechanisms in the NAcSh that may cause increased craving. Synaptic plasticity is dependent on changes in synaptic proteins, many of which have been shown to play significant roles in addiction. Experimental alterations of some NAcSh synaptic proteins can either enhance or reduce drug seeking, however, the mechanisms are not fully understood. Synaptic proteins include ubiquitin, a protein that tags other proteins to earmark them for degradation. Ubiquitin tags on proteins can be removed by ubiquitin specific proteases (USPs), thus USPs can prevent synaptic degradation. Previous studies have demonstrated that some USPs modulate many synaptic proteins, however, the role of USP5 has not been studied in relation to synaptic proteins and drug seeking. Since USP5 could regulate the strengthening and formation of opioid-induced synaptic plasticity in the NAcSh, we hypothesized that knocking down NAcSh USP5 would increase heroin seeking. To test this hypothesis, we used RNA interference by cloning a novel short hairpin RNA (shRNA) plasmid, a type of RNA that silences genes by degrading their messenger RNA. This cloned shRNA targets USP5, and we next packaged it into an adeno-associated viral vector (AAV-shUSP5). A shRNA plasmid that targets the luciferase gene was used as a control vector (AAV-shLUC). Using stereotaxic surgery, these viruses were injected into the NAcSh of rats. An in vivo characterization for the AAV-shUSP5 was tested using qPCR and the outcome was a successful NAcSh USP5 knockdown. The rats were then allowed to self-administer heroin in operant chambers for at least 14 days and afterwards were tested for drug seeking. Our results show that NAcSh USP5 knockdown does not alter heroin-taking behavior, however, it does increase heroin seeking significantly. Therefore, enhancing endogenous NAcSh USP5 levels could be therapeutic in the management of opioid use disorder.

Poster #3

A Neurotomographic Approach for the Mesoscale Mapping of Convergent Neural Circuits

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Brain regions receive convergent inputs from multiple neural sources; this prolific connectivity enables these regions to integrate disparate information streams that are necessary for higher-order neural computations. At the mesoscale level, these integrative computations are structurally supported by global interconnections among widely-dispersed brain nuclei and areas. In this regard, the spatial separation of interacting brain regions poses a significant challenge for understanding the physiological functions of anatomically-defined neural circuits. Ultimately, this understanding requires analyzing the physiological characteristics of each component of the connected neural ensemble, i.e. multi-site neural recordings from interconnected brain regions. However, such global recordings require a priori knowledge of the distribution of globally connected neurons that maintain these functional neural circuits. Therefore, we describe here a neurotomographic approach for mapping the mesoscale connectivity of globally connected neural networks, as assessed in the mouse auditory cortex. We conjugated colloidal gold with a retrograde tracer, wheat-germ agglutinin (WAHG) tracer, which was stereotaxically injected into mouse primary auditory cortex (A1) unilaterally. Micro-computed tomographic imaging was employed to scan the brain in vivo and ex vivo with 3-D image reconstruction. The brain was then histologically processed using silver staining enhancement to reveal the extent of the colloidal gold-coupled tracer labeling. Our data demonstrates the areal extent of convergent inputs to the primary auditory cortex from convergent forebrain sources. These data also demonstrate the applicability of this approach for identifying brain areas for multi-site electrode recordings and for the structural assessment of convergent neural circuits in vivo.

Poster #4

Reinforcing temporal judgement boosts sense of agency and modulates its underlying neural correlates

Leonardo Barzi, Chris Hill, Numa Samnani, and Matt Wilson

Louisiana State University (Leonardo Barzi and Chris Hill), Northern Illinois University (Numa Samnani and Matt Wilson)

The sense of agency (SOA), a feeling of being in control of one's actions, is fundamental to the formation of action-outcome relationships. Reinforcement and its valence also change the action-outcome relationship, either through behavior promotion or diminishment. However, the relationship between reinforcement and SOA is not well understood. This study evaluated how reinforcement valence modulates SOA, via intentional binding (IB) and brain activity. 33 young healthy adults [Mage ± SD: 21.84 ± 2.52] were randomly and equally allocated to one of three feedback groups [Reward, Punishment, Control]. Participants performed counter-balanced active and passive interval estimation tasks, where either themselves (active) or the experimenter (passive) pressed a button triggering an audio tone. Participants then estimated the length of time between the button press and tone which was presented at one of three intervals (200, 400, or 800ms ± 100ms random jitter). Estimation error (EE) was calculated as the difference in actual and estimated time and presented on a computer screen according to group assignment and accuracy. An EE difference of <100ms was presented in green for Reward and white for Punishment. Conversely, EE difference of >100ms was presented in white for Reward and red for Punishment. Reward and Punishment were associated with monetary gain or loss respectively. Control received white EE feedback regardless of EE accuracy. IB was calculated by subtracting the mean active EE from mean passive EE, across time intervals. Electroencephalography recorded P300 amplitude, associated with EE feedback presentation. Punishment increased IB between the button press and tone more than reward [ANOVA MD: 52.588, p=0.039] but not control [MD: 31.747, p=0.244]. Punishment elicited greater P300 compared to reward [RMANOVA MD: 5.554, p=0.041] and control [MD: 7.131, p=0.006]. Punishment [MD: 2.535, p=0.023] and reward [MD: 2.421, p=0.038] P300 amplitude diminished when the participants did not actively evoke the tone. Our findings showcase that reinforcement boosts SOA and modulates associated neural activity more than no reinforcement, as a function of increasing attention and arousal illuminating how reinforcement shapes behavior and brain activity through SOA.

Poster #5

Role of Prefrontal Cortex in Verbal Fluency and Confrontation Naming in Persons with Aphasia: Insights from fNIRS Investigation

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Aim: To investigate PFC activation during both verbal fluency tasks (VFT) and confrontation naming tasks in persons with aphasia (PWA) using fNIRS. By comparing hemodynamic responses in the prefrontal cortex (PFC) between PWA and healthy controls (HC) during VFT and confrontation naming, we aim to explore and identify specific patterns of neural activation associated with verbal fluency and confrontation naming in PWA.

Methods: We employed a 16-channel fNIRS 2000c Imager (Biopac, Inc) to measure PFC hemodynamic responses associated with naming tasks. Our sample included ten PWA and ten neurotypical HC, matched for age and educational background. Participants engaged in two widely recognized naming tasks:1. VFT (phonemic vs semantic naming) and 2. confrontation naming tasks (object vs action naming), assessing word retrieval ability. Obtained behavioral and neural data were compared between groups.

Results and Discussion: The results provide compelling evidence for the presence of word retrieval deficits in PWA. Behavioral results between groups indicate that HC consistently exhibited higher levels of correct response compared to PWA on both the VFT (phonemic and semantic) and confrontation naming (object vs action) emphasizing multifaceted cognitive-linguistic deficits inherent to aphasia. Furthermore, neural results between the groups showed that, unlike the predominantly left-lateralized PFC activation typically observed in HC, PWA demonstrated significantly increased lateralized activation in the right PFC (dorsolateral/frontopolar) during both the VFT and confrontation naming. This shift is likely a compensatory response in which the right hemisphere supports language production in the context of left-hemisphere damage (Baldo & Shimamura, 1998; Lindell, 2006). The recruitment of right BA 45/46 may reflect attempts to engage homologous language regions, while right BA 9/10 activation could signify increased cognitive control and error monitoring to offset inefficient left-hemisphere networks (Aben et al., 2020). This could further explain the recruitment of right hemisphere during naming tasks among PWA. Future studies using fNIRS in aphasia can explore everyday language-based communication ability in PWA.

Poster #6

The overexpression of Mei-p26 throughout the Drosophila brain results in embryonic lethality while its overexpression in specific neuronal subpopulations leads to behavioral deficits.

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Background: Meiotic P26 (Mei-p26) is a TRIM-NHL RNA-binding protein essential for the differentiation of the Drosophila germ cells. It forms a complex with Sex lethal (SXL), Bag-of-marbles (BAM), and Benign gonial cell neoplasm (BGCN) to repress nanos (nos) mRNA translation and promote differentiation. Additionally, Mei-P26 interacts with miRNA pathway components like Ago1, inhibiting the microRNA pathway. Due to its role in germline stem cell differentiation, Mei-P26 is considered a tumor-suppressor gene. Our lab observed elevated levels of Mei-P26 in the brains of male offspring from fathers consuming an obesogenic diet. Target prediction tools indicate that miR-10-3p and miR-1006-3p, which have identical seed regions, may potentially target Mei-P26.

Methods: We conducted experiments using fly lines with RNA interference for miR-10-3p/miR-1006-3p and Mei-p26 under the Elav promoter. Subsequently, we assessed a partial knockout of Mei-p26 in whole flies and an overexpression of Mei-p26 under the Ddc promoter. The behavioral assays included a consumption/excretion assay, a locomotor assay, and a passive avoidance assay. To confirm expression levels, we performed quantitative PCR (qPCR).

Results: The knockdown of miR-10-3p and miR-1006-3p resulted in hyperphagia in flies, whereas the knockdown of Mei-p26 led to a decrease in feeding behavior. Overexpressing Mei-p26 in dopaminergic and serotonergic neurons produced locomotor defects similar to those observed with a partial deletion of Mei-p26 throughout the entire fly. This partial deletion improved performance in the passive avoidance assay after 24 hours. qPCR confirmed the manipulations of Mei-p26, revealing bidirectional effects with miR-10-3p and miR-1006-3p.

Conclusion: Collectively, these findings indicate that Mei-p26 contributes to neuronal defects that may result in lethality or behavioral impairments. Although the causal relationship between Mei-p26 and miRNA alterations is not yet fully understood, there seems to be a notable correlation between the upregulation of Mei-p26 and the downregulation of miRNAs that target it. This suggests a tissue-specific effect of Mei-p26 that warrants further exploration using powerful Drosophila genetic tools.

Poster #7

"Maresin-1 Regulates Senescence Triggered by ?-syn PFF in Human Astrocytes

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The substantia nigra pars compacta (SNpc) is a structure of the midbrain that is crucial for modulating the initiation of motor movement, among other specific cognitive and emotion-processing functions and is composed of a group of neurons that fire rhythmically at a rate of 2-10 Hz. This characteristic makes SNpc vulnerable to metabolic stress, characteristic that is altered in Parkinson's Disease (PD) patients. In normal conditions, astrocytes sustain neuronal function. Recently, it came to our attention that there is a wide spectrum of phenotypes that astrocytes may acquire depending on the signaling they encounter, but the most striking observation is that astrocytes become progressively impaired under protein-misfolded pathological conditions. We hypothesize that astrocytes exposed to neurons undergoing degeneration related to alpha-synuclein (?-syn) aggregates, become senescent reactive and Maresin-1 revert this status. To determine the changes in phenotype, we exposed rat and human astrocytes in culture to 100 ng/ml ?-syn preformed fibrils (?-syn PFF) in the presence or absence of 200nM Maresin-1 and recorded the nuclear translocation of NFkB/p65, a pro-inflammatory transcription factor; the expression of markers of senescence (CDKN2B/p15), stress (HMGB1) and inflammation (IL1B) and the activity of ALOX12, an enzyme in the synthetic pathway of Mar-1. ?-syn PFF induced the upregulation of the senescence marker CDKN2B/p15INKB by two and a half folds along with the activation of p65 and the increase transcription of HMGB1 and IL1B. Mar-1 addition decreased all four parameters. In addition, the activity of ALOX12 was decreased by ?-syn PFF, suggesting that the aberrant form of ?-syn may induce not only senescence but also an impairment of the astrocytes to secrete the pro-survival bioactive lipid Mar-1. Altogether, the results point to an induction in the impairment of the astrocytes by the ?-syn PFF instead of promoting an inflammatory phenotype. In future directions we will focus on the mechanisms by which ?-syn PFF induces senescence and the link between this cellular process and the decrease in the synthesis of Mar-1.

Poster #8

Optimal circulating high-density lipid concentration in associated with lower midlife white matter hyperintensity volume: The Bogalusa Heart Study

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Background: Reports of the relationship between circulating serum cholesterol components (high-density lipid or HDL, low-density lipid or LDL, and triglycerides) and brain health in midlife and late life have been mixed. We aimed to assess the association between cholesterol components in the fourth and fifth decades of life, and MRI-based white matter hyperintensity (WMH) volume in the sixth decade of life, in a community-based cohort.

Method: The Bogalusa Heart Study collected longitudinal blood samples from 1973 to 2024, and brain MRI from a subset of participants 2018 to 2024. Serum-based HDL, LDL, and triglycerides were averaged within participants at visits that started in their early 30s (mean age at first visit: 31.0 ± 4.1) and ended in their early forties (mean age at last visit: 42.9 ± 4.2). Participants were categorized according to HDL, LDL, and triglyceride levels being within or outside of the optimal range (i.e., HDL ? 60 mg/dL, LDL < 100 mg/dL triglycerides < 150mg). MRI-based WMH volume, which was measured when participants were in their mid-fifties (mean age at MRI: 54.8 ± 4.3), was compared between these cholesterol component categories in ANOVA models controlling for sex, race, and age.

Result: MRI recipients (n=170) were predominantly female (66%) and Caucasian (83%). The optimal HDL group had lower WMH volume than the sub-optimal HDL group (mean difference: -0.249 cm^3, CI: [-0.4734, -0.0242], p=0.0301). No significant differences in WMH volume were observed between LDL categories or triglyceride categories.

Conclusion: Optimal mean serum HDL concentrations in the fourth and fifth decades of life may be associated with reduced WMH burden in midlife. Contributions of separate cholesterol components to midlife brain health are worthy of further study.

Poster #9

Tracing Modified or Novel Retinorecipient Regions in the Anableps Brain

Alyssa S. Daspit, Louise N. Perez, and Patricia Schneider

Myself, Mentor, and PI

Morphological innovations allow organisms to adapt to new niches and exploit new ecological opportunities, yet how such innovations arise has been a longstanding problem in evolutionary biology. In the lab, we exploit the unique features of the four-eyed fish Anableps anableps as a model for investigating innovations of the visual system. The Anableps inhabit the waterline and are capable of simultaneous above and below water vision. Light from above or below the waterline enters the eye through a uniquely duplicated set of corneas, and traverses a single pear-shaped lens, to finally reach the retina. It is still unclear how the four eyed fish brain processes the simultaneous visual stimuli. We will first generate a detailed Anableps brain atlas and map retinal axonal projections and their target regions. We use the zebrafish as a reference since these regions have been well studied in this species. Furthermore, we will combine antibody staining for specific neuronal markers and neuronal labeling techniques to begin mapping the retinorecipient areas receiving visual information in the four eyed fish brain. Finally, we hope to combine atlases of other Anablepids, to test the hypothesis that the origin of the unique eyes of the Anableps was accompanied by evolution of modified and/or novel brain nuclei associated with processing of visual information.

Poster #10

Studying the Synaptic and Molecular Mechanisms of ANKRD17-linked Intellectual Disability in Drosophila

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Intellectual disability (ID) is a neurodevelopment condition affecting up to 3% of the general population. Patients with ID often exhibit a spectrum of dysfunctions, including impaired intelligence, communication, self-care, and ability to function independently. Gene-association studies in ID patients identified an increasing number of genes whose genetic variants are linked to ID. However, a vast gap persists between gene discovery and treatment development due to our poor understanding of the molecular mechanisms linking cognition defects and specific gene functions. Among the list of recently identified ID-linked genes is ANKRD17. Mutations in ANKRD17 were considered as the genetic basis of the recently characterized Chopra-Amiel-Gordon Syndrome that features ID as the major manifestation. Like other genes, it is unclear how the ID-linked mutations in ANKRD17 lead to cognitive impairment. Our studies on mask, the fly homologue of ANKRD17, shed light on how ANKRD17 may modulate learning and memory by controlling normal synaptic structure and function. Mask, ANKRD17, and another Ankyrin Repeats and KH domain-containing protein, ANKHD1, exhibit high structural and functional conservation across species. We demonstrated that reducing mask levels in the dopaminergic neurons causes learning and memory deficits in adult flies. Moreover, loss of function of mask in flies results in abnormal presynaptic arborization and active zone structure, altered postsynaptic receptor composition, and impaired electrophysiological response at the fly larval neuromuscular junction, suggesting a causal relationship between defective synapse and brain functions. These results prompt the hypothesis that a similar link may exist between the synaptic defects and the ID-associated symptoms caused by genetic mutations of ANKRD17 in human patients. Building upon these results, we propose to establish the mask loss-of-function as a fly model to dissect the synaptic and molecular mechanism of ANKRD17-linked ID. Using this model, we performed initial structure-function analysis, and results showed that different domains of Mask mediate its different functions in regulating synaptic structures and functions, suggesting diverse pathologies caused by different mutations in the ANKRD17.

Poster #11

SATED - Studying Appetitive response, Taste perception, and Eating behavior with GLP-1RA-based Drugs

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The global rise in obesity and type 2 diabetes (T2D) presents a critical public health challenge, with evidence suggesting that ultra-processed food consumption alters dopaminergic reward signaling, reinforcing a cycle of overconsumption and weight gain. Glucagon-like peptide-1 receptor agonist (GLP-1RA) based compounds are efficacious anti-obesity agents that reduce food intake and lead to weight loss. Importantly, these central effects are observed without any change to the food environment. However, the extent to which these effects translate to reward-based ingestive behaviors, including dietary choices, food preference, and taste perception, remains unclear.

To address this gap, we will conduct a single-blind, parallel-arm, longitudinal pilot study to investigate the effects of weekly GIP/GLP-1RA administration on brain activity in response to nutrient stimuli and measures of ingestive behavior in adults with overweight or obesity and T2D. Participants (N=12) will undergo assessments at baseline and after approximately eight weeks of treatment, following a dose escalation (2.5 mg for four weeks, followed by 5.0 mg for four weeks) in the active arm, while the control group (N=12) will not receive study medication.

The primary outcome is brain response to food images assessed via functional magnetic resonance imaging (fMRI). Exploratory outcomes include ingestive behavior in both free-living and controlled laboratory settings. Assessments in the free-living setting include continuous glucose monitoring, dietary intake collected via the Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA24) and Remote Food Photography. Assessments in the laboratory include questionnaires related to perception of food and ingestive behavior (e.g., food noise). Additionally, taste preference and perception will be assessed using the Drewnowski Test. Food intake and selection as well as eating microstructure (e.g., eating rate) will be assessed using the Macronutrient Self-Selection Paradigm.

Findings will contribute to understanding whether GLP-1RA-based treatment can rescue reward signaling, thereby disrupting the cycle of overeating in the modern food environment by reshaping dietary preferences and ingestive behavior.

Poster #12

The Role of CeA-VTA Circuits in Decision-Making and Ranked Choice during Learning.

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The central amygdala (CeA) and ventral tegmental area (VTA) form a critical circuit regulating reinforcement learning, decision-making, and approach-avoidance behaviors. While VTA and amygdala (CeA) are known to influence learning, the extent to which CeA-VTA pathways shape the balance between reward and aversion learning remains unclear. In this study, we investigated how the inhibition of CeA GABAergic projections in the VTA, and VTA glutamate or dopamine releasing terminals in the CeA affects ranked choice decision-making in reinforcement paradigms. Neural projections were modulated using chemogenetic DREADDS, and its agonist Compound 21 (C21). In conditioned place preference and aversion tests, the target sides contained either 20% sucrose as the reward, and a bitter tasting mixture as an aversive stimulus. Double-floxed AAV5-DIO expressing hM4Di - an inhibitory GPCR - was injected into the CeA of VGAT-Cre mice while a cannula was positioned in the VTA. Similarly, in VGlut2Cre and THCre mice AAV5-DIO-hM4Di was injected into the VTA while a cannula was positioned in the CeA. For baseline preference (CPP) and aversion (CPA) tasks, animals were exposed to the reward and aversive stimulus without C21 modulation. After a wash period of 3 days, mice were tested in these tasks with chemogentic modulation of CeA terminals in the VTA or VTA terminals in the CeA. Our results show that inhibiting CeA GABAergic terminals in the VTA enhanced reward learning but impaired aversion discrimination. Modulation of VTA terminals in the CeA had minimal impacts on reward or aversion learning. Notably selective modulation of VTA dopamine inputs caused modest changes in reward learning and mice maintained aversive responses. Furthermore, inhibiting VTA glutamate inputs to the CeA did not significantly change behavioral outcomes in both reward and aversion learning. Together, our results showed that CeA GABAergic modulation of the VTA plays a key role in balancing positive and negative valence in decision-making, shaping how organisms prioritize choices based on past reinforcement experiences.

Key words: CPP, CPA, Learning, CeA, VTA, Circuit, Reward, Avoidance

Poster #13

The Language-Specific Neural Basis of Word Learning from Context

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Word learning (WL) from context relies on the activation of brain regions typically associated with language processing. The overlapping neural activation between WL and language processing might suggest a level of neural efficiency where the brain repurposes existing circuits for new learning, explaining rapid vocabulary acquisition. By examining these overlaps, the current study explores how the brain supports both the acquisition and use of language, aiding both theoretical advancements and practical applications. Eighteen adults completed an auditory WL task (Momsen et al., 2022) and auditory language localizer task (Scott et al., 2016) in the MRI scanner. Using a Group-Constrained Subject-Specific (GCSS) analysis, we identified subject-specific brain networks underlying WL and language processing. The left Inferior Frontal Gyrus (LIFG), Frontal Orbital Cortex (LOFC), Precentral Gyrus (LPC), Supramarginal Gyrus (LSMG), bilateral Superior Frontal Gyrus (SFG), Frontal Pole (FP) and the Cingulate Gyrus (CG) were engaged during WL, and the bilateral temporal lobe (superior, middle and inferior), LOFC, left Pre- and bilateral Post-Central Gyrus, LIFG, left FP, right SMG and bilateral Cerebellum were engaged during language processing. Using Local Pattern Similarity Analysis (LPSA) within these language specific regions, we found positive cross-task correlations in the LIFG ($t(14) = 2.68$, $p = 0.02$) and right Cerebellum ($t(14) = 2.12$, $p = 0.05$). These findings are the first to define the auditory WL network in individual brains and suggest that existing language circuits in the LIFG and the right Cerebellum are integral for successful WL, facilitating rapid vocabulary acquisition.

Poster #14

Subtyping Parkinson's disease by symptom dominance reveals group differences in postural sway

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Assessment of motor symptoms through the Unified Parkinson's Disease Rating Scale, section III (UPDRS-III) and functional postural and gait measures can offer researchers and clinicians insight into disease progression and treatment outcomes. Investigators use subjective UPDRS-III scores to quantify the cardinal symptoms of Parkinson's disease (PD), including tremor, rigidity, bradykinesia, and postural instability, in addition to the dysfunctional outcomes, like changes in gait and standing posture. Since total UPDRS-III scores include functional outcomes, the positive correlation with objective measures of posture and gait are expected. Subtyping people with PD and subtotaling scores from the UPDRS-III would offer better insight into the relationship between symptoms and functional measures of postural control and gait. Thus, we examined whether objective postural and gait measures differed between subtypes of PD and/or correlated with subtotal scores to determine whether symptom and functional differences aligned. We assessed 20 people with PD to characterize them as tremor-dominant (TD) and akinetic-rigid (AR) subtypes using the UPDRS-III (Schiess et al. 2000) and quantified their postural sway while standing still on a force plate with eyes open/closed and measured their gait kinematics while walking on an instrumented walkway under varied conditions. Total UPDRS-III scores did not differ between groups. Postural sway for TD exceeded AR to suggest poorer postural control in TD than AR. Only tremor subtotals of the UPDRS-III positively correlated with postural sway measures with eyes open, so that people with greater tremor scores swayed more with visual inputs available. Hypokinetic scores negatively correlated with double support during fast walking, so that people with greater hypokinetic scores spent less time in double support when asked to walk quickly. We conclude postural sway differences between PD subtypes of TD and AR exist and that tremor subtotals may help differentiate performance differences in multiple aspects of postural control.

Poster #15

The influence of crowding and cortical spacing on visual working memory

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The neural basis of visual working memory (VWM) remains contentious. One prominent theory, the sensory recruitment hypothesis, posits that the visual cortex both perceives and maintains visual information. In contrast, competing theories propose that only cortical regions outside visual cortex maintain visual information after perception. The current study addresses this debate by investigating the effects of spatial crowding - constraints on cognition due to object spacing that are typically observed during perception - on VWM maintenance. We hypothesized that crowding would influence cortical competition in visual cortex during maintenance and impair VWM performance, even if crowding cannot occur during initial perception. In Experiment 1, we address this hypothesis using a VWM recall task for color. Participants encoded five sequentially-presented colored squares that were displayed at locations either closer together (crowded in space) or farther apart. At test, a single location was highlighted, and participants used a continuous color wheel to report the color of the probed location. In Experiment 2, we address this hypothesis using a VWM recall task for spatial orientation. We found significantly impaired memory for objects initially presented closer together compared to objects presented farther apart. Model-based analyses revealed that this difference in VWM performance was due to an increase in spatial binding errors, instead of a decrease in memory precision for the remembered feature. Together, these results emphasize the importance of spatial crowding on VWM maintenance and support the hypothesis that cortical competition in visual cortex is an important constraint on working memory performance.

Poster #16

Role of the Temporoammonic Pathway in Memory Integration

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Memory integration involves forming long-term memories and integrating new information into the existing memory representations. While we have previously shown that delta oscillations in the temporoammonic (TA) pathway of the entorhinal cortex (EC) drive long-term memory formation, the role of the TA pathway in memory integration remains unknown. We have previously shown that chemogenetic hyperpolarization and depolarization of glutamatergic neurons in the entorhinal cortex using the CaMKII? promoter effectively alters the power of delta oscillations of the TA pathway. However, the CaMKII?-mediated expression of the chemogenetic modulators targets both layer II and III neurons in the entorhinal cortex and is not specific to the TA pathway. To target the TA pathway neurons specifically, we used Oxr1-Cre mice known to express Cre recombinase in the TA pathway neurons. Membrane hyperpolarization and depolarization of TA pathway neurons were achieved using Cre-dependent expression of chemogenetic receptors hM4Di and hM3Dq, respectively, which can be activated by the synthetic ligand deschloroclozapine (DCZ). The effect of chemogenetic modulation of the TA pathway neurons on working memory was tested using the Y-maze spontaneous alteration task. There was no significant effect of chemogenetic modulation of the TA pathway neurons on the performance of the Y-maze spontaneous working memory, suggesting that the TA pathway does not modulate spatial working memory. The effect of chemogenetic modulation of the TA pathway neurons on memory integration was tested using the remote memory update task that we developed. Mice with chemogenetic depolarization of the TA pathway neurons showed better performance in the remote memory update task, indicating enhanced memory integration, while those with hyperpolarization showed diminished performance, suggesting decreased memory integration. Thus, our findings elucidate the role of the TA pathway in memory integration.

Poster #17

Does Sex Matter? Murine Model of Traumatic Brain Injury During Chronic Methamphetamine Exposure Reveals Sex Differences in Acute Behavioral Outcomes

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Epidemiological studies indicate men are 40% more likely to suffer a Traumatic Brain Injury (TBI) than women. However, studies also show that women exhibit worse outcomes and recovery than males following TBI. Substance use disorder, both a risk factor for and outcome of TBI, is known to affect men and women differently with men being more likely to use illicit drugs, while women develop physical dependence faster. Despite known sex differences in the human experience, there exists a recognized gap in preclinical TBI studies with male rodents almost exclusively used in experimental models. Our study, which utilized a binge dosing regimen of methamphetamine administration and the Closed-Head Impact Model of Engineered Rotational Acceleration (CHIMERA) to expose both male and female C57/Bl6 mice to TBI in the presence and absence of methamphetamine, revealed sex differences in acute behavioral outcomes measured in loss of righting reflex, open field, and rotarod. Female mice with combined TBI and methamphetamine exposure had a shorter time to right following impact and increased latency to fall on rotarod when compared to females with TBI alone. Methamphetamine exposure did not have a significant effect on time to right following impact or latency to fall on rotarod in male mice undergoing TBI. Female mice exhibited significantly higher locomotor activity when compared to male mice regardless of treatment group. These data suggest that methamphetamine may play a protective role in females following TBI that is not observed in males and highlight the need for the inclusion of females in preclinical research.

Poster #18

Mental Rotation: Sex and STEM Differences

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Mental rotation is a valuable skill for individuals in many STEM-related fields. Further, females are underrepresented in many STEM disciplines. Sex differences in mental rotation abilities may be a contributing factor, as evidence suggests that males outperform females on mental rotation tasks. In this study, we directly compared sex differences in mental rotation to differences in performance between STEM and non-STEM majors. Undergraduate participants (N=91) judged if two block stimuli presented side-by-side were either the "same" (non-mirrored objects) or "different" (mirrored objects). The angle of disparity (AoD), between the two objects ranged from 0-160°. For sex differences, we observed a main effect of sex for accuracy, such that male participants had higher accuracy than female participants. This main effect of sex was not observed in response times (RT), suggesting that when female participants accurately rotate the objects, they are doing so as quickly as their male counterparts. However, there was a three-way interaction between AoD, trial type (same/different), and sex for RT. The difference between same and different trials is smaller overall for the harder trials (AoD 120°, 140°, & 160°) and this decrease in the effect at larger AoDs is more pronounced for females. For STEM versus Non-STEM majors, there was no main effect of major for accuracy or RT. However, there was an interaction between trial type and major. Specifically, accuracy on same trials was consistently higher than accuracy on different trials for non-stem majors, but this difference was less consistent for STEM majors. STEM majors may use a different strategy than non-STEM majors on some trials that is not biased toward better responses on same trials. These results suggest that differences in mental rotation associated with sex impact performance in a different way than differences associated with STEM experience.

Poster #19

Downregulation of huntingtin in offspring brain is linked to paternal western diet, behavioral changes, and alterations in miRNAs

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Huntington's disease (HD) is an autosomal dominant neurodegenerative disorder caused by a trinucleotide CAG repeat expansion in the huntingtin gene. In humans, this mutation leads to atrophy of the striatum, particularly affecting the caudate nucleus, accompanied by neuronal loss, gliosis, and a progressive decline in motor function and cognition. Recent studies suggest it may also be a systemic disorder, manifested by metabolic abnormalities, insulin resistance, altered leptin levels, and hyperphagia in HD patients.

Altered miRNA expression and processing have been observed in HD mouse models and human patient brains. MicroRNAs (miRNAs) are small non-coding RNAs that regulate gene expression by targeting nucleolar and mitochondrial genes, resulting in transcriptional regulation and translational repression. Several transcriptional regulators, such as REST (Repressor Element-1 Transcription Factor), TBP (TATA-Box Binding Protein), CBP (CREB-binding Protein), RE1 (Repressor Element-1), and p53, are known to interact not only with HTT but also with small non-coding RNAs like miRNA. In a previous proteomic study, we observed a downregulation of normal Htt levels in the brains of offspring following paternal exposure to a Western diet. This finding suggests that metabolic dysregulation in fathers-encompassing obesity and altered feeding behaviors-may heighten offspring susceptibility to neurological deficits. Since mir-10 is predicted to target Htt mRNA in this study employing Drosophila genetic tools, we explored whether manipulating this miRNA could replicate the HD phenotype. Our data indicates that miR-10 and miR-1006 appear to regulate metabolic and behavioral responses to a Western diet. Their depletion led to increased food consumption, alterations in locomotor activity, and changes in sleep patterns and thus may contribute to the development of obesity. Their independent and possibly synergistic roles in managing diet-induced metabolic dysfunction echo HTT deficiency, suggesting they may play a part in HD-related pathways. Gaining a deeper understanding of this interaction could offer novel insight insights into miRNA-based therapeutic strategies for HD and other metabolic disorders.

Poster #20

CONVERGENCE OF BILATERAL AUDITORY TECTOTHALAMIC PATHWAYS

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The medial geniculate body (MGB) receives diverse and robust ascending and descending projections, making it a critical hub in the central auditory system. Ascending excitatory and inhibitory inputs to the MGB originate from the auditory midbrain (inferior colliculus: IC), which convey and regulate auditory signals. While the ipsilateral auditory tectothalamic pathways are well characterized, the contralateral tectothalamic pathways are largely unexplored. Therefore, to explore the cell-type specific organization of the contralateral pathways, we employed a cre-lox mediated, dual-anterograde, viral tracing approach using C57BL/6J, VGlut2-Cre and VGAT-Cre mice. We assessed the pattern of convergence from bilateral tectothalamic sources to characterize their topographic and convergent organization across meso- and micro-anatomical scales. Our data demonstrate a topological alignment of terminal arbors originating from bilateral tectothalamic inputs onto MGB neurons. The relative neuroanatomical weight of excitatory and inhibitory terminals from the contralateral IC suggests a substantial role in influencing MGB responses. These data are supported by ongoing optogenetic electrophysiological experiments to delineate the functional impact of these contralateral projections on the MGB and auditory processing. Overall, our data highlights the overlooked roles of the contralateral tectothalamic projections in central auditory processing.

Poster #21

Neuronal CFTR interactions and implications for synaptic transmission.

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The function of the cystic fibrosis transmembrane conductance regulator (CFTR) is well established in the context of epithelial tissue due to the debilitating effects of mutations that cause the disease cystic fibrosis. In our lab, a role for CFTR has been established in the regulation of cytosolic Cl- in retinal amacrine cells (ACs) (Krishnan et al., 2017). Here we ask if there are specific interactions between CFTR and synaptic proteins. Co-Immunoprecipitation (Co-IP) experiments demonstrate that the synaptic proteins Syntaxin-1A (STX1A) and SNAP-25 bind CFTR. These interactions are further supported by a binding assay that demonstrates an increase in STX1A and SNAP-25 from adult chicken brain derived Co-IP samples that have been supplemented with additional purified recombinant CFTR protein (0.63 ?g/mL, 1.26 µg/mL). To further characterize the CFTR interactome in neurons, adult chicken brain Co-IP samples were analyzed via mass spectrometry and the resulting peptide information was processed in Proteome Discoverer (Thermofisher). Resulting interactors were ranked using the Sequest score and the interactome was visualized with network interactions displayed from StringDB. A total of 621 unique proteins with 93 proteins linked to synaptic transmission were identified. We then asked if CFTR is associated with synaptic or other neuronal structures in the transmission electron microscope (TEM). Adult chicken retinal sections were processed with post-embedding immunogold labeling with a polyclonal CFTR antibody (Abcam). CFTR labeling was found on synaptic vesicles in the inner plexiform layer (IPL) and near active zones, in the outer plexiform layer and IPL. Labeling against CFTR was also found on the ellipsoid mitochondria of photoreceptors. To begin to understand the synaptic function of CFTR in ACs, we asked whether CFTR inhibition effects synaptic function by making whole cell voltage clamp recordings of spontaneous postsynaptic quantal currents from embryonic equivalent day 18-21 ACs with ?3 presynaptic ACs. Pharmacological inhibition of CFTR with CFTRinh172 (10 µM) increases the frequency of events as compared to control [control, 68.2 ± 20.6 (mean ± SEM, n =5) CFTRinh172, 99.6 ± 25.9, (mean ± SEM, n =5, p =0.003) and wash 81 ± 24.1 mean

Poster #22

Sex differences in caudate and putamen dopaminergic and cholinergic signaling following long-term alcohol self-administration in rhesus macaques

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Chronic alcohol consumption alters the dorsal striatum (DS), a brain region implicated in alcohol use disorder (AUD). The DS consists of two subregions: the caudate nucleus (CN), which is linked to goal-directed drug seeking, and putamen (PT), which is involved in habitual drug seeking. Changes in dopamine (DA) signaling are implicated in the development from initial hedonic seeking to the habitual intake of alcohol. Prior research has examined alcohol-induced alterations in DA signaling, however, it remains unknown if these alterations differ between CN & PT and sexes. Studying non-human primates provides a translationally relevant model for investigating the long-term effects of alcohol use. In this study, we assessed DA release with in-vitro fast scan cyclic voltammetry in brain slices from CD and PT of rhesus macaques following six months of alcohol self-administration. Additionally, the nicotinic acetylcholine receptor antagonist dihydro-?-erythroidine (DH?E; 1uM) was applied to investigate the cholinergic modulation of DA release. DA release was evoked using electrical stimulation under different conditions, including single-pulse (1p) and high-frequency, phasic stimulation (6p50Hz), to evaluate DA release. Analysis of single-pulse stimulation input-output curves revealed a significant effect of sex ($p=0.046$) on DA release in the PT. The cholinergic contribution to DA release following chronic alcohol exposure. A significant effect of sex was found in the CN, with females exhibiting lower DH?E-induced inhibition of DA release. Additionally, during phasic stimulation, a main effect of treatment ($p=0.04$) and a trend for sex differences were observed in the CN ($p=0.057$), while in the PT, trends for both a sex effect ($p=0.08$) and a treatment-sex interaction ($p=0.08$) were observed. Furthermore, the percent change in DA release from 1p to phasic in DH?E trended towards a sex difference ($p=0.057$), suggesting differential responses to cholinergic modulation between sexes. These findings suggest that chronic alcohol self-administration alters the cholinergic modulation to DA release in the CN, with sex differences in both regions, and implicate the cholinergic system as a target for the development of AUD treatments.

Poster #23

Neural encoding of valencies in the BNST-CeA-DRN circuits, and the implications for stress-linked behavioral responses

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Neural circuits containing projections from the dorsal raphe nucleus (DRN), bed nucleus of the stria terminalis (BNST), and central amygdala (CeA) govern the expression of psychosocial states, anxiety, and other related behaviors. How these circuits contribute to the expression of anxiogenic behaviors primarily driven by aversive stimuli has been tested with great certainty. However, the role of this circuit (triad) in the expression of behaviors that discriminate between positive and negatively valenced stimuli is still poorly understood. This study deploys multi-site high throughput in vivo recording methods, with chemogenetics, to investigate the encoding mechanism of this circuit when positive and negatively valenced stimuli are presented. Electrophysiological profiles (ground-truth) of serotonergic (5-HT) neurons in the DRN were determined by photostimulation (AAV-DIO-hChR2-eYFP) in sert-cre mice. In head-fixed anesthetized mice (7 males), the response of putative cells in the DRN, CeA, and BNST was assessed by firing rate analysis when ethologically relevant odorants were presented to produce positive or negative contexts. The results demonstrate that the DRN encodes differences in valencies earlier than the CeA and BNST, suggesting it may be the source of the circuit. The CeA encodes valency responses after exposure (late response). To elucidate the role of DRN serotonergic neurons and their terminals in modulating BNST and CeA neuronal ensembles, we injected AAV-hSyn-DIO-hM3D(Gq) or hM4D(Gi)-mcherry in the DRN of two separate cohorts of animals. Activating 5-HT terminals in the BNST allows valency recognition in the BNST. The inhibition of 5-HT terminals in the BNST allows for valency recognition and discrimination in the BNST and CeA.

Poster #24

Manipulation of the Brain's Motivation Circuitry Increases Heroin Seeking in Rats

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Opioid use disorder (OUD) is a condition in which individuals use opioids despite the harm caused by their use. In addition, relapse occurs in 72-88% of individuals with OUD. In order to study the brain mechanisms behind relapse to OUD and discover treatments, rodent models of opioid self-administration can be used. For example, using rodent models where rats first self-administer heroin and then are later tested for heroin seeking, we can examine behaviors similar to opioid craving in humans with OUD. Animal studies have shown that the nucleus accumbens is a portion of the brain's circuitry responsible for dopamine signaling, motivation, and addiction. Within nucleus accumbens neurons, a major signaling protein that regulates heroin seeking is phospholipase C gamma 1 (PLCg1). Since opioid use increases PLCg1 signaling in the accumbens, we hypothesized that targeting accumbal PLCg1 would decrease heroin seeking. Using viral vector techniques, transgenic rats, and cre/lox technology, we can control the expression of specific genes within specific cell types. Thus, we were able to knockdown PLCg1 specifically within neurons that selectively express dopamine receptor 2 (D2) in the accumbens with these technologies. We found that heroin seeking is increased by PLCg1 knockdown within D2-expressing neurons in the accumbens, suggesting that under normal circumstances, heroin-seeking behavior is typically kept in check by endogenous PLCg1 within D2-expressing accumbal neurons. This data suggests that translational methods or therapies that increase accumbal PLCg1 signaling could be clinically beneficial for those suffering with OUD.

Poster #25

GI Exposure Is Required For The Leptin Lowering Effect Of Ethanol Treatment

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Introduction and Objective:?Hypoleptinemia is a potent orexigenic signal. Ethanol (EtOH) consumption is associated with weight gain in humans, and acute ethanol treatment leads to reductions in leptin levels in both fasted humans and rats. The objective of this study was to determine whether the route of administration or treatment in the fed or fasted state influences the leptin lowering effect of EtOH.

Methods:?Three separate groups of male Sprague Dawley rats were exposed to either oral or intravenous (IV) treatment with EtOH (2g/kg via oral gavage/0.067 g/kg/min IV for 30 min; n=7/group) on three consecutive days. Each rat served as its own control and received saline treatment either 7 d prior to or 7 d following exposure to EtOH. Two groups were fasted overnight prior to treatment. Plasma leptin levels were measured each day at baseline and 3 h following EtOH treatment. Data are expressed as mean?+?SEM. A two-way ANOVA was used to test the effect of treatment on leptin levels (saline vs. EtOH).

Results:?Baseline leptin levels in the oral/fasted and IV/fasted groups were 3.7?+?0.7 and 2.3?+?0.8 ng/mL, respectively, and were 6.9?+?1.2 ng/mL in the IV/fed group. There was a significant main effect of treatment in the oral/fasted group ($p=0.005$) where the average daily change in leptin levels 3 h post EtOH treatment was -0.72?+?0.21 ng/mL. There was no effect of treatment on leptin in the IV/fed or IV/fasted groups ($p=0.86$ and $p=0.25$, respectively). In the IV groups, average daily changes in leptin levels 3 h following saline vs leptin treatment were -1.7?+?0.4 vs -1.3?+?0.3 ng/mL in the fed group, and -0.4?+?0.5 vs -0.3?+?0.2 ng/mL in the fasted group.

Conclusion:?Although we were able to replicate previous work indicating a modest reduction in leptin levels following acute EtOH treatment in fasted rats, our results do not support a cumulative leptin-lowering effect of recurrent EtOH treatment. Surprisingly, IV EtOH treatment in either the fed or fasted state had no impact on leptin levels. This suggests that the leptin-lowering effects of EtOH requires oral ingestion and exposure of the GI system to EtOH.

Poster #26

Ethanol and Stress: effects in female and male mice

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Background: Alcohol use disorder (AUD) is a chronic condition that is often comorbid with mental disorders like depression or post-traumatic stress disorder. Furthermore, prolonged stress and anxiety can increase the severity of AUD. However, the mechanisms controlling the effect of stress on AUD are still not fully understood. Thus, preclinical animal models of stress-induced changes in alcohol drinking are needed. Finding stress models with high face validity and predictive value that closely resemble stress-induced increases in alcohol consumption in humans may allow us to develop better AUD treatments. Therefore, we aimed to determine how different stressors alter alcohol consumption in mice.

Methods: Male and female C57Bl/6J mice were first allowed to self-administer ethanol in a two-bottle choice (2BC) protocol for at least five weeks (15% ethanol vs water, 2hr/day). Then, mice were split into either a control (N=6-8M, 6-8F) or stress group (N=6-8M, 6-8F). Next, mice in the stress group were exposed to four different stressors: 1) injection of 5mg/kg i.p. U50,488 (a kappa opioid receptor agonist), 2) repeated predator odor stress with 2,5-dihydro-2,4,5-trimethylthiazoline (TMT) (1hr/day for 5days), 3) 1-hour exposure to a live cat, and 4) injections of 1.25-5mg/kg i.p. of yohimbine (an alpha-2 adrenoceptor antagonist). In a separate experiment, 3-week-old mice were separated at into either group housing (N=2M, 6F) or single housing (N=2M, 5F) for 5 weeks to study the effect of isolation stress on 2BC as adults. For all experiments, ethanol consumption was measured and analyzed with t-tests or ANOVAs using GraphPad.

Results: After five weeks of 2BC, we exposed mice to U50,488 and saw significant increases in ethanol consumption in both sexes. After TMT exposure, female mice increased ethanol drinking, but males did not. In contrast, both yohimbine and a live cat predator exposure reduced ethanol consumption in both sexes. Finally, isolation stress did not produce any significant differences in alcohol drinking.

Conclusion: Our results show that different stressors can increase, decrease, or have no effect on alcohol consumption. Interestingly, female mice were more sensitive to the TMT stress, suggesting potential sex differences. Understanding the molecular events responsible for these different effects may allow us to determine mechanisms of how stress alters alcohol consumption.

Poster #27

Chronic intermittent ethanol effects on dorsal striatal cholinergic signaling

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Alcohol use disorder (AUD) is a prevalent issue in the United States, with over 28.9 million people fitting the criteria for the disorder in 2023. Alcohol misuse has adverse health and socioeconomic impacts totaling over $240 billion annually in the United States. Despite this, FDA approved medications for AUD are limited. Thus, further understanding of neurobiological mechanisms underlying AUD is required for the development of new treatments. The neurotransmitter acetylcholine (ACh) plays a role in cognition and decision-making processes, both of which are adversely affected in AUD making it an attractive pharmacotherapeutic target. Therefore, this study aimed to determine how chronic ethanol affects ACh signaling in the dorsal striatum (DS). We previously reported the effects of ethanol on striatal ACh release by performing brain slice photometry using iAChSnFR, a biosensor that increases fluorescence intensity upon binding ACh. We used stereotaxic injection of AAVs to express iAChSnFR in DS of C57BL6J mice. We found that mice that underwent chronic intermittent ethanol (CIE) vapor exposure, a model of ethanol dependence, had a deficit in dorsomedial, but not dorsolateral, striatal ACh release. To determine what underlies this DS ACh release deficit, we examined DS cholinergic neurons in the striatum and the pedunculopontine nucleus (PPN), the primary sources of DS ACh. We immunolabeled cholinergic neurons and performed stereological counting of DS cholinergic ineterneurons (CINs) in control and CIE mice. Following CIE treatment, mouse brains were perfused, and 40um-thick coronal sections underwent immunofluorescent staining with a choline acetyltransferase antibody to label cholinergic neurons. Stereological counting of DS CINs showed a deficit of CINs in the dorsomedial, but not dorsolateral, striatum of CIE treated mice, mirroring our ACh release data. Stereological counting of PPN cholinergic neurons revealed no significant group differences. Altogether, we found that chronic alcohol has striatal subregion-specific effects that may contribute to the symptoms of AUD.

Poster #28

Ahnak knockdown in the nucleus accumbens shell decreases heroin seeking in rats.

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Drugs of abuse such as heroin induce drug-seeking behavior over time, however, the underlying mechanisms remain unclear. Heroin use activates the nucleus accumbens shell (NAcSh), a key component of the brain's reward circuitry that plays a critical role in mediating motivation, reinforcement learning, and goal-directed behaviors. Repeated heroin use can lead to increases in the drive for seeking the drug and this may be related to altered synaptic plasticity in the NAcSh. Previous results shows that reward signaling and synaptic plasticity in the NAcSh is mediated in part by phospholipase Cgamma1(PLCg1) an important protein for substance use disorder (SUD). PLCg1 can be activated by an interaction with a protein called Ahnak. Ahnak, means 'giant' in Hebrew and is a very large protein with a molecular mass of 680 kDa. Due to Ahnak's interaction with PLCg1, we hypothesized that reducing NAcSh Ahnak would reduce drug seeking. To test this, we used an adeno-associated virus (AAV) as a type of brain-region specific gene therapy. AAVs can be modified to express short hairpin RNAs (shRNA) to induce RNA interference to knockdown target genes. In this study, first we made an AAV-shAhnak to reduce Ahnak mRNA and protein levels. Then we injected it or a control AAV into the NAcSh using stereotaxic surgery in rats. Two weeks later, we performed a chronic, indwelling, jugular vein catheter surgery on them. After a week of recovery, we allowed the rats to self-administer heroin for at least 12 days by lever pressing in operant conditioning chambers. Seven days after the last self-administration session, we then tested for drug seeking by measuring lever pressing in the absence of heroin infusions for at least six days. Our results show that knockdown of NAcSh Ahnak decreases the number of lever presses in the drug-seeking phase in comparison with controls. In conclusion, since Ahnak knockdown in the NAcSh decreases drug-seeking behavior, this suggests that endogenous NAcSh Ahnak typically increases drug-seeking, possibly through an interaction with PLCg1. These results deepen our understanding of addiction mechanisms and suggest that decreasing Ahnak in the NAcSh could offering a potential path for new treatments to reduce drug-seeking behaviors and to improve SUD outcomes.

Poster #29

Intranasal Alpha-synuclein Preformed Fibrils Delivery Induce Olfactory Deficiencies

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In 2003, Braak and collaborators proposed an association and route from olfactory centers in the brain to the development of protein aggregates in Parkinson's Disease (PD). Currently the alpha-synuclein (?-syn) seeding models utilize stereotactic injection in rodents to introduce ?-syn preformed fibrils (?-syn PFF) for a focal dissemination of aggregates. In addition, it was reported that intranasal delivery of ?-syn PFF induces inflammation and accumulation of ferrous ion (Fe II) in monkeys. Previously, in our lab, we found that Maresin 1, a lipid derivative of docosahexaenoic acid, prevents the damage caused by ?-syn PFF to astrocytes and microglia in vitro. We hypothesize that the intranasal administration of ?-syn PFF will induce olfactory behavioral changes due to toxicity triggered on astrocytes and microglia by the aggregates and Maresin 1 will prevent this deleterious effect. To test this hypothesis, we administered 60 ug alpha-synuclein fibrils in 12 ul (30 ug per nostril) or saline (control) followed by 5 ug of Maresin 1 (2.5 ug per nostril) or the equivalent volume in saline (vehicle) in a set of four-month-old male rats, 2 rats per condition. Three months after the treatment, the rats were housed separately and prepared for Buried food test (BFT). Briefly, in BFTs, rats were sensitized to Froot Loops (Kellogg Cereals) for 3 weeks before testing. During testing, rats had the opportunity to find the food hidden under the bedding, and the time required for it was recorded. The times were recorded once every week, during a 9-week period, and the results were compared using two-way ANOVA with multiple comparisons test, Tukey's HSD. There was no significant difference between control rats (Saline-Saline) for the time it took them to find the buried food, during the 9 weeks tested. Fifty percent of the rats treated with ?-syn PFF alone showed differences with the control rats ($p=0.001$) and rats treated with Maresin 1 ($p=0.004$). The same success rate was applied to the protection elicited by the treatment of Maresin 1 to ?-syn PFF treated rats. Rats treated with Maresin 1 and ?-syn PFF showed no significant difference with the control rats. Future experiments will obtain the proper number of observations for the effects of a-syn and protections by Mar-1.

Poster #30

Quantifying Brain Activity Changes in Freely-Swimming Zebrafish Larvae: A New Approach Methodology for Evaluating Developmental Neurotoxins

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Developmental exposure to environmental toxicants has been linked to the onset of various neurodevelopmental and neurobehavioral disorders. Zebrafish-based behavioral assays have proven effective in predicting the neurotoxic potential of chemicals by allowing us to understand how exposure to environmental toxicants affects neurobehavior. However, they fall short in identifying the specific brain structures, cell types, or molecular mechanisms affected. To bridge this gap, this study utilized embryos expressing the genetically encoded calcium indicator, calcium-modulated photoactivatable ratiometric integrator2 (CaMPARI2), which were enzymatically dechorionated to facilitate direct exposure to known brain activity modulators-tricaine-s and pentylenetetrazol-as well as developmental neurotoxins, including lead (Pb), arsenic (As), and 2-Ethylhexyl diphenyl phosphate (EHDP). At 120 hours post-fertilization, impacts on brain activity and their correlation with changes in behavioral endpoints were assessed. CaMPARI2 undergoes a permanent green-to-red photo-conversion when exposed to ultraviolet light in the presence of elevated intracellular Ca2+ concentrations, which allows for a "snapshot" of brain activity of freely-swimming larvae, which can then be examined using confocal microscopy. Our findings revealed significant alterations in both baseline behavioral activity and visual stimulus responses following exposure to all tested chemicals. Corresponding changes in brain activity were observed not only across the whole brain (WB) but also in specific brain regions, including the forebrain (FB) and hindbrain (HB). These findings underscore the effectiveness of behavioral assays in detecting developmental neurotoxins and demonstrate the added value of this new approach methodology in identifying associated region-specific brain activity changes. This study highlights the advantages of integrating behavioral assays with functional neuroimaging to gain a more comprehensive understanding of neurotoxic outcomes.

Poster #31

Longitudinal Analysis of Behavior and Neuropathology in a Mouse Model of Alzheimer's Disease.

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Alzheimer's disease is one of the most common forms of dementia. It is marked by degeneration of both neurons and glial cells, the formation of amyloid plaques, and disruptions in the brain's cholinergic systems. Its manifestations include compromised cognitive abilities, memory impairment, alterations in visuospatial skills, personality shifts, and depression. The onset and progression of Alzheimer's disease is influenced by numerous factors, such as age, genetics, brain and vascular trauma, infections, and environmental triggers. Numerous therapeutic approaches address symptoms linked to Alzheimer's disease, and recent research indicates that N-methyl-D-aspartate (NMDA) receptor antagonists like ketamine may offer neuroprotective benefits along with a reduction in neuropsychiatric symptoms. Notably, ketamine shows promise in potentially safeguarding neurons, glial cells, and astrocytes, offering therapeutic advantages and potentially delaying symptom onset. Therefore, we explored the potential neuroprotective advantages of early, low-dose administration of ketamine in a mouse model of familial Alzheimer's Disease. Animals were assessed behaviorally and neuroanatomically longitudinally for several months following treatment. Behavioral assessments included the novel object recognition, Y maze, and forced swim tests. Neuropathological examination of brain specimens was used to assess neurodegenerative alterations and amyloid plaque formation. As a result of these studies, we established and validated a pre-clinical framework for the longitudinal analysis of therapeutic potential for Alzheimer's disease and related dementias, which can inform future studies of the disorder.

Poster #32

MEI-P26 Modulates Feeding Behaviour and Metabolic Regulation via Mitochondrial and Lipid Dynamics in the Brain of Drosophila melanogaster

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MEI-P26, a well-known regulator of growth and differentiation, has been implicated in metabolic homeostasis. Previously, we have observed the upregulation of meip26 in western diet-fed offspring. However, its role in mitochondrial function and energy metabolism remains poorly understood. Using the GAL4-UAS system, we investigated how MEI-P26 overexpression and knockdown influence mitochondrial dynamics, nutrient sensing, and subsequent behavioral changes in Drosophila.

Fat body GAL4 drivers were crossed with MEI-P26 overexpression and knockdown lines, and metabolic outcomes were assessed. Behavioural assays, including FLIC (Food-Liquid Interaction Counter), locomotor analysis, and Food consumption and excretion (Con-ex), were performed to evaluate energy balance. We conducted qPCR on mitochondrial dynamics genes and microRNAs and performed lipid staining of brain and fat body tissues using BODIPY, MitoTracker, and LysoTracker. Additionally, flies were fed a Western diet to assess metabolic shifts, with qPCR targeting nutrient-sensing pathways.

MEI-P26 overexpression resulted in increased activity in males while decreasing female activity. This was measured in FLIC and locomotor assays, whereas knockdown reversed the effects. Preliminary qPCR data suggest alterations in mitochondrial dynamics and microRNA expression, with potential implications for metabolic reprogramming.

Our findings suggest that MEI-P26 overexpression disrupts metabolic function, likely due to microRNA-induced changes in protein expression. This metabolic alteration is reflected by decreased feeding behaviors and locomotor deficits, positioning MEI-P26 as a potential epigenetic regulator of transgenerational phenotypes. Further validation through Western blotting and functional assays is underway to uncover the molecular mechanisms underlying MEI-P26's role in transgenerational programming.

Poster #33

Spatial resolution of gene expression in the duplicated cornea of the four-eyed fish Anableps anableps

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The Anableps eye is composed of duplicated corneas, a single pyriform lens and a sub-functionalized retina. Aerial light stimuli travel through the dorsal cornea and reach the ventral retina, while light stimuli from below the waterline, cross the ventral cornea and reach the dorsal retina. With a single optic nerve to receive and process visual inputs, the four-eyed fish has developed adaptations to accommodate simultaneous aerial and aquatic vision. Among the principal modifications that evolved in the Anableps lineage are the advent of a dorsal cornea adapted to aerial vision and the regionalization of the retina into distinct dorsal and ventral photoreceptor gene expression domains. The subdivided cornea is a key adaptation of the Anableps, yet the molecular programs that distinguish aerial and aquatic cornea remain poorly understood. To obtain high throughput gene expression data and positional information, we have deployed spatial RNA-seq technology using the Visium Spatial platform (10x Genomics). This technique yielded ~2000 spatial 'spots' at a spatial resolution of 55?m, corresponding to ~5-10 cells per spatial spot. Detection of gene expression patterns that correspond to the correct cell populations was confirmed by assessing known markers of the cornea (krt5), lens (cryaa), and retina (crx). Our findings demonstrate that spatial RNA-seq is effective in delineating gene expression territories and identifying distinct clusters in the ventral and dorsal corneas. Our group has established spatial transcriptomics as an invaluable tool for research using non-model species, where the number of available specimens can be a limiting factor.

Poster #34

Examining Perceptual Grouping on Stages of Processing in Visual Working Memory: an ERP Study and a Registered Report

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Visual working memory (VWM) is a capacity-limited system that is more efficient when stimuli can be grouped based on similarity. It is not fully understood during which VWM processes grouping benefits occur. We will test the effects of grouping based on feature repetition with event-related potentials that are correlates of attention, encoding (N2pc), maintenance (CDA), comparison (N2), and decision-making processes (FN400). Participants will encode colored-squares with or without color repetition and then respond to a single-item probe. At the behavioral level, the results showed that repeated stimuli improved the overall accuracy of change detection. In arrays with color repetition, items probing a repeated stimulus (vs. unrepeated stimulus) improved accuracy. In addition, arrays including repeated stimulus (vs. only unrepeated stimulus) improved memory for unrepeated items, suggesting compression of repeated stimuli. At the neurophysiological level, an increase in N2pc and a decrease in CDA amplitude for repeated stimuli will provide evidence of grouping during encoding and maintenance. A decrease in N2pc onset latency or N2 and FN400 amplitudes for trials probing a repeated stimulus will provide evidence of prioritization of grouped representations for comparison and decision processes. In change trials, a decrease in N2 and FN400 amplitudes for repeated stimuli will provide evidence of grouping effects on comparison and decision processes. Taken together, these results will further our understanding of processing efficiencies in VWM. The results to be presented at the Neuroscience Symposium are part of a registered report (see the protocol for stage 1, doi.org/10.17605/OSF.IO/8ZS96).

Poster #35

Identifying novel neuroinflammatory biomarkers to diagnose normal pressure hydrocephalus

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Normal Pressure Hydrocephalus (NPH) is a neurological disorder characterized by ventriculomegaly and clinical symptoms such as dementia, gait disturbances, and urinary incontinence. Diagnosing NPH remains challenging due to the lack of reliable laboratory tests or definitive biomarkers. Identifying specific neuroinflammatory markers associated with NPH could improve diagnostic accuracy, enabling earlier intervention and more effective treatment. In this study, cerebrospinal fluid (CSF) samples were collected from patients diagnosed with NPH and other neurological conditions, including pseudotumor cerebri (PT), traumatic brain injury (TBI), aneurysm, subdural hematoma (SDH), and chronic subdural hematoma (CSDH). Inflammatory profiles in these CSF samples were analyzed using the Biolegend LEGENDplex Human Neuroinflammation Panel 1, a multiplex bead-based assay kit, by flow cytometry. Preliminary results revealed the presence of two key neuroinflammatory markers, CCL2 and sTREM-2, in the CSF of NPH patients. Additionally, a trend was observed indicating higher concentrations of inflammatory markers in the CSF of patients with traumatic conditions (TBI, aneurysm, CSDH, SDH) compared to those with non-traumatic conditions (NPH, PT). This suggests that the inflammatory response may differ between traumatic and non-traumatic disease states. The presence of CCL2 and sTREM-2 in NPH suggests these markers could serve as potential diagnostic biomarkers. However, further studies are needed to confirm their role in NPH and determine their specificity. Future research will also include comparisons with normal CSF samples to assess whether these markers are unique to NPH or part of a broader neuroinflammatory response seen in other neurological disorders. Identifying a neuroinflammatory profile specific to NPH could lead to the development of a diagnostic biomarker panel, improving the diagnosis and treatment of this often-misdiagnosed condition. These findings underscore the importance of exploring neuroinflammation in NPH and open avenues for future research into more reliable diagnostic tools for this disorder.

Poster #36

Functional analysis of conserved cis-regulatory elements in the retina of the four-eyed fish - Anableps anableps

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In the vertebrate retina, spatially restricted expression of genes establishes the Dorsal-Ventral (DV) boundary and enables the processing of light coming from different environments. The four-eyed fish, Anableps anableps, is a surface-dweller species and has modifications leading to partially duplicated eyes, with duplicated corneas and pupils, a modified lens, and a single retina. In the four-eyed fish, the dorsal retina receives light from underwater and the ventral retina from above the waterline. Our group and others have observed the asymmetric expression of genes in the retina, however, the mechanisms underlying the regulation of these distinct retinal territories remain unclear. Here, we performed bulk RNA-seq of dorsal and ventral retina compartments and identified distinct dorsal and ventral gene expression profiles, revealing up regulation of conserved dorsal markers , such as tbx5b, in the dorsal retina. Spatial Transcriptomics and Hybridization Chain Reaction (HCR) confirmed the expression of this gene restricted to the dorsal domain of the retina. Next, we used ATAC-seq to identify open chromatin regions and potential cis-regulatory elements involved in the establishment of the DV territories in the retina of the four-eyed fish. We identified potential enhancer candidates nearby tbx5b and used mVISTA alignment to assess evolutionary conservation of this region across species. Two highly conserved enhancers candidates were identified within tbx5b intronic regions. To functionally assess these potential cis-regulatory elements, we used zebrafish transgenesis and generated transgenic lines. Our initial findings suggest that these regions are potential enhancers and drive gene expression in the dorsal retina, suggesting a conserved role of these region in establishing the DV domain in fish and providing insights into the regulatory mechanisms governing DV patterning in vertebrate eye.

Poster #37

VTA glutamate projections guide hippocampal encoding of space and contexts

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Reciprocal connections between the mesocorticolimbic ventral tegmental area (VTA) and hippocampus constitute an anatomical loop that governs aspects of learning, and processing of information for long-term cortical storage. Although the VTA contains diverse neuron types, the role of VTA glutamate projections in guided spatial learning is less studied than dopamine, especially in the reward context and valence discrimination. Here, we investigated VTA glutamate terminals innervation of the hippocampal CA1 region, and its role in encoding spatial learning that is contextualized in the presence of reward modality. To test the functional implication of VTA glutamate innervation of the CA1, light controlled excitatory opsin was expressed in VTA glutamate neuron projections by stereotaxic injection of AAV-DIO-ChR2 into the VTA of Vglut2cre mice (n=6). To assess the VTA-CA1 glutamate tract in mice, a fiber-optic cannula was positioned in the CA1 (close to the VTA) while neural probe shanks were positioned in the dCA1 (dorsal CA1) for recording. A baseline T-maze test was performed without neural modulation. After a washout period, the behavioral task was performed with optogenetic activation of the VTA glutamate projections when a correct choice was made to obtain a sucrose reward. Behavioral task events, dCA1 recording, and photo-modulation were synchronized by behavioral tracking and hardware control TTL systems. The results of this experiment during the baseline phase show reward-guided decision-making behaviors. On the contrary, Optogenetic modulation of VTA glutamate terminals to CA1 leads to an overall increase in dCA1 firing rate during reward-guided decision making. This firing rate increase was robust during the decision phase in comparison to the point of reward acquisition. To conclude, VTA-CA1 glutamate terminals that innervate the hippocampus underscores decision-linked spatial reward learning.

Poster #38

The thermogenic effect of FGF21 is mediated by both brown and beige adipose tissue activation

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Our lab and others have shown previously that the increase in energy expenditure (EE) and other metabolic benefits observed when dietary protein is restricted are mediated by FGF21 signaling to the brain and that this phenotype can be blocked by Ucp1 deletion in adipose tissue. Both brown (BAT) and beige adipose tissue exhibit a robust increase in thermogenic genes, however, it has been unknown what pathways downstream of the brain are responsible for increased thermogenesis. To help answer this question we used a mouse model that lacks the thermoregulatory gene Prdm16 only in white adipose tissue (WAT), rendering them unable to produce beige adipose tissue, while leaving intrascapular BAT intact. We placed these mice on isocaloric low protein (LP, 5% casein) and control (20% casein) diets for 3 weeks and found that animals on LP diet had less body weight (BW) gain and greater food intake as expected, but Prdm16 deletion had no impact. Next, we placed animals on LP or control high-fat diets and measured glucose and insulin tolerance. Again, as expected animals on LP diet had improved glucose handling and insulin sensitivity, but there was no difference between genotypes. To determine if BAT is responsible for LP-induced thermogenesis, we included a group of animals that received a sympathectomy to the BAT pads, effectively blocking their activation, in conjunction with Prdm16 deletion. We measured EE with indirect calorimetry and found that while neither Prdm16 knockout in WAT nor BAT sympathectomy alone were sufficient to block the LP-induced increase in EE, their combination effectively blocked the LP-induced increase in EE. These studies demonstrate that both depots of thermogenic fat contribute to increased EE with LP and can exert the effect alone, but future studies must determine how each tissue is activated and adapts. This finding may also be relevant to other stimuli of thermogenesis such as cold exposure and food intake.

Poster #39

Contextual Cueing in Complex Visual Environments: Behavioral and Neural Mechanisms

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Visual search performance benefits for a target in a repeated context are well documented (i.e., contextual cuing). However, these benefits appear reduced for complex visual stimuli despite strong explicit memory for the repeated displays. We examined behavioral benefits and neural mechanisms, as revealed through eye movement patterns, of contextual cuing during visual search in repeated visual displays of varying visual clutter. Participants completed a visual search task with repeated/non-repeated displays across 10-16 blocks of trials in lower or higher visually cluttered arrays. Behavioral results demonstrated robust contextual cueing effects, with response time (RT) improvements for repeated displays emerging rapidly and persisting across blocks. The early behavioral improvements dissociated from gradual oculomotor effects, as revealed by modeling of fixation and saccade dynamics. Two distinct neural mechanisms emerged: (1) improved attentional guidance (reduced time to first target fixation) and (2) response facilitation (reduced time between first target fixation and response), both developing nonlinearly across blocks. Eye patterns differed within each mechanism, showing either gradual, linear emergence or nonlinear patterns. The lower-clutter condition at 16 blocks showed strong optimization of all eye patterns. However, in the lower-clutter condition analyzed over the first 10 blocks, optimization of gradual, linear eye patterns was hindered despite strong RT benefits. Similarly, the higher-clutter condition at 10 blocks showed hindered optimization of all eye patterns, though RT benefits remained intact. This temporal dissociation between rapid RT benefits and clutter-sensitive eye optimization suggests distinct neural substrates for contextual learning versus visuomotor adaptation over time. Our findings demonstrate that complex stimuli engage temporally distinct neural mechanisms supporting contextual cueing. While visual clutter selectively disrupted oculomotor efficiency, it did not diminish behavioral improvements, suggesting dissociable neural pathways for task performance and visuomotor refinement. Future research should investigate how distributed neural systems interact during search efficiency development in complex environments.

Poster #40

Knockdown of KCNK1 in the Nucleus Accumbens Reduces Stress-Induced Alcohol Consumption in Mice

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Alcohol use disorder (AUD) is a common chronic disease comorbid with stress-related disorders. Alcohol use can lead to dysregulation of stress-response systems in the brain causing increased alcohol drinking in the presence of stressors. This dysregulation may be caused by changes in the nucleus accumbens (NAc): an important brain region that is part of the reward system. Some of these changes may be due to epigenetic regulation involving a specific gene called histone-lysine N-methyltransferase 2 also known as G9a. Knockdown of NAc G9a mRNA was previously shown to lead to a reduction in stress-induced ethanol intake in mice. G9a epigenetically regulates many genes including a potassium channel called KCNK1. We hypothesized that KCNK1 could potentially be a new downstream epigenetic target for altering stress-induced alcohol drinking. In mice, we tested this hypothesis by knocking down NAc KCNK1 via RNA interference with an adeno-associated viral vector. These mice were then allowed to self-administer ethanol or water via a two-bottle choice protocol. After a baseline drinking level was established, they were then injected with a compound to produce dysphoria and stress. Their drinking levels at baseline and during the stressor period were recorded. By reducing NAc KCNK1, a significant reduction in alcohol drinking was observed when exposed to a stressor. From these results, it can be inferred that knockdown of NAc KCNK1 produces a significant drop in stress-induced ethanol consumption. Consequently, NAc KCNK1 knockdown could offer a novel therapeutic target for reducing alcohol drinking in people with AUD exposed to high-stress environments.

Poster #41

Spatial adaptations of sympathetic innervation and immune cells in adipose tissue depots

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Adipose tissues, dynamic for their ability to change with metabolic demands, is a focus for new therapies in individuals with obesity. Understanding the organization of sympathetic innervation and how it interacts with the localized immune system is critical for improving metabolic health. Sympathetic nerves dynamically innervate adipocytes with dense (brown adipocytes), moderate (beige adipocytes) or weak innervation (white adipocytes). Obesity is known to decrease adipocyte innervation and increase immune cell infiltration in white adipose tissue (WAT). Additionally, under environmental pressures such as extended cold exposure, WAT receives signals to increase beige adipocytes and innervation to contribute to thermogenesis, however, the impact on immune cell infiltration spatially is unknown.

Here we exposed mice to chronic warm (30ºC) and ambient temperature (10º C) for 7 days. These animals were perfused, and adipose tissue depots were prepared for immunohistochemistry. IMARIS software was used to identify CD45, CD68 (immune cells) and counted to show visual changes in immune landscape and compared to previous work on the sympathetic innervation (Huesing C, 2022).

With 10º C exposure, a browning response occurred across the WAT tissue, increasing beige adipocytes (beige islands) and sympathetic innervation. In these beige islands, the macrophage density was significantly decreased when compared to the less innervated white adipocytes at 10ºC ($p>0.005$). In core iBAT, interestingly during cold exposure core BAT macrophage significantly increased ($p>0.03$), visually becoming difficult to distinguish between core BAT and surrounding WAT.

This data suggest that immune cells are repelled by sympathetic innervation levels, as observed by comparing core BAT or beige islands to surrounding white fat areas. However, the increased macrophage count in core iBAT was surprising and suggests an additional layer of regulation that overcomes the innervation density. These diverse spatial changes highlight changes in the immune counts are not always indication of metabolic disease and can be overcome by environmental challenges like cold exposure. This method allows a clearer insight into spatial interactions between the sympathetic and immune systems in adipose tissue.

Poster#42

Heightened Neural Oscillatory Power During Movement Preparation in Anxiety Disorders

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Anxiety disorders are the most common psychological disorder nationwide, with a lifetime prevalence of 34% in the United States alone. Many neurological diseases (e.g. Alzheimer's) often develop an anxiety disorder prior to diagnosis and as comorbidity. Previous studies have shown changes in motor behavior like slower reaction time in people with anxiety disorders (PwAD). Theta oscillations, a brain frequency (3-12 Hz) associated with cognitive control, are changed by anxiety disorders. Specifically, movement-related theta represents activation of the hippocampus, a subcortical area typically affected by anxiety. This suggests that movement-related theta may serve as early biomarker for cognitive dysfunction. However, no study has examined theta oscillatory changes during motor behavior in PwAD. Thus, the purpose of this study is to investigate how theta oscillatory power changes during skill learning in PwAD. We recruited PwAD and without anxiety disorders (control) and had them learn a visuomotor adaptation task, where participants learn to reach and hit a target using cursor corresponding to their hand movement on computer screen. During testing, the cursor and hand movement eventually becomes incongruent, forcing the participant to adapt their movement to hit the target. To successfully hit the target, the participant must adapt 45 degrees counterclockwise to offset the incongruency. To assess learning we monitored the hand's angular movement in response to the offset. Theta oscillatory power at movement onset was collected via electroencephalography (EEG). We found that PwAD demonstrated greater theta oscillatory power and greater rates of learning. These findings showcase the compensatory brain mechanisms used by PwAD to facilitate movement and skill learning. The overall goal of this research is to develop a model of movement cognition that can be applied to wider neurological diseases to better understand their underlying brain processes that affect quality of life.