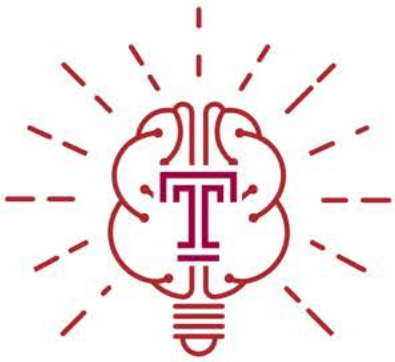
April 28, 2023 | 10am – 3pm | SERC Lobby

ANNUAL BIOLOGY DEPARTMENT UNDERGRADUATE STUDENT RESEARCH DAY

PROGRAM



10am - 12pm

Session I

1pm - 3pm

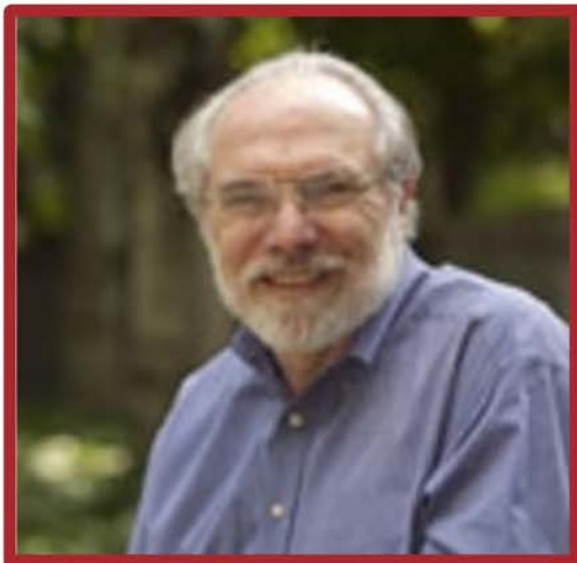
Session II

3pm - 4pm

Special seminar

Certificates of Distinction in Major will be presented to students after the seminar.

SPECIAL SEMINAR



Joel Sheffield, PhD

PROFESSOR EMERITUS
DEPARTMENT OF BIOLOGY

"Looking Back, Looking Forward"

In his more than 40 years of exemplary teaching, research and service to the Biology Department, the College of Science & Technology, and Temple University, Dr. Sheffield mentored thousands of students in Cellular Biology and Microscopy. His compassion and love of science made lasting impressions on his students, who have since graduated and moved on to an array of STEM careers.

His talk will take a look back on his research, teaching, and mentoring, before looking forward to his next publishing endeavors.

ABSTRACTS

In alphabetical order

Multi Chemokine Antagonist RAP 103 Inhibits Anxiogenic Expression of Methamphetamine in Planarians Displaying Withdrawal-like Behaviors

Abiru M., Wiah S., Milton M., and Rawls S.
Center for Substance Abuse Research, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

Introduction: Previous research has reported the relationship between antagonism of chemokines such as CCR2, CCR5 and their effects on opioid analgesia. Yet, the relationship between chemokine receptor antagonism and psychostimulant-evoked behaviors remains understudied. Methamphetamine exposure upregulates the expression of CCR2 and CCR5, which may have implications in sustaining Methamphetamine reward reinforcement and relapse. Therefore, modulating methamphetamine-induced changes in chemokine receptor expression may serve as a suitable therapeutic target for minimizing psychostimulant reward and reinforcement. RAP103 (R103), a dual antagonist of both CCR2 and CCR5, has been previously studied for neuropathic pain but has yet to be explored in the context of psychostimulants. In this paper, we want to see if its chemokine blocking ability could be useful in preventing Methamphetamine addiction like behaviors in planarians.
Methods: The experiments performed include pairing the planarians habitual preferences to the two drugs of testing (methamphetamine and RAP103) to get a baseline for behaviors. The behaviors studied include the light-dark preference and their motility. These correlate to a measure of anxiety-like behaviors and depression-like behaviors in the worm. The last phase of experimentation saw the induction of methamphetamine withdrawal like effects and using R103 as a 'savior' drug.
Results: R103 significantly increased time in the light and increased motility Methamphetamine displayed the same effects. Early Methamphetamine withdrawal showed a decrease in time spent in the light but no discernible effect on motility. Late Methamphetamine withdrawal showed decreased motility with no discernible effect on the time spent in the light. Planarians displaying withdrawal-like behaviors and given R103 showed increase in time spent in the light across all doses. However, there was no discernible effect on motility.
Conclusion: R103 has a significant effect on the early anxiolytic expression of Methamphetamine withdrawal like behaviors in planarians but does not make any significant effect in the late depressive expression behaviors of Methamphetamine withdrawal.
Keywords: Methamphetamine, R103, Cytokine/Chemokine, Psychostimulant

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A Machine Learning-based Approach for Unsupervised Classification of Proteins using Hamming Distance and Clustering Techniques

Aurelio Aquila, Toshan Doodnauth, Victoria Olevsky, Joseph Campagna, Harris Syed, Vincenzo Carnevale
Institute for Genomics and Evolutionary Medicine, Department of Biology, College of Science and Technology, Temple University, Philadelphia, PA 19122, USA

Protein sequence analysis is an important tool for understanding the function of proteins. Here, we present a novel approach to analyze and classify protein sequences using unsupervised clustering and hamming distance analysis. The working hypothesis is that pairwise distances contain sufficient information to determine a meaningful partitioning (or clustering) of the sequence dataset and thus a classification scheme to predict protein function. To this end, we developed an algorithm to calculate the all-against-all hamming distances in multiple sequence alignments. The resulting distances are stored in a matrix, which is then used to perform cluster analysis. Protein sequences are then assigned to groups based on their similarity, thereby providing a classification criterion. Our novel method for protein sequence annotation, implemented in Python and based on the scikit-learn modules, is completely general and computational efficient. Its use on the human genome could potentially shed light on the function of uncharacterized proteins, especially thus involved in human diseases.

Removal of Understory Vegetation: Impact on Temporal Animal Activity in Morris Park

Zaina Archer, Payton Philips, Dr. Jocelyn Behm
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Wildlife is constantly under pressure to adapt to environmental changes, including the introduction and control of invasive species. One of the ways that species adjust to environmental change is by altering their daily activity periods. Previous research in our lab has shown that mammalian community composition and diversity change following the large-scale removal of invasive understory vegetation, but there is little understanding of whether mammals can alter their temporal dynamics in response to such change. Discerning the temporal change in activity can help advance ecological theory and guide conservation and management strategies. Therefore, we employed an opportunistic Before-After/Control-Impact study (BACI) in Morris Park in Philadelphia. In this study, a site that receives an experimental vegetation removal treatment is compared to a control location that receives no treatment. We used Bushnell Trophy Camera Traps to record the mammalian activity during the 24-hour cycle from August 1st, 2020, to August 25th, 2021. During this period, we quantified the diel behavior of the specie northern raccoons (*Procyon lotor*) at the experimental and control sites in three periods prior to removal and three periods following removal. Our results show a decrease in the proportion of nighttime activity of raccoons following the removal which might suggest that raccoons use their temporal habitat as a physical cover. Even slight shifts in temporal activity can have consequences for individual fitness, species evolution, and community food webs. Therefore, the changes that follow the removal of the vegetation should not go unnoticed. Although our findings are preliminary, our research represents one of the first studies to examine the link between mammalian behavior and invasive vegetation management.
Key Words: Understory, vegetation removal, mammal, BACI, community composition, habitat, temporal activity, treatment, control, camera trap, invasive vegetation, diel, urban.

The alternative pre-mRNA splicing contribution of alpha-synuclein to Parkinson's Disease

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Alpha synuclein (SNCA) has long been linked to Parkinson's Disease (PD), dementia with Lewy bodies (DLB), as well as other degenerative diseases although very few have investigated the pre-mRNA alternative splicing of SNCA and subsequent protein isoforms. Fewer still are the investigations into the differential aggregation properties of specific isoforms and their role in disease pathology. In this study, Cerebral Organoid (CO) models are treated with 1-methly-4-phenylpyridinium (MPP+) to simulate dopaminergic neuronal loss and recapitulate alternative pre-mRNA splicing alterations seen in PD. Then, individual isoforms are cloned into expression vectors to transfect and determine the localization and other characteristics of the long form, SNCA-140 and shorter SNCA-112. These vectors were transfected into VERO cells and expression of SNCA-140 and SNCA-112 was confirmed with western blotting. Our results suggest that COs are a more reliable model for inducing alternative pre-mRNA splicing with MPP+ than SK-N-SH or SH-SY-5Y neuroblastoma cell lines. Also, our data points towards HIV infection altering the expression of SNCA alternatively spliced pre-mRNA transcripts, although the precise reason is not known. Overall, our data suggest that MPP+ induced toxicity and HIV infection in cerebral organoids impacts alternative pre-mRNA splicing of SNCA which may contribute to PD pathology.
Keywords: organoid, synucleopathies, Parkinson's, splicing, mRNA, cell culture, alpha-synuclein, expression, plasmid, cloning

The impact of cigarette smoke and ethanol co-exposure on mice

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1Department of Microbiology, Immunology, and Inflammation, Temple University; 2Center for Inflammation and Lung Research, Temple University; 3Department of Thoracic Medicine and Surgery, Temple University; 4Department of Neural Sciences, Temple University; 5Center for Substance Abuse Research, Temple University, Philadelphia, PA 19140, USA

Cigarette smoke can increase the risk of lung diseases. Alcohol consumption can lead to respiratory dysfunction. However, the impact of cigarette smoke in combination with ethanol consumption on the lungs is poorly understood. Wild-type mice were exposed to cigarette smoke every day for 4 weeks with access to 10% ethanol. We analyzed the preference for consuming ethanol and water during mice exposure to cigarette smoke. Gender differences were analyzed. We found that male mice had a higher intake and preference for drinking ethanol during exposure to cigarette smoke than female mice. Regarding body weight, male mice exposed to cigarette smoke alone and co-exposed to cigarette smoke and ethanol had a significantly lower body weight than control groups. Also, this co-exposure decreased body weight in female mice compared to controls, especially during the first 2 weeks. Moreover, a histological analysis of murine lungs was performed to determine lung injury. Furthermore, we analyzed the cGAS-STING pathway to define the DNA-sensing mechanism in the pro-inflammatory responses in murine lung tissue by Western blotting. Understanding the impact of cigarette smoke and ethanol co-exposure can improve our knowledge of lung disease pathophysiology. Also, it can lead to the development of novel therapeutic strategies against respiratory dysfunction.

Duplicated genes and the evolution of functional diversity in Drosophila

Nathan Duda, Rob Kulathinal
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Although fruit fly species have a similar set of genes in their genomes, only a subset of these genes are shared across the entire Drosophila phylogeny. In fact, nearly two-thirds of all genes in eight phylogenetically diverse Drosophila species have undergone widespread gene duplication and gene loss, indicating a dynamic evolutionary history of functional genomic change. In this study, we use an evolutionary computational approach to investigate the function of recently duplicated genes in these eight genomes. We identified over 1,400 parent and child paralogous pairs (i.e., recent duplicates) and their ancestral gene using phylogenetic and divergence statistics. By comparing a standardized library of transcriptomes derived from seven different tissues (Yang et al. 2018), we estimated the fraction of recent duplicates that follow various models of functional divergence. Overall, we found that most duplicate pairs gain a new function in either one of their copies but a large portion also conserve their ancestral function. This research quantifies the functional fate of duplicated genes in order to gain a deeper understanding of the genomic mechanisms that allow new genes to become integrated into diverse functional networks and ultimately drive species differences at the phenotypic level.
Keywords: Drosophila; duplicate genes; gene expression; evolution

Psychophysical Studies of Long-Chain Fatty Alcohols as Drug Delivery Vehicles in Edible Film Formulations

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Introduction: Although rapidly dissolving edible films are useful drug delivery systems, these films often incorporate low amounts of drugs. However, long-chain fatty alcohols such as myristyl alcohol [C-14] or cetyl alcohol [C-16] show promise for complexing drugs into microparticles that can be incorporated into edible film formulations. Our preliminary psychophysical studies indicate that cetyl alcohol-containing films elicit minimal taste responses but show a cooling effect in the absence of nasal airflow when taste circles are placed at either the circumvallate region or tip of the tongue.
Methods: For preparing microparticles, cetyl alcohol and myristyl alcohol were melted with either stearic acid [control], sucralose [sweet], or sucrose octa-acetate (SOA) [bitter], and rapidly cooled to a waxy solid. The solid contained 70% stimulus by weight. The solid was then ground into a fine powder for addition to pullulan-containing film solutions that also included sonicated phosphatidylcholine vesicles and Mg-stearate as dispersing agents. Dried films were heated to melt microparticles into uniform layers to yield edible films that were approximately 0.005 inches thick. These films were then folded into multiple layers.
Results: Blank and stearic acid-containing control films elicited a minimal taste response, sucralose-containing films elicited a strong sweet-bitter taste response, and SOA-containing films elicited a bitter taste response above strong on the gLMS. Edible film sandwiches composed of sucralose and SOA in separate layers decreased bitter taste intensities.
Conclusions: These studies indicate that both hydrophobic and hydrophilic compounds can be uniformly embedded within edible films at amounts that are adequate for drug delivery. Also, these films may decrease choking hazards in both the young and the elderly. Finally, these edible films can be modified to decrease the aversive taste of pediatric and adult drug formulations.
Key words: Edible films, drug delivery, taste, psychophysics, fatty alcohols.

Do genes that escape the inactivated X-chromosome in females play a role in sex disparities in disease?

Nala Hamilton, An Nguyen, Dr. Rob Kulathinal
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It is well-known that socio-behavioral factors contribute to higher rates of many diseases in males compared to females. However, the role of genomics, in particular, the role of sex chromosomes, remains unclear. While one of the two X-chromosomes is silenced in females to assist in dosage compensation, genes have been found to escape this silencing and act like diploids. Here, we investigate whether these X-inactivation escapees in females can explain sex disparities in diseases in either protective (e.g., cancers) or harmful (e.g., autoimmune diseases) capacities. By performing a systematic review of the literature on X-inactivation escapees, we first provide a comprehensive list of genes which have been reported to escape X-inactivation that may be involved in disease. We further extend this list of X-inactivation escapees to other mammals to understand evolutionary conservation. To test our primary hypothesis that escape genes will affect different diseases depending on their tissue of expression, we develop a framework to identify escape genes that contribute to various diseases. We are beginning to apply this framework on various forms of cancer using phenotype and expression data from the TCGA (the Cancer Genome Atlas) and GTEx. We plan to further develop this EXILED (escape from X-inactivation in loci expressed in disease) hypothesis using other large disease/phenotypic datasets including UK BioBank.

Mitragynine Reduces Anxiety and Chemotherapy-Induced Peripheral Neuropathic Pain through CB1 and CB2 Mechanisms in Mice

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Introduction: Kratom is a plant with compounds that have both opioid and stimulant effects, including the bioactive alkaloid mitragynine. It is used anecdotally for pain and anxiety, often in combination with CBD. The potential pharmacological similarities between kratom and CBD are worth exploring for pain and anxiety. Based on the pharmacological profile of mitragynine, it is hypothesized that it can reduce mechanical allodynia in chemotherapy-induced peripheral neuropathy, and that this effect is inhibited by CB1 and CB2 antagonists.
Methods: C57BL/6J mice were used to test the potential benefits of mitragynine for neuropathic pain caused by oxaliplatin. CB1 and CB2 pathways were explored by injecting antagonists along with mitragynine during allodynia models. The anxiolytic effects of mitragynine were studied using the Elevated Zero-Maze model. qt-PCR gene expression was used to test differences in enzyme levels responsible for producing endocannabinoids.
Results: Mitragynine dose-dependently inhibits oxaliplatin-induced mechanical allodynia. Its anti-allodynic effects are inhibited by CB1 and CB2 antagonists. Gene expression analysis shows inconclusive results for endocannabinoid production enzymes in several brain regions. Mitragynine produces a significant anxiolytic effect from chronic use, but not acutely.
Conclusions: Mitragynine significantly reduces allodynia in CIPN mice and its effects are inhibited by CB1 and CB2 antagonists. This suggests a role for mitragynine in the endocannabinoid system, but not at the gene level. Mitragynine produces significant anxiolytic effects with chronic use in mice, but not acutely, indicating consecutive administration over several days is necessary.
Significance: Mitragynine's potential to alleviate CIPN and anxiety in chemotherapy patients is significant given the lack of effective treatments with SSRIs and NSAIDs. This could have important implications in medical oncology and chronic pain management.
Key Words: mitragynine, chemotherapy-induced neuropathic pain, peripheral neuropathy, cannabinoids, anxiety, elevated zero maze, kratom, pharmacology

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Benchmarking Computational Methods for Absorption of 4-Substituted Indole

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Department of Chemistry, College of Science and Technology, Temple University, Philadelphia, PA, 19122, USA

This project examines computational methods for calculating the absorption of indole, a known chromophore that is responsible for the fluorescent properties of tryptophan, with substituents placed at the fourth position to maximize its use as a fluorescent probe and examine its properties. Two computational levels of theory, CAM-B3LYP and EOMCCSD, were used to perform single point calculations with QChem in both gas and aqueous phases. Values such as the excitation energy, oscillator strength, and dipole moment for each excited state were found and compared to previously obtained experimental values as a means of benchmarking computational methods and examining solvatochromic shift. Plot files of the natural transition orbitals were also obtained and viewed using Molden to visualize the orbitals of the ground and excited states and ensure that the bright states were calculated correctly. Computational values were blue shifted compared to experimental, and correlations between computational energies and known parameters such as electrophilicity corresponded more closely with experimental trends. Utilizing the natural transition orbitals provided more accurate bright state excitation energies, leading to improved correlations between methods for each individual substituent. This demonstrates the promise of utilizing computational methods, which are cheaper, less time consuming, and easier than experimental methods, for studying and developing more effective fluorescent probes. It also displays the potential of using substituted indole or substituted tryptophan as a more effective probe that fluoresces brighter and for more time.
Keywords: Fluorescence, absorption, excited states, computational chemistry, solvent effects, molecular orbitals

Psychophysical Studies of the Oral Trigeminal Stimulus Piperine

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Piperine is a hydrophobic alkaloid from pepper plants that gives black pepper and long pepper its pungent “taste.” Piperine may also cause a bitter taste when circumvallate papillae at the back of the tongue encounter this stimulus. Piperine is a trigeminal stimulus that binds to TRPV1 and TRPA1 receptors in the oral cavity. Due to its poor solubility in water, few psychophysical studies have examined piperine perception. However, this compound is readily incorporated into rapidly dissolving edible films at both threshold and suprathreshold amounts for human psychophysical studies. Threshold studies were examined by the ascending limits method where each trial consisted of two blank and one experimental strip. Thresholds with piperine produced an average threshold of 15 nanomoles. At the threshold amount, participants perceived the oral chemosensory quality of piperine as bitter, sweet, fatty/oily, or spicy. For suprathreshold studies, the general Labeled Magnitude Scale was used for intensity measurements. Both 1000 nanomole and 2000 nanomole piperine strips were tested over a period of sixty seconds. Piperine intensities were maximal after 20 seconds, with values in the “weak” to “moderate” range. Hedonic values were primarily “neither like or dislike.” An oral sucrose rinse was administered to determine its effect on the piquancy of piperine. After a sucrose rinse, subjects reported an approximate one-third decrease in intensity with 2000 nanomole piperine strips. Finally, the volatility of piperine in the oral cavity was examined. In the absence of retronasal stimulation, piperine intensities decreased an average of 55% over sixty seconds. In summary, these results indicate that piperine can be incorporated in edible strips at amounts that are appropriate for psychophysical studies. These findings provide valuable information that could be implemented into the human diet, especially in the diet of children who are highly sensitive to pungent oral stimuli.
Keywords: piperine, suprathreshold, threshold, nasal airway, sucrose rinse

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Impact of Seasonality on Avian Biodiversity in Disturbed Old-Growth Forest

Colin Lynch, Danielle Smith, Daniel Taratut, Amy Freestone, Mariana Bonfim
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With the increasing unpredictability of extreme weather events due to changing climate, it is crucial to understand the ecological succession and niche overlap of biological communities following high wind-disturbance events. To examine how a recent severe windstorm may have shifted avian community composition and resource use, we conducted thirty-meter point-count surveys at six distinct areas in Eastern Pennsylvania. The survey sites included tornado-disturbed and undisturbed older growth deciduous forests located less than 1-mile apart. To account for seasonal differences in bird activity, we conducted surveys during the summer and fall of the year following the wind disturbance. Our results show that avian diversity varies with disturbance and season. Our findings suggest that disturbance events can alter the availability of niches for forest birds. To gain a more comprehensive understanding of the relationship between disturbance and niche overlap, future studies could explore the extent to which bird species overlap in their use of resources across different disturbance regimes.
Keywords: Avian biodiversity, Climate change, Ecological succession, Extreme weather events, Forest bird communities, Niche overlap, Resource use, Seasonality, Wind-storm disturbance

Fentanyl Enhances HIV Infection in Microglia and Macrophages

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In the past two to three decades, there has been a surge in the use, abuse, and misuse of opioids. Among opioid users, illicit fentanyl use has become widespread in the US. Moreover, synthetic fentanyl rapidly floods the illicit drug market due to its cheap manufacturing and similar chemical structure but is not routinely detected in toxicology testing. Importantly, fentanyl is commonly detected in urine drug-screen tests in people living with HIV. Recent reports also suggest that there is an increased risk of acquiring HIV infection in those who inject fentanyl. There are HIV outbreaks in areas of high fentanyl availability. Although it is known that opioids and their receptors are implicated in the immunopathogenesis of NeuroAIDS, there is no information available about whether fentanyl has effects on the HIV infection of the CNS.
In this study, we investigated whether fentanyl impairs intracellular innate immunity and enhances HIV infection of human microglial cells and macrophages. We demonstrated that fentanyl treatment of monocyte-derived macrophages (MDM) and iPSC-derived microglia (iMg) enhanced HIV infection and increased the expression of HIV entry receptors, inflammation cytokines, and inflammasomes, while inhibiting the expression of interferons and HIV restriction factors. Since many infected individuals are fentanyl users, it is important to further identify the pathological role of fentanyl in HIV-infected reservoir cells and understand the mechanisms of HIV persistence to develop strategies for the viral eradication.
Keywords: Fentanyl, HIV, Interferons, Cytokines, Inflammasomes, Macrophages, Microglia

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Investigating the Role of TMEM65 In Mitochondrial Calcium Efflux

Angelina D. Makhoul, Anna E. Schmidt, Dima Y. Khalil, Adam S. Mangold, Oniel Salik, Joanne F. Garbincius, and John W. Elrod
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Mitochondrial calcium (mCa2+) flux plays a fundamental role in regulating cellular bioenergetics and cell death. Dysregulation of mCa2+ homeostasis contributes to human disease. The mitochondrial Na+/Ca2+ exchanger (NCLX), the primary mediator of mCa2+ efflux, is essential to maintain mCa2+ homeostasis. Data from our lab and others suggests that enhancing calcium efflux through NCLX is protective against heart failure and neurodegenerative disease. However, there are no specific pharmacological modulators of NCLX activity, and little knowledge exists about the endogenous mechanisms regulating NCLX. Our goal is to understand the endogenous mechanisms modulating NCLX activity to develop therapeutic approaches for disease. Using a proximity biotinylation assay with mass spectrometry, we identified potential NCLX protein regulators. TMEM65, a mitochondrial inner-membrane protein, was among these candidates. We focused on this target as it is linked to severe mitochondrial encephalomyopathy, highlighting its importance for mitochondrial function. We are testing the hypothesis that TMEM65 binds to and stimulates NCLX, helping to limit mCa2+ overload. We generated AC16 cardiomyocyte and C2C12 myocyte cell lines with stable overexpression, knock-down, or knock-out of TMEM65 to assess its impact on mCa2+ efflux in vitro. We observed that TMEM65 overexpression enhances mCa2+ efflux, but this effect is attenuated with NCLX inhibition. We are now using genetic approaches to confirm whether TMEM65 promotes mCa2+ efflux specifically through NCLX or in a NCLX-independent manner. Interestingly, TMEM65 expression is downregulated in several diseases characterized by disrupted mCa2+ homeostasis, but whether this contributes to pathology is unknown. Thus, TMEM65 conditional knock-out and overexpression mouse models are being generated to establish its pathophysiological relevance in vivo. We also generated an epitope-tagged NCLX mouse to facilitate studies of direct NCLX-TMEM65 interactions. These findings could elucidate new strategies to control mCa2+ homeostasis for the treatment of human disease.
Keywords: TMEM65, NCLX, mitochondria, calcium, homeostasis, heart failure, neurodegenerative disease

Morphometric Analyses of Microglial Changes in a Mouse Model of Alzheimer's Disease with Oligodendrocyte-Specific IL-33 Conditional Knockout

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The deposition of amyloid plaques, a pathological hallmark of Alzheimer's disease (AD), are thought to be toxic to neural cells and induce neuronal loss and gliosis. The disease-associated microglial changes play a critical role in β-amyloid (Aβ) plaque accumulation in the brain, either by phagocytosis-mediated Aβ clearance or promoting Aβ spreading via unknown mechanism. Recent studies suggested that microglial phagocytic activity is promoted by interleukin 33 (IL-33) during brain development and AD, and IL-33 is thought to be expressed mostly by astrocytes. However, our previous study revealed that, unlike the young brain, the major fraction of IL-33 is expressed by oligodendrocytes (OLs), the myelinating glia, in the aged healthy and AD-afflicted mouse brain. Moreover, there were significant increases in Aβ plaque deposition by IL-33 cKO in APP/PS1 male mice. Here, following these findings, we sought to determine whether OL-derived IL-33 regulates microglial activity against or for Aβ plaque deposition. We performed quantitative image analyses of microglia in the brains obtained from 12-month-old male APP/PS1 and APP/PS1 mice lacking OL-specific IL-33 (n=11 per group). Our results show that the composition of diffuse and dense-core plaques was not different between the control and IL-33 cKO APP/PS1 mice. Yet, axonal dystrophy was exacerbated in OL-derived IL-33 cKO, suggesting oligodendroglial IL-33 is necessary to slow neurodegeneration. However, no significant differences were observed in microglial regional occupancy or microglial migration into Aβ plaque between the groups. The Imaris software-assisted 3D cell phagocytosis analysis indicated that microglia-mediated Aβ plaque engulfment was not altered by IL-33 cKO. Taken together, our findings suggest that oligodendroglial IL-33 may play a neuroprotective role in AD, but not through activation of microglia.
Keywords: beta-amyloid (Aβ) plaque, oligodendrocytes, microglia, IL-33, Alzheimer's disease

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Identification of AAV2 transfection in large diameter motor neurons through IB4 staining

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Department of Bioengineering, College of Engineering, Temple University, Philadelphia, PA, 19121, USA

Following a spinal cord injury, electrical epidural stimulation (EES) has been proven useful in providing locomotion improvement in lower limbs by excitation of large diameter sensory neurons. However, there is no specificity in whether large or small diameter neurons are being stimulated. When small diameter neurons are hit, the individual receiving stimulation experiences pain. This study aims to use chemogenetic aids to specifically stimulate large diameter sensory neurons and avoid pain afferents by accurately identifying the AAV2 transfection with IB4 staining overlapped with DsRed of injected virus.
Rats were injected in the lumbar region dorsal root ganglion (DRG) with AAV2 virus that is activated by designer drugs, DREADDs. A unilateral hemi-section is performed as a spinal cord injury. BBB scores, treadmill kinematics, and ladder walk scoring was collected. Control groups received saline and experimental groups received Clozapine- N-Oxide (CNO). Animals were euthanized and immunohistochemistry practices allowed DsRed to amplify mCherry signal and IB4 identified pain receptors. DRG tissue was counted to determine the overlap of staining between cells.
Histology practices showed minimal overlap between the IB4 and DREADDs with a percentage of positive cells at 10.9 ± 8.3%. There was minimal or absent dual labeling between DsRed (red) and IB4 (green) which imaging would show as a yellow color.
The minimal overlap indicates the accuracy of the AAV2 injection towards large diameter sensory neurons. Given the data, AAV2 injection at the DRG proves to be a viable method of virus introduction at target specific sensory neurons.
This study is significant because it allows for positive response in use of AAV2 as a transfection virus when injected into the spinal cord and DRG. Dual labeling stain allows for precision targeting of sensory neurons and ultimately reduction in pain response when conducting spinal cord injury studies.
Keywords: Electrical epidural stimulation, AAV2, DREADDs

Effect of White-Nose Syndrome on Proportion of Cold Arousals and Disturbance-Driven Cold Arousals

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Since its discovery in North America in 2006, white-nose syndrome (WNS), a fungal disease, has been decimating hibernating bat populations. Despite these mass mortality events, some remnant colonies persist despite WNS, which suggests that bats from these persisting colonies may exhibit traits that facilitate their survival. WNS impacts bats by disrupting their physiology during hibernation, which increases arousal frequency and contributes to the premature depletion of their fat reserves. These arousals can be warm, reaching euthermic temperatures, or cold, increasing body temperature by only a few degrees, which may thus allow torpid bats to respond to minor disturbances while avoiding the energetic cost of a warm arousal. In the context of WNS, prioritizing the use of cold arousals is one potential way by which surviving bats may minimize energy expenditure and reduce mortality, yet it remains unclear whether the incidence of cold arousals vary with previous exposure to the disease. Using skin temperature dataloggers, we thus compared the ratio of cold versus warm arousals in experimentally infected little brown bats (*Myotis lucifugus*) captured from colonies with different WNS experience – an experienced colony previously impacted by the disease, and a naïve colony with no WNS history. We found that the ratio of cold arousals was lower in naïve bats, while individuals from the experienced colony did not differ from control (uninfected) bats, which suggests that infected bats' propensity for warm arousals lessens in experienced colonies in favor of cold arousals. However, when focusing on arousals caused by disturbances, we found that the ratio of cold arousals for both the experienced and naïve colonies was lower than that of control bats. WNS may thus negatively affect bats' response to disturbances when torpid, making them less prone to using the energetically beneficial cold arousals irrespective of their colony experience.

White-tailed Deer Activity in a Disturbed Forest Understory

Brendan O' Neal, Mary R. Cortese, Mariana Bonfim, Amy Freestone
Temple Ambler Field Station, Temple University, Ambler, PA 19002

Large-scale wind disturbances can alter the composition of forest understory, directly impacting the behavior of species occupying these disturbed environments. White-tailed deer (*Odocoileus virginianus*), a generalist herbivore species found predominantly throughout the Americas in woodland environments, can influence vegetation dynamics by selectively foraging on various plant species, which can impact plant community composition and structure. This research investigates the correlation between white-tailed deer activity and understory density following a recent EF-2 tornado that leveled a 4-ha old-growth forest stand in Eastern Pennsylvania. Utilizing four trail cameras located in the Temple Forest Observatory (TFO) in Ambler, PA, deer frequency was calculated for the Fall seasons both directly after the tornado (2021) and following one full growing season and recovery period (2022). In comparing the deer frequencies through time, we observed a substantial increase in deer presence between 2021 and 2022. There was no relationship between deer activity and understory density immediately following the disturbance event, potentially indicating that the severity of the disturbance eliminated a density gradient– leaving deer to forage in areas that were accessible rather than preferential. This research demonstrates the impact of large-scale disturbance on a keystone herbivorous species.
Keywords: Ecology, Odocoileus virginianus, Disturbance, Trail Camera, Understory Density, Keystone Species, Deer Occurrence, Foraging Habits

Evaluating sex difference in neurophysiological response to stimulus detection using an auditory oddball paradigm in mice

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Department of Psychology & Neuroscience, Temple University, Philadelphia, PA 19122, USA

There is evidence suggesting sex differences in deficits in pre-attentional processing and cognitive decline resistance. Studies suggest an enhancement in attentional processing in simple stimulus detection tasks with the use of nicotine. The neurophysiological mechanisms by which nicotine impacts sex differences in cognitive resistance is not fully understood. Investigating nicotine-evoked electrophysiological recordings can give rise to neurophysiological mechanisms of pre-attentional processing, which could be translated to human research on cognitive decline. The effect of nicotine in sex differences in rodent attentional processing can be studied through electroencephalography (EEG) studies and event-related potential (ERP) analysis to measure brain wave oscillations in the parietal (PC) and prefrontal cortices (PFC). To assess pre-attentional auditory responses, we conducted EEG studies and ERP analysis in awake male and female C57BL/6J mice performing a passive auditory oddball paradigm task consisting of 500 trials with normal auditory stimulus presented at 80dB and 2KHz frequency and a deviant stimulus at 80dB and 4KHz frequency with 20% probability. ERP components were analyzed from the PFC and PC following acute nicotine or saline injections. Mismatch negativity (MMN), a deviance detection measuring pre-attentive processing, was calculated to quantify changes in attention in response to the oddball paradigm. Sex-specific differences in ERP profiles reveal the magnitude of pre-attentional deficits is higher in males than females. Males had a positive percent change from saline to nicotine trials, while females had a negative percent change in MMN amplitude. The results suggest that nicotine had an impact on cognitive attentional processing in males but not females. This finding is consistent with human studies that report greater resilience to age-related cognitive decline in older women than men. The study supports the use of ERP components as endpoints in preclinical studies to assess the efficacy of psychotherapeutic interventions targeting attentional mechanisms in neurological disorders.
Keywords: Attentional processing, EEG, ERP, nicotinic intervention, sex differences

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HIV promotes A2aR-mediated AQP4 dysregulation in astrocytes and may contribute to accumulation of aberrant proteins in the brain

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Approximately 50% of people with HIV (PWH) suffer from HIV-associated neurocognitive disorder (HAND) resulting in decreased quality of life. Previous studies have demonstrated people with symptomatic HAND display increased level of AQP4 expression in brain homogenates from the mid-frontal gyrus compared to PWH with asymptomatic HAND. Additionally, past research has shown that dysfunction of AQP4 occurs through adenosine (A2aR) signaling that results in PKC-mediated inhibitory phosphorylation of AQP4. As a result, channel internalization, mislocalization, and lower levels of AQP4 expression occur. Ultimately, a gap in knowledge in whether changes in AQP4 contributes to HAND and cognitive impairment (CI) by decreasing clearance of toxic aberrant proteins, such as pTau and Aβ and whether HIV changes AQP4 via dysregulation of A2aR exists.
Post-mortem brain tissues from 10 HIV controls, 10 HIV positive individuals without CI, and 10 HIV positive individuals with CI with varying degrees of HAND were examined. IHC labeling of AQP4 and A2aR using formalin fixed paraffin embedded (FFPE) tissue sections from the frontal cortex, ventrolateral prefrontal cortex, and mid frontal gyrus was performed. qRT-PCR of RNA extracted from frozen brain tissues was used to analyze RNA levels of AQP4 and A2aR. Western analyses were performed to assess changes in protein expression of AQP4, A2aR, and downstream targets of A2aR signaling (PKC and aberrant proteins).
We have found that ATP levels are increased in the frontal cortex in PWH with the largest increase observed in PWH with CI. AQP4 and A2aR protein and RNA levels increase in PWH with worsening CI status. Frontal cortex tissue from PWH showed significant differences in astrogliosis with diffuse labeling of AQP4 in HIV with CI. IPSC astrocytes treated with R5 HIV-1 ADA demonstrated a significant increase in AQP4 and A2aR RNA levels. Ultimately, these results suggest that A2aR inhibition could be potential therapeutic target for PWH.
Keywords: HIV, A2aR, AQP4, HIV-associated neurocognitive disorder, astrocytes, cognitive impairment

Neuro-VISOR (Virtual Interactive Simulation Of Reality)

Shreya Shah, Gillian Queisser, Benjamin Seibold
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Neuro-VISOR (Virtual Interactive Simulation Of Reality) is a 3D virtual reality tool developed by Temple University's Center for Computational Mathematics and Modeling (C2M2) that explores applications in computational neuroscience. It allows users to select and arrange different neurons as well as connect them via synapses, check voltage at arbitrary points, and apply voltage clamps, all while seeing the effects of said changes modeled in real time. Although the system itself contains complex geometries obtained from the NeuroMorpho database, it does not precisely allow for the establishment of simple microcircuits or populations of neurons. The purpose of this study was to outline and test the process of implementing a basic microcircuit into the software in order to test and expand its capabilities. Simultaneously, a key goal was to identify and work on fixing any bugs or issues observed while using the VR or desktop versions of Neuro-VISOR, as this is a key element of software development and code maintenance and would be the segway into releasing a new version of the software. The goal of this particular research endeavor was to delve into the model outlined in *Gloveli et al (2005)* and find a way to somehow implement the simple microcircuit into the system. Through an in-depth literature review and comparison of computational models between the literature and the code, I was able to experimentally test out simple microcircuitry in Neuro-VISOR through slight modifications to the code as well as the use of manually-created simple geometries, taking into account the limitations of the software in comparison to the proposed circuit.

Tornado effects on Temperate Deciduous Forest Mortality: A Macro Report of the Temple Forest Observatory

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Temple Ambler Field Station, Temple University, Ambler, PA 19002; Department of Biology, College of Science and Technology, Temple University, Philadelphia, PA 19122, USA

Forest resilience refers to the speed into which an ecosystem may recover after a disturbance and reflects the functional integrity of the ecosystem and its adaptability to a range of stresses, which are important factors to understand ecosystem change. Following the EF-2 tornado that levelled the Temple Forest Observatory (TFO) in 2021, the Ambler Field Station has been leveraging this event as a unique opportunity to study forest resilience to novel large-scale climate-driven disturbances in Eastern Pennsylvania to examine forest resilience, we compared pre- and post- tornado forest stand. Composition of woody plants was obtained through ground censuses and stem survivors surveys conducted during Summers 2021 and 2022, where all living woody stems were tagged, measured, and identified. Using exploratory data analysis conducted in R, we provide a comprehensive macro-level report on TFO by analyzing data to examine rates of loss, predict potential forest regeneration trajectories, and identify patterns of species mortality. Deceased stems were obtained by concluding that whichever stem tags were present in the pre-storm census and absent in the post-storm census were likely lost due to storm damage. Our results show that lost was substantial throughout the 4-ha forest with a loss of approximately 3800 stems. Certain areas of the forest, however, displayed higher loss than others suggesting a spatial zonation and likely heterogenous response. Further, disturbance shifted dominance of species, and American beech and Spicebush were the most common species post-storm. Ongoing monitoring and reporting efforts are essential for developing an accurate assessment of forest resilience at TFO. This information will help us gain a deeper understanding of the long-term sustainability of forest ecosystems in the face of climate change.
Keywords: *Temple Forest Observatory, Marco Report, Forest Resilience, Climate Change*

Mushroom Colony Responses to Ecological Disturbance at Temple Forest Observatory

George Shewman, Mary Cortese, Dr. Marianna Bonfim, Dr. Amy Freestone
Temple Ambler Field Station, Department of Biology, College of Science and Technology, Temple University, Philadelphia, PA, 19122, USA

In September 2021, Temple Ambler's Forest Observatory (TFO) was struck by a Tornado – a large-scale ecological disturbance. As a result of this disturbance, there was an increase in dead organic material in the forest that requires decomposition. Since disturbances of this kind can lead to increases in mushroom diversity, this project assessed mushroom colony richness and abundance patterns one full growing season after the disturbance. We returned to quadrants with previously observed mushroom activity and recorded every distinct mushroom colony and individual in the area. Compared to previously recorded fungal data, there was an increase in the number of species found across quadrats. Additionally, the most observed species shifted from T. Versicolor to T. Hirsuta which may be due to an increase in fallen beech trees, T. Hirsuta's preferred host. When looking at patterns in growth form, species such as I. Lacteus and S. commune were commonly observed in overlapping colonies. An increase in mushroom species richness may be positively correlated to an increase in habitat space on available dead organic material. However, since both seasonality and disturbance can cause a shift in mushroom diversity, more research would be required to estimate their respective influences.
Keywords: Ecological disturbance, mushroom colonies, dead organic material, seasonality, species richness, species diversity, decomposition, forest recovery

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Arthropod Biodiversity in Philadelphia's Vacant Lots

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The biodiversity of arthropods is a crucial factor in the rate and effectiveness of ecosystem functions. Within cities, the lack of formal green space places even more importance on the biodiversity and richness of the populations within unconventional green spaces, like vacant lots. Vacant lot "greening" in Philadelphia is a city-run program that cleans up land by removing trash, grading the land, planting new grass and a small number of trees, as well as installing a low wooden perimeter fence. Our goal was to understand how the vacant lot greening affects the overall biodiversity of arthropods in the orders Hemiptera, Hymenoptera, Diptera, Coleoptera, and Aranea. To do so, we first asked how lot greening affects insect habitats. Next, we evaluated how lot greening affects taxonomic richness and abundance. Finally, we investigated whether response to greening varied across taxonomic groups. To answer these questions, we collected arthropods from 25 vacant lots (13 greened; 12 ungreened) using bug nets, stored them in freezer bags, and then sorted and counted them by hand to determine the abundance among taxonomic groups within each lot.

Through this research, we discovered that although lot greening has a major effect on the homogenization of arthropod habitats, response to greening varies widely among taxonomic groups. Some families appeared to thrive in greened lots while others declined massively, we also found that certain groups were equally abundant across greened and ungreened habitats.

Our results show that lot greening affects both habitats and insect abundance, however, there are certainly tradeoffs that make management challenging. While lot greening may improve neighborhood aesthetics and real estate prices, our results show that it may also have a detrimental effect on ecosystem health and services. Future research may reveal lot greening alternatives that reconcile biodiversity conservation with meeting social needs.
Key Words: Biodiversity, Ecology, Insects, Lot Greening, Management, Conservation, Habitats, Arthropods, Vegetation.

Identifying Genes Implicated in Hyperhomocysteinemia-Induced Alzheimer's Disease

Danni Sigler1, Xianwei Wang2, Lu Liu2, Hang Xi2, Jason Saredy2, Ramon Cueto2, Nathaniel W Snyder2, Wenhui Hu2,3, Xiaofeng Yang2,4, Hong Wang2

1Department of Biology, College of Science and Technology, Temple University;.2Center for Metabolic Disease Research, Department of Cardiovascular Science, Lewis Kats School of Medicine, Temple University; 3Department of Pathology and Laboratory Medicine, Temple University, Lewis Katz School of Medicine; 4Centers for Cardiovascular Research, Department of Cardiovascular Science, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

Introduction: Hyperhomocysteinemia (HHcy) has been linked to development of Alzheimer's disease (AD) neuropathologically characterized by the accumulation of amyloid β (Aβ) in the brain. Microglia (MG) play a crucial role in uptake of Aβ oligomers and fibrils and its dysfunction worsens AD. However, effect of HHcy on MG Aβ phagocytosis remains unstudied.

Methods: We isolated MG from the cerebrum of HHcy mice with genetic cystathionine-β-synthase deficiency (Cbs-/-) and performed bulk RNA-seq. HHcy MG transcriptome analysis identified HHcy-altered MG differentially expressed genes (DEG). In combination with comprehensive meta-analysis for publicly available AD MG transcriptome databases, we analyzed expression profile of phagocytosis-related genes in MG from HHcy mice, human AD and mouse AD models to to identify molecular targets for MG Aβ phagocytosis in human and mouse AD and in HHcy condition.

Results: HHcy and hypomethylation conditions were identified in Cbs-/- mice. Through Cbs-/- MG transcriptome analysis, 353 MG DEGs were identified. Phagosome formation and integrin signaling pathways were found suppressed in Cbs-/- MG. By analyzing MG transcriptomes from 4 AD patient and 7 mouse AD datasets, 409 human and 777 mouse AD MG DEGs were identified, in which 37 were found common in both species. These 37 common AD MG DEGs possess functions related with cell migration, phagocytosis, and alternative polarization. Through further combinatory analysis with transcriptome from MG Aβ phagocytosis model, we identified 130 functional-validated Aβ phagocytic AD MG DEGs (20 in human AD, 110 in mouse AD, and 9 overlapped in both species), which exhibited expression change in the same direction in AD MG reflecting a compensatory activation of Aβ phagocytosis. Interestingly, we identified 14 human Aβ phagocytic AD MG DEGs which exhibited reverse expression change in AD MG representing impaired MG Aβ phagocytosis in human AD. In addition, we identified 23 hypomethylated phagocytic AD MG genes possessing functions related with MG activation, phagocytosis, inflammation, and survival. Finally, through a cascade of meta-analysis of transcriptome of AD MG, functional phagocytosis, HHcy MG, and human AD brain methylome dataset, we identified 6 HHcy-suppressed phagocytic AD MG DEGs (Flt1, Hsp70, Calponin 3, Igf1, Cacna2d4, and Celsr) which were reported to regulate MG/MΦ migration and Aβ phagocytosis.

Conclusion and significance: The study established molecular signatures for a compensatory response of Aβ phagocytosis activation in human and mouse AD MG and impaired Aβ phagocytosis signature in human AD MG, suggesting Aβ phagocytosis activation and impairment process may consequentially take place during the development of AD. Hypomethylation may modulate HHcy-suppressed MG phagocytosis and impaired MG Aβ phagocytosis in AD. This will allow future drug research and development to counteract this suppression, neuroinflammation and depleted phagocytosis.

Impact of Novel Large-Scale Wind Disturbance on Bird Habitat Use

Danielle Smith, Colin Lynch, Dr. Mariana Bonfim, Dr. Amy Freestone
Temple Ambler Field Station, Temple University, Ambler, PA 19002; Department of Biology, College of Science and Technology, Temple University, Philadelphia, PA 19122, USA

Birds are commonly used as reliable indicators of ecosystem health due to their sensitivity to environmental changes and ease of detection. The Temple Forest Observatory, an old-growth forest, was struck by an EF-2 tornado on September 1, 2021, resulting in extensive destruction of the forest stand and shift in habitat structure. This novel disturbance could have profound and long-lasting effects on how birds utilize the forest for activities such as foraging, nesting, and mating, ultimately influencing their lifetime fitness and overall population dynamics. To examine whether an unprecedented large-scale disturbance may shift bird habitat use through time, we surveyed the avian community at the disturbed Temple Forest Observatory and the nearby undisturbed old-growth forest at Robbin's Park through summer, fall and spring post-disturbance. We recorded avian richness, abundance, and individual behavior on 30-m radius point-counts, later separated into trophic, foraging, and nesting guilds. Our results indicate that while species richness was higher at the disturbed forest, the undisturbed site had significantly higher detections of environmentally sensitive species. At the disturbed site, a greater number of birds displayed behavior correlated with lifetime fitness – foraging, territorial behavior, and courtship. While adaptable species were able to utilize the disturbed forest, our results suggest that further recovery may be needed for more enviornmentally0sensitive species to return. These findings contribute to our understanding of how large-scale disturbances can shape bird communities and provide insights into the ecological resilience of old-growth forests to such novel events.

Keywords: Avian diversity, disturbance ecology, avian behavior, birds, tornado, novel disturbance, forest recovery, resilience

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Influence of transportation networks and environmental conditions on Spotted lanternfly invasion

Ian Stonefield, Mariana Bonfim, Chris LeClair, Mark Swartz, Mathew Banks, Amy L. Freestone, Brent Sewall

The Spotted lanternfly (*Lycorma delicatula*, hereafter SLF) is a newly introduced invasive species to the United States, causing devastating economic and ecological impacts in infested regions. Its spread can be facilitated by unintentional transportation via road vehicles, along with other suitable environmental factors that could contribute to its establishment in invaded ranges. Using the transportation logs of an infested area that serves as central hub for military training, Fort Indiantown Gap (FTIG) National Guard Training Center, we assessed risk of invasion of SLF to other counties throughout North America. We hypothesized that more FTIG vehicle traffic in areas with suitable environmental conditions may increase invasion risk. Our preliminary results show that many convoy trips are going to already infested or quarantined areas during the mobile stages of the SLF life cycle (May - December). We further observed that most destinations are located in temperature ranges which fit the ideal conditions for SLF (10-15 ºC), serving as potential recipient regions for the invasive insect to thrive and with potential low environmental resistance. Overall, we observed that while risk of new introductions is lower, the FTIG network can contribute to sustain propagules pressure in already infested areas, making eradication cumbersome. Understanding these routes and pathways can substantially aid in containment of their invasion and provide insights in how road vehicles can serve as vectors of spotted lanternfly spread.

Key Words: Spotted Lantern Fly, SLF, Transportation Networks, Infestation, Invasive Species, Environmental Matching, Prediction Model

The role of Nogo-B in aortic aneurysms

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Aneurysms are the second most common disease affecting the aorta with no known cure and are defined as a permanent localized dilation minimum 1.5 times larger than the original size. The protein Nogo-B was shown to be highly expressed in both vascular smooth muscle cells (VSMC) and endothelial cells (EC) within vascular tissue and is known to regulate vascular remodeling and homeostasis. Here, we are investigating if Nogo-B plays a pathophysiological role in aortic aneurysms. To establish its relevance, we performed immunofluorescent staining of Nogo-B in healthy as well as aortic aneurysm and aortic dissection human samples. Our result showed a suggestive negative correlation of the Nogo-B expression in aortic VSMCs, especially in aortic dissection. We developed a mouse model for aneurysms by using Apolipoprotein E deficient (ApoE-/-) mice and infusing Angiotensin II (Ang II) at a rate of 1 ug/kg/min for 4 weeks. Based on echo imaging, after Ang II infusion, the gross diameter of the aorta increased. We determined the protein expression of Nogo-B and smooth muscle cell contractile protein, smooth muscle α-actin (SMA), across the vascular wall area as well as Nogo-B expression within the endothelium. Mice infused with Ang II showed a significant decrease in both Nogo-B expression and SMA expression within the vascular walls. Nogo-B expression was nonsignficantly shown to decrease within endothelial cells. To further investigate Nogo-B within aneurysm formation, we established a genetic Nogo deficiency (Nogo-/-) on an ApoE-/- background (ApoE-/- Nogo-/-) mouse model. We infused Ang II into 8-week-old male ApoE-/- Nogo-/- and ApoE-/- mice. Our results showed that loss of Nogo-B reduced the survival rate and increased both the rate of aneurysmal formation and gross aortic diameter. Taken together, our study suggests that Nogo-B expression is negatively correlated with aneurysm development and exhibits a protective role against aortic aneurysms.
Keywords: Nogo-B, aneurysm, aorta, smooth muscle cells, angiotensin II

Interspecific Differences in Bats Affected by White-Nose Syndrome

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White-nose syndrome (WNS) is an emerging infectious disease of hibernating bats that is caused by the invasive fungus *Pseudogymnoascus destructans* (*Pd*). The fungus grows within the skin of the wing membranes, nose, and ears of bats, causing lesions, physiological disruptions, and even death. Some populations of bats are more susceptible than others; two prominent species that have suffered massive declines are the little brown bat (*Myotis lucifugus*) and the tricolored bat (*Perimyotis subflavus*). The big brown bat (*Eptesicus fuscus*), however, is not as severely affected by WNS, as they appear to have lower fungal loads and mortality rates. Interspecific differences in infection rates have not been thoroughly explored though, and the visual patterns of infection on the wings have yet to be qualitatively assessed. Therefore, we aimed to compare infection rates and visual patterns of wing lesions across *M. lucifugus*, *P. subflavus*, and *E. fuscus* to better understand why some species are more vulnerable to WNS than others. To accomplish this, we analyzed 85 photos of bat wings from our three species of interest taken in 2021 and 2022 at Ohio hibernation sites, using ultraviolet fluorescence to detect lesions. *M. lucifugus* had the highest average infection level, with *P. subflavus* and *E. fuscus* having significantly lower infection. The qualitative assessment of wings showed that *P. subflavus* had a unique spatial distribution of lesions, and bats with higher infection levels had more clusters with larger lesions. Ultimately, the three species of bats found at these sites exhibit unique responses to *Pd*, which suggests that there may be physiological or behavioral differences that underlie their varying susceptibilities to WNS.
Keywords: Myotis lucifugus, Perimyotis subflavus, Eptesicus fuscus, white-nose syndrome

Attenuating Opioid Withdrawal Associated Pain Using Cannabinoids

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Center for Substance Abuse Research, Department of Pharmacology, Lewis Katz School of Medicine, Temple University, Philadelphia, PA 19140, USA.

Opioids are effective analgesics that are often used for the management of acute and chronic pain. Precipitated withdrawal can occur when an individual who is physiologically dependent on opioids, is administered an opioid antagonist, such as naloxone, a medication used to prevent fatal respiratory depression due to overdose. Precipitated withdrawal is intensely painful, and management of the associated symptoms is an essential aspect of providing care for someone who is experiencing withdrawal. This study aims to investigate the potential of using cannabinoids, including delta-9 tetrahydrocannabinol (THC), cannabidiol (CBD), novel CBD analog KLS-13019, beta-caryophyllene (BCP), and cannabigerol (CBG) to mitigate symptoms associated with precipitated opioid withdrawal. It was found that mice treated with 10 mg/kg THC had a significant reduction in jumping and mice treated with 10 mg/kg KLS-13019 had an almost significant reduction in jumping. This indicates that cannabinoids can be effectively used to mitigate the painful symptoms associated with precipitated opioid withdrawal.

AAV-mediated Gene Expression in Oligodendrocytes with Improved Cell Specificity

Nathan Zubin1, Julia Coakley2, and Shin H. Kang2
1Department of Biology, College of Science and Technology, Temple University, Philadelphia, PA, 19122, USA; 2Department of Neural Sciences, Lewis Katz School of Medicine at Temple University, Philadelphia, PA, 19140, USA

In neuroscience research, recombinant adeno-associated virus (AAV) vectors have been successfully utilized for targeting and delivering transgenes into neurons and astrocytes. However, most available AAV serotypes have poor tropism for oligodendrocytes, the myelinating glia in the central nervous system (CNS), limiting their use in studies of underlying molecular mechanisms of myelination and demyelination in health and disease. Although a new AAV capsid protein (named Olig001) was recently developed for a better tropism for oligodendrocytes, transgenes were often delivered to neurons as well. In this project, we developed an approach to improve oligodendrocyte-specific expression in AAV-mediated gene transduction. We employed the Cre-dependent flip-excision (FLEx) system by placing double pairs of loxP variants flanking a transgene in AAV constructs. With the Olig001, an AAV vector was generated for the nuclear mCherry expression and injected into various brain regions of two lines of oligodendrocyte-specific Cre mice (4-6 months of age, unbiased gender, n ≥ 3). The mCherry expression was significantly improved in the oligodendrocyte-specificity, especially in tamoxifen-administered MOBP-iCreER. We generated another AAV vector for diphtheria toxin (DTa) expression to induce acute oligodendrocyte ablation in a specific brain region as a model of focal demyelination. After the Olig001/AAV-FLEX-DTa was injected into the hippocampus of MOBP-iCreER mice (4-6 months of age, unbiased gender, n ≥ 3), most oligodendrocytes in this region were abated without apparent losses of neurons or astrocytes. Therefore, our developed AAV system demonstrated highly improved oligodendrocyte-targeted cell specificity and efficiency and will serve as a powerful tool for oligodendrocyte-specific, focal *in vivo* gene manipulations.
Keywords: oligodendrocytes, adeno-associated viruses (AAVs), Cre-loxP

SESSION I: 10AM-12PM

Posters 1 - 15

P1 Salma Mami *Cellular and Molecular Neuroscience*
Morphometric Analyses of Microglial Changes in a Mouse Model of Alzheimer's Disease with Oligodendrocyte-Specific IL-33 Conditional Knockout

P2 Danni Sigler *Cellular and Molecular Neuroscience*
Identifying Genes Implicated in Hyperhomocysteinemia-Induced Alzheimer's Disease

P3 Matthew Calderone *Cellular and Molecular Neuroscience*
The alternative pre-mRNA splicing contribution of alpha-synuclein to Parkinson's Disease

P4 Nathan Zubin *Cellular and Molecular Neuroscience*
AAV-mediated Gene Expression in Oligodendrocytes with Improved Cell Specificity

P5 Olivia Rojek *Cellular and Molecular Neuroscience*
HIV promotes A2aR-mediated AQP4 dysregulation in astrocytes and may contribute to accumulation of aberrant proteins in the brain

P6 Safah Majid *Cellular and Molecular Neuroscience*
Fentanyl Enhances HIV Infection in Microglia and Macrophages

P7 Rachel Winter *Cellular and Molecular Neuroscience*
Attenuating Opioid Withdrawal Associated Pain Using Cannabinoids

P8 Laila Heydari *Cellular and Molecular Neuroscience*
Mitragynine Reduces Anxiety and Chemotherapy-Induced Peripheral Neuropathic Pain through CB1 and CB2 Mechanisms in Mice

P9 Memunat Abiru *Cellular and Molecular Neuroscience*
Multi Chemokine Antagonist RAP 103 Inhibits Anxiogenic Expression of Methamphetamine in Planarians Displaying Withdrawal-like Behaviors

P10 Sarah Nice *Cellular and Molecular Neuroscience*
Identification of AAV2 transfection in large diameter motor neurons through IB4 staining

P11 Angelina Makhoul *Cellular and Molecular Neuroscience*
Investigating the Role of TMEM65 In Mitochondrial Calcium Efflux

P12 Kena Patel *Cellular and Molecular Neuroscience*
Evaluating sex difference in neurophysiological response to stimulus detection using an auditory oddball paradigm in mice

P13 Emilie Lee *Cellular and Molecular Neuroscience*
Psychophysical Studies of the Oral Trigeminal Stimulus Piperine

P14 Jeane Gama-Wilson *Biology*
Psychophysical Studies of Long-Chain Fatty Alcohols as Drug Delivery Vehicles in Edible Film Formulations

P15 Trent Tighelaar *Biology*
The role of Nogo-B in aortic aneurysms

SESSION II: 1PM-3PM

Posters 16 - 30

P16 Zoe Davis-Luizer *Biology*
The impact of cigarette smoke and ethanol co-exposure on mice

P17 Nala Hamilton *Biology*
Do genes that escape the inactivated X-chromosome in females play a role in sex disparities in disease?

P18 Nathan Duda *Genomic Medicine*
Duplicated genes and the evolution of functional diversity in Drosophila

P19 Shreya Shah *Cellular and Molecular Neuroscience*
Neuro-Visor

P20 Aurelio Aquila *Biology*
A Machine Learning-based Approach for Unsupervised Classification of Proteins using Hamming Distance and Clustering Techniques

P21 Jordan Howe *Biochemistry*
Benchmarking Computational Methods for Absorption of 4-Substituted Indole

P22 Faisal Shaikh *Data Science*
Tornado effects on Temperate Deciduous Forest Mortality: A Macro Report of the Temple Forest Observatory

P23 Brendan O' Neal *Ecology, Evolution, Biodiversity*
White-tailed Deer Activity in a Disturbed Forest Understory

P24 George Shewman *Environmental Science*
Mushroom Colony Responses to Ecological Disturbance at Temple Forest Observatory

P25 Zaina Archer *Biology*
Removal of Understory Vegetation: Impact on Temporal Animal Activity in Morris Park

P26 Colin Lynch *Biology*
Impact of Seasonality on Avian Biodiversity in Disturbed Old-Growth Forest

P27 Shira Novkov-Bloom *Ecology, Evolution, Biodiversity*
Effect of White-Nose Syndrome on Proportion of Cold Arousals and Disturbance-Driven Cold Arousals

P28 Laura Walker *Biology*
Interspecific Differences in Bats Affected by White-Nose Syndrome

P29 Ben Silbar *Ecology, Evolution, Biodiversity*
Arthropod Biodiversity in Philadelphia's Vacant Lots

P30 Ian Stonefield *Ecology, Evolution, Biodiversity*
Influence of transportation networks and environmental conditions on Spotted lanternfly invasion

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DISTINCTION IN MAJOR

CELLULAR & MOLECULAR NEUROSCIENCE

Memunat D. Abiru

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Sarah Nice

Kena Patel

Olivia Rojek

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Rachel Winter

Nathan Zubin

BIOLOGY

Aurelio Aquila

Zaina Archer

Zoe Marie Davis-Luizer

Trent Tighelaar

Laura Walker

ECOLOGY, EVOLUTION & BIODIVERSITY

Ben Silbar

GOLDWATER SCHOLARS

The Goldwater Scholarship is the premiere merit-based research scholarship for sophomores and juniors in STEM

Nala Hamilton

Biology junior and first-generation student, Nala Hamilton, has been awarded the 2023 Goldwater Scholarship. Her work in Dr. Rob Kulathinal's lab in the Biology Department focuses on computational genetics, specifically sex disparities in cancer. This work previously awarded her with the Velay and Smith scholarships. Beyond her many academic accolades, she also founded the Sci-Design club at Temple.

Leah Deflitch

In 2020, Leah Deflitch was the first woman from Temple University to be awarded the Goldwater Scholarship. Leah graduated from Cellular and Molecular Neuroscience in 2021, where she worked on Neuroimmunology in Dr. Susan Patterson's Lab in the Biology Department. She is currently doing research on epilepsy in the Goldberg Lsb at the Children's Hospital of Philadelphia (CHOP).

Read more about Biology's Goldwater Scholars here:

Nala Hamilton Leah Deflitch

FEATURED STUDENT SOCIETIES

Student Clubs and Societies Dedicated to Biology

American Physician Scientists Assocation

Undergraduate Neuroscience Society

Biology Society

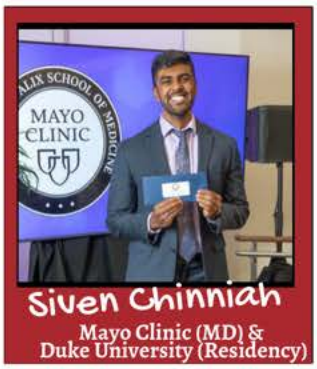
Grey Matters Journal

Health-Link Society

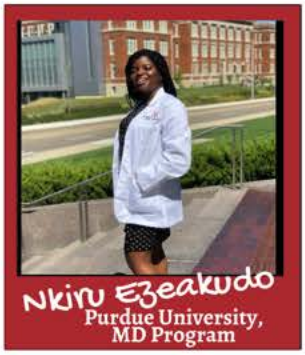
WHERE ARE THEY NOW?

Recent biology graduates have joined prestigious research and medical programs

Micaelly Alves
Temple University, Biomedical PhD



Siven Chinniah
Mayo Clinic (MD) & Duke University (Residency)



Nkiru Ezeakudo
Purdue University, MD Program

Daniel Farkas
Temple University, Biomedical PhD

Sean Hayduk
Temple University, Biomedical PhD

Saouleak Khim
University of Maryland - Baltimore, PhD Program

Ashini Patel
Temple University, Biomedical PhD

Areebah Rahman
Brown University, PhD Program

Nikita Sajeev
Washington University MD Program

Nikkita Salla
Yale University, PhD Program

Samantha Shallop
Cornell University, PhD Program

Gianna Vitelli
Emory University, Neuroscience PHD

RESEARCH ADVISORS

Thank you to all the mentors for their training and support

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