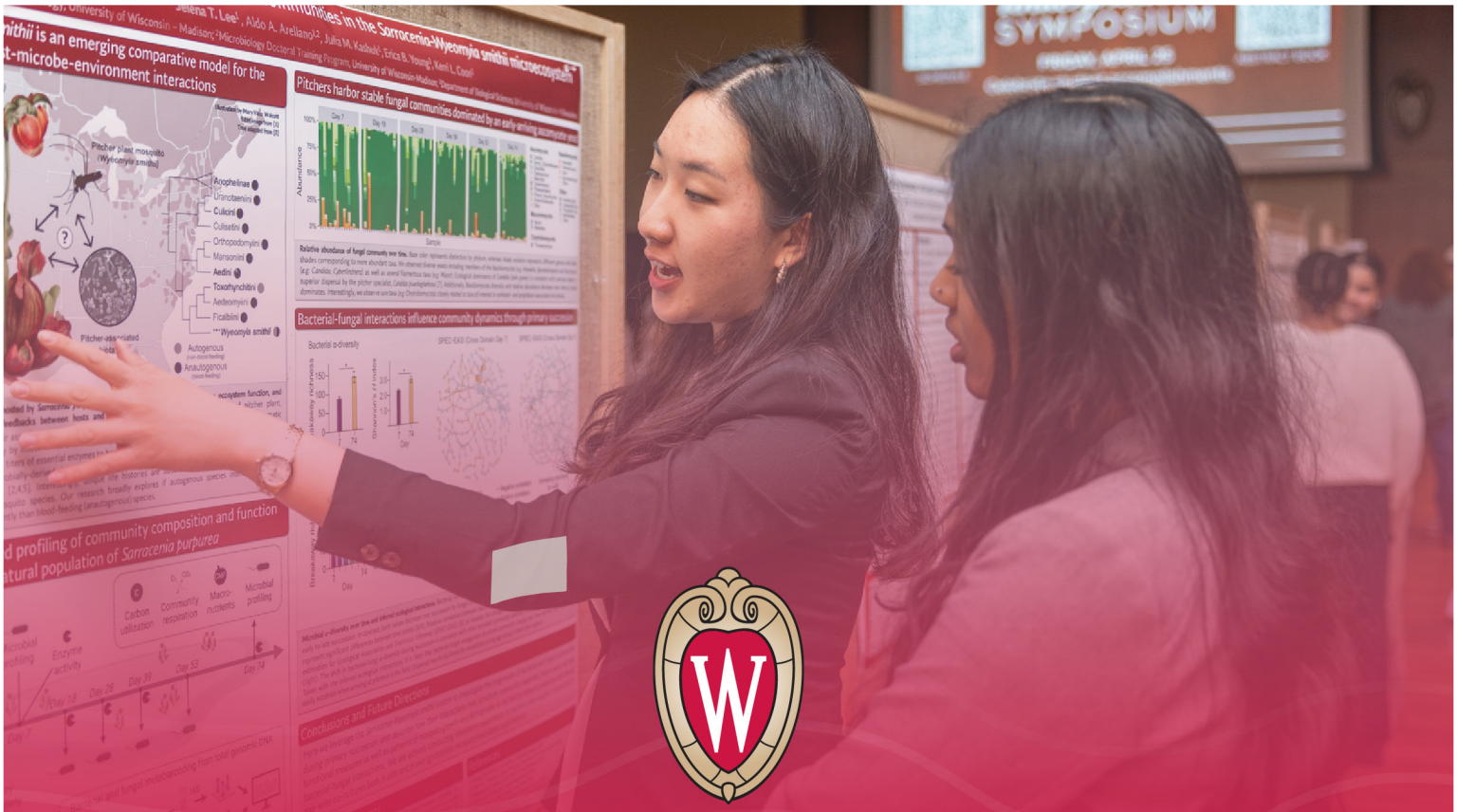

Undergraduate SYMPOSIUM

2026 ABSTRACT BOOK

Celebrating research,
creative endeavors,
and service-learning

ugradsymposium.wisc.edu

We are very pleased you are joining us for the 28th annual Undergraduate Symposium at the University of Wisconsin–Madison. Our university proudly honors its multifaceted mission of leading edge knowledge discovery and quality undergraduate education. The two meet in the Undergraduate Symposium. Our 28th year is an extraordinary milestone demonstrating our steadfast commitment to the Wisconsin Experience where students display their relentless curiosity, intellectual confidence, empathy and humility, and purposeful action.

Janet Branchaw, Interim Vice Provost for Teaching and Learning
University of Wisconsin–Madison

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Special thanks to all Undergraduate Symposium moderators, volunteers, and awards judges.

Cover photo by Sirtaj Grewal/SMPH Media Solutions

CONGRATULATIONS 2026 MENTORING AWARD WINNERS

Jacee Cho, Associate Professor, English

Jacee Cho is an associate professor in English and the founding director of the Second Language Acquisition Lab (SLAB), established in 2015. Her research focuses on bilingualism and multilingualism from linguistic and psycholinguistic perspectives. She describes her approach to mentoring as a scaffolded one, ensuring that her mentees progressively build their critical thinking and research skills through carefully thought-out and tailored engagement with her mentees' growth.

Brendan Eagan, Scientist, Wisconsin Center for Education Research

Brendan Eagan's goal is to support students in defining and maintaining high standards for their professional practice. Through a distributed mentorship model, he builds a reflective community rooted in care and mutual support. To sustain this, his undergraduates engage in deep training in leadership and management, empowering them to serve effectively as peer mentors for their colleagues and establish a solid foundation for their future careers.

Aditi Gargeshwari, Research Associate, Waisman Center

Aditi Gargeshwari is a researcher in auditory neuroscience and clinical audiology, and she is passionate about mentoring undergraduates through supportive, hands-on learning. She emphasizes individualized mentorship, blending structured guidance with open-ended exploration so each student can develop their own voice, connect their interests to meaningful questions, and grow with confidence and purpose. Her approach focuses on meeting students where they are while helping them build independence and a deeper understanding of the "why" behind their work.

Alexey Glukhov, Associate Professor, Medicine

Alexey Glukhov earned his PhD from the Moscow Institute of Physics and Technology and completed postdoctoral training at Washington University in St. Louis, The Ohio State University, and Imperial College London before joining UW–Madison in 2015. He is a dedicated and inclusive mentor who has guided more than 40 undergraduate students through sustained, hands-on research experiences over the past 11 years, with trainees contributing to 22 peer-reviewed publications, over 50 conference presentations, and earning competitive fellowships (Hilldale-Holstrom, Goldwater, American Heart Association). His mentoring philosophy is intentional, mentee-centered, and adaptive, emphasizing individualized research projects, clearly defined roles, and evolving professional development within a supportive environment that fosters creativity, resilience, and intellectual ownership.

Valerie Hammer, Graduate Student, Curriculum & Instruction

Valerie Hammer is a doctoral candidate in Curriculum and Instruction who mentors preservice teachers in the Elementary Education Program. Her mentoring philosophy is rooted in compassion, humility, and curiosity. She is passionate about collaboratively exploring the art of teaching with mentees, cooperating teachers, and community partners, and finds deep fulfillment in supporting preservice teachers as they discover their unique paths to flourishing in the profession.

Shamya Karumbaiah, Assistant Professor, Educational Psychology

Shamya Karumbaiah is an assistant professor in the Department of Educational Psychology, where she directs The Responsible AI for Learning (TRAIL) Lab. As a mentor, she brings her training in learning sciences to foster an inclusive and equitable learning environment that values all voices. She works one-on-one with her mentees and tailors her mentoring strategies to support them in becoming independent researchers. Together, they have co-authored fifteen stringently-reviewed articles.

Seth McGee, Lab Instructor, Biocore

As an instructor in UW's Biocore Program, Seth McGee facilitates undergraduate honors biology through a hands-on, inquiry-based approach that emphasizes curiosity and authentic scientific questioning. Seth leads internships at UW's Biocore Prairie, a living laboratory in the Lakeshore Nature Preserve that has become a national model for teaching the process of science through the lens of ecology. He founded the UW Bat Brigade, engaging students in bat research on campus, and the Biocore Adventure Club, a program dedicated to fostering community-building outside the classroom. His mission in mentoring undergraduates is to inspire a love of science through curiosity and wonder.

Caglar Uyanik, Assistant Professor, Mathematics

Caglar Uyanik is an assistant professor of mathematics, and the founder and director of the Madison Experimental Mathematics Lab (MXM), which has provided a robust research experience in mathematics for more than three hundred UW undergraduates so far. The MXM creates a synergistic experience involving all stages of academia: the undergraduates' research reinforces their coursework; graduate students' research blends with mentoring; and faculty foster a deeper connection between research and teaching. He has personally advised more than 25 undergraduates in various settings such as REUs, semester-long research projects, and senior theses, and he is excited to continue to train the next generation of mathematicians.

Joseph Walston, Graduate Student, Botany

Joseph Walston is a third year PhD candidate in the Department of Botany studying the evolution and diversity of carnivorous plants commonly known as pitcher plants, and he runs an undergraduate mentoring program aptly named the "PitcherPals." Joseph emphasizes long-term development of his mentees, often taking on students early in their college career, and is excited by showing students the behind-the-scenes processes in science, helping to make it more accessible. He mentors students from different majors in multiple colleges on campus, meeting them where they are in their botanical education and working to adjust their research experience to suit their professional plant-related goals.

Ziyen Wu, Graduate Student, Civil & Environmental Engineering

Ziyen Wu is a PhD student in the Department of Civil and Environmental Engineering. Her mentoring philosophy is treating each of her mentees as a whole human being and meeting each mentee where they are. What excites her about mentoring undergraduate students at UW-Madison is seeing the sparkling eyes when they do something that excites them in the lab or in the project, and seeing them grow along the way.

2026 UNDERGRADUATE SYMPOSIUM ABSTRACTS

DUPLICATION OF CIS-REGULATORY ELEMENT 3 IN THE GATA2 REGULATORY REGION CAUSES IMPAIRED FACIAL MOVEMENT

Liv Abegglen
Mentor(s): Bryn Webb
Additional Author(s): Lauren Onigkeit

Hereditary congenital facial paresis type 1 (HCFP1) is a rare disorder characterized by congenital facial weakness and the inability to smile. HCFP1 is caused by noncoding variants at the chromosome 3 locus that alter cis-regulatory elements controlling GATA2 expression. Increased GATA2 activity, resulting from duplication of enhancer elements (cRE1 or cRE3) or disruption of a nearby silencer (cRE2), leads to facial branchial motor neuron (FBMN) maldevelopment and impaired facial nerve function. We previously demonstrated that mice carrying a duplication of cRE1 (cRE1dup/+) exhibit abnormal facial nerve development and reduced whisker movement. In this study, we show that mice with duplication of cRE3 (cRE3dup/+) similarly demonstrate significantly decreased whisker movement compared to wildtype controls, with a phenotype comparable to cRE1dup/+ mice. These findings further support the role of dysregulated GATA2 expression in HCFP1 and highlight the critical contribution of noncoding regulatory elements to human Mendelian disease.

HMF AND COLOR REMOVAL FROM DAIRY SUGAR HYDROLYSATE

Ornella Adanhou
Mentor(s): Wenjia Wang

Wisconsin produced 25.2% of U.S. cheese in 2024, generating large whey coproduct streams. Mineral-acid-catalyzed lactose hydrolysis produces a glucose-galactose syrup (GGS) but also forms impurities, including 5-hydroxymethylfurfural (HMF) and colored humins. This project evaluates activated carbon (AC) polishing of hydrolysate generated in UW-Madison Babcock Hall pilot operations to reduce HMF and color while limiting sugar loss. In batch contact tests, hydrolysate was treated with AC and analyzed by High-Performance Liquid Chromatography (HPLC) for lactose, glucose, galactose, and HMF. AC achieved up to 99.5% HMF removal with measurable but small sugar co-adsorption. An AC dose near 0.5 wt% per mass of total sugars balanced impurity removal and carbon usage. Data will support isotherms and polishing-step design.

EVALUATING THE PREDICT V3.0 PROGNOSTIC MODEL FOR MALE BREAST CANCER IN THE UNITED STATES

Manal Aditi
Mentor(s): Pei-Chen Peng, Yi-Wen Hsiao
Additional Author(s): Paul D.P. Pharoah

Male breast cancer is rare and underrepresented, limiting treatment guidelines and resulting in a lack of prognostication tools. We validated PREDICT Breast v3 in 2,685 U.S. male patients with primary breast cancer (SEER, 2000–2018; >10 years follow-up). Compared to women, men were diagnosed later—median age 66, six years older—with more advanced disease and higher mortality. PREDICT v3 showed good discrimination for breast cancer-specific survival (AUC 0.69 for ER-positive and 0.71 for ER-negative). Calibration was acceptable, with overprediction of breast cancer deaths by 15.6% (ER-positive) and 4.5% (ER-negative). This is the first contemporary U.S. validation of PREDICT v3 in men. Refining the model with male-specific data may enhance prognostic accuracy and inform improved treatment guidelines for male breast cancer.

RELATIONSHIP BETWEEN INJURY CHARACTERISTICS AND EARLY NEUROLOGIC FUNCTION IN INFANTS WITH PERINATAL BRAIN INJURY

Samuel Afah Annah, Hannah Gotelaere
Mentor(s): Bernadette Gillick, Kellie Collins
Additional Author(s): Cameron Casey

Perinatal brain injury can affect early brain development and increase the risk of long-term motor impairment. This study examined whether the type and location of brain injury are linked to early neurologic function in preterm infants. Twenty-three infants with confirmed brain injury were evaluated at three to six months corrected age using a standardized neurologic exam. Overall motor scores and differences between the left and right side of the body were compared across injury types. Infants with white matter injury near the brain's ventricles had significantly lower overall scores than those with other injury types. Injury affecting both sides of the brain showed a trend towards poorer outcomes. These findings suggest that specific injuries may help identify infants at higher risk for later motor difficulties.

CHEMICAL ECOLOGY OF *MONARDA FISTULOSA* IN REMNANT PRAIRIES AT THE UNIVERSITY OF WISCONSIN-MADISON ARBORETUM

Madeleine Afonso
Mentor(s): Linden Taylor, Ken Keefover-Ring
Additional Author(s): Ken Keefover-Ring

Plants produce myriad organic compounds to defend against herbivory, attract pollinators, and repel pathogens. The quantity and diversity of these compounds can vary within species and across ecological gradients. *Monarda fistulosa* L. (bee balm, wild bergamot), demonstrates a high variety of chemical diversity. A specimen typically displays a specific chemical phenotype, or chemotype, which could be one of several including carvacrol, thymol, linalool, geraniol, eucalyptol, and α-terpineol. *M. fistulosa* chemical diversity was analyzed in a comparison between both remnant and restored and dry-mesic and wet-mesic prairies at the UW-Madison Arboretum. Rarer chemotypes were identified in the wet-mesic prairie type, and there was not a significant difference in chemical levels between prairie site histories and types. This shows that *M. fistulosa* potentially maintains its internal chemistry over time and across diverse sites.

CUTTING CORNERS: BIOMETRIC FUZZY EXTRACTORS USING OFFSET-STACKED LATTICES

Ansh Aggarwal
Mentor(s): Rahul Chatterjee

Biometric fuzzy extractors (BFEs) enable secure authentication without storing raw biometric data. Recent advancement in machine learning algorithms enable embedding biometric data onto real-valued vectors that allow using lattice-based FEs to build modality-agnostic BFEs. However, these approaches typically underperform compared to Euclidean matching, even with complex lattices. This gap arises because, in high-dimensional spaces, lattice regions poorly approximate the decision boundaries of Euclidean classifiers. We address this limitation with an offset-stacked lattice framework, which replaces a single complex lattice with multiple simple lattices that are offset from one another. We further introduce Dyson stacking, which positions many small lattices near a hypersphere's surface, yielding substantially better volumetric alignment with hyperspherical decision regions. Experiments on large face and voice datasets show performance compareable to traditional classifiers.

CHARACTERIZING AND MITIGATING LASER PHASE NOISE FOR NEUTRAL ATOM QUANTUM PROCESSORS

Ruben Aguilo Schuurs
Mentor(s): Mark Saffman

A leading quantum computing approach involves optically trapping individual neutral atoms. The fidelity of quantum gates on atomic qubits, driven by laser beams, is in part limited by laser noise, as quantum gates require narrow, stable laser frequency and amplitude. A standard technique to stabilize laser frequency is Pound-Drever-Hall (PDH), but it leads to phase noise (servo bumps) in the few MHz range. A promising technique to mitigate phase noise is to complement the PDH locking mechanism with a feedforward loop. We present progress towards implementing feedforward and analyze the servo bump's predicted impact on gate fidelity. Successfully reducing phase noise will enable higher fidelity gate operations that are important for utility-scale quantum advantage.

VALIDATION OF LOWEST PERTURBATION

Katherine Ahlquist, Ashmita Bhowmik
Mentor(s): Jack J. Jiang
Additional Author(s): Kelly Shih, Jakob Holm, Owen Wischhoff

These findings demonstrate that normophonic individuals can intentionally increase vocal perturbation while maintaining a stable lowest-perturbation baseline. CPP, NEDR, and VTCP collectively captured progressive degradation in phonatory stability, supporting their complementary utility in multidimensional voice assessment and the establishment of individualized acoustic baselines. Background: Cepstral peak prominence (CPP), nonlinear energy difference ratio (NEDR), and voice type component profile (VTCP) are effective acoustic measures of voice quality. However, their behavior during intentionally degraded phonation in normophonic individuals remains unclear. This study examined whether the lowest perturbation state remains stable despite voluntary phonatory degradation. Methods: Thirty-three normophonic adults (15 male, 18 female) sustained /a/ under normal, breathy, and distorted conditions at controlled sound pressure levels. CPP, NEDR, and VTCP were extracted and analyzed using mixed-design ANOVA. Results: Phonation significantly affected CPP ($p < 0.001$), with normal phonation showing higher CPP than breathy and distorted conditions. NEDR and VTCP demonstrated parallel trends, with increasing aperiodicity as phonation degraded. No sex effects were observed. Conclusion: Preliminary findings indicate perturbation worsens systematically with degraded phonation, while the lowest-perturbation baseline remains stable within individuals.

HOW COMMUNICATION STRUCTURE AFFECTS STARTUP PIVOTS

Shiloh Ajiginni, Jose Godoy
Mentor(s): Stav Atir
Additional Author(s): Chang Liu

Startups often pivot and readjust in response to feedback and uncertainty. While research has examined how teams learn from feedback, less is known about how a startup's internal structure shapes these pivots. This project tests whether flat teams, where members can communicate freely, differ from hierarchical teams, where information flow is defined by roles, in how they adapt. We examine whether flatter structures enable faster and more substantial pivots but influence decision quality differently. Utilizing a pre registered, randomized experimental design, teams of four complete a web-based vehicle design simulation and repeatedly redesign a product based on performance feedback. We measure how quickly teams pivot, how extensively they change designs, and design performance to provide insight into how communication structure shapes adaptation under uncertainty.

FROM VOICE TO VISIBILITY: MAPPING IMMIGRANT SELF-DISCLOSURE ACROSS PLATFORMS

Mai Alessaly, Jake Leismer
Mentor(s): Dhavan Shah

Our study examines which types of events cause immigrants to “self-disclose” their immigration status on X and Reddit and this discourse’s polarity. Building on research showing high-profile events affect how immigrants view the risk of self-disclosure, we use large language models, verified by human coders, to compile a timeline of all major U.S. immigration-related events between June 2024 and January 2026. These events are measured against daily self-disclosure volumes collected from X and Reddit. Associated spikes and troughs demonstrate how events promote visible immigrant identities online and how others choose to respond to this openness. By analyzing how distinct information environments influence when people open their identities to affirmation or attack, this project supports scholarship about political communication and immigrants’ role in America.

DEVELOPING AN ELECTROCHEMICAL CELL FOR GROUNDWATER CONTAMINATION REMOVAL AND AMMONIA FUEL PRODUCTION

Tiana Alfsen, Lola Alshihri
Mentor(s): Ziyan Wu

Groundwater nitrate contamination has intensified alongside rising fertilizer use, posing risks to both ecosystems and human health. Electrochemical reduction of nitrate to ammonia offers a promising approach to removing nitrate from contaminated water while producing ammonia, a valuable fuel and fertilizer feedstock. This project aims to utilize electrochemistry to remove nitrate while recovering ammonia from contaminated groundwater. Various conditions of applied voltage, electrode material, and reaction duration will be tested to investigate the performance of the electrochemical setup. A copper-based electrode is selected to facilitate the reduction from nitrate to ammonia. Experiments use controlled nitrate solutions analyzed via high-performance liquid chromatography to quantify ammonia yield, nitrite intermediates, and nitrate removal. Results will inform the feasibility of deploying electrochemical treatment for groundwater decontamination and ammonia recovery.

IN VITRO T6SS-MEDIATED KILLING BY *ACINETOBACTER SOLI* DOES NOT TRANSLATE TO ENHANCED MOSQUITO GUT COLONIZATION

Yasmin Ali
Mentor(s): Kerri Coon
Additional Author(s): Holly Nichols

Mosquitoes transmit pathogens that cause substantial global morbidity and mortality. As insecticide resistance and ecological concerns limit traditional control methods, microbial-based strategies have gained attention. Because introduced bacteria must compete with the native mosquito gut microbiome, understanding interbacterial interactions is essential. We investigated the role of the Type VI Secretion System (T6SS) in bacterial competition and colonization using *Acinetobacter soli*, a T6SS-encoding bacterium. In vitro assays showed T6SS-dependent killing of mosquito-derived *Acinetobacter pittii*. However, mosquito colonization assays revealed no enhanced colonization or in vivo killing, indicating that T6SS-mediated antagonism observed in vitro does not translate to the gut environment. These findings underscore the importance of studying microbial interactions in realistic host contexts to guide the development of effective microbe-based mosquito control strategies.

UNDERSTANDING HUMAN-MACHINE INTERACTION IN REMOTE DRIVING OF LEVEL 4 DRIVING AUTOMATION

Sabrin Ali, Lenny Wang
Mentor(s): Tony Mcdonald, Mateo Ma

Fully automated driving has proven more challenging than expected. As a result, remote driving may play an important role in compensating for current limitations in vehicle automation. However, communication latency remains a critical challenge that can affect driving safety and performance. This study investigates how latency influences driving behavior, including longitudinal and lateral control, as well as safety-related metrics such as time-to-collision. Using a driving simulator, the study introduces uplink and downlink latency to replicate challenges faced by remote drivers in safety-critical scenarios. Driving performance data will be collected alongside human factors measures, including workload, situation awareness, and trust. The goal is to understand how latency affects driver control stability and perceived system reliability and inform system design for safe and reliable remote driving operations.

SHARED TIME, SHARED TENSION? MATERNAL PERSPECTIVES ON CONFLICT AND RELATIONSHIP QUALITY IN SHARED PARENTING FAMILIES

Jordyn Allen, Amber Herzberg
Mentor(s): Quentin Riser

Coparenting arrangements are increasingly promoted in post-divorce policy to support children's relationships with both parents, yet less is known about day-to-day coparenting dynamics. Grounded in family systems theory, this study examines whether coparenting is associated with domain-specific conflict and overall interparental relationship quality. Surveyed data from 793 divorced mothers in Wisconsin, we applied inverse probability weighting to address selection into shared versus sole mother placement. Results show that coparenting is associated with higher likelihood of conflict around parenting decisions, schooling, and COVID-19 precautions, but not health care, time sharing, or finances. At the same time, mothers in shared arrangements reported better overall coparenting relationship quality. These findings suggest coparenting may intensify task-specific conflict while supporting stronger global rapport, highlighting the need for targeted coparenting support.

DEVELOPMENT OF A KINETIC ISOTOPE EFFECT STUDY FOR TRANSITION METAL CATALYZED AMMONIA OXIDATION

Vash Allen
Mentor(s): Catherine Getty

Ammonia is being explored as an alternative fuel for clean energy in the form of the direct ammonia fuel cell. These cells require a transition metal catalyst to facilitate the ammonia oxidation half-reaction. Current research focuses primarily on catalyst development, but reliable characterization methods are needed to better understand their reaction mechanisms. This work investigates the use of the kinetic isotope effect, a change in observed reaction rates due to isotopic substitution, to determine an ammonia oxidation reaction mechanism. The reduction of Ru2(chp)4OTf (chp- = 2-chloro-6-hydroxypyridinate, TfO- = trifluoromethanesulfonate), a precatalyst developed by our group, to Ru2(chp)4NH3 is used to refine the methodology. Previous work on this catalyst shows the feasibility of this method and provides a reference for comparison throughout the study.

DEVELOPING AN ELECTROCHEMICAL CELL FOR GROUNDWATER CONTAMINATION REMOVAL AND AMMONIA FUEL PRODUCTION

Lola Alshihri, Tiana Alfsen
Mentor(s): Ziyan Wu, Mohan Qin

Groundwater nitrate contamination has intensified alongside rising fertilizer use, posing risks to both ecosystems and human health. Electrochemical reduction of nitrate to ammonia offers a promising approach to removing nitrate from contaminated water while producing ammonia, a valuable fuel and fertilizer feedstock. This project aims to utilize electrochemistry to remove nitrate while recovering ammonia from contaminated groundwater. Various conditions of applied voltage, electrode material, and reaction duration will be tested to investigate the performance of the electrochemical setup. A copper-based electrode is selected to facilitate the reduction from nitrate to ammonia. Experiments use controlled nitrate solutions analyzed via high-performance liquid chromatography to quantify ammonia yield, nitrite intermediates, and nitrate removal. Results will inform the feasibility of deploying electrochemical treatment for groundwater decontamination and ammonia recovery.

DEFINING THE ROLE OF A NOVEL DOMAIN IN THE REPLICATION RESTART INITIATOR PROTEIN

Sarah Altabakha
Mentor(s): Molly Dolan

DNA replication is essential for cell proliferation, and cells must overcome obstacles such as DNA damage. When the replication machinery (replisome) encounters a lesion, it can dissociate, leaving an abandoned replication fork. If DNA replication is left incomplete, it can lead to cell death. In bacteria, the replication restart pathway recognizes abandoned forks and reloads the replisome. The helicase PriA binds these forks and recruits the replisome to initiate restart. This study investigates a predicted novel domain of PriA in *Bacillus subtilis* using a DNA–protein crosslinking assay. We hypothesize that this domain binds the leading strand at abandoned forks, stabilizing PriA for replisome recruitment. Defining the function of this uncharacterized domain will advance understanding of how bacteria survive replication stress and preserve genome integrity.

DANCING WITH THE STARS: MEASURING THE ROTATION CURVE OF THE MILKY WAY GALAXY

Annelise Alvin, Isabelle Bubnick, Hunter Krauklis, Phoebe Kyriopoulos, Abby Nelson, Nadia Talbi
Mentor(s): Snezana Stanimirovic
Additional Author(s): Natalie Broderick

We obtained radio observations of the 21-cm emission line from neutral hydrogen(HI) to test the existence of dark matter in our own galaxy. Using the UW Small Radio Telescope (SRT), we obtained HI spectra at Galactic longitudes 22°–72° and applied a geometric method to extract the orbital velocity of HI clouds and their corresponding distance from the Galactic center. We then constructed a rotation curve and the enclosed mass profile, and compared results with predictions from luminous matter alone. Our rotation curve shows a plateau in velocity, though classical physics expects the rotation curve to decline with radius due to the distribution of visible matter in the galaxy. These results suggest the existence of dark matter and confirm trends found in previous published studies.

YOUNG HOT JUPITER KELT-20 B DID NOT ATTAIN ITS ORBIT VIA TIDAL MIGRATION

Annelise Alvin
Mentor(s): Melinda Soares-Furtado, Juliette Becker
Additional Author(s): Meng Sun, Adam Distler

Hot Jupiters are gas giants located within a 10-day orbit around their star. Planetary formation theory dictates that gas giants form beyond the stellar snow line, indicating that hot Jupiters migrate to create their observed orbital architectures. In this work, we explore high-eccentricity tidal migration as a potential pathway to produce KELT-20 b, a hot Jupiter orbiting a young (60 Myr) A-type star. Using the analytical equilibrium-tide framework of Hut (1981), we analytically model the tidal evolution of the system's semi-major axis, eccentricity, and stellar rotation over time. We find that the current orbital architecture of the KELT-20 system cannot be recreated using high-eccentricity tidal migration within the system's age constraint. We discuss potential alternative migration mechanisms that could explain this unique system.

IMPROVING EXPRESSION OF PLANT CYTOCHROME P450 ENZYMES IN *E. COLI*-BASED CELL-FREE SYSTEMS

Raunak Anand
Mentor(s): Sarah Noga

Plants produce complex compounds that are high-value products in medicine, agriculture, and sustainable manufacturing. Central to producing these compounds are a class of enzymes called Cytochrome P450s (CYPs). These enzymes require a complex cellular environment, which renders them difficult to study and utilize in plant engineering efforts. To overcome these constraints, we use cell-free systems, which utilize *E. coli* cell extract containing biocatalytic machinery to synthesize enzymes in a test tube. I employ several strategies to enhance CYP expression, including engineering DNA construct design and tuning the concentration of essential cofactors. Increasing CYP expression in cell-free systems will aid in plant CYP characterization studies and ultimately increase the utility of CYPs in plant engineering.

INVESTIGATING THE TRANSGENERATIONAL EFFECTS OF GUT MICROBIAL SULFOTRANSFERASES ON *C. ELEGANS* AGING

Nandini Anantha
Mentor(s): Snehal Chaudhari
Additional Author(s): Nicole B. Wicker

Caenorhabditis elegans (*C. elegans*) is a powerful model organism for studying aging and longevity. The gut microbiome is a complex community of microbes that inhabit our gastrointestinal tract and play a major role in our health. It also has the ability to sulfonate small molecules via sulfotransferases. *Bacteroidetes thetaiotaomicron* (*B. theta*) is an abundant gut commensal and it has a sulfotransferase. Parent worms exposed to *B. theta* that do not have the enzyme (delta sult) outlive their counterparts that do have the enzyme (wild type). This study investigates whether longevity effects from sulfotransferase activity in *C. elegans* are inherited. To characterize these effects, we conducted a variety of behavioral and physiological assays including lifespan analysis, brood size quantification, lawn avoidance behavior, and fluorescence imaging.

NUCLEAR REACTOR POWER OUTPUT PERCENT BASED ON LIGHT EMITTED BY CHERENKOV RADIATION

Graydon G Anderson, Wade Congdon, Avery Lindon, Elsa Dow, Matthew Okladlo, Samuel Pence
Mentor(s): Charles A. Hirst

Redundant detectors are utilized in nuclear reactors to measure power output. In case one of these integrated devices fails a separate detector can be used to measure the visible light from the Cherenkov radiation from the active reactor site and can be used to validate the power output is at the indicated level to ensure reactor operation. We built a high-precision, photosensitive device to measure visible light from Cherenkov radiation at varying power levels, providing another system of redundancy to the UWNR to monitor reactor power. According to the literature, we will likely find a linear relationship between the reactor power output and the Cherenkov radiation levels we detect. To test our device we will use three different power levels and the corresponding light emission, using three different points plotted linearly we will then attempt to interpolate and predict a fourth unknown power level. Our device was built so that it meets safety standards as well as reports accurate data.

SLEEP-DISORDERED BREATHING MODERATES THE ASSOCIATION BETWEEN WHITE MATTER HYPERINTENSITIES AND MEMORY PERFORMANCE IN ADULTS WITH DOWN SYNDROME

Henry Andersen
Mentor(s): Sigan Hartley, Emily Schworer

Adults with Down syndrome (DS) have an increased risk for Alzheimer's disease (AD). Sleep-disordered breathing (SDB) is highly prevalent in this population and may exacerbate AD-related cognitive decline by adding to cerebrovascular damage. In a sample of 84 adults with DS (aged 25-57), we examined whether SDB (apnea-hypopnea-index; AHI) measured via a home sleep test moderated the association between white matter hyperintensities (WMH) - an index of small vessel damage measured with neuroimaging - and memory performance. Total WMH was negatively correlated with memory performance ($r = -.31$, $p = .004$). This effect was moderated by SDB; participants with higher AHI showed lower memory performance than those with lower AHI due to elevated WMH. Findings suggest that SDB may compound effects of AD-related white matter impairment on memory for adults with DS.

WHAT'S ON THE MENU? EXPLORING CHACMA BABOONS' (*PAPIO URSINUS*) INDIGENOUS AND INVASIVE PLANT FEEDING BUDGETS AND THEIR IMPLICATIONS FOR FOREST MANAGEMENT

Isabelle Anderson
Mentor(s): Margaret Bryer
Additional Author(s): Carla van Hasselt, Kris Sabbi

Invasive plant species threaten biodiversity globally, often spread by indigenous herbivores. This study investigates the feeding behaviors of habituated chacma baboons (*Papio ursinus*) (n=8-16) in Nature's Valley, Western Cape, South Africa, to assess their role in plant dispersal. From July 2023 to July 2025, 243 hours of data were collected using ten-minute focal follows, where feeding duration, plant species and part consumed were recorded. The troop allocated 45.91% of feeding time to indigenous species, 9.84% to alien invasive species, 0.80% to non-invasive alien species. These findings show that the baboons feed from both indigenous and introduced plants and may aid in the spread of indigenous plant species, with a more limited role in spreading invasive species, informing local Afrotemperate forest restoration and management efforts.

ROLE OF TRK1TOK1 IN FUNGAL PATHOGEN, *CANDIDOZYMA* (*CANDIDA*) *AURIS*

Maisy Andes
Mentor(s): Jeniel Nett, Adam Glawe, Chad Johnson
Additional Author(s): Emily Eix, Robert Zarnowski

Candidozyma (*Candida*) *auris* is a fungal pathogen that poses a significant public health threat largely due to its ability to effectively colonize skin and subsequently cause invasive disease when catheters are inserted through skin. We previously found *C. auris* to require potassium (K+) to grow in the skin environment. Here we investigated the impact of knocking out the K+ transporters TRK1 and TOK1. trk1Δ demonstrated a growth defect in synthetic sweat media and on human skin ex vivo. In contrast, studies showed little effect due to tok1Δ. We further examined growth in a K+ gradient, biofilm formation, and membraned potentials. Our goal is to better understand the effects of K+ homeostasis and its potential role in future prevention and treatment strategies of *C. auris* infection.

INVESTIGATING THE EFFECTS OF THE NOVEL ANESTHETIC KSEB ON DISTINCT GABA TYPE A RECEPTOR SUBTYPES

Irene Leah Angelidakis
Mentor(s): Cynthia Czajkowski
Additional Author(s): John Merrick, Cat Chu

Inhibitory signaling in the brain is primarily regulated by the opening and closing of GABA type A receptors (GABARs). GABARs are the target of numerous clinically relevant drugs, including intravenous (IV) anesthetics. Recently, a new intravenous anesthetic, KSEB 01-1, was shown to act on GABARs without causing negative side effects such as adrenal suppression or blood pressure changes. This study investigates how the novel anesthetic KSEB modulates distinct GABAR subtypes that mediate phasic, tonic, and slow inhibition. Wild-type rat GABAR subunit cRNAs were expressed in *Xenopus laevis* oocytes, and two-electrode voltage clamp electrophysiology (TEVC) was used to measure GABA-activated currents. Preliminary recordings and GABA dose-response curves have been obtained for multiple receptor subtypes, and experiments examining KSEB modulation are ongoing.

HOW DOES ABDOMINAL SURGERY AFFECT FALLS IN OLDER ADULTS?

Anvika Annyapu
Mentor(s): Julia Berian, Randi Cartmill

Falls are a major problem for older adults, leading to poor health outcomes such as hospitalization, severe injury, and death. Abdominal surgery can significantly disrupt core muscles which are required for stability. This analysis aimed to use state-wide data (1) to describe the incidence of falls requiring emergency department (ED) visits after major abdominal surgery, and (2) to compare fall rates between Minimally Invasive Surgery (MIS) approaches and open abdominal surgery. This is a retrospective analysis of Healthcare Cost and Utilization Project (HCUP) Data from October 2015 - March 2017 analyzing patients age 60 years and older who underwent major abdominal surgery in Wisconsin. Data from the State Inpatient Databases (SID), the State Ambulatory Surgery and Services Databases (SASD), and the State Emergency Department Databases (SEDD) were combined to create a cohort of older adults with the most common CPT codes for abdominal procedures. A total of 30,565 patients underwent major abdominal operations. Within 9-months after surgery, there were a total of 1,045 falls (3.4%). The approach was open for n=13,788 (45.1%) and MIS for n=16,777 (54.8%). There was a significant difference in the rate of falls after open N=549 (3.9%) vs MIS N=496 (2.9%) approaches ($p=0.0016<0.05$). We found that the rate of falls was low (3.4%). The distribution of falls and the increase within 3-6 months after surgery may suggest opportunities for intervention. Future work will perform additional modelling and compare trends to other states.

DEVELOPMENT OF FIBRONECTIN TARGETED MICELLE NANOCARRIERS FOR TRIPLE NEGATIVE BREAST CANCER

Owen Antholine
Mentor(s): Glen Kwon, Maryam Kianpour

Triple negative breast cancer (TNBC) is a highly aggressive cancer with few therapeutically useful targets. While TNBC tumor cells exhibit few targetable abnormalities, they are associated with high fibrosis in the tumor microenvironment, characterized by overexpression of fibronectin. Previous research has shown that Functional Upstream Domain (FUD) peptide exhibits high binding affinity for fibronectin, suggesting FUD has potential as a novel targeting ligand for TNBC. Here cysteine-modified FUD (CFUD) was conjugated to maleimide functionalized polyethylene glycol-polylactic acid copolymer (Mal-PEG-b-PLA) micelles. The resulting CFUD-Mal-PEG-b-PLA micelles were characterized via DLS and HPLC to optimize CFUD conjugation. CFUD-Mal-PEG-b-PLA showed high fibronectin binding affinity using BLI and notable TNBC cytotoxicity in 4T1 cell lines. This suggests CFUD-Mal-PEG-b-PLA micelles show promise as an active targeted therapy for TNBC.

EFFECTS OF CROSSLINKING DEGREE ON WATER AND SALT TRANSPORT IN REVERSE OSMOSIS MEMBRANES: A MOLECULAR DYNAMICS STUDY

Naomi Au
Mentor(s): Subhamoy Mahajan, Ying Li

High-pressure reverse osmosis uses thin-film composites for water remediation, where contaminants (e.g., salts) are excluded by selective polyamide layers. Past research shows that increasing membrane degree of crosslinking (DC) can reduce permeant (e.g., water and ions) mobility. However, membranes are heterogeneous, with varying DC across space, and their effective transport response remains poorly understood. While molecular simulations have examined water self-diffusion across extreme DCs, a detailed relationship has not been established, and studies on salt self-diffusion remain limited. This project examines how varying DC from 30–98% influences the self-diffusion of water, Na^+, and Cl^- within polyamide membranes at feed pressure of 10 bar and varying salt concentrations. Understanding these structure-function relationships can improve predictions of membrane transport properties from structural characterization.

MEDIGAP AND MEDICARE ADVANTAGE ACCESS CONTRIBUTE TO INEQUALITIES IN OLDER ADULT FINANCIAL WELLBEING

Jenna Auth
Mentor(s): J. Michael Collins

Drawing on the National Health Interview Survey (NHIS) and the National Health and Aging Trends Study (NHATS), we examine how the demographic and socioeconomic characteristics of beneficiaries selecting traditional Medicare, Medicare Advantage, and Medigap have shifted over the past decade. We find widening disparities in financial security across coverage types. Seniors relying solely on traditional Medicare remain a stable share but experience the most pronounced financial hardships, including elevated rates of food insecurity. These trends expose older adults to greater out-of-pocket expense risk, as well as contribute to medical hardships and foregone care. By identifying how the shifting insurance landscape shapes vulnerabilities, this study offers insights for policymakers and health practitioners seeking to strengthen population health and economic resilience among older people.

STARSHIP-MEDIATED HEAVY METAL RESISTANCE IN *ASPERGILLUS FUMIGATUS*

Lily Axelrod
Mentor(s): Emile Gluck-Thaler
Additional Author(s): Justin Eagan

Aspergillus fumigatus is an opportunistic human fungal pathogen whose prowess depends on its ability to resist stress in its environment. Starships are giant transposons found in fungal genomes capable of horizontally transferring DNA between individuals. My research aims to answer the question: can a horizontally transferred Starship confer heavy metal resistance in the recipient genome? I will confirm that the Nebuchadnezzar-h2 Starship, which carries genes predicted to increase heavy metal tolerance, horizontally transfers into a new *A. fumigatus* strain and then observe how it functions, if at all, within that new genome. I will do so by comparing the heavy metal tolerance of the recipient strain to the wild type by testing the resistance against arsenic and copper using phenotyping assays.

MODELING CLUSTER PRECIPITATION IN RPV STEELS USING KINETIC MONTE CARLO SIMULATIONS

Sophia Ayer
Mentor(s): Yongfeng Zhang

Better understanding of particle interactions and cluster morphology under irradiation through simulation is an important step in understanding material embrittlement, which is a concern for reactor pressure vessel (RPV) steels. Kinetic Monte Carlo simulations can be used to model clusters of solute atoms (Cu, Ni, Mn, Si) in RPV steels with different dislocation structures. Parametrization of accelerated diffusion along dislocation was used to better match simulation results with prior literature results. It was found that lower accelerated diffusion better aligns. Simulated shear loop dislocations were also helpful in understanding how clusters form, and it was determined that Cu rich clusters can be found in the tensile regions created by edge dislocations.

IDENTIFYING THE NEUROPATHOLOGIC AND MOLECULAR FEATURES OF LABRADOR RETRIEVER LATE-ONSET PERIPHERAL NEUROPATHY AT THE NEUROMUSCULAR JUNCTION

Norisha Badhwar
Mentor(s): Susannah Sample
Additional Author(s): Ryan Anderson

Late onset peripheral neuropathy (LPN) in Labrador Retrievers, frequently known as “laryngeal paralysis," is a common, life-limiting disease. Presently, there are no treatment options available and novel therapeutic interventions are needed. The mechanisms underlying the disease are not fully understood, but it has been established as a hereditary (autosomal dominant), length-dependent axonopathy. The objective of this fellowship is to identify the neuropathologic and molecular basis of LPN in the neuromuscular junction (NMJ). To fulfil our aim, we will employ immunofluorescence to investigate innervation patterns, identify neuropathologic features and identify variations in the localizations and expression of an associated protein at the NMJ. By characterising NMJ dysfunction at the molecular level, we aim to discover key neuropathologic features that contribute to disease progression. The proposed study is critical as it will help uncover potential neuropathological and molecular mechanisms involved in LPN, providing essential insights that could expedite the development of early diagnostic markers and targeted therapeutic interventions.

HOW UNSTRUCTURED DISCUSSION WITH PARENTS SUPPORTS BIOLOGICAL UNDERSTANDING IN CHILDREN

Grace Baeb
Mentor(s): Phoebe Miller
Additional Author(s): Hema Subramanian

The Biogames Project, which was designed to evaluate the effectiveness of a card game in promoting children’s learning about biological variability, included both a gameplay intervention and a fun fact discussion condition. Although designed as the control condition, the fun fact discussion revealed meaningful variability in caregiver scaffolding behaviors. This suggests that without the constraints of game rules, the simple presence of scientific materials acts as a catalyst for unprompted caregiver-child discourse. By exploring the nature of these organic interactions, this project examines whether the absence of formal prompting allows caregivers to more fluidly expand upon content, generating further discussion about the power of gamified learning vs quality interaction with a more experienced other in children’s science learning.

EXAMINING SPATIAL VARIATION IN THE USE OF FLORIDA HARVESTER ANT (*POGONOMYRMEX BADIUS*) MOUNDS BY VERTEBRATES

Puja Bajwa
Mentor(s): Hannah Ashe

Florida harvester ants (*Pogonomyrmex badius*) distribute excess seeds on top of their mounds, which may be utilized by vertebrate granivores such as birds or mice, but granivore behavior can vary depending on proximity to edges and habitat fragmentation. To determine whether mound location affects vertebrate use of ant mounds, we deployed camera traps on mounds at the edge, middle, and corridors of connected and unconnected patches. We detected a total of twelve species foraging on mounds, with the highest richness found within habitat corridors. We also found that mourning doves (*Zenaida macroura*) were more likely to be found at patch edges than in the interior. These findings suggest that multiple species utilize ant mounds, and that fragmentation and edge effects may significantly affect granivore behavior.

LEARNING EMBRYO DEVELOPMENTAL TRAJECTORIES FROM TIME-LAPSE IMAGING USING DEEP LEARNING

Aadhitya Balaji, Jens Lundsgaard, Raffael Ho
Mentor(s): Dhananjay Bhaskar

A key challenge in in vitro fertilization (IVF) is choosing the embryo most likely to implant and develop into a healthy pregnancy. Currently, embryologists assess embryos through visual inspection and the timing of a few developmental milestones. However, embryo development is a continuous process, and these snapshots capture only part of the full story. Modern time-lapse imaging systems record videos of embryos developing in the incubator, providing a rich dataset for automated analysis. In this project, we developed a deep convolutional recurrent neural network that learns embryo development from these videos. Our method represents each embryo's development as a continuous trajectory and summarizes these trajectories using path signatures to identify patterns that distinguish high-quality embryos from those less likely to succeed.

AIDER BREAST CANCER PREDICTION

Nithila Balaji
Mentor(s): Pallavi Tiwari
Additional Author(s): Dheerendranath Battalapalli

Deep learning models show promise in automated breast cancer detection, yet architectural trade-offs remain unclear for limited medical imaging datasets. This study compares three pretrained architectures --EfficientNet, DenseNet-121, and Vision Transformer (ViT-B/16) --for binary classification of bilateral mammography DICOM images (n=409). Models were fine-tuned using focal loss to address class imbalance and evaluated using PR-AUC, sensitivity, specificity, F1-score, and calibration (Brier score). DenseNet achieved the highest PR-AUC (0.916) and best probability calibration, while ViT demonstrated competitive sensitivity and global feature modeling. Results highlight performance trade-offs between convolutional and transformer-based approaches and emphasize the importance of threshold selection and calibration in clinically relevant decision-making.

THE MULTILINGUAL GAY /S/: HOW THE /S/ IS PRODUCED AND PERCEIVED IN GAY SPANISH-ENGLISH BILINGUALS

Theo Bang
Mentor(s): Rajiv Rao

In past studies, looking at both Spanish and English, the /s/ phoneme has been shown to have certain marked articulation that index "gayness" in those communities: Spanish having the /s/ fully realized in places where it is typically weakened (Walker et al., 2014), and English having an "over-articulated" /s/ with higher peak frequencies, and more negatively skewed distributions (Mack & Muson, 2012). With the importance of /s/ phoneme in both languages, this study attempts to see whether those marked changes still stand true cross-linguistically for Spanish-English bilinguals. Through both production and perception tasks, this study finds that while the L1 /s/ characteristics stay pretty robust, in the L2, speakers are more likely to reproduce their L1 /s/, leading to potential miscategorizations on the perception side.

MICE WITH A PUTATIVE AUTISM MUTATION IN MBD1 (MBD1-E339K) EXHIBIT AUTISM-LIKE BEHAVIORAL DEFICITS

Arina Baranoff
Mentor(s): Xinyu Zhao
Additional Author(s): Yu Gao

Methyl-CpG Binding Domain Protein 1 (MBD1) binds methylated CpGs in the genome to regulate gene expression. MBD1 is an essential gene for humans, and we have shown that MBD1 knock-out mice have autism-like behavior. MBD1 variants in humans are associated with autism spectrum disorders (ASD). However, how MBD1 variants lead to ASD remains unclear. We have used CRISPR/Cas9 genome editing to create a mouse model that has a point mutation found in a group of ASD individuals: MBD1-E339K (equivalent to human E315K). Behavioral analysis show that MBD1-E339K mice exhibit autism-like behaviors.

MAPPING THE IMPACT OF THE UW-NIFS FUSION RESEARCH PARTNERSHIP

Matthew Gabriel Barrera
Mentor(s): Adelle Wright

This study explores the relationship between the University of Wisconsin - Madison and Japan's National Institute for Fusion Science, and will examine the role of both individual and institutional collaboration. The project seeks to map the impact of this partnership by gathering information from researchers at both institutions and will explore whether there exist possible barriers to strengthening this partnership.

EXAMINING THE EFFECT OF LEARNING SCHEDULES ACROSS VISUAL, VERBAL, AND MOTOR DOMAINS

Melis Baskaya
Mentor(s): C. Shawn Green, Ezgi Yüksel

Previous research has shown that learning is more effective when different topics/tasks are mixed together during learning as compared to when they are separated into distinct blocks. While this effect has been found across many different learning domains (e.g., sports, education, categorization), whether individuals show the same degree of benefit from domain to domain is unclear. Here, we asked whether the magnitude of this effect is consistent within individual participants. Participants were asked to complete a learning task in each of three domains (visual, verbal, and motor), using both mixed and blocked schedules. The benefit of mixing was calculated for each participant in each domain and consistency across domains was assessed. Our results provide important information for individualized learning practices.

ELECTROSTATIC INTERACTIONS BETWEEN CWC15 AND IPI-O1 MEDIATE SPLICING-BASED DEFENSE OF *PHYTOPHTHORA INFESTANS* IN POTATOES

Elizabeth Baudhuin
Mentor(s): Aaron Hoskins
Additional Author(s): Ray B. East

Late blight is a highly contagious plant disease that causes severe crop loss in potatoes. In blight-resistant cells, infection by *Phytophthora infestans* (*P. infestans*) triggers secretion of the effector protein IPI-O1, which induces alternative splicing of the resistance gene RB and activates plant immunity. This response initiates a hypersensitive reaction that can limit growth and reduce tuber size. RB splicing is regulated through a direct interaction between IPI-O1 and Cwc15, a key spliceosome component. My research investigates the molecular and electrostatic basis of this interaction using yeast two-hybrid (Y2H) assays, western blotting, and genetic modification. By clarifying how immune activation occurs after infection, this work aims to support the development of P. infestans-specific Effector-Triggered Immunity potato lines and improve crop stability and food security.

RELATIONS BETWEEN GRADES 7–9 STUDENTS' PROPORTIONAL REASONING STRATEGIES AND FRACTION SCHEMES

Ella Bauman
Mentor(s): Ana Stephens
Additional Author(s): Martha W. Alibali

Knowledge of fractions is widely recognized as both a critical challenge for students and crucial for success in algebra. However, much still needs to be learned about the relationship between specific aspects of fraction knowledge and specific aspects of algebraic performance. One conceptual framework for understanding students' construction of fractions knowledge is fraction schemes. This project investigates relations between Grades 7–9 students' fraction schemes and their proportional reasoning strategies. We hypothesized that students operating with more advanced fraction schemes would engage in more sophisticated multiplicative reasoning that would allow them to reason more flexibly about situations involving proportions. We indeed found that students who demonstrated stronger performance on items designed to measure their fraction schemes tended to use more proportional reasoning strategies in problem solving.

EMOTIONAL AND MENTAL BOUNDARIES FOR COMMUNITY RESOURCE NAVIGATORS

Gabrielle Beaman, Lauren Fligge
Mentor(s): Ashleigh Ross

This project proposes a framework on mental and emotional boundaries to support the training of incoming Community Resource Navigators. Navigators often work closely with individuals experiencing complex social and health challenges, which can lead to emotional strain and burnout without clear boundaries. This framework introduces practical strategies for maintaining professional boundaries and managing emotional engagement while still providing compassionate support. By incorporating empathetic communication skills and boundary-setting practices into navigator education, the framework aims to promote sustainable advocacy and effective client relationships. Strengthening these skills early in training can improve navigator well-being and support long-term success in community-based resource navigation roles.

BATCH KINETICS AND PILOT COMMISSIONING FOR DAIRY SUGAR PROCESSING

Gio Bean
Mentor(s): Wenjia Wang

Wisconsin produced about 25% of U.S. cheese in 2024, generating over 3 billion gallons of cheese whey byproducts. This dilute stream is costly to process and often not upgraded. Whey contains about 5 wt% lactose, which can be hydrolyzed to glucose and galactose using sulfuric acid at elevated temperature and low pH. This project supports pilot-scale continuous hydrolysis by combining bench-scale kinetics with system commissioning. We measure batch lactose hydrolysis profiles versus time and pH using HPLC quantification of lactose, glucose, and galactose. We also commissioned a 1 gal/min pilot loop using heated water under pressure to verify flow stability, temperature control, pressure containment, sampling hardware, leak tightness, sensor signal integrity, and data logging. These results establish readiness for lactose and whey runs.

VARIATIONS IN FLUCTUATION ACTIVITY BELOW AND ABOVE THE GREENWALD LIMIT IN MADISON SYMMETRIC TORUS TOKAMAK PLASMAS

Emi Bell
Mentor(s): Noah Hurst

The Madison Symmetric Torus (MST) is capable of creating and sustaining tokamak plasmas of a high normalized density, up to 18 times the Greenwald limit (nG). When the electron density exceeds 2nG, the current density profile is observed to flatten. This is likely due in part to radiative collapse, which causes global cooling. Another potential reason for this loss of energy and profile flattening is turbulence driven by resistive interchange instability. We used an 11-chord interferometer, internal Langmuir probes, and edge magnetic coils to study a set of plasmas over a range of densities from below 1 nG to above 2 nG. We compared fourier and wavelet transforms to study fluctuations with frequency in the range 1 kHz to 50 kHz to identify changes in fluctuation activity over time. The wavelet analysis reveals a burst of density fluctuations during startup for plasmas with densities above 1nG which does not appear below the limit. And, following current-profile flattening events, all frequencies of the magnetic field data showed an increase in amplitude. These studies aim to determine some of the underlying mechanisms of the Greenwald limit and understand the behavior of plasmas when the limit is surpassed.

AN INTERDISCIPLINARY APPROACH TO HISTORICAL MISSING IN ACTION INVESTIGATIONS

Maddee Bell, Trinity Dreyer, Miya Gentile, Thomas Sime
Mentor(s): Gregg Jamison

There are over 80,000 United States service members declared MIA since WWII. The UW MIA Recovery and Identification Project was the first academic organization to collaborate with the Defense POW/MIA Accounting Agency (DPAA) in their efforts to find and repatriate MIA soldiers from the WWII era. We utilize research methodologies from a wide variety of fields, including history, archeology, cartography, information sciences, and biotechnology. Through this interdisciplinary approach to historical data analysis, our team is able to locate, scout, recover, and genetically identify the remains of MIA Wisconsinites across the globe.

WNT AND SHH DYNAMICS BIAS HUMAN CORTICAL INTERNEURON SUBTYPE SPECIFICITY IN AN MGE ORGANOID SCREEN

Grace Benish
Mentor(s): André M.M. Sousa
Additional Author(s): Hannah M. Doll, Hailey Thurston

In the human dorsolateral prefrontal cortex lies a subpopulation of inhibitory neurons which exhibit human-specific properties and can express both somatostatin (SST) and tyrosine hydroxylase (TH). To model this population, we perform an organoid protocol screen to pattern SST cortical interneurons from medial ganglionic eminence (MGE) progenitors. We vary the timing, duration, and concentration of morphogens Wingless-related Integration Site (WNT) and Sonic-Hedgehog (SHH) to bias subtype fate. We find that while some conditions enrich the overall population SST+ cells, few cells express both TH and SST across all conditions, indicating our patterned TH+ neurons are unlikely to belong to the SST/TH subtype. Nonetheless, this optimized protocol provides valuable insights for subtype specification of the SST inhibitory subclass as a whole.

STRUCTURAL AND FUNCTIONAL ANALYSIS OF RSV MATRIX PROTEIN MUTATIONS IN VIRAL ASSEMBLY

Ava Berdelman
Mentor(s): Elizabeth Wright
Additional Author(s): Hayley Hirsch, Bryan Sibert, Jae Yang

Respiratory syncytial virus (RSV) is a respiratory pathogen that can cause severe disease in infants and the elderly. RSV assembly is driven by the matrix (M) protein, which forms a lattice beneath the viral membrane and coordinates particle formation. Phosphorylation at residue T205 within M modulates viral infectivity, yet the structural basis for this regulation remains unknown. I hypothesize that T205 phosphorylation regulates M lattice organization, influencing viral particle morphology and release efficiency. I will compare wild-type RSV with two engineered M mutants (T205A and T205D) using cryo-electron microscopy, cryo-electron tomography, and quantitative analyses to define how phosphorylation-dependent structural changes in the M lattice control RSV assembly. These studies will advance understanding of RSV replication and provide a structural framework for targeting viral assembly mechanisms.

ISOLATION OF NITROGEN-FIXING BACTERIA FROM MAIZE ROOTS

Beth Berger
Mentor(s): Junko Maeda, Valentina Infante, Jean-Michel Ané

Nitrogen is an essential macronutrient for plant growth, yet atmospheric dinitrogen (N_2) must be converted to bioavailable forms—such as ammonia—before plants can assimilate it. While synthetic nitrogen fertilizers support modern crop production, their manufacture is energy-intensive, and their overuse contributes to environmental degradation. Biological nitrogen fixation (BNF) by plant-associated bacteria offers a promising, sustainable alternative. In this study, we isolated more than 200 bacterial strains from the endosphere and rhizosphere of maize (*Zea mays*) and characterized their nitrogen-fixing potential by amplifying the nifH gene. The isolation of nifH-positive strains from maize roots establishes a foundation for continued screening of the remaining isolates, with the goal of identifying effective diazotrophic candidates to reduce dependence on synthetic nitrogen inputs in cereal cropping systems.

INVESTIGATING THE ROLE OF TRANSCRIPTION FACTOR BLIMP1 IN PRIMORDIAL GERM CELL DEVELOPMENT

Ruby Bergstrom
Mentor(s): Rupa Sridharan, Harshi Cormaty

Primordial germ cells (PGCs) are essential for transmitting genetic information to the next generation. In mice, PGC specification is driven by BMP signaling, which activates transcription factors including Blimp1 (Prdm1). BLIMP1 promotes germ cell fate by repressing somatic gene expression and facilitating epigenetic reprogramming. The removal of the repressive histone mark H3K9me2 is an early event in PGC specification. Recent findings in the Sridharan Lab show the knockout of the H3K9me2 demethylases Kdm3a and Kdm3b in mouse embryonic stem cells (ESCs) results in failure of PGC-like cell (PGCLC) specification, suggesting Kdm3a/3b may regulate PGC specification through the activation of Blimp1. This project tests whether the overexpression of Blimp1 can rescue PGCLC specification in Kdm3a/3b knockout ESCs using an established in vitro differentiation model.

APPLICATIONS OF 3D MODELING AND RENDERING FOR PALEONTOLOGICAL RESEARCH AND SCIENCE COMMUNICATION

Konrad Berryhill
Mentor(s): Dave Lovelace

3D software is extremely versatile and has many applications in different STEM fields, including paleontology. 3D tools have revolutionized visualization of fossils and enabled complex simulations that provide crucial insights into Earth's past. In order to more broadly share and apply results it is essential to communicate scientific concepts to both researchers and the general public, and 3D rendering allows us to create life reconstructions of extinct animals in great detail. Digital 3D art has cemented itself as an invaluable medium in science, and technical innovations constantly bring new ways of utilizing it. From biomechanics simulations to 3D printing, in this presentation I will cover the ways I've applied digital techniques in my work and the broader implications they have on STEM research and education.

BIOPHYSICAL PROPERTIES OF CHROMOSOMAL INSTABILITY (CIN), A HALLMARK OF CANCER

Neeraj Bhogavilli
Mentor(s): Aussie Suzuki

Faithful chromosome segregation during mitosis (cell replication) is essential for maintaining genomic stability and preventing aneuploidy, a hallmark of solid tumors. This project investigates the genetic functions of the Constitutive Centromere-Associated Network (CCAN) protein, CENP-U, an inner kinetochore protein that organizes centromere structure and recruits and directs other kinetochore proteins required for accurate chromosome segregation. To better characterize its role, I analyze RNA-seq and ATAC-seq datasets from wild-type (unmodified/normal) and CENP-U knockout (gene-deleted/dysfunctional) cell lines. RNA-seq measures genome-wide gene expression by sequencing cellular RNA transcripts, while ATAC-seq measures open chromatin (DNA regions accessible to transcription/gene regulation). Comparing these datasets reveals transcriptional and chromatin changes caused by CENP-U loss, providing insight into its role in gene regulation and genome stability.

CONTROLLING SELECTIVITY IN THE ELECTROCHEMICAL DEHYDROGENATION OF ALKANES

Satyam Bhushan
Mentor(s): Lee Fuller
Additional Author(s): Moonjoo Kim, Gong Zhang, Marcel Schreier

The transition from conventional naphtha steam cracking to electrochemical dehydrogenation is reshaping light alkene production. This work examines this shift through the electrochemical dehydrogenation of n-butane as a representative system. Unlike high-temperature steam cracking, electrochemical approaches enable selective alkene formation under milder, near-ambient conditions while upgrading short-chain hydrocarbons. These systems also offer the potential for improved energy efficiency and integration with renewable electricity. Current research focuses on enhancing alkene selectivity and overall process efficiency through improved catalyst design, optimized electrochemical cell architecture, and better control of mass transport within the reactor. Collectively, these advances highlight electrochemical dehydrogenation as a promising pathway for more sustainable and selective light alkene production.

DO WORDS SLOW US DOWN? FRACTION PROCESSING ACROSS DIGIT AND WORD FORMATS AMONG COLLEGE STUDENTS

Mingxuan (Aster) Bi
Mentor(s): Percival Matthews, Sangmi Park
Additional Author(s): Anna Schellin

Fractions are essential in education and everyday decision making but are often difficult to learn and use effectively. This project examines how people understand fractions when written with digits versus written with words, as measured by differences in speed and accuracy. College students completed fraction naming and magnitude comparison task whereby fractions were represented using digit ("3/4"), horizontal ("three-fourths"), or vertical word format ("three/four or "three/fourths"). Data collection is currently ongoing. Preliminary analyses of the magnitude comparison performance suggest that participants were accurate across formats but responded slower when fractions were written in words rather than digits. Coding of the naming task is currently in progress, and final results will be reported at the presentation. This study may help guide future teaching practices.

DEHUMANIZATION OF DISABILITY

Willy Bishop
Mentor(s): Garrett E. Huck

The dehumanization of people with disabilities has been a persisting social framework throughout history and the modern day that sustains negative views of disability which inherently creates a myriad of discriminatory practices. Unlike historically blatant dehumanization, modern day dehumanization is often concealed behind a thin veil of humanitarianism and ignorance. Due to this, much of the data on this issue emphasizes the importance of education and exposure to disability; however, these proposals lack attention to potential unintended consequences. This presentation will discuss patterns of behaviors and thought processes that lead to the dehumanization of disabled people and will explain why, consequently, caution and care are needed when implementing these proposals to avoid opposing outlook from the public as well as reinforcing dehumanizing rhetoric.

EMPOWERING THE FUTURE: BUILDING FOUNDATIONAL SKILLS IN RURAL NEPAL

Nischal S. Bista
Mentor(s): Mayra I. Oyola Merced

Rural Nepal faces significant challenges in access to quality STEM and technology education. While urban centers like Kathmandu have seen a growing technology sector, children in rural communities are often left behind due to limited infrastructure, lack of trained teachers, and inadequate learning materials.

The target population was students in Grades 7 through 10, a critical age range where early exposure to technology can shape long-term academic and career trajectories. The project was grounded in the belief that every child, regardless of geography or socioeconomic background, deserves access to the tools of the digital age.

INVESTIGATING BILE ACID EFFECTS ON *BIFIDOBACTERIUM PSEUDOLONGUM* AND LIVER STELLATE CELL ACTIVATION

Ella Blackburn
Mentor(s): Vanessa Leone, Jake Hermanson, Kanghee Bae, Evan Chrisler, Lauren Lucas

Metabolic liver disease involves fat buildup and inflammation in the liver and is strongly influenced by diet and the microbiome. Beneficial gut bacteria, particularly *Bifidobacterium pseudolongum*, may help protect the liver, while certain bile acids produced during high-cholesterol intake can be harmful. This project examines how the bile acid deoxycholic acid affects the growth of *Bifidobacterium pseudolongum* and whether substances produced by this bacterium can reduce activation of liver stellate cells, which drive scarring of the liver. Bacteria will be grown with different bile acid levels to measure survival, and liver cells will be treated with bacteria-derived products to assess inflammatory and fibrotic responses. Understanding these interactions may reveal how gut microbes influence liver health and support development of microbiome-based therapies for metabolic liver disease.

IMAGE ANALYSIS DRIVEN APPROACH TO IDENTIFYING MACROPHAGE POPULATIONS DURING MYCOBACTERIA INFECTION

Carmen Blanca Nieto
Mentor(s): Marina Slawinski, Elebeoba May

The body's immune response to tuberculosis (TB) infection is to generate granulomas, which are clusters of immune cells that surround the TB bacteria in an attempt to contain and clear infection. Past research has shown that granulomas vary in their ability to control infection. Our objective is to gain greater insight on the initial events involved in granuloma formation and to use our data to inform population and computational models of infection dynamics. In our work, we infect fluorescently labeled macrophages with mycobacteria, analyze confocal microscopy data, and focus on optimizing the cell segmentation to most accurately characterize macrophages. Understanding how these early dynamics shape granuloma formation will help identify factors that influence infection outcome and improve strategies for predicting and targeting active TB.

ICYPLOT: A USER-FRIENDLY GRAPHICAL INTERFACE FOR MODELLING LATE WINTER WATER TEMPERATURES IN ICE-COVERED LAKES

Ari Bloch
Mentor(s): Benjamin Smith, Jennifer Franck

Accurate modeling of the water temperature in freshwater ice-covered lakes is critical for understanding biophysical processes including phytoplankton dynamics. In the late winter, light can penetrate through the ice cover and heat the water beneath, which can lead to mixing near the ice. To facilitate understanding, we created a web-based application featuring an easy-to-use interactive graphical user interface that allows users, such as biologists, to observe how the water temperature evolves with time. They can vary environmental factors including ice composition, solar radiation, and lake depth. The application implements HTML, CSS, and JavaScript for the user interface and Python for the backend computations. Users can successfully observe the evolution of the water temperature, allowing for predictions of under-ice mixing and its interactions with biological systems.

COLLABORATIVE WORK GROUP INITIATIVE: BEFORE BREAST CANCER DIAGNOSIS

Katherine Blue
Mentor(s): Kailey Taebel

Black women are 38% more likely to die from breast cancer, according to Breast Cancer Research Foundation. Collaborative Work Group Initiative: Before Breast Cancer Diagnosis (BBCD) aims to raise awareness about breast cancer; particularly amongst young Black women. This program aims to shift the standard of prevention and screening to be preventative rather than reactive. In Racine and Milwaukee, the CWG initiative works alongside Community Health Workers to distribute valuable lifesaving information and connect patients to services such as mammograms, genetic testing, and local resources. But what is a quality resource; this is what this project will define. As young Black women are at the highest risk for developing aggressive, advanced stage cancer at younger ages, it is important to emphasize the importance of early detection.

EVALUATION AND REFINEMENT OF PREOPERATIVE PLANNING AND INTRAOPERATIVE GUIDANCE WORKFLOW FOR PERIACETABULAR OSTEOTOMY

Caroline Blust
Mentor(s): Josh Roth

Periacetabular osteotomy is a surgical procedure commonly used to treat developmental dysplasia of the hip, an anatomical abnormality that frequently leads to hip osteoarthritis later in life. Due to the technically complicated nature of this operation, intraoperative guidance is likely beneficial to mitigate surgical errors. Our group has developed a preoperative planning and intraoperative guidance workflow that allows virtual execution of periacetabular osteotomy and outputs a simulated fluoroscopic image of the desired surgical correction, which can be referenced by the surgeon throughout the procedure. However, the efficacy of this workflow has not been thoroughly evaluated. Accordingly, my objectives were to (1) refine and (2) evaluate the efficacy of our preoperative planning workflow. By doing so, I expect to move it closer to widespread implementation.

EVOLUTION AND CONSERVATION OF ICE CRAWLERS

Jose Enrique Bonilla Gaytan
Mentor(s): Sean Schoville

Grylloblattidae are a group of cold specialized insects that inhabit montane areas, caves, lava tubes and canyons. These areas are typically characteristic of colder regions, which makes Grylloblattidae particularly vulnerable to past and present global warming. The goal of this proposal is to understand how historical climate change has affected the genetic differentiation of the ice-crawlers in the *Grylloblatta* genus. Historical glacial periods have been hypothesized to have a significant effect on the speciation of ice crawler populations. To test this hypothesis, samples will go through a reduced representation genome sequencing process to measure variation, estimate relationships and reconstruct demographic changes. The results will be correlated with glaciation events to understand the effects of past changes in climate on genetic diversity among ice-crawler populations.

FROM SATELLITE MAPPING TO FIELD VALIDATION: CORRELATION OF USDA AND LABORATORY SOIL TEXTURE CLASSIFICATIONS

Juliann Bonomi
Mentor(s): Daniel Igirimbabazi

Soil texture (proportion of sand, silt, and clay) is a critical property in land management. Accurately calibrated soil texture maps are necessary to understand the implication of texture differences on soil aggregation and erosion. On-site investigations are needed to test the accuracy of commonly used USDA Web Soil Survey (WSS) maps. We compared texture classifications from field-based hydrometer measurements across four sites in Wisconsin to WSS classifications. We hypothesized that laboratory and WSS particle size distributions would differ due to broader spatial scale from WSS mapping, but not enough to change overall texture class. Our findings will contribute to the credibility of using soil maps as a reliable resource for soil management and research.

INCREASED FIRE CORAL DENSITY SUPPORTS GREATER ABUNDANCE OF JUVENILE DAMSELFISH

Allison Bontempo, Tess Brazee, Kate Clausen, Emily Gronert, Lucy Wineberg
Mentor(s): Catherine L Woodward

The role of the genus *Millepora* (Fire Coral) often outcompetes slower-growing species by deploying venomous nematocysts that deter neighboring organisms. This study investigated the correlation between the percent cover of multiple *Millepora* species and associated reef rugosity, and their influence on juvenile reef fish abundance, diversity, and shelter use across Glover's Reef, Belize, focusing on fire coral's contribution to terrain heterogeneity. Over the study's four days of data collection, 19 five-meter transects for a total of 95 m^2 of area were surveyed. Reef rugosity was collected through the tape-chain rugosity method. Juvenile fish count was conducted by swim-over surveys. This data was used to find the total number of individuals observed, the average number of juvenile fish per square meter, the frequency occurring for each species, and the total number of juvenile individuals within all plots.

SURGEON'S POINT OF VIEW: GAZE TRACKING TO ASSESS TEAM COORDINATION IN ROBOTIC-ASSISTED SURGERY

August Booth, Nicole Silva
Mentor(s): Jackie Cha
Additional Author(s): Patrick Fuller

Effective non-technical skills (NTS), such as communication, situation awareness, and leadership, are critical to surgical safety. In robotic-assisted surgery, where the surgeon is physically separated from the team, there are additional NTS requirements and it becomes harder to assess using traditional observation methods. Eye-tracking offers a continuous, objective measure of surgeon attention during live procedures. In this study, surgeons wore eye-tracking glasses during 30 robotic-assisted surgeries, and 24 gaze metrics such as fixation frequency and duration, were calculated to infer NTS capabilities. We examined whether gaze patterns can indicate effective NTS, especially teamwork and situation awareness. Findings may inform the development of feedback systems to reduce NTS-related failures in the operating room to improve patient outcomes.

DO ADULTS' MESSAGES ENGENDER SELF-RESEMBLANCE PREFERENCES IN RACIALLY-MINORITIZED CHILDREN

Andriana Boulos
Mentor(s): Ashley Jordan

We examine the emergence of children's preferences for self-resembling others. Prior work shows that adults' labeling promotes young children's self-resemblance preferences; whereas spontaneous self-similarity emerges at 6 years (Jordan & Wynn, 2022). Past work is limited to trait differences that vary noticeably among majority-race children. Here we examine preferences based on skin tone and hair texture, features encoding social status information (Lei et al., 2024) and varying noticeably among U.S. Blacks. Black children 3–6 years are assigned to an Explicit, wherein self-other similarity is ostensively communicated, or Implicit condition wherein trait labels alone are provided. We predict the youngest children will prefer self-resemblance following explicit messages, but only older children will do so spontaneously. Bias favoring lighter hues and looser textures will be explored.

GOING TOWARDS THE LIGHT: MEASURING RELATIVE NUCLEAR REACTOR POWER THROUGH CHERENKOV RADIATION, LIGHT SENSATION, AND INTERPOLATION

Jason Brammeier Zayas, Carlos Fairbanks, Ben Ferguson, Janiya Martin, Garrett Poynter, John Qualley
Mentor(s): Charles A. Hirst

To meet rising demands for energy, investments into nuclear reactors have soared in recent years. Since a reactor's function is to produce energy, power output is a leading metric in how we evaluate these reactors. Ion chambers, the most commonly used device for sensing reactor power, typically cost thousands of dollars. This high cost barrier makes them less desirable for taking reactor measurements in environments that don't demand the precision they provide. In our project, we built a sensor using an Arduino, photodiode array, and support housing that measures and interpolates reactor power through the intensity of emitted Cherenkov radiation. By utilizing more commonly available materials, we provide a low-cost alternative for recording reactor power, making this process more accessible for lower-stakes applications.

ACTIVIST NETWORKS & HUMAN RIGHTS DATA COLLECTION

Edie Branner
Mentor(s): Joseph Conti

This project examines human rights organizations and their influence across different regions and policy areas. It explores how advocacy groups use the concept of "human rights" to frame their work, and how activist networks shape international human rights policy. Based on internet, documentary, and tax records, we have created an original dataset capturing the connections and ties among human rights organizations across countries, issue areas, and levels of activity (e.g. international, regional, and local) for the year 2020. By mapping these relationships, the study offers a systematic, network-based understanding of how organizational ties influence the protection of civil liberties on different geopolitical levels. This is a unique approach compared to prior studies that have mainly relied on individual organizational websites.

EXTRAPOLATING NUCLEAR REACTOR POWER OUTPUT USING SUBMERSIBLE SENSOR PROBES TO DETECT CHERENKOV RADIATION

Jacob Brochtrup, William Brandt, Jackson Langreck, Chloe Johnson, Talen Dickson
Mentor(s): Charles Hirst

Nuclear reactors are an important part of our energy future, and given the potential dangers of a core failure, systems to monitor core conditions are critical. Cherenkov radiation, a form of visible light, is released during fission when charged particles travel faster than light through a medium and can be used to monitor core conditions. However, the exact correlation between Cherenkov radiation and the UW reactor's power output is unknown. To understand this relationship, we constructed a submersible, multi-sensor probe to collect Cherenkov radiation data and chart light intensity versus known reactor power outputs. It is then possible to interpolate how Cherenkov radiation intensity changes with differing reactor power outputs, providing another method to monitor core safety.

DEVELOPMENT OF ION IRRADIATION EXPERIMENTS OF POWDERS FOR ANALYSIS BY DIFFERENTIAL SCANNING CALORIMETRY

Casey Brophey
Mentor(s): Charles Hirst

Defects produced by radiation damage frequently present challenges for analysis of irradiated materials particularly due to defect size. Nano-calorimetry has been proposed to examine this radiation damage by uncovering the atomic scale defects produced by neutron or ion bombardment. Ion bombardment provides many benefits compared to neutron irradiation but fails to produce substantial analysis regions due to electronic interactions with target specimens. Preparing properly sized analysis specimens from bulk irradiated materials introduces an obstacle to efficiently producing experimental data. Using microscopic powders as an irradiation target is proposed to increase experimental efficiency, flexibility, and data quality. A new experimental design has been developed to account for the change in irradiation specimens.

INVESTIGATING DIFFERENTIAL DNA METHYLATION ASSOCIATED WITH IDIOPATHIC GENERALIZED EPILEPSY IN FAMILIES

Evelyn Browning
Mentor(s): Steven Schrodi

The epigenetics of idiopathic generalized epilepsy, a complex neurological disorder, are widely unknown. DNA methylation, an epigenetic process that regulates gene expression, captures signals from genetic and environmental effects making it a promising candidate for complex disease research. Current literature implicates DNA methylation-linked gene expression in epilepsy development through abnormal neuronal structure and function. This study will investigate genome-wide DNA methylation patterns in familial cases of idiopathic generalized epilepsy, providing insight into implicated molecular pathways. Here, I test the hypothesis that genomic regions with known epilepsy associated genetic variants exhibit differential methylation between familial cases and controls, with cases sharing patterns in these regions. This study aims to provide targets for genomic and molecular-level therapeutics, and to present opportunities for new, non-invasive epilepsy diagnosis tools.

INVESTIGATING THE EFFECTS OF THE *ESCHERICHIA COLI* RNA POLYMERASE OMEGA SUBUNIT ON POST-INITIATION TRANSCRIPTIONAL PROCESSES

Jonathan Buscher
Mentor(s): Robert Landick, Rachel Mooney

RNA polymerase (RNAP) is a universally conserved multi-subunit enzyme essential for transcription, and the smallest subunit, omega (ω), is nonessential in most bacteria, yet widely conserved. *E. coli* RNAP structures show ω positioned to interact with various transcription factors, including pausing, termination, and antitermination modulator NusA. Utilizing RNAP core purified with wild-type ω, mutant N60D ω, or lacking ω completely (Δω), we demonstrate robust transcription on promoter-based templates in vitro. We find that, relative to RNAP containing wild-type ω, N60D ω and Δω RNAP reduce termination efficiency and are less sensitive to NusA-mediated termination enhancement. We aim to further characterize this apparent interaction by measuring termination efficiency with C-terminally truncated ω and NusA-truncation, and will investigate a possible global regulatory role of ω by ChIP-seq.

INFLUENCE OF WHITE-TAILED DEER ON THE DIVERSITY OF SOIL SEED BANKS WITHIN MIXED DECIDUOUS FORESTS

Danny Byrne
Mentor(s): Aundrea Taylor, Nick Balster

Increasing white-tailed deer (*Odocoileus virginianus*) populations, coupled with selective herbivory, has been shown to alter the diversity of herbaceous flora in forests. However, the compensatory effect of deer herbivory on the composition of below ground soil seed banks remains unclear. Diverse seed banks increase the resilience of forest ecosystems following disturbance events such as intensive browsing. This study investigates the effects of deer foraging habits on seed bank diversity within mixed forests of Wisconsin. We will compare the species diversity of seed banks between deer exclosures and paired non-exclosure plots (controls) using the Shannon Weiner Index. This experiment will assess the magnitude of deer herbivory on seed bank diversity as an inferential legacy effect on the floral recovery of forest ecosystems in Wisconsin.

TRACING TRAINING-INDUCED NEUROPLASTICITY IN THE HUMAN BRAIN

Brianna Calderon Ribera, Sophia Yang
Mentor(s): Nike Gnanateja Gurindapalli, Dhatri Devaraju
Additional Author(s): Megan Hernandez

Adults often struggle to learn non-native speech contrasts, and prior work shows that perceptual gains emerge early while subcortical changes, reflected in frequency-following responses (FFRs), appear only after extended training (Reetzke et al., 2018). Building on this research, this project examines how perception, production, and feedback-based training shape cortical and subcortical encoding during Mandarin tone learning. Training includes a six-block feedback and generalization paradigm, production practice, and EEG recordings that capture cortical activity and brainstem FFRs to /yi/ tones. By comparing behavioral gains to neural changes across the auditory pathway will help determine whether cortical adjustments emerge before subcortical plasticity and whether this pattern supports Reverse Hierarchy Theory. The overall purpose of this project is to investigate how perceptual and production training shape neuroplasticity across cortical and subcortical levels of the auditory system.

CHARACTERIZING CANOPY STRUCTURE IN COASTAL BLUFFS USING DRONE LIDAR

Halle Lyn Callahan
Mentor(s): Christian Andresen

Soil erosion has been affecting coastal landforms increasingly in recent years. Vegetation has the potential to become an essential tool in understanding long-term bluff stability and erosion reduction. The canopy structure of vegetation on the Wisconsin bluffs provides insight into patterns, clusters, and various metrics which will assist in further action. This study employs drone LIDAR systems to construct data on relationships between the elevation of a North Beach Park bluff along Lake Michigan, and various vegetation metrics. This will explore imagery patterns unable to be processed with photogrammetry and conclusions continue to the next steps for vegetation management recommendations.

INTERROGATING THE INFLUENCE NARS1 TOR SIGNALLING HAS ON EARLY LEAF DEVELOPMENT IN *ARABIDOPSIS THALIANA*

Lazlo Camou
Mentor(s): Jake Brunkard, Rory Greenhalgh

NARS1 is an essential gene that encodes asparaginyl tRNA synthetase plants. The NARS1 protein has also been shown to promote Target of Rapamycin (TOR) activity, a conserved eukaryotic kinase that plays a key role in growth and development. To further explore the developmental consequences of NARS1's TOR signalling, a phenotypic analysis of early leaf area in *Arabidopsis thaliana* was performed. In this analysis, wild type *A. thaliana* and transgenic overexpressing lines overexpressing NARS1 or NARS1ΔWHEP, a NARS1 mutant incapable of signalling to TOR, are compared. The different mutants were also then compared across growth media with and without sucrose, as sucrose has been shown to upregulate TOR activity. Preliminary results suggest that there is a positive correlation between TOR signalling through NARS1 and leaf area.

ADOLESCENT MENTAL HEALTH IN THE TIME OF COVID-19 SCREENS

Ella Capomaccio
Mentor(s): Kristin Kotleski

In 2020, over 104 countries reported elevated adolescent anxiety levels due to the COVID-19 pandemic. While social media use is associated with anxiety, its role in communication during isolation makes the pandemic's impact on this relationship unclear. The purpose of this study is to explore how the frequency of anxiety and stress related to social media alongside general anxiety rates changed among Dane County adolescents pre, during, and post-pandemic. This secondary analysis will utilize data from the Dane Conty Youth Assessment (2018, 2021, and 2024), a county wide survey of high school students across 17 public school districts. Primary variables include anxiety from social media use and general anxiety among Dane County adolescents.

GENERATING OPTIMIZED STELLARATOR COILS WITH AUTOENCODERS AND DIFFUSION NETWORKS

Isaac Carpenter
Mentor(s): Dominic Seidita

Stellarators are donut-shaped fusion devices that confine plasma using precise magnetic fields. Those magnetic fields are produced by electromagnetic coils, and small changes in coil shape can strongly affect performance and manufacturability. Today, coil designs are usually found by repeatedly running computationally intensive optimization, which becomes slow for large databases and can fail when started from a poor initial guess. I propose a machine-learning pipeline that generates high-quality coils directly from the stellarator surface. First, a neural network compresses surface information into a compact latent vector. Then, a diffusion-based generator creates a set of coil latents for this surface latent. Lastly, this set of coil latents is decoded into full coil shapes. This approach can rapidly and cheaply produce good initializations and near-optimal coils.

VEGF AND PDGF TETHERED LIGANDS FOR TISSUE ENGINEERED MICROVASCULATURE GRAFT

Tristan Carrington
Mentor(s): David Dean, Joshua Alexander

The inability to create functional microvasculature remains a significant barrier to tissue-engineered graft survival because insufficient perfusion at implantation leads to nutrient deficiencies and waste accumulation. This project investigates how tethering VEGF and PDGF ligands influences microvasculature formation within perfusable GelMA/SA hydrogel microvascular sheets for bone grafting. Aim 1 establishes a calibration curve to optimize ligand concentration by varying soaking concentration, UV exposure time, and wash conditions. Aim 2 evaluates HUVEC and pericyte organization under four conditions (no ligand, VEGF, PDGF, VEGF+PDGF) and assesses lumen formation and morphology. We hypothesize that VEGF+PDGF will promote coordinated lumen formation and organization, allowing for arterial-like morphology. This work aims to advance reproducible strategies for engineering vascularized grafts transferable to future regenerative medicine applications.

DO LAWYERS MATTER? USING GENERATIVE AI TO ANALYZE COURT OPINIONS

Will Carter
Mentor(s): Kathryn Hendley

Having a lawyer in the U.S. legal system is a near-requisite to win anything beyond the simplest of cases. This project aims to understand the necessity of legal counsel outside of the United States. Using Westlaw's large language model, CoCounsel, we will analyze decisions in defamation cases made in Russian economic courts and determine whether the parties were represented. Defamation cases are an ideal case study because they present complicated legal issues for which legal expertise ought to be helpful. Once the cases are coded with the help of AI, we will plot our findings in a series of Excel tables. These tables will reveal whether having a lawyer increases litigants' chances of winning.

A COMPOSABLE MULTI-MODAL ML FRAMEWORK FOR REAL-TIME REASONING AND TASK GUIDANCE

Elias Cassis, Arihan Yadav
Mentor(s): Alan McMillan

This project addresses the challenge of real-time AI guidance for complex, real-world tasks. Current AI models rely heavily on visual data and struggle to process multiple information types simultaneously, limiting their usefulness in physical environments. To bridge this gap, we propose a novel, "composable" framework. Rather than relying on a single massive model, our approach creates an agent orchestrating a suite of specialized AI models. Together, they act as an intelligent reasoning layer that seamlessly interprets multi-modal data. This framework enables high-accuracy reasoning for real-time error correction, task summation, and step-by-step guidance. Ultimately, this technology aims to optimize human performance in complex scenarios, ranging from intricate mechanical maintenance to advanced robotics and medicine, reducing cognitive load and preventing critical errors during physical task execution.

THE SEARCH FOR ULTRA FAINT DWARF GALAXIES

Anna Castello
Mentor(s): Keith Bechtol
Additional Author(s): Kayleigh Excell

Ultra faint dwarf galaxies are small galaxies orbiting larger galaxies that are fossils from the early formation of the universe during a period called the Epoch of Reionization, when the first stars and galaxies were formed. They contain very old stellar populations, little to no gas, and most known UFDs orbit the Milky Way. We can look for these old stellar populations by searching for stars emitting longer wavelengths, which would indicate a population of red, low mass stars (low mass stars live the longest). We have been developing an algorithm that searches for ultra faint dwarf galaxies (UFDs), utilizing currently publicly available Euclid data. Euclid is a space telescope designed to observe billions of galaxies in our universe.

INFUSINATOR: A COMPANION HARDWARE-SOFTWARE ARCHITECTURE FOR STRUCTURED INTRAVENOUS MEDICATION MANAGEMENT

Evan Cedeno
Mentor(s): Joe Krachey

For individuals living with chronic rare conditions such as bleeding disorders, prophylactic treatment often requires daily self-administration of intravenous medication. Patients are routinely advised to maintain detailed infusion records to support insurance verification, monitor adherence, and track remaining doses. Despite the availability of mobile applications for manual logging, integrating documentation into an already time-intensive infusion workflow remains burdensome. I present Infusinator, a companion hardware-software system centered around a smart tourniquet that integrates directly into the infusion process. By embedding structured logging within the physical act of administration, the system is designed to reduce documentation friction for at-home infusion care while supporting regimen traceability and auditability.

BLASTOMYCES AST METHOD FOR LIFE-SAVING CLINICAL INTERVENTION

Arvin Challuri
Mentor(s): Alana Sterkel, Francesca Scala

Blastomyces is a potentially deadly dimorphic fungal pathogen endemic to the Great Lakes region, yet treatment is often hindered by the lack of Antimicrobial Susceptibility Testing (AST) methods. Unlike the majority of pathogens, physicians are forced to choose their treatments without laboratory data, leading to prolonged treatment and recurring disease. We have developed a first-of-its-kind yeast-based AST method that provides rapid data from the physiologically relevant yeast form. In an effort to optimize this method for fast and slow strains, this study evaluates the specific contributions of key media components (buffers, serum, and nutrients) by measuring the growth rates when certain reagents are selectively added. With concerns for anti-fungal resistance, AST methods will provide swift and reliable data for life-saving clinical intervention.

PHYTOCHEMICAL ANALYSIS OF BIOACTIVE COMPOUNDS IN *SOLANUM SISYMBRIIFOLIUM*

Aiden Chang
Mentor(s): Hashim Ibrahim

Potato nematodes threaten global food security by causing significant yield losses in potato crops, with an ability to remain dormant in the soil for multiple growing seasons. While synthetic pesticides are effective, the high environmental and health costs necessitate sustainable alternatives. Building on research showing that certain plant extracts, such as those from the solanum species, can act as natural biopesticides, this research analyzes the phytochemical profiles of *Solanum sisymbriifolium*. Using UV spectroscopy and High-Performance Liquid Chromatography, we evaluate different extraction methods for compounds such as flavonoids, phenols, and tannins. Different plant parts and solvents with varying polarity showed differences in the concentration of flavonoids, phenolics, and tannins. The results will guide the selection of plant parts and solvents for the extraction of specific compounds.

CONDITIONAL LETHALITY IDENTIFIES MITOCHONDRIAL COMPLEX I AS THE PRIMARY FUNCTIONAL TARGET OF DEGUELIN

Gavin Chang
Mentor(s): Jason Cantor
Additional Author(s): Kyle Flickinger

Deguelin is a derivative of rotenone that has shown efficacy in multiple cancer types. Our previous high-throughput chemical screens identified deguelin as a compound whose lethality varies with respect to nutrient availability. Here, we investigated conditional deguelin sensitivity in derivatives of a physiologic cell culture medium (HPLM) and a conventional cell culture medium (RPMI). Through this work, we identified Mitochondrial Complex I as the primary functional target of deguelin. Additionally, we traced this conditional sensitivity to differential metabolite availability between HPLM and RPMI. We then leveraged these drug-nutrient interactions to reveal intriguing perturbations of several metabolic pathways upon deguelin treatment. Together, our findings provide a basis for revealing new mechanistic insights into cellular metabolism and understanding how deguelin conditionally inhibits cancer cell growth.

BIAXIAL VISCOELASTIC CHARACTERIZATION OF HUMAN AND PORCINE AORTIC VALVE LEAFLETS TO VALIDATE PORCINE SURROGATE TISSUE MODELS

Sudhindra Chavadam
Mentor(s): Colleen Witzenburg

Porcine aortic valve leaflets are widely used as surrogates for human tissue in biomechanics research, yet their ability to replicate human viscoelastic behavior remains uncertain. Prior validation has focused on elastic stiffness and anisotropy under quasi-static loading, despite native valves undergoing continuous cyclic deformation and exhibiting time-dependent behaviors such as stress relaxation and energy dissipation. The mechanical validity of porcine tissue under physiologic loading conditions therefore remains unclear. This project will directly compare the biaxial viscoelastic response of healthy human and porcine aortic valve leaflets using identical stress relaxation and cyclic loading protocols. By quantifying species-specific differences in time-dependent mechanics, this work will address a critical validation gap and improve the reliability of surrogate models used for constitutive modeling and bioprosthetic valve design.

UNLEASHING AI IN SURVEY RESEARCH: EVALUATING THE POWER AND PITFALLS OF LARGE LANGUAGE MODELS IN EVALUATING SURVEY QUESTIONS

Jiahao Chen
Mentor(s): Jennifer Dykema, Nadia Assad

This study evaluates Large Language Models (LLMs) as tools for survey question assessment by comparing their performance to human coders using the Question Appraisal System (QAS). We examine how accurately GPT-4o identify potential data quality issues in survey questions and assess their consistency across models and implementations. The analysis uses questions from three established surveys: the General Social Survey, Wisconsin Longitudinal Study, and Voices Heard Survey. By measuring the reliability and accuracy of LLMs in predicting data quality indicators, we determine whether these AI systems can effectively function as diagnostic tools in survey methodology. Results will inform researchers about the viability of incorporating LLMs into survey design processes, potentially offering efficient alternatives for pre-testing survey instruments before human review or field testing.

DESIGN AND BUILD A VACUUM BED FOR A UV LASER

Jingcan Chen
Mentor(s): Logan Joseph Fitzpatrick

Many of the components inside a battery — such as separators and electrodes — are fragile and must be cut with precision. This project aims to design and build a vacuum bed system that securely holds these thin materials flat and stable while using a UV laser. A vacuum bed works like a perforated platform connected to a small pump, creating suction to keep materials from shifting or wrinkling.

ADAPTING THE RB-TNSEQ METHODOLOGY FOR FUNCTIONAL GENOMICS IN THE SYMBIONT *VIBRIO FISCHERI*

Nicole Chen
Mentor(s): Avery Imes, Mark Mandel
Additional Author(s): Vincent T. Watring, Avery Imes, David M. Hershey

Randomly Barcoded Transposon Insertion Sequencing (RB-TnSeq) enables rapid high-throughput bacterial mutant library screening and subsequent mutant identification. We modified RB-TnSeq to generate a transposon library in the marine symbiotic bacteria, *Vibrio fischeri*. We challenged this library during growth in different media, representing conditions *V. fischeri* experiences in the environment and the squid host. We focused on three gene hits: rlmL (VF_1287), ravA (VF_A0498), and clpX (VF_0797), which have growth defects at pH 8, pH 5, and in glycerol, respectively. To validate the media results from the library, we deleted each of the three genes and are examining growth phenotypes. Overall, this work developed RB-TnSeq for functional genomics in the valuable symbiosis model bacterium *V. fischeri*.

DEFINING THE CRITICAL PERIOD FOR FMRP RESTORATION IN FRAGILE X MICE

Sixing Chen
Mentor(s): Xinyu Zhao
Additional Author(s): Zhiyan Xu

Fragile X syndrome (FXS), a leading cause of inherited intellectual disability, is caused by the silencing of the Fmr1 gene and the resulting loss of the fragile X mental retardation protein (FMRP). While FMRP restoration rescues behavioral deficits in Fmr1-knockout mouse models, the critical period for restoration remains unknown. Our study analyzes behavioral data after restoration in juvenile mice (1–3 weeks) and young adult mice (5–8 weeks). We hypothesize that juvenile intervention will rescue a broader range of behavioral deficits than adult intervention. Using PCR for mouse genotype confirmation and an automated behavioral analysis software, AnyMaze, our preliminary results support the existence of a specific critical period for restoration. Establishing this timeline for restoration is crucial for guiding future therapies for FXS patients.

HOW IS LENDING SCALE ACHIEVED AMONG NON-TRADITIONAL MORTGAGE LENDERS, AND HOW DOES THIS SCALING RELATE TO MARKET CONCENTRATION AND MARKET SHARE?

Qinxuan Chen, Brynn Ronk
Mentor(s): Charles Rehfeld Smith

This project aims to explain what drives growth patterns in the U.S. non-bank mortgage lending market. The first half examines whether market trends are primarily explained by existing firms expanding or contracting their lending activity, or by firms entering and exiting the market. We also investigate whether growth within individual firms is driven by expanding into new geographic markets or increasing lending within states where firms already operate. Using firm-level data by activity year, we measure how geographic and local expansion contribute to mortgage originations.

The second half examines how lending scale relates to market concentration and market share. We analyze how lending activity is distributed across institutions and compare the composition and rankings of top lenders across years. We hypothesize that lending activity is transaction-intensive and concentrated among a small number of large lenders.

THE REGULATION OF NATURAL KILLER CELL TRAFFICKING AND ADAPTATION DURING PREGNANCY

Xiang Yi Chen, Roghyah Hasan
Mentor(s): Mona Mohamed

During early pregnancy, natural killer cells (NK) accumulate differentially in the decidua to support fetal development, however how they populate this tissue remains unclear. In this study, we use serial intravascular labeling in mouse models to distinguish peripheral NK cells that traffic from the circulation from uterine NK cells that originate within the uterus. Half of each tissue sample is analyzed by flow cytometry to quantify these NK cell subsets, while the other half undergoes immunofluorescence staining to confirm their spatial distribution within the decidua and clarify how NK cells home to and localize in the pregnant uterus. With past research, the goal is to understand NK cells in the pregnant uterus, allowing the development of targeted therapies for disorders involving dysregulated NK cell function.

THE EFFECT OF TIKTOK'S "WHAT I EAT IN A DAY" VIDEOS ON YOUNG WOMEN'S SELF-PERCEPTION AND SOCIAL COMPARISON

Xinwei Chen
Mentor(s): Kajsa Dalrymple
Additional Author(s): Audrey Weber, Kayla Northway, Yang Li

Young adult women increasingly turn to TikTok for healthy lifestyle information, yet little is known about how short-form food content influences their self-perception and social comparison tendencies. This project addresses that gap by examining how "What I Eat in a Day" (#WIED) videos on TikTok influence body-image self-perceptions and social comparison effects among women ages 18-22. In the experiment, participants were randomly assigned to either a #WIED or a neutral control condition. Self-perception and social comparison were measured before and after stimulus. Results showcased that acute exposure to #WIED did not produce significant changes. However, participants with lower prior exposure to #WIED content reported higher levels of social comparison after the stimulus, suggesting that fresh viewers are more reactive to such content.

DOES INCREASED NITROGEN AVAILABILITY ENHANCE TREE GROWTH IN YOUNG LODGEPOLE PINE FORESTS?

Collin Cheney
Mentor(s): Monica Turner, Timon Keller

Ecosystem function of young forests is understudied, a critical research gap as young forests become more prominent due to more frequent and severe disturbances driven by climate change. In young postfire lodgepole pine (*Pinus contorta* var. *latifolia*) forests of the Greater Yellowstone Ecosystem (GYE), stands grow rapidly after establishment but it is unknown what the constraints of tree growth are as stands reach peak productivity. In my study I ask whether tree growth in young subalpine forests is limited by available nitrogen. By collecting tree cores from different aged lodgepole pine stands (9, 25, and 37 years old) within a fertilization experiment I will demonstrate the responses of stem growth from variable N fertilization (0, 20 kg N ha-1, and 50 kg N ha-1).

CHIRAL S(VI) PLATFORM UNIFIES SELECTIVE C–H AMINATION OF COMPLEX MOLECULES AND ALKANE FEEDSTOCKS

Stanislav Cherempei
Mentor(s): Derek Hu
Additional Author(s): Tuan Anh Trinh, Derek Hu, Anna Kenny, Ethan Warrington, Jennifer Schomaker

Complex molecules and simple alkanes present fundamentally different challenges for catalytic C–H functionalization—precise, catalyst-controlled selectivity versus high intrinsic activation barriers—precluding a generalizable solution. Herein, we report a unified strategy that address both challenges by repurposing a classic chiral auxiliary framework from carbonyl chemistry into a stereocontrolled C–H amination platform via silver-catalyzed sulfur(VI) nitrene transfer. This system enables stereodivergent, late-stage amination of activated C–H bonds in complex molecules with broad functional-group tolerance and aqueous compatibility, while also mediating mild, selective amination of unactivated chemical feedstocks. The modular, stereodefined S(VI) motif functions as a multi-vector pharmacophore, providing a versatile linchpin for rapid library diversification and enabling both target- and diversity-oriented synthesis.

DINING AND SCROLLING: THE MOTIVATIONS AND PERCEPTIONS OF PERSONAL DEVICE USE IN UW MADISON DINING HALLS

Nalina Cherr
Mentor(s): Dominique Brossard

Through anecdotal evidence and casual conversations, I've heard that while some students genuinely intend to be productive in the dining halls, many only revert to computers and phones in the absence of camaraderie. Although previous research seems to show that increased device use is associated with less engagement in on-site social interaction, and phone use can blindside people to their physical surroundings, it's unclear what the motivations and perceptions of personal device use in the Madison dining halls are, and how or if these devices change social behavior within these sites. Using quantitative and qualitative methods from science communication including interview and observational study, I hope to explore this understudied topic.

PROBING THE EFFECTS OF INCREASED CONFORMATIONAL FLEXIBILITY ON OXYNTOMODULIN ACTIVITY AT THE GLUCAGON AND GLUCAGON-LIKE PEPTIDE-1 RECEPTORS

Andrei Chiruta
Mentor(s): Justin Suter, Samuel Gellman

Oxyntomodulin (OXM) is a peptide hormone that acts on both the glucagon and glucagon-like peptide-1 (GLP-1) receptors, resulting in weight loss and appetite reduction. OXM and glucagon (another hormone) share their first 29 residues, but OXM has an additional eight amino acid tail. OXM is less potent at the glucagon receptor, but more potent at the GLP1-1R compared to glucagon. I hypothesize that the eight amino acid tail is interfering with OXM's ability to activate the glucagon receptor, and that more flexible analogues will reduce interference. More flexible analogues have been rationally designed, synthesized, and tested for potency at both the glucagon and GLP-1 receptors using cellular assays. Initial tests have not yet yielded more potent analogues, but further exploration is ongoing.

SIGNALS OF THREAT AND FAIRNESS: HOW ALLIES' DEFENSE SPENDING SHAPES AMERICAN SUPPORT FOR OVERSEAS U.S. TROOP PRESENCE

Minwoo Choi
Mentor(s): Katherin Cramer

This study examines how allied defense spending influences U.S. public support for overseas troop presence through two mechanisms: fairness and threat. Using panel survey data (2002 - 2024) and a DDD design centered on the 2022 Russia-Ukraine war, the research finds that higher allied spending generally increases American support regardless of partisanship by signaling burden-sharing and threatened security. However, in high-threat contexts, increased spending weakens support --particularly among Republicans --by amplifying fears of the security dilemma and U.S. entrapment in major conflicts such as nuclear wars. Ultimately, the study reveals that allies' defense spending typically sustains the durability of alliances, serving as credible signals for American public. But, it is also manifested that signaling threat through increased spending exerts mixed effects on American public support.

THREAT PERCEPTION EXPANSION: A MEDIATION PATHWAY LINKING PERCEIVED NORTH KOREAN NUCLEAR THREATS TO VIEWS OF CHINA'S PEACE CONTRIBUTIONS

Minwoo Choi
Mentor(s): Katherin Cramer

This study examines how South Koreans' perceptions of China's contribution to peace on the Korean Peninsula are shaped by perceptions of North Korea's nuclear threat. Using nationally representative survey data from 2024 and causal mediation analysis, the study identifies a pathway linking these attitudes. The results show full mediation: nuclear threat perceptions do not directly shape views of China's peace contribution but operate through negative evaluations of strengthened Sino -North Korean cooperation. Higher perceived nuclear threat increases the likelihood of viewing Sino -North Korean alignment as problematic, which leads respondents to believe China does not contribute to peace on the Korean Peninsula. These findings highlight a cognitive mechanism of threat-perception expansion, whereby evaluations of third-party states are filtered through perceptions of relations with primary adversary.

TRANSIENT ISCHEMIC INJURY'S EFFECTS ON PATHOLOGICAL AGGLUTINATION IN RHESUS MACAQUE PREGNANCIES

Arya Choudhury
Mentor(s): Logan Keding
Additional Author(s): Eiman Mir

Transient ischemic injury, or a temporary cessation of blood to the placenta, is commonly hypothesized to cause adverse human pregnancy outcomes. However, reliably studying ischemic injury in humans raises both ethics and feasibility issues. In order to explore transient ischemia's effects on placental health, we compared ischemic placentae samples to healthy controls in the rhesus macaque pregnancy - employed in literature for its similarity to human placental physiology. Placental samples were collected, H&E stained, scanned, annotated by tissue type, and annotated for pathological agglutination (abnormal placental villi structure/vascularization). Agglutinated samples (n=12) were analyzed by size and location, then compared to controls (n=12). These preliminary data will add to literature's currently-sparse knowledge about ischemic injury identification and classification, and further advance therapeutic development.

H4K16ac AND H4K20me1 GATE TRANSCRIPTION TO REGULATE MUSCLE STEM CELL ACTIVATION

Adam Chu
Mentor(s): Roméo Blanc

Skeletal muscle regeneration relies on muscle stem cells (MuSCs) maintaining "activation-ready" quiescence, a state that erodes with age. This study identifies promoter-proximal pausing as the central mechanism governing this transition. By integrating PRO-seq and CUT&Tag datasets, we identified a mitochondrial gene cohort that is poised during quiescence, characterized by high initiation but stalled elongation. This poising is regulated by the presence of H4K16ac and H4K20me1 at the promoter. We show that H4K16ac removal triggers Pol II release, while H4K20me1 facilitates elongation during activation. Furthermore, we propose that the mTOR-YY1-PGC-1α axis acts as the upstream metabolic sensor timing this epigenetic switch. This research defines a mechanistically linked metabolic-epigenetic framework, offering actionable targets to restore regenerative potential and reduce frailty in aging skeletal muscle.

EXPLORING SARS-COV-2 NSP13 HELICASE AS A SPECIFICITY DETERMINANT IN RNA SYNTHESIS INITIATION

Jake Chung
Mentor(s): Robert Kirchdoerfer, Audrey MacDonald

The viral family *Coronaviridae* is responsible for high-impact outbreaks such as the COVID-19 pandemic. During an infection, SARS-CoV-2 uses a viral RNA-dependent RNA polymerase (RdRP) to copy its genome. Previous experiments have shown that the SARS-CoV-2 RdRP alone is insufficient to impart specificity for viral RNA synthesis. This study will examine the viral RNA helicase as a potential specificity factor influencing the binding of the RdRP to the viral RNA genome. Two copies of helicase, nonstructural protein (nsp) 13, have been observed to complex with the RdRP in vitro. This direct binding could implicate nsp13 in RNA binding specificity. Thus, this study will seek to determine if nsp13 confers RdRP-RNA binding specificity using microscale thermophoresis, a thermophoretic shift assay.

OSSEOINTEGRATION (OI) IN AMPUTEES: A SCOPING REVIEW AND CLINICAL PRACTICE GUIDELINES

Abigail N Cichocki
Mentor(s): Aaron Dingle
Additional Author(s): Ashley N. Maggia, Emily E. Zona, Camille J. LaLiberte

Limb loss affects ~2.5 million Americans, which can result in significant physical and psychological challenges. OI, a cost-effective alternative to traditional socket prostheses, offers greater flexibility and reduced maintenance costs. The absence of clear clinical guidelines for OI eligibility in the US, including consensus on exclusion criteria, results in inconsistent patient selection and access.

This scoping review examines current OI recipients for transfemoral, transtibial, and transhumeral amputations, their associated outcomes, and complications. The 17 included articles covered 1423 OI patients, commonly transfemoral amputees experiencing socket prosthesis dissatisfaction. Soft tissue and stoma-related complications were most common, which sometimes required surgical intervention.

Developing clear multidisciplinary guidelines is crucial for consistent patient selection and improved access to OI, long-term functional outcomes, and quality of life for amputees.

CROSS-ELECTROPHILE COUPLING OF 5-MEMBERED HETEROCYCLES

Gray Cicmanec
Mentor(s): Ben Ahern

Five-membered heterocycles are key components of many top selling pharmaceutical drugs. Cross-electrophile coupling (XEC) enables the coupling of these structures to radical fragments. Under the mentorship of Ben Ahern, secondary alkyl bromides were coupled to five-membered heteroaryl bromides to form Csp3-Csp2 bonds with the use of nickel-catalyzed XEC. This work focuses on optimizing reaction conditions and constructing a reaction scope relating to this chemistry. This work is targeted towards pharmaceutical screening of potential drug candidates and provides an alternative to the Suzuki-Miyaura reaction.

ABUNDANT GREEN GLOWS ON THE SEA FLOOR: HABITAT PREFERENCE AND DENSITY OF BIOLUMINESCENT ATOKE STAGE *ODONTOSYLLIS* SP. OFF THE COAST OF LAYTON, FL

Lukas Coffin Ness, Rachel Neperud
Mentor(s): Gretchen Gerrish
Additional Author(s): Vivian VanDyke

Little is known about the early life cycle and larval distribution of the bioluminescent worm, *Odontosyllis* sp. Spawning behaviors of adult *Odontosyllis* sp. were observed near shore on Long Key, FL. Therefore, we tested whether larval worm distributions decreased at greater distances from shore and varied across benthic substrate types. We found that anchored and floating algal substrates have higher concentrations of luminous glowing worms than the seafloor rocks, and that sloped locations closest to shore contained the highest concentration of luminous glows compared to flat hard bottom habitats farther offshore. Our findings support that there are 100s of early stage worms per meter square and that the highest densities of early stage *Odontosyllis* sp. occurred in nearshore algal substrates.

A COMPARATIVE ANALYSIS OF GENOME-WIDE RG4 DETECTION METHODS USING RNA-SEQ DATA

Alex Cohen
Mentor(s): Mohsen Badiee

RNA G-quadruplexes (rG4s) are highly stable, four-stranded structures formed by guanine-rich sequences that regulate RNA metabolism and gene expression. Available techniques to identify rG4 forming sequences focus on coding regions and long non-coding RNAs (IncRNAs), overlooking structures located within introns. Our lab developed a novel method to locate these sequences within total cellular RNA. To evaluate our method, we will map our identified sequences and compare them against genome-wide RNA-seq datasets from three previously published studies. In RStudio, I will develop the code for this comparative study. This will provide insights into the diversity of identified rG4 sequences across different methods. A key outcome of this study will be finding high-confidence hits, which will guide future experimental validation.

COMBINED FGFR1 AND CDK4/6 INHIBITION IN ER+ METASTATIC BREAST CANCER MODELS

Patrick Colegrove
Mentor(s): Wei Xu, Carstyn Joiner

Of all breast cancer (BC) diagnoses, 70% are estrogen receptor positive (ER+). As mice are generally ER-negative, the novel in vivo ACI rat model was developed, which grows ER+ mammary tumors following estrogen implantation. From these tumors, the MG-1 cell line was derived as an in vitro model. It's been shown that overexpression of FGFR promotes resistance to FDA-approved CDK inhibitors. As our MG-1 liver metastatic subline overexpresses FGFR and exhibits treatment resistance, the efficacy of combined FGFR with CDK inhibition in treating ER+ metastatic BC will be explored with expected synergistic effects observed via reductions in downstream signaling pathways and invasive phenotypes. This novel ACI rat model provides potential to combine FGFR inhibitors with standard treatments to improve ER+ BC patient outcomes.

EQUALITY OR LIBERTY: THE PROTECTION OF SOCIAL INSTITUTIONS AND MAINTENANCE OF A JUST SOCIETY

Ari Collins
Mentor(s): David O'Brien

Political Liberals argue for a theory of justice intended to allow for individuals to follow their reasonable life plans, while disallowing significant inequalities. Social institutions, like the family, generate a tension between these two aims; parents may reasonably want to treat their children in ways that frustrate equality. This paper outlines how reasonable life plans can generate inequalities and then considers two potential resolutions. The first resolution follows a suggestion from Rawls about compensation between institutions, but fails to resolve the tension while maintaining a coherent system. The second, more plausible solution, resolves the tension by suggesting an alternate understanding of the Liberty Principle, under which new liberties can be generated to protect reasonable life plans while maintaining a consistent theory of societal justice.

ANALYSIS OF A NOVEL IRON-SULFUR CLUSTER SYNTHESIS PROTEIN FROM *NOVOSPHINGOBIUM AROMATICIVORANS*

Isadora Collins
Mentor(s): Avery Vilbert

Novosphingobium aromaticivorans is a gram-negative bacterium capable of metabolizing a wide range of aromatic compounds into aliphatic compounds. This ability has been harnessed to enable the funneling of heterogeneous biomass-derived aromatics into several industrially relevant chemicals. While recent work has advanced our understanding of biomass depolymerization and aromatics metabolism in *N. aromaticivorans*, the complexity of its metabolic network and the involvement of poorly characterized metalloproteins that are central to this conversion complicates targeted genetic modifications. Therefore, characterizing regulatory proteins involved in aromatic metabolic pathways is critical for optimizing its metabolic activity. One such protein is Saro0194, a predicted iron-sulfur (FeS) cluster transcriptional regulator of genes that encode proteins required for assembly of FeS proteins of *N. aromaticivorans*. The objective of this project is to characterize the Saro0194 protein and determine its role in *N. aromaticivorans*. In one set of experiments, Saro0194 was expressed and purified under anaerobic conditions to characterize this potential FeS protein. Simultaneously we have created a *N. aromaticivorans* ΔSaro0194 mutant in order to test its role in regulating expression of the FeS assembly machinery and other metabolic pathways in *N. aromaticivorans*. These efforts will allow us to determine the role of Saro0194 in aromatic metabolism and support future metabolic engineering strategies aimed at generating industrial products from biomass.

CHILDREN UNDERSTANDING CHILDREN: DO PEERS PERFORM BETTER THAN ADULTS ON MEASURES OF SPEECH INTELLIGIBILITY?

Lauren Collins
Mentor(s): Katie Hustad, Alex White

This study explores how children understand other children. Intelligibility is defined as how well one person can understand another. Little research has been conducted on child listeners when discussing intelligibility. This study investigates 1) the differences in speech intelligibility ratings between adult and child listeners and 2) whether intelligibility scored by children is different in speakers with and without disability. The participants included twelve typically developing children (ages 9-11) who evaluated speech samples from both typically developing children and children with cerebral palsy. This research examines speech intelligibility assessments by incorporating children as the communication partner. Ultimately, this will improve our understanding of how children perceive and comprehend spoken language compared to adults, which has important implications for improving participation in children with communication disorders.

CHARACTERIZING SLEEP SEX IN INTIMATE RELATIONSHIPS

Jessica Colón
Mentor(s): Sarah (Frankie) Frank

In a 2021 survey conducted by UK-based research organization VictimFocus, 51% of the women surveyed reported waking up to a male partner "having sex with them or performing sex acts on them whilst they are asleep." Despite the pervasiveness of this behavior, which legally constitutes rape, past research on the subject is limited. To better characterize the feelings and experiences of those who have experienced sleep sex in their intimate relationships, this study employs a mixed-methods approach using data collected from the popular internet platform Reddit. Posts and comments relating to sleep sex in intimate relationships are collected and coded for demographic and content information. This study aims to clarify how individuals react to and frame their experiences with sleep-related sexual activity within couples.

ANALYSIS OF THE EFFECTS OF LSM7 DELETION WITHIN THE YEAST LSM2-8 PROTEIN COMPLEX

Marisse Covin
Mentor(s): Aaron Hoskins
Additional Author(s): Ye Liu, Yuichiro Nomura, Samuel Butcher

The U6 snRNP protein complex, which comprises the Lsm2-8 complex along with U6 snRNA and protein Prp24, functions in pre-mRNA processing. The complex aids U6 snRNAs conformational rearrangement by increasing the rate of U4/U6 annealing. My previous work studying the deletion of the individual protein Lsm7 (Δ7) from an *S. cerevisiae* Lsm2-8 complex has identified the formation of multiple subpopulations following purification. Fluorescence polarization revealed that the Δ7 subpopulations show reducing binding affinity to U6 snRNA in comparison to the wild type. Negative staining revealed that the subpopulations maintain the characteristic ring structure of the wild type, while mass spectrometry experiments showed that the subpopulations contain differing amounts of the individual subunits.

SCOPING REVIEW OF SOCIAL ENVIRONMENT MEASURES FOR DIVERSE COMMUNITY SETTINGS

Olivia Crofton, Esmeralda Rodriguez
Mentor(s): Susan Andreae
Additional Author(s): MacKenzie Newkirk, Bao Nguyen

Although prior literature reviews have examined tools for assessing the social environment, few have evaluated the cultural relevance of available measures. This scoping review aims to identify methods for measuring the impact of community-engaged initiatives on the social environment within diverse community settings. We searched for peer-reviewed, English-language studies conducted in community settings that included participants from historically or currently marginalized communities and used a validated tool to measure an aspect of the social environment. Records will be screened, data extracted, and study quality assessed independently by two researchers. Findings will provide insight into the breadth, cultural relevance, and applicability of existing tools for measuring the social environment in community-based research.

DAILY ACTIVITIES, PRIORITIES, AND STRATEGIES TO ADAPT TO LIVING WITH PARKINSON DISEASE AMONG LATINOS

Lisbeth Cruz-Molina
Mentor(s): Laura Prieto
Additional Author(s): Maria Mora Pinzon, Kristen Pickett

Parkinson disease (PD) significantly influences quality of life and mobility among Latinos. The purpose of our study is to describe the impact of PD on the activities of daily living of Latinos. In our qualitative research, semi-structured interviews were conducted using the Canadian Occupational Performance Measure (COPM). Interviews were analyzed using reflexive thematic analysis. Participants (n = 24) demonstrated resilience through strategies (e.g., family support, using websites, reading literature, communication with clinicians) that helped them adapt to their diagnosis, by creating a community for support and increasing their awareness of PD. The most frequently mentioned priorities included personal self-care, engagement in active leisure, and maintaining socialization. These findings will help guide interventions and resources to improve daily functioning and the well-being of Latinos with PD.

PARTNERSHIP BETWEEN THE COMMUNITY RESOURCE NAVIGATOR PROGAM AND NEIGHBORHOOD HOUSE

Annika Cutforth
Mentor(s): J. Ashleigh Ross

This project explores a partnership between the Community Resource Navigator Program and Neighborhood House that supports older adults and their caregivers through two community programs: the Memory Café and the Healthy Living Luncheon. The Memory Café provides a welcoming space for people experiencing memory loss and their caregivers to socialize, participate in activities, and reduce feelings of isolation. The Healthy Living Luncheon brings older adults together for shared meals, wellness education, and conversation that promotes healthy aging. This project examines how the Resource Navigator Program can help older adults access local resources and improve overall well-being. The work highlights the value of partnerships between universities and community organizations in creating inclusive programs that better support the needs of aging populations.

DONOR-DERIVED EXTRACELLULAR VESICLES HAVE IMMUNOLOGICAL PROPERTIES DEPENDENT ON LIVER AGE AND DONOR TYPE

Molly da Silva
Mentor(s): David Al-Adra
Additional Author(s): Heather Jennings, Peter J. Chlebeck, Bret Verhoven, Grace Heise

Donor-derived extracellular vesicles (EVs) influence immune responses following liver transplantation. With ongoing organ shortages, clinicians increasingly use older and donation after circulatory death (DCD) donors, though these organs carry higher inflammatory risk. Using normothermic ex-vivo liver perfusion (NEVLP), we compared EVs released from standard, older, and DCD rat livers. EVs were isolated, quantified, and analyzed for RNA content, then added to mixed lymphocyte reactions (MLRs) to assess immune effects. DCD livers released the highest EV concentrations, followed by older and standard groups. RNA profiling revealed no major transcriptomic differences among groups. However, functional assays showed that standard donor EVs significantly suppressed T-cell proliferation, while older and DCD EVs enhanced immune activation. These findings suggest donor type influences EV-mediated immunological outcomes after transplantation.

PREDICTIVE SENSOR HEALTH INDEX FOR DIESEL ENGINE EMISSIONS MONITORING

Tejas Dahiya
Mentor(s): Saurabh K Gupta

This research develops a machine learning-based Sensor Health Index (SHI) that detects sensor degradation in diesel engines before failures cause emissions violations. Using neural networks trained on 217 operational samples from a 12L diesel testbed, the system predicts sensor outputs with 4-5% mean absolute percentage error, enabling early detection of eight failure modes including drift, noise, bias, dropout, spikes, stuck-at, and saturation. The SHI quantifies sensor health on a 0-1 scale and provides time-to-failure predictions. Multi-sensor monitoring distinguishes actual sensor faults from legitimate engine transients, reducing false alarms. This framework addresses the critical environmental problem of undetected NOx sensor degradation, which causes engines to over-inject fuel resulting in 5-10% increased CO2 emissions per vehicle across commercial diesel fleets.

MULTI-PARAMETER VIRTUAL SENSING USING A SINGLE ANN MODEL IN AN AUTOMOTIVE ENGINE

Siqi Dai
Mentor(s): Saurabh Kumar Gupta

Accurate measurement of airflow, NOx emissions, and combustion phasing is essential for optimizing engine efficiency and enabling robust real-time control. Conventional sensors introduce cost, complexity, and often suffer from drift and limited transient response. This study presents a virtual sensing framework using a single artificial neural network to simultaneously estimate airflow, NOx, and start of combustion. Trained on high-resolution engine data across diverse operating conditions, the model exploits shared dependencies between airpath dynamics, emissions pathways, and combustion timing to achieve a unified representation. The multi-parameter sensor demonstrates strong predictive accuracy and maintains robustness under transient conditions. Results show potential to reduce hardware requirements while improving measurement fidelity, offering a scalable pathway for software-defined sensing in next-generation powertrains supporting cleaner, more efficient, and lower-cost engine technologies.

MAPPING GERM CELL DEVELOPMENT IN THE SEXUAL PLANARIAN *SCHMIDTEA MEDITERRANEA* USING SINGLE-CELL TRANSCRIPTOMICS

Yibo Dai
Mentor(s): Phillip Newmark, Melanie Issigonis

Germ cells are essential for all sexually reproducing species, yet the molecular mechanisms regulating their formation and development remain incompletely understood. The sexual planarian *Schmidtea mediterranea* offers an excellent model due to its remarkable ability to regenerate germ cells. To identify candidate genes involved in planarian germline development, I performed RNA interference (RNAi) to enrich for germline stem cells and somatic gonadal niche cells for better characterization of their transcriptomes, and conducted single-cell RNA sequencing to identify genes highly expressed in those cells. I then validated candidate genes' expression patterns using RNA in situ hybridization. Subsequent RNAi experiments will allow us to characterize candidate genes' functions in germline development. Ultimately, this transcriptomic atlas of sexual planarian will provide important insights into regulation of germline development.

IMPACT OF DIETS BALANCED FOR TARGETED ESSENTIAL AMINO ACIDS ON CIRCULATING AMINO ACID PROFILES IN LACTATING DAIRY COWS

Nam Phuong Dao
Mentor(s): Sebastian I Arriola Apelo, August Hoppmann

This study evaluated balancing dairy cow diets for essential amino acids (AA), histidine, leucine, lysine, and methionine on circulating AA concentrations during early and peak lactation. Cows (n = 63) received a control or balanced AA (BAA) diet; plasma AA were measured via mass spectrometry. BAA supplementation elevated methionine throughout the period; histidine increased at weeks 2, 8, and 12; leucine through week 8; and phenylalanine at weeks 2 and 8. Conversely, threonine and isoleucine decreased at weeks 4 and 12, and week 12, respectively. Diet × week interactions in individual and grouped AAs indicate effects varied by lactation stage. Results suggest BAA supplementation enhances mammary nutrient supply for milk protein synthesis, providing a dietary strategy to improve bovine milk quality to support early childhood development.

INVESTIGATING THE MECHANISM OF COMBINED BET AND CDK9 INHIBITION IN A PAN-24 PANCREATIC CANCER PDX MODEL

Hannah Davidson
Mentor(s): Jeremy Kratz
Additional Author(s): Michela Cadarso, Paulina Esguerra

Pancreatic ductal adenocarcinoma is an aggressive cancer often driven by elevated MYC, a gene expression regulator. When overexpressed, MYC functions as an oncogene promoting tumor growth and metastasis, making it difficult to therapeutically target. We examined whether combined inhibition of bromodomain and extraterminal (BET) proteins and cyclin-dependent kinase 9 (CDK9) suppresses transcription in a heterotopic patient-derived xenograft (PDX) murine model. Mice were treated with BET inhibitor (VIP152), CDK9 inhibitor (ZEN3694), or a combination. Tumors were analyzed by western blot for phosphorylation of RNA polymerase II (Rpb1 Ser-2 and Ser-5), total Rpb1, c-MYC, and MCL-1. I hypothesize that 6 hours after treatment, the combination treatment will pause transcription in tumors, showing reduced phosphorylation of R-bp1 at Ser-2 and Ser-5, downregulation of c-MYC, and apoptotic marker, MCL-1.

ROSENTHAL FIBER DENSITY AND BEHAVIORAL EFFECTS OF GAN MUTATIONS IN ALEXANDER DISEASE MODEL MICE

Lucas de Carvalho
Mentor(s): Tracy Hagemann

Alexander disease is a rare neurological astrocyte disorder caused by mutations in GFAP, the gene for glial fibrillary acidic protein, leading to protein aggregation, astrocyte stress-response and central nervous system deterioration. To investigate the mechanisms allowing for aggregate formation, we used a loss-of-function mutation in GAN, which regulates the turnover of intermediate filaments, including GFAP. Mouse models with one or both mutations were analyzed for differences in glial protein aggregation at the cellular level, and for various sensorimotor behaviors to assess pathology. We found that pathology related to GFAP mutation was modulated by GAN status, with the highest protein aggregation and most deteriorated sensorimotor function observed in doubly-mutated mice. These findings suggest that changes in intermediate filament regulation can exacerbate the development of Alexander disease.

CAPTOR: A CYTOSKELETON LOCALIZATION ASSAY TO INVESTIGATE TOR INTERACTIONS

Caylynn Dedow
Mentor(s): Jake Brunkard, Kate Lund

The Target of Rapamycin (TOR) is a serine/threonine protein kinase that is highly conserved across eukaryotes. It has been studied primarily in mammals due to its link to cancer, but in plants, TOR is not as well characterized. TOR is important for sensing nutrients and the environment and for regulating the growth and development. A key aspect of characterizing TOR is to identify the proteins it is directly interacting with to perform its necessary functions. Understanding these mechanisms would make the TOR signaling pathway an ideal candidate for genetic engineering to generate more resilient crops to withstand variable environments. I have designed and optimized an in vivo, live-cell, microscopy-based protein interaction assay that allows for visualization of these interactions.

INVESTIGATING GRAY WOLF BEHAVIORAL ECOLOGY USING NONINVASIVE SAMPLING METHODS

Olivia Deering
Mentor(s): Adrian Treves
Additional Author(s): Molly O'Neill, Bryce Papp, Alex Seaborg

Gray wolf (*Canis lupus*) behavioral ecology research can inform wolf management, particularly the costs of conflicts and the benefits of wolf-human coexistence. Non-invasive study of wild wolf behavior in private properties can shed light on how wolves coexist with people in minimal conflict. We deployed 78 trail camera positions over a roughly two-year period throughout a 4.5 km² site. We report the frequencies of several variables, including comparisons of the frequency of visits between day and night and across four seasons. By presenting a model of successful coexistence between humans and wolves while adding data on non-invasive observations of their behavior, we hope to contribute to coexistence and wolf management and may also inform future studies of wolves using trail cameras.

THE IMPACT OF SOCIAL MEDIA ON ADOLESCENT SEXUAL ATTITUDES AND BEHAVIORS

Soledad Demeuse
Mentor(s): Tingting Fan, Lydia Bliss

My project reviews prior research to examine how social media exposure influences adolescents' sexual attitudes and behaviors and to identify patterns across studies. As social media becomes central to teenage life, concerns have grown that exposure to sexual content may shape norms, perceptions, and risk-taking behaviors. Research consistently shows that adolescents exposed to sexual media at a younger age are more likely to develop permissive attitudes, perceive peers as more sexually active, and engage in earlier, riskier sexual behaviors. By synthesizing longitudinal, cross-sectional, and meta-analytic, clear links emerged between early exposure and later attitudinal and behavioral outcomes. Overall, results emphasize the importance of early interventions, digital literacy education, and supportive supervision to reduce harmful exposure and promote a safer, developmentally appropriate digital environment.

INVESTIGATING THE ROLE OF MCPYV TLT-PRB INTERACTION IN SKIN CELL REPROGRAMMING DURING MERKEL CELL CARCINOMA DEVELOPMENT

Lauren Dempsey
Mentor(s): Megan Spurgeon, Tejas Sabu

Merkel Cell Polyomavirus (MCPyV) causes 80% of Merkel Cell Carcinoma (MCC), a rare yet highly aggressive neuroendocrine skin cancer. MCPyV+ MCCs are driven by expression of two viral oncoproteins: Small T (ST) and truncated LargeT (tLT), which facilitate neuroendocrine reprogramming of skin cells. tLT inactivates the tumor suppressor pRb through an LXCXE motif, although the functional significance of this interaction in neuroendocrine gene expression is unclear. To test this, we will generate an Rb-binding tLT mutant using site-directed mutagenesis of the LXCXE motif. We will verify that the tLT LXCXE mutant fails to bind pRb using immunoprecipitation analysis and then evaluate gene expression using RNAseq. This study will elucidate the importance of tLT-pRb interaction in reprogramming skin cells toward an MCC phenotype.

DIFFERENTIAL USE OF MHEALTH APP FEATURES AMONG PEOPLE WITH HIV AND SUBSTANCE USE DISORDER ENROLLED IN A CLINICAL TRIAL

Charlie Dentz
Mentor(s): Hailey Ballard
Additional Author(s): Andrew Quanbeck, Ryan Westergaard, Cindy Firnhaber, Rachel Gicquelais

People living with HIV who have co-occurring substance use disorders often face physical and social barriers to care engagement, making mobile health (mHealth) applications a promising tool for improving self-management and social connectedness. This study evaluates the Connections App by analyzing how user characteristics are associated with mHealth use among N = 549 participants enrolled in an implementation-effectiveness clinical trial using chi-squared tests. Initial results show significant associations between usage of the Skill Builder feature and rurality ($p=0.00073$) and race ($p=0.049$), as well as completing the Daily Confidence Report and rurality ($p=0.037$). These findings suggest that tailoring app features towards specific user characteristics may improve engagement and lead to better health outcomes and behaviors.

ARCHITECTURAL ANCESTRY: THE BLIED FAMILY AND THE CULTURAL LANDSCAPE OF WEST MIFFLIN

Anna Depping, Luke Ehrenberg, Alejandro Hernandez
Mentor(s): Anna Andrzejewski
Additional Author(s): Ruth Dikkers

The history of West Mifflin Street is a story of evolution, guided in the late 19th and 20th centuries by the influential Blied family. While the street is now synonymous with student housing and the infamous block party, its foundations were built on the civic and commercial contributions of one of Madison's most prominent families. From the 1890s until Josephine Blied's death in 1982, the family home at 444 W. Mifflin remained in Blied hands. As pillars of Madison's German immigrant legacy, the Blied family expanded their influence through numerous businesses and real estate holdings, as well as Frank C. Blied's campaign for mayor. Their esteem influenced both the construction and long tenure of 444 W. Mifflin, as well as the broader cultural landscape of the neighborhood. This presentation traces the family's history and examines how their legacy informed the development of 444 W. Mifflin and its relationship to the surrounding Mifflandia district.

EFFECT OF GATA4 ON RBM20 EXPRESSION

Sanya Desai
Mentor(s): Wei Guo

Published evidence suggests decreased expression level of RBM20 is observed in disease conditions (Beraldi, 2014). The transcription factor GATA4 has been recognized as potentially playing a role in the regulation of the RBM20 gene. I aim to investigate the mechanism that controls the expression of RBM20 by studying the influence of GATA4 on in-vitro RBM20 expression levels. In-vitro cardiomyocyte cell cultures were transfected with a GATA4 plasmid and tested for RBM20 expression level using Western Blot analysis. I hypothesized that GATA4 would lead to an increase in the expression level of RBM20. Preliminary results show a slight increase in RBM20 expression in GATA4 overexpression cells. However, due to the small sample size, more repeats must be conducted to determine causative effects.

A SCOPING REVIEW ON METHODOLOGIES FOR ADDRESSING RESPONSE SHIFT IN PATIENT-REPORTED OUTCOME MEASURES FOR CANCER SURVIVORS

Khadijah Dhoondia
Mentor(s): Randall J. Kimple
Additional Author(s): Sue Yi, Prachi Upadhyay

Radiation therapy for head and neck cancer (HNC) often causes permanent salivary gland damage, resulting in xerostomia (chronic dry mouth) and reduced quality of life (QoL). Patient-Reported Outcome Measures (PROMs) are essential for assessing xerostomia, but their long-term validity may be affected by "response shift," a phenomenon in which patients adapt by altering their internal standards or definitions of QoL. This scoping review will systematically map clinical methodologies used to assess or adjust for response shift in PROMs among long-term HNC survivors. Guided by the Joanna Briggs Institute framework and PRISMA-ScR guidelines, a comprehensive database search will be conducted. Findings will clarify how response shift theory is applied in clinical research, identify gaps in current approaches, and inform future efforts to improve QoL measurement in survivorship care.

VALUE-DRIVEN CONSTRUCT SELECTION FOR EVALUATING GENERATIVE AI: A NURSING PERSPECTIVE

Chloe Diamond
Mentor(s): Ann Wieben

Introduction: This study's purpose is to explore differences and similarities across groups of nurses when prioritizing key evaluation constructs for generative AI tools, and nursing values underlying those priorities.

Methods: This qualitative study used a co-design approach. Nurses wereprompted to identify and discuss rationale for constructs to incorporate into an evaluation framework for generative AI. Participants ranked the five most important constructs. Deductive content analysis of session transcripts will identify nursing values underlying priority constructs.

Results: Preliminary findings included concordant constructs across groups: ease of use, efficiency, and safety, while discordant constructs included accuracy, transferability, among others. Additional results on the values underpinning priority constructs will be reported.

Conclusions: Findings inform evaluation frameworks for generative AI used in nursing practice.

OBSERVING THE ROLE OF OXIDATIVE STRESS IN RELATIVE RATES OF GREY MATTER MICROSTRUCTURE DEGENERATION IN SOCIOECONOMICALLY DISADVANTAGED PARTICIPANTS

Isaiah Dobbins
Mentor(s): Jason Moody
Additional Author(s): Barbara Bendlin

Clinical studies have shown that socioeconomic disadvantage is one of the most significant risk factors for Alzheimer's Disease, as individuals from disadvantaged neighborhoods have a higher presence of traits related to AD. In this project I observed the biological mechanisms behind this by investigating the role of oxidative stress in relative rate of neurodegeneration in disadvantaged patients. To observe the correlation between oxidative stress and AD in socioeconomically disadvantaged populations, I observed grey matter microstructure in relevant cortical and areas and analyzed relevant biomarkers of Reactive Oxidative Species (ROS). I ran linear mixed effects models with both groups comparing the rate of increase of relevant biomarkers (sTREM, NFL) and microstructure degeneration to observe the differences in progression and risk of AD in both groups.

THE ROLE OF THE TONGUE IN EUSTACHIAN TUBE OPENING

Sam Dobson
Mentor(s): Jack J. Jiang
Additional Author(s): Michael McDonald, Grayson Bienhold, Serena K. Evers, Katherine D. Alquist, Abigayle K. Chapman, Jakob R. Holm

Eustachian tube (ET) dilation is the primary biomechanical mechanism for middle ear pressure equalization. While current literature attributes this mechanism to the interaction of the Levator Veli Palatini (LVP) and Tensor Veli Palatini (TVP), Heidsieck et al. demonstrated through Botox-induced paralysis that LVP action is not essential for glutition-mediated ET dilation. Cadaveric examination suggests a "bow and arrow" model for ET dilation. The pre-tensed TVP acts as a bowstring, while the tongue provides the force creating contractile potential. Potential is realized through a "snap-like" contraction of the TVP, ultimately driving dilation. This model shifts the focus from LVP-dependent movement to a dynamic, tension-release system powered by TVP and tongue coordination.

ASSESSING ARCTIC TUNDRA VEGETATION CHANGE ACROSS POLYGONAL PERMAFROST SITES USING UAVS

Sabine Dolan-Gaschignard
Mentor(s): Christian G. Andresen, Katie Braun
Additional Author(s): Matteo Franke

As the Arctic warms, permafrost degradation is transforming tundra vegetation communities. We use high-resolution multispectral imagery collected by unoccupied aerial vehicles (UAVs) to map vegetation at three sites in Alaska's Arctic Coastal Plain and Brooks Range foothills. UAV and vegetation ground reference data were acquired during the summers of 2024 and 2025. Imagery was processed using Pix4D photogrammetry to generate reflectance orthomosaics and digital surface models. We classified PFT communities at 3–5 cm resolution with support vector machines in ArcGIS Pro and assessed map accuracy. Ice-wedge permafrost degradation severity was also classified, allowing for comparisons of vegetation composition across gradients of degradation. Results highlight how vegetation communities are changing in response to a warming Arctic and permafrost thaw, foundational for assessing Arctic land-atmosphere carbon dynamics.

PERO LIKE, QUE SUENA CORRECT?: THE ACCEPTABILITY OF CODESWITCHING ACROSS SPANISH PROFICIENCIES

Sara Donoso
Mentor(s): Margarita Kaushanskaya
Additional Author(s): Emma Libersky

Bilingual individuals tend to codeswitch or mix languages, creating new ways to communicate like Spanglish. Not all forms of codeswitching are considered grammatical by native speakers, but the impact of the listener's background on these judgments is poorly understood. In a between subjects experiment, we present Spanish-English bilinguals with either English, Spanish, or code-switched sentences and ask them to rate them on grammaticality. We will also collect information about the role of language proficiency, age, and attitude towards codeswitching. We predict that acceptability ratings will be higher in participants who are younger or have balanced language proficiency. Findings will improve our understanding of how codeswitching acceptability judgments are influenced by one's own background.

EXPLORATION OF ELECTROCHEMICAL INTERFACES THROUGH ELECTROLYTE ION MIXTURES

Mawuenam Dossa
Mentor(s): Matthew Gebbie, Sam Johnstone

Electrode-electrolyte interactions play a crucial role in determining the reactivity of electrochemical systems. Even in reactions that do not directly involve ions in solution, these ions impact the interfacial environment through the formation of an electric double layer. However, our understanding of electric double layer properties under reaction conditions remains limited. The goal of this project is to determine how ion identity and ion-ion interactions impact electrochemical interfaces. We use techniques such as cyclic voltammetry on mixtures of alkali metal cations (Na+ and Cs+) and halide anions (F- and I+) in aqueous electrolytes to provide insight into reactivity trends for the hydrogen evolution reaction. When paired with interfacial spectroscopy, we can gain a better understanding of how ionic interactions can be leveraged to tune reactivity.

EFFECTS OF POLYMERIZATION DEGREE ON THE PERCOLATION OF GAS SEPARATION MEMBRANES: A MOLECULAR DYNAMICS STUDY

Lucy Drake
Mentor(s): Subhamoy Mahajan, Ying Li

Percolation of porous media strongly influences transport properties such as gas permeability. Polymeric gas separation membranes are typically dense and nonporous yet contain nanoscopic freevolume elements. Recent BET surface area measurements of glassy membranes suggest that their percolation depends on the degree of polymerization. Here, molecular dynamics simulations are used to examine how polymer length affects membrane porosity and monomer segmental motion in glassy and rubbery polymers. In glassy polymers, increasing chain length reduces segmental mobility and structural relaxation, thereby increasing their porosity. In contrast, rubbery polymers remain flexible, allowing efficient packing, thereby reducing porosity and eliminating percolation. These trends provide critical insight into how polymer state and molecular weight govern membrane structure and gas transport behavior.

CLINICAL BENEFITS OF THERAPEUTIC DRUG MONITORING OF MYCOPHENOLIC ACID IN PATIENTS WITH SYSTEMIC LUPUS ERYTHEMATOSUS

Alexa Dreyfus
Mentor(s): Shivani Garg

With clinical responses to mycophenolic acid (MPA) varying between patients with systemic lupus erythematosus (SLE), therapeutic drug monitoring (TDM) has the ability to promote better outcomes. Through a systematic review and meta-analysis, the objective was to determine the importance of utilizing TDM to improve patient reactions to MPA, with targeted dosage ranges. The data was gathered from studies that researched associations between MPA levels and clinical outcomes in SLE patients. SLE patients without extra-renal manifestations were analyzed separately from SLE patients with extra-renal manifestations. Therapeutic levels of MPA were found to have 12-fold greater odds of overall SLE response and 15-fold greater odds in patients with extra-renal manifestations. This paper identifies the importance of using TDM to provide SLE patients with optimal MPA dosages.

FRAMES AS TIES: THE INTERNATIONAL NETWORK STRUCTURE OF HUMAN RIGHTS ADVOCACY

Leila Dunfee
Mentor(s): Joseph Conti, Skye Xollo

This study aims to understand how framing of missions by human rights organizations (HROs) shapes HRO network connections and influence. This research collected information from HROs worldwide, focusing on how they describe the area(s) (e.g. corruption, gender equality) and levels (e.g. local, national) they operate within. These patterned combinations of area and level (frame dialects) form the basis of ties among HROs—this study characterizes shared frame dialects as social ties. Organizations become connected, or "tied," within a network when they articulate common understandings of domains and levels. Analyzing frames as ties, this study identifies which HROs are most central to the human rights network, how frame dialects cluster together, and an association between central HROs and civil liberties in countries of operation.

CHAMBER SPECIFIC EFFECTS OF THE L709F PKP2 MUTATION IN HIPSC DERIVED CARDIOMYOCYTES MODELING ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY

Minh Duong
Mentor(s): Hee Jae Jang, Tim Kamp
Additional Author(s): Jianhua Zhang, Jeanne Hsieh, Jedd Jang

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is a hereditary heart disease caused by mutations in junctional proteins like plakophilin-2 (PKP2), mainly affecting the right ventricle (RV). Using human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs), we hypothesize that the L709F PKP2 mutation preferentially reduces PKP2 intensity in RV-derived hiPSC-CMs compared to LV-like hiPSC-CMs. Patient-derived L709F hiPSCs and isogenic corrected controls were differentiated into LV-like cardiomyocytes using the GiWi protocol and RV-like cardiomyocytes using a novel Nutlin-3a–based protocol. PKP2 localization was quantified by immunocytochemistry. L709F hiPSC-CMs showed reduced PKP2 intensity compared to corrected controls in GiWi-derived cells ($p=0.0468$), Nutlin-treated cells ($p=0.009$), and RV-like cells ($p=0.0304$). These findings suggest the L709F mutation reduces PKP2 junctional localization and may contribute to chamber-specific ARVC pathology.

MECHANICAL CHARACTERIZATION AND COMPARISON OF PULMONARY ARTERIES AND VEINS FOR IPC-PH AND CPC-PH

Amber DuVal
Mentor(s): Colleen Witzenburg

The current mechanical testing techniques offer great opportunity into exploring the changes that can occur in the transition between post-capillary pulmonary hypertension and combined pre/post capillary hypertension, cultivating new insights on preventing combined pre/post-capillary hypertension. Unfortunately, little research has explored this transition, and therefore little is known about why it occurs and the pharmaceutical/biomedical advances that could prevent the onset of the irreversible condition. Without such solutions, diagnosis of combined pre/post-capillary pulmonary hypertension can be atypical to manage and fatal in some cases. The primary goal of this investigation is to discover the patterns that exist within veins and arteries and the differences between them in hopes of providing greater insights to potential solutions.

BIOACCUMULATION AND BIOMAGNIFICATION OF NANO TO LOW-MICROMETER MICROPLASTICS (NLMMPS) IN FRESHWATER ORGANISMS

Leka Ekambaram, Taylor Papendorf
Mentor(s): Jack Conto

Many freshwater organisms can be adversely affected by environmental pollutants, such as nano- to low-micrometer microplastics (<100 mm). However, there has been limited research conducted on the impacts of multiple sizes of plastics on freshwater organisms. Therefore, we conducted an acute static exposure experiment where adult *daphnia* were exposed to four sizes (1-4 mm, 10-22 mm, 45-53 mm, 90-106 mm) of polyethylene microspheres for 7 days at four different concentrations (0, 1, 10, 100 mg PE L-1 H2O). Endpoints assessed were survival (%), reproduction (# neonates), and heartbeat (BPM). We found that while survival and heartbeat were not affected in any size or treatment, 1-4 mm and 10-22 mm PE significantly decreased reproduction. These experiments provide a basis for future ecotoxicological work concerning freshwater organisms.

EFFECTS OF SODIUM IODIDE AND LITHIUM BROMIDE TRACERS ON MICROBIAL ACTIVITY IN A URANIUM-CONTAMINATED SUB-AQUATIC AQUIFER

Lily Eliopulos
Mentor(s): Catherine Pettinger, Erica Majumder

Microbial communities are widely used in bioremediation as environmental contamination becomes more prevalent, seen in the Riverton aquifer in Wyoming which remains contaminated from former uranium processing. During bioremediation, conservative chemical tracers are often introduced to track water flow within the aquifer. However, many tracers have not been evaluated for potential impacts on microbial growth and activity, raising concerns about unintended biological effects. To assess this, three distinct Riverton microbial communities were grown in the presence of sodium iodide, lithium bromide, potassium pentafluorobenzoate, and sodium 2,6-difluorobenzoate. Growth differences were analyzed using one-way ANOVA and Tukey's HSD test. Sodium iodide showed significant concentration-dependent effects on microbial growth with other tracers in analysis. Tracer evaluation helps determine which compounds least disrupt microbial community function during bioremediation efforts.

THE IMPACT OF HIGH INTENSITY EXERCISE ON COGNITION AND PHYSICALITY IN INDIVIDUALS WITH PARKINSON'S DISEASE

Kendal Ellingson
Mentor(s): Garrett Huck

Every year in America, 90,000 individuals are diagnosed with Parkinson's disease (PD; Parkinson's Foundation, 2024). Classified as a progressive neurological disorder, Parkinson's impacts cognition and mobility due to one's decreasing ability to produce the neurotransmitter dopamine. There are medications to alleviate symptoms of Parkinson's, yet research has been unable to uncover a known cure. The most common treatment for the progression in individuals with Parkinson's disease is high intensity exercise. The purpose of this presentation is to provide an overview of the impact physical activity has on the cognition, physicality, and overall health of individuals living with Parkinson's. Different types of interventions and their efficacy will be discussed, in addition to future directions for this important area of support for those living with PD.

SELECTIVE CROSS COUPLING BETWEEN ARYL BROMIDES AND EPOXIDES

Lars Erikson
Mentor(s): Kasturi Ganguli

The ability to selectively couple epoxides at the more hindered position with aryl bromides in a C(sp2)-C(sp3) cross coupling reaction with homogeneous conditions would have major consequences in synthesis and the pharmasudical industry. Bond formation between these groups have been done previously using a nickel/titanium cocatalyst system, however heterogenous conditions and an additive were required. This project aims to utilize a new organic homogeneous reductant that is able to overcome both of these problems in combination with a nickel/titanium cocatalyst system to successfully cross couple these functional groups at the more hindered epoxide position.

MORE THAN JUST A CHARACTER: EXPLORING HOW POSITIVE MEDIA REPRESENTATION RELATES TO IDENTITY AND CROSS-RACIAL SOCIAL RELATIONSHIPS

Isabella Escobar-Aviles
Mentor(s): Karyn Riddle

Entertainment media's representation of diverse racial/ethnic groups has increased in the past few decades. In this study, we explore the implications of positive portrayals of various racial and ethnic groups in mainstream media. Through an online survey, we gather input on viewing frequency of several television shows and films that center characters of various racial and ethnic groups. Data collected additionally highlights participants' perceptions of themselves and their respective racial/ethnic groups, with a focus on perceptions of social relationships and interactions with people of other races/ethnicities. We aim to find correlations between consumption of their respective groups' positive media representations and variables including identity affiliation and a self-esteem. This can be used to inform production for more inclusive and positive racial/ethnic media depictions.

ROLE OF CYSB IN THE SULFITE STRESS RESPONSE OF *SALMONELLA ENTERICA* SEROVAR TYPHIMURIUM

Madchen Ewig
Mentor(s): Johanna Elfenbein, Vivian Hoang Nguyen

Salmonella is a leading cause of bacterial foodborne gastroenteritis. The purpose of my research is to understand the mechanism by which *Salmonella* tolerates sulfite, a toxic compound found in many environments, including food. I used growth curves to compare sulfite tolerance between the *Salmonella* wild-type and mutants in two genes involved in regulating sulfur homeostasis. I found that *Salmonella* lacking the cysB gene had reduced growth upon sulfite treatment in later growth stages. In addition, the yeiEcysB double mutant had a more severe growth defect than either the cysB or yeiE mutant alone. These data suggest that cysB is important for sulfite tolerance at later time points. This research helps us understand which genes are necessary for *Salmonella* to survive sulfite stress.

QUANTIFYING PROJECTED AIR QUALITY IMPACTS FROM DATA CENTER GROWTH AND COAL POWER RESURGENCE

Jackson Fairley
Mentor(s): Tracey Holloway

Coal power plants are the largest emitter of sulfur dioxide (SO2). Increased energy demand from data centers, due to increased artificial intelligence (AI) use, is delaying coal power plant retirements nationwide. Elevated SO2 concentrations increase respiratory illnesses and act as a precursor to fine particulate matter (PM2.5). This study uses the Avoided Emissions and Generation Tool (AVERT) from the Environmental Protection Agency (EPA) to evaluate how increased coal power plant electricity generation from data center demand will affect SO2 levels. AVERT outputs are input into the Co-Benefits Risk Assessment Model (COBRA) to calculate the annual average PM2.5 concentrations across the U.S., and associated health effects of increased SO2 emissions. Results will inform SO2 emission levels from projected increases in coal power reliance using policy-relevant tools.

DEVELOPING A *NICOTIANA BENTHAMIANA* TRANSIENT EXPRESSION PLATFORM FOR HIGH PROTEIN YIELD AND METABOLITE PRODUCTION

Clare Fallon
Mentor(s): Quentin Dudley
Additional Author(s): Nastassja M. Corrado

Plant-derived natural products (PNPs) are structurally complex molecules with valuable industrial applications, particularly in medicine. *Nicotiana benthamiana* provides an effective plant-based production system where Agrobacterium-mediated transient expression enables rapid testing and reconstruction of PNP biosynthetic pathways. However, prior experimentation has indicated that protein expression in this system may be limited by factors such as expression vector architecture, gene silencing, plant health, and agroinfiltration conditions. To effectively use *N. benthamiana* as a metabolic engineering platform, it is necessary to optimize protocols that improve protein output and experimental consistency. This work investigates factors influencing transient protein expression in *N. benthamiana*, using yellow fluorescent protein (YFP) as a visual reporter to help identify conditions that improve expression efficiency and support future pathway engineering efforts.

QUANTUM STATE TOMOGRAPHY WITH A MULTI-MODE RESERVOIR

Christopher Fan
Mentor(s): Roman V. Kuzmin
Additional Author(s): Brooke M. Becker, Tianshen He

Quantum state tomography is essential in quantum information processing but remains experimentally demanding due to repeated state preparation and ensemble averaging. We present a reservoir computing framework for single-qubit tomography that reduces the number of required preparations and eliminates the need for qubit rotation—two major limitations of traditional methods. Our reservoir consists of bosonic modes coupled via three-wave mixing, enabling nonlinear, multimode dynamics. Dynamical observables are extracted from the reservoir as it interacts with a qubit, allowing high-fidelity reconstruction of the density matrix. We also simulate sequential projective measurements during reservoir evolution, leveraging temporal diversity to further reduce preparation overhead. This approach offers a scalable and efficient pathway toward quantum state estimation and opens new directions for physically realizable, machine-learning–assisted quantum measurement frameworks.

HYDRODYNAMIC PERFORMANCE OF SINGLE VERSUS DOUBLE CHHABRA VALVES: ADDRESSING POSTURE-DEPENDENT OVERDRAINAGE

Meyliya Fang
Mentor(s): Bermans Iskander, Anas Abou Merhi

Hydrocephalus treatment via shunting is often complicated by posture-dependent overdrainage, leading to shunt failure. This study evaluates the Chhabra valve, a cost-effective option in low-income countries, to determine if a dual-valve configuration reduces this risk. Using a "Pseudo-Ventricle" system, we compared single versus double Chhabra assemblies across varying orientations, pulsatility, and ventricular compliances. Results from multivariable linear regression showed that single valves drained significantly more fluid than double-valve systems ($p < 0.0001$). This difference was most substantial in the vertical orientation, where siphoning is most prevalent. The dual-valve setup successfully increased resistance, functioning as an affordable anti-siphon mechanism. These findings suggest that serial valve placement can mitigate gravity-induced overdrainage, offering a scalable surgical solution to improve shunt longevity and patient outcomes in global health settings.

EVALUATION OF HEALTHY AND CANCER PATIENT T CELLS USING OPTICAL METABOLIC IMAGING AND CYTOKINE SECRETION MEASUREMENT

Caitlyn Fardy
Mentor(s): Melissa Skala, Meghana Kalluri
Additional Author(s): Dan Pham, Uzziah Urquiza

T cell metabolism is a key aspect of adoptive T cell therapy. This study compares the metabolic profiles of T cells from a healthy donor and cancer patient. After isolating and activating the T cells, optical metabolic imaging was performed using autofluorescence lifetime imaging microscopy (FLIM) of NAD(P)H. Cytokine enzyme-linked immunosorbent assay (ELISA) was performed on spent culture medium to measure interferon-gamma (IFN-gamma) secretion. The results show that the proportion of free NAD(P)H trended with IFN-gamma secretion, with the highest values in healthy activated, followed by patient activated, patient quiescent, and finally healthy quiescent T cells. These results indicate that FLIM is a useful tool to profile T cells and that metabolic characteristics trend with cytokine secretion in this study.

AFFORDABLE HOUSING AND THE RISK OF GENTRIFICATION: A COMPARATIVE STUDY OF LONDON AND NEW YORK CITY

Olivia Farris
Mentor(s): Loren Peabody

This essay will examine the relationship between social and mixed-income housing initiatives and the possible effects of those housing initiatives on gentrification. Using a comparative analysis of London and New York City, this study will explore the risks that housing policies designed to increase the availability of affordable homes pose to displacing low-income, existing residents. This essay will examine housing initiatives undertaken by London Mayor Sadiq Khan and former New York City Mayor de Blasio, as well as the gentrification-mitigation and anti-displacement strategies used. By analyzing the similarities and differences between these two global cities, I aim to determine whether inclusionary zoning can reduce inequality or perpetuate gentrification.

DENSITY SNAKE CRASHES IN TOKAMAK PLASMAS

Katrina Feltz
Mentor(s): Noah Hurst

Using strong magnetic fields, tokamak machines are able to confine and heat plasma in order to generate energy from nuclear fusion reactions. Helical regions of enhanced plasma density, called density snakes, have been observed in several tokamak experiments. These snakes, which affect plasma stability and confinement, may be caused by impurity ions. However, it is unclear how they lose coherence or "crash," or how they interact with the sawtooth kink instability which is common in many tokamaks. This project aims to parameterize the conditions under which these snakes crash using wavelet transformations to analyze the spectrum of the density and magnetic fluctuations over time. Studying these snakes will advance our understanding of plasma instabilities, which is essential for optimizing magnetic confinement and harnessing fusion energy.

MISINFORMATION IN ONLINE HEALTH DISCUSSIONS: CASE STUDIES OF RAW MILK AND VACCINE SKEPTICISM

Jose G Fernandez
Mentor(s): Joe Salmons

Social media has reshaped how people are informed about health. Two prominent beliefs online are vaccine skepticism and raw milk advocacy, both of which challenge institutional recommendations. There is much research into online misinformation and vaccines, but less is known about raw milk and how these beliefs are framed through logical fallacies. This study analyzed 60 TikTok videos related to raw milk and vaccine skepticism. Videos were transcribed and coded with identifiable fallacies. Both groups used fallacies to support their claims and shared a basis of mistrust. Raw milk content featured selective evidence and natural and traditional values, while vaccine skepticism content emphasized institutional mistrust and absolute safety. Findings suggest emotional and identity appeals are important to mitigate misinformation and increase engagement with factual content.

QUANTIFYING LAND USE CHANGES ON THE LAKE MICHIGAN SHORELINE AND THE RELATIONSHIP TO SHORELINE EROSION RATES

Lauren Fieweger
Mentor(s): Luke Zoet

Between 2012 and 2020, Lake Michigan experienced an extreme water level rise, resulting in varied erosion rates along the shoreline. Many factors may impact a particular area's resiliency to shoreline erosion, one being changes in land use. This project uses GIS processes to analyze the land use changes between 2010 and 2021 along reaches of similar shoreline type in Sheboygan County, Wisconsin. Shifts in land use categories in specific locations are examined in addition to calculation of the total area gained or lost from each land use category. This will then be used to determine the degree to which significant land use changes correlate with higher shoreline erosion rates and if particular land use changes have a greater correlation with high shoreline erosion rates.

EFFECTS OF GUT MICROBIAL METABOLISM OF CHOLINE INTO TRIMETHYLAMINE N-OXIDE (TMAO) ON NEUROINFLAMMATION

Andrew Finley
Mentor(s): Jessamine Kuehn
Additional Author(s): Katie R Zarbock-Hereford, Tyler K Ulland, and Federico E Rey

Alzheimer's disease (AD) is the most common form of dementia. We identified gut microbial metabolites that are associated with progression of AD. Specifically, we found that the bacterial metabolite trimethylamine N-oxide (TMAO) is associated with AD biomarkers. TMAO is produced from dietary choline. In the gut, bacteria convert dietary choline into Trimethylamine (TMA) via TMA lyase, which enters the circulation and is subsequently oxidized by host liver enzymes into TMAO. Here, we examined the role of bacterial choline metabolism in AD mouse models using diets with varying levels of choline and a novel TMA-lyase inhibitor. We used immunofluorescence imaging to quantify AD-associated brain pathology. This work will contribute to our understanding of possible AD treatments.

OPTICAL METABOLIC IMAGING OF *CRYPTOSPORIDIUM PARVUM* INFECTION IN COLORECTAL CANCER ORGANOIDS

Wyatt Flewelling
Mentor(s): Melissa Skala, Gina M. Gallego-Lopez

Colorectal cancer (CRC) patients exhibit 3-fold higher rates of *Cryptosporidium parvum* infection compared to controls, yet mechanisms underlying this association remain unknown. *C. parvum* causes Cryptosporidiosis, a severe diarrheal disease in immunocompromised populations. This study uses patient-derived colon organoids to investigate how *C. parvum* infection alters CRC cell metabolism. We compare *C. parvum*-infected versus uninfected CRC organoids using wide-field optical metabolic imaging to quantify redox changes. We hypothesize that *C. parvum* infection exacerbates colon carcinogenesis through metabolic reprogramming. Preliminary data show infected organoids exhibit decreased redox ratio, indicating a more reduced metabolic state. This first characterization of *C. parvum* in human colon organoids may reveal the pathogen's carcinogenic potential, informing therapeutic strategies.

TEMPORAL FINE STRUCTURE UTILIZATION IN SPEECH PERCEPTION

Calleigh Forgette
Mentor(s): Nike Gnanateja Gurindapalli
Additional Author(s): Jessica Haynes, Zaynab Iqbal, Amelia Jayara, Dhatri Sadholalu Devaraju

Speech perception is crucial for communication, relying on Temporal Fine Structure (TFS) – the rapid oscillations in sound waveforms that convey timing, pitch, and speech cues necessary for understanding in complex listening environments. There are still many questions about the usage of TFS in different types and levels of noise, as well as the utility of TFS in individuals with cochlear hearing loss. This project aims to investigate the utilization of TFS in different levels and types of noise by evaluating the effects of adjusting the integration of TFS in different signal-to-noise ratios over time in individuals with and without cochlear hearing loss. This research should help to create a speech-based test of fine-structure processing for use in cochlear implant and hearing aid users.

RETENTION OF SENSORIMOTOR ADAPTATION IN SPEECH; A PRELIMINARY REPORT

Morgan Fowler
Mentor(s): Timothy Murphy, Caroline Niziolek, Benjamin Parrell

Speakers unconsciously adapt to altered auditory feedback. We are interested in using this phenomenon to improve intelligibility in motor speech disorders, though this adaptation typically diminishes quickly. Here, we ask whether there is any retention of adaptation between training sessions and, if so, whether it is affected over multiple training sessions. Over eight sessions, participants read passages and monosyllabic words from a screen while hearing normal or altered auditory feedback. We measured changes in vowel acoustics within and between sessions to determine whether participants adapted their speech and retained this adaptation. Preliminary results show adaptation occurring within sessions, with evidence suggesting multiple training sessions may be required for long-term retention of adaptation.

VARIABILITY OF PREPOSITIONAL VERBS IN SPANISH AS A HERITAGE LANGUAGE

Ethan Frank
Mentor(s): Joe Salmons

Spanish heritage speakers are Spanish-English bilinguals who grew up speaking Spanish at home and English in most other environments. Existing research has shown that Spanish heritage speakers exhibit variability in their language use, but how they use prepositional verbs (e.g., depender de 'depend on,' soñar con 'dream about') has yet to be examined. Spanish heritage speakers in Wisconsin completed a survey consisting of fill-in-the-blank and multiple choice questions that tested how they use a select nine prepositional verbs. Survey results showed preposition use among heritage speakers is variable, some using standard forms, others using non-standard forms, and a few using multiple forms for the same verb. The results provide a first look into the use of prepositional verbs by Spanish heritage speakers.

UPCYCLING POLYSTYRENE TO HIGHER VALUE COMPOUNDS VIA AUTOXIDATIVE METHODS

Madelyn Frank
Mentor(s): Doohyun Baek
Additional Author(s): Shannon S. Stahl

Plastic waste is a global environmental challenge, and polystyrene (PS) in particular exhibits an extremely low recycling rate (<1%). This project focuses on the upcycling of polystyrene and explores two industrial autoxidation strategies to convert PS into higher-value compounds. The first project analyzed converting PS to phenol via the Hock process, which is a two-step process that introduces a hydroperoxide into benzylic C–H bonds followed by an acid-induced rearrangement. The second project examined converting PS to terephthalic acid (TA) via sequential para-installation of a carbon source on the pendant phenyl group followed by Mid-Century oxidation, which led to the development of a new method employing acetylation and a modified Mn/Br cocatalyst affording a >80% yield of TA.

ROLE OF LAT ENHANCER ON HISTONE DEPOSITION IN EARLY LYTIC INFECTION

Tori Fraser
Mentor(s): Donna Neumann, Pankaj Singh

Herpes simplex virus 1 (HSV-1) is the leading infectious cause of corneal blindness. The HSV-1 Latency-Associated Transcript (LAT) enhancer is a critical regulatory DNA element that orchestrates the virus's ability to maintain lifelong latency within sensory neurons. Following primary infection, the viral genome is heterochromatinized by host machinery through deposition of replication-dependent canonical histone H3.1 and replication-independent variant H3.3. To investigate the role of the LAT enhancer in early epigenetic landscapes, we analyzed histone deposition at 2 hpi. Through ChIP-qPCR, we compared wild-type HSV-1 with a LAT enhancer deletion mutant (ΔA). Our analysis revealed a trend of increased H3.1 deposition at multiple distal genomic loci in the ΔA virus which suggests that the LAT enhancer plays a role in genome-wide chromatin modulation.

DEEP LEARNING-BASED AUTOMATED DETECTION OF PRIMATE VOCALIZATIONS IN WILD FIELD RECORDINGS

Moshi Fu
Mentor(s): Claudia Solis-Lemus

This project develops an end-to-end deep learning system for automated detection and classification of primate vocalizations in long-duration field recordings from African rainforests. Using VGG19-based convolutional neural networks trained on mel-spectrogram representations, the system identifies calls from three target species: putty-nosed monkeys (*Cercopithecus nictitans*), guereza colobus, and chimpanzees. The pipeline addresses the domain gap between clean training clips and noisy field recordings through hard negative mining, which extracts false positives to iteratively improve model precision. Data augmentation strategies compensate for limited labeled data through background mixing and temporal/frequency masking. The system processes hours of audio via sliding window detection, outputs timestamped detections with confidence scores, and extracts detected clips for validation.

ETHYL CINNAMATE-BASED TISSUE CLEARING TECHNIQUE ON VOCAL FOLD MUCOSA WITH VASCULATURE MODEL

Serena Gacek
Mentor(s): Jack J. Jiang
Additional Author(s): Junlong Qin, Sebastian Kiehn, Owen P. Wischhoff, Jakob Holm

Objective: Tissue clearing enables analysis of microvascular network orientation and distribution with cellular resolution. This study adapts the ethyl cinnamate clearing procedure to canine vocal fold mucosa and targets vascular components via the CD31 antibody.

Methods: A novel protocol was developed including mucosal isolation from muscle tissue, reduced dehydration temperature (room temperature to 6℃), optimized antibody concentration (1:200), and post-processing improvements to address shortcomings of ethyl cinnamate clearing in vocal fold tissue.

Results: High-resolution imaging successfully captured CD31-positive vasculature orientation and protein distribution, enabling 3D reconstruction of vocal fold microvascular networks through available segmentation tools.

Conclusion: This adapted ethyl cinnamate protocol effectively visualizes CD31-positive vasculature in the vocal fold lamina propria and can be extended to target other antibodies, including epithelial cells and macrophages, in future research.

MATERNAL MORTALITY AND CRIMINAL JUSTICE IMPACT: ANALYZING 2016-2023 MATERNAL MORTALITY REVIEW INFORMATION APPLICATION (MMRIA) DATA ON MATERNAL DEATHS IN WISCONSIN

Yuan Gao
Mentor(s): Harald Kliems, Jill Denson

People who have been impacted by the criminal justice system experience several health inequities, including maternal morbidity and mortality. However, there is limited research on the specific connection between criminal justice impact, maternal mortality, and other socioeconomic and medical factors. Utilizing Maternal Mortality Review Information Application (MMRIA) database, this project analyzed over 120 maternal death cases in Wisconsin from 2016 to 2023. Our preliminary descriptive analysis integrates criminal justice impacts such as court records, incarceration, or arrests; social determinants of health such as race, education, income, or barriers to care; and medical characteristics such as birth outcomes and complications, causes of death. By identifying these intersections, we aim to develop hypotheses to mitigate systemic harms and improve health outcomes for justice-involved populations.

BENCHMARKING DEEP LEARNING AND LIKELIHOOD-BASED METHODS FOR VIRAL PHYLOGENETIC INFERENCE USING COVID-19 GENOME DATA

Jiayi (Joyce) Gao
Mentor(s): Claudia Solis-Lemus

Inferring viral phylogenies from genome alignments is challenging because viral datasets such as SARS-CoV-2 often contain highly similar sequences and large multiple sequence alignments. In this project, I benchmark several recent deep learning approaches for phylogenetic inference using COVID-19 genome data from the MSA Transformer viral phylogeny dataset. The dataset will be analyzed using four inference methods: MSA Transformer, Phyloformer, PhyloGFN, and CMAPLE. Each method will generate phylogenetic trees from the same multiple sequence alignment. The resulting trees will then be compared using topology-based and consensus comparison metrics, including Robinson–Foulds distance and co-phylogeny analysis. The goal is to evaluate how different neural and likelihood-based approaches reconstruct viral evolutionary relationships and to assess their agreement and structural differences in inferred phylogenetic trees.

ASSESSING RYR2 DEGRADATION IN HEK293 CELLS AS A MODEL FOR VARIANT-DEPENDENT STABILITY

Isabel Garay
Mentor(s): Francisco Alvarado

Ryanodine receptor 2 (RyR2) is an intracellular calcium channel essential for coordinating electrical activity and mechanical contraction in the heart. While genetic variants and alternative splicing of RyR2 are linked to cardiac pathologies, their impact on the channel's stability remains understudied. We established mammalian cell lines expressing wild-type RyR2 and various disease-associated mutants to quantify degradation kinetics using cycloheximide chase assays to inhibit protein synthesis. This platform enables comparison of the stability of the wild-type channel with disease-associated mutations. By defining the degradation profile of the wild-type channel, we provide a framework to evaluate how specific mutations influence RyR2 turnover, contributing to a broader understanding of the molecular basis of inherited heart disease.

ANALYSIS OF CORTICAL NEUROGENESIS IN TRISOMY 21 THROUGH ORGANOID LINEAGE TRACING

Fiona Gaugert
Mentor(s): Anita Bhattacharyya
Additional Author(s): Megan Jandy, Yi-Tang Lee, Cheryl Soref, Jarehlyn Camacho-Mojica, Pubudu Kumarage

Down syndrome (DS), caused by trisomy 21 (T21), is the most common genetic cause of intellectual disability and is associated with altered cortical neuron proportions. However, the biological mechanisms underlying these changes remain unclear. We hypothesize that T21 dysregulates the neural progenitors responsible for generating cortical neurons, resulting in altered neuron numbers. To quantify neurons produced by distinct progenitor types, we developed a fluorescent lineage tracing system that labels neurons according to their progenitor of origin. We have established this system in a T21 iPSC line and confirmed its ability to fluorescently label neurons derived from specific progenitor subtypes in a cortical organoid model. Using this approach, we aim to identify the cellular mechanisms driving dysregulated cortical development in DS.

DETERMINING THE IMPACT OF AML/CAR T-CELL SECRETED FACTORS ON CAR T-CELL CYTOTOXICITY

Sarah Geffe
Mentor(s): Nat Murren

Acute myeloid leukemia (AML) is an aggressive pediatric malignancy with survival rates that remain lower than those in pediatric B-cell acute lymphoblastic leukemia (B-ALL). Although chimeric antigen receptor (CAR) T-cell therapy has transformed B-ALL treatment, its efficacy in AML has been limited. Emerging evidence suggests that leukemia-derived soluble factors suppress CAR T-cell function in AML, yet how these signals differ from those in B-ALL remains unclear. In the Richards Lab, my preliminary data show that CAR T cells cultured in AML-conditioned media exhibit reduced proliferation compared to B-ALL–conditioned media, despite preserved proliferation following direct tumor engagement, indicating soluble-factor–mediated suppression. Building on this, my project will assess how leukemia-derived conditioned media alters CAR T-cell cytotoxicity to define AML-specific microenvironmental mechanisms limiting therapeutic efficacy.

THE IMPACT OF TRAUMATIC BRAIN INJURY ON THE GUT MICROBIOME IN *DROSOPHILA*

Kate Geiger
Mentor(s): Rebeccah Katzenberger

Traumatic brain injury (TBI) is a significant public health issue as it is a leading cause of death and long-term disability. Using a *Drosophila melanogaster* TBI model, the Wassarman lab has gathered data supporting the hypothesis that TBI accelerates normal aging. Since the bacterial microbiome shifts with age, this study tests the aging hypothesis by characterizing microbiome composition following TBI. Real-time PCR of bacterial 16S rDNA was used to compare bacterial abundance and species composition in male and female flies before and at times after injury. Our hypothesis predicts post-TBI microbiome changes will resemble those during aging. However, our preliminary findings are inconsistent: earlier experiments showed an increase in bacterial abundance after injury, whereas more recent experiments show a decrease. These conflicting results underscore the need for further experimentation to resolve the direction and magnitude of microbiome changes following TBI.

BIOLOGICAL PROFILES ON UNIVERISTY OF WISCONSIN-MADISON'S SKELETAL COLLECTION

Miya Gentile
Mentor(s): John Hawks

This project looks at the formulation of biological profiles on the Anthropology Department's Human Skeletal Collection. Biological profiles are an important component of bioarchaeology and forensic anthropology, which allow researchers to reconstruct an individual's relative identity post death. These characteristics allow archaeologists to gain insights about past population demographics, mortuary patterns, and social practices. In this project, osteological metric methods were applied to estimate age, biological sex, and stature through examination of cranial and postcranial features. Through a literary review, standardized techniques were chosen based on morphological assessment and metric analyses. By applying these established osteological methods, this project demonstrates the valuable information that can be obtained about past populations and contributions to our understanding of the University of Wisconsin-Madison's Anthropology Department's Human Skeletal Collection.

DECELERATION OF ULTRA-RELATIVISTIC AGN JETS

Rachel Gerhardt
Mentor(s): Talia O'Shea

Black hole jets travel ultra-relativistically, near the speed of light, and project outwards through their respective galaxies. Some jets extend past the defined edge of their galaxies while others are observed to decelerate beforehand. There are theories on what causes this jet deceleration, one of which is that as jets move through the galaxy, they pick up the mass that stars are giving off, in the form of stellar winds, which effectively mass-load the jet, and would slow it down. I compare observed jet deceleration and stellar winds with a model for stellar mass-loss related jet deceleration in order to find the effectiveness of stellar-mass loading in jet deceleration.

BANDIT-BASED ONLINE ACCELERATION FOR NON-SYMMETRIC LINEAR SOLVERS: EXTENDING PCGBANDIT TO PBICGSTAB IN OPENFOAM

Adonias Getachew
Mentor(s): Mikhail Khodak

Accelerating transient partial differential equation (PDE) solvers is critical for simulations within the physical sciences. While PCGBandit successfully uses online bandit learning to select optimal preconditioners for symmetric systems, many fluid dynamics problems in OpenFOAM simulations involve non-symmetric matrices requiring the Preconditioned Bi-Conjugate Gradient Stabilized (PBiCGStab) algorithm. This project implements a bandit algorithm that adaptively chooses between solver configurations during a simulation run. By utilizing real-time data from multiple linear solves, the algorithm learns to decrease wall-clock cost time without prior training data. This implementation incorporates the benefits of real-time learned acceleration into a wider range of OpenFOAM simulations, providing immediate computational savings for complex, nonsymmetric problems. We assessed the performance of the proposed implementation through simulations involving asymmetric linear solves.

COMPLEXITY VS. CONSISTENCY: A COMPARATIVE ANALYSIS OF REGRESSION MODELS IN INSURANCE ANALYTICS

Aayusha Ghimire
Mentor(s): Saurabh Kumar Gupta

This study evaluates the robustness of multiple machine learning models in performing regression on heterogeneous insurance datasets. By benchmarking four architectures—Linear Regression, Random Forest, XGBoost, and Artificial Neural Networks (ANN)—across diverse datasets ranging from synthetic linear samples to large-scale real-world data, the research assesses the trade-offs between accuracy, robustness, and interpretability. Model performance was compared using MAE, R^2 and cross-validated RMSE, along with rank stability and variability across datasets. Results examine whether greater model complexity consistently improves predictive accuracy, and identify important features of best-performing models. The findings aim to provide financial analysts with a recommendation for a "default" model that balances predictive power with consistent reliability in un-tuned environments.

EVALUATING THE IMPACT OF INTERMEDIATE WHEATGRASS KERNZA UNDER DIVERSE MANAGEMENTS ON SOIL ORGANIC MATTER

Shayla Gilbertson
Mentor(s): Priscila Pinto

This project evaluates the effects of intercropping intermediate wheatgrass (IWG) and legumes on soil organic matter (SOM) at Arlington Research Station. By analyzing particulate organic matter (POM) and mineral-associated organic matter (MAOM) in different cropping systems, it assesses how intercropping influences the SOM pool. Soil samples will be tested for carbon and nitrogen to determine impacts on SOM and nitrogen availability. Initial and final samples from a previous five-year experiment will be analyzed alongside current samples to strengthen interpretation. Nitrogen transfer from legumes to IWG will also be examined to quantify added N availability. This research improves understanding of nutrient dynamics in perennial intercropping systems, supporting sustainable agriculture and soil health management.

NOT THEIR FAULT? CHILDREN'S SENSITIVITY TO CONSTRAINED INFORMATION ENVIRONMENTS

Henry Gilboa
Mentor(s): Pearl Han Li

When someone holds a false belief due to limited information access, are they still at fault? We examined children's sensitivity to epistemic constraints when evaluating others' character. We presented children (6–9 years; N = 103) with pairs of characters holding the same false belief: One epistemically constrained (with access to only one unreliable source), and the other unconstrained (with extensive access to reliable information). Linear mixed-effects models showed that by age 6, children attributed greater intellect, better moral character, and less responsibility to the constrained character. Our findings demonstrate that children are attuned to others' epistemic circumstances and incorporate informational constraints in their evaluations. This has implications for how children engage with those embedded in echo chambers or epistemic bubbles.

INVESTIGATION OF CELL-FREE DNA FRAGMENTATION IN CELL LINE MEDIA

Mila A Gille
Mentor(s): Muhammed Murtaza
Additional Author(s): Bradon McDonald, Kirsten Dennison, Kristin Adams, Austin Stram, Jeremy Kratz, Jessica Lang

Cell free DNA (cfDNA) released into cell culture media may offer a controlled system for studying DNA fragmentation patterns observed in human plasma. We extracted cfDNA from 2D and 3D human cell line culture media and performed shallow whole genome sequencing to characterize cell culture cfDNA. All culture types produced a mixture of high molecular weight DNA and ~150 bp fragments. 85% of sequencing reads aligned to the human genome and 15% to the bovine genome, suggesting that a significant proportion of cell culture cfDNA is contamination from fetal bovine serum in cell culture media. While cfDNA from cell culture could be useful for studying DNA fragmentation patterns, it is critical to analyze samples grown in serum-free media to remove background and improve interpretability.

COMPUTATIONAL MODEL OF LEFT VENTRICULAR GROWTH AND REMODELING IN RATS

Maribel Glodowski
Mentor(s): Colleen Witzenburg

Coarctation of the aorta (CoA), characterized by a narrowed aorta, occurs in approximately 1 in 1,800 live births (Martin et al., 2024). A prevalent long-term complication of CoA is systemic hypertension, associated with premature coronary artery disease, cerebrovascular incidents, heart failure, and aortic aneurysms (Kenny et al., 2011). Contributing to this is the growth and remodeling (G&R) of the left ventricle (LV) induced by CoA before intervention. Experimental data in rats with CoA indicate that progression of LV hypertrophy and fibrosis is altered by age at correction. This project aims to develop a computational model of LV G&R that elucidates the reversibility of LV fibrosis with correction and improves understanding of the long-term effects of LV G&R related to correction timing.

CHARACTERIZING SCENT-MARKING BEHAVIOR IN GRAY WOLVES IN THE CENTRAL FOREST REGION OF WISCONSIN

Zach Gloudeman, Meghan Mendez
Mentor(s): Karie Cherwin

Gray wolves (*Canis lupus*) use scent-marking to define territories and facilitate communication within and between packs (Rothman & Mech 1979, Thiel & DeWitt 2022). These behaviors raise questions about how wolves maintain territorial boundaries and use scent cues to influence social and interspecific interactions. This study examines the ecological role of urine marking, with particular attention to its ties to reproductive timing and interactions with other species in Wisconsin's Central Forest Region (CFR). We developed a field-based approach that integrates behavioral monitoring to document spatial marking patterns and identify physiological cues associated with scent-marking events. Preliminary findings indicate that Gray wolves exhibit distinct behavioral responses to scent-marking. Continued research will clarify both intra- and interspecific communication dynamics.

TASK-SPECIFIC EYE-TRACKING SIGNATURES UNDER SPACEFLIGHT ANALOG STRESSORS

Rithik Gobinath
Mentor(s): Jeevan Ramesh Jayasuriya Arachchige

During long-duration spaceflight, crews simultaneously face fatigue and vestibular challenges that can degrade sensorimotor performance. Previous studies have associated pupil dynamics with fatigue-related arousal and effort, and oculomotor responses are sensitive to galvanic vestibular stimulation (GVS), but their interaction during sensorimotor tasks has not been investigated. Unlike performance scores, pupillometry provides a continuous, objective index of cognitive-autonomic state during task execution. We analyzed eye-tracking data across a 9-task sensorimotor battery following cognitive fatigue and ~28-hour sustained wakefulness, with interleaved GVS and sham blocks. We expected sustained wakefulness to produce arousal-linked constriction in high postural-cognitive demand tasks, cognitive fatigue to elicit effort-related dilation in fine motor tasks, and GVS to modulate these fatigue-related pupillary shifts.

DO STUDENT STUDY STRATEGIES AND SCIENCE MOTIVATION IMPACT ACADEMIC SUCCESS IN INTRODUCTORY HUMAN PHYSIOLOGY?

Zachary Goldberg
Mentor(s): Amanda Butz, Janet Branchaw

Effective study strategies and academic motivation are central to undergraduate students' academic success, yet little is known about how motivation influences change in study strategies. This study examined 162 undergraduate students' self-reported science motivation and study strategy usage in an introductory physiology course across five semesters. Study strategies were categorized into deep and surface level and grouped by when they were used . Cluster analyses, repeated measures MANOVA, and regression analyses, were used to: 1) investigate different motivational student profiles of students; 2) examine how those profiles relate to changes in study strategy use across 3 exams; and 3) how different study strategies relate to exam performance. Recommendations for students and instructors will be discussed.

CREATING A MODEL FOR MALE BREAST CANCER USING THE AUGUST COPENHAGEN IRISH (ACI) RAT

Jasmine Goldsmith
Mentor(s): Kasey Mitchell
Additional Author(s): Wei Xu

Despite the many available models for female breast cancer (FBC), there are no models - in vivo or in vitro - for any male breast cancer (MBC) subtypes. The goal of this project was to test the hormonal requirements for inducing mammary tumorigenesis in male rats over the course of 9 months. Using 32 males across 4 treatment groups, we found that only rats with both estradiol (E2) and medroxyprogesterone acetate (MPA) pellets formed tumors, while rats that had only E2, MPA, or sham (empty) pellets alone did not form tumors. At the experimental endpoint, tumors and other tissues were collected from rats from each experimental group for downstream analysis, including immunohistochemistry, immunofluorescence, RNA and protein extraction, and in vitro (organoid and cell line) generation.

TESTING PROMOTER SPECIFICITY OF THE HERPES SIMPLEX VIRUS TYPE 1 (HSV-1) LATENCY-ASSOCIATED ENHANCER (LTE) IN BLINDNESS ASSOCIATED WITH HSV-1

Andre Good
Mentor(s): Donna Neumann, Kayley Manuel

Herpes Simplex Virus 1 (HSV-1) is a widespread virus that causes lifelong infections with ~67% global prevalence. After primary infection in epithelia, HSV-1 establishes latency in sensory neurons, where viral genes are transcriptionally repressed. Viral reactivation periodically occurs, causing replication and symptoms. Severe reactivation can cause keratitis and blindness, making HSV-1 a leading infectious cause of blindness. No antivirals target latency or reactivation, making understanding reactivation critical. The LTE in the Latency Associated Transcript region is necessary for reactivation; however, this mechanism is unclear. ICP4 is also required for reactivation, and evidence suggests LTE may activate ICP4 transcription. This project will determine whether LTE specifically activates ICP4 by constructing plasmids containing LTE and the ICP4 promoter to quantify transcriptional activation.

DEFICITS IN TONIC GABAERGIC INHIBITION IN EPILEPSY-SUSCEPTIBLE VS. EPILEPSY-RESISTANT MICE

Aditya Gopal
Mentor(s): Mathew V. Jones, Rama K. Maganti

Seizures arise from an imbalance between neuronal excitation and inhibition. GABA, the primary inhibitory neurotransmitter, regulates excitability through phasic and tonic inhibition. Phasic inhibition is rapid and transient (i.e., synaptic), whereas tonic inhibition provides a persistent inhibitory current that stabilizes network activity and prevents hyperexcitation. DBA/2J mice, widely used in epilepsy research, display greater seizure susceptibility than C57BL/6 mice. However, it remains unclear whether altered tonic GABAergic inhibition contributes to this vulnerability. This study investigates tonic inhibitory currents in dentate gyrus neurons using whole-cell patch-clamp electrophysiology in acute brain slices from DBA/2J and C57BL/6 mice. Here, we review our ongoing progress examining tonic GABAergic inhibition in these strains and whether differences contribute to strain-dependent seizure susceptibility.

WHEN NEUROSCIENCE MEETS ANCIENT PRACTICE: WHAT GETS LOST WHEN WE TRY TO MEASURE THE IMMEASURABLE?

Krithi Gopinath
Mentor(s): Gudrun Buhnemann

Contemporary neuroscience research on Buddhist meditation reveals a critical disconnect between what studies measure and what meditation actually aims to achieve. While brain imaging documents real neural changes in practitioners, the dominant research paradigm—focused on stress reduction and cognitive enhancement—fundamentally misrepresents meditation's transformative goals. This analysis examines canonical Pāli texts like the Satipaṭṭhānasutta alongside modern neuroimaging studies to demonstrate how scientific reductionism erases meditation's ethical, soteriological, and communal dimensions. The commodification of "mindfulness" as a productivity tool further distorts practices originally aimed at liberation from suffering. This work argues for intellectual humility in cross-disciplinary research and questions whether neuroscience can study contemplative traditions without stripping them of their essential meaning and transformative potential.

THE ROLE OF TFG IN NEURONAL CARGO TRAFFICKING: INVESTIGATION OF COPII CARRIER DYNAMICS AND LOCAL SECRETION

Krithi Gopinath
Mentor(s): Anjon Audhya, Iryna Pustova

Mutations in TFG, a protein regulating endoplasmic reticulum cargo transport, cause hereditary spastic paraplegia—a neurodegenerative disease targeting long axons. To elucidate how TFG mutations disrupt neuronal trafficking, FRAP microscopy was used to quantify COPII carrier dynamics in human neurons. The disease-associated R106C mutation significantly destabilized COPII assembly sites, increasing mobile fraction from 60% to 77% and recovery time from 5.5 to 7 seconds. Immunofluorescence analysis revealed R106C causes specific cis-Golgi fragmentation while preserving trans-Golgi structure, consistent with disrupted carrier uncoating at early secretory compartments. These findings demonstrate that R106C impairs cargo packaging efficiency, providing mechanistic insight into TFG-linked neurodegeneration and identifying potential therapeutic targets for motor neuron diseases.

ELECTRODIALYSIS CELL FOR LACTATE RECOVERY

Olivia Gorr, Nicoletta Boukouzis, Nina Pfeiffer
Mentor(s): Samantha Kelly
Additional Author(s): Mohan Qin, Daniel Noguera

Bioprocessing systems have been engineered to produce lactic acid, which has industrial relevancy for many applications, including the production of polylactic acid. However, purifying this produced lactic acid requires downstream separations through processes like distillation. The use of an electrodialysis cell has been proposed as a solution to recover and concentrate lactic acid from the bioreactor effluent. By applying a constant voltage to the cell, lactate crosses an anion exchange membrane and is recovered in an electrolyte solution, creating a purified and concentrated lactic acid solution. Current research includes optimizing the experimental conditions, identifying and removing unintended byproducts, and transitioning to using real bioreactor effluent. The overarching goal is to produce a concentrated lactate solution that can be marketed for a variety of industrial usages.

IDENTIFICATION AND CHARACTERIZATION OF BACTERIOPHAGE FOR *XANTHOMONAS TRANSLUCENS* CAUSING FOLIAR DISEASES ON BARLEY

Adam Graham
Mentor(s): Kristi Gdanetz MacCready
Additional Author(s): Mackenzie Cunningham

Xanthomonas translucens is a species of phytopathogenic bacteria that causes foliar diseases on barley, impacting global crop yields. Currently, the control of *Xanthomonas* is limited to host genetic resistance. Bacteriophages are viruses that lyse their host bacteria and have been shown to be promising tools in the control of disease in other crop systems. In this work, we isolated multiple strains of bacteriophage from field soil. Geographically and genetically diverse strains of *X. translucens* were used to characterize the host ranges and efficacy of bacteriophage strains. Our phage strains yielded promising results in controlling *X. translucens* and could be useful for agricultural applications with further research.

IDENTIFYING EXTREMELY YOUNG POST-STARBURST GALAXIES WITH SDSS-IV/EBOSS SPECTROSCOPY

Helaina Grossmeyer
Mentor(s): Christy Tremonti, Marissa Perry

Post-starburst galaxies (PSBs) are galaxies that recently experienced an intense burst of star formation that then shut down very quickly. They can be identified by specific features in their light: strong signatures from intermediate-age stars but little evidence of ongoing star formation. PSBs are rare, making up only about 1% of galaxies. Even more surprising, recent studies have found a few extremely young PSBs, only 5–50 million years past their burst, challenging current models of how galaxies evolve. In this project, I will use data from the Sloan Digital Sky Survey's SDSS-IV/eBOSS program to build a catalog of PSBs at moderate distances. I will identify extremely young systems and measure how common they are, helping determine how quickly galaxies can stop forming stars.

STORYTELLING AND STEM PRACTICES IN LATINE-HERITAGE FAMILIES

Ana Michelle Guerrero-Rivera
Mentor(s): Andrea Buhler-Wassman

Research shows that storytelling strengthens intergenerational bonds by passing down values, histories, and knowledge (Vasudevan et al., 2022). Additionally, storytelling provides a context for the development of STEM-related practices, like asking questions, explaining, and making sense of the world through observation and reasoning. While existing studies emphasize the cultural and emotional dimensions of storytelling, few have examined how storytelling is associated with scientific practices like questioning and explaining during everyday interactions. Latine children often initiate science-related conversations in natural, home-based settings (Castañeda et al., 2022). These interactions, typically about animals, plants, or weather, frequently start with children's spontaneous questions and are full of explanations, analogies, and observational reasoning. The current study explores connections between storytelling and everyday STEM practices of asking questions and providing explanations using semi-structured interviews with Latine caregivers of preschool-aged children. Preliminary self-reported data with 81 Latine caregivers (71 mothers, 5 fathers, 5 grandmothers) living in New York City suggests that 77% of caregivers share stories with their preschool-aged children (Mage = 50 months). Future analysis will explore themes in caregiver-child STEM practices, specifically question asking and explanations. By examining these practices, we can better understand how storytelling functions not only as a mode of cultural transmission but also as a foundation for cognitive and scientific development in young children.

AN EEG INVESTIGATION OF ERROR-RELATED NEGATIVITY IN HUMAN-ROBOT INTERACTIONS

Ania Gugulski
Mentor(s): Rob Spenceley, Ranjana Mehta

Human-robot interactions (HRI) have been integrated into various industries to share workload with robots and improve worker safety. However, robots may not always be reliable. To understand how robot reliability shapes HRI, recent work used an electroencephalography (EEG) component, error related negativity (ERN), which shows increased amplitude when an error occurs. In the present work, we hypothesize that an ERN component will be observed when robot reliability is manipulated. 23 participants collaborated with a robot in a co-lifting task under reliable and unreliable conditions, while equipped with an EEG cap. Our results suggest that no ERN is present during unreliable trials, indicating that participants may have continued to trust robots regardless of errors and could be due to the participant's baseline expectation of the robot.

EXPLORING GONOCOCCAL-*GARDNERELLA* INTERACTIONS

Richard Gui
Mentor(s): Joe Dillard

Neisseria gonorrhoeae causes the sexually-transmitted infection (STI) gonorrhea. *N. gonorrhoeae* infection mechanisms are usually only studied alone. However, in patients, *N. gonorrhoeae* would always be found in the presence of other bacteria, and gonorrhea frequently co-occurs with bacterial vaginosis (BV). BV is a dysbiosis commonly associated with *Gardnerella* species. *Gonococci* and *Gardnerella* are on the same tissue during cervicitis. We hypothesize that *Gardnerella* species and *N. gonorrhoeae* interact in ways that affect the virulence, survival, and spread of both pathogens. We are examining what is causing *Gardnerella* to grow better when *N. gonorrhoeae* is present and if this effect extends to multiple species of *Gardnerella*.

RISK FACTORS FOR ANXIETY AND AGITATION IN MECHANICALLY VENTILATED (MV) ADULT INTENSIVE CARE UNIT (ICU) PATIENTS: A NARRATIVE REVIEW

Taylor Guido
Mentor(s): Yoonsoo Eo, Kristine Kwekkeboom

The associated risk factors of anxiety and agitation among patients receiving MV in the ICU have not been thoroughly examined. A narrative review was conducted to screen articles identified through PubMed and CINAHL. Studies that were published after 2000 conducted in an ICU that analyzed risk factors in adult patients(>18) were included in this study. Of 166 articles screened, seventeen studies were eligible. Across these studies, risk factors for anxiety and/or agitation are clustered into patient-level and ICU-level categories. Patient level factors include reason for MV, inability to communicate, repeated ventilator weaning failure, symptom burden (e.g., dyspnea, pain). ICU-level factors included MV duration, ICU procedures and alarms, the use of physical restraints and sedatives. There is need to develop nursing strategies to reduce patient and ICU-level factors for anxiety and/or agitation in MV ICU patients.

GENOME EDITING OF PILD IN PSEUDOMONAS AERUGINOSA USING TWO-STEP ALLELIC EXCHANGE

Sydney Gums
Mentor(s): Katrina Forest

Pseudomonas aeruginosa is a Gram-negative bacterium that causes nosocomial infections and has robust antibiotic resistance. *P. aeruginosa* infections rely on multiple virulence pathways, including the type IV pilus and type II secretion systems. Both systems require the prepilin peptidase–PilD–to cleave signal peptides and subsequently methylate pilin and pseudopilin substrates. Previously, both systems have been studied with expression of PilD on a plasmid. The exogenous nature of plasmids may confer energetic defects to their host, and promoters aren't always compatible with native proteins. To consistently measure the systems relying on pilD expression and function, this project uses two-step allelic exchange to insert mutated pilD into the chromosome. Mutated strains will be stored and used in future experiments aimed at understanding the physiological role of PilD-dependent methylation.

DEVELOPING A COMPUTER VISION TOOL FOR QUANTIFYING BLUFF EROSION

Arnav Gupta, Viktor Konstantin Mitchell
Mentor(s): Claire Ruggles

This project adapts a preexisting artificial intelligence model to automatically identify, mask, and label coastal bluffs and vegetation along the Wisconsin shoreline of Lake Michigan. Coastal bluff erosion is a natural but concerning process that threatens infrastructure, development, and public safety in Wisconsin. This study investigates whether vegetation coverage plays a significant role in mitigating erosion by using AI based image analysis to quantify vegetation distribution and correlate it with observed erosion patterns. The central hypothesis is that bluffs with greater vegetation density will exhibit reduced erosion rates and that bluffs with less vegetation density will erode at higher rates. To support the hypothesis, the project should find that bluffs with more vegetation will have lower erosion rates. Findings from this work could improve coastal monitoring methods and inform management strategies aimed at reducing erosion risk and protecting shoreline communities.

TRANSCRIPTION-ASSOCIATED MUTATIONS IN BUDDING YEAST

Rutuja Gupte
Mentor(s): Nathaniel Sharp

The highly transcribed regions of the genome are thought to be more susceptible to mutations as the non-transcribed strand may become temporarily reactive and vulnerable to damage. The transcription-coupled repair pathway is responsible for fixing this damage. The goal of this study was to explore the relationships between the processes of transcription, mutation and replication at the genome-wide level to understand the tradeoffs between the instability introduced by transcription and the repair mechanisms in the genome. This study utilized available Nascent Elongating Transcript Sequencing (NET-Seq) data with mutation accumulation data from published studies to characterize the relationships between transcription and mutation rates in *Saccharomyces cerevisiae*. Our analysis indicates that the relationship between transcription and mutation is complex with different effects in genic and non-genic regions.

WHITE DWARF IMPOSTERS AMONG US: DISTINGUISHING BETWEEN WHITE DWARFS AND CHROMOSPHERIC ACTIVITY IN BINARY STARS

Brooklyn Gustaf
Mentor(s): Erin Motherway, Robert D. Mathieu
Additional Author(s): Evan Linck, Ritvik Narayan

Binary stars occur frequently in the universe. In fact, 30% of solar mass stars will deviate from single-star evolutionary tracks as a result of binary interactions [1]. We investigate a sample of such interaction products in the galactic field by utilizing excess ultra-violet (UV) flux to identify main-sequence stars with white dwarf (WD) companions that arise from mass transfer (MT). However, other types of binaries can produce a WD false positive in the form of chromospheric activity. We have utilized the Ca II infrared-triplet spectral feature to characterize the chromospheric contributions in the UV to eliminate false positives in our sample. Correctly identifying binary MT products will allow us to make accurate claims about binary evolution and refine our traditional model of stellar evolution.

MINIMALLY INVASIVE STRATEGIES FOR SCAR REDUCTION IN LARYNGEAL PATHOLOGIES: A STATE-OF-THE-ART REVIEW

Benjamin Gustin, Ara Gargiulo
Mentor(s): Jack J. Jiang
Additional Author(s): Jakob Holm, Owen Wischhoff

To provide a comprehensive review of recent advances in minimally invasive strategies for treating laryngeal pathologies, emphasizing techniques that reduce vocal fold (VF) scarring and preserve vocal function through laser technologies, photodynamic therapy (PDT), photobiomodulation, and cryotherapy. Modern minimally invasive laryngeal interventions represent a shift from lesion clearance to functional preservation. Each modality employs distinct mechanisms which determine its efficacy in various laryngeal pathologies while maintaining minimal scar formation and preserving vocal fold vibratory characteristics. Future research must establish evidence-based protocols through large-scale randomized trials for emerging technologies like blue light lasers, Foscan-PDT, LLLT, and cryotherapy to refine standards of care toward scarless laryngeal surgery and complete vocal function restoration.

USING MECHANISMS OF AAV TO ENGINEER AN IMPROVED RAAV DUAL-VECTOR SYSTEM

Raymond Ha
Mentor(s): Rhiannon Abrahams, Kinjal Majumder

Adeno-associated virus (AAV) is a single-stranded DNA virus in the Parvoviridae family, which is modified to serve as recombinant AAV (rAAV) gene therapy vectors that deliver therapeutic transgenes. Although promising for treatment of genetic diseases, rAAV is limited by the transgene capacity that can be packaged in the viral shell. Therefore, defining the viral features necessary for concatemer formation is essential for improving vector design. I hypothesize that AAV sequences that promote concatemers are sufficient to drive rearrangement of rAAV genomes into larger, functional transgenes. To test this, I developed a dual vector system containing concatemer-associated AAV sequences that generates a GFP protein upon successful linear rearrangement. Measuring protein output relative to current rAAV platforms will inform strategies to overcome size constraints in rAAV technology.

HISTORY OF INCARCERATED WOMEN IN PHILADELPHIA, 1790-1860

Vivian Hadfield, Emilly Montes-Laguna
Mentor(s): April Haynes

This project continues a multi-year quantitative study examining gender ratios in county prisons across the Northern cities of New York, Philadelphia, and Boston between 1790 and 1860. Our component of the study focuses on determining how many women were incarcerated in Philadelphia's Moyamensing County Prison and identifying the proportion of the total prison population that was female. To address this, we compiled and analyzed data from prison reports and handwritten ledgers documenting gender ratios in Philadelphia's Moyamensing County Prison for vagrancy between 1832 and 1860. Ongoing analysis will help reveal broader patterns related to race, recidivism, and the differential treatment of prisoners in these institutions, depending on gender. Ultimately, the study underscores the need to address systemic inequalities embedded within the early American prison system.

COLLEGE STUDENTS' VIEWS OF SEXUAL EXPERIENCES: THE ROLE OF RAPE MYTHS AND RACIAL STEREOTYPES

Hunter Haines
Mentor(s): Kate Walsh

This study examines how rape myth acceptance (RMA) and Jezebel stereotype endorsement (JSE) influence college students' perceptions of ambiguous, alcohol-involved sexual encounters. Undergraduates (N = 624) read vignettes manipulating the race of the involved parties, then reported on perceived consent, blame attribution, and whether the event constituted sexual assault (SA). Cisgender heterosexual men exhibited the highest RMA and JSE levels. Results revealed that blaming the woman was more strongly associated with RMA than JSE. While both RMA and JSE negatively predicted labeling the scenario as SA, their interaction was consistently insignificant. Ultimately, findings indicate that gender stereotypes (RMA) significantly outweigh racial stereotypes (JSE) when attributing blame to women in ambiguous consent scenarios, regardless of the victim's or perpetrator's race.

A MORE ACCESSIBLE APPROACH TO QUALITATIVE RESEARCH USING THE RADaR TECHNIQUE

Olivia Hally
Mentor(s): Rachel Odes

Qualitative data serves as rich, contextual insight for healthcare research as community members share their lived experiences and explore community needs. Despite the complexity of qualitative analysis, community-engaged research benefits from multiple perspectives that enhance data interpretation. Utilizing qualitative data from interviews with mental health crisis response team members, this research employed the "Rapid and Rigorous Qualitative Data Analysis" (RADaR) technique. RADaR supplied the process to organize, reduce, and code data from transcripts into coded data tables to facilitate efficient identification of themes aligned with the research questions. Rigor remains upheld during the phases of reduction via independent analysis and collaborative discussion. Development of this procedure made qualitative analysis more accessible for novice researchers, like me, and provides a model applicable for future community-based research.

PRELIMINARY PATTERNS OF LANGUAGE OUTCOMES AND LESION CHARACTERISTICS IN CHRONIC POST-STROKE APHASIA

Yehee Ham
Mentor(s): Haley Dresang

Aphasia following stroke presents with substantial variability in language outcomes that is not fully explained by traditional clinical factors. This preliminary study descriptively characterizes behavioral performance and lesion patterns in a small cohort of individuals with chronic post-stroke aphasia (N=5). Language ability was assessed using standardized measures of aphasia severity, and structural MRI scans were processed using an automated lesion segmentation pipeline with manual refinement. Lesion volume and distribution were examined alongside individual language profiles, revealing marked heterogeneity across participants in both behavioral performance and lesion characteristics. These findings highlight variability in chronic aphasia and demonstrate the feasibility of integrating behavioral and neuroimaging data in a pilot framework. Ongoing work will incorporate genetic biomarkers of neuroplasticity to further investigate sources of individual differences in recovery.

MAGNETIC USC TUMOR SPHEROIDS ENABLE AN IN VITRO USC INVASION ASSAY

Natalie M Hanka
Mentor(s): Daniel R Matson

Uterine serous carcinoma (USC) is an aggressive uterine cancer subtype that invades into the uterine myometrium after loss of the transcription factor GATA binding protein 2 (GATA2). Unfortunately, there currently are no tractable in vitro platforms to study how GATA2-depleted USC cells invade. I hypothesized embedding ferrous nanoparticles into USC tumor spheroids would allow for positioning of tumors in 3D space and enable an in vitro USC invasion platform. To test this, I grew USC tumor spheroids with ferrous nanoparticles and measured cell viability, tumor spheroid geometry, and tumor movement in response to magnetic forces versus controls. Ferrous nanoparticles enable spatial positioning of USC tumors without impacting cell viability or spheroid shape. Future studies will now measure the impact of GATA2 on spheroid invasion.

INVOLVEMENT OF GATA2 IN OVARIAN DEVELOPMENT IN MICE

Matthew Hanke
Mentor(s): Fei Zhao
Additional Author(s): Shuai Jia

Premature ovarian failure (POF) is characterized by menopause before age 40, resulting in reduced ovarian reserve and infertility, often resistant to assisted reproductive technologies. Mechanisms underlying POF remain incompletely elucidated. In a conditional knockout mouse model (Osr2Cre+: Gata2 f/f, Gata2cKO) deleting Gata2 in Osr2+ mesenchyme, we observed smaller ovaries containing fewer follicles. Lineage tracing confirmed Osr2 expression in ovarian stroma. Preliminary results showed defective blood vessel formation in the stroma and reduced granulosa cell proliferation, which is critical for ovarian development and function. These results indicate that impaired blood supply might contribute to reduced ovarian size in Gata2-deficient mice, suggesting that mesenchymal Gata2 as a potential factor in POF pathogenesis.

DESIGN & DEVELOPMENT OF A THERMOMECHANICAL FACILITY FOR ION IRRADIATIONS

Charlie Hansel
Mentor(s): Charles A. Hirst
Additional Author(s): Smeet Patel

Fusion and fission reactor materials endure simultaneous radiation, mechanical stress, and elevated temperatures. These conditions are not commonly replicated by existing facilities. To bridge this gap, a simultaneous ion irradiation and thermomechanical testing facility is being designed and constructed in the UW-Madison Ion Beam Laboratory, centered around a 3 MeV proton beam and an MT1000 miniature tensile rig, capable of 2.5 kN loading and temperatures up to 800°C. This poster highlights key contributions including a custom chamber mount, tensile rig mount, and specimen alignment system, which are designed to integrate the vacuum chamber, tensile rig, and ion beam into a unified platform. The completed facility will enable real-time creep, fatigue, and thermomechanical testing under active irradiation, establishing a controlled environment to simulate material degradation.

IMPACTS OF GRIDLINE SCATTERING ON THERMOPHOTOVOLTAIC CELL PERFORMANCE

Linda Hao
Mentor(s): Eric Tervo

Thermophotovoltaic (TPV) cells convert thermal radiation into electrical power, making them promising for applications such as waste heat recovery and space energy systems. Studies show that reflectance is a critical parameter in TPV performance and influences device efficiency. However, many studies model the overall reflectance of TPV cells assuming only normal incidence of light. This assumption does not reflect real operating conditions, where radiation arrives from a wide range of angles and interacts with the metal gridlines. Therefore, this work aims to develop a more accurate reflectance model for TPV cells by incorporating variable-angle reflectance measurements using Fourier Transform Infrared (FTIR) spectroscopy. These measurements evaluate reflectance under different incident and reflected angles, improving understanding of optical losses and supporting efficient TPV device design.

NIGHT-NIGHTS AND NEW WORDS: INFANT DIRECTED SPEECH AS A PREDICTOR OF EXPRESSIVE LANGUAGE OUTCOMES IN PRETERM INFANTS

Bhanu Lakshmi Harikumar
Mentor(s): Margarita Kaushanskaya
Additional Author(s): Emily Bagan, Emma Libersky

Preterm infants often experience expressive language difficulties. Speech styles such as infant directed speech (IDS) may help mitigate these challenges. IDS is often characterized by word repetition. Previous research indicates a significant correlation between IDS and later language outcomes, but the correlation significance in preterm infants is understudied. This study will investigate if the frequency of IDS used by caregivers of 16-month-old preterm infants predicts expressive language outcomes at 36-months. 15-minute child-caregiver free-play interactions of preterm infants were recorded at 16-months and 36-months. Interactions were transcribed and analyzed. IDS was tracked by word repetition counts in caregiver speech, and expressive language was measured by average number of words per sentence. This research will help clarify potential benefits of IDS use and inform effective language therapies.

EVALUATING DIFFERENCES IN DNA DAMAGE REPAIR BETWEEN EXTERNAL BEAM RADIATION THERAPY AND RADIOPHARMACEUTICAL THERAPY

Ayush Harish
Mentor(s): Pippa Cosper
Additional Author(s): Sophie Bice , Nikki Messick

Radiation therapy is a cornerstone of cancer treatment, with nearly 50% of patients receiving such interventions. Conventionally, External Beam Radiation Therapy (EBRT) administers high-intensity doses over minutes. In contrast, Radiopharmaceutical Therapy (RPT) delivers a lower energy, more dispersed dose over months. The characterization of DNA damage response and signalling after RPT treatment is unknown. My work compares the difference in DNA damage response and signaling between the two treatment modalities using immunoflourescent microscopy. Using γH2AX and 53BP1 foci as markers of double-strand breaks, an automated quantification tool was developed for standardized analysis and quantification of both markers. The puncta counts of γH2AX and 53BP1 foci were visualized through standard immunoflourescence and compared between modalities. Our results show that lower doses of Lu177 RPT elicits more 53BP1 puncta over a week as compared to EBRT treatment of equivalent or higher doses. γH2AX coverslips are stained and will be quantified in the same manner as 53BP1 to address how the response rate differs between the two treatment modalities.

ASSESSMENT OF THE SAFETY OF RAAV VECTORS CONTAINING CHROMATIN INSULATORS

Eleanor Hart
Mentor(s): Kinjal Majumder
Additional Author(s): Clairine Larsen, Elizabeth Hofer

Adeno-Associated Virus (AAV) is modified to engineer recombinant AAV (rAAV) gene therapy vectors by replacing viral genes with therapeutic transgenes. However, rAAV vectors currently require large doses to be effective, making them expensive and potentially unsafe. To improve rAAV technology, we inserted DNA elements that regulate local chromatin. This leads to improved rAAV transgene expression. To assess the safety of these new rAAV vectors, I developed an assay to monitor their integration efficiency into the host genome that combines adaptor ligation followed by PCR amplification and analysis by gel electrophoresis or sequencing. Preliminary findings using Southern blots suggest that these vectors integrate at lower efficiency into the host genome, confirming their safety profile. Future directions will use Nanopore sequencing to characterize all integration sites genome-wide.

EXPOSURE AND RESPONSE ANALYSIS OF POSACONAZOLE IN EXPERIMENTAL INVASIVE PULMONARY ASPERGILLOSIS IDENTIFIES PK/PD TARGETS LINKED TO CLINICAL SUSCEPTIBILITY THRESHOLDS

William Hartman
Mentor(s): David Andes
Additional Author(s): Justin Massey

Translating in vivo endpoints to clinical outcomes is challenging, but mouse infection models provide essential data for antimicrobial pharmacokinetic/pharmacodynamic (PK/PD) analyses. In the neutropenic murine pulmonary aspergilliosis model, eight *Aspergillus fumigatus* strains were used. Quantitative PCR measured lung fungal burden in mice after posaconazole treatment. This established the pharmacodynamic endpoint for dose-response modeling. It also established the calculation of the free-drug area under the concentration-time curve to the minimum inhibitory concentration (AUC/MIC) ratio associated with stasis. Simulations integrating these endpoints with human posaconazole pharmacokinetics showed that strains with MICs ≤0.5 mg/L are highly likely (>90%) to achieve PK/PD targets.

CULTURAL CONTEXT IN CULTURAL PAIN EXPRESSION AMONG JAPANESE ADULTS

Asuka Hashimoto
Mentor(s): Shinye Kim

Chronic pain affects over 100 million adults in the United States, yet standard tools for pain assessment remain subjective and often fail to capture the cultural and linguistic nuances of pain expression. Asian Americans are underrepresented in pain research despite documented disparities in treatment. This phase of the study focused on recruitment of Japanese participants with chronic pain and conducting interviews to explore perspectives on pain expression and healthcare experiences. Interviews were recorded and transcribed, and analysis is underway to identify patterns in language. These findings will provide information on how culture shapes pain expression and the lab seeks to utilize the knowledge to build a multi-lingual pain expression library and prototype a culturally informed pain index assessment algorithm to equalize pain care.

DO POLYCYSTIC OVARIES ACCOMPANY HIGH LEVELS OF PITUITARY LUTEINIZING HORMONE AND OVARIAN TESTOSTERONE FOLLOWING SILENCED HYPOTHALAMIC ESTROGEN RECEPTOR ALPHA EXPRESSION?

Phoebe Hayes
Mentor(s): David Abbott

Polycystic ovary syndrome (PCOS) is a women's health disorder characterized by high testosterone, menstrual irregularities, and polycystic ovaries. The origins of PCOS, however, remain poorly understood, hindering progress towards a cure. Diminished sensitivity to ovarian estradiol and progesterone negative feedback in the hypothalamus of the brain is intrinsic to women with PCOS, resulting in elevated levels of pituitary luteinizing hormone (LH), overstimulating ovarian testosterone release. Hypothalamic estrogen receptor alpha (ERα) is essential for engaging ovarian negative feedback. Silencing ERα expression in female rhesus monkeys induces elevated LH and testosterone levels. To test the hypothesis that polycystic ovaries accompany these PCOS-like hormone changes, we quantified follicle populations in ovarian sections from control and ERα-silenced females. We found no preferential induction of polycystic ovaries following ERα silencing.

COMPARING DEEP LEARNING ARCHITECTURES FOR FULL-BODY SYNTHETIC COMPUTED TOMOGRAPHY GENERATION IN POSITRON EMISSION TOMOGRAPHY RECONSTRUCTION

Tracy He
Mentor(s): Alan McMillan

Accurate Positron Emission Tomography (PET) reconstruction requires precise attenuation maps to correct for photon absorption. To achieve this without additional structural scans, we investigated the generation of synthetic Computed Tomography (CT) images directly from uncorrected PET data. This study evaluated three deep learning architectures: nnU-Net, Residual U-Net, and UNETR; using 172 paired full-body scans. Synthesis accuracy was assessed using Mean Absolute Error, Structural Similarity, and Dice coefficients to directly compare the performance of nnU-Net against Residual U-Net and UNETR. Clinical impact was evaluated by measuring the Standardized Uptake Value (SUV) error in the final attenuation-corrected PET images. Our results identify the optimal architecture for whole-body CT synthesis, advancing standalone PET workflows, reducing patient radiation exposure, and ensuring high quantitative diagnostic accuracy.

GOING WITH THE GLOW: RECYCLABLE CHERENKOV RADIATION DETECTOR TO PREDICT THE ENERGY OUTPUT OF A 1 MW NUCLEAR REACTOR

Logan Heffernan, Carson Keim, James Gallo, Isabella Miller, Soren Selberg, William McEvoy
Mentor(s): Charles A. Hirst

Cherenkov radiation, the light produced when a charged particle travels through a medium faster than the speed at which light travels in that medium, provides a useful indicator of reactor power. Because the intensity of light varies linearly with the energy output of the reactor, measuring this radiation provides a method for estimating reactor power output. A prototype of a recyclable submersible light detector will be created to measure the amount of Cherenkov radiation produced by the University of Wisconsin Nuclear Reactor at 0.1 MW and 1 MW. These measurements will be used to determine an unknown energy output of the UWNR via the linear relationship between radiation intensity and energy output, providing an additional method for the UWNR to measure reactor power level.

PERCHLORATE TOLERANCE OF PLANT-ASSOCIATED MICROBES IN MARTIAN REGOLITH SIMULANT

Shreya Hegde
Mentor(s): Kyra Keenan, Brian Pfleger

Martian regolith, a promising growth substrate for future interplanetary missions, contains high concentrations of toxic perchlorate (ClO4-) salts. Crops can uptake these salts through their roots, and perchlorate-contaminated plant tissues can cause hypothyroidism when ingested. Existing bioremediation systems, though effective, often require extensive infrastructure impractical for agricultural systems. *S. stutzeri*, a root-colonizing bacteria, is being engineered to reduce perchlorate at the root interface to prevent plant uptake. The growth of *S. stutzeri* in Martian regolith simulant at different depths and perchlorate concentrations was evaluated. This data helped determine perchlorate concentrations that *S. stutzeri* could tolerate and potentially reduce in regolith. Additionally, the simulant's ability to harbor microbial life during storage was characterized to assess what organic compounds may affect bacterial growth even after simulant sterilization.

THE ECOSYSTEM SERVICES TOOL: CULTIVATING SUSTAINABLE FOOD SYSTEMS FOR A THRIVING PLANET

Nolan Hegge
Mentor(s): Alfonso Morales, Edna Ely-Ledesma
Additional Author(s): Elizabeth Khomenkov

Our planet faces ecological threats from all directions. Agriculture, however, is the one major industry whose carbon emissions are not decreasing. Current agricultural practices have a massive negative impact on our ecosystems and food supply. Sustainable agricultural practices can improve biodiversity, soil health, climate change, and preserve natural resources. The Ecosystem Services web tool is designed with this in mind. Through a 15-minute survey, the tool will help farmers track and improve their farming practices. By using six core metrics—soil health, biodiversity, livestock, infrastructure, alternative power, and transportation—farms can develop yearly benchmarks on their agricultural practices. Through direct collaboration with farmers, researchers, and software developers, the Ecosystem Services tool has been further deepened and developed as an invaluable tool to support agriculture and our planet.

USING ANISOTROPY OF MAGNETIC SUSCEPTIBILITY AND GEOCHRONOLOGY FROM THE BUSH LAKE GRANITE, FLORENCE COUNTY, WI TO UNDERSTAND POST-PENOKEAN CONTINENTAL GROWTH

Alyssa Hellrung
Mentor(s): Chloë Bonamici
Additional Author(s): Khalil Droubi, Claire Ruggles

The Bush Lake granite in Florence County, Wisconsin, is interpreted to have emplaced 1835 million years ago at the end of the Penokean mountain building event. The Bush Lake granite occurs just south of the Niagara fault zone, a major structure that marks the location of Penokean mountain building. The Bush Lake intrusion is therefore well located to constrain the timing of ancient granite magmatism and deformation events in Wisconsin. Here, we present microstructural analysis, anisotropy of magnetic susceptibility fabric data, and U-Pb zircon geochronology for the Bush Lake granite to understand the deformation it experienced and the granite's emplacement timing.

CENTERING THE CHILD: YOUTH VOICES, RESILIENCE, AND LIVED EXPERIENCES OF PARENTAL INCARCERATION ACROSS FIVE COUNTRIES

Louise Hemley
Mentor(s): Julie Poehlmann

Children with incarcerated parents represent a significant yet often underexamined population impacted by the criminal justice system. While prior research has focused on risks and outcomes, fewer studies center on children's lived experiences. This study highlights youth voices and explores how children understand and navigate parental incarceration across five cultural contexts: Uganda, Spain, South Korea, New Zealand, and England. Qualitative interviews were conducted with 57 youth aged 11–20 to capture personal narratives and sources of strength. Across countries, youth described challenges including stigma, family disruption, and emotional distress, alongside resilience and personal growth. These findings emphasize the importance of centering youth perspectives in research, policy, and services. By amplifying their voices, this study challenges deficit-based narratives and underscores children's capacity for resilience, optimism, and self-direction.

THE DISTRIBUTION OF ALPHA-SYNUCLEIN IN THE AMYGDALA OF HEMIPARKINSONIAN RHESUS MACAQUES

Claire Hentges
Mentor(s): Marina Emborg

Parkinson's disease (PD) is a complex neurodegenerative disorder typically diagnosed by the presence of motor symptoms such as bradykinesia and rigidity; however, nonmotor symptoms, including anxiety and depression, are common. Motor symptoms are associated with the loss of dopaminergic neurons in the substantia nigra pars compacta, but the neurobiological mechanisms underlying anxiety and depression in PD are not known. The amygdala is known to play a significant role in determining emotional saliency and harbors Lewy bodies in PD patients, which are composed primarily of the protein alpha-synuclein (α-syn). This project aims to study the expression of α-syn in the amygdala nuclei of hemiparkinsonian adult rhesus macaques (n=5) to assess its potential link to the onset of anxiety and depression in PD.

JUDY HEUMANN

Madelyn Sarai Hernandez
Mentor(s): Garrett E Huck

This piece uses hand-drawn text to form a portrait of Judy Heumann, a central figure in the Disability Rights movement. By building her image from words like "human rights," "accessibility," and "advocacy," the artwork connects her identity to landmark efforts such as the 504 Sit-In and the push toward the ADA. The circular framing of the question highlights how her work continues to shape conversations about equality. Layered text across her face and body reflects the movement's long history of protest and community action, creating a portrait that honors both Heumann and the broader fight for disability justice.

UNA NIÑA FELIZ EN UNA NOCHE LLENA DE ESTRELLAS: HOW LATINE CAREGIVERS SOCIALIZE EMOTIONS IN NATURE STORIES WITH THEIR CHILDREN

Arielle Herz, Antonia Arana Larrondo, Sara Bannantine-Moron
Mentor(s): Andrea Buhler-Wassmann

Family oral storytelling can support young children's learning and emotion socialization in culturally meaningful ways. We analyzed the science- or nature-related oral stories that Latine caregivers and their preschool-aged children shared together and coded for emotional experiences and internal states, and evaluative language (positive or negative). The most frequent emotions were related to fear/miedo, happiness/felicidad, love/amor, and sadness/tristeza. With regards to evaluations, caregivers and children most often discussed liking/disliking and wanting/not wanting. Our poster will include quotes from the stories that illustrate the ways that caregivers discuss emotions and make evaluations during their science and nature stories. This project showcases family storytelling as a way to socialize how young children feel and think about nature and science.

HEALTH SYSTEM- AND PAYER-LEVEL DECISION-MAKING FACTORS IN THE ADOPTION, INTEGRATION, AND SUSTAINABILITY OF DIGITAL HEALTH TOOLS

Mallory Herzog
Mentor(s): Andrew Quanbeck

Alcohol Use Disorder (AUD) imposes major health and economic burdens, yet treatment access remains limited by stigma and geographic barriers. Digital tools such as Tula, a smartphone-based AUD intervention shown to reduce heavy drinking days, offer scalable support, but health system and payer adoption remains low. This qualitative study examined decision-making factors influencing adoption and sustainability through nine interviews with senior clinical, operational, behavioral health, and payer leaders at a large academic health center. Interviews explored organizational context, AUD management, perceived value and fit, decision-making factors, evidence requirements, cost considerations, and long-term sustainability. Thematic analysis revealed shared priorities across leaders and highlighted conditions needed to integrate digital tools within complex health systems.

FROM HIGH BLOOD PRESSURE TO CANCER: REPURPOSING LOSARTAN TO TREAT NEUROBLASTOMA TUMORS

Niko Hess
Mentor(s): Alexa Heaton
Additional Author(s): Melissa Skala

Losartan is an FDA approved blood pressure regulator, blocking angiotensin II receptors to dilate blood vessels, decrease blood pressure, and decrease collagen I production. This is desirable for the treatment of neuroblastoma, the most common extra-cranial pediatric cancer. Neuroblastoma tumors have a dense extracellular matrix, including collagen, complicating drug delivery, and are considered "cold," indicating poor immune infiltration and response. Losartan has been shown to increase blood flow and decrease the formation of collagen I in breast and pancreatic cancers, improving tumor responses in mice. Losartan has not been studied in neuroblastoma. Here, we will test the effect of Losartan on mouse neuroblastoma tumors in combination with chemo-immunotherapy using two photon microscopy and animal models to investigate collagen changes, tumor response, and immune infiltration.

JAX-BASED SPECTRAL VLASOV-MAXWELL SOLVER WITH ADAPTIVE BASIS

Matthew Heupel
Mentor(s): Cristian Vega

The Vlasov-Maxwell system of partial differential equations provides a kinetic description of plasma dynamics. This work presents a spectral method for this system that projects a particle distribution function onto asymmetrically weighted Hermite functions in velocity space and a Fourier basis in configuration space. The Hermite basis is adapted in time according to physical criteria so that the zeroth element of the basis remains representative of the global thermal distribution. Adapting the basis allows for a better representation of the plasma velocity distribution with fewer modes. The performance and accuracy of this method are compared to the static basis method. Implementation in the JAX Python package enables just-in-time compilation, hardware acceleration, and auto-differentiation, which allow for applications in high-performance simulation and gradient-based optimization.

DO FEMALE MONKEYS WITH HIGH TESTOSTERONE LEVELS EXHIBIT POLYCYSTIC OVARY SYNDROME (PCOS)?

Lucie Hickey, Max Alper, Lamees Elhassan, Emily Huang
Mentor(s): David Abbott

Polycystic ovary syndrome (PCOS) is a chronic women's health disorder that is characterized by hyperandrogenism (HA), intermittent menstrual cycles (OD) and polycystic ovaries (PCOM). According to diagnostic criteria, PCOS presents as four phenotype s: (A) HA + OD + PCOM, (B) HA + OD, (C) HA + PCOM and (D) OD + PCOM. Absence of naturally occurring animal models hinders progress towards a cure. Recently, naturally occurring HA female monkeys were identified with PCOS-like traits. Our study examined xx HA and xx control female monkeys to define PCOM and test the hypothesis that more HA monkeys exhibit PCOM than controls and that all four human PCOS phenotypes can be identified in monkeys. Our findings could establish HA monkeys as biomedical research models for treating PCOS.

RESOLVING THE BASIS OF QUANTIFYING ANTHELMINTIC DRUG RESISTANCE

Greta Hiltgen
Mentor(s): Natalia Betancourt Rodriguez

Human hookworm infections pose a significant global health challenge, with management largely reliant on mass drug administration. Anthelmintic resistance threatens the effectiveness of these programs. The precise drug resistance mechanism in human hookworm remains unclear. Mutations associated with resistance have been identified in the related dog parasite *A. caninum*. The ability to link genetic variations to phenotypes of resistance still has several challenges. This study aims to develop a platform using the model system *A. caninum* to link genotypic and phenotypic variation. Using a high-content imaging system and an AI-assisted software platform, I performed egg-hatching, larval-development, and larval-motility assays and quantified dose-response curves. This work will enhance our understanding of drug resistance in *A. caninum*, offering a framework for investigating similar resistance in human hookworm.

ENGINEERING TRANSPORTER PROTEIN ACRAB(Z)-TOLC FOR UNDERSTANDING ANTIBIOTIC RESISTANCE

Laniya Hinton
Mentor(s): Anna Mangus

Antibiotic resistance is one of the largest health crises in the world, associated with the deaths of millions due to untreatable bacterial infections. Drug resistant Gram-negative bacteria often employ transporter proteins to export antibiotics, the most notable of which is the efflux pump AcrAB(Z)-TolC, due to its high substrate polyspecificity. AcrZ, a 49-amino acid protein that interacts with the AcrAB(Z)-TolC complex, is hypothesized to affect the pump's specificity, but its explicit function remains unclear. In my project, I will use high-throughput protein engineering techniques to understand AcrZ's role in AcrAB(Z)-TolC efflux. By screening a deep mutational scanning (DMS) library of AcrZ against antibiotics from 6 different classes, I will map the sequence-function landscape of AcrZ to further understand the fundamental mechanisms behind antibiotic resistance.

IMPLEMENTATION OF *BLASTOMYCES* TESTING IN TUBERCULOSIS PUBLIC HEALTH LABORATORIES

Lauren Hjelsand
Mentor(s): Alana Sterkel, Francesca Scala

Blastomyces is a potentially deadly fungal pathogen that is most prevalent in rural Northern Wisconsin. Current diagnostic methods are slow, expensive, technically difficult, and require advanced biosafety precautions. Implementing *Blastomyces* identification into tuberculosis labs would make clinical testing more accessible for patients. These organisms align well within a shared diagnostic workflow, because they have similar clinical presentations and behave similarly in laboratory environments, distinctly from other infectious organisms. Implementation would require developing an SOP, providing training, and troubleshooting expected translational barriers. Adding *Blastomyces* identification to the tuberculosis workflow may present a translational barrier due to the historical differentiation of work within microbiology, and the differences between clinical work and research, but these methods can speed up identification of the infection and improve patient outcomes.

XPS INVESTIGATION OF THORIUM CHEMICAL STATE IN GRAIN BOUNDARY REGIONS OF RECRYSTALLIZED MONAZITE

Lindsey Hmielewski
Mentor(s): Will Nachlas
Additional Author(s): Peter Sobol

Monazite, a rare earth phosphate, is an important source of vital Rare Earth Elements (REEs) and Thorium, which have crucial roles in energy and industry. The recrystallization of monazite is helpful in the facilitation of REE and Thorium extraction, but this process results in new growth at the grain boundaries with distinct chemical composition. The motivation for the project is to use X-ray Photoelectron Spectroscopy (XPS), a surface analysis technique that provides high resolution spectra, to investigate changes to the chemical state of Thorium in grain boundary regions of monazite after recrystallization. X-ray spectral data of the monazite samples are interpreted for any significant shifts of the Th 4f peaks, which would reveal distinct chemistry of Thorium in these minerals.

A CONTENT ANALYSIS OF PUBLIC "A DAY IN MY LIFE" TIKTOK VIDEOS AND THEIR COMMENTS

Gabby Hon
Mentor(s): Kyle Palmberg, Megan Moreno

Little is known about the content of "day in my life" TikTok videos, as well as what is portrayed in their comments. The purpose of this study was to investigate these videos and their viewer comments. This social media content analysis study analyzed 60 public videos from three distinct hashtags on TikTok (20 videos per hashtag) and the top 15 comments from each video. The three hashtags were: "#Adayinmylife, #dayinmylife, #DIML". An inductive codebook was used to evaluate video content, which included eight categories: Makeup, Nutrition, Gym/Fitness, School, Work, Sleep, Hygiene, and Tavel. Comments were evaluated using Linguistic Inquiry and Word Count (LIWC) for the presence of positive and negative language in viewer comments.

HYDRAULIC INFLUENCES ON WINTER ICE PRESENCE AND RELATIVE VULNERABILITY IN THE RECREATIONAL OUTLET CHANNEL OF LAKE KEGONSA

Jalynn Horacek
Mentor(s): Chin Wu

This research addresses growing local concerns regarding winter ice use and safety at the Lake Kegonsa outlet as hydrologic and climate patterns shift. Ice thickness was first estimated using temperature-based ice formation equations and then evaluated under modeled hydraulic conditions. A steady-flow HEC-RAS model was developed to simulate winter velocities and channel hydraulics within the outlet reach. Comparisons between thermally predicted ice thickness and hydraulically influenced conditions were used to identify spatial deviations in ice presence. These deviations were used to develop a relative vulnerability index describing spatial variability within the recreational outlet channel.

EFFECT OF NEUTROPHIL DEPLETION ON EFFICACY OF TIG+ANTI-CD40 TREATMENT OF 9464D-GD2 NEUROBLASTOMA

Benjamin Horwitz
Mentor(s): Paul M Sondel, Alexander Rakhmilevich

Neuroblastoma remains a leading cause of pediatric cancer mortality, particularly in relapsed or refractory disease. Our lab previously demonstrated antitumor efficacy of a combination regimen consisting of Temozolomide, Irinotecan, anti-GD2 (TIG), and anti-CD40 immunotherapy. Because neutrophils can function as antitumor effector cells following administration of anti-CD40, we tested if neutrophil depletion would reduce treatment efficacy. Using a C57BL/6 mouse model of 9464D-GD2 neuroblastoma, we depleted neutrophils with anti-Ly6G during TIG+anti-CD40 therapy. Unexpectedly, neutrophil depletion enhanced antitumor response, with all mice remaining tumor-free in two independent experiments. These findings rule out a role of neutrophils as effector cells and suggest that tumor-associated neutrophils may exert protumor, immunosuppressive effects in this model.

AUTOMATED STANCE DETECTION OF PUBLIC COMMENTS IN FEDERAL RULEMAKING

Suchita Hothur
Mentor(s): Jodi Schneider, Heng Zheng

This research project develops an automated workflow to predict the opinions of stakeholders towards proposed federal regulations. Government agencies are mandated to incorporate public input during the rulemaking process. However, the resulting documents of public comments contain huge quantities of data across topics that are difficult to systematically analyze. This project aims to fill that need by extracting textual data from policy documents and feeding it into existing Natural Language Processing (NLP) pipelines to classify stakeholders' opinions. As a case study, we use the Environmental Protection Agency's emission rules for electric vehicle adoption to develop a scalable tool to uncover stakeholders' opinions towards proposed regulations. In the future, this work will be used to understand the logic behind federal rulemaking.

METHYLGLYOXAL REDUCTASE EXPRESSION FOR 1,2-PROPANEDIOL BIOPRODUCTION IN *CLOSTRIDIUM BEIJERINCKII*

Steven Hsieh
Mentor(s): Eric Agyeman-Duah

Production of 1,2-propanediol, a versatile compound in various industries, currently relies on energy-intensive and pollutive processing of crude oil products. Alternatives in microbial 1,2-propanediol bioproduction have been recently explored, but the key intermediate in the synthesis pathway, methylglyoxal, poses cytotoxicity to microbes thus limiting 1,2-propanediol titer. Our group previously found that overexpressing ydjG (methylglyoxal reductase), an aldo-keto reductase (AKR) that metabolizes methylglyoxal, alongside fucO (lactaldehyde reductase) from *E. coli* enhances 1,2-propanediol production by the solventogenic *Clostridium beijerinckii*. To further investigate the role of heterogenous AKRs in methylglyoxal transformation to 1,2-propanediol, we cloned two methylglyoxal reductases (akrN, pgoN) from *Bacillus subtilis* responsible for its high methylglyoxal resistance, forming ydjG-fucO-AKR and ydjG-AKR constructs. The constructs were expressed in *C. beijerinckii*, then growth and metabolite production were measured.

STRUCTURE TUNING OF HYBRID HALIDE PEROVSKITE VIA INTERMOLECULAR FORCE

Yibo Huang
Mentor(s): Richard Botzoc

Two-dimensional hybrid inorganic-organic halide perovskites (2D HOIPs) exhibit unique structural and electronic properties, making them promising for photoelectrical applications. 2D HOIPs can be classified into Ruddlesden-Popper (RP) and Dion-Jacobson (DJ) phases, each with a distinctive framework and layer interaction. This project aims to investigate the role of the interlayer intermolecular forces (IMFs) in templating inorganic frameworks to enable structure-engineering in 2D HOIPs. I synthesize new 2D HOIPs with selected spacers and A-site cations, characterize their structures by X-ray diffraction, and evaluate their photoelectrical and vibrational properties.

THE SHAPE OF THINGS: EXPLORING TOPOLOGICAL DATA ANALYSIS THROUGH METAPHORS

Helena Huang
Mentor(s): Gary Shiu

Topological data analysis (TDA) offers a mathematical language for uncovering the structural shape of data, and it has been applied in fields like cosmology, biology, and finance. Yet its core concepts, such as connected components and topological loops captured by persistent homology, remain opaque to non-expert audiences. Metaphor has long served as a cognitive bridge between the abstract and the familiar, enabling more intuitive encoding and decoding of complex ideas. We explore interactive tools that map TDA concepts onto metaphors, such as natural phenomena like water filling enclosed regions, rain trapped inside loops, and ecological forms that share topological structure with user-drawn shapes. Through iterative design, we explore how metaphors scaffold understanding of persistent homology.

TRUSTED ADULTS IN SCHOOL: ADULT CONNECTION AND WELL-BEING OF STUDENTS WITH IEPS

Sarah Huber
Mentor(s): Kristin Kotleski

Students with Individualized Education Programs (IEPs) are disproportionately at risk for mental health challenges such as anxiety, depression, and social withdrawal, which can negatively impact school engagement and peer relationships. Connections with trusted adults and a sense of school belonging have been associated with improved mental health outcomes among adolescents. However, less is known about how frequently students with IEPs report these protective factors at the population level. This study will use data from the 2024 Dane County Youth Assessment, a countywide survey of students in grades 7–12, to describe the frequency of IEP status and examine the prevalence of trusted adult connections and school belonging among students with IEPs. Data will be analyzed in terms of frequencies and percentages.

LET THERE BE LIGHT: DETECTING OUTPUT OF THE UW NUCLEAR REACTOR THROUGH CHERENKOV RADIATION LIGHT LEVELS

Ben Hull, Matthew Barrera, Logan Dentinger, Sophia Grosman, Tyler Iha, Abishek Jerome
Mentor(s): Charles A. Hirst

We are designing and building a device that measures Cherenkov radiation and accurately estimates the power output of the University of Wisconsin-Madison Nuclear Reactor. We will address this goal with an innovative design that considers affordability, effectiveness, and usability. This device will consist of a photodiode, an operational amplifier, a resistor, a capacitor, a 5V battery, a breadboard, wires, and an Arduino analog-to-digital converter. We will lower our light detector system in a synthesized box with a black coating of tape and/or paint to block ambient light with a sealed PVC pipe. We will maintain the position until all of our needed data is collected. This setup will utilize minimal resources and expertise to collect data about nuclear reactors.

SOIL PHOSPHOROUS LEVELS PRESENT IN DIFFERENT CROPPING SYSTEMS AT THE WISCONSIN INTEGRATED CROPPING SYSTEMS TRIAL'S 33RD YEAR

William Hunter
Mentor(s): Gregg Sanford
Additional Author(s): Michael Liou

This research evaluates soil phosphorus dynamics across cropping systems in the Wisconsin Integrated Cropping Systems Trial, an experiment in it's 33rd year established to compare agricultural management impacts on productivity and soil health. Phosphorous is the key nutrient contributor to eutrophication in Wisconsin Lakes (via agricultural runoff) and is thus a valuable metric for agricultural soil analyses. Focusing on corn producing systems, we analyzed soil phosphorus using composite samples from each replicated plot. Following initial visualization of data in R, a weighted least squares regression fitted by block was applied. An ANOVA on this model revealed a highly significant effect of cropping system on soil phosphorus (p-value <0.0001). Systems incorporating organic rotations exhibited higher average phosphorus levels, particularly Cropping Systems 3 and 5.

METABOLIC DISPLAY IN *CASSIOPEA XAMACHANA* BASED ON TIME OF DIURNAL CYCLING AND PHENOTYPIC PARAMETERS

Noelle Hurst, Emma Ely
Mentor(s): Olaf Jenson

Cassiopea xamachana rely on energy acquisition in multiple forms, including a symbiotic relationship with photosynthetic zooxanthellae which provide them with the majority of their energy needs. To better understand this process, we observed *C. xamachana*'s shift in contraction rate based on varied light levels and determined any correlation between contraction frequency and diameter, color, and the characteristic of their appendages. At the Keys Marine Lab in Layton, Florida, we collected 20 jellyfish from the bay. Over 48 hours, we recorded their contraction rate at equally spaced intervals, covering all light levels. Results indicated that diameter is the largest predictor of percent variance in contraction rate throughout a 24-hour period and may have the most significant effect on physical displays of metabolism.

EVALUATING STUDENTS' CRITICAL THINKING THROUGH ANALYTICAL ESSAY WRITING IN THE AGE OF GENERATIVE AI

CJ Huynh
Mentor(s): Morton Ann Gernsbacher

Concerns about students' ability to critically evaluate information, question assumptions, and recognize biases have increased since the widespread availability of generative AI (genAI) programs. This study examines whether students enrolled in a Research Methods course designed to enhance critical thinking demonstrate differences in writing analytical essays with the availability of genAI. Using a pre-post design (N=706), students wrote essays before and after course completion; results include essays from pre-genAI period (2017-2019) and genAI-available period (2022-2025). Essays were scored anonymously for thesis quality, supporting reasons, conclusion quality, and introductory hook. Scores were analyzed using a 2x2 repeated-measures ANOVA examining genAI-availability and time of course. This study explores how genAI-availability impacts analytical writing when courses incorporate structured essays, distributed practice, peer feedback, and instructions on evaluating evidence.

REACTION PATHWAYS AND MULTI-PARAMETER STABILITY LIMITS OF GRAPHENE-TO-DIAMANE CHEMICALLY INDUCED PHASE TRANSFORMATION

Ahmed Ibrahim
Mentor(s): Robert Jacobberger, You Jin Koo

Diamane is a promising 2D diamond analogue predicted to retain the exceptional mechanical, thermal, and chemical robustness of bulk diamond, while additionally exhibiting tunable electronic structure, enhanced charge transport, optical emission, and mechanical flexibility. However, scalable diamane synthesis remains limited by an incomplete understanding of the synthesis process. In this work, we use molecular dynamics simulations to investigate the transformation of few-layer graphene to few-layer diamane, mapping a theoretical stability landscape of temperature and surface functionalization. We demonstrate that increasing temperature accelerates Chemically Induced Phase Transition (ChIPT) kinetics, provided the system remains below a threshold temperature. For fully formed F-diamane, we identify a higher thermal limit where fluorine desorption occurs, signaling functionalization breakdown. Comparatively, hydrogenation of bilayer graphene yielded less surface passivation than fluorination.

AN IN VITRO INVESTIGATION OF RNA BINDING AND LIQUID-LIQUID PHASE SEPARATION OF *C. ELEGANS* PROCESSING BODY PROTEIN CAR-1

Devyn Iglesias-Fuller
Mentor(s): Andrea Putnam, Joseph Larson

LSM14B is a vital protein for the function of processing bodies (PBs), membraneless organelles important for embryonic development. However, previous research has been centered on in vivo work, meaning there is limited understanding of LSM14B's mechanistic role in PB formation. PBs form by recruiting translationally repressed mRNAs, but how LSM14B selects and binds specific RNAs to form PBs is still unknown. In this project, I will use CAR-1, the *C. elegans* homologue of LSM14B, to investigate how LSM14B binds RNA. The RNA affinity of CAR-1 will be investigated through filter-binding assays, in which RNA-binding can be measured to determine how well CAR-1 binds RNAs. Studying the RNA-binding properties of CAR-1 will allow for a better grasp of the mechanisms behind PB formation and regulation.

REFLECTING ON LEARNING QUALITATIVE RESEARCH IN A QUANTITATIVE SPACE

Olivia Imberger
Mentor(s): Zachary Stowe

The typical STEM student is mainly exposed to a quantitative curriculum as well as quantitative research methodology. However, very scarcely are these students exposed to qualitative research methodology. Students must look outside the standard curriculum toward research labs on campus for experience involving qualitative methods. Qualitative research is characterized by behaviors, values, and emotions related to an individual's lived experience. Methods highlight the multiplicity of experience, making the participant in control. This methodology mitigates research bias that some quantitative methods do not. It is vital for students interested in healthcare to get exposure to these methods. Appreciation of participants' lived experience is valuable for aspiring healthcare professionals.

COMPARATIVE ANALYSIS OF STROKE LATERALITY ON SEMANTIC VERBAL FLUENCY IN INDIVIDUALS WITH APHASIA

Anthony Imbert
Mentor(s): Haley Dresang, Hayley Olsen
Additional Author(s): Izadora Wright, Bhanu Harikumar

Stroke laterality may differentially impact lexical–semantic retrieval in aphasia, yet effects on semantic verbal fluency (SVF) remain under-defined. This study compares left-hemisphere (LH) versus right-hemisphere (RH) stroke groups on a semantic verbal fluency assessment. 47 adult participants with acute post-stroke aphasia from UW Health University Hospital. Our primary outcome was contingent total correct animal names. Secondary outcomes were contingent on perseverations, intrusions, and incidences in clustering/switching. Clinical measures: Western Aphasia Battery–Bedside (WAB); lesion laterality verified on structural imaging. We hypothesize lower SVF output and altered clustering in LH relative to RH stroke. Findings are intended to refine models of laterality-specific language impairment and inform individualized rehabilitation targets.

INTEGRATING POSITIVE PSYCHOLOGY INTO NURSING PRACTICE: ENHANCING PATIENT CARE OUTCOMES

Sydnie Ingold
Mentor(s): Garrett Huck

The present study investigated the effects of positive psychology interventions on nursing practices. Patients may find themselves at risk of happiness deficiency due to the psychological and physical challenges posed by their specific health condition. Previous data have looked at specific diagnoses and how positive psychology interventions can increase human flourishing. Contrary to previous research, my research findings have concluded that the application of positive psychology interventions does increase patient care outcomes and increase their overall flourishing. This presentation will offer a review of current literature focusing on positive psychology-based interventions that have been applied in nursing practice to encourage patient recovery and well-being. Recommendations for nursing and future directions will be discussed.

CHERENKOV LIGHT DETECTOR FOR THE UW NUCLEAR REACTOR

William Irving, Stacy Zhao, RJ Schoepke, Luke Jambois, Nathan Lamers, Gregory Noll
Mentor(s): Charles A. Hirst

At the UWNR (University of Wisconsin Nuclear Reactor), we propose installing a light detector to measure Cherenkov light emissions. This detector would measure the light's intensity, which relates to the amount of energy being generated at a certain moment. We will accomplish this by installing a Silicon PIN Photodiode in a PVC pipe submerged in the reactor pool and wiring it to an Arduino breadboard connected to a processing unit. This process should allow for accurate reading of the light coming off of the reactor as it is operating, which then correlates with the output of energy that the UWNR is producing.

TOWARD EVIDENCE-BASED ADVOCACY: A NATIONAL ASSESSMENT OF QUEER MUSLIM COMMUNITIES

Reem Itani
Mentor(s): K.D. Thompson

Because of intersecting identities, Queer Muslims face layered oppression, including isolation, imprisonment, even death. Despite growing LGBTQ+ advocacy, they remain marginalized and without hope for a future in which they can fully embrace themselves. Leaders in both Queer and Muslim communities often refuse to engage with Queer Muslims. Additionally, homophobia and islamophobia delay efforts to understand and address their struggles. Dr. K.D Thompson at UW-Madison has previously reported on Queer Muslims within research on progressive Islam, but more focused research is needed to inform advocacy and programming. This project will conduct a national assessment of Queer Muslim needs and organize a conference in partnership with The Ayah Project, a Queer Muslim nonprofit, to promote dialogue, scholarship, and engagement with Queer Muslim rights and wellbeing.

APPLICATIONS OF FAST SCANNING CALORIMETRY IN NUCLEAR MATERIALS CHARACTERIZATION

Alexander Ivey
Mentor(s): Charles Hirst

Nanoscale imperfections (defects) influence the macroscopic behavior of materials. Spatial imaging techniques like Transmission Electron Microscopy (TEM) fail to resolve defects below approximately 1000 atoms, leading to underestimates of the total defect density. This is especially significant for nuclear materials, because irradiation generates additional defects. Fast Scanning Calorimetry (FSC) offers an alternative to spatial imaging techniques capable of detecting the full defect spectrum by measuring defects through their excess stored energy. Previous experiments have measured the stored energy release of irradiated samples, but most were conducted at sub-ambient temperatures. In this experiment, I have designed a high-vacuum chamber to enable FSC measurements under controlled conditions. I also calculated thermal equilibrium vacancy concentrations to provide calibration benchmarks for interpreting stored-energy release measurements in irradiated materials.

DIY DENTISTRY ON TIKTOK

Shakti Iyer
Mentor(s): Chelsea Olson, Megan Moreno

Introduction: Social media drives demand for aesthetic dental procedures. However, the quality of Do-It-Yourself, "DIY dental hacks" on TikTok is unknown. This study aims to evaluate the quality of TikTok videos discussing DIY dental trends and examine whether social media interaction correlates with quality.

Methods: A content analysis will be conducted on the top 25 TikTok videos posted between 2023 and 2025 for each hashtag: #DIYteeth, #teethhacks, #athomedental, and #toothfiling. Videos will be categorized by view count and assessed for source accuracy and quality of information regarding treatment. The DISCERN instrument will be used to evaluate each TikTok video.

Findings: Findings can highlight how DIY dental content appears on TikTok and inform interventions to protect youth from harmful DIY dental practices promoted on social media.

THE EVER EVOLVING WORLD OF NIL

Aria Jackson
Mentor(s): David Bell, Emily Srygler

I plan to present a slideshow on the current state of how NIL has impacted the world of athletics. In the last 5-6 years, there have been major changes to a conversation that has been ongoing for decades. The conversation of whether athletes should be paid in addition to their education they receive throughout their time at a university. There is currently a lack of information regarding what financial incentives motivate athletes to participate in these NIL deals. This concept is currently being explored in the Wisconsin Injury and Sport Lab that is led by Dr. David Bell. The lab is in the development phase of a survey that can assess how financial incentives contribute to stress in youth athletes.

ESTABLISHING VOCAL FOLD SWABBING AS A MICROBIOME SAMPLING TECHNIQUE

Katelyn Jacobs
Mentor(s): Susan Thibeault
Additional Author(s): Anumitha Venkatraman, Ruth Davis

Rationale: Voice disorders, such as benign vocal fold lesions (BVFL), affect 12% of the population, with devastating effects on the ability to communicate and quality of life. Current laryngeal microbiome sampling, to assess microbial dysbiosis involves tissue biopsy, which is impractical and cumbersome. Laryngeal swabbing is a practical alternative but remains unvalidated.

Aim: To establish feasibility of swabs as a laryngeal microbiome sampling technique in BVFL, via comparison with an established technique (biopsies).

Methods: Surface swabs, biopsies from BVFL (N=5) were collected in the operating room. 16SrRNA sequencing assessed laryngeal microbiome composition structure and function.

Results: Laryngeal microbiome composition obtained via swabs, biopsies showed equivalent measures of microbial diversity and abundance of bacterial taxa, confirming viability.

Conclusion: Laryngeal swabs are a feasible microbiome sampling technique, facilitating microbiome informed voice disorder management.

METHYLATION-GUIDED FRAGMENT SELECTION ENHANCES TUMOR SIGNAL AND DETECTION OF COPY NUMBER ABERRATIONS IN NANOPORE CFDNA SEQUENCING

Samanyu Jadhav
Mentor(s): Muhammed Murtaza
Additional Author(s): Bradon McDonald

Plasma cfDNA contains tumor-enriched subpopulations defined by methylation state and fragment size. Using nanopore sequencing data from healthy and lung adenocarcinoma samples, we performed fragment-level methylation calling and size stratification to select hypomethylated (<60% CpG), short (< 151 bp), intersection, and union subsets. Using ichorCNA for tumor fraction estimation, hypomethylated fragments increased inferred tumor fraction by 1.70× ($p = 0.043$) and fragments meeting both criteria by 1.94× ($p = 0.0097$). Combining these subsets yielded a 1.63× increase ($p = 0.0207$), with no false positives in healthy controls. These subsets also improved CNA contrast relative to unfiltered cfDNA. Our results support methylation-guided fragment selection as a complementary strategy to size-based enrichment for improving tumor signal in cfDNA nanopore sequencing.

LARGE-SCALE BIOPROSPECTING OF FATTY ACYL REDUCTASE FOR ENHANCED FATTY ALCOHOL BIOSYNTHESIS: ACTIVITY VALIDATION OF IDENTIFIED HOMOLOGS

Evan Jefferson
Mentor(s): Minseo Jung

Among bio-based products, the broad industrial applications of fatty alcohols make them highly attractive. Accordingly, microbial fermentation-based fatty alcohol production has gained increasing attention as a sustainable alternative production platform. The activity of fatty acyl reductase (FAR) provides one major obstacle in industrial-scale fatty alcohol production, yet no large-scale bioprospecting of FARs has been conducted because no high-throughput assay for FAR activity screening exists. Previous bioprospecting screened activity of 591 homologs and identified 20 promising homologs. This work seeks to validate the in vivo activity of these promising homologs by expressing them in an engineered *Escherichia coli* whose growth is coupled to fatty alcohol production under anaerobic conditions. This study will provide foundational FAR homologs for future research expanding high-activity homolog repertoire.

DIGITAL SEXUAL HEALTH INTERVENTION AMONG ADOLESCENTS AND YOUNG ADULTS: A REVIEW OF LITERATURE

Josephine Rose Jennings
Mentor(s): Weiqi Chen

Adolescents and young adults face challenges in accessing comprehensive sexual health education; digital health interventions may be effective in addressing these barriers in these populations. This review summarized digitally delivered sexual health educations and their efficacies among adolescents and young adults. A literature search was conducted using CINAHL, PsycINFO, and PubMed. Fifteen studies that were conducted in the United States, performed a digital sexual health intervention, and involved participants aged 13–25 were included. Interventions included high school and college-aged participants and involved web-based modules or interactive websites. Overall, findings showed that digital sexual health interventions had generally positive outcomes, although some results were not statistically significant. With further development and evaluation, digital interventions show promise for delivering adolescent sexual health education.

WEAVING THE INDIE WEB: NEOCITIES AND PERSONAL WEBSITES AS SOCIAL MEDIA

Forrest Jensen
Mentor(s): Jason Nolen, Alex Hanna

Neocities is a successor to "Geocities" and an increasingly popular supplement and occasional replacement for mainstream social media platforms, allowing users to create and host static websites for free. The site has seen a spike in usage within this decade, but there is a lack of research on the platform. Using data collected from interviews with Neocities users, text posts from user sites, and ethnographic observation, I analyze how and why users engage with Neocities. Through my analysis, users seem to choose Neocities to avoid corporate oversight and regulation, be a part of a satisfying community, and express themselves in ways mainstream social media disallows. Still, users expressed problems with Neocities, including a lack of engagement and addictive elements.

LEARNING IN THE CONTEXT OF SOCIAL MEDIA DISTRACTION

Kaitlin Jensen
Mentor(s): Shawn Green, Ezgi Yuksel

Contemporary learning environments increasingly include background speech from digital media that uses heightened vocal expressiveness (e.g., "TikTok-style"). There are a number of possible reasons creators may use such speech patterns including social signaling and, the focus of this study, to capture their audiences' attention. Specifically, the present study examined whether TikTok-style expressive speech (vs. monotone speech) automatically captures attention by measuring its impact on a concurrent reading comprehension task t. Approximately 60 undergraduates (ages 18-25) completed a computer-based reading task while exposed to background distractor speech with either highly expressive or monotone prosody, with identical linguistic content across conditions. Participants then completed comprehension questions, distractor memory tests, and media multitasking questionnaires. We hypothesized that expressive prosody would reduce comprehension while increasing incidental distractor memory.

BRAIN STRUCTURAL OUTCOMES OF MINDFULNESS TRAINING IN ASTHMA

Monika Jeraj
Mentor(s): Melissa Rosenkranz, Danielle Carrol
Additional Author(s): Doug Dean III, Robin Goldman, Richard Davidson

Chronic inflammation, including asthma, is highly prevalent and associated with brain structural changes, psychiatric conditions, and cognitive decline. Mindfulness-based interventions have shown positive impacts on mental and physical health, brain structure and function, and chronic inflammation. Our study utilizes self-report questionnaires and advanced diffusion-weighted imaging (DWI) models to assess impacts of Mindfulness-Based Stress Reduction (MBSR) on brain structural and psychological self-report outcomes in people with asthma. Results indicate an unexpected direction of change in DWI metrics from pre- to post-MBSR training, with simultaneous improvements in self-reported well-being. We further aim to assay plasma biomarkers of neuroinflammation and myelin damage in relation to the DWI metrics. Elucidating mechanisms underlying brain structural impacts of mindfulness in populations with chronic inflammation has potential for substantial public health impact.

TRAINING SMARTER, NOT LONGER: COMPARING ADAPTIVE TRAINING APPROACHES IN ROBOTIC-ASSISTED SURGERY EDUCATION

Harvey Ji
Mentor(s): Jackie Cha, Matthew Ball

Training for robotic-assisted surgery (RAS) requires substantial time and individualized instruction. With static curricular, skill acquisition and retention vary among trainees, particularly under high or low cognitive workload. This highlights the need for adaptive approaches that maintain optimal challenge levels. This study compares three training strategies: a fixed training curriculum, personalized task assignment, and a condensed schedule. We examine how each approach influences cognitive workload, performance, and learning progression. Participants completed four sessions of simulated RAS tasks while brains and eye activity were recorded to measure workload. We hypothesize that participants will demonstrate progressive performance improvement and reduced cognitive workload across sessions. Findings may inform adaptive training designs that better support individualized skill development in surgical education.

HACKED ON THE TABLE: COGNITIVE AND COMMUNICATION RESPONSES TO SIMULATED CYBERATTACKS IN SURGERY

Bohan Jia, Seba Al Tawfiq
Mentor(s): Jackie Cha, Matthew Ball
Additional Author(s): Harvey Ji

Cyberattacks on hospital systems are increasingly common, yet little is known about how surgical teams respond when an attack disrupts a surgical procedure. This study examines how simulated cyberattacks, introduced as visual errors such as delays and screen perturbations, affect performance, team communication, and cognitive workload during structured tasks on a laparoscopic surgery training simulator. Participants work with a scripted teammate while a simulated cyberattack type and the helpfulness of the teammate (e.g., cautious or rude) were manipulated. Time to attack recognition, communication behaviors, and brain- and eye-activity tracking-derived workload indices are measured. Findings may inform the development of training protocols and detection algorithms that prepare surgical teams to recognize and respond to cybersecurity threats in technology-dependent operating environments.

PROJECTIONS OF SETS WITH OPTIMAL ORACLES ONTO K-PLANES

Oliver Jing
Mentor(s): Jacob B. Fiedler

Based on work of Fiedler, we study effective dimension on the Grassmannian and affine Grassmannian using tools from Kolmogorov complexity. We develop an algorithmic-information-theoretic "coordinate" characterization of k-planes and extend several key algorithmic and geometric lemmas from points in R^n to k-planes and affine k-planes. Building on projection results of Lutz and Stull, we are developing an algorithmic analogue of Marstrand-type projection theorems for k-planes, together with a matching exceptional-set estimate for projections of sets equipped with optimal oracles.

MEW+FDM POLYMER FIBER REINFORCED ENVELOPES FOR HYDROGEL-BASED MICROVASCULAR APPENDAGE SHEETS

Grant Joe
Mentor(s): David Dean, Joshua Alexander
Additional Author(s): Jillian Philippo, Lauren Nguyen, Javier Vazquez-Armendariz

Melt Electrowriting (MEW), a novel 3D-printing method, is able to weave polymer fibers with diameters ranging between 200 nanometers and 150 microns. We are studying the use of MEW textiles to house hydrogel-based microvasculature scaffolds. These polycaprolactone (PCL) fiber scaffolds are intended to be used along with bone tissue engineering grafts. MEW fibers are not strong enough to hold these constructs to a fixed location by sutures. In order to strengthen these MEW textiles, we are adding thicker PCL fibers to the textile that are produced via a fused deposition modeling (FDM) print head. We are testing different MEW + FDM woven fiber patterns to see if one will be sufficiently strong. This research aims to improve the clinical usability of microvascular appendage sheets (MAS), by optimizing the PCL MEW+FDM-reinforced envelope, in order to provide sufficient suture retention strength.

METHODS FOR QUANTIFYING C-FOS- AND IBA1-POSITIVE CELLS IN BRAIN REGIONS ASSOCIATED WITH SPATIAL MEMORY IN MICE MODELS OF DELIRIUM

Edie Joh
Mentor(s): Cody Wenthur
Additional Author(s): Noelle Cataldo

Delirium is a highly prevalent form of cognitive impairment with limited treatment options due to its poorly understood pathophysiology. To better understand how cognitive impairment affects memory, we used the transgenic TRAP2;Ai14 mouse model which allowed us to immunofluorescently label engram cells active during memory encoding/recall in behavioral tasks. Within this model, we administered lipopolysachharide (LPS) to induce neuroinflammation and stimulate the temporary cognitive defects associated with delirium. We hypothesized that LPS-induced neuroinflammation would result in impaired spatial memory, impaired engram reactivity in spatial-related regions and increased microglial activity. To assess LPS affects on cellular activity and microglial morphology, we developed a novel image analysis pipeline in Fiji to quantify c-Fos and Iba1-positive cells and thus help highlight targetable cellular states associated with memory impairment.

SUPPORTING DEMENTIA CARE PARTNERS: EDUCATIONAL GAPS IDENTIFIED THROUGH A HOSPITAL ASSESSMENT TOOL

Emma Johnson
Mentor(s): Beth Fields

Introduction: Dementia care partners (CPs) often feel unprepared during and after hospitalization. To address this gap, the Dementia Care Partner Hospital Assessment Tool (DCHAT) was designed to help equip CPs for the demands of caregiving.

Objective: Describe CPs' responses to the DCHAT education section.

Methods: This secondary data analysis used data from a randomized clinical trial; ten educational categories were summarized descriptively in Excel.

Results: Among 34 CPs, requested education centered on dementia care strategies (76.5%), community-based services (41.2%), and medical devices/nursing tasks (41.2%). Within dementia care strategies, CPs most often requested communication tips, behavior or sleep management, and disease progression information.

Conclusion: Hospitals can use findings to train clinicians on the education CPs most often need—and should use interprofessional teams to deliver it.

PEATLANDS OF OUR PAST AND PRESENT

Holly Johnson
Mentor(s): Mary Ann Feist
Additional Author(s): Brandon Corder

I am investigating how the composition and distribution of *Sphagnum* moss in Wisconsin has shifted over the past century. This project builds on the historical collections of L. S. Cheney, a 19th-century UW–Madison botanist whose specimens make up over 40% of the *Sphagnum* records at the Wisconsin State Herbarium. Over the past year, I've worked to digitize and restore these fragile, long-overlooked specimens. Now, I am resurveying the sites that Cheney originally collected from to compare past and present *Sphagnum* diversity. As an ecosystem engineer and carbon sink, *Sphagnum* plays a critical role in our wetlands. This project reveals how a century of wetland loss and climate change has impacted *Sphagnum* in Wisconsin, and how it may help us understand broader environmental change.

DOSE-DEPENDENT EFFECTS OF *JUNONIA COENIA* DENSOVIRUS ON *LYMANTRIA DISPAR* LARVAL PERFORMANCE

Len Johnson
Mentor(s): Helen Oker, Amy Trowbridge

Insect outbreaks pose increasing ecological and economic threats expected to worsen under climate change. Invasive insect outbreaks are particularly difficult to predict because populations are shaped by unknown interactions and unpredictable environmental stressors (e.g., pathogens). This study quantified the dose-dependent effects of *Junonia coenia* densovirus (JcDNV), a naturally-occurring insect virus, on spongy moths (*Lymantria dispar*), a significant invasive defoliator. Spongy moth larvae were infected with a range of viral doses, and then weight, consumption, and frass were measured to calculate growth rates and nutritional indices. Immunocompetence was assessed via phenoloxidase activity, an enzyme involved in insect pathogen defense. Our results show viral infection alters larval performance, highlighting pathogen stress as a factor modulating outbreak dynamics for an invasive forest pest.

THE EFFECT OF EXTERNAL CUES ON CATEGORY LEARNING IN ADULTS

Lily Johnson
Mentor(s): Yi Tong
Additional Author(s): Ezgi Yüksel, C. Shawn Green, and Haley Vlach

External cues can support individuals' ability to categorize information, but the mechanisms behind these benefits remain less understood. To address this, the current study examined how verbal and visual cues impact rule-based categorization. Adults (N = 150) were assigned to learn four groups of novel objects, each defined by one rule, in one of three conditions: verbal cues (audio instructions with a novel label; e.g., "Look at the wug"), visual cues (the defining features were circled), or control (no cues). Participants' memory and generalization of the rules were assessed immediately and 24 hours later. Visual cues were the most effective in teaching categories. These findings have implications for identifying effective strategies for category learning.

SUPERWOMAN, BUT AT WHAT COST?: THE SYSTEMIC TOLL THE SUPERWOMAN SCHEMA HAS ON BLACK WOMEN THROUGH HEALTH AND ILLNESS NARRATIVES

Madison A. Johnson
Mentor(s): Susan Passmore

This qualitative study explores how the Superwoman Schema (SWS) shapes the lived experiences of Black women managing chronic illnesses. Participants (n=10) were recruited through snowball sampling and community-based outreach through flyer postings. Using semi-structured interviews, the project examines how SWS domains—obligation to present strength, suppression of emotions, resistance to vulnerability, intense caregiving, and determination to succeed despite limited resources—influence lived experiences including health behaviors, professional identities, coping, and interactions with the healthcare system. Thematic deductive analysis is used to identify patterns related to stress, identity, and the emotional and physical consequences of maintaining the Superwoman role. Findings aim to deepen the understanding of how sociocultural expectations intersect with illnesses, supporting more culturally responsive, strengths-based, and equitable nursing care.

HEART RATE VARIABILITY AS A MARKER OF AUTONOMIC DYSFUNCTION IN POSTOPERATIVE ICU DELIRIUM

Ashley Jones
Mentor(s): Richard Lennertz, Mika Hess

Postoperative delirium in ICU patients may reflect autonomic dysregulation. Heart rate variability (HRV) provides a noninvasive measure of sympathetic–parasympathetic balance but requires rigorous artifact correction to ensure reliable analysis. Cardiac components extracted from electroencephalography (EEG) recordings were used to identify R peaks for HRV analysis. Five-minute segments of eyes-closed resting data from post-surgical ICU patients were processed using automated R-peak detection followed by physiologic thresholding and manual review to remove missed and erroneous beats. Cleaned RR interval series were used to compute time-domain HRV metrics, including SDNN and RMSSD. Signal quality was verified through visual inspection of RR interval patterns following artifact correction. These HRV metrics will be used to examine associations with peak Delirium Rating Scale (DRS) scores in postoperative ICU patients.

FROM LIFESTYLE CHANGES TO MEDICATIONS: PREDICTED ATTITUDES AND USE OF WEIGHT LOSS DRUGS AMONG OLDER ADULTS

Anushka Joshi
Mentor(s): Julie Ober Allen

The rising use of prescription obesity medication spotlights the need to understand the characteristics of older adults who have used or support prescription weight loss drugs. We analyzed previous weight loss activities that predicted usage and support for health insurance coverage of weight loss drugs among a 2023 nationally representative sample of adults 50-80 (N=2658). Of overweight adults, 63% were interested in taking prescription medication for weight management, and 92% had engaged in non-prescription weight loss strategies (physical activity, dietary change, over-the-counter supplements, working with a dietitian, personal trainer, or bariatric surgery). The dietary change group was most likely to have used or supported coverage for weight loss drugs, followed by those who had bariatric surgery or took supplements to lose weight.

SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRI) USE DURING PREGNANCY AND POSTPARTUM: IMPACTS ON LACTATION OUTCOMES

Emma Judd
Mentor(s): Katelyn Desorcy-Scherer

Selective serotonin reuptake inhibitors (SSRIs) are a class of medications used to treat mood disorders, including during perinatal and postpartum periods. Despite common use, whether taking an SSRI influences human milk feeding outcomes is unclear. We systematically searched a synthesis of sources that suggest SSRIs can interfere with milk production, increase risk of adverse perinatal outcomes, and reduce rates of breastfeeding initiation and duration. These findings highlight barriers to SSRI treatment and health promotion in perinatal populations. Our findings highlight a need for further research to better understand how to support mothers and families in management of mood symptoms during pregnancy and lactation.

THE PRESENCE OF HOST RECEPTOR REDUNDANT TO NEONATAL FC RECEPTOR (FCRN) FOR MOUSE ARTERIVIRUS ENTRY

Isaac Jung
Mentor(s): Adam Bailey
Additional Author(s): Teressa Shaw, Mason Roth

Arteriviruses are enveloped, +ssRNA viruses that infect a range of mammalian hosts, but their host cell entry mechanism remains incompletely understood. Previous studies on well-characterized arteriviruses have identified CD163/CD81 and FcRn as key receptors mediating arterivirus entry. However, research on Lactate Dehydrogenase-elevating Virus (LDV), a mouse arterivirus, has been limited due to the late development of its in vitro culture system. This study demonstrates that FcRn is also crucial for LDV entry and provides evidence for the presence of a receptor functionally redundant with FcRn. A mouse surfaceome CRISPR-knockout screen identified Coxsackievirus and Adenovirus Receptor (CXADR)-like Membrane Protein (CLMP) as a strong candidate. Although validation of CLMP's role is ongoing, these findings suggest the existence of a novel host receptor involved in arterivirus entry.

NEUTROPHIL PHAGOCYTOSIS OF *CANDIDA AURIS* INVOLVES SIGNALING THROUGH TLR4

Arianna Kaas
Mentor(s): Ashley Holt
Additional Author(s): Chad Johnson, Robert Zarnowski, Jeniel Nett

Pathogenic fungus *Candida auris* has emerged as a global health threat, characterized by its resistance to all antifungal classes and rapid spread in healthcare settings. Compared to *Candida albicans*, *C. auris* shows decreased recruitment and internalization by neutrophils. In *C. albicans*, neutrophil Toll-like receptor 4 (TLR4) is thought to bind O-linked mannosyl chains in the cell wall; however, *C. auris* displays altered mannan structures. We found that the engulfment of *C. auris* increased surface localization of TLR4 on primary human neutrophils. Inhibiting TLR4 with small-molecule drug TAK-242 reduced phagocytosis of both wildtype *C. auris* and an mnt1Δ/mnt2Δ mutant predicted to contain shortened O-mannans. This contrasts with previous findings in *C. albicans* and suggests potential differences in the O-mannosylation or TLR4 recognition of *C. auris*.

HUMAN STEM CELL MODELS REVEAL ALTERED DEVELOPMENTAL TIMING OF NEURAL PROGENITORS IN TRISOMY 21

Radha Kademani
Mentor(s): Anita Bhattacharyya
Additional Author(s): Jennifer Piciw, Oskar Westin

Down syndrome (DS) is a common genetic condition characterized by intellectual impairment. The number of neurons in the DS brain is altered, but the cellular mechanisms remain unclear. We hypothesize that trisomy 21 progenitor cells exhibit accelerated cell cycle progression and early exit into neurons, skewing the progenitor-to-neuron ratio. To test our hypothesis, we used immunofluorescence to image euploid and trisomy cells for markers of early neurons (DCX) and dividing progenitors (PCNA) across early (Days 4–14) and late (Days 60–90) developmental windows. Using a combination of ImageJ and CellProfiler software, we tracked cell cycle progression and exit, measuring differences between euploid and trisomy 21 neural progenitor cells across stages. Our results suggest that trisomy 21 impacts neural progenitor dynamics differently across development.

ENGINEERING CHROMATIN READER-TN5 FUSION PROTEINS TO IMPROVE EPIGENETIC PROFILING IN MUSCLE STEM CELLS

Aneena Fran Kalarithara
Mentor(s): F. Jeffrey Dilworth, Adity Gupta

Skeletal muscle regeneration relies on muscle stem cells (MuSCs), which transition from quiescence to activation following injury. This process is regulated by epigenetic mechanisms that control chromatin accessibility and gene expression. Histone modifications such as H3K27me3 (repressive) and H3K4me3 (activating) help maintain genes in a poised state. Chromatin profiling techniques such as CUT&Tag allow genome-wide mapping of these regulatory states but rely on antibody-mediated targeting, which can reduce reproducibility. I hypothesize that chromatin reader-Tn5 fusion proteins can directly recognize specific chromatin features without antibodies, enabling more consistent chromatin profiling. To test this, I will engineer and validate reader-Tn5 constructs targeting repressive, activating, DNA methylation, and bivalent chromatin states to improve chromatin mapping and provide better tools to study epigenetic regulation during muscle regeneration.

A STUDY OF THE COLD GAS PROPERTIES OF SMALL MAGELLANIC CLOUD USING THE GASKAP-HI SURVEY

Dhruva Kalyani
Mentor(s): Hongxing Chen, Snežana Stanimirović

Cold neutral hydrogen (HI) and warm neutral hydrogen are the two stable phases of HI that can be found. Via HI absorption and HI emission, we can study the subsequent molecular gas formation, and we can find the integrated properties of the spectrum. In this study, we use the absorption and emission data of the Small Magellanic Cloud from the Galactic-ASKAP HI (GASKAP-HI) Survey conducted by the Australian Square Kilometer Array Pathfinder (ASKAP). Using the radiative transfer method by Gaussian decomposition developed by Hongxing Chen, we split the absorption and emission spectra into individual warm and cold neutral medium components to analyze. Our preliminary results reveal key characteristics of the SMC, and future work aims to compare our results with the Milky Way and LMC.

EFFECT OF APPENDECTOMY ON GUT MICROBIOME COMPOSITION AND COGNITION IN AGING ADULTS ENRICHED FOR DEMENTIA RISK

Naureen Kamal
Mentor(s): Darby Peter, Barbara Bendlin

Alzheimer's disease (AD) is a major neurodegenerative disorder. Prior work has identified broad-scale gut microbiome alterations in individuals with AD, but the effect of appendectomy on the gut microbiome needs further characterization. This study aims to elucidate this relationship through characterization of gut microbial communities and cognitive function in individuals with and without history of appendectomy. 16S rRNA sequencing is used to characterize microbial diversity and composition of fecal samples collected through the Microbiome and Alzheimer's Risk Study. Linear regression (R) and differential abundance analysis will be used to test associations between appendectomy and microbial diversity and composition, and cognitive function.. This research will help characterize the relationship between the appendix and gut microbial composition while improving overall understanding of the gut-brain axis in AD.

INVESTIGATION INTO THE ROLE OF PHOTORESPIRATION AND AMINO ACID METABOLISM DEFECTS ON TOR ACTIVITY IN *ARABIDOPSIS THALIANA*

Jeremiah Kannel
Mentor(s): Jacob Brunkard, Katie Klimpel

Target of Rapamycin (TOR) is a protein kinase that is conserved through eukaryotes and senses amino acids for growth and development. The TOR pathway is understood well in mammals, although less understood in plants. The Fd-GOGAT1 gene is responsible for glutamate formation and carbon recovery from photorespiration. A mutation to this gene impacts leaf shape, rosette size, and causes chlorosis despite hyperactive TOR activity. The phenotypes observed in this mutant can be partially rescued with increased CO2 conditions. Fd-GOGAT1 and other mutants in the photorespiration pathway will be treated with different CO2 conditions to determine which parts of the pathway are related to amino acids recovery or photorespiratory processes. Through this process, we will better be able to understand how TOR is directing plant metabolism.

INVESTIGATING VENUS'S MYSTERIOUS UV ABSORBERS: TEMPORAL CHANGES IN CLOUD-TOP TEMPERATURE AND UV BRIGHTNESS FROM AKATSUKI

Owusu Kantankah, Bashier Salih
Mentor(s): Sanjay Limaye

Unlike Earth, Venus's thick cloud cover absorbs most incoming solar energy, yet the species causing the planet's dark ultraviolet darkening remains a key mystery in planetary science. Building on Akatsuki's observations, this study quantifies how cloud-top temperature and UV brightness changes over time at 283 and 365 nanometers (nm). We processed the LIR & UVI Level 3b mapped images in Python and applied Minnaert normalization to remove illumination and viewing geometry bias. Then computed the long-term global average brightness, and temperature as a function of latitude and time. From 58 images (46 quality-controlled), 365 nm was consistently higher, and both wavelengths showed substantial temporal variability. These results provide observational constraints and insights on candidate UV absorbers and improve our understanding of Venus's atmospheric circulation.

THE BENEFICIAL EFFECTS OF KETOGENIC DIET TO REDUCE MICE BODY WEIGHT

Buna Karanezi
Mentor(s): Ting Fu, Gavin Shou

As obesity rates continue to rise in the US, ketogenic diets (KDs), characterized as a high fat and low carbohydrate dietary approach, show a promising stradegy for managing obesity. Pilot sata from the Fu Lab indiicate that diets exceeding 85% total caloric intake induce ketogenesis. In this study, two ketogenic diets were investigated—80% KD and 90% KD—and their effects on body weight, blood glucose, and ketone body production in obese mice through a high fat diet (HFD). Three groups were examined: HFD control (n=3), 80% KD (n=4), and 90% (n=4). The 90% KD produced significant weight loss and lower blood glucose (57mg/dL), while the 80% KD showed minimal changes and HFD control gained weight. Long term sustainability remains uncertain.

CHIRAL SEPARATION AND QUANTIFICATION OF METHAMPHETAMINE IN WHOLE BLOOD

Cassidy Kartz
Mentor(s): William Naviax

Impaired driving is a serious roadway safety concern, with stimulant use such as methamphetamine associated with aggressive and reckless driving. Interpretation of methamphetamine toxicology results is complicated since it has two enantiomers: S-(+)- methamphetamine, a controlled substance, and R-(-)- methamphetamine, a nasal decongestant ingredient. Many toxicology laboratories do not differentiate these enantiomers, allowing test interpretations to be put into question. We report a UHPLC-based method for enantiomeric separation and quantification of methamphetamine in whole blood using chiral columns. Multiple column types and mobile phase conditions were evaluated to optimize separation while addressing common challenges such as peak broadening and column pressure limits. Validation demonstrated excellent model fit ($R2 > 0.99$), low detection and quantification limits providing enantiomeric separation of methamphetamine analysis useful for forensic interpretation.

DOLOSIGRANULUM PIGRUM BIOFILM FORMATION IN VIVO

A. Solita Kaster
Mentor(s): Jim Gern, Eishika Dissanayake

Dolosigranulum pigrum is an understudied yet promising nasal probiotic candidate for the prevention and treatment of acute respiratory infections (ARIs). Residing in the human upper respiratory tract (URT) epithelium, this Gram-positive bacterium exhibits unique habits that benefit the host, including interactions with bacterial pathobionts, modulation of inflammatory responses, and biofilm-forming tendencies. This study examines the biofilm development potential of twelve individual *D. pigrum* strains using a crystal violet (CV) staining based assay and compares their biomass production to *Staphylococcus aureus*. Seven strains demonstrated statistically significant differences in biofilm formation (Mann–Whitney, $p<0.05$), indicating strain-dependent variability in adherence capacity. Strains demonstrating enhanced biofilm formation may represent promising nasal probiotic candidates associated with improved colonization, host defense, and maintenance of a balanced URT microbiome.

AFRILUMINA PROJECT INITIATIVE

Ndinda Kasyoka
Mentor(s): Jesse Hampton

Youth unemployment and skills mismatches remain major challenges across Africa, especially as technological change widens the digital gap. Research shows that mentorship, early career exposure and skills-based programs can improve confidence and educational outcomes; however, few structured programs bring these elements together for African secondary schools. AfriLumina is a nine-week mentorship and workforce readiness initiative designed to connect secondary education with real career pathways. The pilot began with a cohort of 30 students and concluded with a career fair engaging over 250 students. Pre- and post-program surveys showed increased confidence, greater career clarity and stronger awareness of emerging fields after students interacted with diverse professionals. These findings suggest that integrated mentorship programs can strengthen workforce readiness and offer a scalable model for improving school-to-work transitions.

CLEAN-LABEL CASEIN FERMENTATE CONTROLS *LISTERIA MONOCYTOGENES* IN A HIGH-MOISTURE SOFT CHEESE MODEL

Alanah Kaufmann
Mentor(s): Jae-Hyuk Yu
Additional Author(s): Xingrui Fan, Ashley Chung

Bacterial pathogens pose a significant threat to food safety. While antimicrobials are widely used to extend shelf life, traditional preservatives face growing scrutiny due to concerns over antimicrobial resistance and negative consumer perceptions of synthetic additives. The Yu lab developed food-grade antimicrobials derived from the Generally Recognized As Safe (GRAS) fungus *Aspergillus oryzae* called Natural Preservatives (NPs). Preliminary studies demonstrated NP's antimicrobial activity against *Listeria monocytogenes*, a major pathogen in soft cheeses. This study evaluates NP's efficacy in inhibiting *L. monocytogenes* in a soft cheese model. Additionally, membrane permeability assays will help elucidate NP's potential mode of action against *L. monocytogenes*. These findings will provide critical insights into the application of NPs in the food industry and contribute to developing safe, natural antimicrobial solutions.

LARGE-AREA SYNTHESIS OF HEXAGONAL BORON NITRIDE (HBN) WITH MONOCRYSTALLINITY AND TUNABLE THICKNESS USING CHEMICAL VAPOR DEPOSITION (CVD)

Asma Kazi
Mentor(s): Christopher Barns

Hexagonal boron nitride (hBN) is a leading two-dimensional insulator due to its high thermal and chemical stability, high thermal conductivity, and room-temperature single-photon emission. Its atomically smooth, dangling-bond-free surface with minimal charge disorder enables exceptional dielectric passivation in ultra-high-mobility transistors and devices exploring novel condensed matter physics. However, scalable technologies remain constrained because chemical vapor deposition (CVD) hBN exhibits lower materials quality than mechanically exfoliated hBN. By tailoring catalyst substrates and CVD growth conditions, we demonstrate the synthesis of large-area single-crystal hBN films with tunable thickness. Growth mechanisms on Ge, Cu, and Ni using borazine are investigated. The structural and optical properties of these films are compared with exfoliated flakes, establishing a pathway toward wafer-scale, device-quality hBN with precise thickness control.

EFFECTS OF L-TO-D RESIDUE MODIFICATIONS ON THE ACTIVITY OF THE PTHR1, A TARGET FOR OSTEOPOROSIS TREATMENT

Brian Kee
Mentor(s): Lauren Tran
Additional Author(s): Sam Gellman

The effectiveness of peptide agonist therapeutics–commonly encountered under names like Ozempic or Wegovy–targeting activation of Class B G-protein coupled receptor (GPCR) glucagon-like peptide-1 (GLP-1) have led to increased interest in other receptors within the family as avenues of pharmaceutical research. We sought to further investigate activation in another Class B GPCR, the parathyroid hormone receptor 1 (PTHR1). The PTHR1 is primarily responsible for regulating blood calcium levels and bone assembly; it is a suitable target for treating osteoporosis, consequently. To elucidate structure and activation dynamics of the PTHR1, we produced modified ‘heterochiral’ agonists carrying L-to-D residue substitutions, introducing structural instability. Despite this, heterochiral analogs of parathyroid hormone-related peptide (PTHrP) appeared capable of biased agonism and were also potent–a biological structure function contradiction with motivating results.

MEASURING THE MILKY WAY'S 21-CM HYDROGEN LINE TO TEST SYSTEM TEMPERATURE OF THE UW'S SMALL RADIO TELESCOPE

Erin Kemper
Mentor(s): Snezana Stanimirovic

I observed the Milky Way's 21-cm emission from neutral hydrogen with the 2.3 m UW Small Radio Telescope to test temperature calibration and estimate instrument sensitivity. Measuring the system temperature is important because it sets the noise floor and determines how faint a spectral line we can detect. I observed a position in the disk of the Milky Way with about 15 minutes of integration time. After data processing, the resultant spectrum was compared with data from the published Leiden/Dwingeloo Survey. I find a good agreement in terms of both emission line shape and intensity. This confirms that the Small Radio Telescope is performing well and that its calibration is sound.

IDENTIFYING BEST PRACTICES FOR PEER MENTORSHIP TO INFORM THE DEVELOPMENT OF NEUROPRIDE UW'S SUPPORT PROGRAM FOR NEURODIVERGENT UNIVERSITY STUDENTS

Lauren Kersten
Mentor(s): Jessica Lang
Additional Author(s): Yanghe Christina Gao, Ryan Moreno, Kristin Adams, Zhongmou Jin

High-grade serous ovarian carcinomas (HGSOC) have one of the highest burdens of focal copy number alterations among cancers, reflecting extreme genomic instability that drives tumor progression. To investigate the structural basis of this instability, we previously performed long-read Oxford Nanopore sequencing on HGSOC cell lines to characterize structural variants (SVs) with a PCR success rate of 85.9%. Further analysis of SVs revealed regions of unusually amplified focal coverage. These patterns suggested the presence of extrachromosomal DNA (ecDNA), circular DNA molecules that exist outside of the chromosome. ecDNA has been previously attributed to carrying oncogene amplifications. We are detecting these computationally and experimentally using chromosome spreads. These approaches will allow us to identify ecDNA in HGSOC and better understand its role in driving genomic instability.

PROMOTING SUSTAINABLE CONSUMPTION THROUGH SOCIAL NORMS MESSAGING: AN EXPERIMENTAL TEST

Siena Keys
Mentor(s): Markus Brauer
Additional Author(s): Benjamin D. Douglas

Social norms theory says individuals match their behavior to groups they identify with however, optimal distinctiveness theory suggests individuals will deviate from their group when their sense of uniqueness is threatened. The present study investigated whether insights from social norms theory and optimal distinctiveness theory can be used to encourage people to limit their clothing consumption. Participants completed a task suggesting that they are either quite similar to or rather different from their peers with regard to various consumption habits and were then exposed to information suggesting that either a small percentage or a large percentage of their peers are currently limiting their clothing consumption. The study found that the effectiveness of social norms messages is not affected by an individuals' need for distinctiveness.

OXYGEN-DEPENDENT REGULATION OF CARDIAC METABOLIC PROTEIN EXPRESSION DURING POSTNATAL MATURATION

Nabah Khondaker
Mentor(s): Jingshing Wu, Sarah Lofland

Congenital Heart Disease (CHD) affects approximately 1% of newborns, is the leading cause of congenital disabilities, and is a significant cause of childhood morbidity and mortality. Studies have shown that CHD is multifactorial and influenced by both genetic and environmental factors, yet one critical, understudied environmental factor is oxygen availability. Cardiac metabolic pathways are oxygen-sensitive, and disruptions in oxygen availability may disrupt maturation programs that are essential for normal cardiac development. During normal postnatal maturation, cardiomyocyte metabolism transitions from a primarily glycolytic fetal state to one dominated by fatty acid oxidation. Perturbations in oxygen may disrupt these essential transitions. Chronic hypoxia activates oxygen-sensitive transcriptional regulators and shifts their reliance from fatty acid oxidation to carbohydrate metabolism, and have been shown to affect transcriptional proteins such as NF-κB, activator protein-1, PPARα, and RXRα. Conversely, transcriptomic profiling revealed that neonatal hyperoxia suppresses fatty acid synthesis pathways in the postnatal mouse heart. It remains unclear how oxygen abnormalities regulate protein expression and cardiac metabolism, as few studies have directly compared hypoxic, normoxic, and hyperoxic conditions. Our study aims to examine how oxygen environments regulate metabolic pathways involved in cardiomyocyte maturation. We will use top-down mass spectroscopy on sarcomeric proteins isolated from both ventricular and atrial tissue of mice to quantify proteoforms and modifications under normoxic and hyperoxic oxygen conditions. The results of this study are expected to identify key oxygen-related metabolic proteins that guide postnatal cardiac maturation. Understanding the mechanisms of oxygen-dependent metabolic remodeling is vital for CHD patients who may experience abnormal oxygen exposure either in utero or after birth.

MELT ELECTROWRITING-FABRICATED BIOTEXTILE SCAFFOLDS FOR CORNEAL TISSUE ENGINEERING

Ryaan Khuwaja
Mentor(s): David Dean, Tanya Djemal

Corneal opacity is a leading cause of blindness and is sometimes repaired with limited donor grafts. In order to overcome that shortage Melt Electrowriting (MEW) is a method for weaving polymer fibers, with diameters in the 200 nanometer to 150 micron range. We are creating porous textiles from polycaprolactone (PCL) polymer fiber scaffolds to study the potential use of porcine (pig) corneal stromal fibroblasts (PCSFs) seeded on MEW scaffolds to produce a transparent membrane. If that is possible, this technology could, potentially, be directly translated to humans. I will be culturing corneal fibroblast stem cells harvested from the limbus (edge) of the cornea in porcine eyes.

IMPROVING PARTICLE DETECTION IN A NEXT-GENERATION PARTICLE COLLIDER

Cyrus F Kianian, Moses Glassman
Mentor(s): Abdollah Mohammadi, Sridhara Dasu

This study aims to improve the TauFinder reconstruction algorithm for the MAIA detector concept. Through this work, we seek to increase the reconstruction efficiency and identification of hadronically decaying tau leptons. Here, we introduce a dynamic signal cone, known as a shrinking cone, which adjusts its size based on the transverse momentum of the tau candidate. In addition to the already studied one charged hadron and three charged hadron decay modes we extend TauFinder to include decays that consist of one charged hadron and up to two neutral pions. Furthermore, we have developed a tagger that prevents electrons being misidentified as one-prong tau candidates. Applying this tagger results in near-perfect electron rejection with negligible decrease in one-prong tau reconstruction efficiency.

UTILIZING ETHYLENE INHIBITORS TO ENHANCE SYMBIOSIS IN LUNAR REGOLITH SIMULANT

Cameron Kiger
Mentor(s): Austin VanDenTop

A major spaceflight challenge is providing fresh food to astronauts on increasingly longer missions. A solution to this problem is cultivation using available resources, such as lunar regolith, which is nitrogen-deficient. In this project, we introduced the bacterial symbiont *Sinorhizobium meliloti* to *Medicago truncatula*, allowing it to metabolize nitrogen from the air rather than utilizing chemical fertilizers. Unfortunately, lunar regolith is very dense and induces compaction stress. This results in the production of the stress hormone ethylene, which inhibits normal root growth and symbiotic activity. We previously found that moderate levels of the ethylene inhibitor aminoethoxyvinylglycine (AVG) increased overall *M. truncatula* growth and development. In this project, we are testing various concentrations of the alternative ethylene inhibitor 1-methylcyclopropene for their effect on *M. truncatula* growth.

RISK FACTORS, IMPACTS, AND INTERVENTIONS OF LONG-TERM HOSPITALIZATION IN PEDIATRICS

Meg Kilander
Mentor(s): Garrett Huck

Pediatric long-term hospitalization (LTH), typically defined as hospital stays exceeding 7–10 days, can significantly affect children's developmental, educational, and psychological well-being. Extended hospital stays are associated with increased risks for developmental delays, academic disruption, and social and emotional distress, including anxiety, depression, and behavioral regression. While several interventions have been implemented to support hospitalized children, many focus primarily on inpatient care and overlook the importance of continued support following discharge. This paper examines the consequences of pediatric LTH and evaluates current inpatient interventions (hospital-based education, music therapy, animal-assisted therapy, and child life services) as well as outpatient supports, including family-centered and community-based therapies. Recommendations for improving comprehensive and long-term intervention strategies are also discussed.

EVALUATING DE-ESCALATION PERFORMANCE IN LAW ENFORCEMENT USING AI-DRIVEN VR TRAINING

Abraham Kim
Mentor(s): Aditya Shanghavi, Radiya Firdaus
Additional Author(s): Wenqing Ruan, Wanyi Chen, Aaron Lai, Ranjana Mehta

Virtual reality (VR) is increasingly used to simulate high-risk encounters and evaluate decision-making under pressure. This study examines law enforcement officers (LEO) interacting with AI-driven virtual Persons in Crisis (PIC) within a VR training platform. Thirty-seven participants interacted with 16 virtual PICs, with different conduct (cooperative, non-cooperative) and neurodiversity (neurotypical, neurodivergent) behaviors, and de-escalation performance evaluated using the De-escalating Persons in Crisis Competencies (DePICT) framework. Changes in DePICT scores are analyzed across varying threat levels, behavioral profiles, and repeated trials to assess changes in de-escalation performance and adaptive strategy with continued exposure. By systematically evaluating responses under controlled yet ecologically realistic conditions, this work advances the objective assessment and refinement of VR-based de-escalation training for LEOs responding to PIC situations.

DO OVARIES OF NATURALLY-OCCURRING HIGH TESTOSTERONE FEMALE MONKEYS GROW TOO MANY EGG-CONTAINING FOLLICLES?

Grace Kim, Ella Weber, Lucia Castro, Meadow Leisen, Mohima Aich
Mentor(s): David Abbott

Polycystic ovary syndrome (PCOS) is a prevalent subfertility disorder of reproductive age women in which high testosterone is a key diagnostic criterion. Women with PCOS commonly have more growing ovarian follicles at once than women without PCOS. Female rhesus macaques with naturally occurring high testosterone (HA) exhibit PCOS-like traits. Our study tested the hypothesis that ovaries of HA compared to control monkeys will demonstrate increased numbers of growing ovarian follicles as found in women with PCOS. A total of 46 monkey ovaries were processed, sectioned, and stained prior to digital imaging of three representative sections per ovary. ImageJ was used to count and classify egg-containing follicles. Our findings may identify HA monkeys as biomedical research models for PCOS.

DEVELOPMENT OF A CULTURALLY AND LINGUISTICALLY INFORMED PAIN EXPRESSION LIBRARY AND ASSESSMENT MODULE USING ARTIFICIAL INTELLIGENCE

Suri Kim
Mentor(s): Shinye Kim
Additional Author(s): Jiin Woo

Language barriers in predominantly English-speaking healthcare systems create disparities in how patients communicate pain and receive treatment. This research examines how individuals from diverse racial and ethnic backgrounds, specifically individuals from Asia, express and experience pain. In-person and virtual interviews are conducted with participants in their native languages, including Korean, Chinese, Japanese, Hindi, Hmong, and other languages studied in the lab, such as Spanish. These interviews provide insight into the cultural variations in pain response, utilizing manual coding and thematic analysis on transcripts generated through both manual and AI methods. Assessment tools and expression catalogs, such as symptom lexicons or pain descriptor inventories, can therefore be created to help clinicians more accurately understand and evaluate the pain of individuals from diverse cultural backgrounds.

CONTEXTUALIZING CARDIOMETABOLIC HEALTH BEHAVIORS IN TRUCK DRIVERS: A MIXED-METHODS STUDY THROUGH COMMUNITY PARTNERSHIPS

Chloe Kinander
Mentor(s): Wan-chin Kuo

The environments of truck driving shape a unique constellation of risk factors for cardiovascular diseases, including long hours of concentration and sitting position, along with occupational stress, limited food choices, day-night shift, and irregular sleep. This study aims to understand the challenges and barriers to healthy diet on the road through the lens of the social-ecological model. The long-term objective is to enhance leisure-time physical activity and fruit and vegetable intakes in truck drivers and optimize their metabolic health. This poster focuses on the mixed methods results of the survey and interviews regarding dietary behaviors with the truck driver sample recruited at truck driver events and social gatherings across Wisconsin. This work highlights the current challenge of translating healthy diet recommendations to this industry.

DAP12 SHOWS SUPERIOR EFFICACY TO CD3Z SIGNALING IN GD2 CAR-T CELLS AGAINST NEUROBLASTOMA

Elizabeth King
Mentor(s): Christian Capitini, Evan Dray, Lei Shi
Additional Author(s): Iris Zhu, Katie Huppert, Megan Clancy

Neuroblastoma is a leading cause of pediatric cancer death. Because neuroblastoma cells express GD2, this antigen has been widely targeted in immunotherapy. We engineered a GD2-directed CAR-T cell using DAP12, which contains one ITAM domain, instead of the conventional CD3ζ, which contains three. Anti-tumor activity was assessed using IncuCyte cytotoxicity and rechallenge assays with CHLA20 cells, while phenotype and exhaustion were evaluated by flow cytometry and ELISA. Efficacy was tested in metastatic and flank CHLA20 neuroblastoma NSG mouse models. DAP12 CAR-T cells showed greater in vitro cytotoxicity, superior in vivo tumor control, and 100% survival in metastatic models. They also resisted functional exhaustion and maintained a less terminally differentiated phenotype, supporting DAP12 as a superior alternative to CD3ζ in GD2 CAR design.

EFFECTS OF MILK FAT COMPARED TO SOY-BASED FAT ON LIVER FUNCTION MARKERS IN MICE RECEIVING INTRAVENOUS NUTRITION

Adam Kitay
Mentor(s): Nate Willis

Intravenous nutrition is used to sustain patients who cannot eat or digest food normally. Most formulations rely on soybean oil as their primary fat source. However, long-term use has been linked to fatty liver. In contrast, studies suggest that fats derived from dairy products may help protect against liver disease. My project examines how different fat sources influence liver health in mice and explores why certain fats may be more harmful or protective than others. Understanding these differences may help improve nutritional therapies and reduce the risk of liver complications in vulnerable patients.

ENERGY LEVEL MONITORING FOR UWNR THROUGH CHERENKOV LIGHT DETECTION

Soren Klarqvist, Callen Chittenden, Vera Serebryanaya, Reid Barrett, Logan O'Leary
Mentor(s): Charles A. Hirst

Measurement of core power is critical to controlled operation of the U-W Nuclear Reactor (UWNR). Employing multiple devices to measure reactor power provides additional safety and redundancy to the reactor operation. Our device is designed to calculate the power level of the UWNR, in megawatts, by measuring the light produced near the reactor core. To do this, we designed a cylindrical device that will be submerged in the reactor pool where it will use various detectors to measure the UV light produced by the reactor core. This output will be modeled as a linear function of light intensity, from which power level will be interpreted. This will ensure a second method of power level monitoring in the UWNR.

BODY DYSMORPHIA, DISORDERED EATING, AND THEIR RELATIONSHIP WITH SOCIAL MEDIA: A LITERATURE REVIEW

Jordan Klein
Mentor(s): Kristin Kotleski

For adolescent girls, social media has become a central part of life that combines peer-connection, self-expression, and identity formation. However, during this critical period of development, constant exposure to unrealistic beauty standards on social media can have lasting negative impacts on body image, and contribute to disordered eating behaviors. This will be a literature review of published articles regarding social media, body image, and eating disorders including anorexia nervosa and bulimia nervosa in girls ages 13-22. I will systematically identify articles using UW library databases, excluding articles written prior to 2016 or published outside the US. I will synthesize the results of my search according to PRISMA guidelines.

EXAMINING THE IMMUNOMODULATORY ROLE OF DAIRY CO-PRODUCTS IN ALCL3-INDUCED INFLAMMATION

Olivia Klingbeil
Mentor(s): Tahliyah Mims
Additional Author(s): Joseph Pierre

Aluminium trichloride (AlCl3) is a neurotoxic heavy metal that induces inflammation when ingested. It is blood-brain barrier (BBB) permeable and accumulates in the hippocampus, acting as an inducible model of neurodegenerative disease. This project will investigate the potential anti-inflammatory effects of dairy co-products, whey protein phospholipid concentrate (WPPC) and whey protein isolate (WPI), in vitro AlCl3-induced inflammation models. Hippocampal cells and various immune cells will be treated with AlCl3 and dairy co-products in different paradigms. Cell viability will be assessed, and inflammation quantified using qRT-PCR and Western blot. Expected results will show higher cell viability and lower inflammatory markers in models treated with WPPC and WPI relative to vehicle. The hope is that results find potential therapeutic methods for neurodegenerative disorders such as Alzheimer's.

THE EFFECTS OF AQUATIC-BASED INTERVENTIONS ON PEOPLE WITH CHRONIC PAIN

Megan Klinger
Mentor(s): Garrett Huck

Chronic pain affects millions of people worldwide and creates serious physical, emotional, and financial challenges. In this presentation, I explore how swimming-based interventions can support people living with chronic pain. Traditional treatments like medication and physical therapy do not always provide lasting relief and can sometimes add strain to the body. Aquatic exercise, however, uses water's buoyancy and resistance to allow safe movement while reducing pressure on joints and muscles. Beyond physical benefits, swimming may also improve mood, reduce stress, and increase overall well-being. I will review research on conditions such as lower back pain, neck pain, and fibromyalgia, discuss barriers to aquatic therapy, and consider how these findings could influence future clinical practice and rehabilitation approaches for chronic pain management in diverse patient populations.

RTI AIDED REEVALUATION OF SELECT PALMYRENE RELIEFS

Carl T. Knaack
Mentor(s): Jeremy M. Hutton

Reflectance Transformation Imaging (RTI) simulates a light dome effect, allowing researchers to trace a light source over a computer model of an object. This allows further refined readings of epigraphic inscriptions from various periods. This paper is a component of the larger Wisconsin Palmyrene Aramaic Inscription Project, which seeks to use recent technological developments, such as RTI, to improve our understandings of the surviving Palmyrene corpus. This paper focuses on several inscriptions from the University of Pennsylvania Museum and the Portland Art Museum, including both refined readings of the inscriptions themselves and improved understandings of late-Roman Aramaic scribal culture.

THE EARLY REGULATION IN CONTEXT ASSESSMENT: AN OVERVIEW AND APPLICATION TO THE HEALTHY BRAINS AND CHILD DEVELOPMENT STUDY

Kristin Knope, Ashley Stellick, Elizabeth Stoeberl
Mentor(s): Julie Poehlmann

The Early Regulation in Context Assessment (ERICA) is a validated measure used in the HEALlthy Brain and Child Development (HBCD) study to assess a child's regulation individually and in conjunction with their caregiver for children ages 3 to 9 and 15 to 30 months. Through a series of age-appropriate tasks aimed at mirroring everyday experiences, children are observed in the context of their relationship with their caregiver. Activities, such as washing up where the caregiver undresses and wipes down the child, may elicit frustration. Other activities, such as free play, may elicit enjoyment. This measure enables a greater understanding of parent-child relationships and the socioemotional development of children for broad applications.

AUTOMATED SEGMENTATION AND ANALYSIS OF LI-ION BATTERY ELECTRODE MICROSTRUCTURE

Caleb Knudsen
Mentor(s): Jiamian Hu
Additional Author(s): Zebin Li, Yijin Liu

Microstructural phase segmentation is an essential procedure employed in Li-ion battery (LIB) research to derive properties associated with battery performance, longevity, and safety. Current segmentation processes are typically time- and labor-intensive, with inconsistent degrees of accuracy. This project aims to develop a machine learning framework capable of automatically segmenting and analyzing 3D LIB X-ray transmission microscopy (XTM) data. Our model accelerates and standardizes the research process, completing tasks in a fraction of the time typically required while maintaining consistent accuracy across every run. Furthermore, it is capable of producing a graph-based representation of electrode microstructure, enabling deeper analysis of particle motion, connectivity, and deformation.

DIFFUSION MRI AND MATERNAL STRESS: THE IMPACT OF MATERNAL ANXIETY ON INFANT BRAIN MATURITY

Kaitlyn Knutson, Courtney Schmidt
Mentor(s): Leela Shah

Longitudinal diffusion MRI (dMRI) can be used to track brain development in infants. Collecting this data tracks atypical infant brain development and identifies early biomarkers of risk. We assessed how maternal anxiety is associated with microstructural measures of infant brain maturity. Maternal stress was quantified using the Parenting Stress Index (PSI). dMRI data was collected using diffusion tensor imaging (DTI) metrics including fractional anisotropy, mean diffusivity, and radial and axial diffusivity. Linear models will show assessments of associations between these PSI values and DTI metrics in the first month of life. We expect a negative association between the PSI value and infant brain maturity. Identifying the impact of maternal stress on infant brain development may help identify developmental risk factors and inform early intervention measures.

OVEREXPRESSION OF GLYCOTRANSFERASE PROTEIN ALG12 IS SUFFICIENT TO MODULATE HEPATIC BIS(MONOACYLGLYCEROL) PHOSPHATE LIPID LEVELS

Abigail R. Koch
Mentor(s): Judith Simcox
Additional Author(s): Jess Davidson, Amy Cavanaugh, Thomas Kizzar

Lysosomal vesicles are composed of bis(monoacylglycero)phosphate (BMP) lipids. Little is known about how BMP lipids are regulated. Using a large genetic screen, we identified several proteins as a candidate for genetic regulation of hepatic BMPs, including the protein ALG12. ALG12 is an ER-localized enzyme involved in the synthesis of the glycan precursor for N-linked glycosylation. It is hypothesized that ALG12 is trafficking protein regulators of BMPs to the lysosome. Through targeted liquid chromatography-mass spectrometry (LC-MS), it was found that overexpressing ALG12 led to increased BMP lipid levels. I aim to determine how ALG12 is modulating BMP lipid levels. I found that lysosomal abundance and function are altered with Alg12 overexpression.

EFFECTS OF EXTENDED-RELEASE LEUPROLIDE ACETATE ON OVARIAN MORPHOLOGY IN A PREPUBERTAL RAT MODEL

Marilyn Koehler
Mentor(s): Thomas Niepsuj
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The effects of extended-release leuprolide acetate on ovarian morphology in a prepubertal rat model were investigated following one week of exposure. As a gonadotropin-releasing hormone agonist, leuprolide acetate initially stimulates gonadotropin release but with prolonged exposure ultimately suppresses hypothalamic-pituitary signaling. However, its effects on folliculogenesis in adolescent rats remain unclear. We hypothesize that treatment with extended-release leuprolide acetate will reduce the secondary and antral follicle count while increasing the residual ovarian structures, such as corpora lutea. Prepubertal female rats received injections (.6mg/rat) on postnatal days 24-25 and were euthanized a week later. Ovaries were collected and showed a significantly smaller ($p=0.0004$) ovary-to-body mass ratio using Welch's t-test. Histological analysis, including follicular counts, is underway to further assess follicular development.

MACHINE LEARNING FOR QUANTUM PHASE TRANSITION DETECTION

Divij Kohli
Mentor(s): Gary Shiu, Jacky Yip

Detecting phase transitions in quantum systems remains a challenging problem, especially when the relevant order parameters are not directly observable. This project investigates whether machine learning models can identify phase transitions directly from configuration data. As an initial step, we study the classical XY model as a controlled environment to develop and validate the ML pipeline before extending the approach to quantum systems. Spin configurations are generated across a range of temperatures using Monte Carlo simulation and used to train ML models to distinguish between phases. We compare convolutional neural networks and transformer based architectures to examine how different model structures perform on the transition region. Model predictions are then compared with physical observables to evaluate whether the learned representations reflect the underlying phase structure.

INCREASED PHA PRODUCTION FROM BACTERIA GROWN IN MEDIA WITH FATTY ACID-CONTAINING DAIRY WASTES

Nikkia Kohn
Mentor(s): Rachel Rovinsky, Erica Majumder

Polyhydroxyalkanoates (PHAs) are polymers naturally produced by bacterial strains under nutrient-limited conditions. PHAs are a potential biodegradable alternative to petroleum-based plastics; however, cost of PHA production is a limitation for industrial production. Using agricultural waste streams as feedstock can lower production costs. Whey Cream Buttermilk (WBC) and Whey Protein Phospholipid Concentrate (WPPC) are waste byproducts of dairy production. These contain fatty acids, which can be incorporated into PHA production. We analyzed PHA production by *Pseudomonas putida* KT2440, grown with WPPC and WBC. We found that PHA yield (mg of PHA) increased when grown in WBC, while PHA content (% CDW composed of PHA) remained similar across conditions. PHA composition slightly differed across conditions. These are promising results for utilizing agricultural waste feedstocks in industrial PHA production.

EXPRESSING THE SHIKIMATE PATHWAY ENZYME DHS IN DIFFERENT CELL COMPARTMENTS TO ENHANCE ESSENTIAL AMINO ACID PRODUCTION IN PLANTS

Isabelle Koo
Mentor(s): Jorge El-Azaz Ciudad
Additional Author(s): Hiroshi Maeda

Precursors of important compounds we interact with on a daily basis such as caffeine, lignin, and salicylic acid (used to produce Aspirin) trace their roots to one metabolic pathway- the shikimate pathway, which makes the aromatic amino acids (AAAs) trytophan, phenylalanine and tyrosine. Mammals lack the shikimate pathway, so humans must get these AAAs through diet. In our research, we aim to increase AAA production by experimenting with the subcellular location of DHS, the first enzyme of the shikimate pathway. We performed Agrobacterium infiltration in *Nicotiana benthamiana* to express mutated DHSs from plant and bacteria targeted to cytosol and chloroplast respectively. LCMS analysis showed drastic increases in AAA content, supporting that engineering this enzymatic step can increase AAA production in plants and their nutritional value.

ADAPTIVE LABORATORY EVOLUTION OF *SACCHAROMYCES CEREVISIAE* TO OVERCOME SAPONIN INHIBITION IN BIOFUEL PRODUCTION

Lizza Korolev
Mentor(s): Trey Sato, Lillian Barten, Chris Todd Hittinger

The yeast *Saccharomyces cerevisiae* can produce renewable energy in the form of ethanol by fermenting sugars in plant hydrolysate, a liquid made by deconstructing plants such as switchgrass. Strains of *S. cerevisiae* that have been engineered to ferment xylose, an abundant sugar in switchgrass, show inhibited fermentation in hydrolysate from switchgrass grown during drought. Droughts induce a stress response in switchgrass, including an increasing in the production of saponins, which are anti-fungal molecules. To overcome the inhibitory effect that saponins have on our yeast strain, we conducted an adaptive laboratory evolution experiment with a xylose-fermenting strain of *S. cerevisiae* in switchgrass hydrolysate containing increasing concentrations of saponin. We explore mutations identified in this evolution experiment, as well as mutations in related genes, to understand the genetics behind saponin tolerance.

BETA CELL SPECIFIC ROBO2 KO ISLETS DISPLAY DISORGANIZED CELLULAR ARCHITECTURE

Katelyn Kosfeld
Mentor(s): Barak Blum
Additional Author(s): Rachel Kasper

Pancreatic islets are endocrine cell clusters which regulate blood glucose homeostasis by releasing insulin, glucagon, and somatostatin from β, α, and δ cells, respectively. Normal mouse islet architecture shows α and δ cells forming a mantle around β cells. Islet architecture is important for proper cell-cell communication and hormone release. Robo, short for Roundabout, are transmembrane receptors on β cells. Our lab previously found Robo1 and Robo2 are important for proper establishment of islet architecture and Robo2 is important for maintaining cellular architecture in adulthood. Here, we determine the islet architecture phenotype for a Robo2 knockout mouse. Quantifying this phenotype is important for understanding the function of Robo2 in islet architecture. Establishing this phenotype is critical to inform future studies of mice under diabetogenic stress.

AUTOMATED GENE FUNCTION EXTRACTION IN THE LITERATURE OF A MICROBIOLOGY SUBFIELD USING NATURAL LANGUAGE PROCESSING

Diya Kothari
Mentor(s): Mark Mandel, Jason Lo
Additional Author(s): Julia Dierksheide

Manual literature review for extracting gene function data is a major bottleneck in microbiological research. We developed an automated pipeline using large language models to extract structured gene function information from scientific literature on the *Vibrio fischeri-Euprymna scolopes* symbiosis. The system processes PDF research articles and their supplementary materials, identifying and categorizing gene regulatory proteins, enzymes, RNA molecules, and structural components based on a data schema developed by domain experts. We evaluated the data pipeline using a human expert curated dataset containing over 100 papers. Benchmarking and iterative refinement are ongoing to optimize extraction accuracy. Future work will develop a web interface for searching extracted gene functions and expand the framework to other microbiology subfields, establishing a generalizable approach for automated literature curation.

EXPLORING THE ROLE OF INOSITOL PYROPHOSPHATES IN NUTRIENT SENSING IN *ARABIDOPSIS THALIANA*

Grace Kozel
Mentor(s): Catherine Freed, Jake Brunkard

Phosphate (Pi) is a critical nutrient for plants and is often a limiting factor in food production, as many agricultural soils are limited in available Pi. Inositol pyrophosphates (PP-InsPs) have been recently linked to a variety of plant abiotic and biotic stress signaling pathways, such as Pi starvation response and hormone signaling. Recent evidence shows that depending on how PP-InsPs are altered, plants can increase or decrease Pi accumulation from soil. Here, we evaluate the intersection between PP- InsP accumulation and other signaling pathways involved in nutrient sensing and cell growth. Our results indicate a role for PP-InsPs in regulating protein complexes involved in nutrient sensing outside of the Pi starvation response, which could serve to be useful in enhancing nutrient use efficiency in crops.

INVESTIGATING CF NEUTROPHIL METABOLISM AND ACTIVATION WITH OPTICAL METABOLIC IMAGING

Alek Kralovec
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In cystic fibrosis (CF) patients, excessive neutrophil migration into the airways and release of extracellular traps leads to severe breathing difficulties. The metabolic mechanisms underlying this heightened neutrophil activation at the single-cell level remains unexplored. This is predominantly due to the short lifespan (less than 24 hours) of primary neutrophils, which renders traditional experimental approaches ineffective. To overcome the short lifespan, a cell-line model, HL-60, can be used, allowing easier acquisition of metabolic measurements. Therefore, to investigate the role of metabolism in CF neutrophils, we differentiated both wild-type and CF mutant HL-60s into neutrophil-like cells and compared their quiescent and activated states using fluorescence lifetime imaging microscopy, a non-invasive technique. Furthermore, neutrophil functions such as the production of reactive oxygen species were quantified to validate the results. The data collected from these experiments will aid in the understanding of CF neutrophils and could be used to facilitate therapeutic development.

ENGINEERING BIPARATOPIC SHARK-DERIVED ANTIBODIES FOR IMPROVED TUMOR SELECTIVITY IN LUNG CANCER

Kate Kramer
Mentor(s): Jayden West, Aaron LeBeau

The MET receptor is often overexpressed or mutated in lung cancer, making it an attractive target for therapy. To improve MET targeting, we engineered an antibody that binds two distinct sites on the same receptor, known as a biparatopic antibody. This antibody, called F/H-Seedbody, incorporates shark-derived “VNARs”: naturally small, flexible binding domains that penetrate tissues better than human antibodies. To evaluate the effects of biparatopic structure, we measured F/H-Seedbody uptake in cancer cells with varying levels of MET expression and compared the results with single-site (monoparatopic) antibodies, 2H4-Fc and 2F12-Fc. F/H-Seedbody showed lower cellular uptake than 2H4-Fc, but greater selectivity for the MET receptor. These results demonstrate a tradeoff between uptake and selectivity and highlight biparatopic design as a promising strategy for improving MET-targeted therapies.

LEVERAGING RESEARCH DATA TO SUPPORT POLICY CHANGE

Sydney Krause, Ava Seastrom
Mentor(s): Elizabeth Larson
Additional Author(s): Tim O’Brien

Bills before the Wisconsin legislature propose expansion of recess time. Public school districts often feel compelled to increase time for academics and reduce time for recess. This advocacy project included: reviewing literature and providing current evidence for the benefits of recess, learning about the legislative process and meeting with a legislator to advocate for this change. Previously, we designed and evaluated the impact of an outdoor play space for middle school students. We collaborated with a school that expanded time allocated to recess for tweens. Before and after recess we asked students to rate their learning engagement and emotional state. This data will be leveraged to prepare an advocacy letter to support the proposed bill, providing data on how recess can support learning engagement.

AN ANALYSIS OF TRAINEE-ACTOR COMMUNICATION DURING SIMULATED TREATMENT DECISION-MAKING CONVERSATIONS

Brandon Kreger
Mentor(s): Kristen Pecanac

Surrogates for seriously ill hospitalized patients often face emotionally challenging life-or-death decisions. The Clinician Approach to Shared Decision Making (CASDM) was developed to teach clinicians five communication strategies that facilitate surrogate decision making. This study examined how nine trainees applied these strategies during simulated decision-making conversations and assessed how well the simulations reflected real-world decision-making conversations. Trainees used an average of 3.5 out of 5 strategies; most assessed surrogate understanding and discussed prognosis. All inquired about patient values, though fewer prioritized this early or explicitly asked what the patient would choose. Simulation realism varied, shaped by actor emotion, cueing, and presentation of clinical background, which occasionally influenced conversation direction. By improving training, clinicians can facilitate meaningful conversations, helping surrogates make informed healthcare decisions.

CHARACTERIZING PEER QUESTIONING BEHAVIORS IN ENGINEERING LABS: AN INDUCTIVE ANALYSIS OF COLLABORATIVE DISCOURSE

Malini Krejcarek
Mentor(s): Matthew Grondin, Kate Fu, Mitchell Nathan

Undergraduate engineering learning is often collaborative. Peer-to-peer questioning was found to support problem-solving, promote interaction, and develop deeper conceptualizations. This study examined peer questioning in an engineering lab. Specifically, we ask: what categories of peer-to-peer questions emerged? Prior to testing, thirteen undergraduates were randomly assigned to three groups and answered torsion-related conceptual questions. Group discussions were recorded, transcribed, and inductively coded. Four categories emerged: validation-seeking agreement when uncertain, future action-hypothetical testing outcomes, memory retrieval-prior experiences to ground discussions, and repeating conceptual questions-refocusing group attention. This research focused on peer-to-peer questions as indicators of collaborative learning. However, peer-to-peer responses also play a central role. Such future research should attend to both peer-to-peer questions and their responses to gauge students' collaborative level of conceptual understanding.

BRIDGING THE GAP: STUDENTS AND NAVIGATORS ADDRESS HEALTH INSURANCE ACCESSIBILITY AMIDST FEDERAL CUTS

Anika Krishnamurti, Kyle Digman
Mentor(s): Sarah Davis

The Community Resource Navigator Program partnered UW-Madison students with Covering Wisconsin to address health insurance demand following significant federal cuts to Navigator capacity. Students filled a new "Intake Specialist" role, providing phone-based triage during Open Enrollment to connect underserved consumers with appropriate resources after completing federal and state training. This collaboration exemplifies shared leadership and mutual learning. Students, faculty, and staff co-developed the Intake Specialist role together, with students contributing to program design and exercising independent decision-making during calls. Covering Wisconsin gained essential capacity during peak demand while students gained hands-on experience addressing real barriers to health insurance access. Continuous workflow refinement and on-demand staff support ensured shared learning in real time — demonstrating how community-university partnerships can effectively serve Wisconsin residents while building student competency.

NUCLEAR REACTOR POWER ESTIMATION USING LIGHT INTENSITY

Carter Krueger, Dhruv Vyas, Ben Soule, James Balaton
Mentor(s): Charles A. Hirst
Additional Author(s): Cass Bradley, Carson Vaughn

Currently, nuclear reactor power is mostly calculated using temperature differences in coolant, ion chambers, and other detectors to measure neutron flux. While effective, all of these methods are expensive. Our project uses a cheaper and recyclable alternative: a submersible light sensor that measures variations in light intensity from the emitted Cherenkov radiation. By attaching the sensor to a microprocessor with custom code, the system will calculate the power levels based on the linear increase in light emission from the core (Cherenkov Radiation) relative to the reactor's output. Our simple and inexpensive alternative device offers an additional way to measure UWNR power, decreasing the need for more spending on power detection.

Жаба WHERE ARE YOU?: CODE-SWITCHING PRACTICES IN UKRAINIAN- AND RUSSIAN-ENGLISH SPEAKING CHILDREN

Yana Krutnyk
Mentor(s): Margarita Kaushanskaya
Additional Author(s): Emma Libersky

Code-switching is a common practice amongst bilingual populations, yet little to no work has been conducted on Russian-English and Ukrainian-English bilinguals. We examined the use of code-switching in bilingual children using language samples. Children listened to and retold three stories: once in English, once in Russian or Ukrainian, and once using both of their languages. These language samples were transcribed and coded for code-switches. By documenting typical code-switching practices in these populations, we hope to provide a baseline to help identify atypical code-switching patterns that may characterize language impairment. We will also be able to examine how code-switching varies with children's language profiles in the full sample. Broadly, this work provides insight into language development within understudied Russian- and Ukrainian-English bilingual populations.

QUANTIFYING DEHYDRATION EFFECTS OF PORCINE VOCAL FOLD ATTENUATION WITH OPTICAL COHERENCE TOMOGRAPHY

Michael Kuang
Mentor(s): Jack J. Jiang
Additional Author(s): Owen Wischhoff, Jakob Holm

Objective: The purpose of this study is to use optical coherence tomography (OCT) to characterize the effect of dehydration on the optical attenuation coefficient of porcine vocal fold (VF) tissue. Assessing laryngeal hydration is clinically relevant for evaluating vocal function; however, no reliable noninvasive methods currently exist to quantify it.

Methods: Six porcine larynges were bisected into twelve halves, yielding twelve VFs. Each specimen underwent serial dehydration using a vacuum oven to approximately 5%, 10%, and 15% mass loss, with OCT scans obtained at each interval using a 1300 nm wavelength system. Attenuation coefficients were extracted from OCT B-scans through custom MATLAB processing, and the relationship between tissue dehydration and attenuation was modeled using a linear mixed-effects model.

Results: Across VFs, attenuation decreased by approximately 0.08 units mm-1 for each 1% increase in tissue mass loss ($b = -0.079$, 95% CI [-0.105, -0.054]). Attenuation decreased linearly with increasing tissue dehydration. The true VF exhibited consistently higher attenuation values than the false folds by an average of 1.47 units mm-1 ($P<0.001$). Inter-fold variability was low (ICC = 0.041), indicating strong reproducibility across specimens.

Conclusions: OCT-derived attenuation provides a quantitative, reproducible indicator of VF dehydration. The linear relationship between attenuation and tissue mass loss supports the feasibility of OCT as a noninvasive optical biomarker of VF hydration. Future multi-wavelength and in vivo studies will be critical to translate this approach into clinical monitoring of VF hydration, edema, and lesion formation.

MUTATION IN TAD REGION BLOCK FORMATION OF p53-POLYPHOSHOINISITIDE COMPLEXES

Nick Kucherenko
Mentor(s): Muhammad Salah

The tumor suppressor p53 is the most frequently mutated gene in cancer. p53 is involved in cellular proliferation and tumor supression through linkage with phosphatidylinositol (PI). Subject to phosphorylation into phosphoinositide (PIP), which enables assembly of nuclear AKT-PDK1-MTORC, separate from canonical PI3K-AKT pathway. Integrity of TAD domains is necessary for WT p53 downstream PI kinase interaction. In addition, TAD domains are imperative for hotspot p53 induction of tumor genesis. Mutated p53 TAD regions disrupted phosphorylation of PI-Linkage, but not the formation of the linkage itself. These results demonstrate that mutations within the TAD domains specifically disrupt phosphorylation of PI linkages and subsequent nuclear AKT activation, clarifying how changes in p53 signaling contribute to uncontrolled cell growth and highlights possible avenues for targeted therapeutic strategies.

PRODUCTION OF PARAMETRIC PET IMAGES BY THE RELATIVE PATLAK METHOD

Varsha Kumar
Mentor(s): Alan McMillan

Quantitative dynamic positron-emission tomography (PET) utilizes the Patlak model to generate parametric images of tracer net influx and blood circulation for lesion identification. The standard Patlak approach requires continuous data acquisition immediately following tracer injection, presenting logistical challenges in routine practice. We evaluated the relative Patlak model, which omits these early acquisition time points. Parametric images can be derived from the relative model accurately depicting metabolic activity and tracer circulation, serving as an effective substitute for the standard approach. By eliminating the requirement for immediate post-injection scanning, the relative Patlak model provides equivalent diagnostic utility while significantly improving measurement feasibility, thereby facilitating potential broader clinical adoption of dynamic PET parametric imaging.

INVESTIGATION OF THE MIRNA PROFILE OF BOVINE COLOSTRUM VS MATURE MILK ACROSS LACTATIONS AND THEIR IMMUNOMODULATORY PROPERTIES

Eva Kunz
Mentor(s): Karen Antunes

Despite extensive research on the composition and benefits of colostrum and mature milk as a whole, little is known about the specific lactation timepoints within mature milk after each completed lactation cycle, the complexity of their mRNA, and the resulting anti-inflammatory responses. Colostrum and mature milk were collected from 6 cows, with 2 cows for each lactation point. EV isolation was done for the milk and colostrum of each cow. This is followed by miRNA isolation and sequencing, splenocyte culture and treatment, RNA isolation and quantification, cDNA reverse transcription, and cPCR. The results of these procedures will identify the impact of bovine colostrum and varying lactation point mature milk EV pro-inflammatory response, and provide key insight to the roles of these EVs in in-vivo pathology.

IMPACT OF PH, FIBRILLATION, AND GELLAN GUM ON PEA PROTEIN FUNCTIONALITY

Tim Kurbanov
Mentor(s): Audrey L Girard, Sanjana Sawant

Plant proteins are low-cost, eco-friendly ingredients, but their structure restricts application. This study investigates restructuring pea proteins through fibrillation to improve their food functionality. A 3.5% pea protein solution (pH 2) was fibrillated at 85°C for 16h. Samples were complexed with gellan gum to improve fibril stability at food-relevant pH levels. Foaming capacity and stability were measured via foam volume monitoring. Viscosity was measured with a Rapid Visco-Analyzer. Fibrillation increased protein foam capacity up to 3.5X, and stability by ~64% at pH 7. Gellan gum addition increased foam capacity ~5.3X and stability ~129%. Fibrillated gum-containing samples showed ~7X viscosity of gum-free counterparts, which may enable applications in thickened beverages. Fibrillated pea protein could also be applied in foam-based systems like ice cream.

INVESTIGATING THE BICAUDAL-C(BICC1)-RNA INTERFACE ACROSS *XENOPUS LAEVIS* AND *HOMO SAPIENS*

Matias Kvalsvik
Mentor(s): Michael Sheets, Emily Johnson

Bicaudal-C (Bicc1) is an RNA-binding protein essential for embryonic development and maintaining organ health. Bicc1 selectively binds specific mRNAs and represses their translation, though we currently have a poor understanding of how it selects RNA targets. Most insights into Bicc1's RNA binding functions have come from studying *Xenopus* (frog) Bicc1. However, the protein SEQUENCE is evolutionarily conserved, suggesting its RNA binding functions are similarly conserved. I am testing this idea by analyzing Bicc1 proteins from different species for their binding to several RNA targets using a gel shift assay. Understanding the similarities and differences in Bicc1 binding across species is essential for a broader understanding of the Bicc1–mRNA interface and its biological impact.

GRISEOFULVIN AND THE EFFECTS OF CENTROSOME AMPLIFICATION ON RADIATION SENSITIVITY

Pate E Lantz
Mentor(s): Pippa Cosper
Additional Author(s): Francesca Scribano, Nikki Messick, Sonia Mehta, Katherine Jones, Emily McCunn

Radiation therapy treats over 75% of patients with head and neck cancer, yet most receive identical treatment despite differences in tumor biology. Chromosomal instability (CIN), the missegregation of chromosomes during mitosis, is common in cancer. We previously showed that cancer cells with high baseline CIN are more sensitive to radiation. Centrosome amplification, a form of CIN in which cells contain more than two centrosomes, contributes to chromosomal instability. We previously demonstrated that Griseofulvin (GF), an antifungal polyketide, induces centrosome amplification and multipolar mitosis. Here, we show that GF treatment and PLK4 overexpression, another known method of inducing centrosome amplification, sensitize head and neck cancer cells to radiation. These findings suggest that inducing centrosome amplification prior to radiation therapy may enhance tumor response and support more personalized radiation oncology strategies.

FEAR LEARNING AND AMYGDALA RESTING CONNECTIVITY IN PREADOLESCENT CHILDREN WITH AND WITHOUT ANXIETY DISORDERS

Anna Lauber
Mentor(s): Lisa E Williams
Additional Author(s): Ned H Kalin

Anxiety disorders (ADs) are common in children, with associated worries and fears that can inhibit daily functioning. The present study examined the relationship between fear learning and anxiety-related brain network connectivity in 86 children (age 8-12, n=46 AD/n=40 controls) using a fear conditioning paradigm. AD children reported higher levels of subjective fear to conditioned stimuli, but groups did not differ on skin conductance response (SCR), a physiological measure of fear learning. Participants with higher SCR after conditioning displayed a weaker connection between the amygdala and hippocampus. This suggests that exaggerated physiological responses to feared stimuli may be associated with altered communication between the threat-processing brain regions like the amygdala and the hippocampus which is involved in memory processes.

TRACKING POLYADENYLATION OF SINGLE PRE-MRNA MOLECULES USING FLUORESCENT PROBES

Brielle Lauber
Mentor(s): Aaron Hoskins, Ethan Aubuchon
Additional Author(s): Holly Fagarasan, Lori Passmore

Cleavage and polyadenylation occur during pre-mRNA 3′ end maturation, which is crucial for gene expression in eukaryotes. In yeast, they are catalyzed by the Cleavage and Polyadenylation Factor complex, cleavage factors CF IA, and CF IB. Using TIRF microscopy, we have observed cleavage and polyadenylation of single RNA molecules in real-time. Using fluorescently labeled Locked Nucleic Acid probes, we are gaining insights into the coupling of these reactions. We show that RNAs are heterogeneous regarding their onset of polyadenylation after cleavage, suggesting the potential of regulatory steps between these reactions. We have created standards with poly(A) tails of known lengths to investigate the relationship between probe binding and tail length. Using these methods, pre-mRNA 3′ end mutations can be studied to understand their molecular underpinnings.

DEVELOPING A COMBINATORY TREATMENT APPROACH UTILIZING NOVEL TUMOR TARGETED AGENTS TO TREAT MULTIFOCAL PROSTATE CANCER

Abigail Laughlin
Mentor(s): Josh Lang, Erika Heninger
Additional Author(s): Xavier Hazelberg

Prostate cancer presents clinically with multifocal tumors throughout the prostate gland that often associate with differences in the genomic landscape and tumor biology. Hence, treatment with a single agent may permit the survival of a subclonal tumor cell population or secondary tumor foci. Therefore, we hypothesize that simultaneous treatment with novel tumor-targeted agents may increase malignant cell death of tumor cell lines within an in vitro model system of multi-focal prostate cancer. By utilizing a microfluidic Stacks device, we can co-culture two independent cancer cell lines within a replicated tumor microenvironment, providing insight into the clinical utility of combinatory treatment options in a heterogenous tumor landscape.

EVALUATION OF HISTORIC FLINT MAIZE GERMPLASM FOR POLENTA CORN PRODUCTION IN THE U.S. CORN BELT

Caden Lawrence
Mentor(s): William F. Tracy

Polenta is a versatile dish originating from Northern Italy, made from coarsely ground flint maize. Research indicates that polenta corn tends to have desirable nutritional advantages and exhibits more climate-resilient traits than non-flint maize varieties. As global interest in polenta grows and U.S. growers seek alternative specialty crops, flint maize shows potential for production in Wisconsin and the wider U.S. Corn Belt. This project aims to improve grower access to the polenta market by adapting historic flint populations. Sixteen open-pollinated populations from the U.S. National Plant Germplasm System were top-crossed with an early Spanish flint variety, generating 33 populations and cross-pollinated hybrids. These were grown in two certified organic environments in southern Wisconsin (West Madison and Arlington) and evaluated for agronomic performance.

DNA METHYLATION IS A NOVEL SPLICING REGULATOR FOR TITIN

Bao Le
Mentor(s): Wei Guo

Titin, the largest known protein, plays an important role in elasticity of cardiac muscle. Titin elasticity is determined by exon inclusion, which is primarily regulated by RBM20. The longest and most elastic titin isoforms are expressed during embryonic development, however, the mechanism is unknown given that RBM20 expression is high. We hypothesize that increased intragenic exon DNA methylation promotes exon inclusion in early development. Whole genome bisulfite sequencing shows that titin exon DNA methylation is increased in fetal mouse hearts. This observation is evidence that DNA methylation may influence titin alternative splicing. In this study, we will prove that exon DNA methylation regulates alternative splicing of titin using dCas9-TET1 to demethylate titin exons in an in vitro splicing assay and confirm exon exclusion via RT-PCR.

INVESTIGATING HORIZONTAL GENE TRANSFER OF A HEAVY METAL RESISTANCE STARSHIP IN THE HUMAN PATHOGEN *ASPERGILLUS FUMIGATUS*

Ashton Leahy
Mentor(s): Emile Gluck-Thaler
Additional Author(s): Justin Eagen

Aspergillus fumigatus is an ubiquitous fungal pathogen with wide-spread implications for public health. Starships are giant transposons that have the ability to horizontally transfer themselves between fungal species, often transferring cargo genes that alter the phenotype of their recipients. I hypothesize that the transfer of starship Nebuchadnezzar h2 from a donor *A. fumigatus* strain will increase heavy metal resistance in a recipient strain compared to the wild-types. Successful starship transfers will be verified via PCR, while changes to heavy metal resistance will be assessed using phenotyping assays. Future directions of this research will be evaluating the success of starship transfers across even greater phylogenetic distances.

OPTIMIZING RISK COMMUNICATION ABOUT PFAS IN WISCONSIN DRINKING WATER: A NEEDS ASSESSMENT OF PUBLIC HEALTH OFFICERS

Emily Ledin
Mentor(s): Bret Shaw, Anya Jeninga-Nehls

PFAS (per- and polyfluoroalkyl substances), often called "forever chemicals," are synthetic compounds widely used in consumer products. As detection methods improve, PFAS have emerged as a significant public health concern. This study examines how public health communicators address PFAS in drinking water and what barriers they face, particularly when communicating with residents who rely on private wells. Findings reveal major challenges, such as limited accessible information for non-scientific audiences, lack of local testing and data, uncertainty about responsibility and remediation strategies, and high testing costs. These barriers often compound with resource constraints, particularly in counties without dedicated environmental health departments. This research highlights the need for clearer communication tools and affordable testing options to support effective PFAS outreach in rural communities.

CORRELATION BETWEEN HAMSTRING STRENGTH AND JUMP PERFORMANCE IN ATHLETICALLY EXPERIENCED, RESISTANCE TRAINED INDIVIDUALS: A PILOT STUDY

Caleb Lee
Mentor(s): Scott K. Crawford
Additional Author(s): Quinlan Thompson, Caleb Sandberg

The Nordic hamstring exercise (Nordics) and Romanian deadlift are used for hamstring injury prevention but their effects on jump performance remains unclear. This study investigated relationships between hamstring strength and bilateral and unilateral jump performance. Sixteen resistance-trained participants completed 3-repetition maximum testing in Romanian deadlift and Nordics, and bilateral and unilateral countermovement and broad jumps. Pearson correlation coefficients were calculated between all variables. Between-jump measures were strongly correlated ($r = 0.76–0.86$). Jump performance showed strong correlations with Romanian deadlift strength ($r = 0.73–0.80$) and moderate correlations with Nordics ($r = 0.55–0.71$). Nordic and Romanian deadlift strength was moderately correlated ($r = 0.67$). Hamstring exercises demonstrate different relationships across vertical versus horizontal and bilateral versus unilateral jump performance suggesting these exercises cannot be interchanged.

A PROPOSED LONGITUDINAL STUDY INVESTIGATING THE LONG-TERM MENTAL HEALTH IMPACTS OF AI-BASED VERSUS HUMAN-BASED THERAPY

Lauren Lee
Mentor(s): Polina Beloborodova

Over the years, AI has become more integrated into people's lives. My proposed research investigates AI's ability and efficacy to provide mental health support, with an emphasis on the long-term impact of AI-based therapy. This is a between-subjects, 6-month long study, and I plan to recruit and randomly assign 300 individuals to an AI-based or human-based therapy group, or waitlist control group. I hypothesize that AI-based therapy can provide support for less severe mental health issues, but in the long-term, will not be as effective as humans at helping individuals recover. To measure the effectiveness of AI-based versus human-based therapy, I will evaluate participants' overall improvement in their depression and anxiety symptoms, and levels of positive and negative emotions.

EXAMINING THE ROLES OF CORE GENES IN SPECIES-SPECIFIC ANTIMICROBIAL RESPONSES

Luisa Lee
Mentor(s): Jason Peters, Jin Komerska

Antimicrobial resistance poses a critical threat to global health, with a growing incidence of infections caused by Enterobacterales that can resist last-resort antibiotics. Although the Enterobacterales *Escherichia coli* and *Klebsiella pneumoniae* are genetically similar, they can have different susceptibility to antibiotics. The genetic basis for this difference is unknown. Our research shows that disruption of genes involved in cell envelope stabilization produces differing responses to an antibiotic between these species. I also developed a computational pipeline to identify shared core gene targets across Enterobacterales and other bacteria, providing a framework for future systematic comparison of antibiotic responses across species and strains. Together, our findings reveal how genetic context shapes antibiotic susceptibility and lay the groundwork for more comparative studies, with implications for treating drug-resistant infections.

EVOLUTION BEFORE LIFE: THE EFFECTS OF SERIAL TRANSFERS OF PREBIOTIC CHEMICAL ECOSYSTEMS ON CHEMICAL COMPOSITION

Lukas Neo-Vajyimleej Lee, Naz Michel
Mentor(s): Tym Sokolskyi, David Baum, Ronan Montgomery-Taylor

Evolution is a fundamental aspect of biology because of how it provides a mechanism for adaptation. Our work focuses on examining the origin of evolution in the origins of life, specifically in how organic compounds can demonstrate heritability through perpetuating chemical reaction networks. We did this by performing serial transfers with dilution of incubated mixtures consisting of compounds plausible on early Earth for the purpose of selecting for autocatalytic chemical reactions that would persist between transfers. LC/MS was used as the method of tracking chemical fingerprints to quantify heritability in lineages of serial transfers. The concluding data was variable, however it suggested that chemical diversity increased with serial transfers and that composition tended to trend towards a similar chemical composition.

SYNTHESIS OF HIGH-CSP3 DNA-ENCODED LIBRARIES USING THIANTHRENIUM ON-DNA CHEMISTRY

Ruda Lee
Mentor(s): Jeff Martell, Minjong Lee

DNA encoded libraries (DEL) enable cost and material efficient screening of vast chemical space, but many collections are biased toward planar aromatic scaffolds, which can increase nonspecific binding and limit diversity. This project develops an on DNA strategy to access higher Csp3 DEL members using alkenyl thianthrenium electrophiles as DNA compatible linchpins. These reagents support a modular two step sequence, regioselective nucleophilic addition followed by substitution, to install two distinct nucleophiles from simple building blocks. Building on preliminary Martell Group results showing DNA labeling with thiol and amine type nucleophiles across multiple thianthrenium substrates, ongoing studies will expand scope across representative nucleophile classes while maintaining DNA integrity. This platform aims to expand the DEL reaction toolbox and enable more saturated, leadlike libraries for screening.

CONFIRMING FAP BINDING SPECIFICITY IN ENGINEERED SHARK VNAR-FC ANTIBODIES

Jessica Leff
Mentor(s): Aaron Lebeau

Antibody therapeutics can benefit from protein engineering approaches that enhance pharmacokinetic versatility. Shark variable new antigen receptors (VNARs) are highly stable, single-domain antibodies with small size and flexible binding interfaces, making them well suited for flexible and targeted engineering approaches. Previous PET/CT studies revealed differing clearance patterns that may be attributed to VNAR isoelectric point. To investigate this, we generated VNAR-Fc fusion proteins from which we introduced site-specific mutagenesis via amino acid substitutions to alter the isoelectric point of hFAP-targeted VNAR. Mutant plasmids were generated, expressed, purified, and characterized using biolayer interferometry (BLI) to evaluate binding kinetics to fibroblast activation protein (FAP). BLI results showed mutant variants retained affinity comparable to wild-type counterparts, supporting the versatility of VNARs for future therapeutic development.

CONCUSSION REPORTING PERCEPTIONS AND INTENTIONS AMONG WISCONSIN HIGH SCHOOL ATHLETES

Emily Legois
Mentor(s): Julie Stamm

Objective: To evaluate Wisconsin high school athletes' perceptions regarding concussion reporting and the likelihood of themselves and their teammates to report a concussion.

Methods: An electronic survey measured perceptions of concussion reporting by oneself and among teammates.

Results: Pilot data shows football players are generally supportive of teammate concussion reporting and don't believe a teammate is letting the team down if they report a concussion but are less likely to believe teammates support reporting. Athletes tend to perceive themselves as more likely to report than their teammates.

Conclusion: Overall, athletes perceive themselves as more inclined to report a concussion than their teammates; suggesting that team dynamics and trust could play a role in concussion reporting support. Data collection for the larger multi-sport study is ongoing.

DEMYSTIFYING THE MANUAL: INCREASING INTENTIONAL TEST SELECTION IN STANDARDIZED ASSESSMENTS

Lily Leicht, Taylor Metz
Mentor(s): Courtney Seidel

In speech-language pathology, there is an over-reliance on standardized assessments for clinical decision-making, despite evidence showing that many of these assessments do not report psychometric measures of diagnostic accuracy. Of those that do report, many do not meet acceptable accuracy levels (sensitivity and specificity $\geq 80\%$). Without reported acceptable measures of sensitivity and specificity, clinicians risk misdiagnosis of speech and language disorders. This poster presents findings from an ongoing quality improvement project evaluating 141 standardized assessments across 16 areas of speech-language pathology based on their published psychometric properties, revealing a consistent gap in psychometric transparency and accuracy. This systematic review helps to spread awareness among the next generation of speech-language pathologists and instills an early understanding of psychometric rigor and intentional test selection.

YEAST-PHASE GROWTH OF *BLASTOMYCES* ON MEDIA TO SUPPORT SAFER, EFFICIENT, AND ACCESSIBLE DIAGNOSTIC TESTING

Lauren Leiker
Mentor(s): Alana Sterkel, Francesca Scala

Blastomyces is a deadly fungus whose diagnosis is challenging and slow because routine clinical culture is performed in the mold phase of this dimorphic pathogen, requiring additional biosafety precautions. As a result, access to clinical testing is limited, which can negatively impact patient care. This project investigates faster growing yeast phase of *Blastomyces* as a more efficient, sensitive, and safer alternative that could be implemented in less specialized laboratories. We evaluated culture media commonly available in clinical laboratories to identify those that best support yeast-phase growth. This work will reduce diagnostic barriers by improving the safety and accessibility of *Blastomyces* testing in clinical settings.

INVESTIGATING THE PREVALENCE AND SEVERITY OF POTENTIAL ADVERSE DRUG INTERACTIONS IN FMR1 FULL MUTATION AND PREMUTATION POPULATIONS

Miriam Leo
Mentor(s): Marsha Mailick

Individuals with Fragile X Syndrome (FXS) and FMR1 premutation carriers often manage co-occurring conditions through polypharmacy. To characterize medication use and potential interaction risks, we analyzed longitudinal data from 133 participants with FXS and 134 premutation mothers across six time points. On average, children with FXS and premutation mothers took 2.5 and 2.6 medications, respectively. Using Lexidrug to assess concurrent medication use, we identified an average of 1.9 interactions (0.16 severe) in children with FXS and 1.6 interactions (0.20 severe) in mothers. These findings highlight a prevalence of potential drug-drug interactions in this population that may have negative outcomes.

TESTING LIGHT EFFECTS IN DETERMINING STOMATAL ANATOMY IN RAILROAD VINE: RELATION TO STOMATAL CONDUCTANCE AND LEAF TEMPERATURE

Vanessa Leung
Mentor(s): Eduardo Barragan
Additional Author(s): Kate McCulloh

Amphistomy (stomata on both leaf surfaces) is common in plants adapted to high-light environments, but its adaptive significance is weakly understood (Muir, 2017). Interestingly, stomata on each side of a leaf have been shown to function independently (Lawson, 2021). Railroad vine is a highly productive coastal species that inhabits Florida dunes and is amphistomatous. This project investigates how the stomatal anatomy of vines in both leaf surfaces varies with light exposure and along different sections of vines growing on Florida beaches. We collected transpiration data to evaluate transpiration-stomatal trait relationships. Stomatal imprints made are being imaged and analyzed at the McCulloh Lab to quantify stomatal density and size. Together, these measurements will clarify how variation in stomatal traits relates to railroad vine biology.

RTL DESIGN AND EVALUATION OF PSEUDORANDOM NUMBER GENERATORS

Wuzhen Li
Mentor(s): Bujji Setty

Random numbers play an important role in computing systems, supporting applications such as simulations, security, and scientific modeling. This project explores how pseudorandom number generators can be implemented and tested in digital hardware. Several algorithms are implemented using a hardware description language and evaluated through simulation. The project examines how different designs behave when translated from mathematical algorithms into practical hardware circuits. It measures practical hardware metrics such as look-up table usage in FPGA implementations, as well as path delay and estimated chip area in ASIC synthesis. The project also builds a flexible framework that allows different generators to be tested and compared in a consistent environment. This work helps demonstrate how theoretical ideas about randomness can be translated into reproducible and efficient digital designs.

INTEGRATING HEALTH LITERACY INTO ADULT ESL EDUCATION: A COMMUNITY-ENGAGED APPROACH

Amy Liang
Mentor(s): Zoua M. Vang

Immigrant communities face significant health literacy barriers, including limited English proficiency, cultural differences, lack of insurance, and fear of legal repercussions that discourage care-seeking. These barriers contribute to poorer health outcomes, including higher hospitalization rates, inadequate chronic disease management, and low engagement in preventive care. In partnership with Literacy Network, this community-engaged project integrates health literacy lesson plans into adult ESL classes to address these challenges within existing educational spaces. The curriculum emphasizes practical skills such as understanding medical instructions, navigating insurance terminology, scheduling appointments, and interpreting health forms. By incorporating health literacy into regular English classes, this project shows how adult education can help immigrant learners better understand and navigate the healthcare system.

NAVIGATING BARRIERS AND SUPPORTS FOR DAILY LIFE PARTICIPATION AMONG CHILDHOOD CANCER SURVIVORS: A SCOPING REVIEW

Amy Liang
Mentor(s): Karla Ausderau, Sabrina Kabakov

Advances in pediatric oncology have produced a growing population of childhood cancer survivors with complex long-term needs. This scoping review applied the ICF-Children and Youth Version (ICF-CY) Model to synthesize research on barriers and facilitators shaping survivors' participation in early survivorship. Four databases were searched, yielding 4,724 records; following independent team screening against inclusion and exclusion criteria, 38 articles met criteria. Findings indicate that participation and activity are significantly impacted by body structures/function, environment, and personal factors. Barriers including late effects, stigma, and inaccessible environments interact with facilitators—such as parental, peer, provider, school, community, and self-management supports—to shape survivors' engagement in daily life, relationships, school, work, and play.

INVESTIGATION OF THE MOLECULAR MECHANISM OF VIRAL INHIBITION BY RECEPTOR DECOYS

Siyun Liang
Mentor(s): Duo Xu

The COVID-19 pandemic caused by SARS-CoV-2 has led to a major global health crisis. Beyond SARS-CoV-2, there is an urgent need to develop broadly effective therapeutics against betacoronaviruses with pandemic potential. To address this challenge, our lab has designed multivalent receptor decoys based on the human angiotensin-converting enzyme 2 (ACE2), the host receptor for diverse betacoronaviruses, including SARS-CoV-2. In preliminary studies, we showed that the increase in ACE2 valency translated into continuously enhanced viral neutralization potency. I hypothesize that this enhanced potency could be attributed to crosslinking of multiple viral spike proteins mediated by multivalent ACE2. This proposal aims to biochemically and structurally characterize the complex formation between multivalent ACE2 and spike proteins to provide mechanistic insights into how valency impacts viral neutralization activity. These investigations will also inform strategies for future design of antiviral inhibitors.

OOCYTE-DERIVED RAC1 IS DISPENSABLE FOR FERTILITY

Jonathan Lim
Mentor(s): Cora Thompson
Additional Author(s): Joan S. Jorgensen

The ovarian reserve, defined by the primordial follicle pool at birth, determines female reproductive lifespan. Rho GTPases have been shown to regulate essential processes for follicle formation; however, the specific role of Rac1 in oocytes is still unclear. We hypothesized that oocyte-specific Rac1 loss reduces fertility. Using a conditional knockout mouse model (Rac1cKO) driven by Stra8-Cre, we found no differences in litter frequency or size compared to wild-type controls. Ovarian histology across developmental stages appeared normal. Transcriptomic analysis confirmed Rac1 downregulation in postnatal ovaries and revealed 311 upregulated, including Rac2, and 16 downregulated genes in Rac1cKO samples at birth. Despite these molecular changes, oocyte-specific deletion of Rac1 did not impair fertility, indicating that this Rho GTPase is not essential in oocytes for reproductive success.

DIFFERENCES IN PSYCHOPHYSIOLOGICAL RESPONSES DURING EMOTION REGULATION IN ADOLESCENTS WITH AND WITHOUT INTERNALIZING DISORDERS

Brian Lin
Mentor(s): Galit Karpov

Individuals with internalizing disorders (ID; e.g. anxiety, depression) characteristically have difficulty regulating emotions, a symptom associated with heightened psychophysiological responses. However, these responses are poorly understood in adolescents. To address this, skin conductance responses (SCRs) were recorded during an emotion regulation task from youth with ID (n = 62) and without (n = 70). Participants also completed surveys to report their emotion dysregulation in their day-to-day life. We hypothesized that ID-youth would have greater SCRs and greater self-reported emotion regulation difficulties. Although the results showed that SCRs did not differentiate between groups, day-to-day difficulties in emotion regulation were greater in ID-youth. Therefore, ID-youth have the ability to regulate their emotions in a controlled environment, and interventions can provide techniques to generalize this ability to everyday scenarios.

DEFINING CRITICAL PERIODS FOR FMRP RESTORATION USING FRAGILE X SYNDROME MOUSE MODEL

Charles Lipscomb
Mentor(s): Xinyu Zhao, Zhiyan Xu

Fragile X syndrome (FXS) is the most common inherited cause of intellectual disability and is caused by loss of Fragile X Messenger Ribonucleoprotein (FMRP). Individuals with FXS exhibit behavioral deficits including anxiety, impaired learning, and reduced spatial memory. Although behavioral rescue through FMRP restoration has been demonstrated in several FXS mouse models, the developmental window during which this intervention remains effective is unclear. This project aims to identify these critical periods during which restoring FMRP is sufficient to rescue FXS-associated behavioral deficits. Using a tamoxifen-inducible conditional FMRP restoration mouse model (Fmr1-cON), FMRP will be restored at multiple postnatal ages, and behavioral testing will be performed in adulthood. This study will help define when and how FMRP restoration can rescue FXS-related deficits, deciding future therapeutic strategies.

SHAPING INCLUSIVE CITIES: EXPLORING CULTURAL EQUITY IN URBAN PLANNING THROUGH CULTURAL PLANS IN THE UNITED STATES

Genesis Liriano
Mentor(s): Carolina Sarmiento

City plans guide infrastructure and public services, but cultural planning integrates arts and community values to support economic development, social cohesion, place identity, and revitalization. This project analyzes ninety cultural plans from cities nationwide to examine how social justice themes, including equity and diversity, appear in planning processes. We reviewed existing plans and searched for terms such as gentrification, crime, race, and belonging to understand how cultural development addresses inclusion. The study assesses how municipalities define and prioritize communities, revealing strengths and limitations of cultural planning as a tool for equity. By identifying what plans emphasize or overlook, this research highlights opportunities to strengthen cultural planning so it better reflects diverse community needs and voices nationwide today.

CHARACTERIZING DIFFERENCES IN STRESS TOLERANCE ACROSS ANEUPLOID STRAINS OF *SACCHAROMYCES CEREVISIAE*

Sofia Liss
Mentor(s): Audrey Gasch, Leah Escalante

Aneuploidy, the unbalanced set of chromosomes, leads to various defects and cellular stress. In humans, aneuploidy of Chromosome 21 causes Down Syndrome. *Saccharomyces cerevisiae* is an ideal model organism to observe the effects of aneuploidy, as individual chromosomes can be duplicated within genetically identical strains. This allows for observance of phenotypes caused by the general stress of aneuploidy, and chromosome-specific effects of aneuploidy. Using isogenic panels of aneuploid wild yeast strains and paired euploid controls, we aim to characterize the impact of aneuploidy on the response to different cellular stressors. We will utilize growth assays to evaluate stress resistance to varied cellular stressors. We hypothesize that *S. cerevisiae* strains with a greater predisposed tolerance to aneuploidy will be more resistant to these cellular stressors.

EXPLORING THE ROLE OF VASCULATURE IN 3D MYOTENDINOUS JUNCTION MODELING AND REGENERATION

Samuel Litzau
Mentor(s): Masatoshi Suzuki
Additional Author(s): Zhaoyun Tang

Myotendinous junctions (MTJs) are specialized interfaces that bridge tendon and skeletal muscle, necessary for force transfer and movement but commonly injured. At Suzuki Lab, we have been studying the potential of human induced pluripotent stem cells (hiPSCs) for the derivation of MTJ tissue models in order to better understand the development, damaging process, and regeneration of the MTJ. My project aims to optimize the formation of a three-dimensional (3D) co-culture model from hiPSC-derived progenitors. I formed tendon constructs from hiPSC-derived tenogenic progenitors, which I tested with mechanical stretching and continuous small molecule signaling to observe their effects on tissue maturation. Once finalized, our procedure will provide consistent and reliable modeling of MTJ injury, which is critical for developing regenerative therapies targeting damaged musculoskeletal tissues.

THE GUT BRAIN CONNECTION: EXPLORING HOW MICROBIOME DIVERSITY INFLUENCE ANXIETY AND MENTAL HEALTH IN YOUNG ADULTS

Hangjay Liu
Mentor(s): Xiujuan Jane Zhang
Additional Author(s): Hazel Bloomquist

Anxiety and depression rates have nearly doubled among young adults compared to teenagers, highlighting the need to understand contributing factors to this growing mental health concern. One potential factor is gut microbiome diversity, which influences brain function through the gut-brain axis. This study examines the relationship between gut microbiome diversity and anxiety levels in young adults. Data were compiled from a study measuring Hamilton Anxiety Rating Scale (HAMA-14) scores across three treatment groups and comparing the relative abundances of beneficial gut bacteria among these groups. We hypothesized that greater microbiome diversity would correspond with lower anxiety scores. A one-way ANOVA with a significance level of 0.01 produced a significant result ($p < 0.001$), indicating differences in anxiety scores among treatment groups, though further research is needed.

DOES CORTICOTROPIN-RELEASING FACTOR ACT IN THE MEDIODORSAL THALAMUS TO IMPAIR WORKING MEMORY

Jane Liu
Mentor(s): Craig Berridge

Corticotropin-releasing factor (CRF) neurotransmission in the prefrontal cortex (PFC) impairs working memory and sustained attention. While the mediodorsal thalamus (MDthal) receives dense CRF innervation from the dmPFC and modulates attention, its role in CRF-mediated working memory impairment remains unclear. This study investigated whether CRF acts within the lateral MDthal to influence working memory. Rats were trained in a delayed-alternation T-maze task and received bilateral intra-MDthal infusions of CRF (100ng, 250ng) or muscimol. Unlike muscimol, which significantly impaired performance ($p=0.0005$), both 100ng and 250ng CRF infusions failed to affect working memory ($p100ng\ CRF\text{-}bAECF = 0.9971$; $p250ng\ CRF\text{-}bAECF = 0.2711$). These results indicate that MDthal CRF signaling does not modulate working memory, suggesting a functional dissociation in how dmPFC CRF circuits regulate working memory and sustained attention.

COVALENT ADAPTABLE NETWORKS: BUILDING THE NEXT GENERATION OF RECYCLABLE PLASTICS

Leo Liu
Mentor(s): Padma Gopalan, Sheng Wang
Additional Author(s): Ri Chen, Maryam Al Jawad

Our research focuses on creating new, more sustainable plastics that can be reshaped, repaired, and recycled instead of ending up in landfills. Traditional plastics are made with permanent chemical bonds that make them difficult to reuse once they are formed. In contrast, we are developing a new kind of recyclable plastic called a Covalent Adaptable Network (CAN), which has special bonds that can be rearranged when heated—allowing the material to be reprocessed without losing its strength or quality. In our project, we discovered a simple and efficient way to make these CANs using a one-step chemical process. This method allows us to combine common plastic components with special recyclable ones, forming a strong and durable material similar to everyday plastics like acrylic (PMMA). Our results show that this new material not only resists deformation and heat better than regular plastics but can also be reprocessed multiple times while keeping its toughness. Ultimately, this research helps advance recyclable materials and supports Wisconsin's goals in sustainable manufacturing and environmental protection by reducing plastic waste and promoting innovation in materials science.

ASSESSING AGREEMENT OF TUMOR DIAMETERS IN CLEAR CELL RCC BETWEEN PATHOLOGISTS AND CT-BASED 3D SEGMENTATIONS

Wylie Liu
Mentor(s): Andrew Wentland
Additional Author(s): Hongkun Yu, Lu Mao, Naveedul Ansari, Paige Zuber

Staging of clear cell renal cell carcinoma (ccRCC) depends significantly on tumor size. This study compares pathologist-measured tumor diameters with measurements from CT-based 3D segmentations across T1a and T1b tumors. Segmentation-based diameters (mean = 4.86±2.01cm) were significantly larger than those recorded by pathologists (mean = 3.69±1.52 cm, $p < 0.001$). Bland-Altman analysis revealed a systematic bias of +26.97%. These discrepancies led to segmentation-based upstaging in 14% of T1a and 32% of T1b tumors. Pathologist-based measurements may be limited by the lack of perfusion in excised tissue, whereas 3D segmentations provide an in vivo view unrestricted by measurement planes. These findings suggest that CT-based 3D segmentation consistently yields larger measurements, indicating that size thresholds in tumor staging may need reconsideration.

OBLIQUE AND ORTHOGONAL MEASUREMENTS YIELD EQUIVALENT RENAL TUMOR VOLUME ESTIMATES COMPARED WITH 3D SEGMENTATION

Wylie Liu
Mentor(s): Andrew Wentland
Additional Author(s): Hongkun Yu, Lu Mao, Naveedul Ansari, Paige Zuber

Variability exists in how radiologists perform three-axis measurements of renal masses, often alternating between orthogonal (on-axis) and obliqued orientations. This study compares ellipsoid-derived volumes from both measurement strategies against gold-standard 3D segmentations in 50 patients with T1a clear cell renal cell carcinoma. Results showed no significant differences between 3D segmentation (10.8 ± 7.9mL), orthogonal(11.0 ± 7.3mL), or oblique (10.8 ± 7.4mL) volumes. Error analysis demonstrated that measurement accuracy was independent of tumor obliquity. Although power analysis indicated extremely large cohorts would be needed to find statistical differences, the current findings suggest clinical equivalence. Consequently, the simpler, more objective orthogonal technique is a reliable alternative to time-consuming 3D segmentation for routine clinical practice.

MULTI-METHOD AGE DATING OF TEMPERATE SUPER-EARTHS

Yihan (Ashley) Liu
Mentor(s): Melinda Soares-Furtado

Super-Earths are the most abundant type of planet in our Galaxy, representing a significant fraction of potentially habitable worlds. Their extended atmospheres facilitate detection by instruments such as the James Webb Space Telescope, making spectral features linked to habitability observable. Age is a crucial prior for evaluating habitability, as planets must be mature enough for complex life to emerge. Without accurate age estimates, identifying the most promising targets for life is impossible. This project will systematically determine stellar ages for all known temperate-zone Super-Earths using complementary approaches, including isochronal modeling, gyrochronology, and lithium abundance measurements. These multi-method age constraints will identify a population of Super-Earths that are old enough to potentially harbor life, identifying high-priority targets for future atmospheric characterization with NASA's Habitable Worlds Observatory.

MECHANISTIC STUDY OF BET AND CDK9 INHIBITION IN A PATIENT DERIVED PANCREATIC ORGANOID

Sasha Livingwell
Mentor(s): Jeremy Kratz, Paulina Esguerra

Pancreatic ductal adenocarcinoma (PDAC) is an aggressive cancer with limited treatment options. Many PDAC tumors depend on oncogenic proteins such as c-MYC and MCL-1. Transcriptional elongation is regulated by the BRD4-CDK9 axis, in which BRD4 recruits CDK9 to phosphorylate RNA Polymerase II at Ser2. This study examined whether dual inhibition of BRD4 and CDK9 suppressed c-MYC and MCL-1 expression better than single inhibition in patient-derived Pan-38 organoids. Organoids were treated for 24 hours with control, ZEN2694, SLS009, or combination. c-MYC, MCL-1, total RNA Polymerase II, and Ser2/Ser5 phosphorylation were assessed by Western blot. Combined inhibition nearly eliminated RNA Polymerase II Ser2 phosphorylation and substantially reduced c-MYC and MCL-1 expression, indicating stronger disruption of transcriptional elongation and oncogenic protein production than either inhibitor alone.

IDENTIFYING DIETARY CALORIC SOURCES IN A CROSS-SPECIES ANALYSIS OF NONHUMAN PRIMATES: RHESUS MACAQUES VS. COMMON MARMOSETS (*MACACA MULATTA* VS. *CALLITHRIX JACCHUS*)

Diana Lopez Fuentes, Adeline Sinatra, Tristin Chapman
Mentor(s): Peter Pierre
Additional Author(s): Victoria Alemayehu

The purpose of this study is to identify and evaluate the caloric contribution from available dietary sources of captive nonhuman primates, comparing rhesus macaques and common marmosets. Identifying excess caloric contributors is vital, as increased weight gain is linked to adverse health outcomes for each species. This study will pinpoint and quantify calories from four primary sources: chow, food enrichment, daily produce, and food presented with treatments. Using standardized weighing, caloric conversion, and institutional dietary records, the project will find the relative contribution of each source to determine total caloric intake across both species. By identifying the major caloric contributors, this research aims to improve feeding management practices, support healthier weight regulation, and enhance nonhuman primate welfare, thereby guiding more conscious and balanced enrichment strategies.

PROGRAMMABLE DNA ARCHITECTURES FOR ENHANCED SYNERGISTIC CATALYSIS

Mia Lor
Mentor(s): Jeffrey Martell, Ethan Hartman

This study investigates multiple DNA architectures that vary in geometry, linker attachment length, and catalyst stoichiometry to accelerate the rate of Cu-TEMPO oxidation and advance the development of a functional "DNAzyme." Using 2,2' bipyridine (BPY) as a copper ligand and a TEMPO nitroxyl catalyst attached to a DNA–with free-floating copper in solution–I evaluated the duplex, three-strand system, and tetrahedra DNA geometries. For the duplex and three-strand system, several different linker lengths were tested, while the three-strand system and tetrahedra were examined under different catalyst stoichiometries. These results showed significantly higher yields with certain DNA scaffolds compared to free-floating catalyst systems. Through these experiments, we better understand how these factors influence the rate acceleration of the Cu-TEMPO catalyst system, which allows us to develop better future scaffolds for this system.

WHY HIGH SCHOOL STUDENTS SEEK PSYCHOLOGICAL HELP: A CASE STUDY IN MEXICO CITY

Alondra Lorenzana
Mentor(s): Ximena Ibinarriaga Soltero

This study examines the reasons students seek psychological support in a public high school in Mexico City that offers mindfulness-based services led by three school psychologists. Using thematic analysis, we examined 100 intake entries from students aged 15-18 seeking support in the school for the first time in 2025. Students reported diverse concerns, including academic challenges such as low performance, stress, and being worried about their grades; emotional difficulties; and mental health issues like anxiety and depression. They also described social problems involving peers, friends, family, and romantic partners. Finally, a smaller group reported adverse experiences, including violence or the loss of a close family member. Identifying these varied needs is essential for improving the school's psychological and mindfulness-based support.

THE LINK BETWEEN CODE-SWITCHING AND INHIBITORY CONTROL IN BILINGUAL CHILDREN

Leanne Low
Mentor(s): Margarita Kaushanskaya
Additional Author(s): Emily Bagan

Previous studies on bilingualism have established a relationship between code-switching abilities and inhibitory control. We examine the association between frequency of code-switching and inhibitory control skills in bilingual English-Spanish and English-Mandarin speaking children between the ages of 4-6, while considering dual language proficiency as a possible factor of influence. Children and their caregivers completed a semi-structured play interaction using a digital platform. We coded parent-child interactions for frequency of code-switching. Children also completed a non-verbal Flanker task to index inhibitory control. We hypothesize that children with higher levels of inhibitory control will produce more code-switches, and that balanced language proficiency levels will boost this advantage. Possible differences between language groups will also be considered.

EVALUATION OF PEGYLATED AND UNMODIFIED FIBRONECTIN-TARGETING PEPTIDE FOR PET IMAGING OF ACTIVE LUNG FIBROSIS

Samantha Lu
Mentor(s): Ksenija Bernau
Additional Author(s): Abram Bell, Thomas Harr, Madalyn Osterhaus, Yadira Medina-Guevara, Maryam Kianpour, Angie T. Oler, Ashley Weichmann, Jenna Steiner, Jonathan Engle, Glen Kwon, Reinier Hernandez

Idiopathic pulmonary fibrosis causes progressive lung scarring that limits pulmonary function and is characterized by upregulation of extracellular matrix proteins, including fibronectin. Currently, clinicians lack noninvasive tools to monitor disease activity in real-time. By radiolabeling a fibronectin-binding polypeptide, FUD, disease progression can be monitored using PET imaging. Stability can be increased by adding a polyethylene glycol chain (PEG). To evaluate whether PEGylation improves imaging and pharmacokinetics, we compared [64Cu]-FUD to [64Cu]-PEG-FUD in a bleomycin-induced fibrosis mouse model. Mice were imaged at 1, 4, 12, and 24 hours, followed by organ biodistribution measurements. FUD showed a longer half-life but underwent faster renal clearance. Since PEG-FUD showed greater initial lung uptake with previous evidence of improved stability, it appears more suitable for imaging active fibrosis.

IMPACT OF GRAPE SEED EXTRACT ON FLAVOR AND FUNCTIONALITY OF PEA PROTEIN EXTRUDATES AND PATTIES

Wendy Lu
Mentor(s): Lily Lincoln, Audrey Girard

Increasing consumer demands for plant-based proteins has intensified the need to mitigate off-flavors produced by the Maillard reaction and lipid oxidation. This study examined how grape seed extract (GSE), a proanthocyanidin-rich polyphenol source, modulates these pathways when added pre- or post-extrusion at 0.02% and 1% (w/w) in pea extrudates and meat analogue patties. Pre-extrusion GSE reduced Maillard-derived browning products by 40%, consistent with polyphenol–amine interactions during protein unfolding. Post-extrusion GSE more effectively suppressed lipid oxidation, lowering primary and secondary oxidation products by 53% and 19%, respectively, while significantly increasing antioxidant capacity. Sensory evaluation confirmed that astringency did not increase with GSE. These results indicate that strategically timed polyphenol addition may offer a practical and sustainable route to improving flavor quality in plant-based alternatives.

ESTIMATING POWER OUTPUT OF UW NUCLEAR REACTOR THROUGH EMITTED CHERENKOV RADIATION

Jax Luedke, Penelope Takizawa-Soper, Espen Wellner, Gabriel Ruffolo, Hermione Celestain, Tavin Koenig
Mentor(s): Charlie Hirst

While nuclear reactors are active, they give off a signature blue color defined as Cherenkov Radiation. The amount of this light given off can be used to calculate the energy output of the reactor. We plan to create a device which can be lowered into the water of the UW Nuclear reactor and detect the Cherenkov radiation light emission, then use the data to create a linear graph which relates the intensity of the light with the power output of the reactor. This will allow us to estimate the power output of a randomly given amount of light given out by the reactor, providing the UWNR with an additional method of determining reactor power.

EQUITABLE URBAN AND ENVIRONMENTAL PLANNING PRACTICES RELATED TO URBAN GREENERY IN DALLAS AND HOUSTON

Cornelius Luong
Mentor(s): Miriam Bartleson, Aslıgül Göçmen
Additional Author(s): Miriam Bartleson, Aslıgül Göçmen

Explicitly discriminatory housing practices in the Urban American South left a legacy of segregation, continuing to deprive marginalized communities of basic trees and parks. As equity becomes increasingly central to planning discussions, urban planning has the potential to address urban greenery inequities. This project aims to answer the question: To what extent do current policies operationalize distributional, procedural, and recognitional justice in the two largest cities in Texas? Are there differences in development, Dallas' corporate oligarchy and Houston's free-market, reflected in their plans? We evaluate each city's open space and urban forestry plans, scoring them on their inclusion of environmental justice efforts. These scores help identify weaknesses in how Texas planners approach environmental justice and dismantling of systemic inequality.

COGNITIVE EFFECTS ON AUDITORY NEURAL PROCESSING OF SPEECH SOUNDS IN ADULTS WHO STUTTER

Kayannah Luther, Kaelyn Chmiel, Alexis Muntean-Hapa
Mentor(s): Dhatri Devaraju, Nike Gnanateja

Stuttering is associated with multiple mechanisms involving both speech production and perception. Speech perception requires working memory and phonological processing which is known to be affected in adults who stutter (AWS). We aim to study how speech and phonological processing are affected by cognitive demands using a battery of behavioral and neural measures in AWS. Participants will undergo electroencephalography during a task that requires working memory and phonological processing. The preliminary results on how these processes interact in AWS will be discussed. We expect there to be differences in the neural patterns reflecting the behavioral scores for AWS when compared to adults who do not stutter. Ultimately, our findings will aid in understanding the development of different processes in persistent stuttering.

DIETARY PROTEIN RESTRICTION REDUCES BRAIN PLAQUE AND TAU BUILDUP AND IMPROVES MEMORY IN ALZHEIMER'S DISEASE MURINE MODEL

Joseph Lux
Mentor(s): Fan Xiao
Additional Author(s): Zhaoyang Xiang, Reji Babygirija

Alzheimer's disease (AD) is a neurodegenerative disease without many effective treatments. Protein restriction (PR) offers health benefits in metabolism and longevity. Babygirija et al. (2024) investigated how PR would slow early onset AD pathology and improve cognitive outcomes. Male and female 3xTg-AD and nontransgenic mice were fed either a control diet (21% protein) or a PR diet (7% protein) and underwent behavioral performance and histobiochemical analyses. PR was shown to reduce Aβ density and p-tau/tau, as well as activate autophagy (lowered p61). PR mice survived longer and had improved memory compared to controls. These findings demonstrate PR as an effective regulator of mTORC1 and strategy to reduce AD neuropathology in murine models, opening avenues for therapeutics for slowing AD progression.

PRIVATE PROPERTY BENEATH THE FRUITED PLAIN: THE COLD WAR MINUTEMAN MISSILE PROGRAM AND MILITARY USE OF EMINENT DOMAIN ON TRIBAL AND SETTLED LAND

Arwen Lyons
Mentor(s): Allison Powers Useche, Richard Keyser

In 1959, the Minuteman Missile program began as a Cold War nuclear deterrence initiative. At its peak the Great Plains housed 1,000 underground active ICBMs; 450 remain active today. The siting of these missiles on private farms and tribal lands brings together questions about property rights, militarism, and Cold War historical perspectives. This project asks: How does an examination of the Minuteman Missile program through the lenses of eminent domain and land use inform our understandings of militarization, patriotism, tribal sovereignty, and private property rights in the Great Plains? Combining legal and historical questions about property, patriotism and Cold War militarism is critical for understanding our past and laying the groundwork for future intersectional alliances regarding environmental protection and property rights around nuclear deterrence programs.

INVESTIGATING METABOLIC DYSFUNCTION AND NEUROINFLAMMATION IN AN IPSC-DERIVED CO-CULTURE MODEL OF DOWN SYNDROME

Shawn MacGregor
Mentor(s): Anita Bhattacharyya
Additional Author(s): Nithin Raj Senthil Raj, Jarehlyn Camacho-Mojica, Nicole R. West

Basal forebrain cholinergic neurons (BFCNs) are critical for learning and memory and degenerate early in Down syndrome (DS, T21). To explore potential mechanisms leading to BFCN degeneration in DS, we performed RNA sequencing of human post-mortem basal forebrain tissue. Analysis suggested dysregulated metabolism in DS, causing us to hypothesize that DS basal forebrain cells are experiencing increased reactive oxygen species leading to degeneration. To investigate basal forebrain metabolism, we are using an induced pluripotent stem cell (iPSC) model of BFCNs to assay differential metabolism in T21. Next, we will co-culture BFCNs with glia to identify effects of BFCN oxidation on astrocyte reactivity and microglial activation, phenotypes of the DS basal forebrain. Results could inform therapeutics to delay DS BFCN degeneration.

EXPLORING MORPHOLOGICAL AND STRUCTURAL PROPERTIES IN 2D METAL HALIDE PEROVSKITES

Austin MacIntyre
Mentor(s): Rich Botzoc
Additional Author(s): Willa Mihalyi-Koch, Song Jin

Understanding the complex interplay between crystal structure and morphology in hybrid organic-inorganic 2D perovskites is increasing important due to their technological relevance as next-generation semiconductors for optoelectronics and photovoltaics. In 2D perovskites, alloying chiral organic spacer cations can lead to various morphologies ranging from nanowires to screw-dislocation-driven spirals grown via 'floating growth'. These spirals also exhibit handedness bias at the dislocation core, suggesting coupling between molecular chirality and macroscale crystal growth. Furthermore, ferroelectric 2D perovskites phases have been demonstrated to grow via floating growth. Preliminary observations of known ferroelectric phases show plate-like morphologies that rapidly "click" together in close proximity. Besides floating growth, additional studies investigate the structural interplay with asymmetric cyclic-alkenes spacer cations to develop novel ferroelectrics. Crystallographic and morphological characterization using X-ray diffraction, optical microscopy, atomic force microscopy, and spectroscopy provide insight into how symmetry, chirality, and ferroelectricity influence structure and crystallization.

PERFORMANCE OF NONLINEAR ENERGY DIFFERENCE RATIO AND VOICE TYPE COMPONENT PROFILE ACROSS PHONEME, RELATIVE SOUND PRESSURE LEVEL, AND ENVIRONMENT

Ashvath Madhushankar, Kelly Shih
Mentor(s): Jack J. Jiang
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Nonlinear energy difference ratio (NEDR) and voice type component profile (VTCP) are acoustic metrics for voice classification, but their performance under varying vocal intensities, phonemes, and recording environments remains unclear. Thirty-one normophonic adults produced sustained vowels (/a/, /i/, /u/) and fricatives (/s/, /z/) at five sound pressure levels (very soft–very loud). /a/ was recorded in sound-attenuated and noise-masked settings. Trimmed 0.75s samples were analyzed in MATLAB to compute NEDR and VTCP. Repeated-measures ANOVA evaluated effects of intensity, sound type, and environment. NEDR remained stable except during very soft phonation and /s/. VTCP was more sensitive, misclassifying healthy voices at low intensities and in noise. NEDR showed greater robustness, supporting clinical and telepractice use, though caution is needed at very low intensities and voiceless fricatives.

PERSONALIZING LLM-GENERATED CONTINUING CARE SUPPORT MESSAGING FOR ALCOHOL USE DISORDER

Colin Maggard
Mentor(s): John Curtin
Additional Author(s): Claire E. Punturieri

Alcohol use disorder is a chronic relapsing condition. Clinician-delivered continuing-care can reduce relapse rates, yet it can be costly or even unavailable. Digital therapeutics (DTx) that use AI to identify lapse risks and recommend supports are now emerging as adjuncts to clinician-delivered care. These DTx communicate with patients through daily supportive messages generated by large language models (LLM). However, message tone may be important for engagement and outcomes. In this panel study, we evaluated participant helpfulness ratings for specific LLM generated supportive messages written in varying tones. We also tested if participants' message helpfulness ratings could be predicted from participant demographics and their baseline tone preferences. We use these results to recommend how DTx message tone can be personalized to optimize engagement and clinical outcomes.

PREVALENCE OF PREECLAMPSIA IN A HIGH-ALTITUDE ENVIRONMENT IN ECUADOR

Audrey Mah
Mentor(s): Dachuan Wang
Additional Author(s): Lauren Leiker

Preventive healthcare is fundamental to promoting health-equity. Preeclampsia remains a leading cause of maternal and fetal mortality rates. High altitude exposure is overlooked in maternal health research. This study investigates the relationship between high altitude environments and the prevalence of preeclampsia rates in Ecuador. An elevation above 3500 meters exposes pregnant individuals to reducing oxygen availability. Using a population-based set of over 400,000 births from 2015-2017, results showed a statistically significant association between higher altitude and increased rates of preeclampsia. The adjusted odds ratios suggest that women living above 3500 meters were 2.4 times more likely to develop preeclampsia. This research emphasizes the need for access to preventive measures for the advancement of healthy equity in high-altitude regions.

THYROAID

Tahmid Mahbub, Ibrahim Ahmadli
Mentor(s): Alan B McMillan
Additional Author(s): Anusha Talwalkar, Courtney Balentine

Thyroid cancer survivors frequently face challenges during survivorship fatigue, voice and swallow changes, and long-term hormone management; yet clinical time constraints limit physician counseling. To address this gap, we validated a large language model (LLM)-based chatbot designed to provide supportive, on-demand survivorship education. Physicians contributed commonly asked patient questions, rephrased into 177 queries with verified physician-level answers serving as a reference dataset. Six LLMs (GPT-4o, GPT-4o-mini, GPT-5-mini, GPT-5-nano, Gemini-2.5-Flash, Gemini-2.5-Flash-Lite) were evaluated using BLEU, ROUGE, and LLM-as-a-judge metrics. GPT-5-mini achieved the highest overall LLM-as-a-judge score (9.05/10), while Gemini-2.5-Flash led in lexical overlap. GPT-4o-mini performed lowest across all metrics. GPT-5-mini was selected as the optimal model for correctness, safety, and completeness. Future work will incorporate Retrieval-Augmented Generation (RAG) to enhance clinical performance.

THE EXPRESSION OF CHROMOSOME 19 MICRORNA CLUSTER (C19MC) MICRORNAS FOLLOWING THE KNOCKOUT OF THE PROPOSED REGULATORY REGION

Katherine Mahieu
Mentor(s): Jenna Schmidt, Michelle Koenig

Abnormal placental development contributes to serious pregnancy complications such as preeclampsia and fetal growth restriction. Aberrant placental microRNA (miRNA) expression in the primate-specific chromosome 19 microRNA cluster (C19MC) has been associated with these complications. Differentially methylated region 1 (DMR1) is a proposed regulatory region upstream of the C19MC, but its impact on C19MC miRNA expression is unknown. CRISPR-Cas9 mediated deletion of this region in macaque trophoblast stem cells (TSCs) provides an in vitro model to test this relationship. The objective of this study was to compare C19MC miRNA expression in DMR1-knockout TSCs and wild type TSC lines using quantitative real-time PCR. The outcomes of this study provide insight into the regulatory role of DMR1 on C19MC expression.

EVALUATING FREQUENCY LOWERING ALGORITHMS IN HEARING AIDS

Vijay Mahimtura, Ryan Noori
Mentor(s): G. Nike Gnanateja
Additional Author(s): Kayden Keeney, Jillian Fisher, Dhatri Sadholalu Devaraju

Hearing aids are often thought to simply amplify audible frequencies, but modern hearing devices also include frequency-lowering algorithms that shift high-frequency cues into lower, more audible regions of the cochlea. At the Speech Processing and Auditory Neuroscience Lab, we evaluate whether frequency lowering empirically improves speech processing for hearing-aid users. We combine psychoacoustic speech-identification tasks with noninvasive EEG measures that track acoustic and linguistic encoding, and compare each listener's performance with Phonak Target Frequency Lowering on and off. The aim is to find out when, for whom, and to what extent frequency lowering is beneficial. By defining the conditions under which current technology helps or fails to help, we support evidence-based hearing-aid fitting and guide future signal-processing designs that target real, quantifiable improvements for listeners.

SIMULATING MUON IONIZATION COOLING FOR FUTURE MUON COLLIDERS

Justin Maina
Mentor(s): Matthew Herndon

Muons, charged particles that are heavier than electrons, can be useful for achieving teraelectron volt energy levels and for enabling more precise measurements of other fundamental particles. However, a significant obstacle in creating muon collisions is their microsecond lifetime, which is too short to allow quality collisions. Ionization cooling enables high-quality beam manipulation within the muon's short lifetime, allowing high-energy collisions. For my research, I will analyze how the designed ionization cooling system for a future muon collider will affect parameters such as emittance, momentum, and the position of muons moving through the cooling system by creating simulations through a software called G4Beamline. Research in muon colliders and accelerators can have applications such as muon tomography for noninvasive imaging and future possibilities in cancer treatment.

PATIENT PERCEPTIONS OF AND COMMUNICATION PREFERENCES FOR THE USE OF ARTIFICIAL INTELLIGENCE IN THEIR EMERGENCY DEPARTMENT CARE

Lydia H. Malen
Mentor(s): Hanna Barton

Patients' perspectives regarding clinical AI need to be understood because they are key to developing systems that are trustworthy and accepted. We aimed to understand patient perceptions of and communication preferences for the use of AI in emergency department (ED) care. We interviewed 27 participants and presented each participant with three use cases where AI could be deployed in their care. (1) Monitoring sepsis and ordering antibiotics, (2) generating discharge summaries, and (3) reading radiology scans. We extracted emerging themes by performing structural coding, affinity diagramming, and thematic coding. We identified patient values and communication preferences. These findings can be used to inform the development of AI-enabled work systems that honor patients' values thereby promoting trust and acceptance in complex work systems like the ED.

SHAKING CAMP RANDALL STADIUM: A VIBRATIONAL ANALYSIS

Akesh Mallia
Mentor(s): Thomas Breunung

"Jump Around" is an infamous tradition at Camp Randall Stadium that can cause noticeable vibrations throughout the bleachers. The stadium's precise shape in response to these oscillations remains unknown. Previous tests in stadiums use accelerometers attached to points in the stadium. In this approach, data is only acquired at certain structural members in the stadium, and hypothetical cases cannot be tested. Instead, this study tests a 3D printed model of the stadium on a shaker table. The printed model's behavior is compared to data collected through cell phone accelerometers in the stadium during a football game. This project aims to use data processing to reveal the stadium's natural frequencies and mode shapes, improving knowledge of how Camp Randall Stadium responds to human-induced vibrations.

BUCKY'S CLASSROOM, PROMOTING HIGHER EDUCATION TO YOUNG WISCONSIN MINDS

Mallory Malvitz, Ryan Kopp
Mentor(s): Fran Puleo Moyer

The Bucky's Classroom visit program pairs approximately 40 UW student ambassadors with 7th grade classrooms around Wisconsin. Ambassadors lead 60 to 90 minute sessions to share their UW experience, promote higher education, and present college planning information in a fun, interactive way. The goal of the program is to help 7th grade students build a better understanding of college both academically and socially, gain knowledge about resources to help pay for college, explore possible career options and discover the importance of establishing a strong foundation for their future, rooted in education.

This poster will share the overview, outcomes and impacts of a successful student-led outreach program:
-Who we are
-How Bucky's Classroom works
-Our goals
-Who we serve
-Our research and improvements
-Impact and outcomes

WHAT KIND OF WORDS SUPPORT EARLY MATHEMATICAL THINKING? HOW VOCABULARY, NON-SYMBOLIC RATIO PROCESSING, AND MATHEMATICAL ABILITIES CORRELATE IN YOUNG CHILDREN

Tatiana Mamalakis
Mentor(s): Percival Matthews, Sangmi Park

This study explores how language correlates with processing of non-symbolic ratios presented with various shapes in four year old children. Specifically, we distinguish between general and mathematical vocabulary to examine whether each uniquely predicts non-symbolic magnitude sensitivity, and whether they differentially predict prioritization of relative magnitude, absolute magnitude, and shape. We have five tasks in our study: general language test, mathematical language test, non-symbolic fraction matching task, non-symbolic spatial mapping task, and ratio comparison task. The ratio comparison task measures children's magnitude sensitivity whereas the fraction matching and spatial mapping task measures children's prioritization of magnitude and shape. By separating these components, this study clarifies how different forms of vocabulary (general vs mathematical) support early numeracy and ratio processing.

BOTANY GARDEN AND GREENHOUSE VOUCHERING AND CURATION PROJECT

Neo Manavalan
Mentor(s): Cara Streekstra

The UW-Madison Department of Botany Garden and Greenhouse is home to over 2000 plant taxa. The goal of this multi-year project is to obtain samples of these specimens, identify them, and compile labeled, pressed vouchers for every species, making the first complete pressed plant index of the Botany Garden and Greenhouse. Alongside this, a digital database will be made to catalog them. I've worked on creating this digital database and archiving current pressings, as well as mounting them on permanent fixtures. I've also worked on confirming the species of pressed plants by using taxonomic keys found in regional floras. These vouchers can be accessed even when out of season and can be used for genomic sequencing, gathering phenological data, and preservation.

ONE SIZE DOES NOT FIT ALL: CHALLENGING THE USE OF OVERARCHING GUIDELINES IN DATA VISUALIZATION

Aiyana Mangloña, Aayush Koirala
Mentor(s): Karen Schloss, Halle C. Braun
Additional Author(s): Arvind Satyanaraya

To help people create data visualizations (e.g., graphs, diagrams) that are easy to understand, researchers and designers have developed "guidelines" to describe the dos and don'ts of visualization design. Although guidelines can be helpful, there may be cases where following guidelines makes it harder to interpret visualizations. To test this possibility, we selected the "do not truncate the y-axis" guideline and created data visualizations that either followed or broke this rule. We presented participants with these visualizations and asked them to describe patterns they observed. Our data suggested that breaking this guideline may facilitate noticing important patterns in the data that could otherwise go undetected. These results imply that a nuanced approach to guideline use might be necessary to communicate intended messages in visualizations.

HIDDEN FIGURES: IMPROVING THE SEARCH FOR LYMAN-ALPHA EMITTERS AT LOW REDSHIFTS

Mihir Manna
Mentor(s): Amy Barger
Additional Author(s): Mace Bishop

While research on the high-redshift universe is undergoing accelerated expansion, the low-redshift universe remains relatively uncertain, as we lack a robust sample of the small, low-metallicity galaxies that dominate this phase of cosmic evolution. Among these objects are Lyman-alpha emitters (LAEs), a class of young, star-forming galaxies with strong hydrogen emission lines. In this project, we present a technique to improve the detection rate of LAEs at redshifts between $z = 0 - 1$. After identifying a group of candidate galaxies using photometric data, we conducted followup observations at the Keck Observatory in Hawaii to confirm and characterize their spectral features. Future work involves completing the current spectroscopic analysis, further followup observations, and expanding the search to other regions of sky.

EFFECT OF DISCUSSION PROMPT SCAFFOLDS ON ARGUMENTATION BY INTRODUCTORY PHYSICS STUDENTS

Mihir Manna
Mentor(s): Benjamin Spike

Students' success in physics depends not only on solving problems, but on justifying and evaluating scientific claims--a process known as argumentation. However, despite its importance, argumentation itself receives comparatively little attention in physics curriculum design. In this study, we developed a collection of worksheet problems for Physics 104 structured around the Toulmin argument pattern, a well-established framework for justifying a claim at varying degrees of sophistication. These worksheets were distributed to students throughout the semester and we measured their effect using attitude surveys, written exam problems, and semi-structured interviews. With hundreds of students enrolled in introductory physics each semester, we anticipate the final results of this study to have a meaningful impact across UW-Madison.

AN INVESTIGATION ON PITCHER PLANT ROOT AIRSPACE: *HELIAMPHORA* COMPARATIVE ROOT ANATOMY

Tyler Manzardo
Mentor(s): Joseph Walston

Roots of four species of *Heliamphora* (Sarraceniaceae) were sampled and microtomed for the observation of helophytic adaptations. *Heliamphora*, a genus of carnivorous plants, is endemic to the waterlogged and nutrient-deficient rooting conditions of the Guiana Highlands of Venezuela, Brazil, and Guyana. Cultivated species were selected based on their differing growth habits and environmental conditions. Roots from each species were sampled to look for predicted internal air-space, known as aerenchyma. Aerenchyma was found in all observed species and is hypothesized to aid in the oxidation of root tissues to counteract saturated growing conditions. Studying the unique internal anatomy of each selected *Heliamphora* species aids in the understanding of how and why carnivorous plants have adapted their roots for functions other than nutrient acquisition in extremophilic conditions.

NAVIGATING FATHERHOOD: HOW BLACK FATHERS DEFINE AND EXPRESS LOVE

Nabila Maow
Mentor(s): Janean Dilworth-Bart

This qualitative project uses a constructionist latent thematic analysis of 15 interviews to explore how Black men work through structural and cultural forces while navigating fatherhood. Initially grounded in Double Consciousness and Triple Quandary theories, the analysis focuses on how the fathers define love in between strength and vulnerability. Preliminary findings indicate the fathers demonstrate love through actions. Discipline, commitment to education, and continuity are especially utilized as tools for protection. Additional analyses will likely incorporate intersectional and feminist perspectives to identify further how these Black fathers express love toward their children. The project will add to the current research on Black fatherhood and emotional socialization through strength-based frameworks.

ONLINE CIVIC TRUST IN CLIMATE CHANGE INFORMATION

Avani Marahatta
Mentor(s): Jodi Schneider

Scientists and the public have very different understandings of climate change. This project analyzes research literature about climate communication online, particularly to understand the impact of AI and social media on climate communication. With the rise in usage of generative AI and social media, increased personalization of climate change information is feasible. Personalized information could contribute to public uncertainty about climate change but could also provide personalized explanations to individual citizens. My project started by looking at federal and state laws, policies, and existing research on this topic. I focus on finding common themes and subtopics in the research literature. Strengthening public understanding of climate science is essential for future climate action.

CLINICAL AND QUALITY-OF-LIFE CHARACTERIZATION OF POU4F1-RELATED CHILDHOOD ONSET ATAXIA

Lia Margolin
Mentor(s): Bryn Webb
Additional Author(s): Sophia Salemi

POU4F1 is a gene that is involved with nerve cell development and maturity; regulating movement, balance, and coordination. De novo, heterozygous variants in POU4F1 have recently been associated with POU4F1-related childhood-onset ataxia, an ultra-rare disorder characterized by ataxia, intention tremor, and hypotonia. To further characterize the symptoms, onset, and progression of the disorder, we analyzed clinical and quality of life data from 14 individuals with pathogenic or likely pathogenic variants in POU4F1; expanding on the only 4 cases previously described. Our aim is to expand on the relationship between POU4F1 mutations, the resulting physical characteristics, and direct impact on patients' quality of life. This study is the essential, preliminary step for future clinical trials, treatments, and management recommendations.

ASSESSING GUT MICROBIOME DIVERSITY AND COMPOSITION IN ASTHMA AND DEPRESSION

Ellise Markevitch
Mentor(s): Melissa Rosenkranz, Estelle Higgins, Margaret Thairu
Additional Author(s): Jo Handelsman, Richard J. Davidson, Simon Goldberg

Depression is a leading cause of disability, and asthma is a highly prevalent chronic inflammatory disease. The mechanisms driving these diseases are not completely understood, particularly around their co-occurrence. The gut microbiome has emerged as one system that may link peripheral immune and central nervous system function. To investigate this, I explored differences in gut microbiome diversity and composition between individuals with only asthma, only depressive symptoms, and both asthma and depressive symptoms. I found differences in alpha diversity metrics between groups. Additionally, using ANCOM-BC, I identified bacterial taxa that were differentially abundant in those with both asthma and depressive symptoms compared to those with one condition. These results suggest that the gut microbiome may play a role in the comorbidity of asthma and depression.

HOW DO STUDENTS NEGOTIATE AI USAGE IN THEIR COURSES?

Chloe Marquette
Mentor(s): Brie Bradshaw, Ryan Stowe

With the release of large language models such as ChatGPT, concerns about undergraduate AI use in courses have grown. While instructors have adjusted course policies in response, less attention has been given to how students themselves decide whether to use AI. This study explores how messaging from instructors, peers, and broader academic and social contexts shapes students' decisions about AI use. We conducted interviews with five students enrolled in a first-semester organic chemistry course to understand the messages they encounter and how they interpret them. Findings describe messaging sources salient to students which can inform instructional practices. Insight into students' decision-making can help instructors develop a more complete understanding of students and inform more intentional and transparent instructional approaches to AI use in education.

CONDITION-DEPENDENT CHANGES IN DISPROPORTIONATING ENZYME 2 ACTIVITY ACROSS STORAGE TREATMENTS

Lorelei Martin
Mentor(s): Marcus Vinje

Disproportionating Enzyme 2 (DPE2) plays a key role in leaf starch metabolism by transferring one glucose from maltose onto longer glucan chains. In this project, I measured activity in freshly thawed DPE2 enzyme samples and in samples stored either through repeated freeze thaw cycles or short term refrigeration. Using enzyme assays, I tracked how activity changed over time, observing condition dependent differences in the rate and magnitude of those changes across storage conditions. I also compared these activity patterns to other DPE2 datasets generated in our lab to help interpret when the enzyme is most active. This work provides insight into how typical storage and handling conditions influence DPE2 activity and highlights factors that can affect consistency in enzyme assays.

JOHN NOLEN DRIVE PROJECT

Lacy Matthews
Mentor(s): Anna Bierbrauer

This interdisciplinary research project examines the ability for innovative stormwater Best Management Practices (BMPs) to provide measurable improvements in water quality, pollutant reduction, and long-term climate resilience while also supporting tree survival and canopy growth. A key part of this research project is interdisciplinary, applied learning opportunities, and working to develop more interdisciplinary teaching practices where students from multiple backgrounds can gain knowledge and skills through field-based work in stormwater infrastructure, climate resilience, and urban forestry. Students and faculty have worked together to gather data, analyze findings, and share environmental data about engineered soils, water quality and atmospheric data. This project emerged from conversations with municipal leaders and community partners who wanted to assess the impact of their work along John Nolen Drive.

CURRENT PERIPHERAL NERVE REGENERATION INTERVENTIONS AND FUNCTIONAL OUTCOMES IN LARGE ANIMAL MODELS: A SYSTEMATIC REVIEW

Haley Mayer, Genevieve Simmons, Braxton Druckrey
Mentor(s): Aaron Dingle
Additional Author(s): Abigail Cichocki, Alec Chen

Peripheral nerves in large animals share substantial similarities to humans, improving translational accuracy and patient outcomes. Thus, a systematic review was conducted on peripheral nerve regeneration interventions in large animal models. Each article was screened twice using a set of predetermined inclusion criteria relating to study design, population, intervention, comparator, and outcome measures. Of the 3534 articles identified, 93 were included for data extraction. Animal models included: canine (n=28), primate (n=25), ovine (n=25), porcine (n=14), and caprine (n=1). Lower extremity nerves made up 53.8% of studied nerves, while facial nerves were underrepresented at 11.8%. Data analysis of the interventions and outcomes is ongoing. This review will be a resource to guide future research and enhance current clinical practice.

STUDYING THE ACTIVATION OF THE INTEGRATIVE STRESS RESPONSE IN ANEUPLOID YEAST

Emma Mayhew
Mentor(s): Audrey Gasch, Rachel Kocik

Aneuploidy, an abnormal number of chromosomes, is taxing on a cell, such as an additional copy of chromosome 21 in Down Syndrome. Aneuploid yeast experience complex stresses compared to normal cells, but the mechanisms remain unclear. We discovered that this is potentially due to differences in the translation-promoting TOR network that senses amino acid starvation. The Integrative Stress Response (ISR) is a conserved pathway activated by TOR. Gcn2 kinase is activated by the ISR, resulting in phosphorylation of eIF2α and therefore decreased global translation. In starvation, aneuploid cells grow slowly; however, loss of Gcn2 ablates this phenotype. Western blots of eIF2α-P show that the ISR is active in aneuploids. These data suggest that aneuploid cells experience translational stress resulting in constitutive activation of the ISR.

CARBON DYNAMICS AND SOIL HEALTH IN ORGANIC GRAIN SYSTEMS

Rowan McCann
Mentor(s): Xia Zhu-Barker, Gloria Ambrowiak

Apparent ongoing loss of carbon in soil from sites throughout the Corn Belt (Hall et al., 2019) may complicate the function of common and economically important systems of crop management across the Midwestern United States such as corn-soybean rotation. It is known that carbon and nitrogen are two of the most essential elements involved in plant growth, and research suggests that Soil Organic Carbon stocks generally tend to diminish and nitrogen uptake is promoted when atmospheric CO2 levels are higher (J. Alonso-Serra, 2021). Using the EA-IRMS method of analyzing N and C isotope contents of soil, this study seeks to investigate possible changes in soil health in farming sites in Southwestern Wisconsin over the past 7 years and assess the results of organic farming practices.

BALANCE BOARD MATH: THE INTEGRATION OF SENSORY REGULATION AND EMBODIED COGNITION APPLIED TO MATH EDUCATION

Katie McCaskey, Sara Bannantine-Moron, Amanda Alegria
Mentor(s): Sofia Tancredi, Martha Alibali

For students to excel in mathematics, symbolic expression must be given meaning. This design-based research study extends prior work on symbol grounding and balance metaphors to investigate directly grounding math concepts in the bodily sense of balance. Students sit on rockable balance boards and explore tasks involving moving their hands over a physical number line or placing blocks in bins affixed to either side of the board to experience math relations as balance states. We conducted 16 semi/structured task-based interviews with children in grades 1-6 to explore how children came to ground the meaning of math symbols through balance and movement activities. Our findings suggest that coordinating symbolic activity with balance sensory experiences can support students in grasping key concepts in early mathematics.

UTILIZING A PARENT-MEDIATED MOBILE APPLICATION TO ENHANCE THERAPEUTIC HORSEBACK RIDING FOR AUTISTIC CHILDREN: PERCEIVED FACILITATORS AND BARRIERS

Katie McCaskey
Mentor(s): Beth Fields
Additional Author(s): Benazir Meera

Therapeutic horseback riding (THR) offers many benefits for children with autism yet often lacks generalizability to everyday activities of daily living. To enhance generalizability and to bridge gaps between structured THR sessions and home environments, a mobile application was developed. This study aimed to assess the facilitators and barriers that shape the app's implementation and adoption within THR centers and by the parents of autistic children. A qualitative descriptive case study design was employed. Results show that while participants perceive the app as being a useful tool, several barriers would limit the integration of the app into THR centers and family homes. Future research should focus on how perceived barriers can be addressed for both THR instructors and parents of autistic children.

CHAOTIC OSCILLATIONS ON TISSUE STRESS IN A LUMPED MASS VOCAL SYSTEM MODEL

Brynn McCloskey, Keagan Kautzer
Mentor(s): Jack J. Jiang
Additional Author(s): Michael Kuang

Chaotic vocal fold (VF) vibration occurs in disordered phonation, but its mechanical consequences remain poorly quantified. Using a lumped-mass bilateral VF model with healthy and polyp-affected conditions, we examined how oscillation dynamics influence tissue stress across subglottal pressures (PS) and polyp parameters. Chaotic and stable regimes were identified via bifurcation diagrams and Lyapunov exponents. In stable regimes, healthy and diseased VFs showed comparable stress amplitudes. Under chaotic conditions, diseased folds exhibited higher and more irregular stresses; upon returning to stability, stresses normalized despite elevated PS. A linear mixed-effects model showed chaos increased peak collision stress by ~1.5 kPa and amplified pressure-stress scaling. These findings implicate chaotic phonation, rather than polyp presence alone, as a primary driver of elevated mechanical loading and phonotraumatic injury.

IMPACT OF THE OVEREXPRESSION OF 3-O-FERULOYL SUCROSE FERULOYL TRANSFERASE (FSFT) ON THE DIGESTIBILITY OF *SORGHUM BICOLOR* CELL WALLS

Riley McJunkin
Mentor(s): Rebecca Smith
Additional Author(s): Patrick McGuiness

This study examined the impact of the 3-O-FERULOYL SUCROSE FERULOYL TRANSFERASE (FSFT) gene, putatively involved in forming grass cell wall cross-links, on cell wall digestibility for biofuel production. Cell wall digestibility was measured through saccharification assays, which measure the release of sugars from complex cell wall polysaccharides. Transgenic sorghum released more sugar without acid pretreatment, but less sugar than the wild type under pretreatment conditions. These results suggest that changes to the cell wall in the transgenic lines reduce the accessibility to sugars under our saccharification pretreatment compared to the wild type sorghum. To support future functional and chemical analyses, FSFT and other putative cell wall cross-linking genes are being expressed in the model plant *Arabidopsis thaliana*.

INTERPRETATION OF COLLECTION TRENDS IN THE WHEATLEY CENSUS

Caleb McKernan
Mentor(s): Jonathan Senchyne

Phillis Wheatley is a pioneering Black poet whose scholarly value has shaped conversations of freedom, race, and literature for over 250 years. While enslaved, Wheatley became the first Black American to publish a collection of poetry, Poems on Various Subjects, Religious and Moral, in 1773. The Wheatley Census is a bibliographical research and open-access digital humanities project tracing how many copies were produced, where they circulated, who owned them, and how they were read and preserved. This project analyzes geographic data captured by the census to understand the movement and date of institutional acquisition of copies of the 1773 first edition. With this information, we can offer interpretations about when, where, by whom, and why Wheatley's book was prioritized for inclusion in institutional collections.

AUTOMATING CELL CYCLE STAGE CLASSIFICATION: EVALUATION OF VISION TRANSFORMERS AND CONVOLUTIONAL NEURAL NETWORKS

Mitchell McNeal
Mentor(s): Aussie Suzuki
Additional Author(s): Madhukar Reddy Musku, Akshith Reddy Musku

Accurate identification of cell cycle stages is essential for understanding cellular processes and disease mechanisms, yet manual classification of cells is time-consuming and subjective. This project aims to automate cell cycle stage classification using machine learning, comparing the effectiveness of Vision Transformers (ViTs) and Convolutional Neural Networks (CNNs) on fluorescence microscopy images of cell nuclei. We preprocess 3D image volumes and evaluate multiple deep learning architectures for their ability to distinguish between key cell cycle phases. Our results highlight the strengths and limitations of each model type, providing insights into optimal approaches for high-throughput, objective cell cycle analysis. This work demonstrates the potential of advanced ML models to streamline and enhance quantitative cell biology research.

INDIVIDUAL EXPERIENCE BETTER PREDICTS SIMILARITY OF FUNCTIONAL CONNECTOME THAN GENDER: ANALYSIS OF ROI-TO-ROI ACTIVATION DURING FACE PROCESSING

Erin McQuillan
Mentor(s): Ivette Colon, Tim Rogers

Semantic and functional organization of the brain is highly variable between individuals, impacting behavior and neural activity. However, it is unclear whether shared characteristics such as gender identity play a significant role in determining activity patterns. Using fMRI data from a sample of women, non-binary people, and men, this project investigated the relationship between gender and neural activation patterns while viewing images of faces. Statistical analyses were used to measure differences between gender groups, as well as individual similarity regardless of gender. Results revealed that gender alone was insufficient for identifying significant between-group differences($p>0.05$), and participants were more appropriately grouped based on degree of individual similarity. This suggests that individual experience shapes the brain far more significantly than social constructs like gender.

STRESSFUL LIFE EVENTS, MOOD SYMPTOMS, AND CHALLENGING BEHAVIORS IN ADULTS WITH DOWN SYNDROME

Kaitlyn Meier
Mentor(s): Sigan Hartley

Previous work has shown relationships between stressful life events (e.g., hospitalization, familial death) and mood symptoms and challenging behaviors in adults with Down syndrome (Nevill & Benson, 2018). Using a sample of 142 individuals with Down syndrome, aged 31 to 72 years ($M = 49.68$, $SD = 6.88$), we investigated the relationship between stressful life events and changes in mood symptoms and challenging behaviors over two time points (~32 months). Initial results showed a significant relationship between death of a friend/family member and an increase in anxiety, $t(140)= -2.48$, $p = 0.01$. This highlights the importance of promoting access to coping resources and continued research on the impacts of stressful events and how they can be mitigated for individuals with Down syndrome.

HELPING OR HINDERING: THE ROLE OF CAREGIVER CHARACTERISTICS AND SCAFFOLDING ON CHILDREN'S SCIENCE LEARNING

Kaitlyn Meier
Mentor(s): Martha Alibali

Previous work has shown the importance of early science education and identifying factors that impact its quality (Junge et al., 2021). This study aimed to identify the relationships among caregiver characteristics, scaffolding, and children's learning outcomes during a science game. A sample of 27 caregiver-child pairs (M age of children = 6.9 years, SD = 1.1) were asked to play a simple card game focusing on the insect life cycle. Caregivers provided information about demographics and other characteristics (e.g., education level, science experience). Videos of gameplay were coded for caregiver scaffolding behaviors (e.g., open/closed-ended questions, emotional-motivational support), and children completed pre- and post-tests to measure learning. This study will help identify distinct caregiver characteristics and scaffolding behaviors that promote or inhibit science learning for children.

EVALUATING PEDIATRIC INTERN PROGRESS NOTES THROUGH PROBLEM-BASED CHARTING

Joshua Mello
Mentor(s): Michelle Kelly
Additional Author(s): Navin Pathak, Heidi Twedt, Jess Hunley, Stephen Douglas, Jenny Bunton, Michael Dagenais, Natalia Kot, Kristin Shadman, Laura Chen, Ann Allen, Kristin Nackers, Jessie Bethel

Objective: To evaluate whether implementation of problem-based charting (PBC) using Epic's diagnosis-aware notes functionality was associated with improved intern inpatient progress note writing efficiency.

Methods: We compared all inpatient progress notes written by first-quarter (July-September) pediatric interns in 2023-2024 (pre-PBC) and 2025 (post-PBC). T-tests assessed differences in note length and documentation time.

Results: PBC increased from 0% to 94% after implementation. Despite an increase in average note length of 1,006 characters ($p<0.001$), PBC users spent 231 fewer seconds editing per note (2,771 seconds pre vs. 2,540 post; $p=0.021$).

Conclusion: PBC implementation was associated with improved intern documentation efficiency. Future work will evaluate impacts on note quality, billing metrics and coding capture.

CHARACTERIZING NEURONAL MORPHOLOGY IN TS21 CORTICAL ORGANOIDS

Reese Mengwasser
Mentor(s): Andre Sousa
Additional Author(s): Zachary Gomez-Sanchez

Down syndrome (DS), caused by trisomy 21, is associated with alterations in neuronal development that contribute to cognitive impairment and intellectual disability, but the mechanism leading to this phenotype remains unknown. Human brain organoids derived from iPSCs provide a valuable model for studying DS neurodevelopmental. In this study, we compare the neuronal morphology between control and Ts21 cortical organoids to investigate the morphological differences that lead to the alteration in neural connectivity associated with DS. Organoids were stained with Golgi-Cox method and analyzed using light microscopy-based imaging. By examining morphological differences, this study aims to identify potential morphological alterations associated with DS neurons and provide future insight into the cellular mechanisms underlying neurodevelopmental differences to inform future studies investigating therapeutic interventions.

EARLY DETECTION OF RESPIRATORY VIRUSES THROUGH AIR SAMPLING IN A CLINICAL SETTING

Jacob Meuler
Mentor(s): Shelby O'Connor

Viruses can appear at different times based on the setting, often with no warning as to when concentrations may rise. We collected air samples from August of 2025 to February of 2026 from clinical settings as well as various school settings in the Madison area. Air sampling followed by using an RPP assay allowed us to detect influenza A, influenza B, SARS-CoV-2, and RSV from each site. We hypothesized that increasing viruses in Madison clinics may precede the typical seasonal rise in nearby schools. Continued air sampling and improved sensitivity of assays could make air sampling a valuable tool in viral detection, better informing the community about location specific risk.

DEVELOPING VASCULARIZED COLLAGEN CONSTRUCTS WITH ALIGNED FIBERS FOR MODELING DIRECTIONAL CELL MIGRATION

Danielle Meyer
Mentor(s): Adeel Ahmed, David Beebe

Within tissue, cells are surrounded by a milieu of fibrillar proteins, primarily Collagen I (COL1), the extracellular matrix (ECM). The ECM provides structural support to cells and tissue, but its physical organization also serves as a source of cell-signaling cues. In solid tumors, alignment of COL1 fibers promotes tumor cell migration to vasculature and subsequent metastasis, leading to worse outcomes. We developed a microfluidic model using soft lithography that exploits extensional flow to align fibers in a vascularized COL1 matrix. Fiber alignment was characterized using CT-FIRE. Using MDA-MB-231 cells, an epithelial breast adenocarcinoma cell line, we introduced COL1 fibers and tumor cells into a channeled microfluidic device, demonstrating clear alignment of the cells with collagen fibers.

MECHANISTIC INSIGHTS INTO THE REGULATION OF NEUROINFLAMMATION BY FATTY ACID BINDING PROTEIN 7

Matteo Meyer
Mentor(s): Mariana Pehar
Additional Author(s): Caelan Wright, Sandhya Ramachandran

Fatty Acid Binding Protein 7 (FABP7) is a lipid binding protein found primarily in astrocytes, a glial cell type in the central nervous system. It has been shown to be upregulated in neurodegenerative conditions like Alzheimer's Disease (AD), and to promote a pro-inflammatory phenotype in astrocytes. However, the mechanism underlying this effect remains to be elucidated. FABP7 regulates the trafficking of ligands to various cellular compartments, enabling the modulation of diverse signaling pathways. This project uses mutant versions of FABP7 to study how changes in the subcellular localization of FABP7 modulate the inflammatory phenotype of astrocytes. Understanding these neuroinflammatory mechanisms would improve our understanding of neurodegenerative processes and support the development of novel therapeutics for conditions ranging from traumatic brain injury to AD-dementia.

1,2-OXYAMINATION OF ALKENES THROUGH ELECTROCHEMICAL GENERATION OF A POTENT DIELECTROPHILE

Mina Meyer-Najmi
Mentor(s): Peter Verardi, Zachary Wickens

The reaction of an electrochemically generated N-phenyl phenothiazinium dication with diverse alkene substrates provides beta-sulfonium carbocations. These unusual, highly electrophilic intermediates react with acetonitrile and water to provide 1,2-aminoalcohols.

INSULIN GROWTH FACTOR 1 MODULATES INFLAMMATORY AND ANTIVIRAL RESPONSES DURING INFLUENZA A VIRUS INFECTION

Fahad Mian
Mentor(s): Amali Samarasinghe
Additional Author(s): Laura Doorley

Insulin-like growth factor (IGF)-1 is a hormone involved in cell survival, proliferation, and inflammation. Influenza A virus (IAV) infection increases IGF-1 expression in airway epithelial cells and mouse lungs, but its role in respiratory infection is unclear. We infected airway epithelial cells with IAV and measured IGF-1 and related signaling up to 48 hours post-infection. Elevated IGF-1 correlated with increased pro-inflammatory and antiviral cytokines, including IL-6, TNFα, and MX-1, compared with IGF-1–null controls. In contrast, IFNα, IFNλ, and IL-1β decreased, while IL-1α remained unchanged. These results suggest IGF-1 promotes epithelial resilience by balancing antiviral defense and tissue repair with controlled inflammation. Understanding IGF-1's role in host–virus interactions may inform future therapeutic strategies for respiratory viral disease.

A STUDY OF SERBIA-GERMANY RELATIONS: POLITICAL, ECONOMIC, AND SOCIAL DEVELOPMENTS FROM WORLD WAR II TO THE PRESENT

Suzana Micanovic
Mentor(s): Sarah Frank

Serbia and Germany have had a complex relationship dating back to the 12th century. This paper specifically examines their evolving ties from 1945 to the present. Through an analysis of political, economic, and social developments, I explore the transformation of their relations from World War II to recent dynamics. The present focus is on German relations with the former Yugoslavia and their role in the ethnic conflicts of the 1990s, along with German involvement with the Western Balkans, particularly Serbia, since then. Preliminary findings demonstrate that although formal military occupation of the former Yugoslavia ended following WWII, Germany continues to manipulate Serbia through economic and political strategies, representing a more modern, subversive form of control.

EVALUATION OF CLINICALLY-RELEVANT, ULTRASOUND-BASED TOOL FOR MEASURING SOFT TISSUE TENSION

Madelyn Mickiewicz
Mentor(s): Joshua Roth, Connor Cunningham

Ligament tension is critical to joint function, yet current tension-measurement methods are subjective, invasive, and/or inaccurate. My research team is developing a novel device called the Ultrasound Deflection Tension Sensor (USDTS) to noninvasively measure soft tissue tension by combining force measurements with ultrasound imaging. We conducted a full factorial experiment on the first USDTS prototype to evaluate the sensitivity of the tension measured by the device to application force and device placement (angle and position) along the length of three different tissue-mimicking phantom ligaments. The goal of this study was to identify sources of measurement errors to advise device design changes needed while making steps toward in vivo application of the USDTS.

SOCIAL SUPPORT AMONG TRANS AND GENDER EXPANSIVE INDIVIDUALS

William Mihalovic
Mentor(s): Elliot Tebbe
Additional Author(s): Forrest Tucker, Sonny Graves

Background: This poster synthesizes current research on social support for transgender and gender expansive (TGE) individuals through a systematic review. Across populations, social support is a key protective factor linked to improved mental health. However, reduced suicidality, and better healthcare engagement.

Method: We extracted data from 232 peer-reviewed articles published from 2006 to 2024. Articles were included in the review if they had a substantive inclusion of TGE adults and focus on social support. Data extracted included demographics of study participants, study research questions, forms of social support investigated, and study outcomes associated with social support.

Results: Data will be narratively described and presented in figures.

QUANTIFYING MICROSURGICAL SKILL WITH DEEP LEARNING

Ilia Mikhailenko, Robert Johnson
Mentor(s): Aaron Dingle
Additional Author(s): Lauren Feeley, Dean Spyres, Weifeng Zheng, Samuel O. Poore

Microsurgical training is critical in plastic surgery, yet skill assessments remain subjective and inconsistent. By employing DeepLabCut (DLC), an open-source tool, microsurgical dexterity can be objectively quantified. The trained model tracks instrument motion in video recordings while analyzing metrics like smoothness and jitter. The prototype accurately tracked the motion of instruments in real time in the X-Y plane. Smoothness is quantified by spectral arc length with higher values indicating smoother motion, while jitter was measured using signal processing techniques with higher values representing increased tremor or decreased precision and control. The scoring framework is still ongoing; however, this approach represents a significant step toward standardized microsurgical education using data-driven tailored feedback. Future work will include refining said scoring system and validating outcomes with microsurgical experts.

A MODULAR FRAMEWORK FOR STANDARDIZED BENCHMARKING OF MEDICAL IMAGING FOUNDATION MODELS

James Milgram, Luis Rodriguez
Mentor(s): Alan McMillan
Additional Author(s): Jake Yun, Xue Li

Advanced artificial intelligence (AI) models offer breakthroughs in medical imaging, but their massive size makes them difficult and expensive to use in clinical settings. Recent work suggests that comparable accuracy can be achieved by using these pretrained Foundation Models to process medical images without the need for constant, costly fine-tuning. This project investigates which models are most effective for this efficient approach. We developed an automated testing pipeline that tests the performance of models across diverse medical tasks, including chest X-rays, mammograms, retinal scans, and skin lesion analysis. By identifying the most reliable and most lightweight AI frameworks, this research provides a roadmap for building faster, more accessible diagnostic tools for use in health care.

THE IMPACT OF PARENTS' USE OF SIGNS AND GESTURES ON CHILD RESPONSE RATES IN CHILDREN WITH DOWN SYNDROME

Mackenzie Millard
Mentor(s): Audra Sterling, Marianne Elmquist

Parent-child interactions are a central part of children's language environment. This study will examine whether parents' communication that includes gestures and or signs will increase the likelihood of a child's response and the mode of the child's response (e.g., verbal, non-verbal). I will code 15-minute videos of parent-child interactions for the parent and child's modes of communication. Participants include 38 children with Down syndrome (DS) between the ages of 2-5 years and their parents. Analysis will include sequential analysis with a 5-second event lag. We expect that children with DS are more likely to respond to parent talk that includes sign language or gestures with a combination of verbal and non-verbal communication. Results may inform clinical practice regarding early intervention.

FIRST DETECTION OF THE LOCALIZED COLD NEUTRAL MEDIUM IN IC 1613

Adam Miller
Mentor(s): Ioana Stelea, Snezana Stanimirovic

We present the first localized detection of neutral atomic hydrogen (HI) absorption in the low-metallicity dwarf galaxy IC 1613. The detection of this source is enabled by the high resolution observations of the Local Group L-Band Survey (LGLBS). We identify several external sources towards IC 1613, one of which is found to exhibit a narrow and thin, yet statistically significant absorption feature from the cold neutral medium (CNM). Using radiative transfer techniques, we calculate a spin temperature of 38 K and a low CNM fraction of 0.08 along the line of sight, the lowest fraction yet observed using LGLBS. This gives us a crucial data point of the balance of the interstellar medium in low-metallicity environments like that of the early Universe.

SIRTUIN-6 AND ITS EFFECTS ON LIVER INFLAMMATION DURING NORMOTHERMIC EX VIVO LIVER PERFUSION

Brooke Miller
Mentor(s): David Al-Adra, Heather Jennings

Organ rejection occurs when damaged associated molecular pattern signaling is initiated in response to a transplanted organ, leading to overexpression of the TGF-β pathway and an increase in inflammation of the organ. The TGF-β pathway can be modulated by the enzyme Sirtuin-6 (SIRT-6); normothermic ex vivo liver perfusion can be used to infuse adult rat livers with SIRT-6 small molecule activators to upregulate SIRT-6. Experimental groups were evaluated for inflammation and quality using histology, flow cytometry, qRT-PCR, and Legendplex analysis. Control livers showed an increased inflammatory response when compared to livers that were in the experimental group (infused with SIRT-6), indicating that the relative inflammatory response of the liver can be decreased using SIRT-6.

DOES THE STATE CAPITOL VIEW PRESERVATION POLICY CHANGE THE SPATIAL DISTRIBUTION OF HOUSING DENSITY IN MADISON?

David Miller
Mentor(s): Christopher Timmins

This project investigates the distribution of housing density in Madison as it relates to the Capitol View Preservation Order. Regression discontinuity design, regression kink design, and multiple regression were used in order to determine if the capitol height limit impacts the spatial distribution of housing density in Madison. Analysis showed no statistically significant discontinuity or slope change at the one-mile boundary of the Capitol View Preservation Order. Despite this, comparing Madison's housing density gradient to that of Austin and Lansing reveals that Madison has a higher average housing density than even a much larger city like Austin. Madison has a much lower developable land area downtown when compared to reference cities, which suggests that its geography may impact its uniquely high density.

USING SOIL-DERIVED BACTERIA FOR BIOCONTROL OF *GLOBISPORANGIUM ULTIMUM* INFECTION ON SOYBEANS

Tasha Miller
Mentor(s): Jo Handelsman, Delaney Miller

Globisporangium (formerly *Pythium*) *ultimum* is a plant pathogen that causes major crop loss. It's an oomycete (fungal-like) pathogen with a wide range of hosts, including soy, corn, and wheat, and it easily overwinters in the soil. It infects small seedlings, causing the diseases "damping off" and root rot. My project will examine whether soil-derived bacterial isolates can act as a biocontrol agent against this pathogen. Previous research identified 19 bacterial isolates that were antagonistic to *Globisporangium ultimum* in vitro, and my project has identified 7 of these that are antagonistic in the presence of soybean seeds. These assays will be repeated with corn and wheat, with the goal of identifying bacteria that are able to inhibit *G. ultimum* while also allowing for plant growth.

KHAYELITSHA AND POST-APARTHEID URBANIZATION: PERSISTENT INEQUALITY ON CAPE TOWN'S OUTSKIRTS

Wyndham Mills
Mentor(s): Therese Jasperson

This case study examines Khayelithsa, a Black township on the outskirts of Cape Town, South Africa, to explore how post-Apartheid urbanization has perpetuated socio-economic disparities. Established in 1983 under apartheid policies, Khayelitsha has grown rapidly due to internal migration, resulting in overcrowded informal settlements and inadequate infrastructure. Despite post-1994 reconstruction efforts, the township faces high unemployment, food insecurity, limited access to basic services, and high crime rates. By comparing Khayelitsha with Cape Town's central urban development, this study investigates the systemic challenges rooted in apartheid-era segregation and evaluates ongoing interventions aimed at improving residents' quality of life. The research highlights the complex intersection of historical policy, urban development, and social inequality in contemporary South Africa.

QUANTIFYING PLACENTAL FIBRIN DEPOSITION FOLLOWING TRANSIENT ISCHEMIA IN THE RHESUS MACAQUE PREGNANCY

Eiman Ali Mir
Mentor(s): Logan Kedling
Additional Author(s): Arya Choudhury

Placental injury is a major complication of human pregnancy, with transient ischemia proposed as a key underlying mechanism. Because experimental induction is not feasible in humans, the rhesus macaque provides an important translational model for studying this pathology. Fibrin deposition, which results from necrotic tissue or clotted blood, is a hallmark of ischemic injury across many organ systems. Massive perivillous fibrin deposition is increasingly recognized as a serious placental pathology linked to adverse pregnancy outcomes. In this study, rhesus macaque placental tissue sections were annotated in GIMP to identify sub-tissue regions and fibrin deposition. Pixel quantification was used to compare ischemia-exposed samples with healthy controls to determine whether transient ischemia is associated with increased fibrin accumulation.

CONE-SPECIFIC VISION IN PARKINSON DISEASE: A COLOR VISION OPTOMOTOR STUDY IN LIAIS MICE

Khushi Mitchell
Mentor(s): David Barnett, Freya Mowat

Parkinson disease (PD) is associated with early visual dysfunction, including impairments in cone-mediated color vision that often precede motor symptoms. Understanding early color vision deficits in animal models of PD is an important step toward earlier PD diagnosis in humans. The M83 transgenic mouse model of PD reproduces key aspects of human PD pathology and has demonstrated visual deficits prior to motor impairment. However, studying cone-specific visual function in this model is challenging because wild-type mice have rods and green-sensitive cones with nearly identical sensitivities, making differentiation of cone- and rod-driven responses difficult.

The LIAIS transgenic mouse, in which the native green-sensitive opsin protein is replaced with a human red-sensitive opsin, increases spectral separation and allows precise study of cone function. This project will develop and validate a completely novel rod-silent, cone-driven color optomotor response (OMR) test in LIAIS mice. OMR is a simple behavioral assay in which a mouse reflexively turns its head to follow rotating striped patterns displayed on surrounding computer screens. By adjusting red and green light levels to minimize rod photoreceptor activation, we can measure cone-only responses, and positive and negative control conditions will ensure that tracking behavior is not explained by brightness differences. LIAIS mice and wild-type male littermate controls will be tested twice to confirm reproducibility. Establishing this method is a necessary step before combining LIAIS mice with the M83 model to investigate early cone dysfunction in PD.

DEVELOPMENT OF A PYTHON PROGRAMMING AND RASPBERRY PL BASED AUTOMATION TASK TO MEASURE RHESUS MACAQUES (*MACACA MULATTA*) CHOICE PREFERENCE FOR ENVIRONMENTAL STIMULI PRESENTED AS ENVIRONMENTAL ENRICHMENT

Siddhu Mohan
Mentor(s): Peter Pierre

Evaluating the abilities of nonhuman primates (NHPs) to perform computer-automated cognitive tasks has been used in the development of models of human disease-i.e., measuring motor control to model Parkinson's disease. Our group studies the effectiveness of enrichment options used to ensure NHPs environments are inviting, interactive, and sustain engagement. To evaluate stimulus preference in a pairwise fashion, we developed a 2-lever task on a Raspberry PI with digital I/O control of any user-selected external stimuli (e.g., light, music, scent, or taste) with each lever controlling a single stimulus. Python coding included developing a GUI for inputting session demographics, selectable lever control, and data collection routines that recorded lever press frequency, duration, and the resulting I/O triggering to a CSV format file.

METABOLIC AND COGNITIVE IMPACT OF SLEEVE GASTRECTOMY VS. SEMAGLUTIDE IN AN OBESE APP/PS1 MOUSE MODEL OF ALZHEIMER'S DISEASE

Tristan Molkentin
Mentor(s): Dave Harris
Additional Author(s): Reji Babygirija, Grace Zhu, Twinkle Mathew, Madison Grover, Advaith Ravi Krishnan Nair, Carolyn Winder

Metabolic dysfunction is an emerging and modifiable risk factor for Alzheimer's disease (AD). We hypothesized that improving metabolic health through sleeve gastrectomy (SG) or GLP-1 receptor agonist treatment would attenuate AD progression and allow comparison of the neuroprotective effects of surgical versus pharmacological metabolic interventions. Obese APP/PS1 mice were assigned to one of three treatment groups: sleeve gastrectomy, semaglutide or vehicle injections. Over 12 months, non-surgical mice received subcutaneous injections every other day, and all animals were assessed for cognition, glucose homeostasis, and insulin sensitivity. Following tissue harvest, cortical and hippocampal regions were analyzed for AD-related pathology. Our early findings suggest that improving metabolic health through sleeve gastrectomy or GLP-1 receptor agonist treatment can have neuroprotective effects and slows down the progression of AD.

TRANSNATIONAL MIGRATIONS IMPACT ON INDIGENOUS WOMEN IN GUATEMALA

Vianey Montiel-Lopez
Mentor(s): Anika Rice

In Guatemala, many people lean on migration to support their families financially, especially in rural areas. The project spotlights the experiences of Maya K'iche' women in the department of Totonicapán; their lives are molded by migration's impact on land, society, and capital in the community. Highlighting the advantages and disadvantages of emigration on these indigenous women lives in communities of origin in the 21st century is a key aspect. Data on changing livelihoods was gathered through a series of interviews with the daughters, sisters, and mothers of transnational migrants. Many of these women experience economic and emotional hardships as well as the advantages. Additionally, many for the first time, are exercising agency as they navigate the changing roles and responsibilities, influenced by gender and culture.

GLYCOSYLATION OF HRC DERIVED PEPTIDE TO INHIBIT HPIV3 FUSION

Jee Ching Mook
Mentor(s): Samuel Gellman, Akash Sarkar

Human parainfluenza viruses are responsible for lower respiratory tract infections, particularly in vulnerable populations. The viral F HRC domain was used as a template to design antiviral peptide that has previously been shown to inhibit viral–host cell membrane fusion. Various amino acid substitutions have been introduced to improve proteolytic stability while maintaining antiviral efficacy. Literature precedent suggests that glycosylation of peptides can further enhance antiviral activity and proteolytic stability. Preliminary data from a serine scan of the extended region indicate that the S1 and S2 positions are well tolerated in in-vitro cell–cell fusion assays. This research aims to explore glycosylation and α/β amino acid substitutions throughout the peptide backbone to evaluate their effects on efficacy and potency in preventing viral fusion.

STATE LEVEL AUTONOMOUS VEHICLE POLICY AND MUNICIPAL PLANNING IMPLICATIONS

Howard Moore
Mentor(s): Asli Gocmen

Autonomous Vehicles (AVs) are emerging technologies that may reshape transportation systems, parking demand, and urban land use patterns. In the United States, AV regulation is primarily developed at the state level, while cities retain authority over land use, zoning, parking, and transportation planning. This research examines how state-level AV policies connect to community-level planning and implications for AV-related strategies. The study focuses on four states, California, Michigan, Texas, and Oklahoma, and analyzes planning documents from the two largest cities in each state to determine whether municipal plans reflect state AV policies. Early findings suggest variation across states. California integrates AV regulation with environmental and long-term transportation planning goals, while Texas focuses on enabling AV deployment with fewer reporting requirements, potentially limiting alignment with local land-use planning priorities.

BARRIERS AND FACILITATORS TO LEISURE-TIME PHYSICAL ACTIVITY IN TRUCK DRIVERS: A SOCIAL-ECOLOGICAL PERSPECTIVE

Olivia Moore
Mentor(s): Wan-chin Kuo

Truck drivers experience disproportionately high cardiometabolic risk, yet engaging in leisure-time physical activity can be especially challenging within the structure of long-haul work. Using the social-ecological model as a framework, this mixed-methods study explored barriers and facilitators to leisure-time physical activity among truck drivers in Wisconsin. In total, 83 surveys and 14 semi-structured interviews were collected through community partnerships and analyzed using thematic analysis. Drivers described how long work hours, fatigue, inconsistent schedules, and limited access to safe or convenient spaces made regular exercise difficult. At the same time, participants shared practical strategies to "make it work" on the road, including walking, stretching, and small routine changes. These findings underscore the need for interventions that address structural, environmental, and individual realities of the trucking industry.

EXPLORING PROTEIN BIRTH IN REAL TIME AND DIRECTED EVOLUTION AS COMPLEMENTARY APPROACHES TO PROBE AND CONTROL PROTEIN FOLDING AND AGGREGATION IN THE CELL

Akshata Moorthy
Mentor(s): Silvia Cavagnero, Jinoh Jang
Additional Author(s): Sophia Merrick

Protein folding into the native conformation is critical within biological systems and protein-based pharmaceutical production. I hypothesize that a slower ejection rate of protein from the ribosome allows more immediate post-translational folding to occur, reducing aggregation. Previous research in the Cavagnero group induced site-specific mutations (uL4-Q62K) within the ribosomal exit tunnel (RET) of *E. coli* ribosomes, and concluded that the mutant *E. coli* produced a larger fraction of soluble protein. I will be using genetic recombineering to induce narrowing mutations in the uL22(K83-I96) region at a higher region of the RET, and performing steady-state fluorescence anisotropy experiments on WT and both mutant *E. coli* strains, to measure the corresponding apomyoglobin (apoMb) ejection rates. The results of these findings will be critical to probe whether a narrower ribosomal exit tunnel can act as a "mechanical chaperone" to facilitate protein folding into native conformations.

EXPLORING CLOSED QUOTIENT AND GLOTTAL CLOSURE INSTANT ACROSS PITCH, DYNAMICS, AND SEX IN EXPERIENCED SINGERS

Elise Moreira, Elle Heimer
Mentor(s): Jack J. Jiang
Additional Author(s): Nilanjan Roy, Jakob Holm, Katherine Ahlquist

This study examines the effects of biological sex, pitch (low vs. high), and dynamic level (soft, comfortable, loud) on vocal fold vibratory patterns in trained singers, as measured by closed quotient (CQ) and glottal contact instant (GCI), derived from Electroglottography (EGG) and its first-order derivative (dEGG), respectively. Eighteen normophonic adult singers from the University of Wisconsin–Madison Mead Witter School of Music each produced three sustained /a/ vowels across six pitch-dynamic conditions, yielding six averaged data points per participant. Results indicate that male singers exhibit significantly higher CQ and GCI values across all conditions; both CQ and GCI increase with dynamic level regardless of sex; and higher pitch is associated with decreased CQ but no significant GCI change. Significant interaction effects were identified for sex × dynamics on CQ and pitch × dynamics on GCI. These findings have implications for voice pedagogy and clinical laryngeal assessment.

DEVELOPMENT OF A NOVEL THERANOSTIC AGENT TARGETING MET IN LUNG CANCER

Caroline Mork
Mentor(s): Randall Kimple, Kwang Nickel
Additional Author(s): Rachel Minne, Jayden West, Aaron LeBeau, Reinier Hernandez, Andrew Baschnagel

In patients with non-small cell lung cancer (NSCLC), the MET receptor is altered through mutation or amplification, occurring at frequencies of 3-4% and 6-8%, respectively. If improperly activated or amplified, the MET receptor can stimulate increased cell division, obstruct apoptosis, and resist radiation treatment. We have shown that MET inhibition can enhance the radiation response. Working with our collaborators, we have demonstrated that our novel shark antibody, vMET1-Fc, binds to human MET with a high affinity. When conjugated with Zirconium-89 (half-life of 78.4 hrs), vMET1-Fc exhibited high tumor uptake, indicating a potential use as an imaging agent. In our pilot study, the conjugation of vMET1-Fc with Lutetium-177 (half-life of 6.7 days) demonstrated high tumor uptake over a time span of 120 hours post injection in EBC-1 xenograft model, suggesting a therapeutic potential. We will investigate the therapeutic effects of Lutetium-177 labeled vMET1-Fc since it will deliver radiation over a longer period of time upon its binding to MET. This cytotoxic-targeted radionuclide therapy may have potential translational medicine implications that can enhance treatment efficacy and improve patient outcomes.

VALUES IN SCIENCE IN THE CONTEXT OF GOOD SCIENCE

George Morris
Mentor(s): Aja Watkins

The value-free ideal was initially proposed as an answer to the question "What helps define ideal science?" This presentation aims to recontextualize the contemporary discourse about values-in-science around this question. First, I examine the initial and current contexts of value-free ideal-related literature to highlight the loss of this 'ideal science' context. I then describe that this loss of context may be counterproductive to the values-in-science literature and thus it should return via analyzing arguments through this context. To show this, I reform one of the most prominent arguments against the value-free ideal into a definition of ideal science. This answer is evaluated to reveal an updated proposal for what ideal science is and the usefulness of including the 'ideal science' context in the values-in-science literature.

UNDERSTANDING THE EFFECTS OF LNCRNA ANRIL ON THE ALTERED PHENOTYPES OF THE RISK HAPLOTYPE FOR CORONARY ARTERY DISEASE

Sarah Morrow
Mentor(s): Valentina Lo Sardo
Additional Author(s): Shraddha Suryavanshi

Coronary artery disease (CAD) is a leading cause of death worldwide, characterized by plaque buildup in the walls of arteries. CAD is the most common form of heart disease. The strongest genetic risk factor for CAD is the 9p21.3 locus. This region of the human genome overlaps with a long non-coding RNA, ANRIL. Induced pluripotent stem cells, from individuals carrying the risk haplotype at 9p21.3, differentiated into vascular smooth muscle cells (VSMCs) show increased expression of ANRIL, causing alteration in genes important for the normal function of VSMCs. I explored the effects of ANRIL knockdown on these altered phenotypes of VSMCs.

THE ACCENT COLLECTIVE

Ethan Morse, Phoebe Scalise, Alyssa Caruso
Mentor(s): Colleen Conroy

The Accent Collective is an open-access collection of regional accents of English from a wide range of participants for the purpose of highlighting elements of specific accents and speech for performance preparation. Furthermore, it aims to introduce people to the diverse sounds of English speakers. Filmed interviews containing biographical information, elicitation passages, and extemporaneous speech are collected and then anonymized. This allows the user to analyze the signature sounds and key features of different accents, making accent learning and acquisition easier. Currently, the Accent Collective is transcribing publicly available videos using GenAI to ensure ADA compliance for inclusion to the UW-Madison Digital Collection. Future directions include researching collection methods beyond in person interviews.

TOPOLOGY-AWARE IMAGE SEGMENTATION AND STRUCTURAL ANALYSIS OF COLLAGEN NETWORKS

Merlin Morton, Shashandra Suresh
Mentor(s): Dhananjay Bhaskar
Additional Author(s): Levi Svaren

Second harmonic generation (SHG) microscopy is frequently used to observe collagen tissue networks, which guide cell movement. These structures are continuously remodeled during development, wound healing, and tumor growth. We have developed an automated, topology-aware framework to quantitatively analyze collagen architecture from SHG images. First, we derive interpretable topological descriptors from persistent homology and sweeping-plane filtrations to measure connected components and holes, enabling the assessment of alignment, density, fiber-linking, and porosity. Then, numerical metrics from topological barcodes result in classification and interpretation. Finally, a topology-aware U-Net segmentation model preserves structural properties using a topological loss based on the Wasserstein distance. This approach provides a fast, automated and interpretable method to classify collagen organization, segment SHG images, and understand how tissue structure supports cell migration.

PARISON OF SERA GDF-15 CONCENTRATION IN PROSTATE CANCER PATIENTS RECEIVING PROSTATE CANCER-TARGETING VACCINE IN CLINICAL TRIAL

Colette Mouton
Mentor(s): Daeun Shim
Additional Author(s): Jörg Wischhusen, Douglas McNeel, Beatrice Haack, Laura Johnson, Birgitt Fisher

Overexpression of growth differentiation factor 15 (GDF-15) is associated with poor clinical outcomes in multiple cancers. However, expression in prostate cancer is less characterized. We investigated GDF-15 levels in prostate cancer patients at various stages of disease progression. To quantify GDF-15 levels, we used ELISA to analyze sera from patients before and 12 weeks after receiving prostate cancer-targeting vaccine. We found metastatic castration resistant prostate cancer (mCRPC) patients had significantly increased GDF-15 levels at baseline compared to healthy controls or non-metastatic castration-sensitive prostate cancer patients. Additionally, mCRPC patients without prostate specific antigen decline by 50% or greater (PSA50) had significantly increased GDF-15 levels post-vaccination. We conclude GDF-15 levels increased with disease progression in prostate cancer and is also overexpressed in patients who didn't experience PSA50.

SPANISH L3 PHONOLOGY: THE EFFECT OF SIMULTANEOUS BILINGUALISM ON THE ACQUISITION OF INTERVOCALIC RHOTICS IN SPANISH

Annika Mueller-Owens
Mentor(s): Rajiv Rao

While second language (L2) phonological acquisition is well-theorized, third language (L3) phonology remains underinvestigated. This study examines Spanish L3 acquisition of intervocalic rhotics by six adult speakers with a first language (L1) of English and a different L2 acquired simultaneously in early childhood, using the Bilingual Language Profile (BLP) and the Language History Questionnaire (LHQ3) to determine language profiles. Using elicited imitation tasks with nonce words in carrier phrases, we collected acoustic production data analyzed via Praat to quantify phonetic realization patterns. Native English proficiency was assumed for all speakers, but data were collected to determine pronunciation in L2 as well as Spanish. This research addresses a critical gap by investigating how simultaneous bilingual L1/L2 acquisition influences L3 phonological transfer in understudied language combinations.

EFFECT OF DIET PROTEIN ON GUT MORPHOLOGY IN FRAGILE X MICE

Grace Munro
Mentor(s): Cara Westmark
Additional Author(s): Rachel Nissan, Pamela Westmark

Fragile X Syndrome (FXS) is a rare neurodevelopmental disorder characterized by seizures, autism, and intellectual disability. FXS is studied across the globe; however, with diet often unnoted, published results can be difficult or impossible to replicate and standardize. The objective of this study was to determine if the protein in mouse food alters gut morphology. FXS mice were fed diets containing casein or soy protein. The intestines were harvested and scored for villi count and size. Gut morphology was analyzed as a function of sex and protein. These findings may be relevant to FXS, neurodegeneration, cancer, and other research, as all preclinical drug development is conducted in rodents. Diet-drug interactions could impact drug efficacy preventing identification of the best drugs to move onto clinical trials.

BAYLEY SCALES OF INFANT DEVELOPMENT METHODOLOGY IN THE HBCD STUDY

Abby Murphy
Mentor(s): Leela Shah

The Bayley Scales of Infant and Toddler Development (BSID) is a standardized assessment of early cognition, language, and motor skills used to identify children at risk for developmental delays. The Healthy Brain and Child Development (HBCD) study, a nationwide longitudinal cohort, uses the BSID at 9-15 months to characterize early abilities alongside neuroimaging and environmental measures. This poster describes how the BSID is administered in a multisite research setting using standardized materials, scripted procedures, and limited caregiver involvement to reduce bias while supporting child comfort. It also explains the rationale for including the BSID, highlights methodological strengths and limitations in large cohorts, and considers how early developmental assessment can inform interpretation of infant brain-behavior relationships and guide early support.

IMPACT OF FLANKING MRNA MUTATIONS ON BICC1–RNA BINDING SPECIFICITY

Megan Nchekwaram
Mentor(s): Michael Sheets

Bicaudal-C (Bicc1) is an evolutionarily conserved RNA-binding protein essential for embryonic development. In our model organism, the frog *Xenopus laevis*, disruption of Bicc1 function leads to pronounced anterior and posterior anatomical defects.

Bicc1 regulates development by binding specific mRNAs and repressing their translation. The protein contains five structural domains, and current evidence suggests that the KH2 domain—and its conserved GKGG motif—is critical for specific mRNA recognition across species.

Using wild-type *Xenopus* Bicc1 protein, variants of Bicc1-interacting mRNAs were investigated for their responses to flanking mutations surrounding this KH2-contacting region. Using electrophoretic mobility shift assays (EMSAs), this project examines how these mutations influence Bicc1's selective recognition and binding of its target mRNAs.

EXPLORING THE ROLE OF FICTION IN TESTIMONY: AN ANALYSIS OF CAMUS AND KAFKA

Christine Negovani
Mentor(s): Matt Johnson

Testimony is often defined as non-fictional first-person narration of lived experiences of violence or extremity. Yet, in the wake of World War II, numerous survivors, activists, and creatives such as Albert Camus turned to fiction writers like Franz Kafka as a resource for mediating the overwhelmingly traumatic and seemingly unintelligible experience of the calamities of the mid-century. Building on existing scholarship by Shoshana Felman and Gisèle Sapiro, this project explores the contested role of fiction in testimonial works through a literary analysis of Albert Camus' The Plague, with a focus on passages concerning the societal function and position of the artist/author, and a consideration of the turn to Kafka as a way to think through the literary vis-à-vis catastrophe.

APOPLAST, APOPLAST! WHICH APOPLAST DO YOU LIKE? - BIOCHEMICALLY ALTERED APOPLASTS IN TOMATO FOR *XANTHOMONAS* AND *PSEUDOMONAS*

Dharshita Nellore
Mentor(s): Jeri Barak
Additional Author(s): Kimberly N. Cowles

Plants are often exposed to pathogens that biochemically alter the apoplast, which is the intercellular space in plants. Two such pathogens of tomato are *Pseudomonas syringae* (Pst) and *Xanthomonas gardneri* (Xg). Both bacteria create symptoms that appear macroscopically similar, but they have been observed to manipulate the stomata differently. To further understand the differences the bacteria cause inside a leaf, we focused on how an apoplast that has been biochemically altered by Pst/Xg infection can impact the growth of Xg/Pst compared to a healthy apoplast. We found that Xg shows a higher growth rate in infected apoplasts, while Pst showed no growth in Xg-infected apoplasts (24 hours post infiltration) or it showed low growth rates in both infected and healthy apoplasts (48 hours post infiltration).

ELEVATED CEREBRAL PULSATILITY AND REDUCED CEREBRAL BLOOD FLOW ASSOCIATE WITH CEREBRAL SPINAL FLUID BIOMARKERS OF NEURODEGENERATION IN VERTEBRAL ARTERY HYPOPLASIA

Sophia Nelson
Mentor(s): Jill Barnes, Erin Moir
Additional Author(s): Brandon G. Fico, Sarean Harmoni A. Gaynor-Metzinger, Nicole A. Loggie, Alexander M. Norby, Anna J. Howery, Gwendlyn Kollmorgen, Henrik Zetterberg, Kaj Blennow, Oliver Wieben, Sterling C. Johnson

Alzheimer's disease is increasing in prevalence, and early markers of neurodegeneration require further study. Changes in cerebral blood flow (CBF) and cerebral pulsatility index (PI) may contribute to neurodegeneration. Vertebral artery hypoplasia (VAH), a common congenital narrowing of the vertebral artery, is associated with altered CBF and PI and may provide insight into links between cerebral hemodynamics and neurodegeneration. In 112 cognitively normal adults (aged 45–87 years), 4D flow MRI measured CBF and PI in large cerebral arteries and cerebrospinal fluid (CSF) biomarkers of neurodegeneration were assessed. Lower CBF and higher PI were associated with worse CSF biomarker profiles in adults with and without VAH. However, associations were more prevalent in adults with VAH. Elevated PI and reduced CBF may increase risk of neurodegeneration.

OPTIMIZING THE EXPRESSION AND PURIFICATION OF THE CORE REPLICATION - TRANSCRIPTION COMPLEX FROM MOUSE HEPATITIS VIRUS

Edison Netter
Mentor(s): Robert Kirchdoerfer

Coronaviruses replicate their genomic material using a core polymerase complex comprised of nsp12, nsp7, and nsp8. While this machinery is well-characterized in vitro in other coronaviruses, like SARS-CoV-2, less is known about the laboratory model mouse hepatitis virus (MHV). MHV is a powerful coronavirus model because it is not known to infect humans, allowing the virus to be safely studied at BSL-2. Establishing a recombinant protein system for the core replication proteins will enable in-depth biochemical assay, structural work-up, and targeted mutagenesis which will complement live-virus studies. By reconstituting this machinery in vitro, we aim to discover how species-specific differences shape polymerase function and to provide a toolkit for dissecting the molecular mechanisms of coronavirus replication.

GEOGRAPHIC VARIATION IN COLONIAL IRISH PLACENAMES

Charlotte Neumann
Mentor(s): Rebecca Shields

The English colonization of Ireland involved the translation or adaptation of Irish placenames. This study maps trends in whether small, common words like “the” were retained in the sounds and translations of new words across the island. Preliminary research showed a newly discovered pattern: from east to west, English names showed different levels of retention of the original Irish names. This could be caused by the different types of colonization that took place in different areas of the island. Ongoing research aims to see whether these patterns are replicated in smaller geographic subdivisions by mapping various kinds of sound and translation changes.

OLD BUT GOLD: MEASURING THE AGE AND METALLICITY OF M2 & M15 STAR CLUSTERS

Kyleigh Neuschwander-McDermott, Safyr Barlow, Brooklyn Gustaf, Adam Miller, Lauren Khoury, Mihir Manna, Nicholas Perry
Mentor(s): Snezana Stanimirovic, Nicholas Mcconnell
Additional Author(s): Hongxing Chen

Star clusters are great laboratories for studying stars and their properties because all of the stars were born as a single population, thus having the same age, composition, and distance. Obtaining precise age measurements of star clusters is important to further constrain and test models of stellar and galactic evolution including, stellar dynamics, galaxy formation, and chemical evolution. Using UW-Madison’s 16-inch Linda Sue optical telescope in the Livingston-Stark Observatory, we collected photometric data on the globular clusters Messier 2 (M2) and Messier 15 (M15) in multiple filters and measured each star’s brightness. After calibration, we estimated the age of M2 and M15 to be 12.589 Gyr and 12.5 Gyr respectively, by fitting a stellar evolution model to our observed color-magnitude diagram.

EXPLORING CULTURALLY RESPONSIVE STRATEGIES TO MEASURE THE SOCIAL ENVIRONMENT

Mackenzie Newkirk
Mentor(s): Susan Andreae
Additional Author(s): Bao Tran Nguyen, Olivia Crofton, Esmeralda Rodriguez

Community-engaged research is thought to strengthen aspects of the social environment, yet these outcomes are rarely measured directly. The social environment--encompassing interactions, trust, and kinship among individuals, families, organizations, and businesses-- is a key social determinant of health and reflects community members' capacity to act for the common good. Common indicators include social capital, community capacity, collective efficacy, and empowerment, but these constructs are highly context-dependent and shaped by local, social, and cultural norms. Existing measurement tools are often not developed with diverse communities in mind, limiting their relevance and applicability. This project aims to identify valid measures of the social environment and assess the acceptability and feasibility of selected tools in partnership with community interest-holders.

CHARACTERIZING MONOCYTE METABOLIC DYSREGULATION IN CYSTIC FIBROSIS USING AUTOFLUORESCENCE LIFETIME IMAGING

Mia Ngo
Mentor(s): Melissa Skala, Jeremiah Riendeau
Additional Author(s): Chandramu Chetty

Cystic fibrosis (CF) is a genetic condition, primarily affecting the respiratory system. This genetic mutation impairs ion balance and leads to an overproduction of thick mucus that harbors non-resolving bacterial lung infections. Monocytes, the most common immune cell in the CF lung, play a key role in controlling infections, yet CF monocytes are largely tolerant of bacteria. Currently, little is known about the specific role of metabolism in CF monocyte function. This study aims to identify how the most common CF mutation, F508del, impacts the baseline metabolic state and bacterial tolerance of monocytes. Autofluorescence imaging of the metabolic coenzymes, NAD(P)H and FAD, will offer non-destructive single-cell metabolic insights, bridging the gap between dysregulated monocyte metabolism and function in CF.

FOSTERING COMMUNITY ENGAGEMENT THROUGH ADAPTED TANGO DANCE SESSIONS

Bao Tran Nguyen
Mentor(s): Susan Andreae
Additional Author(s): Laura Prieto

Although evidence-based programs exist to reduce fall risk among older adults, implementing them in culturally diverse community settings remains challenging. Strong community partnerships are essential to addressing these barriers. As part of an ongoing collaboration with a local community-based organization to develop a culturally responsive fall-prevention program, we offered adapted tango classes to support relationship-building with the organization and its residents. Tango was selected for its adaptability, allowing participation across a wide range of fitness levels. Prior research shows that tango can improve mobility, balance, and social interaction—factors critical to reducing fall risk and enhancing well-being among older adults. Here, we describe our experience implementing the adapted tango sessions within this community partnership.

WEATHERING THE STORM: ASSESSING CLIMATE-HEALTH BURDENS AND SOCIAL PROTECTION POLICIES IN U.S. STATES

Chihuu Nguyen
Mentor(s): Vijay Limaye
Additional Author(s): Jaime Madrigano, Kim Knowlton, Shubhayu Saha, John Balbu

Climate change increasingly threatens human health across the US. Climate impacts are likely to worsen financial precarity across the United States by imposing expensive healthcare treatment needs, as well as lost wages, or inability to provide child or elder care, but evidence is limited regarding policy levers that could strengthen resilience. Our national analysis investigates variation in state-level health burdens from climate hazards and examines distinct implementation patterns of 21 social protection policies across five policy domains (wages, housing and energy, nutrition, health, and transportation) that influence households' capacity to withstand and recover from climate hazards. As climate-sensitive disasters worsen, a broader definition of adaptation needs to recognize the role of social protection policies in bolstering climate awareness, preparedness, and resilience.

RECRUITMENT AND RETENTION OF ASIAN AMERICAN WOMEN IN A COMMUNITY-BASED BREAST CANCER PREVENTION PROGRAM

Carolyn Chi Nguyen
Mentor(s): Jingxi Sheng
Additional Author(s): Chenxi Lu

Research involving minority populations often faces challenges in recruitment and retention, contributing to the underrepresentation of Asian American women in health research. As breast cancer incidence among Asian American women rises, culturally-attuned strategies are needed to effectively engage this community in cancer prevention efforts. This study describes recruitment and retention strategies and outcomes from a nurse-led, culturally-tailored, community-based breast cancer prevention program for Asian American women. The study's findings provide nursing-relevant insights into how culturally-attuned, community-based approaches can improve recruitment and retention among Asian American women in cancer prevention programs. This study highlights the pivotal role nurses have in community outreach, health education, and cancer prevention, emphasizing the value of implementing CBPR principles into nurse-led interventions to strengthen trust, accessibility, and engagement with underrepresented communities.

ELECTORATE SHIFTS: THE LOSS OF A 50-YEAR DOMINANCE

Olaotse Ngwako
Mentor(s): Soeren Henn

This study serves to investigate the determinants of party change in the most recent general elections in Botswana. Using Afrobarometer survey data across seven rounds and 2 decades, the study looks at trends in public perception of potential drivers of political shift. Findings suggests that the most plausible answer is erosion in public trust of the president and the ruling party that had been in power since independence. Overall trust decreased from 66.0% in round 3 to 33.5% in round 10. Similar trends are observed when data is stratified by age and developmental region. Notably, findings also suggest that opposition party favorability did not play a big role in election outcomes.

AN AUTOMATED DISSOLUTION SYSTEM FOR PROCESSING OF SOLID-TARGET PRODUCED RADIONUCLIDES

Jonah Nick
Mentor(s): Jonathan Engle

Solid phase accelerator targets for radiometal production are growing because of increasing research and medical demand for these nuclides. The Cyclotron Research Group at UW-Madison is among the world's most prolific groups in radiometals production, and thus has increasing needs for versatile, automated solid target dissolution infrastructure to access their liquid-phase chemistry. This project features an automated dissolution system specificied for the requirements of radioactive metals. This design avoids introducing chemical impurities, operates remotely and automatically, and includes fail safes that protect the operator and the product.

EVALUATION OF ENVIRONMENTAL ENRICHMENT AND PSILOCYBIN AS MODULATORS OF BEHAVIORAL AND NEUROBIOLOGICAL OUTCOMES IN RATS

Nicole Ning
Mentor(s): Suhjung Janet Lee, Cody Wenthur

Psilocybin's therapeutic efficacy is proposed to rely on extra-pharmacological factors, yet the biology connecting environmental context to psilocybin's effects on stress-related and neuroplastic processes remains undefined. This study utilizes a 2x2 factorial design (DrugxHousing) to evaluate how psilocybin (1mg/kg) and environmental enrichment (EE) modulate behavioral (grooming) and physiological outcomes in rats. Using a three-day open-field paradigm, we quantified self-grooming microstructure alongside plasma corticosterone responses. We found that psilocybin elicited heightened acute corticosterone release, reflecting glucocorticoid and hypothalamic-pituitary-adrenal axis activity. Additionally, psilocybin selectively increased grooming bouts in standard-housed animals, with this effect attenuated under EE conditions. Given our results on the differential effect of environment and psilocybin on behavior, future work will assess molecular changes via neuroplastic and glucocorticoid-related factors in the medial prefrontal cortex.

BROTHER, CAN YOU SPARE A DIME?: THE INFLUENCE OF REMITTANCES' LARGE-SCALE IMPACTS ON INDIVIDUAL-LEVEL CHOICES

Ayda Nouman
Mentor(s): Jon Pevehouse

Many scholars have researched remittances' effects and sender attitudes separately, yet few studies have attempted to link individual behaviors to remittances' broader consequences. I examine a potential connection between remittances' impacts and individuals' likelihood to remit. I conduct a survey experiment of adult immigrants in the United States, providing them with a treatment on remittances' impacts before asking about respondents' willingness to send. The results suggest information on remittances' effects does little to impact the likelihood of sending, while sender status is a strong predictor. These findings contribute to our understanding of the drivers of remittances, how information on their consequences influences one's likelihood to send, the potential mechanisms driving responses, and how sender motivations affect responses. The implications for recipient-country policymakers are discussed.

PRE-SURGICAL COGNITIVE FUNCTION AND DELIRIUM OUTCOMES

Isabelle Nowak
Mentor(s): Richard Lennertz

This study aimed to investigate whether preoperative cognitive function was associated with delirium in 338 surgical patients aged 60 years or older, undergoing major elective non-intracranial surgery. Cognitive performance was assessed before surgery using the RBANS, presence of delirium was measured after surgery using the 3D-CAM, and delirium severity was measured with the DRS. T-tests showed that patients who developed delirium had lower total RBANS scores, along with lower index scores in attention and delayed memory. In logistic regression analyses, higher RBANS total scores were associated with lower odds of delirium (OR = 0.97, 95% CI: 0.95-0.99). Linear regression further revealed that each one-point increase in RBANS total score corresponded to a 0.10-point decrease in peak delirium severity score.

SUPPRESSION OF ARFIP RESCUES NEURODEGENERATION IN *DROSOPHILA* MODELS OF UBQLN2-ASSOCIATED ALS/FTD

Katherine Nudgin
Mentor(s): Sang Hwa Kim
Additional Author(s): Randal Tibbetts

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disorder characterized by motor neuron loss, leading to muscle weakness, paralysis, and respiratory failure. Mutations in the ubiquitin-binding chaperone Ubiquilin 2 (UBQLN2) cause X-linked ALS and frontotemporal dementia (FTD), although the underlying mechanisms remain unclear. We investigated whether suppression of Arfip (Arfaptin) acts as a genetic modifier in *Drosophila* models of UBQLN2-associated disease. A third-chromosome deficiency screen identified Arfip as a suppressor of the degenerative eye phenotype in GMR>UBQLN2 mutant flies. Functional rescue was further evaluated using climbing and longevity assays and future brain staining in Elav>UBQLN2 flies with Arfip knockdown to assess motor performance and survival. These findings indicate that Arfip knockdown suppresses UBQLN2-induced neurodegeneration and may represent a potential therapeutic target for ALS.

NAVIGATING ECO-DISTRESS WITH CONTEMPLATIVE PRACTICE: RESULTS FROM AN ONLINE RESILIENCE COURSE

Liam O'Connor
Mentor(s): Christine Wilson-Mendenhall

Climate and ecological crises elicit a range of distressing emotions, termed eco-distress. We evaluated five contemplative practices in the online course Emotional Resilience and the Ecological Self (e.g., forest bathing, somatics, laughter yoga) to determine how these practices impact participants' ecological emotions. Participants identified the eco-emotion they were experiencing before practice and whether a new emotion arose after practice. Using directed content analysis, we coded these emotions into categories. The results revealed that participants experienced a variety of eco-emotions and that there was a significant shift from negative emotions before practice to positive emotions following practice. These results suggest contemplative practices grounded in interconnectedness may be a tool for supporting well-being and building resilience in response to environmental crises.

INVESTIGATING THE IMPACT OF LEAF ANATOMY ON DROUGHT RESISTANCE IN *ZAMIA* AND *CERATOZAMIA* CYCADS

Ross O'Donnell
Mentor(s): Lena Berry, Kate McCulloh

Cycads today are in global decline, with ~70% of species threatened by extinction. A leading cause of plant mortality in an increasingly warm, dry climate is drought-induced embolism, where air blocks the flow of water through the plant's vascular tissue, the xylem. Embolism resistance can be modeled using vulnerability curves, plotting a leaf's drought stress against its efficiency during rehydration. These curves can also be used to compare vulnerability in different sections of the leaf. Cycad species display diverse xylem anatomy, varying in cell and pitting type. In investigating the drought resistance of two species with differing xylem anatomies, and comparing vulnerability curves produced by whole leaves to separated rachises, a more precise understanding can be reached as to what leaf anatomy supports embolism resistance.

FANTASY FILMS: A COMPARATIVE ANALYSIS OF BIBLICAL ALLUSIONS IN *LIFE OF PI* AND *MOTHER!*

James O'Toole
Mentor(s): Sarah Jedd

This paper explores the nuanced relationship between ideologically opposed rhetoric that alludes to the same source material and the resulting implications on understanding rhetors' motivations and broader social disunity. As the most frequently cited work of all time, the Bible was a useful benchmark to compare two contemporary films, *Life of Pi* and *Mother*, which dissimilarly interpret biblical themes. The extent to which audiences understood these messages was considered through the framework of symbolic convergence, which suggests that fantasy themes are the collaboratively constructed imaginations that groups reflect in their stories. A fantasy theme analysis of both films offered deeper insight into the motivations that shaped the films' messages and encouraged future consideration about engaging with fantasy themes in an increasingly divided world.

INVESTIGATING THE ROLE OF FAM120A IN MANTLE CELL LYMPHOMA VIA THE PI3K/AKT/MTOR PATHWAY

Victoria Obernberger
Mentor(s): Lixin Ruin

Mantle Cell Lymphoma (MCL) is an aggressive B-cell malignancy driven by Cyclin D1 overexpression. The PI3K–AKT pathway plays a critical role in MCL development. Recent studies suggest that FAM120A activates PI3K, initiating the PI3K/AKT pathway and promoting cell proliferation. Notably, suppression of FAM120A has been shown to reduce growth in several cancer types. This project aims to elucidate the role of FAM120A in MCL by generating shRNA-mediated knockdown cell lines. The findings are expected to clarify how FAM120A contributes to MCL pathogenesis and may help identify potential therapeutic targets.

A RESEARCH PROPOSAL TO ASSESS INTEROCEPTIVE ACCURACY AND EMOTIONAL DIFFERENTIATION IN DAILY LIFE

Anna Ohm
Mentor(s): Polina Beloborodova

Bodily signals play a critical role in shaping how emotions are experienced and processed. Interoception describes the conscious and unconscious processes through which individuals sense, interpret, and integrate bodily signals. Emotional differentiation is the specificity with which individuals identify and describe their emotional experiences. This project proposes a study examining within-person fluctuations in interoceptive accuracy as a predictor of fluctuations in emotional differentiation in daily life. Methods include studying 250 participants over four weeks through ecological momentary assessment. Participants would receive three daily prompts at stratified-random intervals to allow for analysis of co-variation between reported emotions and performance on heart rate prediction tasks. Supplementary data, including context-based GPS tracking to assess the impact of location on these measures will be discussed.

WHO LOGS IN? EXAMINING PATIENT PORTAL USE AMONG OLDER ADULTS WITH AND WITHOUT CHRONIC DISEASE

Elena Oien
Mentor(s): Julie Ober Allen

As patient portals become integrated into healthcare, differences in engagement with these technologies among older adults, especially those with complex health issues, remain unclear. We analyzed 2023 data from a nationally representative sample of U.S. adults ages 50-80 (N=2562) to investigate portal use among individuals with and without chronic disease. Among those surveyed, 74.87% used a patient portal in the past 12 months. Those with chronic disease were more likely to have used portals, particularly individuals with high cholesterol, heart issues, or hypertension. However, when portal self-efficacy was accounted for, it independently predicted portal use and disease status was no longer significant. Findings highlight the importance of strengthening self-efficacy in older adults to enhance portal engagement.

ASSESSING THE PRESENCE OF MICROPLASTICS IN JUG BAY

Ruth Olawumi
Mentor(s): Jason Davison
Additional Author(s): Alexia Menezes

In recent years, the presence of microplastics in marine environments is becoming an area of increased environmental concern. Aquatic habitats act as a final sink for the improper disposal of plastic waste. The conditions of these environments easily degrade plastics and transport them to large bodies of water that support life around the globe. As the size of microplastics decreases, their toxicity, likelihood of being consumed increase, and ability to absorb contaminants increases. The Patuxent River, which provides drinking water to thousands of Maryland residents and acts as shelter to a variety of aquatic and terrestrial species, suffers from this issue as well. However, there are significant gaps in knowledge around the concentrations of microplastics in this river. This project explores 2 methods of analyzing microplastics in Jug Bay, a tidal estuary along the Patuxent River.

OPTIMIZED MODELING OF THERMAL DESORPTION OF TRITIUM IN IRRADIATED TUNGSTEN FOR FUSION APPLICATIONS

Hunter Olson, Nicholas Zakowski
Mentor(s): Yongfeng Zhang
Additional Author(s): Mohammad Amer Allaf

Understanding tritium retention in tungsten is important for fuel cycle management and plasma-facing component performance in fusion reactors. In this work, we model hydrogen isotope trapping and release in tungsten using the Tritium Migration Analysis Program (TMAP8). The developed model is validated in two steps: 1 - against thermal desorption spectroscopy experimental data of Deuterium charging into Beryllium. 2 - by performing code-to-code comparison for Tritium charging into irradiated Tungsten. The study explores multiple trap populations with distinct detrapping energies to represent defect sites, and by coupling with the Stochastic Tools Module (STM) to calibrate trap properties and optimize the results. The results show how the modelling approach presented is promising in simulating hydrogen isotope transport and trapping in fusion materials.

INTERACTIVE EFFECTS OF INVASIVE SPECIES AND DEER BROWSE ON FOREST UNDERSTORY DIVERSITY AND TREE REGENERATION

Elliot Oquist
Mentor(s): George Meindl

Forest ecosystems across the United States face threats from invasive plants and overabundant white-tailed deer, which can reduce native biodiversity, alter soil and light conditions, and inhibit tree regeneration. In 2023, eight 25-ft² plots were established across four locations in the Lakeshore Nature Preserve. Each location contained paired plots, with one serving as a control and the other receiving invasive plant removal; two pairs were also fenced to exclude deer browsing. Plant diversity was measured within each plot. Results showed significantly higher diversity in fenced plots compared to unfenced plots and in plots where invasives were removed. These findings provide key insights for land managers developing forest conservation strategies.

PRIORITIES AND DAILY ACTIVITIES OF CARE PARTNERS OF LATINOS WITH PARKINSON DISEASE

Yuraima Orozco Velasquez
Mentor(s): Laura Prieto
Additional Author(s): Kristen Pickett, Maria Mora Pinzon

Care partners (CP) provide critical support for people with Parkinson disease (PD), but experiences among Latinos CP within Latino community remain underrepresented. The purpose of this qualitative study was describing the impact PD has on CPs' daily activities and identifying occupational priorities within this community using the Canadian Occupational Performance (COPM), a semi-structured interview tool used by occupational therapists to collect self-identified daily activity goals. We thematically analyzed interviews of 18 participants (60±11.7 years old; 13 females, 2 male), CPs accessed symptom management resources via the internet and Latino-specific groups. Challenges included language barriers to healthcare, negotiating self-care, and caregiving tasks. Leisure (recreation/socializing) and productivity (caregiving/volunteering) were top priorities. These insights are essential for structuring targeted health interventions to support CPs of Latinos with PD.

RISK FACTORS FOR HYPERTENSION IN THE WESTERN HIGHLANDS OF RURAL GUATEMALA

Gabriella Ortiz
Mentor(s): Sean Duffy
Additional Author(s): Alejandro Chavez

Uncontrolled hypertension is the leading preventable cause of death and disability worldwide, with nearly two-thirds of affected individuals living in low- and middle-income countries. Despite this disproportionate burden, epidemiological data necessary to combat the development of hypertension and its associated complications remains scarce.

In 2022, community health workers and physicians conducted paired assessments of 359 patients in a rural indigenous community in Guatemala and reached independent hypertension diagnoses. This analysis uses these physician assessments to describe prevalent risk factors for an elevated blood pressure and hypertension diagnosis.

The multivariable regression models for systolic and diastolic blood pressures included positive associations with BMI, history of diabetes, Spanish language preference, and antihypertensive medication use. For hypertension diagnosis determination, positive associations included BMI, history of diabetes, and age.

WISCONSIN GRASSLAND SOIL IS RESILIENT TO FIRE DISTURBANCE DUE TO SHALLOW HEAT PENETRATION AND FAST RECOVERY OF CHEMICAL PROPERTIES

Olivia Oswald
Mentor(s): Mengmeng Luo
Additional Author(s): Thea Whitman, Emily Kaufman

Fire is the chemical process of combustion, where fuel, oxygen, and ignition combine to produce heat and flame. Fire has a long history of shaping ecosystems and reinvigorating soil by releasing nutrients and long-lived "fire-affected" organic matter that contributes to soil carbon stock. The sample sites are located at the Curtis Prairie in the UW Arboretum, which is a restored grassland previously used for agriculture. We sampled and analyzed 15cm soil cores collected before and after the 2025 spring prescribed fire. From incident heat and total energy during the fire and post-sampling analyses (including carbon, nitrogen, and pH), we found fire impacted soil chemical properties on the surface layer, following recovery to pre-fire conditions within a few months post-fire, indicating grassland resilience to fire disturbance.

TREATMENT OF GNRH AGONIST BLUNTS PREDATOR ODOR INDUCED STRESS RESPONSE IN ADOLESCENT FEMALE RODENTS

Layla Ousseini
Mentor(s): Anthony Auger
Additional Author(s): Amber Truong Nguyen

Adolescence is a time of increased prevalence to mental health risk, characterized by stark increases in anxiety and depression. Our lab previously found that treatment with a GnRH agonist, Lupron Depot, decreased anxiety-like behaviors in an adolescent rodent model. We now examine if blocking adolescent development blunts predator odor exposure (POE) induced stress responses in juvenile female rodents. We find that POE induced a depressive-like measure that appeared to be blunted by prior Lupron treatment. Our findings suggest that the adolescent GnRH system plays a critical role in the development of mental health risk. These findings contribute to our understanding of adolescent development of mental health disorders with direct implications for the safe use of GnRH analogs as treatments in pediatric neuroendocrinology.

THE ROLE OF ENVIRONMENTAL RESPONSIVENESS ON INFANT LANGUAGE LEARNING

Howard Owens
Mentor(s): Jenny Saffran, Ellie Breitfeld

Infants learn by tracking patterns in their environment, a process known as statistical learning. This ability is key to early language development. Interestingly, children differ in their statistical learning ability, and the reasons for these differences are understudied. This study tests whether the responsiveness of an infant's environment explains these differences. We let half of the infants control what happens on a screen using their eye movements, while the other half watches a screen they cannot control. Then, infants complete a statistical learning task with predictable adjective-noun pairs (e.g., "silly birdie" or "happy piggy") to see if they can predict what word comes next. We expect infants who can control the screen to show stronger learning, suggesting that responsive environments may support statistical learning.

FEAST: A NOVEL AGENT-BASED APPROACH TO MODELING FOOD INSECURITY

Efe Ozalp, James DeSilver
Mentor(s): Alfonso Morales
Additional Author(s): Charlie Haight, Tanish Upakare, Ira Hande, Edric Zhou, Shrivas Shankar, Oscar Almaraz, Cornell Stewart, Ella Mitchell

Food insecurity is a longstanding concern across the United States. Even with modern technology, the most widespread metrics used for food access research are descriptive statistics of cities or counties. The FEAST (Food Equity and Accessibility Simulation Technology) tool developed by the Kaufman Lab of the DPLA at UW-Madison deploys composite metrics, including financial constraints and family size, at granular geographies, over time, to simulate how removing and adding food access points degrades or increases local communities' food security. The FEAST enables local governments to better understand how communities are impacted by the removal of locations, i.e. supermarkets, and provision of food access, i.e. farmer's markets. Thus, we bring a new factor to solving the ongoing problem of food insecurity in the USA.

TRACKING ENVIRONMENTAL CHANGE IN WISCONSIN AFTER THE LAST GLACIAL MAXIMUM THROUGH LACUSTRINE SEDIMENT CORES

Aaleeyah Padela
Mentor(s): Eric Giese, Jack Williams

Multiproxy analyses of lake sediments have been shown to reliably track local environmental transitions. Loss-on-ignition (LOI) is a low-cost proxy analysis that heats consecutive core samples in stages and measures weight loss to determine organic carbon, carbonate, and minerogenic sediment proportions. High organic content suggests high biogenic activity and terrestrial stability, while high carbonate content reflects increased authigenic precipitation during arid conditions, and high minerogenic content results from terrestrial erosion. After the last glacial maximum (LGM), as proglacial North American climates warmed and became wetter, environments rapidly changed from periglacial grasslands to boreal forests to a mix of temperate woodlands by the Holocene epoch. This project aims to track terrestrial environmental change in Wisconsin using LOI on a continuous lake core dating to the LGM.

THE EFFECT OF CONDURITOL-B-EPOXIDE ON BARLEY DISPROPORTIONATING ENZYME-1 ACTIVITY

Joanna Pagedas
Mentor(s): Marcus Vinje

Malting is the process that germinating barley seeds undergo to break down starch into fermentable sugars to support seed growth. Disproportionating Enzyme-1 (DPE1), typically involved in transient starch breakdown, was discovered to be expressed during malting. DPE1 can be an important brewing tool, as it utilizes maltotriose, an abundant sugar in wort extracts, and converts it into glucose, the preferred yeast energy source. α-glucosidase is another enzyme that can break down oligosaccharides into glucose during malting. To accurately test DPE1's activity in wort extracts, α-glucosidase must be irreversibly inhibited, which is feasibly done by Conduritol-β-epoxide (CBE). Here, CBE's effect on DPE1 is studied using enzymatic assays and spectrophotometry to determine if CBE can be utilized to measure DPE1 activity in extracts.

IL-6 EXPRESSION DECREASES WITH GATA2 KNOCKOUT IN UTERINE SEROUS CARCINOMA

Cady Pagel
Mentor(s): Daniel Matson
Additional Author(s): Usha Polaki

Uterine serous carcinoma (USC) is an aggressive uterine cancer subtype that accounts for 40% of uterine cancer deaths. USCs rapidly invade into the uterus to spread and metastasize using mechanisms that are not well understood. We previously showed that loss of the transcription factor GATA Binding Protein 2 (GATA2) leads to USC invasion. I hypothesize that GATA2 loss leads to increased tumor cell expression of the cytokine IL-6 to drive USC invasion. USC cells knocked-out for GATA2 (GATA2 KO) had similar levels of IL-6 mRNA compared to wildtype (WT) controls. However, IL-6 protein was expressed in WT cells but was undetectable in GATA2 KO cells. I am now testing whether IL-6 receptor is expressed on USC cells and whether this is GATA2-dependent.

LEARNING PROTEIN DYNAMICS FROM WHAT IS PRESENT IN NMR SPECTRA

Nevin Pai
Mentor(s): Hannah Wayment-Steele, Gina El Nesr

Protein function depends not only on static structure but on conformational dynamics across multiple timescales. While machine learning has transformed structure prediction, predictive frameworks for slow (micro-to-millisecond) protein dynamics — where much of biology resides — remain limited by sparse, fragmented experimental data. We present Dyna-2, a deep learning approach that predicts residue-level micro-to-millisecond dynamics by leveraging ^{1}H-^{15}N HSQC spectral features. Peak broadening in these spectra reflects transverse relaxation and conformational exchange, providing direct insight into slow dynamics. Spectral features extracted from open-access publications were combined with existing chemical shift and assignment data to predict S^2 order parameters and R_2 relaxation rates. By fine-tuning Dyna-1's pretrained representation, we incorporated new quantitative NMR observables while retaining a biologically informed dynamical prior. This work highlights the critical need for centralized, accessible NMR data to advance deep learning in structural biology.

UPCYCLING OF PLASTIC WASTE: A MECHANISTIC STUDY OF THE OXIDATION OF POLYETHYLENE USING COBALT, MANGANESE, BROMIDE CATALYSTS

Cameron Pajot
Mentor(s): Dylan Walsh
Additional Author(s): Shannon Stahl

Plastics have made possible countless medical and technological advancements that shape modern life; however, single-use plastics are a significant hindrance to a sustainable chemical economy. To build a more sustainable industry, chemical recycling processes, such as oxidation, are a promising research direction. This work has looked to leverage the largest chemical oxidation process and applied the conditions of this process to high-density polyethylene recycling. The oxidation's biggest drawback is carbon loss in the form of CO2. To address this challenge, the mechanism behind the oxidation of high-density polyethylene using a Co, Mn, Br system was investigated to identify the causes and to utilize discoveries to find potential solutions.

MECHANISTIC MODELING OF THE MICROBIOME-GUT-BRAIN AXIS IN DEPRESSION

Sruti Palla
Mentor(s): John Yin

Major depressive disorder (MDD) is increasingly understood as a systems-level disorder involving interactions between the gut microbiome, immune signaling, neuroendocrine stress pathways, and neurotransmitter metabolism. This project proposes a mechanistic mathematical model of the microbiome–gut–brain axis integrating microbial dysbiosis, intestinal barrier permeability, inflammatory cytokine signaling, hypothalamic–pituitary–adrenal (HPA) axis activation, and tryptophan metabolic pathways. An ordinary differential equation framework will be used to model how stress-induced shifts in microbial composition influence immune activation and redirect tryptophan metabolism from serotonin synthesis toward the kynurenine pathway. Model parameters will be informed by published experimental data, including measurements of microbial abundance from sequencing studies, circulating cytokine levels, cortisol concentrations, and tryptophan metabolite profiles associated with depressive states. The model will also explore how mindfulness-based interventions may modulate these pathways and influence system dynamics relevant to depression.

PROJECT AMPARO

Nama Pandey, Victoria Rens
Mentor(s): Gita Connolly

By collaborating with the Community Immigration Law Center (CILC) and the Immigrant Justice Clinic (IJC) at the University of Wisconsin Law School, this project aims to reduce the barriers to justice for detained immigrants. In January 2026, over 73,000 individuals were detained in the U.S. Immigration Customs Enforcement (ICE) detention centers nation-wide. Dodge County Jail, which detains over 140 non-citizens, was declared deficient in seven issue areas in its most recent inspection. Furthermore, all immigrants are guaranteed unalienable liberties like due process. Our goal is to ensure that detained immigrants have access to accurate information, legal counsel, communication with loved ones, and/or preparation for repatriation by facilitating access to various services. This project aspires to give a voice to the voiceless, one individual at a time.

A CRITICAL ANALYSIS OF ACT 31: REFRAMING ENVIRONMENTAL EDUCATION THROUGH INDIGENOUS EPISTEMOLOGIES

Nama Pandey
Mentor(s): Benjamin Marquez, Bailey Smolarek

This thesis examines whether Wisconsin's Act 31 has shaped the inclusion of Indigenous perspectives in K-12 science education across Wisconsin public schools. While Act 31 requires instruction on the history, culture, and sovereignty of the state's federally recognized tribes, it does not explicitly address science curricula. Findings indicate that Indigenous knowledge systems are rarely integrated into science classes and are instead most often confined to social studies courses. When Indigenous perspectives do appear in science education, they are typically incorporated through place-based or fieldwork experiences. Drawing on qualitative methods, interviews with educators across the state and relevant scholarship highlight the need for more intentional, statewide integration of Indigenous knowledge across science subjects. Through conversations and literature, such integration may be pushed through increased emphasis on field-based learning experiences and sustained, interdisciplinary incorporation of Indigenous perspectives.

VALIDATION OF A GAS CHROMATOGRAPHY-MASS SPECTROMETRY URINE DRUG TEST

Alisha Parekh
Mentor(s): Zhicheng Jin, Jill Wolken

Qualitative urine drug screening is important in identifying or ruling out the presence of toxic substances in overdose cases. However, high-throughput immunoassay panels only cover a few drug classes. When clinical symptoms do not align with immunoassay drug test results, mass spectrometry-based confirmatory tests are ordered. As a robust, reliable, and cost-effective instrument, GC-MS has been used in toxicology laboratories since the 1980s. Recently, we transferred the in-house GC-MS drug test to a new instrument. Method validation meets the requirement of regulatory standards. Two case studies involving sertraline and xylazine demonstrated the value of broad-spectrum GC-MS drug screen in supporting clinical teams of the emergency department.

MAPPING FACE, PLACE, AND OBJECT SIMILARITY STRUCTURES IN THE HUMAN BRAIN USING SEARCHLIGHT REPRESENTATIONAL SIMILARITY ANALYSIS

Lina Park
Mentor(s): Ivette Colón

Representational Similarity Analysis (RSA) has become a widely used framework for investigating how information is represented in distributed neural activity patterns. I investigate whether different organizational dimensions of the same face, place, and object stimuli are represented in overlapping or distinct brain regions. Using functional magnetic resonance imaging (fMRI) and RSA, I examine how categorical (face/place/object), contextual (urban/rural, daytime/nighttime), and behaviorally derived similarity structures are encoded. Neural representational dissimilarity matrices (RDMs) are computed using a searchlight approach to map local representational structure. These neural RDMs are compared to predefined model RDMs to identify cortical regions whose multivariate activation patterns correspond to specific similarity structures. This analysis characterizes how multiple similarity dimensions of visual stimuli are represented across distributed brain regions.

EXPLORATION OF THE MOLECULAR BASIS OF EARLY LIFE ANXIETY DISORDER RISK THROUGH CELL-TYPE-SPECIFIC GENE EXPRESSION IN THE BASAL AMYGDALA REGION OF NONHUMAN PRIMATES

Lauren Parkins
Mentor(s): Patrick H Roseboom
Additional Author(s): AS Fröhlich, JA Oler, NA Stowe, R Puralewski, EB Binder, NH Kalin

Anxious Temperament (AT), a nonhuman primate model of early life risk for the development of anxiety disorders (AD), is a composite measure of threat-related behavioral and physiological responses, including freezing duration, vocalization (cooing) frequency, and blood cortisol levels. Characterizing the molecular substrates underlying AT is critical for understanding the neural processes that confer AD risk, and for informing early interventions. To investigate cell-type-specific gene expression in the basal amygdala region, a key brain area for stress regulation, we performed single-nucleus RNA sequencing in 68 peri-adolescent rhesus macaques. Although no genes were significantly related to the composite AT phenotype, its components displayed cell-type-specific transcriptional correlates. These findings enhance mechanistic insights into early AD risk and highlight candidate molecular targets for the development of therapeutic interventions.

THE ROLE OF GPER1-ACTIVATED FIBROBLAST EXOSOMES IN DRIVING BREAST CANCER PROLIFERATION AND MIGRATION

Emmy Parks
Mentor(s): Suzanne Ponik, Brian Burkel

Estrogen drives tumor proliferation in ER+ breast cancers, but it may also influence ER- subtypes via the non-canonical receptor GPER1. While expressed on tumor cells, GPER1 is also found on cancer-associated myofibroblasts (CAFs), which secrete exosomes that act as paracrine messengers. Here, we aim to investigate how exosomes from GPER1-activated CAFs impact tumor cell motility and proliferation. We isolated exosomes from CAFs treated with G-1 (a GPER1 agonist) or vehicle controls. These purified exosomes were then applied to scratch wound assays to measure closure time, migration speed, and proliferation rates. This research highlights how estrogenic effects on the stroma may drive disease progression, even in patients with ER- cancer cells.

USING MULTI-OBJECTIVE OPTIMIZATION TO EVALUATE PERFORMANCE OF THE GRAND ETHIOPIAN RENAISSANCE DAM, ETHIOPIA

Tess Parrott
Mentor(s): Paul Block

While future climate and hydrology are well studied globally, a gap remains in connecting projections with long-term reservoir planning and operations. In this study, a reservoir systems operations model of the Grand Ethiopian Renaissance Dam prioritizes two objectives: hydropower generation and timing of downstream flows. Historical streamflow in the Upper Blue Nile River Basin is used to define tradeoffs between objectives, then is altered (e.g. + 5%, + 10% scenarios) to represent plausible future streamflow. This is fed into the model with no adaptation of operational policy to understand expected changes in performance of the objectives and in tradeoffs. Global climate model projections can inform the likelihood of the scenarios. This analysis provides a framework to better inform future operating policies and long-term planning.

CORRELATING OPTICAL METABOLIC FLOW CYTOMETRY MEASUREMENTS WITH CAR-T CELL THERAPY OUTCOMES

Ojaswi Pasachhe
Mentor(s): Melissa Skala, Meghana Kalluri
Additional Author(s): Caitlyn Fardy, Kayvan Samimi, Peiman Hematti, Tyce Kearl, Nirav Shah

Chimeric antigen receptor T (CAR-T) cell therapy is an immunotherapy involving genetically engineering patient T cells to target cancer cells. Here, we investigate the relationship between autofluorescence lifetime measurements of NAD(P)H, a metabolic co-enzyme, in patient T cells and patient outcome with CAR-T cell therapy. Unmodified T cell samples from participants of an anti-CD19, anti-CD20 CAR-T cell therapy clinical trial underwent an expansion process. Autofluorescence lifetime measurements during expansion were related to final fold-expansion, T cell subtype composition, and patient response. Participants with complete disease remission demonstrated significantly higher mean autofluorescence lifetimes than those with progressive disease, suggesting an association between positive therapeutic outcomes and specific T cell metabolic characteristics. Thus, autofluorescence lifetimes could be a predictive tool for CAR-T cell therapy outcomes.

MEASURING MUTUAL COUPLING DIRECTLY IN 21 CM LINE INTENSITY MAPPING EXPERIMENTS

Chris Pate, Anna Heckel, Phoebe Milhollin, Vanessa Bello Ruiz
Mentor(s): Peter Timbie

The 21 cm intensity mapping method uses the redshifted 21 cm radio line emitted by neutral hydrogen gas to study the formation of the first objects after the Big Bang and the Universe's large-scale structure. Unfortunately, the faint hydrogen signal is obscured by bright radio foreground emission from the Milky Way galaxy, and systematic effects in current radio telescopes worsen the situation. An array of antennas can increase the sensitivity to the hydrogen signal. However, signal reflections between antennas affect beam patterns and create spurious signals. We have designed and constructed an antenna array from which we can obtain physical measurements of these effects and compare them with simulated measurements to better understand how they work.

ENGINEERING VIRUS-FREE CRISPR GD2-TRAC CAR T CELLS FOR PEDIATRIC HIGH-GRADE GLIOMA

Anikait Patel
Mentor(s): Portia Smith
Additional Author(s): Dan Cappabianca, Evan Dray, Lei Shi, Anna Tommasi, Austin J Stuckert, Quaovi H Sodji, Krishanu Saha, Christian M Capitini

Pediatric high grade gliomas (pHGGs) are highly aggressive brain tumors with abysmal survival rates. Recently, CAR T cell therapy targeting the GD2 antigen has shown promise with pHGG treatment, though poor T cell memory limits long term durability. Our group used virus-free CRISPR (VFC) CAR methods to develop T cell receptor alpha chain (TRAC)-Knockout (KO) anti-GD2 CAR T cells. This approach achieved >90% TRAC knockout with ~40% GD2-CAR knock-in. In vitro tumor co-cultures showed high antitumor potency against pHGG (SJ-GBM2) and neuroblastoma (CHLA-20) cell lines. Notably, replacing the Ig Heavy-chain VIII signal peptide (SP) with a CSF2R SP increased killing efficiency against the SJ-GBM2, highlighting the SP's effect on antitumor potency. This VFC-CAR methodology establishes the foundation for potent GD2-targeted pHGG therapies.

INVESTIGATING THE EFFECTS OF ELEVATED TEMPERATURE ON GERM GRANULES IN ΔMEG-3/4 *C. ELEGANS* MUTANTS

Alayna Patrick
Mentor(s): Jieon Lee
Additional Author(s): Andrea Putnam

This research examines whether temperature-induced disruptions of embryonic P granules contribute to sterility in wild-type and meg-3/4 mutant *C. elegans*. These roundworms contain membraneless condensate P granules found in germ cells that require the intrinsically disordered proteins MEG-3/MEG-4 for embryonic organization and germline development. Sequential generations were grown under mild (25℃) and moderate (26℃) heat stress, and progeny counts and sterility were quantified. Preliminary data indicate that Δmeg-3/4 mutants maintain fertility at 25℃ but exhibit severe fertility defects at 26℃, including a sharp decline in progeny. These findings suggest that temperature-sensitive disruption of embryonic P granules enhances sterility at 26℃. Furthermore, males were introduced to examine the developmental basis of this phenotype and immunofluorescence imaging was performed to visualize P granule organization.

EVOLUTION AND STRUCTURAL BASIS OF AROGENATE DEHYDROGENASE (TYRA) DEREGULATION IN NON-CORE CARYOPHYLLALES

Brant Paulick
Mentor(s): Hiroshi Maeda, Madelyn Schaut

Plants synthesize diverse specialized metabolites from aromatic amino acids produced through the shikimate pathway. In most plants, this pathway is tightly regulated to maintain levels of aromatic amino acids. For example, the enzyme arogenate dehydrogenase (TyrA) that catalyzes the reaction from arogenate to tyrosine, experiences feedback regulation by tyrosine itself. However, in Caryophyllales, TyrA deregulation has evolved in specific lineages, enabling elevated tyrosine pools supporting the production of betalains. While TyrAs in the core Caryophyllales have been characterized due to the connection with betalains, the non-core Caryophyllales remain understudied. Previous analyses have revealed that deregulated TyrA enzymes in non-core Caryophyllales are restricted to the Polygonaceae subfamily Eriogonoideae. This project aims to better understand TyrA regulation in the sister subfamily Polygonoideae through phylogenetic and biochemical analyses.

EXAMINING PROSTATE CANCER TUMOR MICROENVIRONMENT CELL INTERACTIONS USING A QUAD CULTURE PLATFORM

Hannah Pecoraro
Mentor(s): David Kosoff, Emma Recchia

Prostate cancer (PCa) is the second leading cause of cancer related death in US men. The lethality of PCa is supported by the evasion of tumor cell detection and destruction by the immune system. This immune evasion is supported by the non-cancerous cells within a tumor, collectively known as the tumor microenvironment (TME). Immune evasion leads to tumor growth, invasion, and survival. Immune evasion also limits the use of immunotherapies, which have improved outcomes in many other cancers. Using novel microscale cell culture technologies, we have identified that TME cell populations, such as tumor-associated macrophages (TAMs) and cancer-associated fibroblasts (CAFs), can be reprogrammed from immunosuppressive to immune supportive through T cell derived interferon gamma. This represents a targetable pathway to enhance immune responses in PCa.

THE ART OF REARING A MONARCH

Akhilesh Peddi
Mentor(s): Kristin Phillips-Court

Married into the cadet branch of the Medici family at the age of seventeen as part of a strategic alliance. Maria was thrust into the unfamiliar and violent world of politics which soon took her decorated warrior husband from her. His death therefore placed Maria into a tempestuous world that normally excluded woman. Threatened with exile, execution, and bankruptcy, Maria defied all expectations of a young widow in the 1500s when the most obvious path to follow was to remarry. Exercising remarkable foresight, she orchestrated the education and accession of her outcast son to the seat of what would become the first Italian monarchy. Her correspondence reveals a complex portrait of a woman who overcame the essential marginality that determined women's social contract.

OPTIMIZATION OF WESTERN BLOT FOR DETECTION OF ATM/ATR, HIGH-MOLECULAR WEIGHT PROTEINS, IN ATOVAQUONE-TREATED OVARIAN CANCER CELLS

Meghana Roy Peddoddi
Mentor(s): Sejal Sharma, Manish Patankar

Oxidative phosphorylation (OXPHOS) supports cellular proliferation and is frequently exploited in cancer cell metabolism. Consequently, OXPHOS inhibitors such as Atovaquone are being explored as potential therapeutics in ovarian cancer. However, while Atovaquone induces tumor cell death, emerging evidence suggests it may also increase PD-L1 as an immunosuppressive mechanism. To therefore examine pathways associated with PD-L1 expression, we optimized Western Blot conditions to more efficiently detect the high-molecular weight proteins ATM, ATR, and their respective phosphorylated counterparts in human and murine ovarian cancer cell lines with and without atovaquone treatment. Overall, this study suggests a more efficient Western Blot protocol to identify high-molecular weight proteins and can thus be used to study stress-induced metabolic signaling pathways in ovarian cancer.

ENHANCING DRIVER SAFETY IN LEVEL 2 AUTOMATED VEHICLES

Melissa Penafiel
Mentor(s): Jahinaya Parker, Joon Bum Lee

Automated vehicles (AVs) present great potential for improving congestion and productivity on the roads. AVs are manufactured to manage much of the driving tasks, yet humans remain responsible for mastering an understanding of its functions and perceiving their driving conditions, defined as situational awareness (SA). The purpose of this project is to synthesize and analyze existing research on the mechanisms of SA, applications of driver training, and implications for road safety. This draws upon empirical studies and experiments evaluating how driving training influences readiness. It is found that multi-modal human machine interfaces (HMIs) and driving education & training target drivers SA. This contributes to advancing the framework of driver training and SA, guiding AV researchers to comprehend their crucial integration for road and driver safety.

PRELIMINARY ATTRIBUTES OF INFORMANT ENDORSED EPISODES OF LUCIDITY IN ADVANCED DEMENTIA

Aria Peng
Mentor(s): Haley Kottler, Alison Coulson
Additional Author(s): Andrea Gilmore-Bykovskyi

Recent literature has identified provisional attributes of lucid episodes (LEs) in people living with dementia. This analysis investigated a pilot survey to assess differences in attributes between endorsed and non-endorsed observations. Likert data from 29 surveys measuring ten attributes from informants (N=17) were coded as numerical. Mann-Whitney U tests compared response distributions between endorsed and non-endorsed episodes. Fisher's Exact Test assessed differences in endorsement rates between clinician and care partner informants. Seven items showed significant distribution differences. There was no significant difference in endorsement rate across informant types. These findings support identification of core attributes of lucidity, providing a basis for refining how lucidity is defined and measured. Consistency of endorsement rate across informant types supports the reliability and preliminary validity of the endorsement procedure.

ELUCIDATING THE POTENTIAL INTERACTIONS BETWEEN *E. COLI* DNA REPAIR PROTEINS SMRA AND RECO

Katherine Pennel
Mentor(s): Zoe Wetmore
Additional Author(s): Jim Keck

DNA damage can be both detrimental to cell health and lead to mutations that contribute to the rise of antibiotic resistance. Post-replication gap repair is a method for reducing such damage. In this process, the replication machinery dissociates from the DNA when it encounters a lesion during replication, and reinitiates downstream. The resulting single strand (ss) DNA gap must later be repaired. *E. coli* uses the RecFOR proteins to recruit RecA, which repairs the ssDNA gaps through homologous recombination. SmrA (also known as YdaL), an *E. coli* endonuclease protein, may interfere with RecA-mediated homologous recombination by resolving early intermediates. AlphaFold predictions suggest it interacts with RecO. My research explores the proposed interactions between SmrA, RecO, and different DNA structures, as well as SmrA's endonuclease activity.

WORLDS IN TIME: MULTI-METHOD AGE DATING OF SMALL TEMPERATE PLANETS

Amaya Pereira
Mentor(s): Melinda Soares

Our research aims to more accurately determine ages for known star systems hosting earth sized planets. Accurate aging of stellar systems is crucial to our understanding of their development and can assist in the search for life on other planets by telling us which planets are old enough to potentially be hosts for life. Using data from the NASA Exoplanet Archive, we identified 54 target stars hosting exoplanets about 1-2.5 times the size of earth, with temperatures able to support life. We also gathered data to run gyrochronology, lithium depletion, and comoving ensemble analyses on these systems. By determining agreement between different methods of age analysis on these systems, we will increase our confidence in understanding of the development stage of these earth-like planets.

SYNTHESIS AND CHARACTERIZATION OF N-ACYL-CYCLOLYSINE ACTIVITY IN LUXR-TYPE RECEPTORS

Hannah Pertzborn
Mentor(s): Helen E. Blackwell, Isabel Cannell

Many gram negative opportunistic human pathogens with high rates of antibiotic resistance regulate virulence phenotypes through a cell-to-cell signaling system called quorum sensing (QS). This QS system uses N-acyl-L-homoserine lactones (AHLs) that bind to LuxR-type receptors, triggering a response. Disrupting these bacterial communications could allow for a new anti-virulence strategy. Recently discovered QS systems in Bacteroidota species—commonly found in the human oral and gut microbiome—have signaling molecules called N-acyl-cyclolysine (ACLs). These ACL molecules and AHLs are both small diffusible compounds with long acyl tails. To see if there could be cross-talk between these two systems, we synthesized ACLs and subsequently evaluated them in QS reporter assays of several LuxR-type receptors. Many LuxR-type receptors were agonized and antagonized by ACLs.

THE SYNTHESIS OF THE ELUSIVE MOLECULE METHANEDIOL

Ashley Peter
Mentor(s): Susanna Widicus Weaver, Colton Moore

I have investigated the process of synthesizing a transient molecule called methanediol (CH2(OH)2) from methanol and electronically excited oxygen. Methanediol is an organic compound that plays an important role in atmospheric chemistry, specifically cloud formation. I will focus on why methanediol is considered an elusive molecule, computational characterizations of methanediol to guide laboratory synthesis, and experimental procedures for synthesis.

ENGINEERING A STABLE FLUORESCENT REPORTER VIRUS FOR EPSTEIN–BARR VIRUS INFECTION STUDIES

Emma Peterschmidt
Mentor(s): Mariah Riel

Epstein-Barr virus (EBV) has established a latent infection in over 90% of the population. Most EBV infections have a benign course, but it can cause a wide spectrum of lymphomas including Hodgkin and Burkitt lymphomas. Because of EBV's tendency to establish latent infections, it is not possible to titer by plaque assay. As a result, fluorescent viruses are used to quantify EBV. The M81 EBV strain that we use in humanized mouse studies has its fluorescent reporter situated in the virus's terminal repeats and is frequently lost during viral replication. By modifying this strain using scarless recombination, we can insert a new fluorescent reporter in a locus where it will not be lost, improving the ability to identify infected cells and generate reproducible results.

UTILIZING THE MEASUREMENT OF COLLAGEN TO EVALUATE THE IMPACT OF PERTURBATIONS ON IN VIVO, IN VITRO, AND EX VIVO MODELS OF LUNG FIBROSIS

Emily Peterson
Mentor(s): Nathan Sandbo, Angie Oler
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Idiopathic pulmonary fibrosis (IPF) is a progressive lung disease resulting from excessive extracellular matrix (ECM) deposition. We evaluate multiple assays to measure collagen content in mouse models, primary human lung fibroblasts (HLF), and human precision cut lung slices (PCLS) under perturbations of fibrosis. Using these models, we attenuated various fibrotic pathways with inhibitors to investigate the impact on collagen gene and protein expression. Treatment with ZL0591 significantly reduced the bleomycin induced collagen increase as measured by hydroxyproline in the mouse lung tissue. Primary HLF, when treated with anti-fibrotic inhibitors, FR054 and AICAR, exhibited a decrease in TGF-β1-induced collagen gene expression. Human PCLS, treated with the anti-fibrotic inhibitors, ZL0969, FR054 and AICAR, resulted in a significant decrease of TGF-β1-induced collagen gene expression.

REDUCING REACTIVE OXIDATIVE SPECIES DAMAGE AND PROMOTING ISCHEMIA REPERFUSION USING PRC-210

Hannah Peterson
Mentor(s): Aaron Dingle, Samuel Poore
Additional Author(s): Jusuf Ademi, Natalie Furtado, Miyah Quach, Alec Chen

Studies show that PrC-210, a reactive oxygen species (ROS) scavenger, reduces tissue damage in rats by neutralizing oxidative stress during ischemia–reperfusion injury, but its effects on post-operative recovery are unclear. Donor–recipient rat pairs underwent Vascularized Composite Allotransplantation (VCA), a transplantation of multiple tissue types at once to a recipient, with each pair including a saline control and a PrC-210 treatment group. Post-operative health was assessed through food intake, body weight, and behavior. Because rats share physiological similarities with humans, evaluating PrC-210's role in recovery may provide insight into its clinical potential in surgical and transplant medicine. Statistical analysis showed that PrC-210-treated rats had decreased weight gain, nutritional intake, and behavioral improvement, contradicting the alternative hypothesis. These findings clarify PrC-210's impact on recovery following VCA.

DONOR-RECIPIENT ORIGIN OF BAL-DERIVED ORGANOIDS AND IMMUNE CELLS FROM LUNG TRANSPLANT PATIENTS

Sophie Petta
Mentor(s): Monica Liu, Amy K. Kraak
Additional Author(s): Mackenzie S. Jackson, Lynn M. Schnapp

Rejection is the leading cause of death after lung transplantation, but its mechanisms are poorly understood. We developed a method to model rejection using alveolar and airway organoids from lung transplant recipients' bronchoalveolar lavage (BAL) fluid. Since BAL is collected from the donor lung in the recipient, we asked whether the organoids contain donor or recipient cells. We hypothesized epithelial organoids would be predominantly donor-derived, while BAL immune cells would be recipient-derived. Organoids were expanded, digested to single cells, and analyzed by short tandem repeat (STR) analysis. Alveolar organoids were 100% donor-derived, airway organoids were varied, and immune cells were mostly recipient-derived. This confirms that BAL can provide both donor and recipient cells. Future work will isolate pure populations and co-culture them to model rejection.

CHARACTERIZING THE NEUROPROTECTIVE POTENTIAL OF ADIPONECTIN SIGNALING IN ALZHEIMER'S DISEASE

Brock Peyton
Mentor(s): Eric McGregor

Alzheimer's disease is a growing challenge in Wisconsin, impacting over 110,000 residents and placing a vast strain on families and the healthcare system. Despite this burden, specific mechanisms of cognitive decline associated with Alzheimer's disease (AD) remain unclear. Notably, changes in brain mitochondrial metabolism coincide with functional decline, yet effective therapeutic strategies targeting this relationship are lacking. Here, we investigate the therapeutic potential of mitochondrial targeting via the adiponectin receptor activator AdipoRon (AR). Past findings demonstrated that AR lowers neurofibrillary tangle burden and rescues mitochondrial function. This project seeks to further characterize the impact of AR treatment. Synaptic density and astrocytic branching will be investigated using immunodetection. Hippocampal neuronal density will also be assessed via hematoxylin and eosin (H&E) staining. Together, these studies aim to clarify how adiponectin receptor activation restores neuronal metabolic health and may support the development of new therapeutic strategies for Alzheimer's disease.

EVALUATING A SUPPORTED INTERNSHIP PROGRAM FOR BILINGUAL YOUNG ADULTS ON THE AUTISM SPECTRUM

Aditi Phatak
Mentor(s): Antonio Pagán
Additional Author(s): Hassan, L., Loveland, K.A.

Bilingual young adults on the autism spectrum face severe employment disparities. The Launching! to Adulthood initiative addresses this gap through a twelve-week supported internship program. To evaluate the program's impact, we collected qualitative feedback from interns, their parents, and workplace supervisors. During the program, interns received individualized coaching, while parents and supervisors participated in specialized training. Results indicated that interns gained significant vocational skills and a stronger professional identity. Parents reported noticeable improvements in their children's' self-esteem and social engagement. Supervisors praised the interns' work but highlighted the need for literal communication strategies and streamlined onboarding. Overall, the program successfully fostered employment readiness, demonstrating the value of comprehensive, multi-stakeholder support in improving vocational outcomes for this demographic.

IMPACT OF *SALMONELLA* SULFITE SENSING CAPABILITY ON MOTILITY AND GROWTH

Mikayla Pich
Mentor(s): Johanna Elfenbein, Vivian Nguyen

Salmonella is a bacteria that causes foodborne illness and is able to resist many stressors including sulfite. Sulfite is a toxic compound common in our environment and in foods. Our lab identified that *Salmonella* can tolerate sulfite stress through yeiE. The purpose of this work is to explore how *Salmonella*'s sulfite sensing capability affects phenotypes that are necessary for infection. I performed motility using point mutants of YeiE that are unable to sense sulfite. I found that YeiE point mutants unable to sense sulfite are still motile. Next, I will test the growth of these mutants in sulfite stress. My research will help us understand how sulfite sensing alters *Salmonella*'s physiology to reveal mechanisms in which it can cause foodborne disease.

REGIONAL CELL MAPPING OF THE FEMALE URETHRA DURING URINARY TRACT INFECTION

Akhil Pidikiti
Mentor(s): Chad Vezina
Additional Author(s): Allison Rundquist,Elliot Heye

Urinary tract infections disproportionately affect women and remain amongst the most common recurrent bacterial infections, yet the cellular landscape shaping urethral susceptibility and recovery is poorly defined. To address this gap, we generated a cellular map of the female urethra and examined how infection alters local tissue composition. Adult female mice (6–8 weeks) were anesthetized and instilled with sterile saline or uropathogenic *E. coli* before full urethral segments were collected. Tissues underwent immunohistochemistry and imaging to characterize proximal, medial, and distal regions and to broadly identify epithelial, neuroendocrine, and immune cell populations. Cell density and proliferation were compared between control and infected groups. We expect these findings provide foundational insight into infection responses and inform future therapeutic strategies for women.

ANCIENT ENZYMES IN MODERN HOSTS: CLONING ANCESTRAL NITROGENASES INTO *STUZTERIMONAS STUTZERII*

Camila Piedrahita
Mentor(s): T Laack, Betül Kaçar, Jean-Michel Ané

Nitrogenase is an oxygen-sensitive enzyme-complex crucial for the conversion of atmospheric nitrogen into bioavailable forms; a process essential for the bulk of biological systems. This work represents the construction of a genetic background for testing computationally derived ancestral sequences of nitrogenase. Prior studies have analyzed the function of this set of ancestral nitrogenase sequences using the obligately aerobic *Azotobacter vinelandii* as the chassis. This has constrained the ability to assay the oxygen tolerance of ancestral nitrogenase sequences. The transformation of ancestral variants into the facultatively anaerobic *Stutzerimonas stutzeri* will allow for the efficient screening of oxygen sensitivity of the nitrogenase variants and highlight the differences in variant function due to genetic background. In this work, evolution informs engineering strategies that enhance nitrogenase's applicability in agriculture.

MANDIBULAR MORPHOLOGY OF DIFFERING ANCESTRAL AETOSAURS: INTERPRETATION FOR ENVIRONMENTAL AND TEMPORAL CONSTRAINTS

Carolina Pierri
Mentor(s): David M. Lovelace

Aetosaurs were herbivorous reptiles that roamed during the Late Triassic, belonging to the Archosauria lineage. Though the lineage has distinguished similar anatomical bodies, mandibular morphology variation has suggested differentiation in feeding mechanics and ecological roles. Previous research regarding archosaur jaw structure has shown correlations between dietary differences and resource use. This study analyzes how gross (size/shape) and functional (spatial arrangement) lower jaw morphology among aetosaurs influences dietary divergence and temporal divisions. The mandibular digital segmentation and reconstruction of *Stenomyti huangae* were conducted through high-resolution synchrotron computed tomography (CT) for a comparative analysis with differing Aetosauria species. By investigating digital reconstruction relative to published morphological and phylogenetic data, this research examines the biomechanics, ecological specialization, and temporal niche partitioning of aetosaur mandible configurations.

ASCORBATE PROMOTES POST-TBI NEUROPROTECTION BY ENHANCING DNA HYDROXYMETHYLATION

Maria-Luciana Pineros
Mentor(s): Pallavi Joshi

Every year, ~69 million people worldwide sustain some form of traumatic brain injury (TBI), which depending on the magnitude of impact and the degree of damage, results in motor, cognitive and neuropsychiatric dysfunction. Despite ~5.3 million individuals living with TBI-associated disabilities, there is no current therapeutic option that can prevent the secondary damage and promote long-term functional recovery. The role of epigenetics in post-TBI brain damage is poorly understood. While 5-methylcytosine (5mC) is an important epigenetic modification known to repress transcription, 5-hydroxymethylcytosine (5hmC) in DNA is thought to promote transcription of protective genes and promote neuronal survival under adverse conditions. Since ascorbate acts as a cofactor to the Ten-eleven Translocation (TET) family of proteins that catalyze the oxidation of 5mC to 5hmC, we tested its efficacy after experimental TBI. Adult male C57BL/6 mice subjected to controlled cortical impact (CCI) injury were injected with ascorbate (i.p.; 250 mg/Kg or 500 mg/Kg or 750 mg/Kg; n =4/group) or saline at 5 min, 24h and 48h after TBI. The 5hmC levels (analyzed by dot blot) increased significantly in a dose-dependent manner in the perilesional cerebral cortex in the ascorbate cohort compared with the saline cohort.

PEACE IN THE CITY OF MAN: MACHIAVELLI AND AUGUSTINE ON THE QUEST FOR PEACE IN POLITICS

Sofia Piolanti
Mentor(s): Daniel Kapust

Machiavelli's relationship to religion, specifically Catholicism, has been heavily debated throughout the years. Many scholars have placed him in conversation with religious figures of his time and it has become all the more popular to extend this conversation to Medieval Christian thinkers. This paper draws upon a larger scholarly conversation about Machiavelli's approach to religion and compares his political theory with that of St. Augustine. More specifically, in what ways do they agree, where do they disagree, and what does this tell us? In an attempt to place both thinkers on equal footing, I narrow this investigation to their respective discussions of peace and ultimately conclude that their line of thought regarding man's quest for peace is far more similar than previously thought.

EXPERIMENTS OF HIGH REYNOLDS NUMBER MICROPLASTIC FIBERS IN QUIESCENT AND OSCILLATORY FLOW

Evan Pittam
Mentor(s): Joo Young Bang, Nimish Pujara

Microplastic pollution is pervasive in freshwater systems, yet the settling behavior of microplastic fibers remains incompletely understood across all flow regimes. While settling in quiescent water has been well characterized, the extent to which flow regime alters macroscopic settling dynamics at high Reynolds numbers is unclear. This study experimentally investigates the settling behavior of large-scale microplastic fibers with high Reynolds numbers and varying aspect ratios in both quiescent and wavy flow. Results demonstrate that general settling characteristics like time-averaged settling velocity are equivalent across regimes. These findings indicate that the same governing physical parameters determine microfiber settling independent of flow condition, improving predictive models for microfiber transport and accumulation in natural waters.

THE ROLE OF GNAZ IN JUVENILE BETA CELL COMPENSATION IN OBESITY-INDUCED DIABETES

Shashank Pokhrel-Joshi
Mentor(s): Rodsy Modhurima

Type 2 Diabetes (T2D) is a major global health challenge, and its long-term complications are kidney disease, nerve damage, and vision loss. T2D is distinguished by insulin resistance and the dysfunction of insulin-producing beta cells. I am investigating the role of the inhibitory G protein subunit GNAZ in regulating beta-cell maturation and pancreatic islet health. GNAZ is a component of the EP3 receptor that inhibits cAMP production and insulin secretion. We hypothesize that loss of GNAZ will block EP3 signaling and improve beta cell function by increasing islet cAMP levels. I compared GNAZ knockouts to WT mice to test whether loss of GNAZ confers improved beta-cell compensation during obesogenic stress. I am analyzing beta-cell maturity in pancreas sections from juvenile mice in obesity-induced diabetes model.

PUBLIC INVESTMENTS IN FAMILIES AND HOUSEHOLD DEBT: CROSS-NATIONAL EVIDENCE FROM THE LUXEMBOURG WEALTH STUDY

Rishy Ponnam, Addison Gilbertson
Mentor(s): Trisha Chanda
Additional Author(s): Alec P. Rhodes

Do public investments in families reduce household debt? This study is one of the first to examine individual-level associations between public investments in family benefit programs and unsecured debt levels among single parent households across rich democracies. We use pooled cross-sectional microdata from the Luxembourg Wealth Study for 22 OECD countries from 1995-2022. We measure public investments as total government spending per-capita on family benefits across cash and in-kind transfer programs. We apply advanced econometric techniques to estimate within-country changes in debt as public investments change, for both the full sample and samples stratified by income for single parents. Our preliminary findings suggest that single parents living in countries that invest more in family benefits have lower unsecured debt burdens.

EFFECTS OF CROPPING SYSTEMS ON SOIL ORGANIC MATTER DYNAMICS ACROSS SOIL DEPTHS DURING THE GROWING SEASON

Ella Post
Mentor(s): Soni Ghimire

Understanding how soil organic matter (SOM) fractions differ across cropping systems is critical for understanding SOM persistence. Where and when particulate organic matter (POM) and mineral-associated organic matter (MAOM) differ in composition and their relationship to total SOM is poorly understood. To understand this, POM-carbon (C) and MAOM-C were measured in soils from three cropping systems from WICST at two depths. We hypothesized that i) POM-C will be higher than MAOM-C across cropping systems, depths and time, and perennial systems will have higher C than corn, ii) cropping system effects will be highest on surface soils and during peak growing season. This study will provide insight on factors controlling SOM fractions' spatial and temporal dynamics, improving our ability to predict future fate of soil C.

IMPACTS OF VITAMIN D SUPPLEMENTATION AND NONRENAL CALCITRIOL PRODUCTION ON ATHEROSCLEROTIC PLAQUE FORMATION

Hunter Potter
Mentor(s): Mark Meyer
Additional Author(s): Seong Min Lee

Atherosclerosis is a chronic inflammatory disease characterized by plaque accumulation in arterial walls. Vitamin D is suspected to mediate atherosclerosis but its mechanism remains unclear. Endocrine circulation of calcitriol ($1,25(OH)_2D_3$), vitamin D's active form, is controlled through renal *Cyp27b1* enzymatic activity. However, *Cyp27b1* is also expressed in immune cells, enabling local calcitriol circulation. To distinguish local vs systemic calcitriol effects we developed a specialized mouse model (M1/M2-DIKO), lacking renal *Cyp27b1* enzymatic activity, while retaining immune *Cyp27b1* expression. These mice along with wild-type controls and mice with global *Cyp27b1* inhibition were crossed with LDLR-KO mutants and fed high fat diets containing 0IU, 5IU, or 20IU vitamin D. Aortic arch histology was conducted to quantify plaque burden and assess differences in atherosclerotic severity.

NOISE ANALYSIS FOR FLASH DIFFERENTIAL SCANNING CALORIMETRY

Keyvan Pouladian-kari
Mentor(s): Charlie Hirst

With growing demand for low-carbon energy, advancing nuclear reactor technologies is critical. However, reactor lifetimes are limited by extreme conditions, making material selection crucial. An emerging method to quantify radiation damage is measuring stored energy released during defect annealing using Flash Differential Scanning Calorimetry (Flash DSC). Yet, analyzing irradiated materials with Flash DSC presents a challenge: necessary microscopic sample sizes yield minute energy releases often obscured by instrumental noise. This research focuses on optimizing Flash DSC parameters to overcome this barrier. By systematically analyzing the instrument's noise profiles by varying heating and sampling rates. Understanding how these parameters influence baseline noise is a crucial step toward accurately isolating true defect annealing signals in next-generation nuclear materials.

WHEN DO CHILDREN STAND UP TO BIAS? INVESTIGATING CHILDREN'S RESPONSES TO RACE-BASED EXCLUSION

Rayane Prado Nunes
Mentor(s): Kristin Shutts, Eren Fukuda

In this study, children aged 5 to 10 years viewed stories featuring a protagonist who made playmate selections. In one condition, the protagonist systematically selected same-race playmates and excluded other-race peers; in the other condition, no racial pattern was evident in the protagonist's choices. All participants then completed a pattern-encoding task to assess whether they detected race-based exclusion. Next, participants: (1) evaluated the protagonist's behavior (i.e., reported whether they liked or disliked their choices) and (2) had the opportunity to intervene (i.e., by directly confronting the protagonist, reporting the behavior to a teacher, or including the excluded peers themselves). By examining children's encoding, evaluations, and behaviors, this study sheds light on how children recognize and respond to racial bias.

INHIBITORY CONTROL AS A POOR PREDICTOR FOR GENERAL FRACTION KNOWLEDGE IN UNDERGRADUATES

Annabelle Presly
Mentor(s): Edward Hubbard, Roy Luo

Inhibitory control (IC) is the ability to override a dominant mental response, an aspect of cognitive control allowing us to make goal-driven decisions. Previous studies link cognitive control and learning, implying the significance of cognitive control in early-childhood education, including math. Fractions are difficult to comprehend, and yet fraction-understanding in children can predict later-in-life success. We examined IC and general fraction comprehension in undergraduates to understand the impact of cognitive control on fraction abilities. We used the Hearts and Flowers Task to assess IC and the Fraction Knowledge Assessment (FKA) to assess general fraction knowledge. Across two measures of IC, we found non-significant correlations between IC and fraction understanding, contradicting previous expectations. This unexpected finding implies other components of cognitive control may be at play.

ESTIMATING BIOMASS IN A PRAIRIE THROUGH USE OF STEPWISE REGRESSION ON LIDAR AND HYPERSPECTRAL DATA

Micah Pribbenow
Mentor(s): Sarah Graves, Phil Townsend

In Wisconsin, native prairies are a key ecosystem due to their ability to hold high biodiversity, support many different types of wildlife, and facilitate carbon sequestration. Estimating prairie biomass from remote sensing data can give important information about vegetation quality and carbon stocks on a large scale. Hyperspectral and LiDAR data were collected in the Biocore Prairie of the Lakeshore Nature Preserve along with ground measurements of biomass. Stepwise regression was performed using multiple indices to create a model of predicting biomass based on the known values of biomass collected from plots across the prairie. This model will help with efforts to calculate carbon stocks on the UW-Madison campus and will give a baseline for future monitoring of biomass in the Biocore Prairie.

MOLECULAR INSIGHTS INTO *LEPTOLYNGBYA* SP. JSC-1 PHOTOACCLIMATION

Kyle Prock
Mentor(s): Chris Gisriel, Gaozhong Shen
Additional Author(s): Nikki Magdaong, Christian M. Brininger

The cyanobacterium JSC-1 was isolated from a microbial mat in a thermal spring. Initially studied for its tolerance to environmental stresses, JSC-1 was later discovered to undergo changes when grown under far-red light (FRL) that allow it to utilize this light for photosynthesis. Unlike other cyanobacteria, JSC-1 combines iron tolerance and thermotolerance, traits advantageous for extraterrestrial environments such as Mars. Despite being the first organism in which FRL photoacclimation was described, no molecular structures exist for its proteins involved in photosynthesis. Here we (a) establish cell growth conditions and (b) perform initial characterizations of these proteins in JSC-1. Our results establish JSC-1 as a model for understanding the biochemical bases of FRL photoacclimation, quantify its physiological resilience, and evaluate its role in extraterrestrial biomanufacturing systems.

DAILY FLUCTUATIONS IN PARENT REPORTS OF INFANT DYSREGULATED MEDIA USE

Caroline Pruchnicki, Hana Yemer Aserade, Raina Shah, Caroline McDowell, Molly Geraci
Mentor(s): Heather Kirkorian
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Problematic media use (e.g., tantrums when media use ends) has been attributed partly to children's self-regulation and to parents' media-related behaviors (Domoff et al., 2020). Therefore, this study aimed to characterize day-to-day fluctuations in infant dysregulated media use and its relation to parents' media motivations. Participants were 469 parents of 12–24-month-old children who completed daily diaries for three weeks. On days when parents reported more frequent media use than usual to calm themselves, calm their children, and occupy their children, they also reported more frequent infant media dysregulation than usual (i.e., compared to their own average; within-person effects). Findings highlight the importance of daily parental motivations in understanding infant screen-related dysregulation.

HOW SPIRITUALITY SUPPORTS MENTAL HEALTH AND RESILIENCE IN ADOLESCENCE

Caroline Pruchnicki
Mentor(s): Andrea Buhler-Wassmann

Adolescents and emerging adults are experiencing rising rates of depression and anxiety, highlighting the need to better understand protective factors that foster resilience. Spirituality—often understood as the human search for meaning, direction, and transcendence through relationships with the self, others, nature, or a transcendent reality—has been consistently linked to positive mental health outcomes. Yet the processes through which spirituality supports well-being remain underexplored. This qualitative study examines how emerging adults understand and experience spirituality in relation to coping and resilience. Semi-structured interviews will be conducted with undergraduate students ages 18–25 at UW–Madison. Using thematic analysis, the study explores how spirituality shapes meaning-making, emotional regulation, and responses to adversity, contributing to deeper understanding of spirituality as a coping resource.

CHARCOAL-DERIVED FIRE HISTORY OF NORTHERN WISCONSIN HARDWOOD FORESTS

Hazel Wilder Purins
Mentor(s): Sara Hotchkiss
Additional Author(s): Matthew Lemes

Forest management relies on an understanding of the ecosystem's current and historical disturbance regime, including the area's fire history. While much is known about the fire regimes of Wisconsin's fire-dependent prairies, oak savannas, and jack pine barrens, less is known about the historical fire regime of northern hardwood and mixed conifer-hardwood forests. Some estimate the fire return interval of these forests to be as long as two thousand years between fires. We analyzed charcoal abundance in a lake sediment core dating back to 53 CE to construct a fire history of Dave Lake in Price County, Wisconsin. Charcoal fragment (>125 μm) accumulation rates calculated from continuous sampling suggest a more frequent fire return interval, potentially as low as 120 years.

HYBRID DE NOVO SEQUENCING AND DATABASE SEARCHING REVEAL ENDOGENOUS PEPTIDES IN CRUSTACEAN MODEL

Jenifer Qin
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Endogenous peptides are critical regulators of signaling and immunity but remain difficult to characterize in organisms with incomplete genomic annotation. We developed a hybrid discovery framework that integrates de novo sequencing (Casanovo), neuropeptide-focused database searching (EndoGenius), and empirical false discovery rate estimation via NovoBoard, which enables confident identification of endogenous peptides while expanding coverage beyond conventional database-only or de novo-only approaches. Applied to neuroendocrine tissues from *Callinectes sapidus* and *Cancer borealis*, the workflow revealed numerous high-abundance novel peptides and provided structural and genomic support for their biological relevance. Notably, we report the first histone-2A–derived antimicrobial peptide in blue crab and characterize naturally occurring sequence variants. We also identify unexpected peptide homologies between crustaceans and *Rattus norvegicus*, offering new opportunities for annotating conserved housekeeping proteins.

WHO EXPERIENCES ORGASM COERCION? PREVALENCE OF ORGASM COERCION IN A UNITED STATES NATIONALLY REPRESENTATIVE NON-PROBABILITY SAMPLE

Alethea Quick
Mentor(s): Sara B. Chadwick

Orgasm coercion (OC) occurs when someone pressures their sexual partner to orgasm. In the present study, we examined the prevalence of OC experience and perpetration across sex assigned at birth, gender identity, race/ethnicity, sexual identity, political affiliation, and age in a U.S. nationally representative non-probability sample (N = 500, M age = 45.46 years, SD = 15.63). We found that the majority of participants had ever experienced OC (51.6%-91.4% depending on OC type) and perpetrated OC (51.2%-69.4% depending on OC type). There were no significant differences by sex-assigned-at-birth, gender identity, race/ethnicity, or sexual identity when controlling for orgasm frequency. Republicans reported perpetrating angry OC at a higher prevalence than Democrats and Independents. Older participants reported higher prevalence of perpetrating sad OC compared to younger participants.

DIAZONIUM FUNCTIONALIZATION OF TWO-DIMENSIONAL MATERIALS

Cole Rabe
Mentor(s): Robert Jacobberger

Chemical functionalization provides a route to introduce covalent modifications in two-dimensional materials and examine how surface chemistry influences their properties. In this work, graphene is functionalized using aryl diazonium chemistry to study how reaction conditions affect the extent of surface modification. Graphene samples are exposed to 4-nitrobenzenediazonium (4-NBD) solutions under varying concentrations and reaction times on multiple substrates. Raman spectroscopy is used to monitor changes in the characteristic D and G peaks, with the D/G intensity ratio used to compare functionalization across conditions. Differences in Raman response are analyzed to evaluate how concentration and substrate influence the reaction. These measurements provide insight into how diazonium chemistry modifies two-dimensional materials under different experimental conditions.

ASSESSING THE IMPACT OF DEER HERBIVORY ON THE GROWTH AND PHYSIOLOGICAL PERFORMANCE OF NORTHERN RED OAK SAPLINGS

Madelyn Radtke
Mentor(s): Nick Balster

Northern red oak (*Quercus rubra*; NRO) is a keystone species in U.S. temperate deciduous forests, supporting biodiversity, carbon storage, and forest economies. However, regeneration has declined across much of its range due to elevated White-tailed deer (*Odocoileus virginianus*) populations. Beyond direct browsing, deer may impact above and belowground processes that impact NRO seedlings. This study examines how long-term deer exclusion affects the relative growth rate of NRO saplings, measured by sapling height, basal diameter, leaf production, and canopy trait variation in specific leaf area and leaf dry matter content. Confounding factors of light availability and soil physical and nutrient characteristics are also quantified. These findings will improve our understanding of forest regeneration dynamics with heavy browse pressure, informing oak conservation and deer management.

THE ROLE OF TSC2 IN EPHA-MEDIATED AXON GUIDANCE IN RETINAL GANGLION CELLS INDEPENDENT OF TSC1 AND MTORC1

Samuel Rafferty
Mentor(s): Timothy Gomez
Additional Author(s): Austin Pier, Ngawang Namru, Eliza Rider

Tuberous sclerosis complex (TSC) is an autosomal dominant disorder caused by the monoallelic inactivation of TSC1 or TSC2. TSC causes a wide range of symptoms, including uncontrollable tumorigenesis, seizures, and neurodevelopmental abnormalities. Hamartin (TSC1) and Tuberin (TSC2) form a complex that inhibits mTOR-mediated protein synthesis in response to cellular stressors. Heterozygous loss of TSC2 in human forebrain neurons reduces sensitivity to repulsive guidance cues, like EphrinA1. Surprisingly, these abnormalities were unaffected by pharmacological inhibition of mTOR, suggesting TSC2 signals downstream of EphrinA1 through distinct targets to regulate neurite outgrowth. Here, I show that TSC1 and TSC2 exhibit little colocalization in growth cones, suggesting complex-independent functions. Furthermore, while TSC1/TSC2 colocalization in growth cones increases after 2 hours of cell stress, EphrinA1 stimulation has no effect.

HOW DO WE EVALUATE SOCIAL-EMOTIONAL LEARNING? AFTERSCHOOL EDUCATION AND THRIVING AT THE GOODMAN COMMUNITY CENTER

Rahaditya (Adit) Raisuli
Mentor(s): Tenah Hunt

Social Emotional Learning (SEL), with its proposed benefits for students, poses a problem: how do programs prove SEL benefits to stakeholders? Although preexisting evaluation methods such as surveys, interviews, and standardized testing have been widely used in education, staff at the Goodman Community Center (GCC) wanted to explore more creative evaluation tools that could be used by educators to rapidly obtain information on students. The GCC also wanted to better understand the impacts of SEL, particularly on academic achievement. In our infographic, we present retrospective analysis, alumni outreach, and Project-Based Learning (PBL) as equitable alternative evaluation methods. We also present a guide on selecting appropriate SEL assessments, as well as the benefits of SEL and community education.

LEARNING FROM TOPOLOGY: MACHINE LEARNING FROM THE SHAPE OF DATA

Jiggy Raizada
Mentor(s): Gary Shiu, Jacky Yip

Understanding underlying physics of complex systems such as cosmology and quantum gravity requires identifying structures in high-noise datasets. Large datasets are high-dimensional and noisy, and common analysis methods may fall short when extracting all the features of the data. One way to address this is through persistent homology (PH), which can yield simple and explainable summaries by extracting topological, geometric, and multiscale features from datasets. PH can extract useful cosmological information, such as primordial non-Gaussianities, because topology probes non-local information. We compare PH and a downstream inference model with a transformer model in extracting cosmological information, since transformers also capture non-local interactions through attention. Using spatial attention techniques on cosmological simulation data, such as dark matter halo distributions, we compare inference accuracy and parameter degeneracies.

BUILD: A PHYSICAL ACTIVITY PROGRAM FOR ADOLESCENTS

Lesley Ramirez, Alyssa Nielsen, Sarah Lindsley
Mentor(s): Morgan Shields
Additional Author(s): Yadira Ortiz, Gabrielle Joe

Physical activity is a behavior that reduces the risk of nearly every chronic illness, promotes multiple dimensions of well-being, and improves quality of life. However, rates of participation are low across all age levels, especially in adolescents, a developmental period during which healthy habits are being established. Making accessible low stakes opportunities to engage in exercise during this time is vital because there is a consistent decline in physical activity between the ages of 12-18. BUILD is a program that delivers evidence-informed physical activity sessions for adolescents in Madison through games created and led by UW-Madison Kinesiology students. This program provides a unique and powerful experience for everyone involved, leading to a tight-knit community equipped with the resources and support needed to be physically active.

POLYMER THIN FILM SAMPLE CREATION FOR XUV FEMTOSECOND ABSORBANCE SPECTROSCOPY

Zoe Ramstack
Mentor(s): Varun Mapara, James Harris
Additional Author(s): Aakankshya Mishra, Carlos Alvarez Balladares, John Berry, Uwe Bergmann

Extreme ultraviolet (XUV) spectroscopy is a powerful technique for probing core-level dynamics on femtosecond timescales. We have been collaborating to create thin film samples for XUV femtosecond absorbance spectroscopy, modeled after the approach described by Shari'ati and Vura-Weis in“Polymer Thin Films as Universal Substrates for Extreme Ultraviolet Absorption Spectroscopy of Molecular Transition Metal Complexes.”

We are establishing reproducible methods for thin film creation, potentially allowing us to incorporate a wide range of molecular compounds compatible with XUV measurements into polymer matrices. These samples are designed for use with the X-FAST system, expanding access to ultrafast XUV spectroscopy for researchers who may not have prior experience with thin film preparation or access to specialized equipment.

INVESTIGATION OF CANCER STEM CELL POPULATIONS IN PATIENT DERIVED CANCER ORGANOID MODELS

Amelia Rancour
Mentor(s): Jessica Lang

Organoids are primary tumor cultures embedded in a Cultrex-based matrix that allows for extended culture in a 3-dimensional environment. Studies have found that organoids exhibit a growth rate that more closely reflects the primary tumor, and their response to therapeutics has a higher correlation with clinical responses. Cancer stem cells are cells from the tumor that enter a quiescent state, allowing them to survive chemotherapy treatments while maintaining the ability to reactivate and initiate future tumors. The overall goal of this project is to investigate the properties of cancer stem cells in our more clinically accurate organoid models. We accomplished this by identifying stem cells using common stem cell markers and isolating them for tumorsphere assays to detect changes in physical properties.

PHYSICAL ACTIVITY AND GLIAL FIBRILLARY ACIDIC PROTEIN IN ADULTS WITH DOWN SYNDROME

Anna Ravis
Mentor(s): Emily Schworer

Down syndrome (DS) is a genetic condition associated with a near universal incidence of Alzheimer's disease (AD), a neurodegenerative disorder. Glial fibrillary acidic protein (GFAP) is a protein expressed by astrocytes in response to neuronal injury and neuroinflammation and used to track AD pathology. Physical activity may mitigate AD neuronal injury through anti-inflammatory effects. This study investigated the relationship between physical activity and GFAP levels in 49 adults with DS aged 28 to 61 years. Initial results showed a significant negative correlation between average daily step count and GFAP levels, $r = -0.31$, $p=0.03$. Findings suggest that physical activity may be a protective factor by helping to reduce neuroinflammation caused by early AD pathology in adults with DS.

LATE-GESTATION HEAT STRESS IN DAIRY COWS: IMPACTS BEYOND TWO GENERATIONS

Meghan Reimann
Mentor(s): Jimena Laporta

Heat stress exposure of F0 cows during the dry (late-gestation) period reduces their milk potential, the F1 and F2 early-life mammary parenchyma and fat pad size, and milk yield at maturity. While the F1 generation exhibits reduced body growth, the F2 grows at similar rates to their cooled counterparts. Herein, we investigate the impact of maternal late-gestation heat stress on body growth and mammary development of their great-granddaughters (F3). F0 cows with access to heat abatement (fans and water soakers, CL) or not (HT) for the last 54d of gestation. F1 daughters born to F0, and F2 daughters born to F1 were raised as cohorts. F2 granddaughters gave birth to HTF3 (n=9) and CLF3 (n=10) females. Feed intake, body and mammary growth were monitored until d70. On d70, a biopsy was taken (n=6/group) to quantify epithelial areas, proliferating cells (Ki67), cell death (TUNEL), and estrogen receptor presence (ERα). The goal of this study is to characterize how maternal late-gestation heat stress impacts the mammary gland and gross morphology.

DETERMINING OPTIMAL POST-THAW CULTURE CONDITIONS FOR CRYOPRESERVED NK CELLS

Grace Reimers
Mentor(s): Matthew Forsberg

Natural Killer (NK) cells are an emerging cellular therapy for the treatment of cancer. The percentage of circulating NK cells available in peripheral blood is low; necessitating expansion ex-vivo to achieve the numbers necessary for therapeutic use. Due to the low immunogenicity of NK cells, they can be infused multiple times, requiring thawing of previously cryopreserved cells. This research aims to determine the best way to expand and thaw cryopreserved NK cells using a variety of methods, cytokines, and media. Post-thaw, the cells' killing efficacy was tested on CHLA-20, a neuroblastoma cell line, using an in-vitro killing assay in the IncuCyte Live Cell Imager. Initial results suggest that a 24-hour rest period with low dose IL-15 using human serum is most effective at killing.

PRIMING SEMANTIC ORGANIZATION WITH FREE-SORTING & TRIADIC COMPARISON TASKS

Michelle Ren
Mentor(s): Ivette Colón, Timothy T. Rogers

Priming of mental representation occurs when exposure to one stimulus influences subsequent processing. However, it remains unclear how sorting tasks can prime and reorganize mental representations in subsequent tasks. We test whether initial sorting tasks prime similarity judgements in follow-up triadic comparisons, such that both tasks share similar embeddings between items. In the free-sorting task, participants sorted objects by size (priming condition) or freely sorted objects (control condition). In triadic comparisons, participants chose one of two items most similar to a 'target' item. Similarity analyses on high-dimensional embeddings reveal relative similarities between mental structures in priming and control conditions. Results indicate that size-based sorting increased the influence of body size in subsequent similarity judgments, suggesting that task structure can reshape semantic mental organization.

THE EFFECT OF JUVENILE POLYCHLORINATED BIPHENYL EXPOSURE ON DENDRITIC MORPHOLOGY IN A MOUSE MODEL OF AUTISM SPECTRUM DISORDER

Elsa Reseland
Mentor(s): Kimberly Keil Stietz
Additional Author(s): Lindsey Felth Tanaka, Eshwari Kulkarni

Rates of Autism Spectrum Disorder (ASD) have been increasing, with approximately 1 in 31 children having an ASD diagnosis. This increase may be due to complex gene-by-environment interactions. One environmental chemical of concern is Polychlorinated Biphenyls, known to alter dendritic complexity. SHANK3 gene mutations are also implicated in ASD and alter dendritic complexity. Thus, we utilized a SHANK3 mutant mouse model of ASD and exposed them to PCBs, subsequently assessing hippocampal and cortical neuron complexity through Sholl analysis of Golgi-stained neurons. We present dendritic complexity data for male and female wild-type and SHANK3 mutant mice dosed with 0, 0.1, and 1 mg/kg of MARBLES mixture PCBs. These findings could contribute to explaining ASD prevalence and advance the field in understanding gene x environment interactions.

IMPACT OF WILDFIRE ASH ON THE ETHNOMEDICINAL PROPERTIES OF *PRUNELLA VULGARIS*

Jamie Resis
Mentor(s): Grace Melone
Additional Author(s): Amy Trowbridge

Extreme wildfires across the Western United States generate large smoke and ash plumes. Ash deposition on soil can alter soil nutrients, reduce germination, and affect plant nutrient content. The effects of wildfire ash on plant growth and secondary metabolism are unknown. We hypothesize that ash deposition increases soil pH and oxidative stress, reducing photosynthesis and phenolic content because toxins and heavy metals limit nutrient availability. We used *Prunella vulgaris*, self-heal, an ethnomedicinal plant with antimicrobial properties, to test our hypothesis with a fully-crossed ash and fertilizer amendment study. Ash reduced photosynthesis by 44% and caused leaf chlorosis. Assimilation rates decreased linearly, while transpiration and stomatal conductance declined then plateaued. The findings of this study are important for protecting ethnomedicinal plants amid wildfire intensification.

IMPACT OF HAVING A CHRONIC CONDITION ON PHYSICAL ACTIVITY ENGAGEMENT AMONG SURVIVORS OF AYA CANCERS

Olivia Reska
Mentor(s): Rachel Hawn
Additional Author(s): Kristine Kwekkeboom, Yoonsoo Eo

Survivors of Adolescent and Young Adult (AYA) cancers are at increased risk of developing new chronic conditions and may have lower physical activity (PA) engagement, increasing risk for future health problems. We examined the impact of chronic conditions on AYA cancers survivors' PA engagement and self-efficacy. We surveyed 289 survivors of AYA cancers; 174 (60.2%) had ≥ 1 chronic condition. Compared to those without chronic conditions, survivors with chronic conditions engaged in significantly less vigorous activity and muscle strengthening; but reported no difference in moderate-intense PA or walking. Those with chronic conditions had less confidence that they could overcome barriers to PA. More research is needed to explore how chronic conditions influence PA within this population.

ANXIOUS BEHAVIOR IN A RHESUS MACAQUE MODEL OF FRONTOTEMPORAL DEMENTIA

Jacob Rhodes
Mentor(s): Marina E. Emborg
Additional Author(s): Lena Komar, Madison Wagner-Durr, Jeanette Metzger, Maddie Gloo

Frontotemporal dementia (FTD) is a neurodegenerative disorder associated with behavioral and emotional changes that are often linked to a mutation in the microtubule-associated protein tau (MAPT) gene. This study aimed to determine whether rhesus macaques carrying the MAPT R406W mutation (n=6) displayed anxious behaviors in response to mild stressor conditions when compared to wildtype controls (n=6). The macaques were exposed to the Human Intruder Paradigm (HIP). Behaviors evaluated included freezing, vocalizations, self-injury and pacing, during three different HIP conditions: alone, no eye contact, and intruder stare. The animals' responses were coded by 2 blind investigators. Our results identified age and genotype specific responses, such as an increase in anxious behaviors in MAPT R406W rhesus.

LONGITUDINAL ASSOCIATIONS BETWEEN PARENTAL BURNOUT AND SYMPTOMS OF DEPRESSION AND ANXIETY

Anna-Victoria Richard
Mentor(s): Heather Kirkorian

Parental burnout affects around 10% of parents in the United States and is negatively associated with family well-being. Parental burnout has been positively associated with negative depression and anxiety symptoms. In the current study, 505 parents of infants 12-24 months old received a survey packet at three waves, spaced six months apart, with questions regarding depressive symptoms (PHQ-2), anxiety symptoms (GAD-2), and parental burnout symptoms (PBA). This study aims to look at associations between parental burnout and mental health symptoms over time. Examining depressive and anxiety symptoms as risk factors or consequences for parental burnout can help provide insight for effective intervention targets aimed at supporting parents' mental health and well-being.

EFFICACY OF PILATES INTERVENTIONS IN CHILDREN WITH DISABILITIES AND CHRONIC ILLNESS

Isabella Rivera-Tirado
Mentor(s): Garrett Huck

Within the past ten years, Pilates has been gaining more media attention. While most people know Pilates as an exercise that helps one achieve visible abdominals or as something older women do to keep up with their movement practices, it can be beneficial for people of all ages seeking a more functional lifestyle. With the underrepresentation of individuals with disabilities in research, let alone children with chronic illness and disabilities (CID), the idea of researching how Pilates could affect this population may be valuable. This paper will explore the efficacy of Pilates interventions in children with CID by evaluating the current literature, discussing the merits of the research, and outlining future actions.

THE EFFECT OF METHYLFOLATE ON AXONAL REGENERATION IN A DRG CULTURE MODEL AFTER SPINAL CORD INJURY

Amaya Robbins
Mentor(s): Bermans Iskandar, Anas Abou Merhi

Spinal cord injuries cause permanent deficits partly due to the CNS's limited regenerative capacity. Our group has shown that 5-methyltetrahydrofolate (MTF), the primary active folate metabolite, facilitates in vivo axonal regeneration in a dose-dependent manner, peaking at 80mcg/kg, through enhanced DNA methylation. To determine whether this effect is neuronal or glial, we tested axon growth in glia-free cultures in vitro. Adult rats were pretreated with escalating MTF doses (40–800 mcg/kg) prior to dorsal column transection. After injury, dorsal root ganglia were cultured. Prior work reported a trend for maximal growth at 24 hours with 80mcg/kg. Axonal outgrowth at 12 and 48 hours is currently being analyzed to assess peak regenerative response and determine whether the dose-response relationship is biphasic.

LITERATURE REVIEW OF STAKEHOLDER ATTITUDES TOWARDS THE RETURN OF INDIVIDUAL RESEARCH RESULTS FROM CLINICAL NEURODEGENERATIVE RESEARCH

Micah Roby, Taylor Vander Groef
Mentor(s): Deven Burks

Neurodegenerative research assesses candidate biomarkers for diagnosis, prognosis, monitoring, and safety. Given variability in research biomarker validity, interpretation, and actionability, returning individual research results (IRR) to study participants remains controversial among research stakeholders. To better understand conflicting stakeholder attitudes towards returning IRR from clinical neurodegenerative research, we conducted a literature review of survey and interview studies. Current research into these attitudes surfaces many concerns regarding clinical research and biomarker testing. It is, however, difficult to draw broader conclusions due to differences in research question, study design, and survey/interview items. To summarize current findings and knowledge gaps, our group conducted a literature review of stakeholder attitudes towards returning individual biomarker results. A PubMed title/abstract search returned 144 results for "survey OR questionnaire OR interview OR qualitative AND biomarker OR amyloid AND disclosure". Using the systematic review management software Covidence, one reviewer completed title/abstract screening of these results and full text review of 82 publications, with 44 included in the final analysis. Two reviewers then completed data extraction and conducted a qualitative synthesis of reported themes from the consensus final data. 41 publications explored stakeholder attitudes in sporadic Alzheimer's disease. Most publications consulted only community stakeholders, e.g., patients, families, caregivers. The most frequently studied biomarker was amyloid positron emission tomography imaging. We identified three broad research topics: community stakeholder willingness to enroll in clinical research with biomarker disclosure; community stakeholder interest in predictive biomarker disclosure; professional stakeholder interest in predictive biomarker disclosure. Studies of the first and second topics overlapped on reported themes like clinical utility, personal utility, and balancing risks whereas the third's reported themes were more varied. Our review highlights several gaps, suadestina future research directions. The return of many common IRR (e.g., neuropsychological tests, MRI scans, consensus diagnosis) remains understudied. Few studies consult both community and professional stakeholders. More inclusive studies may enable stakeholders to formulate guidance for returning IRR that is more representative of the full range of stakeholder attitudes and values.

INVESTIGATING THE REPRODUCTIVE CYCLE AND DISTRIBUTION OF NEW NON-NATIVE ASIAN EARTHWORMS IN DECIDUOUS FORESTS OF THE UPPER-MIDWEST US

Andrea Rodriguez
Mentor(s): Bradley Herrick

Non-native, invasive species can significantly impact native ecosystems and biodiversity. Over a decade after Asian earthworms were established in Wisconsin, their population dynamics, particularly with respect to cocoon abundance and distribution in forests, remain unclear. For annual species, cocoon production is vital to population sustainability, growth, and habitat invasion. Due to their small size (~2-3 mm) and soil adherence, cocoons are believed to be a primary spread mechanism. I conducted a field assessment to better understand jumping worm populations and cocoon dynamics. This included adult population counts and spatial distribution analysis at two UW-Madison Arboretum deciduous forests using historical data. I also collected soil samples to estimate cocoon counts and compared these data over time (2015-2025) to examine density-dependent factors influencing population growth.

3D PRINTING AND CHARACTERIZATION OF PPFPS TISSUE ENGINEERED BONE SCAFFOLDS

Yandel Rodriguez
Mentor(s): David Dean, Joshua Alexander
Additional Author(s): Dariia Afanasieva, Matthew L. Becker

Advances in 3D printing have opened new possibilities for personalized tissue engineered bone scaffolds. The current standard-of-care repair for segmental skeletal defects (gaps) of an inch or more is a bone graft taken from another site in the patient's body. We are exploring the novel use of poly(propylene fumarate-co-propylene succinate) (PPFPS) to create 3D printed tissue engineered bone scaffolds. We are working to confirm print accuracy, strength, and resorption. We are also studying the utility of surface-bound growth factors, referred to as tethered ligands that we expect will stimulate bone progenitor cell attachment and bone formation. The internal pore geometry is designed to facilitate bone and vascular ingrowth. We will soon study the utility of these scaffolds in a mouse hindlimb model.

EXPLORING BAL VARIABILITY IN QUASARS

Kaleb Roessler
Mentor(s): Kate Grier

Broad Absorption Line (BAL) quasars provide key insights into the physics of Active Galactic Nuclei (AGN) and their interactions with host galaxies. These quasars, powered by supermassive black holes (SMBHs), have strong outflows of ionized gas, producing broad absorption features in the UV and optical spectra. Understanding the variability of BALs helps us understand the physics of quasars and how they affect their host galaxy. In this study, I focus on the BAL quasar RM-0508 using data from the Sloan Digital Sky Survey V (SDSS-V), using 208 epochs of spectra spanning nearly a decade. I will analyze the C IV (Carbon four) absorption feature (1415-1480 Å) to assess variability and analyze the physical properties of the outflow.

HOUSE FELLOW APPLICATION ANALYSIS

Jenna Rogers
Mentor(s): Daniel Becton

This presentation explores how assessment is used in higher education, with a focus on the housing department at the University of Wisconsin-Madison. Each year, students apply for the House Fellow role through an application and interview process. This project evaluates that process to examine whether first-generation college students may encounter additional barriers when applying. Using the assessment cycle: identifying outcomes, gathering evidence, interpreting evidence, and implementing change, this study analyzes application and evaluation data to identify potential inequities. The presentation will demonstrate how these steps were applied in this project and highlight additional assessment initiatives conducted over the past year. Overall, the findings illustrate how assessment can provide evidence to guide decision-making and inform policy and practice within university housing.

COGNITIVE PREDICTORS OF INDIVIDUAL DIFFERENCES IN CHILDREN'S EMOTION LEARNING

Lauren Rosmarin
Mentor(s): Andrea Stein
Additional Author(s): Seth Pollak

Learning emotion concepts is an essential part of development; understanding emotions helps children recognize and manage their own feelings as well as empathize with others. This study examined the cognitive processes that may support children's new emotion learning. 5- and 6-year-olds completed a task in which they learned associations between an alien's novel emotional displays and his subsequent actions. They then completed measures of selective attention, working memory, and cognitive flexibility. We examined the extent to which scores on these measures accounted for differences in participants' emotion learning. By identifying the cognitive processes that may contribute to emotion learning, this research may inform the design of future tasks and support more effective approaches to teaching emotional understanding.

IDENTIFYING AND COMPARING THE BRAIN REGIONS AND CELL TYPES THAT EXPRESS FMRP THROUGHOUT DEVELOPMENT IN FMR1-KNOCKOUT AND CONTROL MICE

Gwendolyn Roter
Mentor(s): Zhiyan Xu

Fragile X Syndrome (FXS), the most prevalent single gene cause of inherited intellectual disability, is caused by the loss of the Fragile X Messenger Ribonucleoprotein (FMRP). FMRP is an RNA-binding protein that's important throughout development; studies have shown restoring FMRP is a promising therapeutic strategy for rescuing certain behavioral deficits in FXS mouse models. Our previous data suggest that there may be a critical period for FMRP restoration to fully restore behavior in mice. To identify this critical period, we must answer a key question: which brain region and cell types express FMRP during development? Therefore, my research project aims to identify the brain regions and cell types that express FMRP during development and assess the differences in cellular populations between FMRP-knockout and control mice.

QUANTITATIVE ANALYSIS OF P-BODY PROTEINS' PARTITION COEFFICIENTS IN SOMATIC AND GERM CELLS IN *C. ELEGANS*

April Ruiz
Mentor(s): Griffin Clements

Processing bodies (P-bodies) are cytoplasmic condensates composed of translationally repressed RNA and proteins associated with mRNA degradation. Initially, it was thought that the primary function of P-bodies was mRNA degradation, but studies have shown that mRNA decay can occur even when P-bodies are absent.

This project will investigate how P body proteins partition between granules and the cytoplasm during the early stages of *C. elegans* embryogenesis. Different P body proteins exhibit different partition coefficients between the granule and the cytoplasm; this indicates that specific proteins are preferentially enriched in P bodies during the early stages of *C. elegans* development. To test this, embryos will be freeze-cracked and imaged with a spinning-disk confocal fluorescent microscope to quantify protein enrichment in P-bodies.

VAT PHOTOPOLYMERIZATION OF POLY(DICYCLOPENTADIENE) WITH GREEN SOLVENTS

Amanda Rusch
Mentor(s): Sarah Finnegan, AJ Boydston

Vat-photopolymerization (VP) is an additive manufacturing technique that creates 3-dimensional objects by curing liquid photopolymer resin with light, layer-by-layer. Our work investigates a new way to incorporate high performance materials into the process. Polydicyclopentadiene (PDCPD) is known for its high-performance applications and exceptional toughness, making it very useful for protective armor, automotive body panels, and ballistic-resistant products. In this work, we combine PDCPD, which contains alkenes, with thiol-based reagents, and use a photoresponsive thiol-ene polymerization mechanism for VP. The objectives of this research are to understand resin formulation parameters, characterize the material properties of the final products, and establish proof of concept for a robust, metal-free, high-performance materials for light-based additive manufacturing.

DEVELOPMENT OF A MULTI-FUNCTIONAL CRANIAL ATTACHMENT FOR STEREOTACTIC NEURONAVIGATION IN PEDIATRIC NEUROMODULATORY ASSESSMENTS

Orla Ryan
Mentor(s): Bernadette Gillick, Cameron Casey

Single pulse transcranial magnetic stimulation (spTMS) is an important data assessment tool that is becoming increasingly relevant in pediatric neuromodulation studies. Neuronavigation allows researchers to accurately target spTMS to motor regions of the brain, but current systems are not built to accommodate participants as young as those who take part in the Baby Brain Recovery Study (BBRS) held by the Pediatric Neuromodulation Laboratory's (PNL). With issues such as improper sizing and a lack of consistent securement methods, participants are often found fidgeting and moving the neuronavigation head tracker. Given that this can both delay data collection and prolong participants' potential discomfort, there is a significant need for the implementation of a reliable, secure attachment method for use in the ongoing BBRS study.

THE USE OF HETEROBIFUNCTIONAL LYTACS AS A POTENTIAL METHOD OF DEGRADATION OF A-SYNUCLEIN FIBRILS

Geoffrey Saemann
Mentor(s): Aaron Hoskins
Additional Author(s): Chad Rienstra, Moses Milchberg, Musaab Tareen

Amyloidoses including Alzheimer's disease and Parkinson's are characterized by prion accumulation and formation of aggregates. α-synuclein fibrils have been associated with progression of both Parkinson's and Lewy body dementia. Lysosome-targeting chimeras (LYTACs) are heterobifunctional molecules that localize target proteins to extracellular receptors and cause intracellular degradation via the lysosomal pathway. LYTACs are a method of target protein degradation which utilize antibodies or small molecules to localize target proteins to extracellular receptors and degrade them intracellularly via the lysosomal pathway. The asialoglycoprotein receptor (ASGPR) is an endocytic cell surface receptor in hepatocytes which is used to mediate glycoprotein levels in the blood. Here, we are developing an α-synuclein-targeting LYTAC by glycosylating an anti-α-synuclein antibody with tri-antenerary N-acetylgalactosamine (tri-GalNac).

INVESTIGATING THE MECHANISMS UNDERLYING RACK1 REGULATION OF NEURONAL DEVELOPMENT AND MITOCHONDRIAL FUNCTION IN HUMAN NEURONS

Nasteha Sahal
Mentor(s): Xinyu Zhao
Additional Author(s): Jiyoun Lee

Fragile X Syndrome (FXS) results from loss of the RNA-binding protein FMRP, which regulates mRNA stability and translation in neurons. We previously showed that FXS patient iPSC-derived neurons exhibit neurodevelopmental deficits and mitochondrial dysfunction. We identified RACK1 as a species-specific FMRP target, and RACK1 knockdown in human neurons recapitulates mitochondrial defects shown in FXS neurons. Furthermore, we observed that RACK1 deficient neurons exhibit reduced expression of PGC1α and AMPK. However, the mechanisms by which RACK1 regulate neuronal function remain unclear. To define downstream mechanisms, we identified 18 shared FMRP and RACK1 interactors, and we observed that PRRC2A, PGAM5, and PABPC1 contribute to the regulation of neuronal development. We aim to determine which of these interactors mediate mitochondrial functions and neuronal development downstream of RACK1.

DEVELOPING SWIM BEHAVIORS IN ZEBRAFISH (DANIO RERIO) AFFECTS AMBUSH PREDATION SUCCESS

Lateef Saheed
Mentor(s): David Ehrlich
Additional Author(s): Abigail N. Cichocki, Anne F. Weerda, Nick Milicic, Digo Zuniga Mouret

Animals undergo complex developmental changes that shape their interactions with the world around them, and zebrafish are no exception. Interactions with predators are a major determinant of larval fish survival and recruitment, but the nuances of these interactions are largely unknown. This is due to the dynamic interactions of predator behavior, prey physical growth, and prey neural development. This study seeks to disentangle these variables by focusing on how larval zebrafish develop avoidant and evasive behaviors to survive an ambush predator, the dragonfly nymph. This data suggests that the behavior of zebrafish that emerges during the larval period has a strong impact on their survival outcomes, and could provide further methods for how we look at species-specific survival strategies.

DEVELOPMENT AND MAPPING OF DS INSERTIONS OF KNOCKOUT POPULATIONS IN *HORDEUM VULGARE*

Saif Sajjad
Mentor(s): Audrey Mahon, Mali Mahalingham

Hordeum vulgare is a cereal grain used in malting and has high nutritional value. The aim of this project is to aid researchers by providing and developing a catalogue of mutant *Hordeum vulgare* lines in order to test new mutations . To do this, the T3 of two Golden Promise lines were developed, the T0 featured one line positive for a maize Ds transposon, while negative for an Ac transposase insertion and a second negative for Ds but positive for the Ac gene insertion. First lines were screened to confirm the Ds insertion was still present, if the insertion had moved, or if it could continue to move if the Ac insertion was present. The location of stable insertions was then determined using TAIL-PCR.

THE IMPACT OF METHAMPHETAMINE USAGE ON WORKING MEMORY IN A MOUSE MODEL

Jannah Saleh
Mentor(s): Cheri Barta
Additional Author(s): Amelia Warden

The rise in recreational methamphetamine usage has contributed to significant neurological risks among adults, including effects on brain function and impairments of working memory. We used data to extract the reaction times of methamphetamine in a mouse model. Utilizing a mouse model, the data will share functioning of the prefrontal cortex, which houses executive processes such as working memory, to explore prefrontal cortex mechanisms in this study. This study examines how methamphetamine use impairs working memory, measured by reaction time performance and how these reduced reaction times demonstrate reduced efficacy of the pre-frontal cortex. This study's findings suggest that methamphetamine does decrease function in working memory of executive processes in the prefrontal cortex.

DEVELOPMENT AND APPLICATION OF A MECHANICAL SHOULDER SURROGATE FOR EVALUATING SOFT-TISSUE TENSION IN SHOULDER ARTHROPLASTY

Muaz Salem
Mentor(s): Joshua Roth

Soft tissue tensioning is a critical step during shoulder arthroplasty. To enable iterative, pre-clinical testing of novel sensors for enhancing soft tissue tensioning during shoulder arthroplasty, we developed a mechanical shoulder surrogate that reproduces clinically relevant shoulder mechanics for both anatomic total shoulder arthroplasty (aTSA) and reverse total shoulder arthroplasty (rTSA) configurations. Our surrogate employs a modular ball-and-socket articulation with interchangeable spherical ball and socket components. Additionally, we have three different socket heights to isolate geometric effects on soft-tissue tension. We also integrated soft-tissue phantoms into the surrogate representing the conjoint and deltoid tendons enabling direct measurements of tension during use. We will demonstrate the application of this surrogate to (1) replicate intraoperative aTSA and rTSA shoulder mechanics, and (2) evaluate our novel soft tissue tension sensor on the conjoint tendon. We expect these findings will enable (1) other robotic researchers to fabricate surrogates to enhance their research, and (2) justify the future applications of our novel sensor in follow-up ex vivo and in vivo studies.

FRACTIONS OR DECIMALS?: A STUDY OF PATTERNS OF REPRESENTATIONAL FLEXIBILITY

Shubhi Sancheti, Snigdha Jasoria, Kairui Gu
Mentor(s): Jennifer Murray

Full understanding of rational numbers requires flexibility with fractions and decimals across situations. However, research shows that students inconsistently shift between these formats. This study attempts to find patterns in how students shift between fraction and decimal representations across a variety of tasks by examining a mix of written answer data and interview data. We will also investigate how students' strategy patterns relate to relational reasoning ability and fluid intelligence, and whether strategy patterns are task-specific or student specific. To perform analysis, we will use data from an ongoing project with 7th-9th graders and will use a mix of qualitative and quantitative methods, which will further contribute to the field's understanding of rational number learning.

DESORPTION ELECTROSPRAY IONIZATION (DESI) MASS SPECTROMETRY IMAGING OF ALZHEIMER'S DISEASE MICE BRAINS TO ASSESS PHOSPHOLIPID AND GANGLIOSIDE CHANGES

Emiliano Sanchez-Quintanilla
Mentor(s): Emily Hubecky

Alzheimer's disease (AD) is a progressive neurodegenerative disorder defined by β-amyloid plaque deposition, tau neurofibrillary tangles, and chronic neuroinflammation. Increasing evidence implicates gangliosides as modulators of amyloid-β aggregation. However, analyzing ganglioside species is difficult because many share nearly identical m/z values despite differing structural arrangements, making them indistinguishable without an additional dimension of separation. Thus, we employed Desorption Electrospray Ionization mass spectrometry imaging (DESI MSI) for sensitive, matrix-free detection coupled with cyclic ion mobility separation (cIMS) for discrimination of isomeric and isobaric species to spatially analyze gangliosides in wild type and AD mouse brain tissue. Together, cIMS enabled DESI MSI provides a powerful platform for spatially resolved ganglioside analysis and offer new insight into lipid-mediated mechanisms contributing to AD progression.

NEURAL MECHANISMS OF IMPAIRED CONSCIOUSNESS DURING FOCAL SEIZURES

Daleep Sandhu
Mentor(s): Matthew Banks, Urszula Gorska-Klimowska

Epilepsy is a neurological disorder in which abnormal brain activity causes recurrent seizures. Some seizures allow people to remain aware (FAS), while others impair awareness (FIAS). The reason for this difference is not fully understood, but may be linked to how different brain regions communicate. I hypothesize that loss of awareness in FIAS is associated with weaker connectivity within the FPN, which is responsible for attention and cognitive control. Additionally, I predict that communication between the FPN and limbic structures will be more disrupted in FIAS than in FAS. To test this, I will analyze iEEG data from epilepsy patients, measuring how brain connectivity differs across the seizure types. This research will improve our understanding of how seizures impair consciousness and guide future epilepsy treatments.

SHAPING THE VAMPIRE: POLIDORI'S TRANSFORMATION OF A FOLKLORIC FIGURE

Juan Sandoval
Mentor(s): Eric Carlsson

This project examines how John Polidori's *The Vampyre* (1819) transformed earlier European vampire folklore into the foundation of the modern literary vampire. Earlier accounts described vampires as rural revenants tied to superstition, disease, and community disorder. Drawing on Enlightenment debates, medical discourse, and Romantic literary influences, Polidori reimagined the vampire as a charismatic aristocrat embedded in elite society. Through textual analysis of *The Vampyre* and earlier sources such as Calmet's *The Phantom World* and eighteenth-century vampire reports, this study argues that Polidori created a new Gothic archetype: the seductive, socially integrated vampire whose danger lies in psychological manipulation and moral corruption rather than physical monstrosity. This transformation established the template for later nineteenth-century vampire literature.

HOW DO I LOOK?

Keith Santander Paniagua
Mentor(s): Eric Newble

This art piece reflects on how body dysmorphia can be blinding, distorting one's ability to see themselves as they truly are. It contrasts an exaggerated focus on harsh, crude details with a kinder, ethereal perception of the body. Thread runs throughout the piece to exaggerate the malleability the body is often expected to have: the desire for it to be "better." Yet thread is difficult to stretch, symbolizing how the body cannot change on demand. A pastel gradient connects both sides: putrid yellow covers the harsher side, while blue and pink cover the kinder one. At the center lies not just a depiction of flesh and blood, but also stars and color: the body as a vessel for the soul, reflecting what we carry inside.

HISTORY OF PHYSICS AT UW-MADISON

Miriam Santos
Mentor(s): Sarah Perdue

Chamberlin Hall houses UW-Madison Physics, an active department with a rich history. Chamberlin's main entrance contains four underutilized display cabinets, revealing an opportunity to present physics topics within the department from a historical perspective. Two topics identified thus far are the development of public radio and the timeline of photoelectric photometry techniques. Collected through books, archives, primary literature, and accounts from department members, this research builds on existing compilations of department history. Writings, photographs, and relevant objects have been located and organized with the end goal of creating cohesive displays educating the public on the contributions of Madison physicists to Wisconsin communities and the university's role in the progression of the field of physics.

ANALYSIS OF THE CONTRIBUTION OF PROLONGED CELL CYCLE TO REDUCED PROGENITORS IN TRISOMY 21

Charlese Satterfield
Mentor(s): Anita Bhattacharyya
Additional Author(s): Jennifer Piciw

Parents in a bilingual household may or may not intermix (code-switch) languages when interacting with their child. Down Syndrome (DS, T21), caused by a third copy of chromosome 21, is the most common genetic cause of intellectual disability. T21 results in reduced brain volume and a depleted neural progenitor cell (NPC) pool. While cell cycle disruptions are implicated, specific changes, such as a prolonged S-phase, remain unclear. We aimed to define how T21 alters the cell cycle of NPCs. We employed flow cytometry of both euploid and T21 NPCs to analyze cell cycle progression. Using EdU incorporation and DNA content, we quantified G0/G1, S, and G2/M populations. Preliminary data shows a trend toward decreased S-phase duration in T21 populations. Future research will investigate the underlying molecular mechanisms that impair the neurogenic potential of NPCs in the developing T21 brain.

DETERMINING THE EFFECT OF DOSE HETEROGENEITY IN COMBINATION WITH IMMUNE CHECKPOINT INHIBITORS ON THE TUMOR MICROENVIRONMENT

Charlotte Sawicki
Mentor(s): Maya Takashima

In vivo studies demonstrate that dose heterogeneity from 177-Lutetium, including low (2 Gy or less), moderate (8–10 Gy), and high (15 Gy or higher) doses, activates multiple dose-dependent effects that enhance adaptive immunity and therapeutic response within a tumor microenvironment. Icam1 (low-dose), Ifnβ1 (moderate-dose), and H2-K1 (high-dose) genes were used to determine these effects . Icam1 promotes T cell extravasation, Ifnβ1 promotes Type I Interferon activation through cGAS/STING signaling, and H2-K1 promotes CD8 T cell recognition and tumor cell death. Tumors evade immunity through checkpoint molecules, PD-L1, and T cell activation markers, CD69 and IFN-γ. First, this project replicates dose-dependent and heterogeneity effects in vitro using external beam radiation and qPCR, and secondly, splenocyte co-culture with flow cytometry to assess T cell functionality.

IMPACTS OF WHITE-TAILED DEER FORAGING HABITS ON SOIL PHYSICOCHEMICAL PROPERTIES WITHIN WISCONSIN FORESTS

Caroline Sax
Mentor(s): Aundrea Taylor, Nick J. Balster

White-tailed deer (*Odocoileus virginianus*) can alter forest plant communities through selective browsing. This aboveground disturbance may be linked to soil physicochemical properties and thus play a critical role in regulating nutrient availability and supporting ecosystem services. However, evidence remains limited on whether deer-driven changes in vegetation are associated with variation in belowground soil properties. This study examines changes in soil physicochemical properties in relation to deer herbivory across Wisconsin forests. Soil samples were collected from deer exclosures and adjacent deer access plots throughout the state and analyzed for bulk density, pH, soil nutrients, texture, and percent soil organic matter. Testing this response will help evaluate whether soil conditions differ with levels of deer herbivory and provide a statewide assessment of this relationship.

THE NEURAL BASIS OF MATH ANXIETY IN KINDERGARTEN AND FIRST-GRADE STUDENTS

Sophia Schaubel
Mentor(s): Edward Hubbard
Additional Author(s): Maxwell Komisar, Roy Luo

Math anxiety in childhood is closely tied to professional and intellectual opportunities later in life. One factor that hinders math ability is math anxiety: the feeling of fear, apprehension, or discomfort towards mathematics. In the current study, we use fNIRS to explore the neural basis of math anxiety in kindergarten and first grade students. By knowing the mechanism whereby math anxiety impacts math skills, we can inform future directions on how to break the cycle of math anxiety.

NEW ESTIMATES OF VERTICAL DISTRIBUTION OF COLD GAS CLOUDS IN MILKY WAY

Osprey Schauer
Mentor(s): Dan Rybarczyk, Snezana Stanimirovic

Cold hydrogen clouds (the Cold Neutral Medium or CNM) are the fuel for star formation in galaxies. Their distribution plays an important role in galaxy evolution. Recently, a model was built to measure the vertical distribution of these clouds in the Milky Way. We apply this model to a new, large dataset of CNM clouds to explore how the distribution of CNM clouds depends on local CNM properties and position in the Galaxy. Our results will provide important constraints for models and simulations and are important for understanding the structure and evolution of the Milky Way.

INVESTIGATING GROUND-BASED AND SATELLITE RADAR DETECTION PERSPECTIVES IN SEVERE WEATHER CASES OVER THE CONTINENTAL UNITED STATES

Liam Schiffer
Mentor(s): Tristan L'Ecuyer
Additional Author(s): Marian Mateling, Megan Paulette Schaaf, Juliet Pilewskie

Ground-based radar and satellites are among the tools commonly used to identify ongoing weather in the United States. Each has their own benefits and drawbacks that impact their effectiveness spatially and temporally. This project focuses on comparing available imagery in cases where both radar and satellite overlap in their detection of a severe weather event. A convective object database available at UW-Madison provides data from the CloudSat satellite. The project utilizes NOAA NEXRAD and MRMS for ground-based radar data. Cases are located through storm reports collected by the Storm Prediction Center to identify strong convection and signatures of severe weather such as hail. This project compares the information that can be gleaned from the ground-based and satellite perspectives between cases.

NOT-GATED CD123-TARGETING CAR T CELLS REDUCE ENDOTHELIAL CELL TOXICITY IN ACUTE MYELOID LEUKEMIA

Kierstin Schlevensky
Mentor(s): Becky Richards, Otto Kletzien

Acute myeloid leukemia (AML) is a common blood cancer that is currently associated with poor patient outcomes. A promising form of therapy is chimeric antigen receptor (CAR) T cell immunotherapy, which has been successfully used in other leukemias but faces obstacles related to endothelial cell toxicity when implemented in AML. We developed a NOT-gated CAR T cell system with an activating CAR specific for CD123, a common AML target antigen, and an inhibitory CAR specific for VE-Cadherin, a protein expressed specifically on endothelial cells, to protect endothelial cells while maintaining anti-tumor efficacy. Successful development of a CD123-targeted NOT-gated CAR T cell will provide potential for expansion into clinical trials or into other tumor types, enhancing the prognosis for AML and other cancers.

DOSE-DEPENDENT INDUCTION OF MULTIPOLAR SPINDLES BY MAYTANSINE-DERIVED ANTIBODY DRUG CONJUGATE PAYLOADS IN TRIPLE-NEGATIVE BREAST CANCER CELLS

Selah Schmitt
Mentor(s): Beth Weaver
Additional Author(s): Caleb Carlsen

Anti-microtubule (MT) agents are cornerstone chemotherapies for breast cancer. Emerging evidence finds that their clinical efficiency stems from increased chromosomal instability through the formation of persistent multipolar spindles – a phenotype marked by more than the conventional two spindle poles. Clinically relevant anti-MT therapies have been demonstrated to robustly induce multipolar spindles. Several FDA-approved antibody drug conjugates (ADCs) include anti-MT payloads. It remains unclear whether these ADC payloads also result in multipolar spindles. This study examines the impact of maytansine and three payloads, DM1, DM4, and MMAE, across two breast cancer cell lines. Using immunofluorescence microscopy, mitotic spindle phenotypes were quantified across a range of drug concentrations. My results demonstrate that these ADC payloads share a conserved mechanism of multipolar spindle induction with conventional anti-MT therapies.

LEARNING TIME-INHOMOGENOUS MARKOV DYNAMICS IN FINANCIAL TIME-SERIES VIA NEURAL PARAMETERIZATION

Jesse Schmolze
Mentor(s): Alejandra Quintos
Additional Author(s): Jan Rovirosa

Modeling non-stationary dynamics in noisy, continuous sequential data requires balancing structural interpretability with representational flexibility. In this paper, we address this tension by framing the sequence as a feature-conditioned, time-inhomogeneous Markov chain. This formulation transforms the learning problem from discrete counting to continuous conditional density estimation. We demonstrate that this neural-Markov parameterization acts as a regularized estimator, recovering dense, coherent transition structures from data where empirical matrices are otherwise sparse. Furthermore, we show that explicit conditioning on the current state stabilizes the learning process and significantly improves temporal generalization compared to state-free baselines. The resulting framework enables the rigorous analysis of local regime dynamics and multi-step uncertainty propagation without sacrificing the flexibility of deep learning models.

A DAY FOR THE NATION? EXPLORING HOW NATIONAL HOLIDAYS INFLUENCE NATIONALIST ATTITUDES

Max Scholl
Mentor(s): Ethan Vanderwilden, Nadav Shelef
Additional Author(s): Braxton White

This research is a collection of surveys from about 50 countries over more than 40 years that were conducted on the national day. National days are believed to hold a sense of identity with the national group, generating more support for national governments. On the other hand, some contend state demonstrations do not sway the public's view. The intent is to test which perspective holds sway. My job is to review each country, year, and national day, and determine if there was an event that could influence a country's support for its government. Once I review over 500 subjects, I will write a paragraph for each to decipher whether nationalism was affected by an event that could spark an increase or decrease in nationalistic beliefs.

INVESTIGATING THE IMPACT OF BIALLELIC PATHOGENIC VARIANTS IN MARS2 AND WARS2 ON RESPIRATORY CHAIN ENZYME ACTIVITY

Noah Schrodt, Lia Margolin
Mentor(s): Bryn Webb

Mitochondrial aminoacyl tRNA synthetases (mtARSs) are nuclear-encoded enzymes that function within mitochondria, where they charge mitochondrial tRNA molecules with their cognate amino acid. mtARS disorders are associated with biallelic pathogenic variants that destabilize oxidative phosphorylation (OXPHOS) complexes. MARS2 encodes for methionyl-tRNA synthetase 2 which catalyzes the charging of tRNA-met to methionine. WARS2 encodes for tryptophanyl-tRNA synthetase 2 which catalyzes the charging of tRNA-Trp to tryptophan. Deficiencies in mtARSs have shown decreased protein expression in respiratory chain (RC) complexes I-V (CI-CV). Biallelic pathogenic variants in MARS2 and WARS2 are associated with metabolic neurodevelopmental disorders, including: MARS2: Combined oxidative phosphorylation deficiency 25 MIM#: 616430 and WARS2: Childhood-onset parkinsonism-dystonia 3 MIM#: 619738. Our aim is to explore the impact of biallelic pathogenic MARS2 and WARS2 variants on RC enzymatic function in oxidative phosphorylation through enzymology.

LAND-USE MEDIATES CHYTRID INFECTION DYNAMICS IN AMPHIBIAN COMMUNITIES

Marisa Schuldes
Mentor(s): Chloe A. Fouilloux, Jessica Hite
Additional Author(s): Eric Neeno-Eckwall, Jonathan Compton, Jessica Hua

Anthropomorphic disturbances affect environments and therefore disease ecology in ways that are not yet completely understood. Amphibians are often reliable indicators of ecosystem health and are susceptible to *Batrachochytrium dendrobatidis* (*Bd*). Despite rapid urbanization of landscapes and biodiversity loss caused by disease, we still have limited understanding of *Bd* prevalence in urban spaces. We assessed amphibian communities across a land-use gradient of green-rural-urban spaces in Madison, WI for *Bd*. We found that land-use plays an important role in shaping realized amplification. Green spaces had the highest concentration of chytrid, and urban spaces did not demonstrate density dependent scaling despite abundant hosts. These counterintuitive results highlight that, despite competent hosts, infectious disease may suffer at the hands of urbanization in unexpected ways.

INVESTIGATING THE SLEEP-DEPENDENCE OF TEXTURE DISCRIMINATION IN THE MOUSE BARREL CORTEX

Grant Schuman
Mentor(s): Chiara Cirelli
Additional Author(s): Kort Driessen

Sleep is critical for synaptic homeostasis and the consolidation of distinct memory types. However, imaging real-time coordinated synaptic dynamics in vivo remains challenging due to speed and scale trade-offs. Recent two-photon microscopy developments, specifically Scanned Line Angular Projection Microscopy (SLAP2), now enable high-speed, large-scale imaging. Leveraging our lab's newly implemented SLAP2 system, I propose validating a head-fixed Go/No-Go sensory discrimination task in mice to investigate sleep-dependent memory consolidation. Mice will be trained to distinguish between rough and smooth textures. Post-acquisition, an experimental cohort will undergo exactly five hours of sleep deprivation, while control mice will sleep ad libitum. If this behavioral task proves to be sleep-dependent, the paradigm can be combined with SLAP2, allowing the first visualization of the millisecond-scale transmission events driving memory consolidation.

T CELL PHENOTYPE ENRICHMENT THROUGH MRNA DELIVERY FOR ENHANCED CAR-T MANUFACTURING

Giulia Scimonelli
Mentor(s): Krishanu Saha
Additional Author(s): Apoorva Ramamurthy

Chimeric Antigen Receptor (CAR)-T therapy has revolutionized cancer treatment, enabling the genetic modification of T cells to express CARs and equipping them with targeted cytotoxic abilities. Current manufacturing approaches may yield terminally differentiated effector T cells that display limited persistence. This study proposes to transiently express uPAR CAR in T cells using mRNA. This approach aims to optimize manufacturing by enriching for a memory phenotype in T cells, potentially enhancing durability. uPAR CAR mRNA was synthesized and expressed in T cells with an average transfection of 75.8%. An incycyte assay was used to determine uPAR CAR T cells cytotoxic potency and was found to effectively kill uPAR positive cells at higher effective ratios. This strategy offers a new pathway to enhance cellular immunotherapy.

CORTICAL SPEECH REPRESENTATIONS UNDER COGNITIVE DEMANDS IN ADULTS WHO STUTTER

Mary Scott
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Speech perception involves sustained attention and constant manipulation of stored information in phonological working memory. Phonological working memory, in particular, has been found to be deficient in individuals who stutter. Poor cortical auditory speech representations are seen in individuals with developmental stuttering due to deficits in auditory feedback control systems important for phonological processing. Underlying attention deficits in individuals who stutter might influence these phonological speech representations. This project studies the neural mechanisms underlying cognitive and phonological processing deficits in adults who stutter. It utilizes an n-back task and multi-channel electroencephalography to understand how the neural representation of phonological units in speech is altered during sustained attention and working memory demands, which could further help us understand the mechanisms underlying the developmental nature of stuttering.

DEATH CERTIFICATION SYSTEMS AND CERTIFIER QUALIFICATIONS IN UNITED STATES COUNTIES IN 2025

Devin Sebero
Mentor(s): Malia Jones
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Accurate death certification is essential for population research because it is the primary source of mortality data, including specific causes of death and other key demographic details such as the age, race, and gender of the deceased. Counties rely on different systems, including medical examiners, coroners, and other county officials, to determine and certify causes of death. However, training and educational requirements for these roles vary widely. This project focuses on identifying the frequency of Coroners, Medical Examiners, and other officials; formal education requirements as determined by state law; whether they are elected or appointed, and whether there is systematic variation in the medicolegal system by rurality. These factors may directly influence the accuracy, consistency, and completeness of mortality data.

EFFECTS OF KETOGENIC DIETS ON NEUROBLASTOMA TUMOR GROWTH IN ADJUVANT THERAPY VERSUS MONOTHERAPY VIA XENOGRAFT MOUSE MODEL

Tiffany Jiahe See
Mentor(s): Nasya Ramli
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Neuroblastoma is a pediatric cancer with poor prognosis in high-risk cases with a less than 50% survival rate despite current available treatment (Whittle et al., 2017). High risk neuroblastoma's strong dependence on glycolysis (The Warburg Effect), makes it a potential target for metabolic therapies like the ketogenic diet (Morscher et al., 2015). This study addresses how ketogenic diet monotherapy compares to ketogenic diet combined with chemotherapy, or adjuvant therapy, in affecting neuroblastoma xenograft tumor growth and viability. Using a two-way ANOVA, data on tumor volume and survival was extracted and compared from both a monotherapeutic study and an adjuvant therapy study. Through analyzing two cell lines (SH-SY5Y and SK-N-BE(2)) over a 22-day period, results showed no statistical significance of type of treatment or type of cell line on overall tumor volume. However, the interaction between treatment and cell line approached significance, suggesting that an adjuvant approach in a chemoresistant cell line (SK-N-BE(2)) may impact tumor reduction. Overall, this study highlights a potential strategy for reducing toxic chemotherapeutic practices in high-risk pediatric oncology while simultaneously exploring alternate treatments that progress towards reducing neuroblastoma mortality rates.

THE ROLE OF STUDY SEQUENCE IN CATEGORY LEARNING: TESTING DISTRIBUTED PAIRS AGAINST COMMON PRESENTATION SCHEDULES

Fiona Serifov
Mentor(s): Haley Vlach
Additional Author(s): Ezgi Yuksel

Previous research has shown that learning outcomes depend on how study materials are sequenced during learning. Some work suggests that viewing multiple examples at the same time facilitates the abstraction of shared commonalities across exemplars, whereas other work suggests that alternating examples across categories promotes comparison. It remains unclear whether combining these approaches can further improve learning. Here, we examined whether a distributed pairs schedule, presenting two exemplars at a time across learning, produces better category learning than other common presentation sequences. Across a set of experiments, participants studied paintings from twelve artists under distributed pairs, simultaneous, interleaved, and blocked schedules. At test, participants viewed new paintings and selected the correct artist. This work provides insight into how different sequencing structures influence category learning.

THE BOARD LAB: UNDERSTANDING THE IMPACT OF PUBLIC UNIVERSITY GOVERNING BOARDS

Jennifer Serifov
Mentor(s): Isabel McMullen

Governing boards control many aspects of public universities. Yet little is known about who serves on boards or how this varies by important features like state politics or system structure, how boards make decisions, and what influences board member policymaking. This project brings together undergraduate and graduate researchers to explore questions of board governance. Central to the project is a large data collection effort. Using online and archival sources, the team is assembling an across-time (longitudinal) dataset of biographical information on boards nationwide. This dataset will be linked to additional data at the institution level to relate board composition to outcomes like financial and programmatic decisions. Additionally, this analysis is complemented by qualitative evidence from interviews with current and former board members about their experiences.

CT-BASED CRANIOFACIAL SEGMENTATION FOR BIOMECHANICAL MODELING OF CHEWING

Alexis Serrano
Mentor(s): David Dean, Tanya Djemal
Additional Author(s): Luis Olivas

Mandibular reconstruction requires precise fixation plate placement to ensure graft stability and long-term function, yet current surgical planning often lacks biomechanical feedback. This project develops a finite element-based chewing model and biomechanical data that can support future machine learning approaches for optimizing plate placement. CT scans are segmented in 3D Slicer, converted to volumetric meshes in ANSYS, and analyzed using established bone properties and muscle forces. Iliac crest grafts are modeled to compare stress distributions and bone remodeling outcomes with fibula-based reconstructions. Audiences will learn how integrating biomechanics with computational modeling and future machine-learning integration advances virtual surgical planning, reduces implant failure, and improves patient quality of life. This work extends prior studies by creating a biomechanical framework capable of providing predictive feedback for surgical decision-making.

RECONSTRUCTING A HYBRID NITROGENASE ANCESTOR FROM A FUNCTIONAL AND NON-FUNCTIONAL STRAIN

Manav Seth
Mentor(s): Betül Kaçar
Additional Author(s): Elias Kemna

Nitrogenase played a crucial role in nitrogen fixation on early earth to convert nitrogen gas into bioavailable ammonia. Previous work reconstructing nitrogenase ancestors in modern diazotroph *Azotobacter vinelandii* resulted in a mix of functional and non-functional strains. We attempted to bridge the gap in sequence space between a functional and non-functional ancestor of different clades to help determine the necessary aspects for function in *Azotobacter vinelandii*. All this was performed via polymerase chain reaction (PCR) shuffling which involves mixing DNA content from both the strains and seeing the property of the resultant hybrid strain. The primary composition of the hybrid strain included mostly the functional strain as compared to the non-functional one.

INVESTIGATING AND OPTIMIZING THE ELECTROCHEMICAL COUPLING OF ETHYLENE

Jack Ford Shabaker
Mentor(s): Marcel Schreier, Enner Mendoza

The industrial production of 1-butene typically relies on thermal catalytic oligomerization of ethylene using transition metal catalysts under high temperature and pressure, resulting in significant energy consumption and carbon emissions. This work explores an alternative electrochemical approach to ethylene coupling, leveraging renewable electricity to drive carbon-carbon coupling under milder conditions. The electrochemical route offers particularly tunable reaction environments, with a multitude of factors providing precise control for optimizing selectivity. We investigate the electrochemical coupling of ethylene to 1-butene by examining product selectivity as a function of applied potential and holding time. Our results demonstrate a clear potential dependence as well as holding time dependence in the production of 1-butene.

MAPPING CHLOROPLAST LIPID REMODELING AT SINGLE-CELL RESOLUTION IN C4 MAIZE UNDER NITROGEN LIMITATION

Elissa Shan
Mentor(s): Emily Hubecky

Nitrogen (N) is crucial for chloroplast photosynthetic machinery, under N limitations, plants mitigate through intracellular recycling such as chloroplast turnover. Canonical autophagy is important but dispensable during this recycling process, suggesting the existence of alternative pathways. In C4 Maize, two structurally distinct chloroplast types mesophyll and bundle sheath cells were used for cell-type specific analysis of recycling mechanisms. Single-cell resolution MALDI mass spectrometry imaging was used to compare wild-type and autophagy-deficient (atg12) maize leaves grown under N-replete and N-deplete conditions. Lipid mapping revealed enrichment of chloroplast-associated phosphatidylglycerol(PG) and phosphatidylcholine (PC) in bundle sheath cells under nitrogen deprivation. These findings support our hypothesis that chloroplast recycling during nitrogen limitation involves mechanisms that extend beyond canonical autophagy.

RECONSTRUCTION OF MOUSE AND HUMAN PROSTATE USING NANOCT TECHNOLOGY

Simran Sharma
Mentor(s): Ajinkya Limkar
Additional Author(s): William Ricke

Benign prostatic hyperplasia (BPH) leads to the development of lower urinary tract dysfunction as the urethra becomes compressed by the hyperplastic prostatic tissue. To understand the anatomical components of the mouse urogenital tract and its correlation to human prostate pathology, we employed nanoCT imaging to generate three-dimensional reconstructions of mouse prostates. Of the four mouse prostatic lobes (ventral, anterior, dorsal, and lateral), the dorsolateral prostate (dorsal and lateral lobes) possesses analogous physiological function and anatomical configuration relative to the human prostate. Dorsolateral prostatic tissues most similarly represent the expansive tissue surrounding the urethra and may resemble BPH tissue. This anatomical finding supports the utility of mouse models for investigating human prostatic diseases, including BPH.

TOPOLOGICAL DATA ANALYSIS OF BIRDSONG

Ojaswanie Sharma, Rishi Sanganeria, Vikram Varikooty
Mentor(s): Dhananjay Bhaskar
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Much like human babies learning to speak, songbirds develop their songs in stages. Young zebra finches begin with simple subsong and protosyllables and gradually develop complex songs containing repeated multi-syllable patterns. To study vocal learning and the neural mechanisms underlying song production, researchers must identify song patterns and segment songs into syllables. Most existing methods rely on spectral features and supervised machine learning for segmentation. In this project, we explore topological data analysis (TDA) for birdsong analysis. We convert song recordings into spectrograms and analyze them using sliding time windows, then apply persistent homology to capture structural features such as connected components (syllables) and loops corresponding to repeated patterns. Our goal is to determine whether topological features can help identify meaningful segments of birdsong.

AT THE KITCHEN TABLE AND IN THE CLASSROOM: THE SOCIALIZATION OF WHITE RACIAL IDENTITY

Austin Shearer
Mentor(s): Ines Botto

This research project investigates how young white children begin forming racial identities by focusing on social-contextual factors that shape their early learning. The study specifically focuses on the development of racial understandings in both home and school settings. Through thematic analysis of parent and child interviews, and content analysis of district frameworks and school curricula, this project exposes how everyday contexts contribute to white children's racial understandings and conversations about race with their parents. Audiences will gain insight into overlooked processes of early white racial development, as well as why these formations matter for broader topics of race, equity, and the creation of a racially just generation.

WHICH IS LARGER, 11/8 OR 5/3?: A FRACTION PROCESSING STARTED

Jenna Shen
Mentor(s): Jennifer Murray, Sangmi Park

Strong fraction skills are essential for students' success in higher-level mathematics. However, studies show that fraction processing remains challenging into adulthood. This study further explored possible reasons for fraction processing challenges by having 193 undergraduate students from UW-Madison complete a computerized fraction comparison task, and recording their accuracy and strategy use. Very few fraction processing studies incorporate strategy data. Using this data and a mix of quantitative and qualitative analysis, we will investigate how item characteristics such as congruency, distance, symbolic format, and timing may play a role in fraction processing. Additionally, we will look at how strategy relates to all of these item characteristics, providing a unique, in depth analysis of fraction comparison processing.

INVESTIGATING THE IMPACT OF CANCER-ASSOCIATED FIBROBLASTS ON THE DEVELOPMENT OF PANCREATIC DUCTAL ADENOCARCINOMA (PDAC)

Aditi Shenoy
Mentor(s): Jeremy Kratz, Hailee Porter

Pancreatic ductal adenocarcinoma (PDAC) has the most dismal prognosis due to the influence of cancer-associated fibroblast (CAF) in the tumor microenvironment, as well as late diagnosis. Although CAFs are known to promote tumor growth and resistance, far less is known about their epigenetic reprogramming in precursor lesions, intraductal pancreatic mucinous neoplasms (IPMN), and pancreatic intraductal neoplasms (PanIN), as well as their implications on their progression to PDAC. Using a 3D co-culture system, we aim to investigate the role of CAFs on signaling mechanisms in the developmental pipeline. This will be achieved through molecular profiling via qPCR, flow cytometry, and secretome analysis to assess the impact of co-culturing on pathway modulation. Ultimately, understanding fibroblast-tumor interactions may elucidate therapeutic vulnerabilities capable of prematurely interrupting PDAC progression.

ESTABLISHING A GENETIC MODEL FOR FASCIATION IN THE FLOWER *CELOSIA*

Evelyn Shepich
Mentor(s): Jake Brunkard, Kate Lund

Celosia, commonly known as cockscomb, is a flowering plant native to tropical regions of Africa and the Americas. It is classified into three ornamental types based on flower morphology: Plumosa (feathery plumes), Spicata (wheat-like spikes), and Cristata, which forms the distinctive crested “cockscomb” shape associated with fasciation. Despite its ornamental and herbal significance, laboratory protocols for controlled growth and genetic crosses in *Celosia* are limited. The goal of this project is to develop methods for efficiently growing *Celosia* under laboratory conditions and induce earlier flowering to shorten generation time. Controlled crosses between defined parental lines will be performed to generate F1 hybrids, enabling the production of genetically diverse F2 populations. These populations will be used to investigate the genetic basis of fasciation and variation in floral morphology. Establishing reliable growth and crossing protocols will support future genetic studies in *Celosia*.

FEEL. CHOOSE. MOVE. EMPOWERING CHILDREN WITH DISABILITIES THROUGH SENSORY CHOICE AND SELF-DETERMINATION

Zoe Sherman
Mentor(s): Kecia Doyle

For children with intellectual and developmental disabilities, self-regulation is often treated as a luxury, with interventions remaining largely adult-directed and compliance-based. This project addresses this inclusion gap through Sensory-Informed Choice Stations, a modular framework designed to center self-directed choice in therapy. Synthesizing Self-Determination Theory and Sensory Integration Theory, the model ensures that autonomous activity selection is physiologically purposeful.

Utilizing a universal design approach, activities are categorized into five distinct regulation zones supported by visual scaffolding to reduce cognitive load and facilitate independent engagement. By shifting the locus of control from therapist to child, this framework fosters "causal agency," empowering participants to advocate for their sensory needs. The result is a scalable, evidence-based solution that builds essential, lifelong skills in self-determination and body autonomy.

EXPLORING THE IMPACT OF POLICY CHANGES ON SEXUAL VIOLENCE SERVICES FOR MARGINALIZED SURVIVORS

Indigo Shideler, Sumaiyah Kareem
Mentor(s): LB Klein
Additional Author(s): Taylan Stulting

This multi-phase project studies the shifting environment of sexual violence services following recent executive orders. Our goal is to archive and measure changing accessibility to resources for different demographics (Spanish-speaking, LGBTQ+, BIPOC, disabled, etc). By comparing and analyzing 106 national and state coalition websites before November 4th, 2024 and at present, in addition to conducting interviews with professionals to reveal how policy impacts service delivery, this study aims to thoroughly document the range of impact of these policy changes from public availability of information to individual accessibility to services and underscore the urgency of inclusive digital outreach.

EXPLORING THE INTERACTION BETWEEN AI USE AND LEARNING OUTCOMES

Madeline Shields
Mentor(s): Ezgi M. Yuksel, C. Shawn Green

Artificial Intelligence use is increasing in academic settings, particularly in programming and code generation. However, its impact on learning remains unclear, as previous research has been somewhat mixed. Here we added to this literature by asking participants to complete a programming task through three phases: study, practice, and test. For study, participants read an instruction sheet on a basic programming skill. During practice, students answered ten questions, with half the participants having access to Copilot. During the final test phase, all participants completed 25-questions independently. Performance was assessed through both multiple-choice and code-writing questions. We predicted that AI access will lead to better practice performance and perceived learning, but worse outcomes on the test. The present study could inform future use of AI in education.

CREDIBILITY ARCHITECTURE: INSTITUTIONAL DESIGN AND THE LIMITS OF ALLIANCE COMMITMENT IN NATO

Tristan Shomaker
Mentor(s): Andrew Kydd

Why do some NATO security commitments deter aggression while others invite gradual testing? Debates on deterrence credibility often emphasize military power, reputation, or signaling, yet they pay less attention to the institutional structures that translate alliance promises into predictable action. This paper introduces credibility architecture to explain how security commitments become strategically believable. Drawing on insights from political science, international relations, and historical analysis, the study examines how institutional design shapes deterrence within NATO. It compares the ambiguous commitments of the 2008 Bucharest Summit with post-2014 reinforcement measures in the Baltic region, including enhanced Forward Presence and rapid response initiatives. The analysis shows deterrence credibility emerges not from rhetoric alone, but from institutional arrangements that embed commitments within structured consultation and shared reputational stakes.

DEFENSA DE LA VIDA: INDIGENOUS MAYAN SURVIVANCE AND CULTURAL RESISTANCE DURING THE GUATEMALAN CIVIL WAR 1960S-1990S

Ana Shriver
Mentor(s): Allison Powers Useche

From 1960 to 1996, Guatemala was embroiled in a 36-year civil war that was marked by decades of violence, the most extreme targeting and impacting the Indigenous Maya of the region. In the aftermath of the war, the Maya became globally and historically known in their victimhood. Yet despite the genocidal levels of violence that targeted them during the war, 22 distinct Mayan groups that existed then remain today. My thesis aims to shift the focus of Guatemalan Civil War history to center Indigenous Mayan voices. In doing so, I draw on the concept of survivance, a term coined by Anishinaabe scholar Gerald Vizenor, to examine the ways Indigenous Mayan communities practiced resistance rooted in cultural and spiritual epistemologies that occurred beneath the violence.

SPEAKING OF JUSTICE: A NEW DATASET ON HUMAN RIGHTS ORGANIZATIONS' ADVOCACY TOWARD THE ICC

Ava Shumway
Mentor(s): Genevieve Bates

In this article, we introduce the ICC Advocacy Dataset, which provides qualitative and quantitative information about what human rights organizations say about the International Criminal Court, when, and to whom. First, we theoretically motivate the need to understand the ICC's evolving relationship with human rights organizations over time. We then introduce a new dataset on the statements human rights organizations make about ICC. We build a corpus of statements made by three of the world's leading organizations – Human Rights Watch, Amnesty International, and the International Committee of the Red Cross – and present metadata and the qualitative and quantitative information contained in the dataset and available for analysis. We then present an illustrative analysis focusing on the question: does the target audience of a statement influence the level of support for the ICC in the statement? We conclude by outlining potential next steps in ICC advocacy research.

EVALUATING THE ANTI-TUMORAL IMMUNITY AND EFFICACY OF TNFA AND ACD40 COMBINED TREATMENT IN HEAD AND NECK CANCERS

Sananda Shyamkumar
Mentor(s): Huy Dinh, Paul M. Sondel
Additional Author(s): Anqi Gao

Neutrophils are the human body's first responders to pathogens and can exhibit varying effects in tumor microenvironments. Thus, studying neutrophil heterogeneity can help us understand how neutrophils can be utilized in cancer treatment. Previous research has shown that neutrophil-activating therapy (NAT), a combination of TNFα, CD40, and tumor-targeting antibodies, successfully regressed tumor growth. We have been working to test the effectiveness of NAT on a murine model of head and neck squamous cell carcinoma (HNSCC). In this proposal, I hypothesize that using a combination of CD40+TNFα will be as effective as NAT at clearing HNSCC mouse tumors. Using only two components of NAT may have significant benefits by lowering toxicities and extending to cancers in which a tumor antibody target is unavailable.

COMPARING ARAGONITE PRECURSORS PHASES IN THE CORAL SKELETON AND STALACTITE GROWTH

Sufyan Siddiqui
Mentor(s): Pupa Gilbert

Both coral skeletons and stalactites are primarily composed of aragonite. Previous research has shown that the growth of coral skeletons involves two crystalline precursors and two amorphous precursors before maturing into aragonite. Furthermore, similar mechanisms have been widely observed throughout nature, suggesting a potential common pathway for aragonite mineralization in biological and geological systems. The goal of this research is to investigate whether the mechanisms underlying stalactite growth resemble those of coral skeletons, thereby demonstrating universality in aragonite biomineralization. Using Myriad Mapping of nanoscale minerals, this study compares precursor phases in stalactites and coral skeletons to evaluate similarities and differences in their growth mechanisms

INVESTIGATING THE IMPACT OF METHIONINE RESTRICTION AND SLC7A11 INHIBITORS ON TRIPLE-NEGATIVE BREAST CANCER

Mannet Sidhu
Mentor(s): Vincent Cryns, Elena Strekalova

Methionine is an essential amino acid, fueling tumor growth by promoting methylation of tumor suppressor genes, and breast cancer cells (BCCs) are highly dependent on methionine. Methionine Restriction (MR) has been shown to reduce tumor growth. However, research indicates MR upregulates SLC7A11, a transmembrane cystine/glutamate antiporter that regulates reactive oxygen species (ROS) by importing extracellular cystine. Increased SLC7A11 expression elevates BCC sensitivity to inhibitors like Erastin. We hypothesized MR-induced SLC7A11 expression will increase triple negative BCC sensitivity to inhibition. Currently, we are using human triple-negative BCC cultures in controlled medias (+/- methionine) with inhibitors to investigate SLC7A11 gene and protein expression, cell growth and viability. If our findings align with our assumptions, this could lead to new treatments for patients with metastatic BC.

HORIZONTAL TRANSMISSION OF MOSQUITO-ASSOCIATED BACTERIA TO NECTAR

Hailey Sieren
Mentor(s): Kerri Coon, Holly Nichols

Mosquitoes contain diverse gut bacteria that impact larval development, adult fitness, and the capability of blood feeding female adults to transmit pathogens. Adults of both sexes feed on nectar and sugar sources for energy and these nectar sources, derived from many plant species, contain their own microbiomes. Although mosquito gut and nectar microbiomes have been studied, microbial transmission between mosquitoes and nectar is not well characterized. Here, I focused on characterizing microbiota transmission from mosquitoes to nectar sources. Work to date has focused on optimizing experimental conditions, including artificial nectar systems, mosquito feeding setups, contamination-reduction procedures, and DNA extraction workflows suitable for high-throughput 16S rRNA sequencing. These optimizations will enable identification of bacteria reliably transferred from mosquitoes to nectar for future disease-control applications.

INVESTIGATING THE ROLE OF MICROGLIA IN MODULATING EXCITOTOXICITY AND NEUROINFLAMMATION FOLLOWING TRAUMATIC BRAIN INJURY: IN VITRO CO- AND TRI-CULTURE MODELS

Daniel Silverman
Mentor(s): Christian Franck
Additional Author(s): Emily Blick

Following a Traumatic Brain Injury (TBI), glial cells initiate an immune response that can become dysregulated and lead to cell death. One mechanism, excitotoxicity, describes the neurotoxic effects of abnormally high levels of excitatory neurotransmitters. After a TBI, damaged brain cells release excess glutamate, overactivating glutamatergic receptors and causing network signaling changes, hyperexcitability, and calcium-dependent degeneration [2]. Microglia, the brain's first responders to injury, play a key role in inflammatory and neurodegenerative processes. When activated, they adopt an ameboid morphology and secrete pro-inflammatory cytokines [6]. It remains unclear how microglia influence neuronal calcium signaling during excitotoxicity in vitro. This study evaluates calcium responses to extracellular glutamate with and without microglia and measures inflammatory cytokine effects in a tri-culture model using ELISA to better understand microglia's role in the hyperacute and acute phases of excitotoxicity.

USING OVIPOSITOR MORPHOLOGY TO INFER ABOUT SPECIES DIVERGENCE IN GRYLLOBLATTODEA

Sophia Simac
Mentor(s): Sean Schoville

Grylloblattodea is a small order of cold-specialized insects that is rare and poorly studied, because of this research into their morphology has been limited. In this study, I analyze ovipositors of *Grylloblatta* in order to make inferences about species divergence. Images of ovipositors were taken and each image was landmarked for analysis using geometric morphometrics in the MorphoJ software. Tests were run on the data to highlight differences in the ovipositors based on three different groupings. The results showed subtle but significant differences between the ovipositors, with species group being the most significant. This suggests that the morphology of the ovipositor is diverging between the species groups studied. More specimens or other anatomical features might be needed to differentiate fine differences among closely related species.

CONTRIBUTION OF NONRENAL CALCITRIOL PRODUCTION TO ARTERIAL CALCIFICATION IN ATHEROSCLEROSIS

Nathan Simon
Mentor(s): Seong Min Lee
Additional Author(s): Mark B. Meyer

Atherosclerosis is a chronic inflammatory disease characterized by necrotic plaque and arterial calcification. While kidney-produced active vitamin D (calcitriol) maintains mineral homeostasis, non-renal target cells (NRTCs) produce calcitriol locally via the same enzyme Cyp27b1 to invoke anti-inflammatory effects. Previous clinical trials failed to show anti-inflammatory effects of supplemental Vitamin D likely because systemic calcitriol confounds localized production effects. We have generated a unique mouse model that is characterized by renal-deficient Cyp27b1 but retains local calcitriol production in NRTCs. This strain was crossed with Ldlr-/- mice prone to atherosclerosis to understand the therapeutic effects of locally produced calcitriol. By providing graded vitamin D supplementation, we examined arterial plaque calcification using micro-CT imaging, colorimetric mineral assays, and histological analyses including Von Kossa and Alizarin Red.

DEVELOPMENT AND APPLICATION OF A MIXTURE-OF-EXPERTS APPROACH TO CAUSAL DISCOVERY IN ICU HEALTH RECORD DATA

Kayvan Sinha
Mentor(s): Neil Munjal

Randomized controlled trials (RCTs), while essential for establishing clinical evidence, are often constrained by cost, recruitment, and ethical limitations. This project investigates whether causal discovery methods applied to ICU sepsis patients in the MIMIC-IV electronic health record (EHR) database can generate clinically meaningful insights. Following data preprocessing, we applied multiple causal discovery algorithms via ensemble approaches to build causal graphs of pathways leading to adverse outcomes such as respiratory failure, kidney injury, and mortality. The pipeline was evaluated by recovering established RCT-based relationships while testing different algorithms, missing-data strategies, and independence tests. This work demonstrated that causal discovery on observational EHR data can complement RCT evidence, offering a scalable path toward causal understanding of complex conditions in critical care and future treatment-focused hypothesis generation.

THE KATTE AFFAIR: FAMILY, SEXUALITY, AND THE SUBJUGATION OF FREDERICK THE GREAT

Erin Sitrin
Mentor(s): Eric Carlsson

The 1730 Katte Affair was the 18-year-old Frederick the Great's failed flight from his abusive father and life at the Prussian court. This event resulted in the tragic execution of Frederick's close friend, Hans Hermann von Katte, which Frederick himself was forced to witness. This serves as a pivotal and compelling moment in the life of a prominent 18th-century monarch, but the affair itself has relatively limited recent scholarship covering it. The thesis overall explores how the Katte Affair shaped Frederick's political identity by investigating the event through lenses of familial dynamics, law and sexuality, and political significance.

IN OUR OWN WORDS: ORAL HISTORY AND AIDS ACTIVISM IN MADISON, WISCONSIN

Haleigh Smith
Mentor(s): Cat Phan

In the context of AIDS Activism, there is historic discourse on grassroots activism. In this project, through oral histories, I examine the tactics of grassroots activists focused on mutual aid, political activists centered around government response, and medical care providers to reveal a broader illustration of the AIDS activist movement and its complexities. The scope of this project includes folks who were engaging in AIDS activism from the early 1980's to the mid 2010's. This research focuses on UW-Madison student AIDS Activism and University actors (i.e. student health services). Uniquely, this research centers on oral history interviews which allow participants to share their perspective in their own words, beyond curated remembrance by larger organizations.

INVESTIGATING THE EFFECT OF SPRAY-DRIED AND FLUID-BED-DRIED WHEY PROTEIN PHOSPHOLIPID CONCENTRATE ON LIPID OXIDATION

Kimaya Soin
Mentor(s): Xin Qing

Whey Protein Phospholipid Concentrate (WPPC) is a dairy stream enriched in Milk Fat Globules (MFGs) produced during cheese processing. While traditionally used in animal feed and considered a waste product, recent studies show it could have several health benefits such as decreasing inflammation. This study asked whether Spray Drying (SD) and Fluid-Bed Drying (FBD) methods differentially affect WPPC lipid oxidation, possibly influencing digestibility. Lipid oxidation was measured by looking at the extent of secondary lipid oxidation through a Thiobarbituric Acid Reactive Substances (TBARS) distillation method followed by a colorimetric measurement via spectrophotometer. Increased lipid oxidation in FBD particles is hypothesized due to the greater surface area and porosity. These findings provide insight on making more nutrient-rich and digestible dairy products.

IMMUNE REGULATION OF CELL STRESS PATHWAYS IN GLUTAMATE EXCITOTOXICITY: EVIDENCE FROM THE SPASTIC HAN WISTAR RAT

Elizabeth Sommer
Mentor(s): Amali Samarasinghe
Additional Author(s): Hannah Buser, Lisa Banner, Randy Cohen

Glutamate excitotoxicity (GE) is a process wherein hippocampal (HP) and cerebellar (CB) neurons are damaged by overactivation of glutamate receptors leading to progressive neuronal degeneration. Neuroimmune involvement in GE remains unclear. We proposed that this neuronal damage is associated with pro-inflammatory milieu. Using the spastic Han Wistar (sHW) rat, qPCR was performed to assess mRNA levels of cell stress pathway genes and pro-inflammatory cytokines in three age groups within the hippocampus (HP) and cerebellum (CB). Results indicate progressive, age-dependent shifts in stress pathway activation in neurodegeneration. Immunohistochemistry in HP and CB slices targeting LIF and IL-6 showed region and age-dependent differences between phenotypes, indicating dynamic regulation of cytokine expression during disease progression. GE-induced cell degeneration may be triggered by altered cytokine production, promoting cell stress/death.

DIRECT COMPARISON OF SAMPLE CLEANUP METHODS FOR TOP-DOWN PROTEOMICS

Mia Song
Mentor(s): Holden Rogers, Andrew Perciaccante

Proteins exist as diverse proteoforms due to genetic mutations, alternative splicing, and post-translational modifications (PTMs). Phosphorylation of cardiac proteins is a key PTM involved in cellular regulation and serves as a biomarker for cardiomyopathies. Top-down proteomics using mass spectrometry (MS) enables identification and characterization of intact proteoforms, but sample cleanup is essential to remove contaminants that hinder detection. Methanol/chloroform/water (MCW) precipitation and molecular weight cutoff (MWCO) filtration are common preparation methods, yet their impact on proteoform recovery remains unclear. This project will compare how MCW and MWCO influence cardiac proteoform distributions. Gel electrophoresis will assess protein recovery, and liquid chromatography–MS will evaluate proteoform differences. Findings will clarify how sample preparation affects proteoform detection and guide selection of optimal cleanup strategies for future studies.

REPURPOSING ENERGY: EOSINOPHIL METABOLISM AND INFLUENZA A VIRUS INFECTION

Sam Sonsalla
Mentor(s): Amali E. Samarasinghe
Additional Author(s): Meenakshi Tiwary, Kim LeMessurier

Eosinophil mitochondria elicit key roles in cellular immune response through energy production, reactive oxygen species generation, and apoptosis. In both healthy and influenza virus-infected eosinophils, the relative number, size, cristae volume, and inter-organelle interactions of mitochondria decrease. However, virus-infected eosinophils significantly lower mitochondrial remodeling. Using bone marrow-derived eosinophils (BMdEos) from wild type (WT) C57BL/6J mice, we found that influenza infection reduces mitochondrial respiration and alters the transcriptome of mature eosinophils to downregulate activity of the MAP kinase pathway. To elucidate the mechanisms by which eosinophils alter their metabolism, we will perform metabolomics for control and virus infected BMdEos to identify biochemical pathways within the eosinophil response. We expect to identify unique pathways of eosinophils transforming mitochondrial function and enhancing survivability during virus infection.

TIMING OF MAIN CENTRAL THRUST FAULTING, CENTRAL NEPAL, FROM IN-SITU 40AR/39AR DATING

Ana Sotelo Romero
Mentor(s): Brad S. Singer
Additional Author(s): Mary Hubbard, Subit Chhetri, Brian Jicha, Bryan Wathen

The Main Central Thrust (MCT) in the Himalayas is a major fault that accommodates deformation and produces earthquakes. Understanding its reactivation history is important for reconstructing tectonic processes and assessing seismic hazards. This study investigates the timing of past faulting along the MCT in central Nepal using in-situ 40Ar/39Ar dating of cataclasite and pseudotachylyte. Dating these rocks is challenging due to their fine-grained and heterogeneous nature. An ultraviolet laser ablation microprobe (UVLAMP) is used to analyze glassy (melt) and mineral domains within pseudotachylyte and ultracataclasite veins. Pilot microscopic characterization indicates distinct melt domains related to feldspar and biotite breakdown, providing ideal targets for dating. By integrating in-situ 40Ar/39Ar geochronology, this work seeks to better constrain the timing of seismic slip along the MCT. This approach improves our understanding of fault reactivation in active orogenic belts and contributes to seismic hazard assessments in the Himalayas.

COGNITIVE ASSESSMENT OF RHESUS MACAQUE CARRIERS OF A FRONTOTEMPORAL DEMENTIA–ASSOCIATED MUTATION

Allison Sowatzka
Mentor(s): Marina Emborg
Additional Author(s): Lillie Hokanson, Lena Komar, Emilia Johnson, Jeanette Metzger, Maddie Gloo

Frontotemporal dementia (FTD) is the most common dementia in individuals under 60 and lacks disease-modifying treatments. The MAPT R406W mutation, which encodes the tau protein, is implicated in FTD pathogenesis. Researchers at the Wisconsin National Primate Research Center identified a family of rhesus macaques carrying this mutation, creating a valuable nonhuman primate model. Macaques aged 0.5–22.7 years underwent longitudinal cognitive assessment using a puzzle feeder apparatus with eight levels of increasing difficulty. Wild-type and mutation carriers performed similarly until after puberty (7–9 years), when performance diverged and wild-type macaques achieved higher levels, suggesting emerging cognitive differences. These findings establish preliminary cognitive trajectories and baseline differences across the lifespan in MAPT R406W carriers, providing a foundation for future studies and therapeutic development in FTD.

ORGANOIDS AS MODELS FOR INVESTIGATING IN VITRO CORTICAL DEVELOPMENT IN DOWN SYNDROME

Sydney Spiegel
Mentor(s): Anita Bhattacharyya
Additional Author(s): Megan Jandy, Fiona Gaugert, Pubudu Kumarage, Shawn McGregor

Down syndrome (DS), characterized by triplication of chromosome 21 (T21), is the most common genetic cause of intellectual disability. DS is associated with cognitive deficits linked to dysregulated cortical development; however, the mechanisms by which T21 leads to dysregulation are unknown. To investigate the impacts of T21 throughout cortical development, we have generated cortical organoids from three pairs of isogenic T21 and control iPSCs. Organoids are a dynamic human model system used to model cortical development in vitro. Due to the inherent variability between organoids, we have created and implemented a strict control pipeline to evaluate organoid quality and cortical identity. These results establish confidence in our organoids as valid models to investigate hypotheses regarding the impacts of T21 on cortical development in vitro.

CRISPR-MEDIATED GENE REGULATION: GUIDE RNA CLONING IN CRISPR-I AND CRISPR-I TO CRISPR-A CONVERSION

Shalini Sree
Mentor(s): Rupa Sridharan, Khagani Eynullazada, Andrew In-Sun Tak

Gene editing using CRISPR technology has two components: the small guide RNA that allows Cas9 to bind to a target site and the Cas9 protein which is responsible for cutting DNA at said site. Crispr-interference (I) uses a modified Cas9 protein that cannot cut DNA but instead fuses to a KRAB domain that can repress genes while Crispr-activation (A) fuses to VP64 which can activate genes. We have an ideal vector containing the CAS9-KRAB, sgRNA cloning site and a fluorescent protein to identify cells that have taken up the crispr-I. The goals of my project were 1) to clone guide RNAs targeting two genes of interest into the crispr-I system, and 2) to convert the crispr-I to crispr-A by replacing the KRAB domain with VP64.

RETROSPECTIVE MOTION CORRECTION IN 3D BRAIN MRI

Atharvan Srivastava
Mentor(s): Alan McMillan

Small head movements during magnetic resonance imaging (MRI) scans can induce blurring and aliasing brain images, reducing their value for research and clinical use. This project investigates a retrospective motion-correction technique for 3D brain MRI, applied after the scan is complete. The approach involves two methods. One utilizes built-in motion measurement "navigators" into the acquisition from an MRI scanner. The other utilizes motion measurement from a simultaneously acquired positron emission tomography (PET) from a PET/MRI scanner. These motion estimates are then used to adjust the MRI's raw frequency-domain data, so the effects of motion are effectively reversed. The pipeline enables sharper, more robust MR images without extra scanning time.

EFFECTS OF DUST AEROSOLS ON MARCH 19TH, 2025 SEVERE STORM EXAMINED BY WRF MICROPHYSICS MODEL DIFFERENCES

Elaine Standley
Mentor(s): Katie Wilson, Mayra Oyola-Merced

This study examines the effects of dust aerosols on severe weather and the accuracy of the Weather Research and Forecasting (WRF) model using various microphysics schemes. An interesting case of aerosol and severe weather interaction occurred on March 19th, 2025, when a storm containing a large quantity of Texas dust deposited a mixture of snow, rain, ice, hail, and tornadoes across the Midwestern United States. Using four different microphysics parametrizations, two including and two neglecting aerosol interactions, we analyzed reflectivity, surface conditions, accumulated precipitation, precipitation type, and aerosol number concentration. By contrasting modeled results with and without aerosol interactions, then comparing these results to observed data, we can improve our understanding of severe weather and inform future numerical weather prediction.

PHARMACOLOGIC DISRUPTION OF PHOSPHOGLUCOMUTASE 3 (PGM3) ACTIVITY INHIBITS EXTRACELLULAR MATRIX DEPOSITION IN HUMAN PRECISION-CUT LUNG SLICES

Aidan Stange
Mentor(s): Angie Oler
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Idiopathic Pulmonary Fibrosis (IPF) is a fatal lung disease driven by activation and metabolic reprogramming of the lung mesenchyme, which results in excessive extracellular matrix (ECM) deposition. A promising strategy of research into protection against IPF is in the disruption of ECM deposition through manipulation of the PGM3 gene in the hexosamine biosynthetic pathway, a major energetic pathway in the body. Utilizing a cutting-edge ex vivo human model, precision-cut lung slices (PCLS), we inhibited PGM3 in these PCLS slices taken from discarded lungs that were rejected for transplant. We observed a significant inhibition of ECM markers fibronectin, collagen, and CTHRC1 in slices treated with TGF-Beta. This work suggests that this approach has promise for disrupting flux through the HBP and the development of lung fibrosis.

EFFECTS OF STRAW INSULATION ON CARBON AND NITROGEN DYNAMICS IN WISCONSIN FOREST SOILS

Hanah Rose Stark
Mentor(s): Daniel Igirimbabazi
Additional Author(s): Nick Balster

Winter freeze-thaw (FT) cycles strongly influence soil structure, microbial activity, and nutrient cycling in temperate forests. Straw is commonly used as insulation in FT experiments to moderate soil temperature and test effects on these relationships. However, straw may produce decomposition byproducts that alter carbon and nitrogen, potentially confounding physicochemical measurements. This case study evaluates whether winter-applied straw alters soil carbon:nitrogen (C:N) ratios in a conifer-dominated forest soil of southern Wisconsin. Using replicated field plots, we compare C:N ratios among legacy straw, newly treated, and control plots. We hypothesize that cold winter conditions limit microbial decomposition, resulting in no significant differences in soil C:N ratios among treatments because straw is removed before the growing season. Results will support straw insulation validity/ refine the methodology if needed.

UNDERSTANDING REPRODUCTIVE RIGHTS IN MEDIA AND POLITICS

McKaylee Stephenson
Mentor(s): Dhavan Shah, Mengyu Li

Studying political and health communication is crucial in understanding mass media, interpersonal communication, and digital media platforms on social judgments, political engagement, and health support. Dr. Dhavan Shah is examining the effects of media on reproductive health and abortion-related events, opinions, and policies in the United States. By observing and coding events from March 1, 2022, to December 1, 2024, based on coverage from four major news outlets, this project links media events to digital media discourses. This research examines social media as a site where individuals discuss health outcomes, the availability of services, and the civic processes. Data collection is ongoing, with the relationship between news media events, social media discourse, and other reproductive health outcomes still in development.

USING AGENT-BASED SIMULATIONS TO MODEL FOOD ACCESS DISPARITIES

Cornell Stewart
Mentor(s): Alfonso Morales
Additional Author(s): Charlie Haight, Tanish Upakare, Ira Hande, Edric Zhou, Shrivas Shankar, Oscar Almaraz, Ella Mitchell, Efe Ozalp, Robert James

Food insecurity exists in the United States due to structural inequalities in Food systems. This project works to create the Food Equity Access Simulation Technology, or FEAST. This is an agent-based model that evaluates food accessibility on a household level, which can be used to support policy decision-making. Households are modeled as agents using income, household size, employment status, and transportation access, which is used to calculate the household's probability of selecting certain stores. Using a case study in Franklin County, Ohio, we have demonstrated how a food access changes radically by the presence or absence of a supermarket. This highlights the importance of supermarket access in removing food inequalities.

FROM WORKERS TO STUDENTS: THE SOCIAL SHIFT AT 502–510 W. MIFFLIN STREET

Zoe Stoller, Evelyn Srubas, Riley Railsback, Steven Mose
Mentor(s): Anna Andrzejewski

The houses at 502–510 W. Mifflin Street were built in the early 1900s as multi-family flats, each containing several units from the start. For decades, they housed working-class residents, but during the 1960s and 1970s the block shifted dramatically as University of Wisconsin students became the primary tenants. This presentation examines that transition by analyzing the buildings' physical characteristics alongside archival sources such as maps, census records, and city data. The findings show that because these structures were originally designed for multiple households, they required relatively little alteration when converted to student apartments, revealing a continuity of use even as the neighborhood's social makeup changed.

ASSOCIATIONS BETWEEN HANGXIETY REFERENCES AND ENGAGEMENT METRICS ON REDDIT

Lily E Stratman
Mentor(s): Chelsea Olson, Megan Moreno

Hangxiety is defined as the anxiety that arises from a past alcohol use episode. Reddit is an anonymous social media platform focused on fostering discussions about experiences, which could include adolescents and young adults' (AYA's) discussion of alcohol. The purpose of this study is to determine the frequency, content, and engagement with hangxiety references on Reddit.

Data were collected from the top 50 posts from the Reddit search term "hangxiety." Each post was categorized into one of three subcategories: Educational/Advisory, Relatable/Support-Seeking, or Disapproval. Engagement metrics were recorded.

ANOVAs will test engagement metrics for each subcategory of hangxiety posts.

Findings from this study may provide insight into how hangxiety-related conversations are engaged with online and may inform future alcohol-related health communication strategies targeting AYAs.

EXPLORING THE RELATIONSHIP BETWEEN FACIAL COLOR AND THE PERCEPTION OF EMOTION INTENSITY IN CHILDREN

Hailey Sullivan
Mentor(s): Saideeka Jones

When making inferences about how others are feeling, children utilize cues in their environment, such as gestures, social context, and facial muscle movements. A potentially overlooked cue is facial coloration associated with certain emotional states. The present study examines how children judge the emotional intensity of static facial muscle configurations with manipulated color overlay. These findings can expand our understanding of the developmental trajectory of children's emotion perception and provide insight into how color information contributes to emotion judgments. Addressing these gaps has implications for social-emotional learning by informing the development of targeted interventions aimed at improving social and psychological outcomes.

ADVANCING AUTHORITARIANISM: STABILITY OUTCOMES OF CHINESE FOREIGN AID IN LATIN AMERICA

Izzy Sunby
Mentor(s): Jon Pevehouse

What are the effects of Chinese foreign aid on recipient state regime stability, and how does this relationship account for the consolidation of authoritarianism abroad? Political scholarship has debated the domestic effects of Chinese aid; however, this aid's effects on domestic political stability are notably understudied, especially in Latin America. To address this gap, I argue that Chinese aid's effect on political stability is conditioned upon domestic regime and contributes to increased stability in autocracies. I present a novel framework of domestic incentives for recipient state actors and five potential causal mechanisms, and I provide mixed-methods evidence for a potential causal relationship between aid and political stability. These findings have significant implications for scholars' and policymakers' understanding of Beijing's aid program.

INVESTIGATING THE EFFECTS OF TMEM135 MUTATION ON LIPID METABOLISM AND OXIDATIVE STRESS IN THE BRAIN

Lucia Sundberg
Mentor(s): Akihiro Ikeda, Purnima Gogoi

Lipid dysregulation is a driver of age-related degenerative disease, such as Alzheimer's disease. A mutation in transmembrane protein 135 (TMEM135) affects lipid regulation in the brain by decreasing docosahexaenoic acid (DHA) levels. Our preliminary data implicates DHA as a transcriptional regulator of lipid metabolism in the brain. However, it remains unknown how DHA regulates lipid homeostasis to suppress oxidative stress in the brain. We hypothesize that DHA deficiency remodels lipid metabolism, leading to increased oxidative stress. This project elucidates the stress-response pathways activated by lipid dysregulation in the brain and examines how DHA supplementation affects their progression. These findings illuminate pathological mechanisms that contribute to degenerative diseases and establish DHA as a key factor in cognitive health through its role in lipid metabolism regulation.

VISUALIZING HISTORICAL FORAGING TRENDS OF BOWHEAD WHALES USING STABLE ISOTOPE ECOLOGY

Samantha Surges
Mentor(s): Alyson Fleming

Current rising temperatures and sea-ice loss make understanding how keystone Arctic species, like bowhead whales (*Balaena mysticetus*), respond to environmental change imperative. Stable isotope analysis of carbon (δ13C) and nitrogen (δ15N) from whale baleen plates may provide these records of historic bowhead whale population trends. Using historical baleen plates and archival metadata from museum collections, we will analyze bulk and compound-specific δ13C and δ15N values from specimens collected between the mid-1800s and late-1900s to reconstruct temporal trends. These observed isotopic variations across time and location will reflect shifts in prey sources, foraging movements, or environmentally driven trophic changes. By integrating stable isotopes, historical data, and geospatial mapping, this research will reveal how bowhead whale foraging ecology responded to past environmental changes and historical whaling pressures.

QUANTIFYING THE IMPACT OF DATA CENTER POWER OSCILLATIONS ON GRID STABILITY

Rohan Susarla
Mentor(s): Bernie Lesieutre

The rapid growth of artificial intelligence has necessitated a massive expansion of data centers across the United States. Training these models requires vast numbers of Graphics Processing Units (GPUs) proportional to model complexity. These GPUs operate in two distinct phases: a computationally heavy phase for matrix operations and a lower-power synchronization phase. This alternation creates significant power oscillations.

Our findings indicate these oscillations reach magnitudes of 4 to 5 MW. If aligned with grid frequencies, they risk causing harmonic disruption and grid instability. Utilizing five months of power data from governmental entities, we quantify the effects of these fluctuations on grid stability. This is particularly relevant to Wisconsin, where incentives are driving a surge in large-scale data center development.

INVESTIGATING POTENTIAL TARGETS OF THE CELLULAR PROTEASE CASPASE-8 INVOLVED IN ANTIVIRAL SIGNALING DURING KAPOSI'S SARCOMA-ASSOCIATED HERPESVIRUS INFECTION

Lia Sweeney
Mentor(s): Marta Gaglia

Kaposi's sarcoma-associated herpesvirus (KSHV) is an oncogenic virus linked to multiple incurable diseases. Normally, the cGAS/STING pathway activates interferon response to block viral replication, but KSHV has been shown to block cGAS/STING activity. This project intends to investigate how KSHV evades this antiviral response. Previous research from the Gaglia laboratory has shown that the cellular enzyme caspase-8 modulates cGAS activity during KSHV infection, possibly through the cleavage of an unknown target protein. I am using luciferase reporter assays to dissect how caspase-8, HDAC3, and HDAC7 affect cGAS/STING pathway activity. Identifying caspase-8 targets will help better understand KSHV immune evasion strategies and may inform future antiviral therapeutic development.

MODELING LYMPHATIC DYSFUNCTION IN OVARIAN CANCER AND ASCITES DEVELOPMENT

Aurora Swissdorf
Mentor(s): María Virumbrales-Muñoz, Ana Sofia Peraza Muñuzuri

HGSOC is the deadliest gynecological malignancy. A hallmark of terminal HGSOC linked to worse prognosis is the accumulation of fluid in the peritoneal cavity, known as ascites, which is thought to be driven by impaired fluid drainage into LVs. LECs use two distinct kinds of adherens junctions to regulate fluid homeostasis: "button" junctions that facilitate drainage, and "zipper" junctions that prevent fluid leakage. HGSOC tumors secrete factors known to increase BV permeability, but their role in impairing LV drainage has not been investigated. We developed a microphysiological system co-culturing metastatic HGSOC cells alongside a 3D LV. Using our platform, we quantified an increase in button-to-zipper transitions in LVs co-cultured with HGSOC cells, which correlated with a significant decrease in lymphatic drainage capacity.

SEX-DEPENDENT DIFFERENCES IN ULTRASONIC VOCALIZATIONS OF THE TGF344-AD RAT MODEL AT 12 MONTHS

Jaclyn Szabados, Siri Anderson, Chystyna Prokulevich
Mentor(s): Michelle R. Ciucci, Denis Michael Rudisch

Alzheimer's disease (AD) is a progressive neurodegenerative disease that causes communication deficits. Subtle vocal deficits occur early in the disease, long before clinical diagnosis. Although females have a higher risk for AD, little is known about how preclinical vocal deficits might affect this population and how deficits may differ between sexes. The validated TgF344-AD rat model of AD allows for early-stage investigations of vocal communication. We hypothesize that female TgF344-AD rats will show more pronounced early vocal deficits than males. We will use an established ultrasonic vocalization paradigm to quantify sex differences between TgF344-AD rats and wildtype Fischer controls, characterizing vocal intensity (mean power), frequency parameters (peak, high, low frequency), and vocal complexity (call type) at 12mo of age.

MICROBIAL BILE ACID, 3-OXO-LCA, INHIBITS COLORECTAL CANCER CELL GROWTH

Jonathan Sze
Mentor(s): Ting Fu
Additional Author(s): Fei Sun

Bile acids (BAs), derivatives of cholesterol, are essential for lipid digestion and nutrient absorption. BAs also play vital roles in the liver and intestine, mediating postprandial responses via their nuclear receptor Farnesoid X Receptor (FXR) (Hoffman & Hagey, 2014). Recent studies have highlighted microbiome-generated BAs, such as 3-oxo-lithocholic acid (LCA), suggesting their anti-aging, anti-inflammation, and anti-infection potential (Paik et al., 2022; Sato 2021; Makishima et al., 1999). In this study, in vitro mouse and human colorectal cancer (CRC) cell lines, as well as in vivo syngenic and xenograft mouse models to investigate 3-oxo-LCA's effects on CRC progression. 3-oxo-LCA functioned as a potent FXR agonist that suppressed the proliferation of CRC cells. Additionally, 3-oxo-LCA reduced tumor progression in both mouse models and promoted apoptosis within the tumors.

CHRONIC RESPIRATORY ILLNESS SYMPTOM PATTERNS IN RURAL WESTERN UGANDA

Sophia Taffet
Mentor(s): James Gern
Additional Author(s): Taylor Weary, Tony Goldberg

With a unique climate and lifestyle relative to westernized nations, populations in Sub-Saharan Africa are subject to experience unique biological illness patterns, especially during childhood. Despite this, pediatric respiratory illness and virology remain severely understudied in these regions. A prospective cohort of 3-6 year olds in rural Western Uganda were followed over 9 months to record monthly symptoms scores and obtain nasal swabs for viral analysis. This data was compared to a similar cohort from studies done in the US. Results revealed higher rates and severity of chronic respiratory illness with low correlation to virology in the Uganda cohort, which is strikingly different to patterns among US children. This suggests that environmental triggers lead to high rates of non-infectious chronic respiratory symptoms in Ugandan children.

CALIBRATING RADIO TELESCOPE SENSITIVITY WITH STATISTICAL METHODS

Nick Tallon, Preson Schenk, Jetta Gullickson
Mentor(s): Snezana Stanimirovic

We conducted observations with the Sterling Hall and Pine Bluff Observatory small radio telescopes (SRTs) to calibrate system temperature for both instruments. We observed the Galactic plane at the 21-cm line, produced from the hyperfine transition of atomic hydrogen. We estimated system temperature with two methods: measuring statistical noise in the spectra; and firing a calibration signal of known intensity. With the two different estimates of temperature, we compared the results between both methods, as well as both telescopes. We then compared our results to data from past years. We find that the Pine Bluff Observatory SRT obtains system temperature of ~600K, whereas every other estimate from this year is in the range of ~2,300K. Past years had vastly different values in the range of ~100,000K.

MEASURING CO EVOLUTION IN PROTOPLANETARY DISKS WITH JAMES WEBB SPACE TELESCOPE

Nick Tallon
Mentor(s): Abygail Waggoner

Protoplanetary disks are large, broad disks that form around young stars. Inside these disks, the complex processes that create planets occur. Thus, understanding how these disks evolve chemically and physically is vital for understanding where planets will form, and if they will inherit characteristics required for life. I use infrared observations from James Webb Space Telescope to study how the abundant gas CO evolves as protoplanetary disks age. This research helps establish trends in the gas mass of protoplanetary disks, and the material available for planet formation processes.

INVESTIGATION OF OVARIAN CANCER SPHEROID MIGRATION DYNAMICS USING BIOMIMETIC MODELS OF THE EXTRACELLULAR MATRIX

Kristy Tamvakis
Mentor(s): Anupama Nair

High-grade serous ovarian cancer (HGSOC) is the most lethal subtype of ovarian cancer and spreads primarily through spheroid-mediated dissemination across the peritoneum. To investigate how extracellular matrix (ECM) architecture and cytoskeletal cues regulate this process, we cultured OVCAR-5 spheroid on engineered GelMA scaffolds fabricated using multiphoton polymerization (MPE). Two scaffold types were prepared by incorporating either collagen or the integrin-binding peptide GFOGER peptide into GelMA and patterned to represent normal and high grade tissue architectures. Spheroid adhesion, morphology, matrix remodeling were quantified under control and ROCK inhibited conditions. Distinct behavioral and mechanical responses were observed across scaffold types, indicating that both matrix ligand presentation and cytoskeletal contractility jointly determine spheroid ECM interactions. These findings provide a quantitative framework for investigating matrix-guided invasion in ovarian cancer.

DETERMINING THE EFFECT OF FRACTIONATED RADIOTHERAPY ON CHROMOSOMAL INSTABILITY AND CGAS-STING SIGNALING IN LUNG CANCER

Patricia Tan
Mentor(s): Pippa Cosper

Conventional fractionated radiotherapy is widely used in non–small cell lung cancer, yet repeated DNA damage may chronically stimulate cGAS–STING signaling and attenuate downstream type I interferon responses. We compared a clinically relevant 5 × 2 Gy fractionated regimen with a BED-matched single 7 Gy exposure in A549 lung cancer cells. Fractionated radiotherapy increased micronuclei, cGAS-positive micronuclei, and cytosolic dsDNA relative to 7 Gy, consistent with enhanced chromosomal instability and sustained upstream DNA-sensing inputs. Despite this, IFNB1 expression was reduced after 5 × 2 Gy, indicating dissociation between cytosolic DNA accumulation and interferon output, consistent with STING pathway adaptation and desensitization under repetitive activation. These findings support a model in which conventional fractionation promotes innate immune adaptation with potentially immunosuppressive consequences.

INVESTIGATING THE CHLOROPHYLL F SITES IN FAR-RED LIGHT-ACCLIMATED CYANOBACTERIA

Shimo Tang
Mentor(s): Maximino Emerson

Most organisms that do oxygenic photosynthesis use chlorophyll a to absorb visible light in from 400 to 700 nm. While certain cyanobacteria adapt to a shaded environment by additionally synthesizing chlorophyll d and f, absorbing far-red light from 700 to 800 nm. Gaining understanding of the molecular bases of how cyanobacteria use far-red light and the structure of the enzymes that bind to chlorophyll f has agricultural significance. Previous cryo-EM work has revealed the molecular structure of far-red light-absorbing photosystem I from the *Fischerella thermalis* PCC 7521, but it is difficult to distinguish between chlorophyll a and f, whose structures are very similar. Due to the challenges, we further characterize the far-red light-absorbing photosystem I complex from PCC 7521 as preliminary data for crystallization.

DETECTING NEUTRAL HYDROGEN IN THE MILKY WAY GALAXY USING CHART

Nathaniel Tanglin, Ari Graupe, Maxwell Laughan
Mentor(s): Snezana Stanimirovic

Almost everywhere we look, our galaxy is filled with neutral hydrogen. Electrons bound to neutral hydrogen atoms will spontaneously flip from the spin-up state to the lower energy spin-down state, emitting the excess energy as light. Because of the prevalence of neutral hydrogen gas in our galaxy, the light emitted from these spin-flip transitions is possible to detect using amateur technology. The Completely Hackable Radio Telescope (CHART) is an affordable do-it-yourself radio telescope optimized to detect photon emissions from the spin-flip transitions of electrons bound to neutral hydrogen. In this work, we demonstrate the use of CHART in search of this neutral hydrogen signature. The results of this project demonstrate the effective, affordable, and accessible use of amateur technology to observationally verify fundamental concepts in quantum mechanics and astronomy. This method shows promise as an effective tool for astronomy and physics pedagogy, and as a powerful demonstration for science communication.

RESPONSE OF GALACTIC DISK SURFACE DENSITY PROFILES TO PERTURBATIONS

Nathaniel Tanglin
Mentor(s): Elena D'Onghia
Additional Author(s): Bruce Elmegreen, Curt Struck

The exponential surface density profiles observed in galactic disks remain a long-standing puzzle in astrophysics. Although researchers have proposed multiple theories to explain these profiles (including angular momentum conservation, secular evolution, and feedback-driven redistribution), the robustness of exponential profiles across different redshifts and environments suggests a universal mechanism that remains poorly understood. This work has investigated a new mechanism for forming exponential surface density profiles: scattering off dense clumps of stars and gas. Using numerical simulations, we show the effects of "clumpy" scattering in low mass dwarf irregular galaxies, especially in relation to the formation of exponential surface density profiles.

FOSTERING RELIGIOUS IDENTITY AND BELONGING IN STEM FIELDS: DEVELOPMENT OF AN INQUIRY-BASED SCIENCE MODEL TO SUPPORT MILWAUKEE AND MADISON-AREA ELEMENTARY STUDENTS

Musaab Tareen, Khadijah Dhoondia, Bisma Arif, Iqra Arif, Ilhan Mohamed
Mentor(s): Daniel Parrell

Currently, many ethnic and religious communities face barriers in pursuing STEM fields due to a perceived divide between science and religion. The lack of shared identity can also prevent young students from feeling welcomed in STEM spaces at an early age. To address this, we plan to develop a summer curriculum and programming for youth in partnership with the Dawah Center in Milwaukee and Madinah Academy in Madison. By adopting an inquiry-based learning approach to the scientific method, we aim to empower Muslim students of all backgrounds to pursue careers in STEM while maintaining their cultural and religious identities. Ultimately, we hope to reduce feelings of underrepresentation and help students more fully see themselves as scientists while strengthening their scientific reasoning and skills.

DISORDER IS REQUIRED FOR SURFACE EXPOSURE OF TYPE 11 SECRETION SUBSTRATES AS ESTABLISHED BY LUCIFERASE ASSAY

Lauren Tears
Mentor(s): Archishman Dakua, Katrina Forest

Bacteria rely on secretion systems for protein transport across the outer membrane for survival, host interactions, and nutrient acquisition. The Type 11 secretion system (T11SS) is a gram negative bacterial secretion system that can secrete soluble substrates or facilitate surface exposure of lipidated substrates. One of the substrates of the T11SS is NilC, an outer membrane lipoprotein essential for the intestinal colonization of the nematode *Steinernema carpocapsae* by *Xenorhabdus nematophila*. NilC has 3 domains: a C terminal beta barrel recognized by the translocon, a pedestal region of unknown function, and an intrinsically disordered region. Using genetic manipulations and secretion assays we determined that the disordered region is important for NilC surface exposure and developed a high-throughput luciferase-based assay for detection of surface exposure of NilC.

PREVALENCE OF SIMIAN RETROVIRUS IN A CLOSED COLONY OF RHESUS MACAQUES (*MACACA MULATTA*)

Lulia Tekeste
Mentor(s): Allyson J. Bennett

Primates, both human and nonhuman, are often hosts for viruses that may or may not have substantial health consequences within the species, group, or individual. Simian Retrovirus (SRV) is a group of closely-related viruses common in Asian monkeys; however, the relatively small existing literature is mixed with respect to its health effects. Rhesus macaques, among the most common non-human primate species in biomedical and behavioral research, are also a natural hosts for SRV. They have been known to transmit the disease both to one another and offspring. Using archival data, this study examined the prevalence of SRV detected via PCR and antibody, as well as estimates of vertical and horizontal transmission. Together the results can inform our knowledge of both viruses and animal health.

CAREGIVER PREFERENCES FOR SUMMARIZED INPATIENT NOTES: A QUALITATIVE STUDY

Juntao Teng, Kajsiab Xiong
Mentor(s): Jessica Bethel

Federal mandates have required that caregivers have access to medical notes. However, complex jargon often creates barriers to comprehension. Artificial intelligence (AI) has the potential to generate plain-language summaries to improve understanding of medical notes. This study aims to explore caregivers' preferences for inpatient notes and perspectives on AI-generated summaries. Methods include semi-structured interviews with 30 English-speaking caregivers of pediatric patients (ages 0–12) at American Family Children's Hospital. Participants complete demographics and health literacy surveys to contextualize qualitative feedback. Interviews are audio-recorded, de-identified, and transcribed for analysis in Dedoose. Using an inductive thematic approach, the study team performs open coding to identify recurring patterns and themes. Results will guide the future development of the AI summarizing tool in a clinical setting.

HYALURONAN MEASUREMENT AS AN INDICATOR OF FIBROGENESIS IN HUMAN PRECISION CUT LUNG SLICES: AN EX VIVO MODEL OF LUNG FIBROSIS

Tristan Tetting
Mentor(s): Angie Tebon Oler
Additional Author(s): Greta Olson, Madalyn Osterhaus, Aidan Stange, Kade Coulter, Emily Peterson, Ivy S. McDermott, Babita Rahar, Trevor Langel, Ksenija Bernau, Melissa Skibba, Thomas Harr, Zonghui Ma, Jia Zhou, Allan Brasier, Nathan Sandbo

Idiopathic pulmonary fibrosis (IPF) is marked by dysregulated extracellular matrix (ECM) deposition, including altered hyaluronan (HA). Because current therapies are limited, human-relevant ex vivo models are needed to test anti-fibrotic mechanisms. We used human precision-cut lung slices (huPCLS) from non-fibrotic donors and IPF explants to evaluate whether HA released into culture supernatants can serve as a quantitative marker of fibrogenesis. huPCLS were cultured ± 5 ng/mL TGF-β1 and treated with the BRD4 inhibitor ZL0969 or vehicle for 5 days, followed by HA ELISA and qPCR of ECM genes. In non-fibrotic huPCLS, TGF-β1 increased HA, and ZL0969 attenuated this induction. In fibrotic huPCLS, TGF-β1 did not further increase ECM gene expression, while ZL0969 reduced HA in some donors with variable responses.

OPEN-SOURCE TOOLS FOR RECORDING AUDITORY BRAINSTEM RESPONSE

Krishiv Thakkar
Mentor(s): G. Nike Gnanateja

The auditory brainstem response measures neural encoding of sound, central to diagnosing hearing loss; however, commercial systems are expensive and proprietary, limiting access for clinics and researchers. We developed an open-source, Python-based framework for synchronized ABR stimulus delivery and EEG recording using the Lab Streaming Layer, an Arduino microcontroller, and the ADS1299 chip. Through a synchronous loop, our program couples audio output and LSL markers within a single execution thread, eliminating timing variability. The system is undergoing validation prior to human subject recording. Future development will incorporate a custom PCB, portable form factor, and eye-tracking co-registration, advancing equitable neurological diagnosis and brain-computer interfaces that could restore communication for people with disabilities.

THE EFFECT OF LIGHT SOURCE ON THE PHOTODEGRADATION RATE OF PHARMACEUTICAL CONTAMINANTS IN SURFACE WATERS

Lily Thatcher
Mentor(s): Christy Remucal, Adriana Agosta

Pharmaceutical contaminants in surface waters are of environmental concern due to their harmful effects on non-target organisms. Photodegradation is a natural removal process for pharmaceuticals, often studied by irradiating a contaminant under laboratory light in kinetic experiments. However, common laboratory light sources provide higher intensity light in a narrow band of wavelengths compared to broader, lower intensity, natural sunlight. To determine how quantum yield, an overall measure of reaction efficiency, changes between UV-A and UV-B light sources, photodegradation kinetics experiments for seven pharmaceuticals were conducted at both wavelengths. Rate constants determined using first-order kinetics models were combined with control data to calculate the quantum yield of contaminants at each wavelength. Resulting data will be used to improve predictions for the environmental lifetime of pharmaceutical contaminants.

ER-SPECIFIC ACETYLTRANSFERASES ATASE1 AND ATASE2 REGULATE LIPID METABOLISM AND MITOCHONDRIAL DYNAMICS

Abigail Thiel
Mentor(s): Luigi Puglielli
Additional Author(s): Tzu-Lin Cheng

Acetyl-CoA supports energy production, lipid metabolism, and protein modification. In the endoplasmic reticulum (ER), protein acetylation is facilitated by ATase1/NAT8B and ATase2/NAT8 using acetyl-CoA imported from the cytosol by AT-1/SLC33A1. Abnormal ER acetylation is linked to metabolic perturbation and diseases. To examine intracellular metabolic crosstalk regulated by ER acetylation, we analyzed mitochondrial and lipid metabolism in mice with systemic ATase overexpression (sTg) and homozygous knockout of Atases. Prior proteomic analyses revealed comprehensive changes in mitochondrial proteins. Western blotting of brain tissue suggests altered mitochondrial dynamics. Additionally, changes in blood lipid profiles and reduced hepatic lipids were observed in the ATase sTg. RT-qPCR suggests modest expression variations in PPAR genes and a related coactivator. Overall, these findings indicate ER acetylation influences lipid metabolism and mitochondrial remodeling.

IMMUNOGENICITY OF DIFFERENT VACCINES AGAINST H5N1 INFLUENZA IN MAMMALIAN SPECIES

Samaya Thomas
Mentor(s): Clara Cole

Highly pathogenic avian influenza (HPAI) H5N1 is an extremely infectious virus that causes deadly outbreaks in birds with recent spread to mammals like cattle and humans. To help prevent disease, our lab tests different formulations of novel mosaic nucleoprotein (MNP) vaccines and underlying T-cell responses that elicit the most effective response to H5N1 infection. MNP is a construct of proteins from multiple strains of influenza and has potential to be a key component for universal influenza vaccines. Studies involve vaccinating and infecting mice, and the magnitude of the immune response is quantitatively measured through viral titration like flow cytometry and plaque assays. To investigate the potential applications in H5N1 prevention, we also study the impact of gut microbiome composition on immune resistance to viral infections.

INVESTIGATING ISO-ALPHA ACID ISOMERIZATION WITH UHPLC: BUILDING SELF-EFFICACY THROUGH INQUIRY-BASED PROJECTS IN ANALYTICAL CHEMISTRY

Sarah Thomaschefsky
Mentor(s): Amanda Buchberger

Inquiry-based projects in analytical chemistry courses at UW-Madison aim to provide authentic research experiences while introducing students to advanced instrumentation and data analysis. One project lab uses ultra-high-performance liquid chromatography to measure iso-alpha acids cohumulone and N-adhumulone, with students exploring the effects of pH, catalysts, and temperature on the chemistry. Short-term learning outcomes, such as planning and carrying out experiments were assessed by analyzing final presentations. Presentation coding analysis indicated that students included key figure features but did not connect findings to broader applications. To assess long-term learning outcomes, a survey was sent to former analytical chemistry students (n=600). Early survey analysis has shown that students continue to use skills in experimental design ($p<0.001$), but not advanced laboratory instrumentation ($p=0.085$).

THE VISUAL CHERENKOV METER: USING PHOTON INTENSITY SENSORS TO MEASURE THE ENERGY PRODUCTION OF A NUCLEAR REACTOR

Henrik Thompson, Logan Kolasa, Bennett Zingler, Brett MacKay, Erich Nunez Viveros, Cece Adamczyk
Mentor(s): Charles A. Hirst

Nuclear reactors are designed with defense-in-depth control using multiple redundant systems to monitor reactor power. This work focuses on a method to determine reactor power via the reactor's Cherenkov radiation (light) intensity output, which can be measured with photodiodes. This intensity is proportional to the reactor's power level. Using photodiodes at a depth of 10 feet, we will measure the intensity of light at two known reactor power levels (the photodiodes are zeroed to background intensity). From here, any power level of the reactor can be interpolated and measured by our device. The experimentation and findings will provide an increased understanding into potential power measurement redundancy methods for the safe operation of nuclear reactors.

EFFECTS OF AGE AND MAPT GENOTYPE IN THE INTERACTION OF RHESUS MACAQUES WITH SENSORY STIMULI

Brooke Thoren
Mentor(s): Marina E. Emborg
Additional Author(s): Lena Komar, Jeanette Metzger, Maddie Gloo, Lillie Hokanson

At the WNPRC a family of rhesus macaques were identified as carriers of the MAPT R406W mutation which has been linked to human frontotemporal dementia. Sensory interaction assessments across the lifespan of macaques provide insight into the presence and timeline of behavioral changes, which can be translated to humans for improving the overall diagnosis process in patients. The main goal of this study was to evaluate in rhesus macaques whether age (1-22 years old) and/or MAPT genotype (wild type, n= 7; R406W, n=7) affect their interaction with sensory stimuli. During assessments, macaques were presented with a feather, cotton ball, and brush and their behavioral responses were recorded. Overall, a significant effect of age but not genotype was detected in rapidness to approach the stimuli.

REVIVING ANCIENT ENZYMES: THE ACTIVITY OF ANCESTRAL NITROGENASES

Dylan Thurnbauer
Mentor(s): Trenton Laack

Nitrogen is an essential element for life, yet the largest source of it remains biologically inaccessible as atmospheric dinitrogen gas. Nitrogenase is the sole enzyme capable of reducing dinitrogen gas into bioavailable forms and is limited to a subset of prokaryotes called diazotrophs. We have placed computationally predicted ancestral nitrogenase variants into the model diazotroph *Azotobacter vinelandii* in order to investigate the sequence constraints on the enzyme's functionality throughout its evolution. We report the nitrogen fixation rates of these variants through the Acetylene Reduction Assay (ARA). We have derived nitrogenase variants with less than 70% protein sequence homology to the extant host nitrogenase that maintain functionality. These findings provide valuable insights for the engineering of nitrogenase into new environments, aiding sustainability and food security.

LOW-COST FABRICATION OF A NANOCRYSTALLINE METHANE SENSOR VIA MULTISTAGE RF-TO-NIR UPCONVERSION IN A HOUSEHOLD MICROWAVE

Evan Tian, Landon Colaresi, Alyssa Wang, Tessara Clark
Mentor(s): Tessara Clark

We have been fabricating a sensor based on nanocrystalline ZnO on an oxidized Si substrate capable of detecting atmospheric methane at low concentrations. We will discuss our method development process and characterization of sensor capabilities. The methane sensor will be integrated with a simulated Martian rover for in situ methane biosignature measurements.

TROUBLESHOOTING PCR FAILURES OF A HIGH GC AMPLICON USING A NESTED PCR APPROACH

Evan Tian
Mentor(s): Abigail Cordiner

My project involves optimizing the PCR reaction for CRISPR edited DNA sample with multiple high GC loci. We had trouble amplifying out our entire CRISR insert due to our PCR reaction stalling at these high GC loci in our gene. In my poster, I am explaining my process of troubleshooting PCR failures in my high GC amplicon and showing how a nested PCR approach can be used to circumvent this.

COSMIC RAYS BEYOND THE HELIOSPHERE

Reilly Tom
Mentor(s): Paolo Desiati, Juan Carlos Diaz Velez

The Sun's Heliosphere, though beneficial in blocking dangerous radiation, high-energy particles, and galactic debris from reaching our solar system, also obscures our ability to know the distribution of cosmic rays in the Interstellar Medium (ISM) from Earth-based observations. Due to the inefficiency of forward propagation to a small target, we used a simulation that uniformly propagated anti-protons out from Earth, in uniform logarithmic energy. From this simulated data, when isolating for trajectories that reached the ISM, we created a reverse propagation function that predicts what the distribution of cosmic rays would have looked like in the ISM in order to get the map of what the distribution appeared as on Earth.

OUR NEIGHBORHOOD WALK PROJECT

Makinnley Tomberlin
Mentor(s): Jonathan Nelson
Additional Author(s): Rachel Sowinski, Alton Hipps

This project builds on existing geographic and human-animal-environment studies by investigating how people and their dogs jointly construct a sense of place during routine walks. It advances current research by integrating canine behavior and environmental context in a single place-based analytic frame. Using GPS-enabled biometric data, participant reflections, and interactive storymaps, the project analyzes how environmental cues and movement patterns shape shared walking experiences for both the canine and the person. The project offers insights into how multi-species interactions influence spatial awareness and engagement with local environments, demonstrating how maps and data-driven tools can deepen understanding of, and enhance approaches to, everyday place-making. It extends prior knowledge by merging environmental analysis with personal and relational dimensions of dog walking.

SOIL HEALTH IN ORGANIC GRAIN SYSTEMS

Jade Tomberlin
Mentor(s): Xia Zhu-Barker, Gloria Ambrowiak
Additional Author(s): Jordan Cargill

Soil health is the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. The health of a soil affects its physical, chemical, and biological properties, which affect how the soil functions. A healthy soil is one that has the necessary properties to serve its function within in its environment. The three metrics of soil health assessed in this project are soil pH, mineralizable carbon, and organic matter. Data for these soil health metrics was compared across samples taken in 2018 and 2025. The comparison shows that soil health in organic grain systems in Wisconsin can be altered over time via management practices.

SPECIALIZATION, TRADE, AND THE FRECHET DISTRIBUTION

Jonathan Tong
Mentor(s): Simeon Alder

International trade is central to the global economy, yet increased trade policy volatility threatens existing networks between domestic and foreign markets. Consequently, modeling trade has become increasingly relevant and important. Central to trade is the idea of comparative advantage – the tendency of countries to specialize in goods and services they are relatively more efficient at producing. Traditional models have been unable to capture comparative advantage, relying instead on mechanisms like "returns to scale" or "preferences for variety" to motivate trade. We simulate trade using a probabilistic framework, where countries' productivities are drawn from a Frechet distribution. This probabilistic interpretation of trade endogenously captures comparative advantage and allows for counterfactual analysis to examine how global trade patterns respond to changes in trade costs and productivity levels.

COLLECTIVE MEMORY AND THE DIGITAL SPACE: EXAMINING THE ROLE OF COLLECTIVE MEMORY IN POST-CONFLICT COLOMBIA'S DIGITAL SPHERE

Natalia Torres
Mentor(s): Hernando Rojas

Colombia's contemporary political landscape is a direct result of the nation's complex history. Memories of the armed conflict have become integral to Colombia's national consciousness. Through the framework of collective memory, this research examines how young Colombians use and interact with memory to inform their understanding of the past. Instead of exploring traditional spaces of memory, such as museums or monuments, this project examines the role of social media. The central objective of this project is to investigate how collective memory in the digital space influences the role of young Colombians as political participants within the nation. In turn, this research highlights the significant role the digital space plays in shaping the journey of peace, transition, and reconciliation in communities deeply affected by violent conflict.

PROTECTION OF CRYO-EM SAMPLES AT THE AIR-WATER INTERFACE USING LEA PROTEINS

Colten Tramburg
Mentor(s): Kaitlyn Abe, Ci Ji Lim

Late embryogenesis abundant (LEA) proteins, are important for protecting cells under desiccation stress. Our research has shown that LEA proteins can be used to preserve the molecular structure integrity of fragile biomolecular samples during cryogenic electron microscopy (cryo-EM) sample preparation. It prevents samples from getting damaged at the air-water interface (AWI) by forming a protective barrier between the sample and the AWI. Our first tested LEA proteins from nematodes and tardigrades resulted in sample-dependent particle orientation issues, leading to anisotropic cryo-EM maps. I hypothesize that bias in particle orientation is due to sample interaction with the LEA proteins and that the LEA protein isoelectric point can serve as a proxy to identify new LEA proteins that can offer a more diversified particle orientation.

PREPUBERTAL LUPRON TREATMENT DOES NOT AFFECT LONG-TERM VAGINAL EPITHELIAL HEALTH

Emilie Tran
Mentor(s): Johanna Hannan, Anna Barrett
Additional Author(s): Thomas Niepsuj, Anthony P. Auger, Joan S. Jorgensen, Walid A. Farhat

Precocious puberty is the early onset of secondary sex characteristics in young children. Lupron is a gonadotropin-releasing hormone (GnRH) agonist, inhibiting testosterone and estrogen production to stop early puberty. We investigated the temporal effects of lupron therapy on vaginal epithelial health. Female Sprague-Dawley rats 24-25 days old were treated with lupron (0.6mg) and vaginal tissue was collected at juvenile (1-week), short-term (11-weeks), and long-term (31-weeks) timepoints post-treatment. Masson's Trichrome stain was used to assess vaginal epithelial thickness and number of epithelial layers. In juvenile rats, lupron thinned the vaginal epithelium. No changes were observed short-term, lupron-treated rats and long-term vaginal epithelial thickness increased. These results suggest Lupron has no negative long-term vaginal effects and we will next evaluate vaginal elastin fragmentation and collagen deposition.

URBANIZATION, DEINDUSTRIALIZATION, AND POVERTY: HOW STRUCTURAL RACISM AND METROPOLITAN DEVELOPMENT DEFINED ECONOMIC AND SOCIAL CONDITIONS IN "BLACK MILWAUKEE"

Alex Trevithick
Mentor(s): Loren Peabody

Milwaukee, WI is currently one of the most segregated cities in the world, and has frequently been named the "worst place to live" for Black individuals in the United States. Black communities in Milwaukee frequently face higher rates of poverty than their White counterparts, with particularly high concentrations of families and children living in poverty. This project examines how policy decisions and racism – both institutional and individual – amid the era of deindustrialization shaped this segregated environment; leaving a legacy of low incomes, housing unavailability, food scarcity, and environmental hazards in Milwaukee's Black communities. To do this, I will explore Milwaukee's history of racial covenants in housing, contemporary redlining and interstate construction, and the history of various employment sectors in Milwaukee.

THE ROLE OF DIET IN EMOTIONAL AND BEHAVIORAL REGULATION

Julia Trias
Mentor(s): Garrett Huck

With increasing rates of attention deficit/hyperactivity disorder (ADHD) diagnosis, concerns about children's emotional and behavioral health has grown (Tuncer-Ebetürk et al., 2025). In addition to symptoms of hyperactivity and attention deficits, ADHD is linked to challenges in dysregulation. A child's ability to manage emotions is related to outcomes involving brain development and executive functioning. While ADHD is often discussed in terms of genetics and neurobiology, a contributing factor that is often overlooked is diet. Developing research indicates that nutrition plays a role in brain functions, inflammation, and the gut brain axis, all of which can be contributing factors to regulation outcomes. The focus of this research is to examine how diet may influence emotional and behavioral regulation in children with ADHD.

RICHARD STRAUSS IN AMERICA

Isaiah Trice
Mentor(s): Laura Schwendinger

This project studies the overlooked time that German Composer Richard Strauss spent in the United States, and how his visit to the country influenced his music and fame.

DEEP LEARNING FOR TROPICAL CYCLONE SATELLITE IMAGE

Benjamin Truong
Mentor(s): Andi Wang

This project focuses on applying artificial intelligence and machine learning techniques to analyze satellite imagery of tropical cyclones.The primary goal is to develop a computer model that can learn from large sets of satellite image data to improve the identification of storm structure and accurately determine key features such as the storm center. Using Python-based image processing and deep learning methods, the project involves organizing, preparing, and training models on complex atmospheric data. By leveraging data science and image analysis approaches, the research aims to enhance automated storm detection and tracking, contributing to more efficient and reliable analysis of tropical cyclone behavior.

THE IDEA-EXPRESSION DICHOTOMY IN THE AGE OF AI

Gwendolyn Tuffnell
Mentor(s): Jan Miernowski

The idea-expression dichotomy is a fundamental part of US copyright laws that establishes that ideas are not protected by law, but expressions of ideas are. This distinction is nuanced due to the human creative process and legal definitions of "idea" and "expression," and has been facing pressure due to the ever-growing prominence of AI usage in creative works. Using two case studies of authors who have interacted with AI, I aim to assess whether this core dichotomy requires updating. This brings into question the concept of degrees of authorship, which could be a necessary addendum to current laws.

INCARCERATION, POVERTY, AND RACE; THE IMPACT OF THESE FACTORS ON THE "SCHOOL-TO-PRISON PIPELINE" THROUGHOUT HISTORY IN LOUISIANA

Avani Tummala
Mentor(s): Loren Peabody

The question guiding my research is, how has the "school-to-prison" pipeline impacted Black Americans throughout history in Louisiana? I will review the literature on the school-to-prison pipeline and apply it to the case of Louisiana. Louisiana is an important research site because of its uniquely high incarceration rates and low levels of educational attainment. I will explore the history of incarceration in Louisiana, the relationship of incarceration to educational outcomes, and how it all relates to poverty. I will be comparing rates of incarceration and educational outcomes by race, by rural and urban location, and if possible, by parents' income level. I will also examine attempts to reform school discipline and the use of alternative schools in Louisiana.

ELUCIDATE GLOBAL MECHANISMS UNDERLYING GATA2 REPRESSION OF INFLAMMATORY SIGNALING

Dhruvika Uppal
Mentor(s): Tim Xiong
Additional Author(s): Emery Bresnick

GATA2 is an essential zinc-finger transcription factor required for definitive hematopoiesis. Germline GATA2 mutations cause GATA2 deficiency syndrome, a disorder associated with immune cytopenia, infection susceptibility, and predisposition to myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML).

Beyond its established role in hematopoietic stem and progenitor cell maintenance, GATA2 also constrains inflammatory components. Loss of GATA2 leads to ectopic inflammatory gene expression and hyperresponsiveness to inflammatory cues in myeloid progenitor cells. It has been proposed that inflammatory signaling exacerbates modest defects caused by germline variants, thereby promoting disease manifestation.

However, the mechanisms by which GATA2 represses inflammatory components remain unclear. To address this, this study will integrate RNA-seq, ATAC-seq, and gene ontology datasets to identify genes coordinately regulated at both the transcriptional and chromatin-accessibility levels.

EQUILIBRIUM SUGAR ADSORPTION ON ION-EXCHANGE RESINS TO SUPPORT TAGATOSE SMB PROCESS DESIGN

Natalia Uzhca
Mentor(s): Wenjia Wang

Wisconsin accounted for 24.9% of U.S. cheese production in 2024, generating over 3.8 billion gallons of cheese whey, a byproduct containing about 5 wt.% lactose. This lactose can be converted into tagatose, a natural sweetener with 1/3 the calories of table sugar, through lactose hydrolysis, galactose isomerization, and downstream purification. In this study, we evaluated candidate ion-exchange resins for future tagatose purification by measuring adsorption isotherms of lactose, glucose, galactose, and tagatose. These equilibrium data were used to compare resin performance for sugar separation relevant to simulated moving bed (SMB) chromatography. The results provide fundamental separation parameters needed for future resin selection, SMB design, and tagatose recovery from whey-derived sugar streams.

BCG-INDUCED TRAINED IMMUNITY AND ITS ROLE IN REDUCING LUNG INFECTIONS IN CF: INSIGHTS FROM BIOBANK DATA

Akshara Vaddi
Mentor(s): Hara Levy, Chandramu Chetty
Additional Author(s): Qianqian Zhao, David Schreier, Laura Kirawan, Godfrey Fletcher, Pippa M. Simpson

This study explores whether prior Bacillus Calmette–Guérin (BCG) vaccination is associated with improved pulmonary outcomes in individuals with cystic fibrosis (CF). BCG, though designed to prevent tuberculosis, is increasingly recognized for its capacity to induce "trained immunity," which can enhance innate immune responses to diverse pathogens. Leveraging longitudinal data from the Cystic Fibrosis Registry of Ireland (CFRI), we compared respiratory infection outcomes among individuals with CF born before and after end of Ireland's universal BCG program in 2015. Preliminary analyses indicate that those with prior BCG exposure experience fewer and less severe pulmonary infections. These findings suggest that BCG-induced trained immunity may strengthen host defenses in CF and highlight the potential of immunomodulatory approaches to complement current CF therapies.

FICTION AND NONFICTION IN SARAH SCHULMAN'S WORK

Midnight Van Gundy
Mentor(s): Matthew Johnson

This project examines writer and activist Sarah Schulman's representation of the AIDS crisis, with a focus on the interplay between fiction and nonfiction in her novelistic and political-historical work. As a first-hand witness to, and later historian of, the AIDS crisis, and as a participant in the direct-action organization ACT UP New York, Schulman has recurrently grappled with the ethics and affordances of fictional mediation of real-life events, a topic of ongoing and pressing concern (e.g., responses to violence, the MeToo movement). Using a mixed-methods approach, combining literary analysis, oral history, queer theory, and building upon existing scholarship on testimony and the AIDS crisis, this project delineates how Schulman has navigated the tension between the fictional and nonfictional across the span of her career.

PARENTAL STRESS OVERLOAD AND HOUSEHOLD CHAOS IMPACT ON INFANT NEUROCOGNITIVE DEVELOPMENT

Rylee Van Keuren
Mentor(s): Melisa Carrasco McCaul

Cognitive abilities are essential for daily functioning and first emerge during an infant's initial year of life. Infants with neurodevelopmental disorders are at increased risk for delays in attention. This study examines the impact of parental stress overload and home environment on cognitive development for infants at risk for cognitive disability. Parental stress overload is assessed using the Reilly Role Overload Scale, while household chaos is assessed with the Confusion, Hubbub, and Order Scale (CHAOS). Analyses will evaluate the associations between these stressors and developmental outcomes, including comparisons between typically developing and high-risk infants defined as those a history of extreme prematurity or neonatal hypoxic ischemic encephalopathy. Results of this study may help inform intervention strategies for parents of high-risk infants and improve developmental outcomes.

FROM SIMULATION TO CLASSROOM: STRENGTHENING FEEDBACK PRACTICE FOR FUTURE SPECIAL EDUCATORS

Victor Vasconcelos
Mentor(s): Sarah Lent

Incorporating mixed-reality (MR) simulations in teacher preparation programs can provide a practice opportunity for instructional skills in a realistic, low-risk environment. K–12 classrooms are unpredictable and complex environments where teachers must make thoughtful instructional decisions in real time. Simulations offer a meaningful tool for building those skills before entering the field. In this study, we explore how MR simulations delivered in the SimLab and implemented within teacher preparation coursework help future special education teachers practice delivering clear and constructive feedback to support student learning in inclusive mathematics classrooms. This research not only highlights how structured practice strengthens instructional skills and confidence before they are applied in real classrooms, but also emphasizes the practical application of simulation-based learning for developing educator readiness.

REGULATION OF NEUTROPHIL MIGRATION WITH PIM1 IN ZEBRAFISH MODEL

Shreya Vattem
Mentor(s): Yiran Hou, Anna Huttenlocher
Additional Author(s): Julie Rindy

Proper wound healing requires early recruitment of neutrophils and timely inflammation resolution, which could be achieved through neutrophil reverse migration. This pathway has important therapeutic potential, and our research aims to identify molecules that regulate it. Genomic screening suggested that PIM1, a serine/threonine kinase is involved in regulating neutrophil reverse migration. To investigate this, we generated a zebrafish model to examine the effects of pim1 on neutrophil migration. We found reduced wound-site neutrophils in pim1 CRISPants, suggesting that pim1 promotes neutrophil recruitment. To understand PIM1's relationship with LYN, a known regulator of neutrophil recruitment and reverse migration, we probed for phosphorylation levels of LYN and found reduced phosphorylation at activation site in pim1 CRISPants. This suggests that pim1 may promote neutrophil recruitment through LYN phosphorylation.

A GEOSPATIAL APPROACH TO X-FILE IDENTIFICATION FOR MIA SERVICEMEMBERS

Haley Veeser, Jack Berkey
Mentor(s): Gregg Jamison

When missing-in-action (MIA) servicemembers are buried without identification, they are assigned X-file designations (e.g., X-863) within the Individual Deceased Personnel File (IDPF) system. Through the University of Wisconsin's server, our team has accessed an estimated 13,000 X-files containing associated recovery location data. By transferring X-file records into structured Excel timelines, we document each unidentified servicemember's journey from initial recovery site to final interment, tracking designation changes, disinterment dates, and reinterment locations over time. This data is then rendered into an interactive geospatial map, allowing researchers and the public to trace the movement of unidentified remains across time and geography. Ultimately, this project aims to leverage locational patterns and proximity data to surface potential identification matches for America's unidentified fallen servicemembers.

EVALUATION OF THE BIOPESTICIDAL ACTIVITY OF *SOLANUM SISYMBRIIFOLIUM* EXTRACTS

Gabriella Vernik
Mentor(s): Hashim Ibrahim

Potato cyst nematodes (PCN) are destructive potato crop pests that affect the yield and health of potato crops. By switching from synthetic pesticides to natural pesticide alternatives, producers can protect crop yields without contributing to chemical runoff that harms aquatic ecosystems and wildlife. Plant extracts from *Solanum sisymbriifolium* were analyzed using UV-vis spectroscopy to evaluate different extraction methods and solvents of varying polarity for compounds such as flavonoids, phenols, and tannins for biopesticide potential. Variations in flavonoid, phenolic, and tannin concentrations were observed in different plant parts, extraction methods, and solvents. Evaluating different combinations of these factors can be used to identify the most effective method for producing a biopesticide.

GENETIC DIVERSITY AND DISTRIBUTION OF *PONTOSCOLEX CORETHRURUS* IN PUERTO RICO

Paula Vidal-Tama
Mentor(s): Sean Schoville
Additional Author(s): Roberto Raúl Carrera-Martínez

This project investigates whether environmental factors influence the genetic structure of *Pontoscolex corethrurus*, an invasive earthworm species in Puerto Rico. Invasive earthworms can alter soil structure, reduce forest floor vegetation, and affect ecosystem processes and soil biodiversity. DNA samples from *P. corethrurus* populations across Puerto Rico were analyzed to assess genetic variation and population structure in relation to environmental variables, including rainfall, altitude, and human activity. Understanding how these factors shape the distribution and diversity of this invasive species can provide insight into invasion dynamics and contribute to conservation strategies aimed at protecting soil biodiversity under increasing anthropogenic pressures.

EVALUATING A GRAS FUNGI FERMENTATE AS A CLEAN-LABEL ANTIFUNGAL PRESERVATIVE IN BAKED GOODS

Raagav Vijayalakshmi Siva
Mentor(s): Xingrui Fan, Jae-Hyuk Yu

Bread products are highly susceptible to fungal spoilage, contributing to significant food waste. While chemical preservatives extend shelf life, consumer demand for clean-label foods has increased interest in natural alternatives. Natural Protectants (NP), antimicrobial fermentates derived from the GRAS microorganism *Aspergillus oryzae*, have shown promising antifungal activity. This study evaluates the antifungal efficacy of the NP formulation NPy against common bread spoilage molds and its compatibility with yeast fermentation. Antifungal activity will be assessed using broth assays against *Aspergillus niger*, *Penicillium commune*, *P. roqueforti*, *P. chrysogenum*, and *P. camemberti*. Yeast compatibility will be tested using a *Saccharomyces cerevisiae* disk assay with voriconazole as a control and dough leavening experiments with freeze-dried NP. Bread mold challenge tests evaluate preservative performance in baked products.

OVERCOMING MRTX1133 RESISTANCE IN MUTANT KRAS G12D COLORECTAL CANCER THROUGH THE DEVELOPMENT OF COMBINATION THERAPIES

Yuva Vijaykumar Shunmugapriya
Mentor(s): Dustin Deming, Elizabeth Boeree, Cheri Pasch

Colorectal cancer is a leading cause of cancer-related death in younger adults. KRAS mutations drive 40% of cases, with the most common of such being the KRAS G12D mutation. While the inhibitor MRTX1133 targets this mutation, its effectiveness is limited due to adaptive resistance. A promising solution utilizes combination therapies to simultaneously target multiple [EB1.1] pathways exploited by colorectal cancer. We have recently performed a high-throughput drug screen in patient-derived cancer organoids to investigate 115 different anti-cancer agents in combination with MRTX1133. Combinations of MRTX1133 with MK-8776, molibresib, and lorlatinib have increased efficacy compared to MRTX1133 alone. Further study of these combinations could lead to increased efficacy of KRAS G12D inhibition, and thus, improved patient outcomes.

SOLVING THE SPATIAL PUZZLE: HOW TEAM POSITIONING PREDICTS PERFORMANCE IN ROBOTIC-ASSISTED SURGERY

Dhruv Vir, Annika Alva
Mentor(s): Jackie Cha, Patrick Fuller

Robotic-assisted surgery systems fundamentally change surgical team dynamics by physically separating the surgeon away from the patient, increasing demand for teamwork and non-technical skills (NTS). NTS are cognitive and interpersonal (e.g., situation awareness, communication, teamwork) critical to surgical performance. Traditional NTS assessments are checklist-based and fail to capture granular information across an entire procedure; thus, continuous measures – such as sensor-based location tracking – are needed to understand how team proximity and mobility relate to NTS. Using locational data from 37 robotic-assisted surgery cases, we investigate whether spatial metrics can predict traditional NTS assessment scores. The findings could enable real-time feedback systems that enhance team coordination during robotic-assisted surgery .

UNDERSTANDING LINUX KERNEL POLICIES: AN ANALYSIS OF CPU SCHEDULING AND TRADEOFFS

Ananya Virmani
Mentor(s): Michael Swift

Operating systems rely on policies – a set of rules that decide how the limited resources are shared among different applications. These policies determine how fast and efficiently a computer works, yet they are traditionally discussed in isolation. This study presents a comprehensive survey of the Linux kernel, identifying distinct policies across the scheduling subsystem specifically. We categorize these policies by implementation style, varying from hard-coded constants to flexible decision functions, to evaluate how easily they can be modified or improved. Focusing on CPU scheduling, our analysis demonstrates how these diverse policies navigate inherent, often contradictory, tradeoffs between system latency, throughput, and fairness. By mapping them, we provide a foundation for using AI and extensible schedulers to automatically tune systems for better performance across different workloads.

SCIENCE COMMUNICATION IN FUSION RESEARCH

Dhruv Vyas
Mentor(s): Adelle Wright

Fusion energy research conducted at the University of Wisconsin-Madison contributes to the scientific foundations for developing sustainable fusion energy sources. Researchers study plasma confinement, foundational plasma physics, and employ computational modeling to simulate and predict plasma behaviour. However, accessibility outside of specialized audiences may be restricted due to the technical language and complexity of fusion research. To translate these developments into understandable, precise, and interesting explanations for larger communities, science communication is essential. Complex fusion concepts are reframed to maintain scientific rigor while improving understanding through the creation of readable research summaries and publicly accessible articles. Increasing public awareness of the difficulties and possibilities of fusion energy is supported by stepping up communication initiatives.

PRENATAL CANNABINOID EXPOSURE AND EARLY BRAIN DEVELOPMENT: EVIDENCE FROM THE HEALTHY BRAIN AND CHILD DEVELOPMENT STUDY

Aryana Wadhwani
Mentor(s): Kerrie Fanning, Julie Poehlmann

Prenatal exposure to cannabinoids has increased in prevalence, raising concerns regarding potential effects on early brain development. This study examines associations between prenatal cannabinoid exposure and neonatal brain structure at one month of age using data from the Healthy Brain and Child Development study. Prenatal cannabinoid use was retrospectively reported by mothers during pregnancy, and neuroanatomical outcomes included total brain and total gray matter volumes. Correlational analyses and t-tests will evaluate associations between prenatal exposure and neonatal brain volume while adjusting for age, child sex, and household income. We hypothesize that infants exposed prenatally to cannabinoids will exhibit reduced brain volumes relative to unexposed infants. Findings may help identify early neurodevelopmental markers associated with prenatal cannabinoid exposure, informing early intervention and public health policy.

EXPLORING THE UTILITY OF THE EARLY CHILDHOOD LONGITUDINAL STUDY–BIRTH COHORT: A REVIEW OF FINDINGS AND FUTURE RESEARCH OPPORTUNITIES

Aryana Wadhwani, Lianna Lee
Mentor(s): Quentin Riser

Large-scale longitudinal datasets offer opportunities to inform more equitable systems of care and education. The Early Childhood Longitudinal Study–Birth Cohort (ECLS-B) follows children from infancy through school entry and enables nuanced analyses across children, families, and learning environments.

Guided by a developmental–ecological perspective, we synthesized research on cognitive, socio-emotional, and behavioral outcomes while mapping underutilized dataset areas. Findings show that ECLS-B studies have advanced understandings of early learning disparities. However, we identify notable gaps in research on physical development and health, especially motor functioning and longitudinal health trajectories.

We outline directions for future research that leverage ECLS-B more fully by connecting health, education, and family support. Through this dataset, practitioners can generate evidence that strengthens partnerships across systems and fosters equitable early childhood policies.

COOKING AS AN INTERVENTION FOR THE GERIATRIC POPULATION TO SUPPORT INDEPENDENCE

Nicole Wagner
Mentor(s): Garrett Huck

Food is not only a survival need, but a way of life. However, each day, individuals become older and gradually lose the independence that once allowed them to cook. The process of cooking may be an effective intervention to promote independence for geriatric individuals as it can improve mental and physical well-being, resulting in a greater quality of life. This topic is critical to explore due to the aging population, a lack of effective pharmacological interventions, and a shortage of caregivers, increasings pressures on individuals to stay independent for as long as possible. This presentation will explore the benefits of cooking, specifically related to increased emotional well-being, improved motor functioning, enhanced nutrition, and reduced dementia related symptoms, while also addressing potential barriers and considerations.

EFFECTS OF AGING ON CD4+ T CELL ACCUMULATION AT THE CRIBRIFORM PLATE IN KIKUME MICE

Katherine Genevieve Wahr
Mentor(s): Zsuzsanna Fabry
Additional Author(s): Jenna Port

Aging is related to chronic inflammation within the central nervous system (CNS), which may influence immune cell drainage. Previously, we observed increased CD4+ T cell accumulation within the perineural environment of the cribriform plate (CP) during experimental autoimmune encephalitis. We hypothesize that aging alters CNS drainage, leading to the accumulation of T cells at the CP. To test this, we will use 24-month-old Kikume Green-Red protein (KikGr) mice. After CNS UV light exposure, tissues will be stained with a CD4 antibody and analyzed via confocal microscopy to visualize and quantify CD4+ T cells at the CP and cervical lymph nodes. Age-related changes to T cell abundance will indicate altered function and may reveal mechanisms linked to neurodegenerative diseases.

SEX DIFFERENCES IN ROUGH-AND-TUMBLE PLAY IN ADOLESCENT COMMON MARMOSETS (*CALLITHRIX JACCHUS*) TREATED WITH LEUPROLIDE ACETATE

Marcella Wait, Ellie Huebner
Mentor(s): Gabriela De Faria Oliveira, Anthony Auger

The study examined the effects of the puberty blocker, Leuprolide acetate, on sex differences in juvenile rough-and-tumble play behavior in adolescent male and female marmosets. Sixteen subjects (4 male control; 4 male treatment; 4 female control; 4 female treatment) between 8 and 10 months of age were observed. Across eight 30-minute home-cage sessions, we quantified the duration of rough-and-tumble and independent play. Leuprolide acetate-treated males have impacted play behavior compared to untreated males, reflecting a potential testosterone-dependent mechanism underlying male social play. In contrast, we saw minimal treatment effects in females and no significant differences in independent play across groups. This study aims to clarify the role of pubertal hormones in shaping adolescent social development.

INCREASED PRESSURE AND ITS IMPACT ON EARTHLIKE OCEAN WORLDS

Hannah Wallace
Mentor(s): Hannah Zanowski, Marissa Tripus

Wind forcing is an integral driver of ocean circulation on Earth and the ocean's response to this forcing is dependent on multiple properties such as wind speed and atmospheric pressure. However, it is unlikely that an exoplanet will have the same property values or responses as Earth. Here, we use ROCKE-3D (Resolving Orbital and Climate Keys of Earth and Extraterrestrial Environments with Dynamics), a course resolution General Circulation Model (GCM), to investigate atmospheric and oceanic circulation and thermodynamics on a modern-Earth-like aquaplanet to understand how these processes are impacted by changes in atmospheric pressure. Two simulations, a control with modern atmospheric pressure and a perturbation at 10x atmospheric pressure, are compared to understand this relationship. The structure of atmospheric and ocean properties, such as temperature, salinity, cloud cover and sea ice are analyzed along with surface and deep ocean currents.

SYNTHESIS OF NASICON ELECTROLYTE FOR APPLICATION IN SEAWATER BATTERY

Andrew Walter
Mentor(s): Eric Kazyak, Diprajit Biswas

The transition to renewable electricity sources will necessitate large scale means of storing energy. Current solutions such as Lithium batteries pose safety and economic concerns. Seawater batteries (SWB) represent a solution, utilizing a safe solid-state electrolyte, sodium ionic super conductor (NASICON), and an abundant active material, sodium. Commonly SWB set-ups are done in isolated containers not representative of a real environment. This work designed an SWB which is to be tested in a flow-controlled seawater environment and utilize NASICON synthesized in-lab to better understand the behavior of these systems in a realistic environment. In doing so a method to synthesize NASICON was developed, employing materials characterization techniques to verify the validity of this process, and electrochemical testing to understand the properties of synthesized NASICON.

EVALUATING A NOVEL AI-BASED TASK TO MEASURE EVENT KNOWLEDGE IN ADULTS WITH APHASIA

Anna Wang
Mentor(s): Haley Dresang

Aphasia is a language disorder that often follows stroke and impairs communication. People with aphasia may adapt by recruiting event knowledge, a mechanism underlying treatments such as Verb Network Strengthening Training (VNeST). Event knowledge includes understanding how everyday situations unfold, including who does what (agent), to whom or what (patient), with what (instrument), and where (location). However, no clinical tools adequately measure event knowledge. This pilot study tests a novel AI-developed assessment in five adults with chronic post-stroke aphasia. Participants completed the measure twice with cognitive-linguistic testing and a VNeST-proxy word retrieval task. Analyses examined reliability, validity, and the hypothesis that event knowledge correlates with VNeST-task and language performance. Results will provide preliminary evidence for the assessment's usefulness in research and clinical evaluation of aphasia.

SEASONAL AND DIEL ACTIVITY OF PORCUPINE IN RESPONSE TO FISHER IN WISCONSIN

Jitong Wang
Mentor(s): Laura Berman
Additional Author(s): Phil Townsend, Fabian Schneider, Ryan Pavlick, Jennifer Stenglein

The North American Porcupine (*Erethizon dorsatum*) only has one major predator, the Fisher (*Pekania pennanti*), and predation happens predominantly during winter at locations with snow cover. However, there is little evidence on how predators shape porcupines' activity patterns temporally. In our study, we used SnapShot Wisconsin camera trap data to test if porcupines' diel activity patterns differ based on season and the presence of predators. We found that porcupines' winter activity pattern shifts and overlaps more with fishers', and the shift is consistent between sites with and without predators. Our results suggest that the increase in porcupine depredation by fishers in the winter, which has been observed in previous studies, may in part be due to their increased diel overlap in the winter months.

EXPLORING MACHINE LEARNING TECHNIQUES FOR MICROPLASTIC DETECTION IN MICROSCOPY

Patrick Wang, Keng Chang
Mentor(s): Ziyan Wu, Mohan Qin
Additional Author(s): Keng Chang, ZiYan Wu

The quantification and characterization of microplastics in environmental samples are essential for understanding their ecological impact, but reliable methods to detect microplastics are not easily accessible and are often labor-intensive. This research presents two different machine learning approaches to detecting Microplastics: 1. Microplastics are first segmented using SAM. These segmentations are cleaned and used to adapt SAM via Low-Rank Adaptation (LoRA), improving detection accuracy. 2. A sequential inference pipeline utilizing YOLOv8 CNN to classify and localize microplastics. These regions are then forwarded to SAM2 to generate segmentation masks. The aim of this project is to increase the scale and speed of analyzing environmental samples.

ROBUST HR AND HRV ESTIMATION FROM WEARABLE PPG USING GREEDY-FUSION SHORTEST PATH ALGORITHM

Youran Wang
Mentor(s): Yuxin Cai
Additional Author(s): Aditya Shanghav

Accurate estimation of heart rate (HR) and heart rate variability (HRV) from wearable photoplethysmography (PPG) during movement remains challenging due to motion artifacts. To obtain robust HR and HRV estimates from wrist-worn PPG data collected during daily activities with varying ambulation levels (e.g., sitting, walking, and stair climbing), we implement a greedy-fusion shortest path (GFSP) algorithm that integrates multiple PPG morphological features to construct a consistent interbeat interval (IBI) sequence. Compared with conventional signal processing (CSS), GFSP algorithm-derived PPG metrics demonstrated stronger agreement with ground truth electrocardiography (ECG) measurements in estimating HR and HRV (RMSSD) across varying ambulation levels. Future work will apply the algorithm to real-world operational datasets collected from uncontrolled field studies.

A TOOL TEST FOR TOR TRANSLATION DEPENDENCE

Yushan Wang
Mentor(s): Jake Brunkard, Katherine Marie Lund

This project aims to develop a luciferase-based tool to measure Target of Rapamycin (TOR)-dependent translation in plants. TOR is a central regulator of plant growth that modulates protein synthesis in response to nutrient availability, yet tools to directly quantify TOR-regulated translation in plants are limited. We will construct a dual-luciferase reporter system in which one luciferase gene contains a TOR-dependent 5′TOP regulatory motif and the other serves as a TOR-independent control. The system will be expressed in *Arabidopsis thaliana* using a plant expression vector delivered through Agrobacterium-mediated transformation. By comparing the luminescence ratio under nutrient-rich and nutrient-limited conditions, we can quantify TOR-dependent translational activity. This tool will enable systematic investigation of translation factors interacting with TOR and provide insights into nutrient-regulated plant growth.

MEASURING PLANT WATER USE IN AGRIVOLTAIC SYSTEMS: DEVELOPMENT OF A LOW-COST SAP FLOW SENSOR FOR HERBACEOUS STEMS

Vivian Wanjing
Mentor(s): Steven Loheide, Steve Lawton

Agrivoltaics combines agriculture with solar energy to make land use more efficient and sustainable. By growing crops under and around solar panels, the system can reduce heat stress, limit evapotranspiration, help soils hold more moisture, and also generate renewable energy for farms. This study develops a low-cost sap flow sensor based on the heat ratio method, which applies heat pulses to plant stems and tracks temperature changes to measure sap movement. The device combines a 3D-printed casing, heating element, temperature probes, insulation, and a microcontroller for heat control and data collection. Sensor performance was validated in a controlled transpiration chamber and tested outdoors. Ongoing refinements aim to improve heat control, design, and signal filtering to better characterize plant water use in agrivoltaic systems.

OPTIMIZATION OF AN ASYMMETRIC COPPER-CATALYZED C-H AMINATION VIA NITRENE TRANSFER

Ethan Warrington
Mentor(s): Jennifer Schomaker
Additional Author(s): Jed Kim, Ken Lee, Derek Hu, John Berry

Asymmetric C-H amination via nitrene transfer is a powerful tool for the synthesis of pharmaceutically valuable chiral amines and nitrogen heterocycles. Although this transformation has been well developed with precious metal catalysts, there is very little precedent for copper-catalyzed asymmetric nitrene C-H insertion. With the hope of developing a more sustainable and accessible catalyst through the use of copper, we investigated the effects of solvent and ligand on the reactivity and enantioselectivity of copper-bisoxazoline catalysts. Mechanistic studies revealed that solvents drastically change the structure and behavior of the copper complex. These insights, however, can inform the design of new catalytic species capable of achieving both high productivity and enantioselectivity for the sustainable, streamlined synthesis of nitrogen heterocycles.

BIOCHEMICAL INVESTIGATION OF THE RNA EXONUCLEASE MUT-7/EXD3

Abby Watz
Mentor(s): Mohsen Badiee

MUT-7 is a 3'-5' exoribonuclease that has been evolutionarily conserved, from nematodes to humans, and plays a critical role in gene regulation, transposon silencing, and RNA interference (RNAi). We have preliminary data that suggests that MUT-7 displays a unique substrate preference, acting primarily on double stranded (dsRNA) with a 3' recessed end. However, the precise mechanisms and role MUT-7 plays in biology are not fully understood. This project focuses on expressing and purifying MUT-7 and its human homolog EXD3 to be used for further enzymatic and structural studies. Through chromatography techniques such as ion exchange and size exclusion chromatography (SEC), we aim to produce highly purified proteins that will help to illuminate the mechanisms by which MUT-7 engages in gene regulation and RNAi.

ASSOCIATIONS BETWEEN CUMULATIVE STRESS, HIPPOCAMPAL VOLUME, AND HIPPOCAMPAL FUNCTION

Alexandra D. Wayss
Mentor(s): Stacey M. Schaefer
Additional Author(s): Sarah Skinner, Elizabeth Nord, Lauren Gresham, Frank Mann

Stress exposure has been linked to cognitive decline and structural brain changes, particularly in the hippocampus, which supports learning, memory, and emotional regulation. Prior research suggests higher perceived stress is associated with reduced hippocampal volume and poorer spatial reasoning, but the impacts of cumulative adult stress remain unclear. Using longitudinal data for the Midlife Development in the U.S. study (N = 118, mean age = 65.33±0.852, 71 Female, 47 Male), we examined whether cumulative adult stress predicted hippocampal volume and performance on a spatial reasoning task. Stress was quantified across three waves using Area Under the Curve (AUCg) scores from 19 self-reported measures. Larger hippocampal volume significantly predicted better spatial reasoning performance. However, cumulative adult stress was not associated with hippocampal volume or task performance.

OUTRUNNING LIGHT: REALTIME, LOW-COST, AND PORTABLE MEANS OF MEASURING CHERKINOV RADIATION VIA PHOTODIODES AND OFF-THE-SHELF ELECTRONIC COMPONENTS

Brody Weaver, Sophia Caracci, Sebastian Cerda, Justin Herrera, Taylor Lorona, Max Mallay
Mentor(s): Charles A. Hirst

The University of Wisconsin-Madison is home to a 1 MW TRIGA research reactor. The reactor is 1/3,000th the size of a commercial reactor but does not produce electricity. The visible blue glow emitted is from electrons passing through a dielectric medium, known as Cherenkov Radiation. The goal of our device is to measure the power output of the reactor based on 10% and 100% baseline measurements. The housing will be a water-tight plastic enclosure with five windows and a water-tight detachable top, attached to a PVC tube. Inside the housing, photodiodes will be positioned with optical grease. Photodiodes will be wired to a multiplexer, voltage booster, and arduino and data will be extracted in real-time through a wire routed within the PVC tube.

TESTING A PUTATIVE INTERNAL START CODON WITHIN BIOFILM REGULATOR SYPF

Lydia Weaver
Mentor(s): Anna Dickfoss, Mark Mandel

The bioluminescent bacterium *Vibrio fischeri* forms a mutualistic partnership with its squid host, *Euprymna scolopes*, providing a model system for studying beneficial colonization. Biofilm formation is required for successful colonization and depends on the symbiosis polysaccharide (Syp) pathway. Expression of the syp operon is controlled by a phosphorelay signaling pathway centering around the hybrid histidine kinase SypF. Previous experiments showed that only the 3' end of sypF is required for biofilm formation, suggesting that a proteoform of SypF is produced from an internal start codon within sypF. This project tests whether methionine 670 functions as the internal start codon. I am testing this hypothesis to advance our understanding of bacterial gene regulation and beneficial bacterial colonization.

INDUCING MITOCHONDRIAL DYSFUNCTION USING ROTENONE TO MODEL MITOCHONDRIAL DISEASES IN IPSC DERIVED CARDIOMYOCYTES

Ty J Weaver
Mentor(s): Melissa Skala
Additional Author(s): Xiaotian Zhang

The heart's energy demand makes it vulnerable to mitochondrial dysfunction, yet progress is hindered by heteroplasmic drift in patient-derived lines and bulk assays. To overcome these barriers, we model mitochondrial injury in iPSC-derived cardiomyocytes (iPSC-CMs) using rotenone, a Complex I inhibitor that disrupts respiration and elevates oxidative stress. Using NAD(P)H fluorescence lifetime imaging microscopy (FLIM), we longitudinally track recovery at single-cell resolution. Furthermore, we will compare signatures of this injury model against hiPSC-CMs harboring Leigh Syndrome (LS) mutations. This comparison will determine if acute Complex I inhibition models the chronic metabolic effects observed in LS. By mapping these trajectories, we aim to validate that our pipeline can bridge the gap between injury models and patient-specific disease states, providing a platform for future interventions.

MORPHOLOGICAL VARIATION AND SPECIATION OF RELICT EXTREMOPHILE

Annika Webb
Mentor(s): Sean Schoville

The unprecedented pace of climate change threatens to drive species to extinction before they are discovered. Alpine organisms are especially at risk, as their environments are temperature sensitive. Ice-crawlers (Grylloblattodea) are insect extremophiles that live in the cold climates of alpine environments, but they remain poorly studied. I propose to evaluate the morphological variation of more than 150 ice-crawler samples. Morphological data will be compared to previously published genetic data to see if there's a strong suggestion of species status. This research would provide more information about this family of insects, and useful knowledge to plan for conservation of ice-crawler biodiversity.

CHILDREN'S STATUS-BASED IDENTITY DISCLOSURE DECISIONS

Julia Weber
Mentor(s): Ashley Jordan

Children must choose whether to conceal or disclose parts of their identity, yet little is known about how status and intergroup interactions shape these decisions. In a novel-groups paradigm, 4–8-year-olds were assigned to a high-, low-, or no-status contrast group and completed eight trials choosing whether to reveal or conceal their group identity to either an ingroup or outgroup peer. We hypothesized greater disclosure to ingroup than outgroup peers, specifically among high-status participants. Preliminary trends suggest that high- and no-status children disclose more to outgroup peers, while low-status children disclose more to ingroup peers. These patterns suggest children's identity management is shaped not only by belonging, but by individual responses to social hierarchy, providing insight into how early interactions may reinforce or combat status differences.

COMPARATIVE ANALYSIS OF NOCTURNAL BIRD SPECIES RICHNESS AND FEEDING GUILDS IN THREE NORTHERN TANZANIAN LANDSCAPES

Audrey Wegener
Mentor(s): Catherine Marler, Candice Malone, Egidius James Rwebuga
Additional Author(s): Sam Zwiefelhofer, Luke Young

Despite contributions to agricultural productivity, nocturnal birds remain understudied in East African agroecosystems. We assessed nocturnal bird diversity across three habitat types–forest edge, wetland rice fields, and highland maize fields–in northern Tanzania. We used transect walks, playback surveys, and mist netting to survey nocturnal birds. A total of 117 species and 2,122 individuals were recorded, with nocturnal species present at all sites. Species richness and abundance were highest in wetland rice agriculture, which supported a greater diversity of insectivorous and carnivorous birds. Our findings emphasize the importance of nocturnal birds in regulating pests and highlight the need for further research on their role in agroecosystem dynamics. Long-term monitoring and locally informed conservation strategies are recommended to support sustainable land use and avian biodiversity.

HOW PRIOR KNOWLEDGE AND DIRECTED ATTENTION TASKS AFFECT THE RESTORATIVE EFFECT OF PLANTS?

Elsa Wei
Mentor(s): C. Shawn Green, Freya Joessel

Today's constant cognitive activity calls for design on environments and interventions supporting our mental wellbeing. Attention Restoration Theory posits that exposure to natural elements causes our directed attention to temporarily disengage, allowing its resources to be replenished. However, it remains unclear how (1) this restorative effect might be modulated by the way one engages with natural environment, and (2) how this effect might be modulated by individual factors. Here, we measured sustained attention before and after viewing streetscapes with trees under four conditions of varying attentional demands and plant knowledge. We hypothesized that prior knowledge about the trees will enhance the restoration effect, while active task demands during picture viewing will reduce it by not allowing attention to fully disengage.

EPIGENETIC REGULATION OF PRIMORDIAL GERM CELL DIFFERENTIATION: TESTING *TFAP2C* OVEREXPRESSION IN *KDM3A* AND *KDM3B* DOUBLE KNOCKOUT CELLS

Ruth Weisberg
Mentor(s): Harshini Cormaty

Primordial germ cells (PGCs) are precursors to sperm and egg that transmit genetic material across generations. In mouse embryos, PGCs are specified by three transcription factors: Blimp1, Tfap2c, and Prdm14. Following specification, PGCs undergo major epigenetic reprogramming, including removal of the repressive histone mark H3K9me2. We have previously found that the in vitro differentiation of mouse embryonic stem cells (ESCs) to PGC-like cells (PGCLCs) is prohibited with the loss of Kdm3a and Kdm3b, the H3K9me2 histone demethylases. This study tests whether overexpression of Tfap2c can rescue PGCLC differentiation in these knockout ESCs. These findings would support that Tfap2c works downstream of Kdm3a and Kdm3b, suggesting that Tfap2c can compensate for the loss of H3K9me2 and can compensate for the loss of H3K9me2 in regulating cell differentiation.

THE INTERPLAY OF CAFFEINE, PHYSICAL ACTIVITY, AND ANXIETY IN HIGH SCHOOL STUDENTS

Amber Weiss
Mentor(s): Kristin Kotleski

Anxiety is a prevalent mental health concern among high school students and can be exacerbated by caffeine use. Physical activity is associated with decreased anxiety. Little is known about how these variables vary and interact across high school grades. The purpose of this study is to examine the relationships and patterns of these variables among high school students. This is a secondary analysis of the 2024 Dane County Youth Assessment, a cross-sectional survey of students in 9th–12th grade. Responses to questions about anxiety symptoms, caffeinated beverage intake, and physical activity will be analyzed for frequencies, and physical activity will be tested as a moderator between caffeine intake and anxiety. Results may provide insight into developmental patterns and intervention strategies.

CHARACTERIZING ACTIVE LAYER PROPERTIES TO EXAMINE VULNERABILITY OF THAWING PERMAFROST

Cayley Weiss
Mentor(s): Katie Braun
Additional Author(s): Sabine Dolan-Gaschignard, Halle Callahan, Christian Andresen

Permafrost across the Arctic is rapidly thawing. Above this continuously frozen soil is the active layer: seasonally thawed soil. When permafrost thaws, the active layer deepens, ecosystems are disrupted, landscapes are degraded, greenhouse gasses are released, and global climate change is exacerbated. This project began in the field measuring thermal, soil, and hydrological conditions across a thaw gradient. In the lab, physical and biogeochemical properties of permafrost soil were measured. Together, this work aims to characterize active layer properties from thawing permafrost sites, as these properties influence heat transfer into permafrost and thus thaw severity. Ongoing work will estimate active layer depth using drone thermal imaging and soil characteristics. These analyses further our understanding of permafrost thaw vulnerability.

DEVELOPMENT OF AN ASYMMETRIC INHERITANCE SYSTEM

Elliott Weix
Mentor(s): Scott M. Coyle, Dennis T. Bolshakov

In living systems, asymmetric cell division gives rise to differentiation and complex emergent behaviors. A means of constructing synthetic asymmetry across cell division would enable bottom-up characterization of such phenomena. Here, we use fluorescence microscopy in budding yeast to screen a library of evolutionarily diverse MinDE-family proteins and identify a novel protein pair that generates asymmetric inheritance of constituent proteins. The *Pseudomonas poae* MinD and *Pantoea sp.* Mhis MinE protein pair create highly polarized oscillations and can partition the MinD content of a cell unevenly across mother and daughter. We screen a library of yeast strains at fixed expression levels, identifying an expression regime that suggests broad generation of phenotypic heterogeneity from asymmetric inheritance. This platform reconstructs asymmetric inheritance in a genetically tractable unicellular system.

LAYERS OF CHANGE: TRACING MIFFLIN STREET'S SHIFT FROM DWELLINGS TO FLATS 1930-1942

Claire Wendland
Mentor(s): Anna Andrzejewski
Additional Author(s): Oliver Chanschatz, Virginia O'Brien

Between 1930 and 1942, there was a large transition of dwellings to flats, which reveals and explains changes about the cultural landscape of Mifflin St. Throughout our project we looked at the changes in our buildings from 1930 to 1942 as during that time frame all of our buildings turns from dwellings to flats. Using historical references such as Sanborne Maps, Preservation Files, Building Permits/Archive Files, City Directories, & Fieldwork we were able to see how the owners, occupants, and landscape of Madison changed the physical form of the building as well as the purpose of it.

IMPACTS OF CHILDCARE STABILIZATION PAYMENTS ON WISCONSIN PROVIDERS

Sarah Wesela, Hailey Kjersten
Mentor(s): Liesl Hostetter

In response to the challenges the COVID-19 pandemic posed for Early Care and Education (ECE) providers, Wisconsin developed the Child Care Counts (CCC) Program, funded through federal pandemic relief efforts, which provided monthly payments directly to ECE providers. This study uses open-ended from a statewide survey administered by the Institute for Research on Poverty and the Wisconsin Department of Children & Families, representing the majority of Wisconsin providers. We conducted qualitative analysis on the reported impacts of the funding, especially for providing access to high quality care and supporting ECE staff. This research contributes to the understanding of the impacts of this unprecedented level of flexible ECE funding. Findings showed providers used funding to stay open during the pandemic, retain staff, and limit parents' financial burden.

A CHEMICAL APPROACH TO UNDERSTAND MROQ PROCESSING OF ARGD IN *STAPHYLOCOCCUS AUREUS*

Cecilia Weseman
Mentor(s): Troy Vulpis

Staphylococcus aureus uses the accessory gene regulator quorum sensing (QS) system to sense its population density and coordinate harmful group behaviors including virulence. The biosynthetic mechanism used by *S. aureus* to produce the autoinducing peptide (AIP) QS signal is not completely understood. I will take a chemical approach to gain a better understanding of the mechanism by which the peptidase MroQ contributes to AIP biosynthesis. To do so, I will synthesize a set of peptides with different lengths and amino acid sequences and measure MroQ's ability to process these substrates to produce mature AIP. Insights from this project will explain what site specificities are necessary to MroQ processing, providing us with a better understanding of the QS system and a basis for designing MroQ inhibitors.

THE AFFECT OF GROCERY STORES ON FOOD INSECURITY ACROSS RACIAL GROUPS

Sincere Whaleysmith
Mentor(s): Katherine Curtis, Mosi Ifatunji

There has been a shift in the academic understanding of food insecurity. Once characterized by "food deserts", scholarship has transitioned towards a focus on the roles of a myriad of other systemic factors in the perpetuation of unjust food systems. Unlike much of academia, many Black feminist thought producers and community activists nationwide have been major proponents of this understanding for years. Still, there is a lack of quantitative studies that investigate how grocery store infrastructure affects food security across racial groups. This study, built on the framework of longstanding Black feminist food theory and praxis, uses Census data on household food insecurity and grocery store counts in metropolitan areas to identify how grocery store counts affect the area's residents' likelihood of food insecurity.

ADOLESCENTS' REPRESENTATIONS OF PHYSICAL ACTIVITY ON SOCIAL MEDIA: SOLO OR SOCIAL?

Cleo Whitney
Mentor(s): Christopher N. Cascio, Soyeong Cho

Social media is part of everyday adolescent life, raising concerns about its influence on behavior. Previous research has largely focused on time spent on social media in relationship to behavior, however, there remains room to further explore how adolescents frame physical activity in their social media posts, particularly across different social contexts. In order to address this question, the current study aims to examine displays of physical activity on social media as a form of self-presentation. Specifically, we examined representations of solo forms of physical activity versus socially oriented forms of physical activity. These representations may shape how physical activity is perceived and valued among adolescents and their peers. Understanding how these depictions frame physical activity may provide insight into adolescents' self-identity and self-presentation.

CASSIOPEIA VENTRAL APPENDAGE MORPHOLOGY FOR UV RADIATION PROTECTION

Elyse Whittaker
Mentor(s): Olaf Jensen
Additional Author(s): Gretchen Gerrish

Cassiopeia xamachana and *frondosa* spp. host symbiotic algae in the mesoglea, between their outer epidermis and inner gastrodermis. Their mechanisms for protection against UV rays is unclear, a few appendages on their ventral side are poorly understood for their function. Namely lapelets: leaf-like, soft-bodied dark attachments that vary in size, coloration, spotting, and abundance. This study aims to understand the function of lapelets in relation to UV protection properties of *Cassiopeia*. 30 individuals of the two species were investigated for their diameter, average length of lapelets, and percent cover of lapelets against their depth. The findings of this study indicate a relationship between increased percent cover at shallower depth, demonstrating a potential function of UV protection from lapelets.

IDENTIFICATION OF UBR1 AS A CANDIDATE DRIVER PROTEIN OF METABOLIC DYSFUNCTION ASSOCIATED STEATOTIC LIVER DISEASE (MASLD) THROUGH MS PROTEOMICS

Miller Williams
Mentor(s): Margaret Lea Robinson

In the United States, about 1 in 3 adults will develop Metabolic Dysfunction Associated Steatotic Liver Disease (MASLD) in their lifetime, largely due to limited understanding of the disease's progression. In order to develop more effective treatments and medicines, we used past mouse liver research and found that the E3 ubiquitin ligase Ubr1 is associated with MASLD severity in mice. To validate our mouse liver results, we analyzed 38 different human liver samples, both with and without MASLD, and used mass spectrometry-based proteomics to identify candidate driver proteins. We found that the same UBR1 gene is related to metabolic dysfunction in humans. Now, we are using ubiquitin enrichment proteomics with mouse livers to identify possible targets by UBR1 to understand its effects on steatosis.

THE CAUSAL EFFECT OF THE COLORADO OPPORTUNITY FUND ON GRADUATION OUTCOMES

Rachel Williams
Mentor(s): Jessica Pac

The current administration is reassessing the role of the United States Department of Education and federal financial aid, raising questions about the effectiveness of state-level college subsidy programs such as the Colorado College Opportunity Fund (COF). Established in 2005, the COF subsidizes tuition for nearly all in-state undergraduates. This study will estimate the causal effect of the COF on in-state undergraduate graduation rates from 2- and 4-year colleges. Using the 2001-2012 American Community Survey data, the project will deploy a Difference-in-Differences design to compare the graduation rates of in-state Colorado students with that of comparison states 5 years before and after the COF was implemented. As federal funding shifts and college costs rise, findings inform whether state-funded tuition stipends improve educational attainment of the workforce.

CHANGES IN AIRFLOW EXHIBIT A SEXUALLY DIMORPHIC EFFECT ON DIET-INDUCED OBESITY IN MICE

Carolyn Winder
Mentor(s): David Harris
Additional Author(s): Grace Zhu, Fan Xiao, Twinkle Mathew, Dudley Lamming

Medical research requires representative and standardized mouse models. Female mice are resistant to diet-induced obesity, so the majority of mouse models of obesity use male mice, which does not represent the 80%-female bariatric surgery patient population. We have shown that environmental factors affect mouse behavior and can be leveraged to increase obesity in female mice. One modifiable metric of mouse housing is humidity, regulated by air exchange. We subjected 94 mice to variations in air changes per hour (ACH) ranging from 0 to 60, monitoring body weight, adiposity, and glucose tolerance from 3 to 19 weeks of age, finding that decreased ACH increased obesity in female mice. These findings carry implications for the standardization of mouse models, specifically the representativeness of models of obesity.

TRACKING PLANT BIODIVERSITY SHIFTS IN SOUTHERN WISCONSIN'S PRAIRIES

Lucille Wineberg
Mentor(s): Christian Villanueva, Sara Hotchkiss

North American prairies are among the world’s most diverse ecosystems. While prairies used to be extremely common throughout southern Wisconsin before European settlements, their coverage has now become minuscule in comparison. Our study analyses the change in species richness and plant biodiversity within southern Wisconsin's prairies, specifically investigating the role of drought in changing dominant root morphology. Ten different prairies across southern Wisconsin were surveyed using a quadrat approach to collect data on species presence, species cover, and soil conditions. This study will help create a present base for long-term prairie monitoring as average temperatures and the length and severity of droughts are expected to increase, along with changes to ecosystems in response to anthropogenic effects.

WORKPLACE EXPERIENCES AND POLITICAL ACTIVATION AMONG COLLEGE STUDENTS IN THE RESTAURANT INDUSTRY

Peyton Woley
Mentor(s): Katherine Cramer

While existing research analyzes other primary agents of political learning and activation, the workplace remains less examined. This study explores how college student restaurant workers use workplace experiences to interpret politics. Drawing on small-group listening sessions, I explore how experiences at work activate employees politically. I define political activation as the process through which workplace experiences shape how individuals interpret political institutions beyond the workplace. I find that activation occurs both directly, when political policies shape workplace conditions, and indirectly, through exposure to economically precarious or immigrant coworkers and the acquisition of industry knowledge. This activation is not rooted in economic self-interest. Because many students view low-wage restaurant work as transitional, political activation emerges primarily through relational proximity rather than personal vulnerability.

RELATIONSHIP BETWEEN MATERNAL DEPRESSION AND LANGUAGE ABILITIES OF CHILDREN BORN PRETERM

Gabriela Wendling Wolf
Mentor(s): Margarita Kaushanskaya, Emma Libersky

Children born preterm are at increased risk for poor language outcomes. As children's language outcomes are shaped by their early environments and interactions, it is critical to identify predictors of successful language outcomes. Here, we examine the relationship between maternal depression and the language ability in a sample of children born preterm at age 36 months. In this study, we recorded play sessions between the 36 month old child and their mother. We will examine the relationship between maternal depression levels and their child's language ability, and investigate impacts of socioeconomic status and parent input quality on this relationship. Findings will improve our understanding of the impact of parent-child interactions on language development and may indicate potential areas for intervention in preterm children's language environments.

QUANTIFYING PH DEPENDENCE OF NUCLEOTIDE EXTINCTION COEFFICIENTS: CONSIDERATIONS FOR UV TRANSMISSION IN PREBIOTIC WATERS

Henry Wolfe
Mentor(s): Zoe Todd

The Early Earth had an abundance of UV light compared to the Modern Earth. This UV light could have been used to drive chemical reactions important for the development of life, but it also could have led to the degradation of important prebiotic molecules. This study was done to understand how the five nucleotides used in modern RNA and DNA could act as shields to absorb UV light, with a consideration of how the pH environment affects this absorption. The results show that the five nucleotides can effectively reduce the penetration depth of UV light, and that pH environment effects the absorption spectra in different ways. Further work could be done to understand the shielding properties of other biomolecules, like amino acids.

BENEFICIAL MICROBES INDUCE PLANT DEFENSE RESPONSES IN *HORDEUM VULGARE* PLANTS LEADING TO REDUCED DISEASE AND INCREASED BIOMASS

Ella Wolff
Mentor(s): Kristi Gdanetz MacCready

Plant defense responses are constitutive or induced deterrence of disease causing agents. The fungus *Fusarium graminearum* causes head blight disease, which particularly threatens barley (*Hordeum vulgare*), by reducing grain quality and increasing human health risks. Previous research has suggested that applying synthetic agents can promote defense mechanisms before infection, decreasing disease symptoms and reviving crop value. However, no commercial products exist that are 100% effective in protecting barley from *F. graminearum*. This study hypothesized that inoculating *H. vulgare* with beneficial microbes also activates defense responses, decreasing disease and maximizing growth. Increased germination rates and plant weights were observed in support of this. Identification of these beneficial microbes can be used to develop new biocontrol agents to enhance production for agricultural practices and food systems.

TOP-DOWN OR BOTTOM-UP? DIRECTIONALITY OF RATIO VISUAL PROCESSING

Nina Wolff
Mentor(s): Percival Matthews
Additional Author(s): Sangmi Park

This study will examine whether individuals typically show a directional bias when processing visual stimuli depicting ratios. Although everyday nonsymbolic ratio representations (e.g., water in a glass) may imply bottom-first processing, symbolic conventions often promote top-first processing. To explore this inconsistency, this study will employ three tasks: Directed Fraction Estimation, whereby participants will report fraction values when prompted to process stimuli either top-to-bottom or bottom-to-top; a Directed Forced Choice Task, whereby participants will select between top-as-numerator and bottom-as-numerator interpretations; and an Unprompted Forced Choice Task, whereby participants will choose between these interpretations without directional instruction. Accuracy, response time, and interpretation choice will be analyzed to assess directional bias and spontaneous processing preferences. Findings may inform educational practices to better align with students' intuitive preferences.

IMMUNOSUPPRESSION VIA PD-L1/IDO-1 FUSION PROTEIN IN MESENCHYMAL STROMAL CELLS AND DERIVED EXTRACELLULAR VESICLES OFFERS ALTERNATIVE APPROACH TO MANAGING AUTOIMMUNE RESPONSE

Kiara Wolfram
Mentor(s): Adam Pagenkopf

Autoimmune diseases arise from inappropriate immune cell activation, leading to the destruction of healthy tissues. Mesenchymal stromal cells (MSCs) exhibit robust immunomodulatory abilities, and offer a promising therapeutic approach for autoimmune diseases. A fusion protein (PIDO) containing programmed death ligand (PD-L1) and indoleamine 2,3-dioxygenase 1 (IDO-1), combines two immunosuppressive pathways. PD-L1 dampens T cell activation by engaging the PD-1 inhibitory receptor, while IDO-1 promotes an anti-inflammatory environment. When packaged into MSC-derived extracellular vesicles (EVs), PIDO offers an alternative strategy to enhance MSCs' immunosuppressive properties. In vitro, PIDO-expressing MSC-EVs engage the PD-1 receptor, and activate the PD-1/PD-L1 immune checkpoint pathway that signals for T cell exhaustion and apoptosis. These findings suggest that PIDO-expressing MSC-EVs may serve as a cell-free therapy for immunoregulation.

THE EFFECT OF BIOCHAR ON MANURE NITROGEN USE EFFICIENCY COMPARED TO CONVENTIONAL FERTILIZERS

Allison Wong
Mentor(s): Brendan Baird, Natasha Rayne, Brendan Baird, Michael Moul

1. Evaluate the effect of biochar on manure nitrogen mineralization and crop nitrogen use efficiency compared to conventional fertilizers. 2. Evaluate the effect of biochar on first-year manure nitrogen credits in corn 3. Investigate nitrogen movement throughout the soil profile. 4. Assess the year-over-year nitrogen retention capacity of biochar. 5. Utilize vegetation indices to optimize nitrogen application rates

TO BEE OR NOT TO BEE: EFFECTIVENESS OF NEURAL NETWORK MODEL IN POSE-ESTIMATION OF *BOMBUS FERVIDUS* FLORAL FORAGING

Ted Wong
Mentor(s): Acacia Tang
Additional Author(s): James Crall

As various human activities cause increasing changes to the environment, it is of conservation interest to study the effects of such environmental changes on animal behavior. Manually evaluating behavioral data is often prohibitively labor-intensive and expensive. With the help of improving technologies on data collection, data becomes more readily available at larger quantities. Various computer vision models have been developed to help with data collection and analysis. However, their effectiveness on analyzing animal behavior within complex 3-D environments such as pollinator foraging is yet to be tested. In this study the effectiveness of neural network models to track foraging behavior is tested by using DeepLabCut to analyze behavior of wild *Bombus fervidus* in videos captured in the Arnold Arboretum, Boston, MA.

IMPROVING FATIGUED OPERATOR'S TRUST TOWARDS ROBOT USING ADAPTIVE LEARNING METHOD IN HUMAN-ROBOT COLLABORATION SCENARIOS

Yunyang Wu
Mentor(s): Aakash Yadav

Human-Robot Collaboration (HRC) is increasingly common in physically demanding industrial settings. However, most HRC systems are hard-coded, forcing human operators to adapt to robots' movements. Robots like other machines are prone to failure; operators' trust in robots is critical for safe operation and productivity. In addition, extended work shifts can lead to workers' cognitive and physical fatigue. Participants performed collaborative lifting with a robot in a 2 (reliable/unreliable) x 2 (fatigue/no-fatigue) within-subjects study. We utilize reinforcement learning methods (6 state spaces, 3 action spaces) to offer adaptive assistance for operators and eye tracking methods for participants' state determination. Adaptive learning methods have the potential to positively contribute to HRC under altered human states.

LEARNING ENHANCED NUMERICAL SIMLATION

Yuan Feng Wu
Mentor(s): Mikhail Khodak

This project investigates computational performance bottlenecks in OpenFOAM simulations that rely on the PBiCGStab linear solver. Working within a modified solver framework that logs persystem solve times and iteration counts, I run and analyze CFD simulations to identify cases where linear solves dominate overall runtime. I evaluate how solver configurations, including preconditioners and simulation parameters, influence convergence behavior and computational cost. By systematically collecting empirical performance data, the project aims to better understand when PBiCGStab becomes inefficient and to inform the development of improved tuning strategies for faster simulations. This work connects numerical linear algebra with large-scale scientific computing and highlights opportunities for algorithmic optimization in applied mathematics.

DEVELOPMENT OF OPEN SOURCE TOOLS TO OBTAIN PHYSIOLOGICAL DATA RELEVANT FOR COMMUNICATION

Anna Xiong
Mentor(s): Nike Gnanateja Gurindapalli

Speech perception, the ability to understand speech at an intelligible level, is a fundamental brain function for its importance in learning, conversation, and spatial awareness. Listening effort, the product of cognitive demand and motivation working to understand speech, contributes to speech perception. Listening difficulty can be accommodated to using rehabilitative hearing options like hearing aids or cochlear implants to help better identify dialogue. In this field, a new tool has emerged: pupillometry. Pupillometry uses pupillary dilations associated with listening effort to measure speech perception. This study uses pupillometry to measure listening effort using framework from previous literature to test if a newly developed, low-cost open-source tool will provide data similar to other pupillary tools. The overarching goal is to provide another alternative hearing rehabilitative option.

SPIRITUAL CAPITAL IN STEM: INVESTIGATING THE IMPACT OF RELIGION AND SPIRITUALITY ON STUDENTS' SOCIAL NETWORKS AND SCIENCE IDENTITY

Natalie Xiong
Mentor(s): Nidia Banuelos

Research has shown that Latines are underrepresented in the STEM field. This is the result of the lack of support and belonging from institutions within STEM environments. This study investigates the relationship between Latine STEM students and their cultural community wealth, specifically spiritual capital. Focusing on interviews conducted over three years, we are currently using qualitative coding to find patterns regarding Latine STEM students and their motivations to pursue a STEM degree. We have discovered a positive correlation between religion, the size of students' social networks, and an increase in the number of different types of support students receive. At the end of our study, we hope to diversify the STEM field through developing methods to support more Latine students in pursuing their goals.

FROM DETECTION TO INTERPRETATION: A MULTILEVEL REVIEW OF ALERT PERCEPTION IN AUTOMATED DRIVING

Yun-Ning Xu
Mentor(s): Joonbum Lee

Partially automated driving systems can control some aspects of driving but still rely on continuous human supervision. This creates two sources of imperfection: automation may generate errors or ambiguous alerts, and human drivers, who must monitor and intervene, are themselves fallible in attention, perception, and judgment. When either side fails, trust degrades, increasing the risk of miscommunication even when later alerts are accurate. To examine this phenomenon, a systematic literature review was conducted using Boolean searches and structured thematic coding. The review examines three domains: how alert outcomes shape trust, how real driving contexts create perceptual "gray zones," and how emotional, contextual, cognitive, and individual factors modulate interpretation. These insights explain trust miscalibration and inform the design of trust-adaptive human-machine interfaces for a safer driving.

DECODING THE "SILENT" DISEASE: ANALYZING PREDICTIVE RISK FACTORS IN CHRONIC KIDNEY DISEASE MODELS

Ellison Xu, Devanshi Jain, Mihir Narayan, Saaketh Suvarna
Mentor(s): Amy Cochran

Chronic Kidney Disease (CKD) is often called a "silent" condition, because in early stages it has almost no symptoms. CKD is difficult to treat. If patients are referred too early, doctors are unable to offer valuable treatments, and if they are referred too late, patient conditions can worsen. To help with this, doctors use mathematical "risk models" to predict future conditions. Our project takes a closer look at the Nelson model which uses patient demographics and other lab information. Using Shapley values (a method of data interpretation) we determine the most important predictors, and evaluate whether the omission of controversial factors like race can improve clinical equity without sacrificing the accuracy of these life-saving predictions.

CANNED: MARKUPS AND THE PRISON COMMISSARY

Kristen Xu, Shannon Yen
Mentor(s): Zohal Barsi, Leah Pomerantz, Frankie Lin

The prison commissary provides a marketplace for individuals who are otherwise restricted from economic activity. In recent years, prison cost-shifting practices have meant a reduction in provisions and an increase in the importance of commissary systems. This project aims to provide a comprehensive landscape of the prison commissary in America. For our presentation, we will showcase the landscape of commissaries within one state--Michigan. Utilizing newly FOIA'ed and digitized data on the purchases within the Michigan commissary, we highlight nearly 10 years of products and pricing on all items sold within the Michigan prison system.

LEVERAGING FUNDATION MODELS FOR OVARIAN LESION SEGMENTATION IN ULTRASOUND IMAGES

Iris Xu
Mentor(s): Irene M. Ong

Early detection of ovarian cancer is crucial for improving survival rates, however, ultrasound interpretation remains highly operator-dependent. Here we develop a hybrid deep learning approach fine-tuning a foundation model pretrained on large-scale ultrasound data and combining it with a custom convolutional neural network decoder for automated lesion segmentation. Using the publicly available Multi-Modality Ovarian Tumor Ultrasound dataset, the model was trained and evaluated on binary segmentation tasks to identify lesion regions of interest. The approach demonstrates promising segmentation performance. This work shows that adapting general-purpose ultrasound foundation models with task-specific transfer learning can achieve strong performance for ovarian lesion detection.

CONSTRAINING THE PRIOR: A BOUNDED KOLMOGOROV FRAMEWORK FOR BAYESIAN EPISTEMOLOGY

Jiaqi Yan
Mentor(s): Michael G. Titelbaum

Bayesian epistemology is confronted with a long-standing tension: the prior problem. Bayesianism permits any coherent prior, while objective Bayesianism imposes overly rigid or circular constraints. This article constructs a compromise framework for the subject of bounded rationality. This framework does not regard Kolmogorov complexity as an objective prior, but rather as the upper limit of an acceptable prior in a specific problem context. Assumptions that the minimum description exceeds this limit of representation will be regarded as cognitively untenable and excluded. This gives rise to a normative constraint on a priori acceptability, which retains rational diversity while excluding pathological or overly detailed assumptions. This limited approach reconciles the limited representational capabilities of Bayesian rationality and true reasoners.

CHRONICALLY ONLINE: STUDYING WHAT ADOLESCENTS POST ON SOCIAL MEDIA

Addison Yanez
Mentor(s): Ellen Selkie

The effect of social media use on adolescent wellbeing is disputed. Limited prior research exists describing specific adolescent-created content, but knowledge of this nuanced information could be important for parents and medical professionals to understand potential emotional impacts. The purpose of this study was to describe social media profiles and posts among Wisconsin adolescents. We evaluated social media accounts of 344 Wisconsin adolescents aged 13-15, using a qualitative codebook informed by the biopsychosocial model. Participants posted 5,350 self expression posts, 5,251 relationships posts, 4,669 activities posts, 4,296 environment posts, and 3,273 online interests posts. The findings from this study will help identify important associations between specific social media activities and emotional outcomes such as self-esteem, stress, and social support.

THE ROLE OF GENE REGULATION IN THE HYPOXIC ADAPTATION OF MONTANE GROUND BEETLES

Colin Tsuchi Yang
Mentor(s): Zach Farrand

Ecological shifts in montane environments may require physiological adaptations to varying oxygen levels. We examined high and low altitude species of the ground beetle genus Nebria under experimental hypoxia. RNAseq data from the subspecies cantinata showed significant upregulation of 18 genes, but no genome-wide significance when combining isoforms, suggesting hypoxic conditions may modulate specific gene isoforms. Following these results, we investigated hypoxia tolerance by quantifying expression of Neuropeptide F (NPF) and Dopamine Receptor D1 (DRD1) across species, which regulate metabolic conservation and locomotor arousal, respectively. Contrary to expectations, neither NPF nor DRD1 showed significant upregulation. These results mirror the RNAseq data, suggesting that hypoxia adaptation relies on isoform switching rather than broad transcriptomic shifts. Current research is characterizing specific isoforms to further explicate hypoxic adaptation.

MOLECULAR SPACING CONTROL IN MULTILAYER GRAPHENE FOR CHEMICAL SEPARATION

Rosey Yang
Mentor(s): Michael Arnold, Jia Wang

Graphene is a single layer of carbon atoms that is exceptionally strong, thin, and electrically conductive. Controlling the distance between stacked graphene layers is important for applications such as selective filtration and nanoscale fluid transport. In this project, thin graphene flakes were placed on silicon surfaces and chemically modified using a so-called two-step electrochemical method. The molecules are designed to attach to the graphene surface and act as tiny spacers, helping regulate separation between layers without significantly damaging the carbon structure. Surface imaging and spectroscopy measurements were used to evaluate surface modification and structural changes after treatment. Ongoing efforts focus on achieving more uniform molecular coverage and precisely controlling interlayer spacing. This work represents a step toward designing controllable graphene-based nanochannels for future energy and environmental technologies.

OPTIMIZATION OF THE DEINTERCALATION PROCESS FOR SYNTHESIZING TOPOLOGICAL SUPERCONDUCTOR CANDIDATE 2M-WS_2

Taeren Yang
Mentor(s): Daniel Rhodes
Additional Author(s): Brenna Bierman

The 2M phase of the transition metal dichalcogenide (TMDC) WS_2 has shown potential for topological superconducting surface states, which if harnessed could lead to fault-tolerant qubits for quantum computing. Due to its meta-stability 2M-WS_2 cannot be synthesized directly and must be synthesized through alternative methods, such as deintercalating K_xWS_2 with strong oxidizers in dilute acids or dilute acids alone. Here, we investigate several different environments for the deintercalation process. Through residual resistivity ratio (RRR) and inductively coupled plasma mass spectroscopy (ICP-MS) measurements, we find a link between potassium content and bulk crystal quality, even at ultra low potassium concentrations. Our results suggest a more complex deintercalation mechanism than previously proposed, and opens further research questions into investigating the mechanisms behind deintercalation processes.

PROBING THE H2O ORTHO-TO-PARA RATIO IN PROTOPLANETARY DISKS WITH JWST/MIRI SPECTROSCOPY

Carl (Jinghuai) Yao
Mentor(s): Ke Zhang

Protoplanetary disks are planet-forming regions of dust and gas surrounding newly formed stars. The ratio between the nuclear spin isomers of H2O, namely the ortho-to-para ratio (OPR), is a stable tracer for the formation history of H2O in the disks. In this project, I perform mid-infrared spectroscopy using James Webb Space Telescope (JWST) data and slab models to analyze the contributions of ortho and para H2O to the emission spectrum, providing the first measurements of OPR in protoplanetary disks. The OPR measurements are compared against other parameters of the disks, including stellar age, disk size, disk structure, and water luminosity, providing important clues regarding the water reservoirs for planet formation.

CMB AND GALAXY OVERDENSITY FIELD ANALYSIS FOR LARGE-SCALE VELOCITY RECONSTRUCTION

Balkan Yildirim
Mentor(s): Moritz Muenchmeyer

This project combines temperature maps of the Cosmic Microwave Background (CMB) with galaxy distribution data from the Dark Energy Spectroscopic Instrument (DESI) to reconstruct the large-scale velocity field of matter in the Universe. I analyze ACT DR6 CMB maps in HEALPix format, examining their angular resolution and computing their power spectra to understand temperature variations across different scales. I perform similar analyses on DESI galaxy overdensity maps and apply sky masks to ensure consistent comparisons between datasets. These measurements prepare for implementing a quadratic estimator, a statistical method that uses patterns in the CMB together with galaxy density maps to infer how matter moves through space. By combining early-Universe radiation with present-day galaxy surveys, this project traces structure of electron distribution and investigates structure growth.

DNA STRAND SPECIFIC REPLICATION COUPLED REPAIR AND REGULATION OF ERROR PRONE TLS POLYMERASES

Keira Ylvisaker
Mentor(s): Kavi P. M. Mehta
Additional Author(s): Gopishankar Thirumoorthy, Drew Jordahl, Marcel Morgenstern, Katherine Overmyer, Joshua J. Coon, Molly Dolan, James Keck, Dhruthi Suresh

DNA damage pathways (DDT) have evolved to complete faithful replication. Many cancers, including those that have BRCA deficiency rely on these pathways to maintain cellular viability. Two DDT pathways that respond to replication stress are translesion synthesis (TLS) polymerases and replication fork reversal, the former which is thought to be error prone, and the latter thought to be error free. Both processes act during DNA replication which is a complex process that occurs differently on the leading and lagging strand. I hypothesize that TLS activity differs between DNA strands and interfaces with fork reversal processes and is regulated acutely by the replication stress kinase CHK1. I will define DDT pathway engagement on leading and lagging strands using single molecule, cellular viability, and immunosignaling.

INCREASING THROUGHPUT OF MULTIPHOTON-PATTERNED HYDROGEL SCAFFOLDS FOR GENE EXPRESSION ANALYSIS

Kennedy Young
Mentor(s): Paul Campagnola

Idiopathic Pulmonary Fibrosis (IPF) is a chronic lung disease characterized by progressive tissue scarring that restricts lung expansion and reduces oxygen delivery throughout the body. Current mouse models lack physiological accuracy, while existing hydrogel models do not capture the biological complexity observed in vivo. Multiphoton-excited photochemistry mitigates this by allowing for precise collagen patterning and more physiologically relevant scaffold stiffness.

This project aims to increase the throughput of multiphoton-fabricated scaffolds to support gene expression analysis. Current approaches only allow for a small number of cells to be plated, restricting studies to imaging-based assays and providing little biological insight. Scaffolds are fabricated using a GelMA and Collagen Type I hydrogel, UV-crosslinked, and patterned using multiphoton-excited photochemistry.

INSTITUTIONAL DETECTION AND CLASSIFICATION IN GLOBAL TRAFFICKING DATA

Kevin Yuan
Mentor(s): Lola Loustaunau

Quantitative trafficking statistics are often interpreted as indicators of prevalence, yet they may reflect institutional biases rather than objective trafficking patterns. Using the Counter-Trafficking Data Collaborative (CTDC) Global Synthetic Dataset (2016–2020), this study examines how institutional entry channels shape the gendered construction of trafficking victim identification. Building upon prior findings on disproportionate classifications, we model interactions between gender, age, and datasource. Results show that hotline-originating cases are overwhelmingly coded as sexual exploitation, and that the gender gap in sexual classification is substantially amplified within hotline systems. Additional statistical analysis suggests the observed and archetypal "ideal victim" profile is institutionally mediated rather than purely demographic. These findings position trafficking data as an administrative classification pipeline rather than a neutral map of exploitation.

NEURAL CIRCUITS UNDERLYING SIT-TO-STAND TRANSITION

Aleksandar Zafirovski
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During movement animals explore their environment using a series of behavioral syllables, including walk, pause, orient and rear. Of these, rear is an ethologically significant syllable that allows animals to survey their environment or reach toward a specific goal. However, the precise neural circuit mechanism of 'rear' remains unknown. Water restricted mice were trained in a two-port alternation task in which they learned to execute sit-to-stand movements hundreds of times over five 30 min sessions of training. To identify rear circuits, we combined training with Fos/TRAP profiling to generate a brain-wide atlas of neurons that are active during this task. These studies may hold significance for understanding sit-to-stand transition in humans which is affected in a number of neurodegenerative conditions.

QUANTUM SYMMETRY IN TWO-DIMENSIONAL MATERIALS: INVESTIGATING CHARGE DENSITY WAVES IN MONOLAYER-TAIRTE4 VIA TEMPERATURE DEPENDENT RAMAN SPECTROSCOPY

Nicholas Zahn
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Two-dimensional (2D) materials are an emerging field exhibiting unique properties that defy classical physics. Among these is the Charge Density Wave (CDW) a quantum effect, where electrons reorganize into periodic patterns. This project investigates monolayer TaIrTe4, a Weyl semimetal. Due to the material's unique anisotropic structure, this results in CDWs that form in quasi-1D patterns. Using temperature-dependent Raman spectroscopy (a spectroscopy that uses light to measure atomic vibrations) we observe optical signatures of CDW formation. By mapping these changes across various temperatures and linear polarization, we uncover the interplay between material structure and its quantum behavior. This works contributes the foundational physics required to build faster and more efficient next-generation electronic devices.

NITRATE REMOVAL AND AMMONIA RECOVERY FROM CONTAMINATED GROUNDWATER VIA AN ELECTROCHEMICAL PROCESS

Yousif Zakir
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Agricultural regions like Wisconsin face contamination from fertilizer use, with nitrate posing significant health and environmental risks. This project develops an electrochemical system designed to remove nitrate from groundwater and convert it into ammonia, providing both water remediation and a sustainable fuel source. Using a dual-chamber electrochemical cell with separate anolyte and catholyte solutions divided by an ion-selective membrane, we apply low-voltage electroreduction to drive nitrate conversion. While experiments are ongoing, the project aims to identify key conditions that maximize nitrate removal and ammonia yield. The methods used include preparing an electrochemical cell, conducting controlled experiments, and measuring chemical concentrations using high-performance liquid chromatography. This work builds on prior electrocatalytic research and offers a pathway for cleaner water, reduced fertilizer pollution, and renewable ammonia-based energy.

YY1-DEPENDENT CHROMATIN STRUCTURAL FUNCTIONS ARE ESSENTIAL FOR NORMAL HEMATOPOIESIS

Jingxi Zhang
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The chromatin structural regulator Yin Yang 1 (YY1) is essential for hematopoietic stem cell (HSC) functions. To investigate whether YY1-dependent chromatin structural regulation governs adult HSC function, we generated an mouse model expressing an N-terminal truncated YY1 mutant (YY1 201-414), which mediates long-range chromatin interactions, in a YY1-null background. While conditional YY1 deletion in adult hematopoiesis system causes pancytopenia and lethality, expressing the YY1 201-414 fragment fully rescued this phenotype. The mutant mice exhibited normal lifespans and rescued blood composition and HSC numbers. Furthermore, YY1 201-414 restored long-term HSC quiescence, lineage differentiation, and serial re-plating capacity. These findings demonstrate that the YY1 chromatin structural domain is sufficient for normal hematopoiesis, highlighting chromatin architecture as a key regulatory factor in supporting HSC functions.

SENSITIVITY OF SEMANTIC DISTANCE IN VERBAL FLUENCY RELATED TO POST-STROKE APHASIA

Reigna Zhang
Mentor(s): Haley Dresang, Hayley Olson

Verbal fluency (VF) is an individual's ability to quickly generate words. Measures of VF can assess language processing, executive function, and more. Semantic distance (SD) similarity values can be calculated by assigning each word in a seuqence a vector in a semantic space and comparing it to neighboring vectors. This study tests the hypothesis that there are differences in strategy between cognitively healthy adults (CHA) and left- or right- hemispheric cerebrovascular infarct (L- or R-CVA) patients that can be detected by analyzing SD similarity values produced during VF tasks. Namely, damage in LCVA patients may restrict word access, resulting in limited reach of a more tightly related set of words, presenting as higher average SD similarity values compared to CHA.

IDENTIFYING THE STRONGEST PREDICTORS OF WELL-BEING: A COMPARATIVE ANALYSIS OF THE HEALTHY MINDS FRAMEWORK

Zexuan Zhang
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The Healthy Minds Program (HMP) is a mobile intervention grounded in four fundamental pillars of well-being—Awareness, Connection, Insight, and Purpose (ACIP). While research demonstrates these pillars collectively reduce psychological stress, it remains unclear whether participants benefit more significantly from one specific pillar than the others. Using data from the Advancing Dynamic And Personalized Training (ADAPT) study, I evaluate which pillar best predicts symptom reduction. I hypothesize that connection—the ability to cultivate healthy relationships with oneself and others—will be the strongest predictor of reductions in depression and anxiety scores. These findings will help optimize the efficacy and personalization of digital mental health interventions.

TRANS FATTY ACIDS REMODEL THE HEPATIC MITOCHONDRIAL PROTEOME AND SUPPRESS BIOENERGETIC PATHWAYS

Allen Zhao
Mentor(s): Lingjun Li, Jiahao Zhang

Trans fatty acids are associated with metabolic disorders, yet their subcellular molecular effects remain unclear. To investigate mitochondrial responses to trans-fat exposure, HepG2 hepatocytes were treated with BSA, oleic acid (cis-9), or elaidic acid (trans-9) for 48 hours, followed by mitochondrial isolation and label-free quantitative proteomics using an Orbitrap Fusion Lumos. A total of 967 mitochondrial proteins were identified, with 495 significantly altered after elaidic acid treatment. Trans-fat exposure caused widespread downregulation of proteins involved in electron transport chain assembly and mitochondrial gene expression, particularly inner membrane and ribosomal proteins. In contrast, enzymes involved in lipid activation, de novo lipogenesis, and oxidative stress response were upregulated. These findings reveal trans-fat–induced disruption of mitochondrial bioenergetic and translational pathways alongside compensatory lipid metabolic remodeling in hepatocytes.

THE IMPLICATIONS OF INCREASED NUCLEAR POWER PLANTS ON AIR QUALITY CO-BENEFITS

Stacy Zhao
Mentor(s): Tracey Holloway

In this project, we evaluate how nuclear energy can aid in creating a higher standard of air quality and public health. Using the COBRA (CO-Benefits Risk Assessment) model, it can be estimated how changes in air quality can cause benefits (known as co-benefits) for human health and economic value. The substitution of coal, fossil fuels and natural gas with nuclear energy is assumed to support air quality co-benefits. By running COBRA, we expect to see a positive correlation between increased nuclear power usage in the United States and the reduction of harmful air pollutants such as, PM 2.5, SO2, and NOx, which are cited by the Environmental Protection Agency (EPA) for their effects on human life.

MINOR GENETIC CHANGES IN SYMBIOTIC *V. FISCHERI* CONFER MAJOR HOST SHIFTS

Ander Zheng
Mentor(s): Mark Mandel
Additional Author(s): Katherine Bultman, Andrew Luy, Emily Goetz

Symbiotic microbes play vital roles in host health and are acquired selectively from a diverse array of environmental microbes. Bobtail squid are colonized by a single bacterial symbiont, providing a model system to study colonization specificity. Previous research identified that specificity in Hawaiian bacterial symbionts depends on the rscS gene, which regulates biofilm formation via SypF exopolysaccharide production. Mediterranean symbionts lack rscS and contain a key regulatory protein called SypF that confers colonization. We hypothesized that the SypF receiver (REC) domain is necessary and sufficient for rscS-independent colonization. Swapping the Mediterranean SypF REC domain into a Hawaiian ΔrscS strain conferred robust colonization comparable to the parent strains, supporting the hypothesis and providing insight into the complex mechanisms by which animal hosts select their microbial symbionts.

STEMY: DESIGNING INTERACTIVE AGENTS TO SUPPORT STEM-CELL RESEARCH

Enson Zheng
Mentor(s): Amy Koike, Jianhua Zhang, Arissa Sato
Additional Author(s): Vivian Trach, Timothy Kamp, Bilge Mutlu

Socially interactive systems such as social robots and AI agents have supported learning and collaboration across diverse settings, yet their potential to assist in laboratory research, particularly in studying stem cells, remains underexplored. Stem-cell research is technically demanding and cognitively intensive, creating opportunities for interactive systems that complement, rather than replace, laboratory expertise. To address this gap, we conducted co-design sessions with eight stem-cell researchers to explore the design of interactive systems to support stem-cell research. Through the co-design sessions, we identified preferences for situated interaction, desired forms of assistance, and contextual constraints that shape how such systems could be integrated into research laboratories. In addition to these design considerations, this paper presents the conceptual design of SteMy, a tablet-based social agent designed to support stem-cell researchers, grounded in co-design findings.

SEX DIFFERENCES IN *DROSOPHILA* BRAIN REGENERATION AFTER INJURY

Ivan Zheng
Mentor(s): Grace Boekhoff-Falk, Eli Scott
Additional Author(s): Shawn Ahern-Djamali

As the average lifespan of humans in recent years has increased, neurodegenerative diseases have become an increasingly common affliction. The WHO estimates that more than ~50 million people worldwide suffer from a neurodegenerative disease, characterized by neuron loss or impairment, and expects the affected population to rise with the absence of effective treatment. We use adult *Drosophila melanogaster* to explore the potential of neurogenesis as a lead for developing regenerative therapies to combat neurodegeneration. With the understanding that females have a longer lifespan than males and the anatomical and functional differences in the male/female brain, we attempt to identify the disparity between male and female *D. melanogaster* brains after 24 hours of penetrative traumatic brain injury (PTBI).

COST-EFFECTIVE FABRICATION OF METER-SCALE SINGLE-CRYSTAL CU(111) SUBSTRATES FOR HIGH-PERFORMANCE GRAPHENE AND H-BN ELECTRONICS

Tim Zhou
Mentor(s): Robert Jacobberger

Single crystal 2D materials that lack grain boundary defects are expected to revolutionize semiconductor electronics by enabling devices with ultrafast operation and ultralow power consumption. In order to produce single-crystal 2D materials, single-crystal metal substrates, such as copper (Cu), are required. In 2018, a breakthrough technology was reported where inexpensive, commercial, large-area (e.g., meter-scale) polycrystalline metal foil can be transformed into large-area single-crystal foil by using a simple annealing process. Unfortunately, the effect of gas composition / pressure, annealing temperature, and foil purity on the transformation into single-crystal foil is poorly understood. In this work, we will overcome this challenge by combining controlled annealing experiments with robust materials characterization via electron backscatter diffraction (EBSD) and scanning electron microscopy (SEM) to determine how such variations affect the yield of single-crystal Cu(111) foils with minimal misorientation. Then, high-quality single crystal graphene or h-BN films will be grown on the annealed Cu substrates. This work will culminate in reproducible annealing protocols for large-scale, cost-effective, commercial Cu(111) foil production and single-crystal synthesis of graphene and h-BN. We expect our results will have broader implications for 2D materials beyond graphene or h-BN growth and will advance semiconductor manufacturing.

MEASURING THE GAP: SIMPLE BURST SIZE MODELS FAIL TO PREDICT MULTI-STEP VIRAL GROWTH

Daniel Zhu, Michael Feng
Mentor(s): John Yin

Viruses replicate through discrete infection cycles, and accurately predicting their growth across multiple rounds is essential for optimizing therapeutic interventions and designing effective vaccines. While single-cycle experiments provide foundational burst-size parameters, it remains uncertain whether these measurements reliably predict multi-cycle replication kinetics. For Vesicular Stomatitis Virus (VSV), a two-step growth curve revealed that burst size measurements overpredicted first-cycle titers by approximately 10-fold, indicating that early infection dynamics differ from later cycles. For OC43 (a strain of SARS-CoV-2), a three-step growth curve demonstrated that burst sizes increased progressively across successive cycles, with later cycles producing several-fold higher burst sizes than initial rounds. Our findings demonstrate that accurately predicting multi-cycle viral replication requires sophisticated modeling that incorporates viral absorption kinetics and the dynamic interplay between infection parameters across successive replication rounds.

OPTIMIZATION OF A CRISPR-ASSOCIATED TRANSPOSASE SYSTEM FOR COMBINATORIAL EFFLUX PUMP KNOCKOUTS IN *E. COLI*

Yichen Zhuang
Mentor(s): Silas Miller, Srivatsan Raman

Multidrug efflux pumps can cause antibiotic resistance in bacteria by actively transporting toxic compounds, including antibiotics, out of the cell. *E. coli*, an opportunistic pathogen that frequently exhibits multidrug resistance, encodes 35 such transporters with overlapping and poorly defined functions. In order to understand how different efflux pumps contribute to drug resistance under different stresses, we are optimizing a CRISPR-associated transposase system to delete combinations of genes. Transposons are integrated into efflux pump loci, with successful insertions validated by gel electrophoresis and whole-genome sequencing. By varying the number of genes disrupted simultaneously, incubation time, and growth conditions, we achieved insertion efficiencies of 80-100%. Next, we will construct pooled knockout libraries and quantify growth and antibiotic susceptibility to systematically map efflux pump contributions to multidrug resistance.

THE PERSISTENCE OF PANIC: HOMOPHOBIA AND THE EVOLUTION OF THE GAY PANIC DEFENSE

Diego Zibell
Mentor(s): Sarah Frank

This thesis examines the historical development and continuation of the gay panic defense in U.S. courts. Although various states have formally banned the defense, this study argues that the logic of the defense persists through informal strategies that draw on homophobia, victim blaming, and harmful masculinity. Through a qualitative analysis of legal documents and reporting for criminal cases spanning the nineteenth century to the present, this research follows the defences' shift from explicit doctrine to subtler courtroom rhetoric as legal arguments adapted to changing heterosexual social attitudes toward homosexuality. The analysis demonstrates that legal actors can continue to frame gay men as threatening, therefore mitigating the defendants' culpability. These findings suggest that bans are insufficient to eliminate bias that justifies violence against gay men.