199. A Supersensitive ELISA for Detecting Amyloid-β Oligomers in Alzheimer's Disease and Its Potential Diagnostic Utility

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Alzheimer's disease (AD), the most common form of dementia worldwide, is characterized by the abnormal accumulation of soluble oligomers of β-amyloid peptide (AβO) and neurofibrillary tangles formed by hyperphosphorylated Tau. There is significant evidence supporting that AD pathogenesis begins years before symptoms appear, with neurotoxic AβOs playing a central role in disease triggering by contributing to synaptic dysfunction and neuronal death. Even though AβOs are hypothesized as a key biomarker for early AD diagnosis, diagnostic challenges remain, as non-invasive methods for early and definitive confirmation are scarce, along with antibodies that specifically target and discriminate among soluble toxic species. Amongst the antibodies selected against ABOs, the single chain fragment variable (scFv) NUsc1 demonstrates reliable selectivity to AD-relevant neurotoxic AβOs and serves as a prime candidate for their detection. We conducted a supersensitive ELISA with phage-bound NUsc1, where we used the phage-displayed version of the scFv fragment to detect AβO concentrations in AD mice brain homogenates, human brain homogenates, and lastly human CSF samples. The assay successfully detected AβOs in brain homogenates from both mice and humans. More importantly, it also detected AβOs in human cerebrospinal fluid (CSF), representing a significant advancement for clinical use. ELISA with phage-bound NUsc1 (pbNUsc1) displayed significantly higher concentrations of AβOs in patients with AD compared to non-AD patients. These findings support the potential utility of this supersensitive assay as an early diagnostic tool for AD. By specifically targeting soluble, neurotoxic AβOs using the pbNUsc1 antibody, this assay may provide a clinically relevant method for diagnosing and detecting AD. Further investigation will reveal potential correlation between CSF AβO levels and disease progression in patients without clinical AD.

197. Design and Synthesis of Quinoline Derivatives as Antibiotics Through Inhibition of the Sodium-Dependent NADH: Ubiquinone Oxidoreductase (NQR) in Pathogenic Bacteria

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Antibiotic resistance is an escalating global concern, driven by the rise of multidrug-resistant pathogens, demanding the discovery and development of new antibiotics. Although efforts to limit antibiotic use in clinical settings have shown some promising outcomes, eliminating established resistance remains challenging, and new resistant strains continue to emerge. As bacteria adapt and evolve to evade current treatments, there is an ongoing need for therapeutics that target previously unexploited bacterial mechanisms. The Sodium-Dependent NADH: Ubiquinone Oxidoreductase (NQR) enzyme is a six-subunit respiratory enzyme complex found in several pathogenic bacteria, including V. cholerae, Pseudomonas, and Klebsiella species. While NQR performs a role in bacterial respiration similar to that of mitochondrial complex I, it is unique in terms of structure, mechanism, and phylogeny. NQR contributes to essential bacterial processes such as energy generation, motility, and toxin secretion. Our lab is focused on identifying potent inhibitors of NQR to serve as potential new antibiotics. A targeted library of ubiquinone-like compounds were screened against NQR, which identified a series of quinoline-based lead molecules that inhibit NQR activity and induce bacterial cell death. The synthesis and optimization of the ubiquinone-like lead compounds is progressing with a focus on enhancing potency and selectivity towards the NQR enzyme complex.

198. Cryogenic Filters for Quantum Measurements

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Quantum mechanics governs the behavior of matter and light at the microscopic scale, underpinning modern technologies like semiconductors, lasers, and emerging computing platforms. Studying them requires precise quantum-limited measurements, involving fragile quantum states that can only survive in ultra-low electronic temperature environments. External electrical noise from measurement electronics and the surrounding environment can heat ultra-cold electrons and disrupt these quantum states. To mitigate noise-induced decoherence, cryogenic low-pass filters are required in quantum measurement systems to suppress high-frequency noise. In this work, we present the design, fabrication, and experimental characterization of silver-epoxy cryogenic filters for ultra-low electronic temperature quantum measurements. The filters are constructed by embedding resistive wiring in conductive epoxy, providing broadband electromagnetic attenuation while simultaneously thermalizing the measurement lines. We characterize filter performance through attenuation measurements and evaluate their impact on electrical noise in low-temperature transport experiments. The measured performance aligns with expectations from established cryogenic filter designs and demonstrates effective suppression of high-frequency noise relevant for quantum devices. Practical considerations including fabrication reproducibility, mechanical robustness, and integration into cryogenic wiring stacks are also discussed. This work validates the implementation of silver-epoxy filters and highlights their importance in improving measurement stability and noise performance in quantum condensed-matter experiments.

195. Peripheral Nerve Injury Does Not Alter VGluT1 Synaptic Density on Isl1+ Premotor Interneurons

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Peripheral nerve transection results in the permanent loss of sensory muscle afferent synapses that, otherwise, provide monosynaptic input to motor neurons. This loss in synapses results in persistent motor deficits such as the absence of the stretch reflex and occurs independent of successful peripheral axon regeneration. Interestingly, the same parent sensory axons double their number of boutons in the deep dorsal horn of the spinal cord, where a heterogeneous group of premotor interneurons reside. The objective of this project was to identify if a specific group of interneurons receives this increased synaptic drive with the future goal of determining its functional consequence, such as facilitating increased muscle co-contraction also known to occur post-injury.

We focused on dI3 interneurons that express the Islet 1 transcription factor (Isl1+). These cells were selected because they are glutamatergic interneurons known to project to motor neurons, receive muscle afferent input (defined by expression of the Vesicular Glutamate Transporter isoform 1 (VGluT1)), and coordinate motor output. We hypothesized that peripheral nerve injury would significantly increase VGLuT1 synaptic density on Isl1+ premotor interneurons.

Adult *Isl1*^{tdTomato} mice underwent either sciatic nerve transection or sham surgery. Three months later, post regeneration, we perfused the animals, collected lumbar spinal cord, and processed tissue to identify interneurons expressing the tdTomato reporter protein. We then conducted immunohistochemistry to label sensory synapses expressing VGluT1. 3D reconstructions were generated from confocal image stacks to quantify VGluT1 synaptic inputs on the soma and proximal dendrites of Isl1 interneurons and compared between injured and control animals.

Against our hypothesis, our analysis revealed no significant difference in synaptic density on Isl1+ interneurons between nerve-injured and sham groups. Though a negative result, this finding clarifies which cells do not show increased synaptic drive post-injury, allowing focus on other interneuron subtypes involved in motor control for future studies.

196. Targeted Synthesis of Protein-like Polymers as JAK2 Inhibitor in Intracellular Pathway of Alopecia

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Janus kinase 2 (JAK2) hyperactivation drives sustained STAT1 phosphorylation and pathogenic immune signaling in inflammatory skin diseases such as alopecia areata. Although FDA-approved JAK inhibitors are clinically available, their ATP-competitive mechanisms often result in limited specificity and adverse effects, motivating the development of alternative strategies for more selective pathway inhibition. This project tested that protein-like polymers (PLPs) designed as proteomimetics of the endogenous JAK/STAT regulator SOCS1 can selectively inhibit JAK2 through substrate-site binding while improving intracellular stability and cellular uptake. SOCS1-derived peptides were synthesized and displayed multivalently on peptide brush polymers with synthetic backbones to generate JAK2-targeting PLPs of defined lengths. Monomer purification and polymerization were validated using mass spectrometry, analytical and preparative high-performance liquid chromatography, and proton nuclear magnetic resonance spectroscopy. Additional analysis was performed in human keratinocyte models using cell viability assays and western blot analysis of cytokine-induced STAT1 phosphorylation. Competitive binding assays further demonstrated specific interactions between PLPs and the JAK2 enzyme, while peptide-only and scrambled polymer controls showed no measurable binding. The PLPs entered cells autonomously, exhibited extended intracellular stability, and produced on-target inhibition of STAT1 phosphorylation without ATP competition. Cell viability assays showed that the 10mer PLP was non-cytotoxic up to 10 μM, whereas the 20mer remained viable up to approximately 7 μM, with the 10mer demonstrating greater efficacy in suppressing STAT1 phosphorylation. Collectively, these results indicate that multivalent PLP design enables selective JAK2 inhibition with improved safety and functional performance relative to conventional small-molecule inhibitors. This work supports protein-like polymers as a therapeutic for selective intracellular kinase inhibition and advances their potential application for inflammatory skin disease.

193. Novel Superconducting Materials for Improved Quantum Circuits

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Superconducting quantum bits (qubits) are a leading platform for quantum computing. One of the main drawbacks is the relatively short coherence time, typically ~ 100 ms, for qubits that utilize superconducting Nb thin film capacitor pads. This is attributable to the RF lossy Nb oxide layer that has oxygen vacancies that lead to local magnetic moments. Here we examine a NbRe alloy (Nb0.18Re0.82) that has a superconducting TC ~ 7K-9K, close to that of Nb, but is mostly Re metal that has a minimal surface oxide. X-ray photoemission spectroscopy (XPS) is used to examine the surface oxide of the alloy thin films grown by sputtering. As-made amorphous films are compared with more ordered annealed films [1]. Focus here is on annealed films. The principal result is that the observed Nb oxide peaks are those of fully oxidized Nb2O5 in the annealed films, without evidence of oxygen vacancies. The alloy thus has promise as a replacement for Nb.

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194. Constructing the Largest Ever 3-Dimensional Turbulence Box

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The study of particles, droplets, or flying vehicles and their interaction with turbulence is difficult in wind tunnels due to their tendency to be advected away from the test section. A solution to this issue is to study the effects of turbulence on objects in a turbulence box, which generates a volume of turbulence without a mean flow direction [1]. Previous air turbulence boxes have been characterized by 2D measurements [2], but a turbulence box designed to utilize state-of-the-art advancements in 3D characterization has not been realized yet [3]. The purpose of this project is to design, build, and test a turbulence box specifically with 3D measurements that will enhance the current state of turbulence interaction studies. This box has an octagonal geometry, with four inward-facing walls of air jets, over six feet tall, separated by four acrylic walls for optical observation and 3D particle tracking. So far, individual components have been successfully tested in a benchtop setup driven by Python. Forcing schemes for the jets were intended to be run to produce low mean turbulence over a large envelope. Results indicate that 24 Volts and 10 Amps will need to be independently supplied to each wall of jets and that potential back electromotive force caused by 96 solenoid jets per wall is not a concern. Benchtop testing of an array of 36 jets was conducted to rule out connection point leakages to explain large reduction in pressure upon jet activation. Additional testing at higher pressures to cause air leaving the jets to approach Mach 1 is needed. The insights that will follow demystifying the impact of turbulence on particles set up more research on other entities, including drone stabilizer responses in sudden gusts to the interaction of small flying insects with turbulence.

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191. Microglia Depletion Does Not Impact CD8+ T Cell Infiltration into the Young Mouse Brain 8 Hours Post-Traumatic Brain Injury

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Traumatic Brain Injury (TBI) accounts for approximately one-third of injury-related deaths in the United States. In aged mice, microglia facilitate recruitment of CD8+ T cells to the brain following TBI, contributing to worsened health outcomes, including decreased motor and cognitive abilities. Microglia depletion in aged mice reduces CD8+ T cell infiltration. Since CD8+ T cell infiltration is not typically observed in young mice, we hypothesized that microglia depletion would not affect this recruitment post-injury. Young male and female mice (12 weeks, n=5/group) underwent microglia depletion via a PLX5622, a colony-stimulating factor 1 receptor inhibitor, diet, or were placed on a control diet. Mice underwent TBI using controlled cortical impact or sham injury, in which an incision was made, but TBI was not induced. Eight hours post-injury, mice were euthanized, and brain and blood samples were collected. Flow cytometry confirmed microglia depletion in the PLX5622 diet group and quantified leukocyte and CD8+ T cell populations. Microglia depletion in young male mice did not result in significant differences in T cell populations 8 hours post-TBI compared to the control diet groups ($p > 0.05$). No significant differences were observed between CD8+ T cell or leukocyte populations in the microglia depletion groups compared to control diet groups or between the TBI and sham injury groups 8 hours post-injury ($p > 0.05$). These findings support our hypothesis that microglia depletion does not influence CD8+ T cell infiltration in the young mouse brain at 8 hours post-injury. Additionally, these results suggest that CD8+ T cell infiltration after TBI is an age-dependent mechanism. Understanding the interactions between microglia and CD8+ T cell recruitment is crucial for confirming that CD8+ T cell infiltration is age-specific, which may reflect similar mechanisms in humans.

192. Tabloids and Sceptics: Examining the Development of British Euroscepticism in the *Daily Express* in the Build Up to the 2016 Brexit Vote

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The 2016 UK referendum on continued European Union (EU) membership resulted in a narrow victory for Leave, with 51.89% [1] voting for Brexit, a result that shocked the international community and prompted questions about the social and political forces driving the campaign. This study argues that deeply entrenched Eurosceptical attitudes, rooted in a longstanding cultural disposition toward British exceptionalism, were systematically mobilised by the tabloid press to influence public opinion in favour of Leave. To examine this, the study first traces the history of British Euroscepticism from the 1975 European Economic Community (EEC) referendum to the 2016 vote, before conducting a content analysis of over 350 Daily Express headlines published during the official campaign period (April 14 – June 23, 2016), categorised around the themes of immigration, the EU, Brexit, and its economic impacts. Analysis revealed a consistent deployment of emotive, provocative language including terms such as *fury*, *attacked*, and *slams*, alongside delegitimising labels for the Remain campaign, such as *Project Fear and scaremongers*. These findings suggest that the Daily Express played an active role in reinforcing Eurosceptic sentiment by framing the debate in emotionally charged and one-sided terms. It is concluded that tabloid media coverage, grounded in and amplifying pre-existing cultural attitudes, was a significant contributing factor in shaping the public's decision to vote Leave.

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189. Analyzing the Taphonomy of a Miocene-age Threespine Stickleback Fish Series

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The Truckee Formation near Hazen, Nevada, presents a 10 million year old sequence of fossilized threespine stickleback fish (*Gasterosteus doryssus*). Fossil fish are preserved in diatomite, consisting of the salacious shells of ancient diatom remains that were continuously deposited on the Lake Truckee floor upon death. This depositional setting allows a high-resolution, near-continuous account of morphological evolution, stasis, and local extinction among stickleback populations. Within the formation, a series spanning about 21,000 years displays a replacement of low-armored stickleback fish to high-armored variants. Understanding the paleoecology of these fish can help inform the cause of this replacement event. Here, we present the taphonomy, or fossilization and depositional context, of this stickleback fish series. We photographed the approximately 4,000 unique fish from this series, including all available counterparts, and noted trends in disarticulation of various anatomical regions indicative of a taphonomic process. For instance, disarticulation of fin elements of an otherwise perfectly articulated fish is evidence of decay at low temperatures. The anatomy we noted included the skull, fins, ribs, vertebral column, and general skeleton, among others. We also noted trends in anoxia-induced muscle convulsions, or tetany. This takes form as expansions of the jaw and fins and extreme curvature of the spine. Any combination of these provides evidence of a low-oxygen environment. Tetany and disarticulation variables were each documented on scales of increasing magnitude, ranging from not present to extremely present. Other trends relevant to taphonomy were also noted, including excavation bias and fossil visibility. In collecting these variables, we reconstruct temperature, depth, and oxygen content throughout the time series. Given the Truckee Formation's temporal resolution, abundance of specimens, and expansive evolutionary phenomena, analyzing the taphonomy that underlies these patterns can further our understanding of evolutionary modes.

190. Investigating the role of Fibrillin-1 (FBN-1) in Ovarian Aging

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Ovarian aging results in a rapid decline in oocyte quality and quantity, contributing to infertility, miscarriage, and broader health consequences such as impaired cardiovascular, musculoskeletal, and immune function. While cellular mechanisms of ovarian aging, such as aneuploidy and mitochondrial dysfunction in oocytes, have been explored, the epigenetic underpinnings of this process remain poorly understood. To bridge this gap, we performed spatial ATAC-seq of mouse ovaries across ages. We identified Fibrillin-1 (FBN-1), a key extracellular matrix gene that modulates tissue elasticity and TGF-β1 signaling, as the top gene with reduced chromatin accessibility in aged murine ovaries. Subsequent RNA in situ hybridization (RNA-ISH) revealed reduced *FBN-1* transcript levels in the ovarian stroma and follicle theca layer of reproductively old mice. Western Blot analysis further confirmed the decline in whole ovary total FBN-1 protein levels with age. Immunohistochemistry (IHC) demonstrated that FBN1 is localized throughout the ovarian stroma with a distinct staining pattern in theca-layer. Quantification of IHC staining intensity demonstrated reduced FBN1 levels in ovarian stroma with advanced age. This study highlights FBN1 as a critical gene with reduced accessibility and expression in ovarian aging, and contributes to our understanding of the mechanisms of ovarian functional decline with age. Our ongoing experiments explore elastic fiber organization, comprised of FBN1-based microfibrils and elastin, and the regulation of TGF-β1 fibrosis signaling pathway by FBN1.

187. Lauroyl-MBEH-Loaded Nanoparticles as a Targeted Anti-Melanoma Treatment

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Melanoma is the deadliest form of skin cancer and has seen an increase in diagnosis by 32 percent over the past few decades [1]. To treat melanoma and, specifically, metastases of this cancer, we propose to target the melanogenic pathway, where the natural amino acid L-tyrosine is converted into the melanin pigments that give skin its color. Such targeting would be highly selective for melanoma-originated cancers and can side-step the side effects usually associated with conventional chemotherapies [2]. Moreover, when such pathway is targeted using phenolic drugs such as monobenzyl-ether of hydroquinone (MBEH), an L-tyrosine mimic drug, enhanced antitumor immune activity is observed, providing an additional mechanism for killing cancer cells. We proposed that nanoparticles (NPs) loaded with lauroyl-MBEH, a novel MBEH derivative, can offer additional selectivity through their small size, their abilities to target cancer cells, and their ability to deliver a large quantity of the active drug to such cells [3]. This presentation will report the synthesis and characterization of the lauroyl-MBEH-loaded liposomal NPs. Also will be discussed are: i) the use of biochemical assays to evaluate the antitumor activity in B16-F10 model cells; ii) mechanistic studies using Western Blot analysis in an attempt to decipher the biochemical basis of the drug's antitumor activities.

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188. t^6A Inhibition Decreases Cell Proliferation of Cisplatin Resistant Ovarian Cancer Cells and May Alter Protein Translation Dynamics

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t^6A is a modified nucleotide in tRNAs that has been found to play a significant role in ensuring proper translation of mRNAs into proteins. Specifically, t^6A has been found to promote translation of mRNAs starting at the expected AUG start codon site instead of cryptic start codons [1]. Past research has found that t^6A expression is amplified in ovarian cancer cells compared to normal, non-cancerous cells. We hypothesize that inhibition of t^6A in ovarian cancer cells increases cryptic translation of mRNAs. Thus, we predict that t^6A inhibition can increase the synthesis of neoantigens, triggering immune system responses that kill ovarian cancer cells with increased efficiency. This project focuses on how t^6A inhibition, via t^6A biosynthesis enzyme knockout, impacts translation within cisplatin sensitive and resistant ovarian cancer cell lines. We analyzed cell proliferation via a colony formation experiment, and we analyzed global translation via a flow cytometry experiment. We found that cisplatin sensitive PEO1 cells had little change in cell proliferation due to t^6A inhibition. Alternatively, we found that cisplatin resistant PEO4 cells had a large decrease in cell proliferation due to t^6A inhibition. This indicates that cisplatin resistant ovarian cancer cells are more sensitive to t^6A inhibition than cisplatin sensitive cells. We also found that global translation in the cisplatin resistant PEO4 cells did not decrease with t^6A inhibition. With these results, we believe that cisplatin resistant PEO4 ovarian cancer cells treated with t^6A inhibition have reduced proliferation due to altered translation, indicative of increased production of neoantigens, as predicted in our hypothesis. Further investigation will reveal the specific impacts of t^6A inhibition, allowing for a clearer understanding of immunotherapeutic applications of t^6A inhibition.

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185. Disrupting Skin-specific Serine Palmitoyltransferase Subunits Reduces Filaggrin Expression and Epidermal Differentiation

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Atopic Dermatitis (AD; also called eczema) is a common inflammatory skin condition that can reduce quality of life, causing itching, treatment burden, and sleep disruption. Central to disease pathogenesis is a reduction in the expression of filaggrin (FLG), whether a primary genetic deficiency or secondary to the pathologic increases in type 2 cytokines, and disruption of the epidermal ceramide barrier. The essential sphingoid backbones of these ceramides are synthesized by the serine palmitoyltransferase (SPT) complex, and RNAseq data demonstrates that AD lesional skin shows significant reductions in expression of skin-specific SPT subunits, SPTLC3 and SPTSSB. However, the function of the unique sphingoid bases synthesized by these SPTs is poorly understood. We hypothesized that altering the SPT complex composition by knocking down (KD) SPTLC3 and SPTssb in keratinocytes would compromise the barrier function. SPTLC3 and SPTSSB were KD in keratinocytes using shRNA-expressing-lentivirus, followed by the generation of 3D skin organoids. After 12 days of differentiation, keratinocytes were harvested for mRNA analysis and immunofluorescent staining of differentiation markers and SPT complex subunits. KD of either SPTLC3 or SPTssb reduced expression of the FLG gene, which is known to be deficient in AD. FLG protein was also reduced based on immunofluorescence staining, as were early (DSG1, K10) and other late (LOR) differentiation markers. SPTLC3 KD reduced expression of other SPT complex subunits, suggesting its role in controlling SPT complex activity overall, whereas SPTSSB KD selectively lowered expression of SPTLC2, perhaps as a compensatory response to limit short chain LCBs. These findings suggest that the recently observed reductions in SPTLC3 and SPTSSB in AD may contribute to both the decreased FLG expression and the characteristic dry skin of AD, in addition to altering ceramide composition via changes in the SPT complex.

186. Impaired Docking and Recycling of Synaptic Vesicles in Krabbe Disease

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Krabbe Disease (KD) is a fatal lysosomal disorder caused by deficiency of galactosylceramidase (GALC), leading to accumulation of the cytotoxic sphingolipid psychosine. Although KD is characterized as a demyelinating leukodystrophy, patients also exhibit significant cognitive and behavioral impairments, suggesting neuronal dysfunction. However, the synaptic mechanisms underlying these features remain poorly defined. In this study, we investigated how galactosylceramidase (GALC) deficiency affects synaptic structure and function using the Twitcher (TWI) mouse model of KD. In vivo electrophysiological recordings demonstrated significant reductions in paired-pulse facilitation and excitatory postsynaptic potential amplitudes in hippocampal neurons from TWI mice. Additionally, decreased dendritic spine density, abnormal synaptic vesicle organization, and reduced postsynaptic density size at both excitatory and inhibitory synapses were found. Mechanistically, we observed that psychosine accumulated mainly within presynaptic membranes and synaptic vesicles. Its elevated biosynthetic rate in TWI synaptosomal fractions further suggests local production within synaptic compartments. Dysregulation of the SNARE protein SNAP25, together with enhanced SNARE complex formation, indicated impaired vesicle docking and fusion at presynaptic membranes. Consistent with these findings, in vitro assays confirmed that psychosine disrupts synaptic vesicle cycling and SNARE-dependent membrane fusion. Collectively, our findings identify presynaptic psychosine accumulation and defective vesicle docking and fusion as drivers of synaptic dysfunction in KD. This work reframes KD as not only a demyelinating disorder but also a disorder with synaptic pathology, providing mechanistic insight into the neuronal dysfunction underlying cognitive impairment in affected patients.

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183. Adverse Childhood Experiences and Obesity Risk Among Young Adults in the United States

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Adverse Childhood Experiences (ACEs) are potentially traumatic events occurring before age 18, including abuse, neglect, and household dysfunction [1]. Exposure to ACEs has been linked to long-term health outcomes such as obesity, depression, and chronic disease [2]. This study examined the association between ACE exposure and obesity among young adults aged 18–24 using data from the 2019 Behavioral Risk Factor Surveillance System (BRFSS). The analytic sample included 8,621 respondents representing approximately 13,121,538 young adults in the United States. Univariate and bivariate analyses were conducted to assess relationships between specific ACE categories and obesity. Results indicated that all ACE categories were significantly associated with obesity ($p < 0.05$). The highest prevalence of obesity was observed among individuals reporting sexual abuse (15.4%), being forced to touch a parent or guardian (10.2%), and experiencing unwanted touching by a parent or guardian (9.4%), while other ACE categories ranged from 5.2% to 8.7%. The relationship between ACE exposure and obesity may be explained by biological stress pathways. Chronic exposure to early-life stress can dysregulate the hypothalamic–pituitary–adrenal (HPA) axis and activate immunoinflammatory responses, leading to sustained cortisol imbalance and long-term alterations in metabolic regulation [3]. These physiological changes may contribute to increased visceral adiposity and insulin resistance. Emerging research also suggests that depression and obesity share overlapping biological mechanisms, including HPA axis dysregulation and inflammation, potentially positioning depression as a mediator linking childhood adversity to later metabolic risk. These findings highlight the importance of trauma-informed healthcare, early resilience-building strategies, and routine ACE screening in clinical practice to reduce long-term cardiometabolic risk among individuals exposed to early-life adversity.

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184. Optimizing MS2 Virus-Like Particle Assembly Around Nucleic Acid Cargo for Drug Delivery

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Virus-like particles (VLPs) derived from the MS2 bacteriophage are promising nanocarriers for the delivery of therapeutic molecular "cargo" to diseased cells. The *in vitro* cargo-loading process first requires disassembly of the VLP protein capsid and removal of its native RNA, followed by spontaneous capsid re-assembly around an exogenous, negatively charged cargo, typically nucleic acids. However, there remains no standardized framework for packaging and quantifying the encapsulated cargo: protocol parameters such as disassembly incubation time and re-assembly conditions are not well defined, and packaging efficiency varies with cargo type and structure. Here, we compared multiple quantification techniques for MS2 VLPs and found that traditional absorbance-based measures of MS2 concentration can be cargo-dependent and therefore unreliable for assessing encapsulation yield, particularly across heterogeneous cargoes. We determined that area-under-the-curve absorbance from chromatographic separations provides a rapid yet more consistent proxy for encapsulation yield when supported by mass-based reporting of the cargo-to-protein ratio (as compared to a molar-based ratio). During this process we also identified parameters for a more reproducible re-assembly protocol, including an optimal capsid disassembly incubation time. With this standardized framework in place, we then explored how cargo type and structural features influence differences in cargo-packaging efficiency during *in vitro* VLP reassembly. Specifically, we examined VLP assembly with different nucleic acid cargoes and observed distinct yield and stability profiles, indicating that both chemical composition of cargo (i.e. DNA vs. RNA) and cargo structural determinants, such as stem-loop motifs and secondary structures, modulate packaging efficiency and capsid stability. These findings suggest that maximized VLP assembly and cargo loading require both accurate yield quantification and an understanding of the biophysical principles governing nucleic acid-capsid interactions, including sequence and structural features. This work holds great potential to inform the sustainable and scalable design of emerging VLP-based drug delivery platforms.

181. Man Up! An Exploration into Male Emotional Vulnerability Through the Lens of Collegiate Athletes

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Emotional vulnerability is the voluntary ability to acknowledge and express emotions. This willingness is often averted in social settings for males, especially in the male athletic setting where "mental toughness" is prioritized. In this thesis, male emotional vulnerability is examined within the collegiate male population. It evaluates the psychological impact through utilization of a self-report measure of emotional vulnerability and disclosure within the collegiate circuit, specifically within the NCAA. Participants were recruited from University of Chicago and Ivy League institutions, and all were required to complete an online survey that assessed discomfort with emotional expressiveness among family, friends, teammates, and peers. Both collegiate athletes and non-collegiate athletes participated in order to assess differences between the groups. The experiment utilized a 18-item psychological vulnerability composite including demographics, practice duration, and college experience. The exploratory factor analysis also allowed assessment of other dimensions, specifically self-worth and sports cultural impact. After collecting the survey answers, collegiate athletes reported lower emotional vulnerability than non-athletes with significant difference between the mean scores, and these findings supported the hypothesis, suggesting that collegiate athletics is associated with greater emotional avoidance. The results could demonstrate that team masculine norms and peer pressure increase the inability to share emotions. The results also should promote more help-seeking interventions and mental health treatment, hopefully de-stigmatizing the ideals within toxic masculinity.

182. When Morality and Meritocracy Collide: How Values and Social Closeness Shape Wealth Deservingness Judgments

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Judgments about who deserves wealth and social rewards are primarily guided by two normative principles: meritocracy (effort and responsibility) and morality (benevolent intentions and concern for others' welfare). Although these principles often align, they can conflict when information about how wealth was obtained diverges from information about moral character. Beyond these factors, deservingness judgments may also depend on social closeness. Hence, in this within-subjects study (N = 106), we tested the hypothesis that deservingness judgments are jointly shaped by moral character, source of wealth, and social favoritism.

U.S. adults evaluated targets who obtained money through hard work, luck, or theft and who varied in moral value orientation (benevolence, security, or hedonism). Participants rated each target's deservingness, evaluated a close friend in parallel, and reported their own value priorities and endorsement of meritocratic beliefs.

Results showed that the source of wealth exerted the strongest influence on deservingness judgments: hard work was rated highest and theft lowest. Moral character independently shaped evaluations, particularly when wealth was obtained through luck, but did not override strong merit violations (e.g., theft). Participants also displayed consistent favoritism toward close others, though stronger endorsement of meritocratic principles constrained this favoritism. Together, these findings suggest that deservingness judgments reflect structured integration of meritocracy and morality.

179. Assessing the Impact of BH3 Mimetics on Mitochondrial Dynamics in Activated Human T Lymphocytes

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The B-cell lymphoma-2 (BCL-2) family of proteins controls mitochondrial-based intrinsic apoptosis. BH3 mimetics are small-molecule inhibitors that were developed to specifically engage anti-apoptotic BCL-2 family members, including BCL-2, BCL-X_L, and MCL-1, to induce apoptosis in a wide range of malignancies. However, little is known about how these drugs affect healthy immune cells, which rely on the BCL-2 family of proteins for survival, development, and function. BCL-2 proteins have also been shown to regulate mitochondrial dynamics and mitophagy, but this has not been extensively studied in immune cells. Given that changes in mitochondrial morphology have been shown to alter T cell energy production and effector functions, we investigated how BH3 mimetics alter mitochondrial dynamics in T cells isolated from human peripheral blood mononuclear cells and expanded *ex vivo* in the presence of these therapeutics. To do this, T cells were treated with sublethal doses of BH3 mimetics to enable assessment of mitochondrial dynamics in non-apoptotic cells. Confocal microscopy of $CD4^+$ T cells revealed that inhibition of BCL-2 promotes mitochondrial fission, whereas inhibition of MCL-1 induces mitochondrial fusion. However, treatment of $CD4^+$ T cells with either BCL-2 or MCL-1-specific BH3 mimetics caused a two-fold increase in mitochondrial mass and membrane potential measured by flow cytometry, suggesting improved mitochondrial health and energy capacity. Thus, it appears that different anti-apoptotic BCL-2 family proteins may exert distinct effects on mitochondrial morphology independently of their anti-apoptotic functions. Future work will test whether these changes are mediated through phosphorylation and subcellular translocation of the fission mediator Drp-1, and whether distinct BH3 mimetics alter protein-protein interactions between BCL-2 family members and fission and fusion-related proteins. This work will uncover how BH3 mimetics alter mitochondrial morphology in immune cells, shedding light on their non-apoptotic immunomodulatory potential for the treatment of immunologically-relevant diseases.

180. Deficits in Contextual Remapping Underlie the Tendency to Generalize Fear: Implications for Post-Traumatic Stress Disorder

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Women are disproportionately vulnerable to developing Post-Traumatic Stress Disorder (PTSD), yet the neurobiological mechanisms underlying this susceptibility remain poorly understood. A core symptom of PTSD is fear generalization, in which fear learned in a specific context is inappropriately expressed in safe contexts. We propose that fear generalization reflects impaired memory-updating, characterized by a failure to remap trauma-related memory traces in the presence of new information (e.g., safety signals) and their persistent reactivation outside the original trauma context. Memories are stored as hippocampal engrams, providing a tractable framework for examining memory flexibility. Here, we investigated sex and individual differences in fear-related engram remapping within the dorsal dentate gyrus using WT male and female mice from both inbred (C57BL/6) and outbred (Swiss Webster) strains. Fear memory ensembles were tagged using the TetTag system, followed by immunohistochemistry and fluorescent confocal microscopy to quantify engram overlap. Mice were pre-exposed to a neutral context (B), fear conditioned in a distinct context (A) during which the fear engram was tagged and tested 24 hours later in either the conditioned (retrieval) or neutral (generalization) context, followed by testing in the alternate context. Brains were then collected to assess overlap. In parallel, mice were pre-screened using an acoustic startle reflex (ASR) assay to classify individuals as stress-susceptible or resilient prior to fear learning. We predict that fear generalization is associated with impaired engram remapping. We further predict that ASR-based pre-screening reliably predicts both behavioral fear generalization and engram-level remapping deficits.

177. Influence of Candida Derived Arginine on Salmonella Virulence

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Salmonella enterica serovar Typhimurium is an enteric, facultative intracellular bacterial pathogen known for causing gastroenteritis in humans. Invasion of the intestinal epithelium by *Salmonella* is driven primarily by the Type III Secretion System 1 (T3SS-1), a syringe-like apparatus that translocates effector proteins into epithelial cells to manipulate the cytoskeleton to facilitate bacterial entry. Recent studies suggest a novel interplay between *Salmonella* and the gut commensal fungal opportunist, *Candida albicans*. Notably, a T3SS-1 dependent interaction tied to the upregulation of L-arginine in *C. albicans* by *Salmonella* has been observed in both in vitro & in vivo co-culture models. This increase in L-arginine correlated with enhanced gene expression of the T3SS-1 and increased epithelial invasion of *Salmonella* within the host. To investigate this mechanism, this study examined gene knockouts of arginine transporters and regulators in *Salmonella*. Results have indicated that co-culture with *C. albicans* or supplementation with L-arginine increased T3SS-1 gene expression and further propagated invasion into the host. Gene knockouts of arginine transporters and regulators in *Salmonella* reduced T3SS-1 activity and impaired invasion of the host, supporting the notion that fungal-derived arginine can act as a key signal promoting *Salmonella* virulence in the gut. This study aims to elucidate the precise role of L-arginine on *Salmonella* Typhimurium virulence in vitro. These findings could offer insight into how fungal-derived metabolites influence bacterial pathogenesis and provide a framework for future studies on fungal-bacterial interactions.

178. A Novel Function of CXCR-4: Findings from Proteomic and Lipidomic Analysis of Oligomeric Assemblies

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G-protein-coupled chemokine receptors facilitate the migration of leukocytes to sites of inflammation, infection, or injury. Excessive activation of leukocytes is observed in inflammatory diseases and many forms of cancer in an aggressive immune response. Chemokine receptors are thus an important target for therapeutic development. Our previous research has found that chemokine receptors form oligomeric assemblies at high cell surface density, leading the receptors to allosterically modulate their structure, remodel ligand binding sites, and enhance G-protein activation. It has been demonstrated that there is an increased presentation of chemokine receptors is observed on the cell surface in oncogenic cells as well as in the cells of patients with neurological and neuroinflammatory diseases, resulting in the inflammatory response. Proteomics and lipidomic analysis reveal unique signaling pathways and receptor-associated lipids between monomeric and trimeric CXCR-4, indicating a unique function of these oligomeric assemblies. Data shows increased levels of proteins involved in the oxidative stress response in the trimeric samples, indicating a probable role of trimeric CXCR-4 in managing oxidative stress and responding to reactive oxygen species. We also find significant difference in ether-linked CXCR-4 associated lipids, suggesting a role in the progression of metabolic disease. This study aims to elucidate major differences between oligomeric assemblies and their potential role in pathogenesis. We anticipate these findings will assist in the development of pharmaceuticals and therapies for the many diseases in which CXCR-4 is implicated.

175. The Distinct and Overlapping Roles of Endothelial Notch1 and Notch4 in Retinal Endothelial Angiogenesis

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Angiogenesis is the process of the formation of new blood vessels from pre-existing ones. Notch signaling is a juxtacrine signaling pathway that plays a critical role in the mediation of this process. Of the four Notch proteins, Notch1 has been extensively studied, while the role of Notch4 in vascular development is less well understood. Notch1 is broadly expressed in many different cell types. Meanwhile, Notch4 is predominantly found in endothelial cells and has been less extensively studied. The murine retinal angiogenesis model has shown that the loss of endothelial Notch1 results in hypersprouting while the global loss of Notch4 is characterized by reduced radial outgrowth of vasculature. However, their similar protein structure and targets suggest that Notch1 and Notch4 may have overlapping functions. Therefore, we hypothesize that endothelial Notch1 and Notch4 have both distinct and redundant roles in angiogenesis. To investigate this further, we used four experimental groups: control mice with only the Cre allele, an endothelial Notch4 knockout group, an endothelial Notch1 knockout group, and a double mutant endothelial Notch1; Notch4 endothelial knockout group. Mice were injected with tamoxifen at either postnatal days 1-3 or days 5-7 to knockout endothelial Notch4 and/or Notch1 at different points of vascular plexus development. Retinas were harvested from mice at postnatal day 5, day 10, and day 12 to analyze vascular growth in the superficial and deeper plexuses. Samples underwent wholemount immunofluorescence staining for Isolectin B4 to identify vasculature, Iba1 to identify macrophages, and ESM1 to identify tip cells. Vascular smooth muscle cells and pericytes were also identified with alpha SMA and NG2 staining, respectively. Retinas were then mounted and imaged using widefield microscopy for vascular analysis.

176. ERα Knockout in Pdgfrα+ Cells Impairs Beige Adipogenesis and Thermogenesis via TGFβ Activation

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Beige adipocytes within inguinal white adipose tissue (iWAT) contribute to thermogenesis and energy expenditure and represent a potential target for obesity-related metabolic disorders [1]. However, the molecular mechanisms regulating beige adipocyte formation remain incompletely understood. We hypothesized that estrogen receptor alpha (ERα) signaling in platelet-derived growth factor receptor alpha–positive (PDGFRα$^+$) progenitor cells is required for beige adipogenesis [2]. To test this hypothesis, we generated Pdgfrα-specific ERα knockout mice (PRα–ERα KO) and evaluated beige fat formation under cold exposure. Loss of ERα in PDGFRα$^+$ cells resulted in impaired cold-induced beige adipocyte differentiation, reduced thermogenic gene expression, increased adipose tissue fibrosis, and metabolic dysfunction. Mechanistic analyses revealed that ERα deletion enhanced transforming growth factor beta (TGFβ) signaling, which suppressed the differentiation of smooth muscle actin–positive (SMA$^+$) progenitor cells into beige adipocytes. Pharmacological inhibition of TGFβ signaling using the small-molecule inhibitor CJJ300 restored beige adipogenesis in PRα–ERα KO mice, reduced fibrotic remodeling, and improved thermogenic capacity. Notably, aged mice exhibited similar defects in beige fat formation and thermogenic function, which were also substantially rescued by CJJ300 treatment. Together, these findings identify ERα–TGFβ signaling crosstalk in PDGFRα$^+$ progenitor cells as a critical regulatory pathway governing beige adipocyte biogenesis. Targeting TGFβ signaling may therefore represent a promising therapeutic strategy to enhance thermogenesis and counteract obesity-associated metabolic decline, particularly in aging populations.

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173. Designing Structure-Guided Inhibitors of eIF2A as a Therapeutic Strategy for Cancer Pathogenesis

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Squamous Cell Carcinoma (SCC) is an aggressive malignancy driven in part by dysregulated protein synthesis. Cancer cells rewire translation to upregulate oncogenic proteins, making translational regulators attractive therapeutic targets. eIF2A (eukaryotic initiation factor 2A) is highly expressed in SCC, lung, and ovarian cancers and correlates with poor patient prognosis, yet the lack of structural and functional characterization has impeded drug development efforts.[1,2] We hypothesize that eIF2A promotes tumorigenesis by remodeling translation of oncogenic transcripts, and that disrupting its interaction with the 40S ribosomal subunit will inhibit cancer cell growth.

Using biochemical and structural approaches, we have characterized the eIF2A-40S interaction. eIF2A comprises three main domains: C-terminus α-helical domains (RAD1 and RAD2) and a β-propeller WD40 domain. Biolayer interferometry (BLI) revealed that full-length His-tagged eIF2A binds 40S ribosomal subunits with a robust nanomolar affinity (Kd = 1.4 nM). Single-particle cryo-electron microscopy resolved the eIF2A-40S complex to precise 2.8 Angstrom units, showing the WD40 domain positioned above the P-site while the C-terminal helical domains anchor to the 40S body. Mutational analyses confirmed that the C-terminal domain (residues 428–585) is responsible for 40S binding (Kd = 2.3 nM), while the isolated WD40 domain shows no detectable interaction.

Building on this structural foundation, structure-guided small molecule inhibitors targeting the C-terminal helical domains of eIF2A are being developed to disrupt 40S engagement. De novo virtual screening and AI-driven modeling using Boltz Gen, BindCraft, AlphaFold2, and ChimeraX will be performed against commercially available compound libraries, with top candidates validated by BLI and cell-based assays in SCC cell lines. These studies aim to establish eIF2A inhibition as a first-in-class therapeutic strategy for SCC and potentially other cancers driven by translational remodeling.

174. Analysis of Tumor Cell and Neutrophil Distribution Relative to ACKR1 Expressing Venules During Breast Cancer Metastasis

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Metastasis is the leading cause of breast cancer-related mortality. However, the success of metastatic colonization is not solely determined by tumor cells' ability to disseminate; it is also influenced by the establishment of premetastatic niches within distant organs. Neutrophils promote lung metastasis by priming the premetastatic niche to make it a more hospitable environment for disseminating tumor cells. Atypical Chemokine Receptor 1 (ACKR1) is expressed on endothelial cells and is critical for neutrophil migration in inflammatory conditions, but its role has not previously been characterized in pre-metastatic niche formation.

We hypothesize that eliminating this endothelial ACKR1 may reduce neutrophil extravasation into the lungs, thereby disrupting the formation of the pre-metastatic niche and decreasing metastasis. To study the role of endothelial ACKR1 in tumor cell and neutrophil extravasation, we analyzed the distribution of disseminating tumor cells and neutrophils relative to ACKR1-positive versus ACKR1-negative vessels in the lungs of orthotopic mammary tumor-bearing mice. To analyze disseminating tumor cells and extravasated neutrophils, we performed immunofluorescent staining of lung vasculature from immunocompetent mice implanted with E0771.LMB mammary tumor cells 28 days post-tumor injection. We developed a semi-automated workflow to analyze the distance between disseminated tumor cells, neutrophils, and their proximity within 50, 100, or 150 microns of ACKR1-positive or -negative venules. Our analysis revealed a significant increase in the average number of tumor cells within 50 microns of ACKR1-positive venules compared to ACKR1-negative venules. Similarly, neutrophil analysis showed a significant increase in neutrophils within 50 microns of ACKR1-positive venules. These findings demonstrate that both disseminated tumor cells and neutrophils preferentially localize near ACKR1-positive lung venules during breast cancer metastasis, suggesting that both cell types extravasate preferentially through ACKR1-expressing venules. Understanding this mechanism may open new avenues for therapeutic strategies aimed at mitigating breast cancer metastasis.

171. Acceleration of Cardiac MRI Water Fat Separation and Chemical Shift Correction Using Temporal Information

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For select magnetic resonance (MR) acquisitions in the cardiothoracic region, the separation of water and fat signals by means of chemical shift correction is paramount for quantitative characterization. Conventional methods utilize iterative optimization-based separation, and while effective in most anatomical regions, cardiac water fat separation suffers from suboptimal initialization. Here, we examine a multistep graph cut initialization method known as Simultaneous Phase Unwrapping and Removal of Chemical Shift (SPURS) [1] applied to data obtained across a cardiac cycle. Inherent is the physiological consistency of fat between timepoints in motion-invariant regions, that can be exploited by constructing a single low-rank initialization seed point derived across multiple cardiac phase volumes. A series of low-rank plus sparsity (L+S) decomposition algorithms was optimized to separate beating motion and temporal outliers. Singular Value Decomposition (SVD) was employed across the temporal dimension of the cardiac MR data to compute SPRUS using the primary non-sparse channels, thereby lessening the weight of sparse channels that contain outliers. The proposed processing was compared against conventional SPURS processing per volume frame. Region-of-interest measurement analysis was performed by AHA-classified ROIs (n=960) using both SPURS outputs. Computation benchmarking was additionally performed. Three quantitative measurements were derived after water fat separation occurred to evaluate the multivariable optimization at every time point. This similarity was achieved with 2.13 ± 0.31 acceleration on an Apple M4 Pro System. Pearson's correlation yielded R=0.93 and 0.97 (n=960) in derived quantitative ROI measures, where numerical outliers suggested algorithmic correction of failed measures using our method. This approach with two-fold computation reduction, yielded comparable outputs while further addressing initialization errors associated with SPURS.

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172. Corticotropin-Releasing Factor Signaling in the Medial Prefrontal Cortex Modulates Fear Generalization in a Sex-Specific Manner

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Post-traumatic stress disorder (PTSD) is a severe psychiatric condition often marked by fear generalization, in which threat responses extend to stimuli beyond the original traumatic event. The medial prefrontal cortex (mPFC) plays a central role in fear learning and expression, making it a key target for studying anxiety disorders and PTSD. Corticotropin-releasing factor (CRF), a stress-related neuropeptide, is expressed in a subset of inhibitory interneurons in the mPFC and is often elevated in the cerebrospinal fluid of individuals with PTSD, suggesting persistent CRF neuron hyperactivity. Within the mPFC, CRF primarily acts on corticotropin-releasing factor receptor type 1 (CRF1), located on excitatory projection neurons that influence downstream fear circuits. However, the specific role of mPFC CRF-CRF1 signaling in fear behaviors, particularly fear generalization, remains unclear. We hypothesized that fear expression would increase CRF release, and that inhibiting or activating mPFC CRF neurons would decrease or increase fear behaviors, respectively. To test this, we used a classical auditory Pavlovian fear conditioning task, pairing a tone with a shock in mice. We then used fiber photometry with a CRF sensor to measure mPFC CRF release, optogenetics to test the causal role of mPFC CRF neurons, and pharmacology to test the necessity of CRF1 signaling. Fear conditioning increased both freezing behavior and CRF release during acquisition and generalization. In males, inhibiting mPFC CRF neurons reduced freezing during fear generalization, but not during acquisition or recall, an effect not observed in females. Conversely, activation of mPFC CRF neurons increased freezing during generalization in males, suggesting a causal role of mPFC CRF neurons in regulating fear generalization. Also, pharmacological inhibition of CRF1 showed a general trend toward reduced freezing. These findings support a sex-specific circuit mechanism in which mPFC CRF-CRF1 signaling selectively regulates fear generalization, advancing our understanding of neural mechanisms underlying PTSD and anxiety disorders.

169. Neural Signatures of Human- and Large-Language-Model- Derived Surprise in Story Listening

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You might remember feeling surprised by a plot twist in a story. Surprise is a cognitive process that occurs when reality deviates from our expectations, and can arise in a variety of contexts – encountering an unexpected conversation, watching an unexpected play in a sports game, or reaching an unexpected outcome in a board game. Previous research identified a brain-based model that predicts surprise in a learning task and, importantly, generalizes to predict surprise while subjects watched a basketball game [1]. Here, I extend this framework to language and ask a novel question: what are the behavioral, neural, and computational mechanisms of linguistic surprise? Participants (n=90) listened to short narratives and provided continuous self-ratings of surprise, while we collected functional near-infrared spectroscopy (fNIRS) data. We quantified large language model (LLM) measures of narrative surprise by prompting an LLM to generate text predictions as additional story context is revealed. We computed two metrics: (1) surprisal, defined as how unlikely the model judges the upcoming word to be given the preceding context, and (2) representational dissimilarity, defined as how different the model's internal semantic representations are between the actual text and its own predicted text as the story unfolds. We observe stronger alignment between representational dissimilarity and human surprise ratings than surprisal, suggesting that narrative surprise may be better captured by changes in internal semantic representations rather than word-level improbability. Furthermore, fNIRS analyses reveal brain regions associated with human-rated and LLM-derived surprise dynamics. Together, these findings shed light on the neural dynamics underlying linguistic surprise and position LLMs as a useful computational framework for studying narrative expectations and comprehension.

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170. Culture of Divinity: Sacred Space and Folk Aesthetics in the 'Young Poland' Visual Canon

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This paper addresses the themes of folk aesthetics and their use by artists of the Young Poland movement to delineate sacred space and develop national visuals. My research focuses specifically on the renovation and redecoration of church interiors in Kraków, Poland, during the late 19th century and the beginning of the 20th century. The analyzed spaces include the St. Mary's Basilica, Basilica of St. Francis of Assisi, and Wawel Cathedral, all of which constitute important religious monuments within the city. By examining the projects completed by Poland's most famous artists at the time, Jan Matejko, Stanisław Wyspiański, and Józef Mehoffer, in the mediums of polychrome as well as stained glass, I aim to present the underlying contexts of artistic creation during this period. Considering the shift in cultural dynamics with the elimination of serfdom, lack of Polish political autonomy, and Western artistic influence, the climate in which the Young Poland current developed warrants further examination of its art's reflection of exterior modernist trends as well as unique cultural introspection. That which forms the central investigation of this research is the aforementioned artists' inclusion of Polish traditional crafts and folk elements within religious decoration, acting as a visual code in expression of national unity through the incorporation of newly emancipated serfs. This involves the analysis as well as cultural interpretation of representations showcasing folk patterns, native flora, and peasant imagery executed in the public worship spaces of urban churches. Supplementing general English-language art historical studies on the art of Young Poland, my thesis discusses the movement's effective conflation of religious and socio-national themes to create patriotic messages.

168. Concentration-Dependent Pro- and Antithrombotic Effects of Proton Pump Inhibitors are Associated with ATP6V and VEGFR Signaling

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Venous thromboembolism (VTE), a pathological clot formation in the venous system, is the third leading cause of cardiovascular mortality. VTE can be either acquired (e.g., from elevated estrogen levels) or inherited. Blood thinners are standard-of-care medications, but carry significant bleeding risks, highlighting the need for safer therapies. Our laboratory previously screened FDA-approved drugs in zebrafish models of VTE, leveraging zebrafish for their conserved coagulation pathway, optical transparency, and high fecundity (Yaman, Su, et al., 2025). The results identified that for estrogen-induced VTE, proton pump inhibitors (PPIs) had dual effects: nanomolar-to-micromolar concentrations increased clot formation (prothrombotic), while higher PPI levels (>5 μM) were antithrombotic (Yaman, Habiger, et al., 2025). Electronic health records reflected the prothrombotic influence, showing higher thrombosis rates in patients on PPIs and estrogen-containing contraceptives. The V-type ATPase proton pump (ATP6V) was hypothesized to mediate this effect. Complete knockouts of the catalytic subunits (*atp6v1aa* and *atp6v1ab*) led to >50% increase in thrombosis in controls, even without estrogen treatment. CRISPR-mediated knockdowns of other subunits (*atp6v0c* and *atp6ap2*) recapitulated the prothrombotic effect, emphasizing ATP6V as a major modifier of thrombosis. To explain the antithrombotic effects at higher concentrations, we hypothesize that PPIs may engage with secondary targets to attenuate the prothrombotic response. At high PPI concentrations, which caused >40% reduction in estrogen-induced VTE, no abnormalities/lethality were observed, implying involvement of mechanisms besides ATP6V. Computational studies using SwissTargetPrediction suggested vascular endothelial growth factor receptors (VEGFRs) as secondary PPI targets. The effect of PPIs against estrogen-induced VTE was partially diminished in VEGFR3 knockouts, supporting a mechanistic role for VEGFR3 - investigations on other VEGFRs are pending. Our data suggest ATP6V and VEGFRs as candidate modifiers of estrogen-induced thrombosis. Further study of these may improve strategies for disease management and targeted therapies.

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166. Determination of Heavy Metal Content in Chicago Industrial Corridors

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Industry plays a prominent role in Chicago's economy, emphasized by the creation of industrial corridors to facilitate industrial activity by the City of Chicago. Over the last century, these industrial corridors have been used continually for industrial practices, like metalwork or energy production. Industry is a source of pollution, notably heavy metal pollution. As such, industrial corridors likely contain larger amounts of pollution than non-industrial areas. While some heavy metals play an important role in human health, others, like cadmium, chromium, and lead, can be extremely harmful, posing threats to residents in industrial areas. Thus far, copper, cadmium, chromium, and lead have been quantified in soil and plant samples from industrial corridors using atomic absorption spectroscopy. Notably, a distribution center in Little Village contained levels of copper, cadmium, chromium, and lead that exceeded safe levels of heavy metal content in soil. Due to the high levels of heavy metals in industrial corridors like Little Village, the effectiveness of wild carrot, or *Daucus carota*, as a bioindicator will be explored. *Daucus carota,* if deemed effective, can be analyzed for unsafe levels of heavy metals because of its ability to uptake copper, cadmium, chromium, and lead in industrial corridors. Wild carrot plants have been grown in soil exposed to various concentrations of heavy metals; the plants and their soil have been analyzed via atomic absorption spectroscopy to measure the uptake of heavy metals in the plant. Overall, this project has revealed the dangerous levels of heavy metal in Chicago industrial corridors and continues to investigate the usage of *Daucus carota* as a bioindicator in future pollution research.

167. Reassessing Beta-Blockers in HFpEF, Prescribing Patterns and Outcomes in the Cardiometabolic Center Alliance Registry

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Beta-blocker (BB) therapy improves survival in heart failure with reduced ejection fraction, but its role in heart failure with preserved ejection fraction (HFpEF) is uncertain. Recent post-myocardial infarction trials have further questioned routine, long-term beta blockade. We analyzed 620 adults in the Cardiometabolic Center Alliance registry (March 2019 - May 2025) with HFpEF and two or more visits across 11 sites. BB exposure was categorized as none, low, moderate, or high per guideline dose equivalents.
Among 620 patients, 72.8% were on BBs at index: 3.3% low-, 80.0% moderate-, and 16.7% high-dose therapy. Dose intensity was not aligned with recent ischemic events: 83.2% of patients whose coronary events occurred over 12 months prior remained on moderate-high doses. Guideline-directed HF disease-modifying therapies were underused and less frequent without BBs (ARNI 11.3% vs 6.5%; SGLT2 inhibitor 60.4% vs 58.9%). Unadjusted one-year HF hospitalization (22.4% vs 23.0%) and syncope (3.8% vs 3.6%) were similar for BB-treated vs untreated patients.
In this multisite HFpEF cohort, nearly 75% of patients received BB therapy, most at moderate or high doses, despite limited HFpEF-specific benefit and few hemodynamic indications. These patterns reflect a lack of tailored prescribing and highlight opportunities to de-escalate or discontinue therapy in selected patients while emphasizing lifestyle and alternative treatments.

164. The Efficacy of the Potent LRRC8/VRAC Inhibitor DCPIB Is Limited by Its Cell Permeability and Off-Target Effects on Ca^{2+} Signaling

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Volume-regulated anion channels (VRACs), composed of leucine-rich repeat-containing 8 (LRRC8) proteins, are emerging as promising therapeutic targets, but their pharmacology is poorly defined. Small-molecule VRAC inhibitors share lipophilic properties and exhibit a wide range of off-target effects, rendering them unsuitable for physiological studies [1]. Furthermore, the mechanisms of action underlying their on- and off-target effects remain largely unclear. Here, we use intracellular calcium measurements, cell viability assays, and membrane permeability assays to show that the best-in-class small-molecule inhibitor of VRACs, DCPIB, exerts its cellular effects by accumulating in and permeating the cell membrane in an albumin-dependent and VRAC-independent manner. Additionally, we find that in conditions lacking serum or albumin, DCPIB not only inhibits VRAC function but also disrupts store-operated Ca^{2+} entry (SOCE), Ca^{2+} signaling, and the activation and function of human and mouse T cells. Mechanistically, we use mitochondrial function assays, fluorescence microscopy, and western blotting to show that DCPIB depolarizes the mitochondrial membrane potential, leading to disruption of Ca^{2+} signaling, increased oxidative stress, actin aggregation, and apoptosis in T cells. These adverse effects are completely mitigated by the presence of serum or albumin in the buffer or culture media. Interestingly, while knocking out LRRC8A and LRRC8C protects T cells from VRAC-mediated cell death, DCPIB and dicumarol failed to mimic this effect under standard culture conditions, suggesting that the ability of DCPIB to accumulate or permeate the cell membrane is critical for inhibiting LRRC8/VRAC transport. Our results demonstrate that even though DCPIB is a potent inhibitor of VRACs, its use in functional studies may be limited by its cell permeability and off-target effects on Ca^{2+} signaling. As such, we strongly recommend avoiding the use of DCPIB in functional in vitro and in vivo studies and suggest limiting its application to short-term electrophysiological experiments to prevent confounding effects.

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165. Quantifying Ionospheric Delay Variations from Satellite Ephemeris Errors in Distinct Solar Periods

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The rapid expansion of Low-Earth Orbit (LEO) satellite services has made it essential to understand how satellite positioning errors affect signal propagation. Some orbit determination methods exhibit initial errors on the order of kilometers, which grow over time due to unmodeled forces such as atmospheric drag. The goal of this research is to quantify how satellite ephemeris errors translate into ionospheric signal delay, and how this relationship varies across different phases of the solar cycle. The Sun follows an 11-year magnetic activity cycle that directly influences the Total Electron Content (TEC) of Earth's ionosphere, which in turn governs the delay experienced by satellite signals. Our hypothesis is that ephemeris-induced delay errors are not negligible in high-precision applications and that they are significantly larger during periods of maximum solar activity. Vertical TEC profiles were generated using the International Reference Ionosphere (IRI) model at 1 km altitude resolution for two contrasting solar conditions: solar minimum (December 1, 2019) and solar maximum (August 1, 2024), at a location near Chicago (42° N, -88° W). Earth was modeled as an ellipsoid, and slant signal paths through the ionosphere were formulated as a function of elevation angle. The slant TEC was computed by integrating the vertical electron density profile along the discretized signal path using the trapezoidal rule. Orbital position offsets of 2.5 km and 10 km were applied to simulate ephemeris errors, and both the absolute (TECU) and percentage delay errors were calculated. Results show that for a 500 km altitude satellite, absolute and percentage errors peak at elevation angles near 20° and 30°, respectively. Counterintuitively, the solar minimum period exhibits higher percentage errors. For a Ku-band satellite (10.7 GHz) such as Starlink, a 2.5 km orbital error introduces delays of up to 1.8 picoseconds during solar maximum, while lower-frequency VHF-band meteorological satellites (137 MHz) can experience delays reaching 11 nanoseconds. These findings demonstrate that satellite ephemeris errors produce measurable ionospheric delays that should be accounted for in mission planning and high-precision system design.

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162. Telomere Dysfunction in Drug Resistant Glioblastoma and Therapeutic Targeting With the Nuclear Import-Export Inhibitor KPT-330

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Glioblastoma (GBM) is a deadly cancer where the standard of care treatment is the guanine-targeted chemotherapy – temozolomide (TMZ) [1]. Post-TMZ treatment, gross nuclear and chromosomal abnormalities are observed. To protect chromosome integrity, the shelterin complex binds G-quadruplexes (G4s), guanine-rich structures that can be found in telomeres [2]. Disrupted shelterin binding can cause telomere crisis, nuclear envelope rupture, and ultimately the DNA damage phenomenon chromothripsis (CT) [3]. Here we show that TMZ disrupts shelterin binding and increases both nuclear envelope rupturing and chromothripsis. We investigate the hypothesis that TMZ treatment increases cell reliance on nuclear import-export machinery, making TMZ-resistant cells more sensitive to the nuclear export protein (XPO1) inhibitor KPT-330. To study telomeric mechanisms and interactions with KPT-330 in drug sensitive and resistant GBM, we used PacBio HIFI sequencing, immunofluorescence and cell-proliferation assays for in vitro mechanistic studies. We also used KPT-330 (Selinexor) treated clinical trial samples to determine the clinical efficacy of targeting a nuclear export protein in combination with TMZ in a real world setting. We show that TMZ-resistant GBM cells display shortened telomeres, and the canonical chromothripsis markers of nuclear envelope rupturing and protein mislocalization in vitro. We show that chromothripsis-positive TMZ-resistant cells have significantly increased sensitivity to the XPO1 inhibitor KPT-330, as compared with TMZ-sensitive cells. We also find that CT is sufficient for KPT-330 induced cell death, and that G-targeted chemotherapies specifically can increase KPT-330 sensitivity. Finally, we observe that patients treated with KPT-330 (Selinexor) see a decrease in CT markers, where higher baseline CT markers led to longer overall survival. Overall, our findings show that G-targeted chemotherapy can increase chromothripsis which leads to increased nuclear envelope rupturing and protein mislocalization. These changes affect telomere integrity, leading to increased dependence on import/export machinery and increased sensitivity to KPT-330 both in vitro and in patients.

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163. Substrate Temperature Preference During Egg-Laying in Drosophila

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Ectotherms like fruit flies cannot regulate their internal body temperature and instead rely on behavioral strategies to avoid temperatures outside of their optimal range. Unlike adult flies, *Drosophila* larvae are limited in their ability to escape unfavorable conditions, and thus, female flies carefully select the substrate where they lay eggs to increase the survival of the progeny; however, little is known about how temperature affects this behavior in *Drosophila*. We developed a new 2-choice temperature assay, where gravid female flies are given a choice between substrates kept at different temperatures, and observed that *Drosophila* evaluate substrate temperature when choosing where to lay eggs. In addition, we investigated the preferred temperature for egg-laying in *Drosophila* species from different thermal environments. *D. melanogaster*, a cosmopolitan species, prefers 25°C over hotter or cooler temperatures. *D. teissieri*, from sub-Saharan tropical rainforests, strongly avoids 30°C, but does not have a preference in the cooler range. *D. yakuba* from African savannahs, displays an avoidance for 30°C and 15°C and lays eggs at 20-25°C. *D. santomea*, a species from the São Tomé Island, prefers 25°C over cooler temperatures, but does not show a preference in the hotter range. These results suggest that substrate temperature preference during egg-laying is species-specific, and this behavior may have adapted to match the temperature of the native environment. Finally, we found that a known thermosensor does not mediate temperature preference in egg-laying, suggesting that a novel thermosensory circuit is likely involved in this behavior.

161. VT-109 Restores Alveolar-Capillary Barrier After COVID-19 Related Lung Injury in Preclinical Models

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Severe COVID-19 pneumonia causes persistent damage to the alveolar epithelium, disrupting the alveolar-capillary barrier and leading to pulmonary edema. Despite the role of endothelial dysfunction in COVID-19 pathology, only a few therapeutic strategies specifically target vascular repair mechanisms. The goal of this study was to determine whether VT-109, an allosteric inhibitor of end-binding protein-3 (EB3) that blocks pathological calcium signaling in endothelial cells and stabilizes VE-cadherin junctions, can restore lung vascular integrity and support epithelial repair following COVID-19-related lung injury. Using preclinical models of SARS-CoV-2 pneumonia, we assessed pulmonary vascular leakage, lung edema, and structural injury to both endothelial and epithelial barriers. VT-109 treatment was administered following infection, and outcomes were measured using albumin extravasation assays, histological analysis, and bronchoalveolar lavage protein quantification. VT-109 treatment significantly reduced albumin extravasation, indicating restoration of endothelial barrier function. Importantly, VT-109 promoted regeneration of damaged alveolar epithelial cells, resulting in improved lung structure and function, assessed by histopathological scoring. Mechanistically, VT-109 inhibited calcium-dependent NFAT/NFκB signaling in endothelial cells, promoting reannealing of VE-cadherin junctions. Results in mice model of COVID-19 demonstrated that VT-109 rapidly restored the pulmonary endothelial barrier as reduced protein levels in bronchoalveolar lavage. These results identify endothelial calcium signaling as a key regulator of lung barrier dysfunction in COVID-19 and establish VT-109 as a promising therapeutic candidate capable of accelerating recovery by promoting vascular repair. This work advances our understanding of post-acute sequelae of COVID-19 and provides a mechanistic foundation for developing targeted therapies that address persistent lung injury.

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159. Adaptive Kalman Filtering and Correlated Noise: Dynamic Process-Noise Covariance Scaling for Financial Time Series Forecasting

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The Kalman filter is one of the most influential algorithms for recursive estimation in noisy systems, with applications spanning aerospace navigation to financial forecasting. At its core, it is a state-space framework grounded in Bayesian inference that produces both point estimates of latent states and measures of uncertainty. While financial markets present an appealing domain for Kalman filtering, practical applications remain limited because the standard filter assumes Gaussian disturbances and fixed noise covariances; assumptions frequently violated by regime shifts, volatility clustering, and heavy-tailed return distributions. A central limitation is the specification of the process-noise covariance matrix Q_t, which governs how uncertainty enters the state dynamics. Typically treated as fixed or estimated via maximum likelihood over rolling windows, Q_t adapts slowly to structural market changes, leading to persistent forecast errors during regime transitions. This paper proposes a lightweight scaling mechanism that dynamically adjusts Q_t using a dynamic factor g_t derived from the normalized innovation squared (NIS). Unlike Mehra's classical covariance moment-matching approach, which relies on iterative optimization, our method directly scales the covariance matrix in the correct direction using recent innovation statistics to respond rapidly to regime changes. We evaluate this approach within a two-factor state-space framework inspired by the Schwartz–Smith commodity pricing model, comparing four specifications: a baseline Kalman filter, the proposed g-scaling model, Mehra's method, and a combined specification. Results demonstrate that the proposed g-scaling mechanism yields an 18% increase in both RMSE and MAE efficiency relative to Mehra's specification, with approximately half of the gain arising independently of Mehra's structure, confirming that the two methods capture complementary sources of misspecification. Distributional testing via the Kolmogorov–Smirnov test shows that the baseline Kalman filter fails chi-squared alignment, while all augmented models pass. The combined model reduces tail misspecification by 66% relative to the standard filter and improves Mehra's tail calibration by 20%, achieving the closest empirical coverage to the theoretical 95% threshold.

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160. Potential Interactions Between Pharmaceuticals and Microbial Biofilms on Microplastic Surfaces

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Microplastics (MPs) and pharmaceuticals are both anthropogenic contaminants commonly found in urban streams. Pharmaceuticals can absorb MP surfaces due to their high surface area and hydrophobicity. In urban streams, MP surfaces are also colonized by microbial biofilms, which are communities of surface-attached microorganisms that can include both bacteria and algae. Biofilms are important members of stream ecosystems that contribute to nutrient cycling and serve as a valuable food source for higher-trophic level organisms, including invertebrates and fish. Previous studies have demonstrated significant impacts of various pharmaceuticals on stream biofilms, but the potential role of MPs in facilitating interactions between pharmaceuticals and biofilms remains poorly understood. We hypothesized that pharmaceuticals would adsorb to MPs when both were present in laboratory-scale stream mesocosms, and that the adsorption of pharmaceuticals onto MPs would alter the diversity and composition of microbial biofilms colonizing the MPs. We added polyester fibers to twelve stream mesocosms, and to a subset of streams, we added a cocktail of seven pharmaceuticals (acetaminophen, azithromycin, caffeine, ciprofloxacin, diphenhydramine, erythromycin, sulfamethoxazole) at environmentally relevant concentrations. Streams were run for 15 days, and then MP and water samples were collected. HPLC analysis confirmed the adsorption of all seven pharmaceuticals to the MPs. Bacterial and algal communities on the MPs and in the stream water were analyzed by amplicon sequencing and bioinformatics analysis. Results indicated that the addition of pharmaceuticals did not alter the diversity or composition of bacterial or algal communities on the MPs or in the stream water, which contradicted our hypothesis. This lack of effect may be attributable to the low concentration of pharmaceuticals added to the streams or the short duration of the experiment.

157. What Drives Variability in Salivary Progesterone among Males?: An Exploratory Study in Outpatients with Cannabis Use Disorder

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Salivary progesterone (P4) in males remains poorly categorized, despite growing evidence that biological, environmental, and demographic variables influence sex hormone patterns. Little empirical work has examined these influences on male salivary P4 levels or their stability over time. Archival data from male outpatients with cannabis use disorder (CUD; N=92) enrolled in an online cognitive behavioral therapy intervention at the Medical University of South Carolina were analyzed. Linear regression models examined trait-level correlates of (1) mean salivary P4 level per person and (2) within-person P4 variability (per-person standard deviation in P4 levels). Predictor variables included demographics (age, race, ethnicity, weight, BMI, partnered status, marital status, and fatherhood status), medication use (psychotropic medications, hormonal medications, and NSAIDs), clinical diagnoses (alcohol use disorder, generalized anxiety disorder, social anxiety disorder, major depressive disorder, obsessive compulsive disorder, and post-traumatic stress disorder), and substance use (quantity and frequency of cannabis use). Outcome variables were log-transformed to improve normality. Lower salivary P4 levels were found in Asian participants compared to White individuals ($p=0.040$). Use of hormonal medications was associated with greater day-to-day variability in salivary P4 ($p=0.018$). Additionally, fatherhood status was correlated to greater P4 variability ($p=0.043$). No other predictors were significantly linked to mean levels of P4 or P4 variability. These findings suggest that hormonal medications, even those not immediately involved in progesterone metabolic pathways, may increase variability in male salivary P4 levels. The potential influence of fatherhood status on P4 variability builds upon prior literature which has found a positive correlation between men's commitment to a relationship and the presence of patterned progesterone fluctuations [1]. Although these results should be interpreted cautiously given the modest sample size, they suggest that racial and social/relational factors along with medication status may be more relevant than clinical diagnoses or substance use when assessing salivary progesterone consistency in males.

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158. Investigating Cytokine-Specific eQTMs in Airway Smooth Muscle Cells (ASMCs)

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Asthma is a chronic inflammatory disease driven by complex gene-environment interactions that differ by relevant airway cell types. Airway smooth muscle cells (ASMCs) are a key cell type in asthma that is responsible for airway hyperresponsiveness (AHR), the increased contractility in response to inhaled irritants that causes wheezing and shortness of breath. To investigate how inflammatory cytokines regulate ASMC function, we cultured and exposed primary ASMCs from 69 lung donors to interleukins 13 and 17 (IL-13 and IL-17) and vehicle, and quantitatively investigated their effects on gene expression and methylation in a subset of 26,659 likely functional CpGs from the EPIC array. Using matrixeQTL, we identified statistically significant associations between gene expression and methylation levels at nearby CpGs (±125Kb), also known as eQTMs. Pathway analysis of significant CpGs and genes corresponding to each treatment showed enrichment in biological processes and traits relevant to airway inflammation and remodeling (such as fractional exhaled nitric oxide and atopy). We also found that when donor sex and asthma status were incorporated as interaction terms in the eQTM model, these terms modulated the association strength and direction of significant CpG-gene pairs (n=1,374 unique pairs for sex and 1,665 for asthma across conditions; fdr ≤ 0.05). These results lead us to believe that cytokine treatment effects in ASMCs are mediated by more complex mechanisms than a causal methylation-expression relationship. In conclusion, these studies address a significant gap in genomic studies in asthma by exploring epigenetic regulation in a critical but understudied cell type. Our findings will enhance understanding of potential molecular mechanisms linking environmental exposures (such as asthma-inducing cytokines) to disease, and add to the arsenal of approaches used to analyze genomics data in complex disease research.

155. Association Between Subjective and Objective Assessments of Walking, Mobility, and Balance in Individuals with Chronic Stroke: Influence of Individual Stroke Characteristics

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The alignment of perceptions of stroke recovery and actual physical recovery has important implications for stroke walking rehabilitation. This study aimed to determine the association between subjective and objective measurements in post-stroke recovery and the influence of stroke-related characteristics. Data from a clinical trial (NCT03492229) was used to test the association of the Stroke Impact Scale (SIS) and its subscales with objective tests of maximal walking speed and Fugl Meyer Lower Extremity (FMLE). General linear modeling (GLM) was performed to include demographic and stroke-related characteristics (age, sex, race, time since stroke, affected brain region, affected hemisphere, and stroke type) as potential interactive factors. Data was collected from 92 people with chronic stroke [mean (SD); age, 59 (9); 63 male; time since stroke, 5.7 (4.6); affected brain region, 38 cortical; affected hemisphere, 51 right-sided; stroke type, 60 ischemic]. Most SIS subscales were not associated with any objective tests ($R^2 \geq 0.04$, $p \geq 0.06$). The SIS total score was associated with FMLE ($R^2=0.11$, $p=0.001$), and the SIS mobility subscale was associated with maximal walking speed ($R^2=0.05$, $p=0.03$). In a GLM predicting FMLE, age ($p=0.004$) and the interaction between age and SIS total score ($p=0.006$) were significant predictors. In a GLM predicting maximal walking speed, the interaction between biological sex and SIS mobility score ($p=0.01$) was a significant predictor. Individual SIS subscales did not have strong associations with objective tests, but the SIS total was associated with overall function. The results suggest that people are better at accurately perceiving their broad function than individual components of function (e.g., mobility). Age and biological sex interacted with and impacted the association between subjective and objective tests, and could be considered.

156. Application of Embedded Systems and Microcontrollers in Buildings: Modeling and Deployment of Analog Circuits for Steam Trap Systems

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Steam heating systems rely on steam traps to maintain efficiency and proper operation, yet most systems lack modern monitoring solutions and depend on reactive maintenance practices. As a result, failures are often detected only after significant energy losses, safety risks, and increased operational costs have already occurred. Without affordable, real-time diagnostic tools, steam trap malfunctions remain a persistent and expensive problem in commercial and industrial facilities. This research focuses on developing a low-cost, continuous Steam Trap Monitoring (STM) device capable of accurately measuring temperature differentials and ultrasonic data to assess steam trap efficiency. By capturing both thermal and acoustic signatures, the system enables early fault detection and overcomes the limitations of current diagnostic methods, which are typically costly, labor-intensive, and performed infrequently. A custom printed circuit board (PCB) was successfully designed in KiCad and deployed within an operating steam system. The device is designed for easy installation, scalability, and wireless integration with building control systems for centralized monitoring. Data collected from deployed STM units shows that temperature measurements before and after the steam trap provide useful insight into its functional state, helping distinguish normal operation from potential failure conditions. Overall, this work presents a practical, scalable, and cost-effective solution to modernize steam trap diagnostics, reduce energy waste, improve reliability, and support predictive maintenance strategies.

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153. High Bleeding Risk, Steady Outcomes: Watchman Implantation in Chronic Kidney Disease

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Chronic kidney disease (CKD) is common among patients with atrial fibrillation (AF) and is associated with both increased thromboembolic risk and heightened bleeding risk, complicating long-term anticoagulation management. Left atrial appendage occlusion (LAAO) with the Watchman device offers an alternative strategy for stroke prevention, yet it remains unclear whether baseline kidney dysfunction impacts post-procedural outcomes. We performed a retrospective cohort study of 117 patients undergoing Watchman implantation, stratified by presence of CKD (n=53) versus no CKD (n=64). Baseline characteristics and clinical outcomes at 6- and 12-month follow-up were compared using t-tests and Fisher's exact tests. The groups were well balanced in age (71.0±10.1 vs 72.4±8.3 years, p=0.44) and hypertension prevalence (90.6% in both groups, p=1.00). As expected, diabetes was more prevalent in the CKD group (67.9% vs 48.4%, p=0.04), and mean HAS-BLED scores were significantly higher (4.36±0.92 vs 3.06±1.15, p<0.001). Despite this higher comorbidity burden, there were no significant differences in major clinical outcomes. Six-month stroke rates were similar (1.9% vs 1.6%, p=1.00), as were major bleeding events (11.3% vs 15.6%, p=0.59), all-cause readmissions (24.5% vs 31.2%, p=0.54), and expanded major adverse cardiovascular events (17.0% vs 20.3%, p=0.81). At 12 months, stroke, major bleeding, and all-cause readmission rates remained unchanged from 6-month follow-up, while expanded major adverse cardiovascular events were 17.0% vs 21.9% (p=0.64). There were no deaths at either 6 or 12 months in both groups. In this single-center cohort, patients with CKD undergoing Watchman implantation experienced comparable short- and intermediate-term outcomes to those without CKD despite higher baseline bleeding risk. These findings suggest that CKD alone should not preclude consideration of LAAO in appropriately selected patients.

154. A Computational Vector Space Mapping of the Sublime Across Literary History

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A fundamental problem in cultural studies is the analysis of "fuzzy concepts". Fuzzy concepts are ideas and words that are highly contested. We used a Word2Vec model by Mikolov, Chen, Corrado, and Dean demonstrating a distinction in measuring synaptic and semantic word similarities to generate seed words for downstream analysis of the term "sublime". It argues a disposition — tracing how culture has reached for it, wrestled with it, worn it differently across time. This paradox of the scientific and the deeply humanist reveals itself in the trained model: words that have long been grasping at awe and terror, at vastness and overwhelm, without ever naming the sublime directly. The model surfaces what language has always been doing in its absence. Where centuries of aesthetic discourse have circled the concept without consensus, the DTM traces what language does when it attempts the sublime, mapping the themes and words that gather around it in the act of trying. TensorFlow Embedding Projector (Smilkov et al., 2016) instrument used to visualize the embedding space and clustering. We found that the 'sublime' is most associated with the words – disregarding the names of people ex. Kant, Burton, Wordsworth– "deceptions", "sensuous", "imaginative", "longing", and "impressionable", indicating these seed words, signal more than association — they illuminate it as a realm of impression, of felt encounter. It follows, then, to move outward into the literary corpus, gathering all texts that orbit these "fuzzy" conceptual territories, training the model on a larger, richer body of work toward a more complete picture of how the sublime has been rendered in text, image, and media.

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151. The Effects of Identity Denial (and Identity Centrality) on Perceived Stigma and Self-Esteem in People with Disabilities

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Individuals' connections to their social identities are important to their senses of well-being. Therefore, denial of these identities can have a negative impact, and strategies to make an identity *more* central to one's sense of self support feelings of self-esteem, even when those identities are stigmatized and devalued. Disability is one of the most common stigmatized minority identities yet relatively underrepresented in identity research, so the present study examined whether denial of individuals' disability identities impacts and what the corresponding roles are of perceived stigma (predicted mediator) and identity centrality (predicted moderator) in participants with disabilities. Identity denial, in a vignette design, did not significantly predict reported self-esteem, though higher perceived stigma did. Participants with higher disability identity centrality were more likely to perceive an instance of identity denial as *un*supportive (and lack of identity denial as supportive), which in turn predicted greater perceived stigma and lower momentary self-esteem. These findings suggest that identity centrality plays a complex role in the self-esteem of people with disabilities, which is not directly explainable by identity denial alone. Centrality has been shown in prior research to have protective effects, and buffer against instances of stigma. However, higher identity centrality also may direct individuals' attention to increased perceptions of discrimination, consistent with our data indicating that disabled participants high in centrality generalized instances of identity denial to increased perception of stigma and lower self-esteem. The causal direction of this pattern requires further investigation.

152. Development of a Novel Fully Implantable Opto-Electrical Cochlear Implant

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Global hearing loss impacts roughly 1.5 billion individuals today, and estimates suggest this figure could reach 2.5 billion within the next few decades [1]. Standard cochlear implants (CIs) use electrical currents that diffuse broadly across tissue, limiting the exactness of sound perception. While using light to stimulate nerves allows for far greater targeting accuracy, it requires a substantial power draw. We propose a solution that maximizes both battery life and focal accuracy: a hybrid opto-electrical cochlear implant (oeCI). This system leverages weak electrical currents to pre-condition the auditory nerves, fundamentally decreasing the light intensity needed to trigger a neural response. To investigate this concept, we engineered an implantable 42-channel device that combines electrical drivers with infrared neural stimulation (INS). We concurrently built a unique software algorithm, the opto-electrical frequency-modulated phase coding (oeFMPC) strategy. Unlike standard CI programming, our method keeps pulse strengths strictly constant to prevent dangerous heat accumulation in tissue. Loudness is instead communicated through variations in the average speed of randomized, Poisson-like pulse sequences. Wide acoustic frequencies are routed to power-saving electrical nodes, whereas tight frequency ranges activate the highly accurate optical nodes. Initial animal testing confirmed the hardware's functionality, successfully producing compound action potentials in mice and guinea pigs via both stimulation methods. We also conducted human trials on 17 CI recipients to test the algorithm's electrical mapping using HINT exams. Even with under an hour of exposure to our custom software, test subjects demonstrated rapid comprehension, with select individuals scoring above 80% and one achieving a perfect score of 100%. Average word recognition remained below their everyday, long-term CI configurations, yet the immediate results strongly support the viability of this energy-conscious, high-fidelity neural prosthetic. Future clinical trials will evaluate the complete hybrid system to assess long-term user adaptation and overall improvements in spatial resolution.

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149. Kinesin Family Binding Protein (KIFBP) Inhibits Microtubule Binding of the Kinesin-3 Family

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Cells utilize intracellular trafficking to move necessary materials to their subcellular location. Kinesins are essential motor proteins that transport cargoes along the microtubule cytoskeleton. Kinesins carry out intracellular trafficking by binding the microtubule lattice and hydrolyzing ATP through their motor domains. This process imposes mechanical stress upon microtubules and uses cellular energy. To mitigate these impacts, kinesins can utilize a mechanism of self-regulation called autoinhibition, which prevents the motor domain from binding to microtubules. However, a less-understood regulation mechanism involves KIFBP (kinesin family binding protein), which has been shown to inhibit the binding of some kinesins to microtubules. Whether KIFBP inhibits all kinesins remains unknown. To investigate this, we developed a microscopy-based assay that determines which kinesins are impacted by KIFBP. Using the kinesin motors kinesin-3 KIF1A (positive control) and kinesin-1 KIF5C (negative control), we determined assay conditions effective in elucidating KIFBP activity. We then applied our assay to determine the effects of KIFBP on additional members of the kinesin-3 family. Our analysis indicates a statistically-significant reduction in microtubule binding of the kinesin-3 proteins KIF13B and KIF16B. These results suggest that KIFBP may be a general regulator of kinesin-3 motor proteins which play critical roles in intracellular trafficking in neuronal cells. We are continuing with this assay to investigate the potential relationship of KIFBP with other kinesins.

150. Growth Profile for *Comamonas testosteroni* Metabolism of TPA and Benzoate

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The accumulation of synthetic plastics in the environment is becoming an increasingly urgent problem, with levels expected to reach 33 billion tons by 2050 [1]. Polyethylene terephthalate (PET) and polystyrene (PS) are two aromatic polymers widely utilized in plastic products, and their resistance to standard hydrolytic or enzymatic degradation makes them an attractive target for bioremediation strategies [2]. While *Comamonas* species are known to metabolize aromatic compounds such as terephthalic acid (TPA) and benzoate – key degradation products of PET and PS, respectively – the pathway by which *Comamonas testosteroni* KF-1 metabolizes benzoate remains unknown [3]. Additionally, the accumulation of catechol, a downstream intermediate in one known benzoate degradation pathway, may impose toxicity that limits the ability of the bacterium to metabolize this substrate. In this study, we examined the growth profile of *C. testosteroni* KF-1 on mixtures of TPA and benzoate using optical density measurements, high-performance liquid chromatography (HPLC), and liquid chromatography-mass spectrometry (LC-MS) to characterize intracellular metabolites. Our results suggest a preferential utilization of TPA over benzoate and reveal evidence of a metabolic switch during co-substrate growth. These findings may be used to inform future approaches to metabolic engineering of the bacterium.

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147. Is That What They See?: How Hair Texture Shapes College Students' Depictions of Black Womanhood

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Stereotypes of Black women, deeply rooted in a history that casts concepts of whiteness and blackness (e.g., "Strong Black woman", "Jezebel", "Mammy", and "Sapphire") as oppositional, continue to shape portrayals of Black womanhood in media and film [1]. But, how do everyday perceivers not only internalize but reproduce these portrayals with minimal cueing? This study adapts the Draw a Scientist test [2, 3], exploring how college students (N = 76) between the ages of 17 and 26 (M = 18.96, SD = 1.78) visually represent Black women through the lens of hair texture. We hypothesized that most participants would draw natural vs. straight hair. Additionally, we predicted that natural hair depictions would co-occur with a higher frequency of stereotypical inferences (e.g., Mammy, Jezebel, Sapphire) when compared with straight hair depictions. Participants completed a drawing task, followed by a survey probing their elemental choices (e.g., having a specific person in mind while drawing). Drawings were coded for hair type (straight vs. natural), and hair subtype within natural hair (e.g., tight curls, loose curls, and braids/braided) using a coding scheme with interrater reliability (κ >.80). Results demonstrated hair depicted in 97% of drawings, with mostly natural hair depicted (81.57%), indicating hair texture serving as a salient racial cue in representations of Black women. Hair texture systemically co-occurred with specific trait inferences (e.g., gold jewelry, red lipstick). Participants, most of whom "didn't draw a specific person in mind" (66%), spontaneously produced depictions that reflected both historically rooted stereotypes (e.g., Mammy, Jezebel, Sapphire) and emerging contemporary stereotype content. Select associated inferences based on hair type include tightly curled hair associated with strength, labor, and burden, while straight hair was linked to professional characteristics. Findings help to shed light on the importance of examining intragroup variability to better understand how stereotypes are maintained and applied.

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148. Characterizing Progressive DTP States Across Cancer Cell Models

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Drug tolerant persisters (DTP) are a small population of cancer cells that resist anti-cancer treatment. The DTP cell population is not defined by prior genetic differences, and little is known about molecular changes that occur during drug exposure. However, at the point of cancer relapse, clinical treatments are less effective, highlighting the need for an improved understanding of DTP progression. This project characterizes progressive DTP states across different cancer cell models and anti-cancer drugs. We hypothesize that the DTP population of cells is heterogeneous, with subpopulations progressing through diverging trajectories. We first performed dose-response experiments on ten cell line models, representing ovarian, pancreatic, gastric, lung, and breast cancer, to establish appropriate inhibitor concentrations to generate DTPs. Next, we generated cell survival curves for the cell lines across 6 days of treatment. We then performed live-cell imaging experiments using FUCCI reporters. All cell lines had a surviving DTP population by the final day of treatment and a high proportion of quiescent cells. However, cytotoxic and cytostatic survival dynamics differed across cell lines. Finally, we performed single-cell RNA sequencing on the cell lines treated across several days. Our preliminary analysis of single-cell sequencing data showed that the DTP population were highly heterogeneous, displaying molecular phenotypes that dynamically changed across days of treatment. These results show that while DTPs exit the cell cycle in response to treatment, they are a dynamic, heterogeneous population that undergoes different transcriptional changes and exhibit varying survival dynamics. This study fills a critical knowledge gap regarding the earliest cellular states that enable cell tolerance to anti-cancer therapies. Recognizing DTPs as a heterogeneous group, rather than a unified subpopulation, will allow for improved therapeutic targeting.

145. A Pilot Study on the Stigma Surrounding Parents of Children with Autism in Italy Versus South Korea

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This study sought to examine how cultural stigma and caregiving expectations shape the experiences of parents of children with autism in Italy and South Korea. By comparing policies, medical models, parental stress, and perceptions of blame across two cultural contexts, the study aimed to generate insights into how societal attitudes influence parents as advocates in their child's treatment. Data collection took place in both countries, where surveys were distributed to two Italian and four South Korean parents of children with autism through local ASD resource centers. The survey was designed based on the Beach Centre Family Quality of Life Scale (Alshaigi et al., 2020) and the Self-Stigmatizing Thinking's Automaticity and Repetition Scale. In Italy, a neurodevelopmental psychiatrist and psychoanalyst was interviewed, while in Seoul, two licensed social workers specializing in behavioral therapy were interviewed. Interviews addressed available public services, parental stress, gendered caregiving burdens, and broader systemic challenges. A literature review of peer-reviewed articles published after 2012 contextualized findings within each country, focusing on parental stigma, caregiving stress, diagnostic accessibility, and societal attitudes toward autism. Due to the small sample size, survey data were insufficient to determine whether self-stigma and enacted stigma directly affected parents. However, literature and interviews suggested that many Italian parents felt responsible as "co-therapists," whereas South Korean parents more commonly described an expert-driven medical model. Experiences of social exclusion, loneliness, and unequal caregiving burdens were reported across contexts, with mothers experiencing higher levels of stress and self-blame. Findings suggest that societies emphasizing social conformity may create additional barriers to inclusion, while more socially flexible contexts may foster greater acceptance. Continued cross-cultural research with larger parent samples is needed to further examine these dynamics across diverse global settings.

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146. Longitudinal Effect of Parental Popularity Pressure on Adolescent Popularity: Serial Mediation of Popularity Status Insecurity and Relational Aggression

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In order to address a gap in social development literature regarding how parents influence adolescent popularity, this study examines how parental pressure for popularity longitudinally influences adolescent popularity through a serial mediation model across three timepoints, controlling for Time 1 (T1) popularity status, age, and gender. We hypothesized that parental popularity pressure may internalize into T1 popularity status insecurity, which could externalize into Time 2 (T2) greater relational aggression, ultimately increasing Time 3 (T3) popularity.
The results found that T1 parental pressure for popularity directly predicted higher T3 peer-nominated popularity ($\beta = .1667$, $p < .01$), mediated sequentially by T1 popularity status insecurity and T2 relational aggression (indirect effect = .0096, 95% CI = .0033, .0191). Specifically, greater parental popularity pressure led to increased popularity status insecurity ($\beta = .2480$, $p < .001$), which then manifested as relational aggression ($\beta = .1771$, $p < .001$), leading to increased popularity ($\beta = .2115$, $p < .001$). These results exemplify how adolescents' experiences with their parents in the home environment translate into their experiences with their peers in the school environment. Parental pressure, even when well-intentioned, may unintentionally promote popularity through relational aggression, rather than possessing likability. Understanding this process is important so that parents may learn how to encourage social goals in ways that support adolescents' well-being, rather than increasing their insecurity or maladaptive social behaviors.

143. Targeting Epithelial Plasticity: Small Molecule Strategies for Salivary Gland Regeneration in Sjögren's Disease

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Sjögren's disease (SjD) is a chronic autoimmune disorder characterized by immune-mediated destruction of salivary glands, leading to irreversible hyposalivation and significantly reduced quality of life. Current therapies do not address regeneration of damaged secretory tissue, despite evidence that salivary glands retain regenerative capacity through epithelial plasticity of ductal, acinar, and myoepithelial cells (Rocchi et al. 2021). This project identifies small molecules that promote differentiation of acinar and myoepithelial cells (MECs) to restore salivary gland function in SjD patients.

Candidate compounds were identified through a high-throughput RASL-sequencing screen of 1,800 small molecules in mouse salivary gland organoids, measuring expression of acinar marker Aquaporin 5 (Aqp5) and MEC marker Calponin 1 (Cnn1). Validated hits were tested in both 2D and 3D mouse salivary gland cell culture systems across multiple doses using RT-qPCR and immunofluorescence imaging. Additionally, 17 structural derivatives of a lead compound were synthesized via flow chemistry and evaluated for biological activity.

Treatment with Compounds A, B, and C significantly upregulated Cnn1 and Aqp5 expression in both 2D and 3D culture systems in a dose-responsive manner. Immunofluorescence confirmed increased numbers of Cnn1-positive cells localized to the outer edges of organoids, consistent with proper MEC positioning. Aquaporin 5 upregulation was variable across compounds; Compounds 3, 6, 12, and 16, derivatives of the lead compound, showed properly localized Aqp5 expression at the lumen membrane. Overall, 5 of 17 synthesized derivatives successfully upregulated acinar or MEC markers. These findings demonstrate that small molecules can promote salivary gland cell differentiation in vitro, supporting a regenerative strategy that complements existing immune-targeted SjD therapies.

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144. Exploring How Aggressive Immigration Policies and Anti-Immigrant Rhetoric Affect Latino Immigrant Health

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Political rhetoric and immigration policy, along with individual behaviors, shape health disparities among Latino immigrants in the United States. While the detrimental effects of structural barriers, such as limited access to healthcare or unsafe housing, are documented, the physiological and psychological impact of living under constant threat of surveillance, detention, and deportation remains largely underexplored [1]. This study aims to investigate the research question: How do anti-immigrant rhetoric and aggressive immigration policy enforcement affect the physical and mental health of Latino immigrants? Using a qualitative research design, semi-structured interviews were conducted with Latino immigrants residing in mixed-status communities. Interviews explored participants' experiences with immigration rhetoric, perceptions of enforcement practices, and reported impacts on daily life and health behaviors. Preliminary findings indicate that participants experience chronic stress, persistent fear of detention or deportation, sleep disturbances, and avoidance of healthcare and social services due to perceived risk of exposure. Many participants reported altering daily routines, including limiting time in public spaces and delaying medical care, even when experiencing serious symptoms. These behavioral adaptations were present among both unauthorized immigrants and individuals with legal status living in mixed-status households, suggesting that enforcement environments generate community-wide health consequences. Participants also described how criminalizing language in media and political discourse shaped their sense of belonging and psychological well-being. These findings demonstrate that anti-immigrant rhetoric and enforcement operate as social determinants of health, resulting in psychosocial stress and behavioral changes that contribute to adverse health outcomes. This project contributes original empirical evidence to interdisciplinary conversations in public health and underscores the need to recognize immigration policy as a form of health policy.

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142. Tet-1 Proteomimetic Polymer for Neuron-Targeted Delivery.

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Protein-protein interactions (PPIs) play essential roles in cellular signaling and are implicated in neurodegenerative disorders such as Huntington's disease (HD). Although peptides have shown promise as PPI modulators due to their high affinity and specificity, their therapeutic potential has been limited by short half-life, rapid elimination, and poor cellular permeability. Proteomimetic polymers, or protein-like polymers (PLPs), have emerged as an alternative strategy to overcome these limitations by functioning as multivalent binders with improved stability and tunable chemistry. A major challenge in applying PLPs to neurodegenerative disease is achieving efficient and selective neuronal targeting. This project focused on the use of the Tet-1 peptide, a short sequence originally identified by phage display for its ability to bind neuronal receptors and undergo neuron-specific internalization. (Spinelli et al., 2025). We investigated the hypothesis that PLPs derived from the Tet-1 peptide sequence would retain neuronal targeting capabilities while enabling improved intracellular delivery relative to the free peptide. Tet-1 peptide sequence conjugated to a norbornene backbone was synthesized via solid phase peptide synthesis and was used as the foundational peptide for PLP synthesis. The monomer was purified by liquid chromatography and characterized with mass spectrometry. Polymers were generated through ring opening metathesis polymerization, fluorescently labeled for cell uptake, and purified using liquid chromatography. Structural and physicochemical characterization was performed using mass spectrometry (LC-TOF), SDS-PAGE, circular dichroism, and dynamic light scattering, while polymerization kinetics were monitored via nuclear magnetic resonance spectroscopy to confirm reproducibility and control. Neuronal uptake was assessed using fluorescence-based assays in neuronal cell models relevant to Huntington's disease. It was found that Tet-1 based PLPs were successfully synthesized, supporting their use as neuron-targeted delivery platforms. Tet1-derived PLPs provide a promising framework for the development of intracellular PPI modulators and expand the applicability of proteomimetic polymers for therapeutic strategies in Huntington's disease.

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140. Area Deprivation Index (ADI) as a Measure of Equitable Representation in Monogenic Diabetes Research

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Precision medicine approaches hold promise for improving diabetes care globally, with monogenic diabetes serving as a key example. However, existing inequities in precision diabetes care risk exacerbating healthcare disparities. While underrepresentation of minority racial and ethnic groups in monogenic diabetes research has been documented, less is known about representation across educational and socioeconomic strata. This study examines Area Deprivation Index (ADI) – a measure of neighborhood-level disadvantage – and provider type as indicators of health literacy, socioeconomic status, and healthcare access among the University of Chicago Monogenic Diabetes Registry participants. We conducted a cross-sectional analysis of Registry participants, calculating ADI for each individual. Descriptive statistics were analyzed using R, with Wilcoxon and Kruskal-Wallis tests used for comparisons. Preliminary analysis demonstrated that Registry participants had a median US ADI of 32, significantly below the expected median of 50 ($p<0.001$), with only 27% residing in neighborhoods above the 50th percentile for deprivation. Preliminary data also showed higher rates of specialty care among participants compared to the general diabetes population and that provider-referred participants have a higher median ADI than self-referred participants, reflecting differential access patterns across the lifespan. These results suggest substantial national inequities in monogenic diabetes diagnosis, with individuals from disadvantaged neighborhoods and those without specialist access being underrepresented. These results highlight the critical need for targeted efforts to reach disadvantaged populations and ensure equitable access to the benefits of precision diabetes medicine.

141. Cell-type-specific Genetic Contributions of Melanogenesis Pathways to Skin Cancer Using Transcriptomic Prediction Models

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Skin cancer is one of the most aggressive types of cancer while being the 17th most common cancer in the world with high incidence rates in North America and Europe and high mortality rates in Asia. It can be a result of both genetic and environmental factors. Previous genome-wide association studies (GWAS) have identified susceptibility loci, however, the functional impact of these variants across tissues and specific cell types remains poorly understood. To address this gap, we analyzed data from the Million Veteran Program (MVP; n = 635,969) to identify genome-wide significant SNPs associated with skin cancer and evaluated their predicted gene expression in skin tissues and single-cell immune models to understand genetic contributions to melanogenesis pathways and metastatic progression of skin cancer. Multiple significant gene-level associations were identified. Replication analyses using single-cell PrediXcan (Sc-PrediXcan) in the All of Us (AoU) cohort confirmed several single-cell-associated signals. *DBNDD1* ($p = 3.96 \times 10^{-21}$), *ARNT* ($p = 1.42 \times 10^{-19}$), *MINDY1* ($p = 2.76 \times 10^{-19}$), and many other genes demonstrated strong replicated associations across cohorts in different immune cell types. To further investigate whether these associations reflect cell-type-specific or cell-type-enriched regulatory effects, we applied the Aggregated Cauchy Association Test (ACAT) to immune cell PrediXcan results from the AoU cohort. Four genes were cell-type enriched: *MYH7B* in dendritic cells ($p = 3.47 \times 10^{-5}$), *TXNDC9* in $CD4^+$ αβ T cells ($p = 2.36 \times 10^{-6}$), *IRF4* in transitional-stage B cells ($p = 1.56 \times 10^{-5}$), and *ENSA* in platelets ($p = 1.38 \times 10^{-4}$). ACAT p-values suggest that the observed associations are driven by cell-type-enriched regulatory mechanisms that contribute to skin cancer susceptibility. Although *ENSA* appears cell-type-enriched, it is expressed in a limited number of immune cell types.

139. Platelets Drive Immune Suppression and Glioblastoma Growth in a Sex-Dependent Manner via PAR4 Signaling

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Glioblastoma (GBM) is the most common primary malignant brain tumor, with outcomes shaped by biological sex differences that influence disease progression, immune function, and interactions within the tumor microenvironment (TME). Although platelets are increasingly recognized as active participants in tumor biology, their contribution to sex-specific immune regulation in GBM has not yet been defined. Here, we identify platelet PAR4 signaling as a central mechanism linking sex hormones to antitumor immunity. To investigate the role of platelets in the immunosuppressive TME, we integrated analyses of human platelet function, multiple murine GBM models, genetic and pharmacologic perturbation of PAR4, hormone manipulation, and immune profiling of tumor-infiltrating cells. We found that GBM patients display elevated platelet activation driven by protease-activated receptor 4 (PAR4). In mouse models of GBM, both pharmacologic inhibition of PAR4 and genetic deletion of PAR4 markedly extend survival in females but not males. This benefit is estrogen dependent, as we have shown using in vivo and in vitro models. Mechanistically, PAR4 inhibition enhances $CD8^+$ T-cell infiltration into the TME,establishing a platelet-driven, sex specific immune response. We further show that estrogen receptor β (ERβ) physically interacts with PAR4 to amplify calcium signaling in platelets, revealing a previously unrecognized hormone-receptor crosstalk that shapes platelet behavior in tumors. PAR4-activated platelets suppress CD8+ T-cell function within the TME, and depletion of CD8+ T cells eliminates both the heightened platelet reactivity induced by GBM and the survival advantage conferred by PAR4 inhibition. Together, these findings position platelet PAR4 signaling as a key regulator of GBM progression and demonstrate that sex-dependent immune mechanisms critically determine therapeutic efficacy. This work highlights a mechanistic link between estrogen signaling, platelet activation, and antitumor immunity, offering new therapeutic targets for sex-dependent treatment of GBM.

138. From Black Box Warning to Wake-Up Call: Underutilization of Menopausal Hormone Therapy

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To characterize menopausal hormone therapy (MHT) prescribing patterns over 18 years in a large academic medical center and evaluate demographic and clinical factors associated with MHT use.

We conducted a retrospective observational study using electronic health record data from 1/1/2007–2/31/2024. The cohort included biologically female patients 45 years or older with at least one outpatient encounter (N = 305,053). The primary outcome was the proportion of women with any documented MHT prescription. Prescriptions were categorized as local, systemic, or a combination (local + systemic). Associations between MHT use and race, birth year, comorbidity burden (Charlson Comorbidity Index), and urinary tract infection (UTI) history were evaluated using chi-square tests and multivariable logistic regression.

Overall, 6.99% (21,327/305,053) of women had at least one documented MHT prescription. Among MHT prescriptions, 54.61% received local therapy, 37.66% systemic, and 7.37% combination, and 0.37% had unknown type. In adjusted analyses, African American (adjusted odds ratio [AOR] 0.467; 95% CI 0.443–0.492), Hispanic (AOR 0.563; 95% CI 0.537–0.591), and Asian women (AOR 0.701; 95% CI 0.635–0.772) had lower odds of MHT use compared with White women. Each additional comorbidity was associated with lower odds of MHT use (AOR 0.901; 95% CI 0.892–0.910). UTI history was strongly associated with MHT use (AOR 12.315; 95% CI 11.73–12.93).

MHT prescribing remained persistently low over 18 years, with marked racial disparities and reduced use among women with greater comorbidity burden, highlighting a sustained gap between evidence-based recommendations and real-world menopause care.

136. Intersectional Racism and Familial Pressure and Their Correlation to Mental Health Struggles and Eating Disorders Among Asian American College Students

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Mental health concerns, including eating disorders, have increased among college students; however, the Asian American student population remains understudied due to cultural stigma, racism, and limited representation in research. This study examined the prevalence of depression, anxiety, and eating disorders among Asian American college students in the United States. A total of 145 students participated in a Qualtrics survey using validated screening tools (PHQ-2 for depression, GAD-7 for anxiety, and EAT-26 for disordered eating), with 111 completing the survey, yielding a 77% response rate. Half of the participants identified as Asian, and 63% were female. The mean age was 21 years. Health and medical science undergraduates comprised the largest participant group (43%). EAT-26 results indicated that 9% of participants met criteria for referral to a mental health professional for eating disorders. Numerous participants reported disordered eating behaviors, such as binge eating (22%) and the use of laxatives or diet pills (8%) and overexercise (30%) for weight control. Twenty-two percent of participants exhibited signs of depression, and 64% met criteria for referral for anxiety disorder. Chi-square analyses were conducted to assess whether Asian American students were more likely to experience disordered eating, depression, and anxiety. No statistically significant differences were found for disordered eating, $X^2(1, N = 85) = 1.30$, $p = .25$, and anxiety, $X^2(1, N = 95) = 0.05$, $p = .82$, but depression was significantly associated with Asian American participants, $X^2(1, N = 97) = 5.46$, $p = .02$. These findings suggest that college students in this sample experience substantial mental health concerns, with Asian American students particularly affected by depression. The study highlights the need for culturally informed mental health interventions and increased research attention to this underserved population. Additional details regarding disordered eating, depression, and anxiety data will be presented in the poster presentation.

137. Conformational Dynamics of Enzyme Topoisomerase I in its Interactions with DNA

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DNA topoisomerases are essential enzymes that regulate DNA supercoiling through cutting, strand passage, and resealing, which is crucial for keeping genetic material stable while copying and reading DNA. Given their pivotal role in DNA metabolism, topoisomerases have emerged as attractive targets for cancer therapies, but current inhibitors face challenges such as toxicity and resistance, highlighting the need for drug design informed by deeper understandings of enzyme dynamics. Despite detailed structural insights, the conformational changes enabling Topoisomerase I (TOP1) to perform strand passage remain unclear, with models proposing various movements between its four domains. The present study explores the role of domain movements in DNA relaxation by TOP1 using a technique called single-molecule FRET (smFRET). We began with protein growth and purification using the *E. coli* C41(DE3) cell line. One domain of the TOP1 enzyme was labeled with a Cy3 fluorophore (a fluorescent tag) and another with a Cy5 fluorophore. We used a 561 nm laser to excite the fluorophores in a microfluidic flow cell, with DNA present in one channel and absent in the other, enabling comparison of protein behavior between the two conditions. The MATLAB-based DeepLASI software was then used to find traces where the Cy5 signal exhibited an anti-correlation with Cy3 fluorescence, confirming direct energy transfer from one domain to another due to spatial proximity and interaction. Analysis of FRET data reveals novel conformational changes within different domains as a result of DNA binding. These findings demonstrate for the first time that FRET can be used to observe TOP1 conformational dynamics. We will continue to investigate the interactions between all domains of TOP1 and ultimately provide the foundation for designing better inhibitors to overcome current therapeutic challenges.

135. Biokinetic Risk Factors in Young Total Knee Arthroplasty Patients: A Gait Analysis of 88 Knees with Implications for Sports Participation and Implant Survivorship

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Total knee arthroplasty (TKA) rates are increasing among younger patients, who have higher functional demands for return to sport. However, there is limited in-vivo biomechanical data to guide postoperative activity recommendations in this population. The purpose of this study was to define gait kinematics and kinetics in young (≤60 years) and older (>60 years) TKA patients compared to healthy controls. We hypothesized that younger TKA patients would demonstrate altered movement patterns associated with increased joint loading. Eighty-eight knees from an institutional biomotion database were analyzed in this retrospective study, including older TKA (n=50), young TKA (n=21), and healthy controls (n=17). All procedures were performed by fellowship-trained surgeons at a single institution. Three-dimensional gait analysis using marker-based motion capture and force plates was conducted to evaluate joint kinematics and kinetics. Statistical Parametric Mapping and Kruskal–Wallis tests were used to compare groups across the gait cycle (α=0.05). Young patients demonstrated substantially higher knee extension moments at initial contact and terminal stance compared to older patients and controls. At initial contact, extension moments in young patients (1.4 ± 1.4 %BW·ht) were approximately five times higher than older patients (0.2 ± 0.8 %BW·ht) and over four times higher than controls (0.3 ± 0.8 %BW·ht; $p<0.05$). At terminal stance, extension moments in the young group (0.5 ± 0.6 %BW·ht) were more than twice those of older patients (0.2 ± 0.5 %BW·ht) and five times higher than controls (0.0 ± 0.3 %BW·ht; $p<0.05$). Additionally, young patients demonstrated persistent varus alignment throughout the gait cycle compared to valgus alignment in older patients and controls ($p<0.05$). These findings suggest that younger TKA patients experience elevated tibiofemoral loading, placing them at greater risk for implant wear, loosening, and revision. Identifying biomechanical risk factors in this high-demand population may inform personalized rehabilitation and surgical decision-making, ultimately improving long-term outcomes.

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133. Photometric Variability of Warm Hypergiants in M31 and M33

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Warm Hypergiants (WHG) are extremely luminous A–F type supergiants, approximately 20–40 times the mass of the Sun, located on the Hertzsprung–Russell diagram near the Humphreys–Davidson limit and the yellow void, where stars are thought to undergo unstable evolutionary transitions. Previous photometric studies of WHG, including work by Dorn-Wallerstein et al. [1], identified irregular brightness variations but were not sensitive to very long-period variability. This project investigates whether WHG exhibit long-term periodicity in their brightness variations with amplitudes large enough to potentially drive episodes of mass loss and evolutionary change. Twelve years of photometric data for ten WHG in the nearby galaxies M31 and M33 are analyzed using Lomb–Scargle time-series methods to search for variability on timescales from weeks to several years. The targets are grouped into at least three categories: those showing periods of several hundred days, those with periods longer than 1000 days, and those with no discernible periodic variation. These results help characterize how pulsation and episodic mass loss influence the late evolutionary stages of massive stars.

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134. Investigating the Role of Snail Family Transcription Factors in Gene Expression Regulation Networks for Ectodermal Specification

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During embryonic development, specification of ectodermal cells into the three ectodermal fates of the Neural Crest (NC), central nervous system (CNS) and skin (epidermis) is a crucial process for forming body structures. The NC forms the peripheral nervous system & craniofacial skeleton and develops between the CNS and epidermis [1]. These fates are separated into regions with defined boundaries, but disruptions can cause severe birth defects [2]. A complex regulatory network controls this specification but is incompletely understood; Snail family transcription factors (Snai 1/2) are good candidates for investigation of specification, since they regulate NC expression patterns at certain stages [1]. This study investigated the hypothesis that Snail factors regulate gene expression during ectodermal fate determination to separate the three initially overlapping regions. Using *Xenopus laevis* embryos as a model system, Snail activity was manipulated through knockdown (KD) and overexpression (OE) approaches through injection of dominant-negative constructs and Snai1/2 mRNA injections respectively. Embryos were injected at the two-cell stage to manipulate one side of the embryo and keep the uninjected side as an internal control. *In situ* hybridization probes targeted marker genes for each fate, using *foxd3* (NC), *sox2* (CNS), and *epik* (epidermis) to visualize expression of these genes to compare changes in expression patterns between the manipulated and control sides. For the NC, KD decreased *foxd3* expression and OE increased expression. For the CNS, KD caused an expansion of *sox2* expression while OE reduced expression. While *epik* results were inconsistent, they can inform later research. Together, these results suggest that Snail transcription factors help create a defined boundary between the ectodermal fates by regulating genetic expression to simultaneously reduce specification into CNS and promote specification into NC. Ongoing work builds off these results, exploring how Snail factors regulate specification of cells directly in the boundaries between ectodermal fates.

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131. Stellar Rotation and White Dwarf Cooling in Post-Mass-Transfer Binary Systems

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Stellar rotation provides a critical diagnostic of stellar angular momentum evolution. While spin-down models are well studied for single solar-type stars, less is known about the rotational evolution of stars that have experienced binary interactions such as mergers and mass transfer. We analyzed a sample of 250 candidate post-mass-transfer main sequence–white dwarf (MS–WD) binary systems identified from Gaia DR3 astrometry, each with far-UV (FUV) and near-UV (NUV) photometry from GALEX. We cross-matched Gaia DR3 with TESS light curves, extracting photometry using the eleanor and lightkurve software packages and measuring rotation periods with Lomb–Scargle periodograms. Of the 250 MS–WD binaries, 127 systems exhibited periodic brightness variations suitable for rotation analysis. We recovered rotation periods spanning 0.5–10 days, with clear variability signatures consistent with starspots moving in and out of view. To test whether stellar rotation traces the time since mass transfer, we derived gyrochronology ages from rotation periods and Gaia colors, and inferred white dwarf cooling ages using ultraviolet photometry and theoretical cooling models. We find that rapid rotators are preferentially found among systems with hotter white dwarf companions, as indicated by FUV–NUV color. We further find that gyrochronology ages broadly follow the expected white dwarf cooling trend. This correlation is consistent with angular momentum transfer scenarios in which mass accretion accelerates stellar rotation, with subsequent spin-down occurring on timescales comparable to standard gyrochronology models of the same stellar type.

132. Mothers and Their Scars: A Literary Analysis of the Destructive and Healing Power of Black Mothering

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So many Black mothers experience intertwining forces of oppression that have continuously barred them from stability, autonomy, and resources. The burden of being centered between racial and gendered oppression, too often results in Black women facing psychological consequences. Black mothers have a unique role in navigating the ways in which they parent children to empower and protect their children from a society that fears and often rejects them. The purpose of this piece is to explore how Black motherhood is depicted in literature and used as a scope to explore how systemic racism, societal beauty standards, neglect, and violence impact the way Black mothers in select literature raise their children. This work analyzes *The Bluest Eye* by Toni Morrison, *Push* by Sapphire, and *Memphis* by Tara M. Stringfellow to compare the way intergenerational trauma and structural violence can offer a path of healing or one of destruction. The authors are not just the tellers of these stories but have lived experiences mirrored through their narratives. Intergenerational trauma occurs when a parent has suffered their own abuse and or negative childhood experiences which affect their parenting and creates a cycle of abuse. They challenge the readers to recognize that through the addressing and dismantling of various social structures, Black mothers will no longer have to parent under conditions of fear, insecurity, and pain. Across these three novels, the authors reveal how Black motherhood is greatly influenced by the weight of racism, policies, and societal pressures. It brings up the point that Black women are not the ones failing their children, systems are failing Black mothers.

129. Neuroinflammatory and Demyelination Changes in the Townes Model of Sickle Cell Disease

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Sickle cell disease (SCD) is an autosomal recessive monogenic disorder characterized by anemia, painful vaso-occlusive episodes, and an increased risk for neurological complications such as cognitive and motor dysfunction. Although the clinical manifestations of SCD are well recognized, its cellular effects on the brain, particularly concerning demyelination, remain poorly understood. In this study, we hypothesized that neuroinflammation and demyelination in the cortex and corpus callosum are significantly altered in SCD mice compared with both control and sickle cell trait groups. To evaluate this, male and female Townes mice (B6;129-Hbbtm2(HBG1,HBB*)Tow/Hbatm1(HBA)Tow/J) aged six to twelve months were divided into three groups: normal healthy controls (AA), heterozygous mice (AS) carrying one mutant allele while remaining phenotypically normal, and homozygous mice (SS) expressing the sickle cell phenotype. Neuroinflammation was assessed by immunostaining for astrocytes (GFAP), microglia (Iba1), and the proinflammatory mediator TLR4, whereas demyelination was quantified by measuring myelin basic protein (MBP), neurofilament (NF), and oligodendrocyte precursor cells (NG2). Statistical analyses were performed using one-way ANOVA followed by Tukey's post-hoc test with GraphPad Prism 10.0, and significance was defined at $p < 0.05$. Results from six animals per group revealed that, in comparison to AA and AS mice, SS mice exhibited an increased number of GFAP-positive and Iba1-positive cells along with elevated TLR4 expression, but a marked decrease in MBP levels in both the cortex and corpus callosum. Furthermore, despite the reduction in MBP, NG2-positive cells were increased, and many neurofilament-positive axons lacked MBP. These findings indicate that SS mice experience heightened neuroinflammation and myelin damage, contributing to neuronal dysfunction in SCD, and may provide valuable insights for future therapeutic strategies aimed at mitigating the neurological complications of this disorder. These results underscore the importance of targeting neuroinflammation and enhancing remyelination as promising avenues to improve neuronal integrity and outcomes in SCD patients.

130. Combined Effects of Wastewater Treatment Plant Effluent and Parasitism on Bluntnose Minnows from the Chicago River

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Despite effluent from wastewater treatment plants (WWTPs) meeting EPA guidelines to support aquatic life, pollutants such as pharmaceuticals, heavy metals, and organic compounds are present in effluents and are discharged into surface waters potentially impacting aquatic biodiversity. The bluntnose minnow (*Pimephales notatus*) is a common species of the Chicago River and, while often regarded as pollution-tolerant, it can still experience sub-lethal effects from pollution. Moreover, this fish serves as host to parasites, including parasitic flatworms (i.e., trematodes). While ubiquitous and ecologically relevant, the role of fish parasites in modulating host responses to pollutants is rarely accounted for. As such, this study aims to evaluate the combined effect of WWTP effluent and parasitism on the condition factor of *P. notatus.* To this aim, we measured and weighed fish upstream (control site) and downstream (impact site) from a WWTP outfall. Preliminary results suggest that *P. notatus* at the impact site have a higher condition factor compared to fish from the reference site. Ongoing dissections confirm the presence of trematodes in the fish with infection intensities ranging from 3 to 479 parasites per fish. We expect that parasitism will have a detrimental effect on the condition factor of *P. notatus* and an interactive effect with WWTP effluent. Results will shed light into the roles of parasites in modulating ecotoxicological dynamics in freshwater systems.

127. @DarkHumor: Race-Blindness, Racism, and Racialization in Mexican Digital Discourse

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Racialization, the process through which one is marked and treated as a certain race, can be complex and contradictory. My project uses a contemporary case study of satirical political discourse on social media during the 2024 Mexican presidential elections to document the ways in which racialization is operationalized without the explicit naming of race. The ideology of mestizaje, which touts the development of an exceptional "raceless" race through centuries of racial mixture in Latin America, is a core component of the Mexican identity. However, racism remains a central facet of Mexico's landscape, perpetuating the erasure and subjugation of the Black, Indigenous, and Asian presence and experiences in the country's national identity. Despite claiming unity, mestizaje sustains the race-blind conditions needed to ignore, deny, and disavow racism in Mexico. The public nature of social media can provide important insights into the process of racialization by providing an accessible view of popular reactions to racism. Digital satirical environments are rife with racist language, made permissible under the guise of dark humor. The novelty of digital social network research, coupled with the recency of the 2024 presidential elections, signal an opportunity to address understudied phenomena. I focus on a racist political post by popular Mexican meme account @EsDeMamador on X (previously Twitter) on the day of the election. I utilize an intersectional framework to analyze an array of 56 pre-selected (sub)replies to the original post. Drawing from literature on ethics in the digital humanities, Critical and Computer-Mediated Discourse Analysis, post-colonialism, and Critical Race Theory, I illuminate how non-racial categories (i.e., class, political party, religion) are weaponized as instruments of racialization. These reflect, refract, and advance exclusionary national imaginaries. My findings accentuate how white supremacy, anti-Blackness, and anti-Indigeneity continue to permeate daily interactions in Mexico today, despite the country's alignment with race-blind ideologies.

128. Understanding Glycolysis-Dependent Inflammatory Responses in Rheumatoid Arthritis Macrophages

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Rheumatoid arthritis (RA) is a chronic autoimmune disease in which synovial macrophages sustain joint inflammation and drive progressive tissue damage. Inflammatory macrophage phenotypes are increasingly linked to metabolic reprogramming, particularly a shift toward glycolysis and lactate production, but how these pathways operate in human RA cells remains incompletely defined. This project investigates how a lactate-rich, glycolytic environment shapes inflammatory responses in RA patients - derived macrophages and whether blocking glycolysis can reduce this activation. Peripheral blood mononuclear cells from RA patients were isolated by density-gradient centrifugation and differentiated into monocyte-derived macrophages with granulocyte–macrophage colony-stimulating factor (GM-CSF) to model the synovial compartment. Macrophages were then treated with phosphate-buffered saline (PBS, control) or lactate, with or without a hexokinase-2 inhibitor (HK2i) to limit glycolytic flux. RNA was extracted, converted to cDNA, and analyzed by quantitative PCR to measure pro-inflammatory cytokines and chemokines (e.g., IL1B, IL6, CCL2), interferon-stimulated genes, M1- and M2-associated markers, and transcripts encoding glycolytic and oxidative metabolism enzymes. Preliminary results show that GM-CSF–primed RA macrophages upregulate glycolytic mediators (GLUT1, HK2, LDHA) and downregulate oxidative metabolism genes, consistent with a glycolytic shift. Lactate further increases expression of M1-associated markers and inflammatory cytokines, whereas M2-associated genes are relatively suppressed, indicating a glycolysis-linked, hyper-inflammatory phenotype. In contrast, treatment with HK2i attenuates lactate-induced cytokine expression, partially restores M2-associated markers, and enhances oxidative metabolism transcripts. These findings support the hypothesis that dysregulated glycolytic metabolism reinforces pathogenic macrophage activation in RA and suggest that targeting glycolysis, particularly HK2, may represent a promising metabolic strategy to modulate macrophage-driven synovial inflammation. This project contributes to a growing field of RA immunometabolism by directly testing metabolic control of human RA macrophages.

125. Benito Mussolini and the Narrative Constructed about Italian Colonization in Fascist Italy

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My paper analyzes the narrative constructed by Benito Mussolini about Italian colonization in Fascist Italy. The methodology I will use to address this topic is archival research specifically using Mussolini's speeches in the Opera Omnia. After synthesizing these speeches (and using them to collect qualitative data), I have found that the political speech of Mussolini justifying the colonization of Ethiopia can be divided into two thematic categories: speeches that make the Fascist Regime into the rebirth of a new Roman Empire, and speeches that create a racist narrative that Italians are superior to Ethiopians. Mussolini gave speeches addressing Blackshirts in various cities and towns around Italy in the months leading up to the 1935 invasion. Although he did not specifically reference the Roman Empire in these speeches, or Italian colonization, he did speak in a way meant to inspire patriotism and strength in the Blackshirts: two traits the Italian populace needed if it was to rebuild itself into an empire. Additionally, in these speeches Mussolini would also appeal to the people of Italy by explaining that they are the ones who can help bring Ethiopia into the future because of their superior civilization-building. These narratives would create a lasting impact on how Italians today view their nation's colonial past. Monuments venerating Italian colonization efforts still stand in places including Rome. This is an ongoing project with a completion date set for April 2026.

126. Foreclosure to Financialization: Mapping Institutional Investor Penetration in Single-Family Housing Markets After 2008

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For many aspiring first-time homebuyers, the single-family home has shifted from a pathway to stability to a contested financial asset, as indicated by the changing age of first-time buyers and shrinking supply of starter homes. This project examines how the post-2008 rise of institutional investors in the single-family rental market has reshaped access to homeownership, investigating whether large-scale investor ownership reflects a long-term structural shift or a cyclical response to crisis-era conditions and unusually low interest rates.

This study draws on CoreLogic property-level data to construct a longitudinal, spatial dataset of single-family transactions, foreclosures, tenure status, and owner types across three metropolitan areas – Atlanta, Charlotte, Jacksonville – with substantial institutional investor activity. Institutional ownership is identified using CoreLogic classifications and name-matching to major investor portfolios, aggregated to census-tract and ZIP-code units. Using GIS mapping and descriptive statistics, the analysis traces changes from the foreclosure wave to the present, supplemented by spatial correlations and regression models relating investor presence to prices, tenure, and owner-occupancy rates.

Preliminary descriptive patterns align with existing research to suggest that institutional investors acquired large volumes of distressed properties in targeted markets, with some neighborhoods seeing investor ownership reach 5% – 8% of the housing stock. These purchases appear concentrated in relatively affordable, high-foreclosure areas in which cash-based investors offer outcompeted mortgage-dependent buyers. Early evidence suggests that these holdings have generally been maintained rather than quickly unwound, contributing to durable shifts in local tenure structures and the availability of entry-level homes for owner-occupants. In the neighborhoods where investors gained early traction, it has become significantly more difficult for first-time buyers to secure an affordable single-family home.

By mapping institutional portfolio intersections with historically accessible ownership opportunities, this project contributes to debates about financialization, intergenerational wealth-building, and housing equity.

123. Simulation and Validation of the ICARUS PMT Adder-Board Response

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The ICARUS liquid argon time projection chamber (LArTPC), operating as part of the Fermilab Short-Baseline Neutrino (SBN) program, detects neutrinos by capturing ionization electrons and scintillation photons produced in neutrino–argon interactions. The scintillation photons are collected by photomultiplier tubes (PMTs), which convert light into electrical signals used for event reconstruction and triggering. In 2023, a new hardware component known as the adder board was introduced to improve the light-trigger efficiency for low-energy neutrino events (<300 MeV). This board sums, reshapes, and outputs the analog signals from 15 neighboring PMT channels to help identify potential neutrino interactions. This work presents the first simulation of the adder-board electronics response and its validation against ICARUS data. The simulated waveforms reproduce detector data with 93.2% agreement in signal amplitude, demonstrating accurate modeling of the adder-board response. The validated model will be integrated into the ICARUS trigger-simulation framework, enabling more accurate detector simulations and improved detection of low-energy neutrino events.

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124. Digital Light Processed (DLP) 3D-Printed Microfluidic Artificial Lungs

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Extracorporeal membrane oxygenation (ECMO) is a life-support system that temporarily takes over heart and lung function, but it comes with major limitations, including high pressure drops, risk of blood clotting, and poor long-term compatibility with blood. Microfluidic artificial lung devices aim to overcome these limitations by replicating the architecture and transport efficiency of the native pulmonary microvasculature. In this project, we aimed to improve both the materials and the internal geometry of a 3D-printed artificial lung device. We hypothesize that optimizing custom UV-curable resin materials and multilayer microfluidic geometries fabricated via high-resolution digital light processing (DLP) 3D-printing will reduce pressure drop and clotting risk while improving gas exchange efficiency. Artificial lung devices were designed to be small, robust, multilayer distribution networks that mimic physiological blood flow patterns. Blood is introduced through a centralized inlet and bifurcates into multiple layers using Murray's Law-optimized channel diameters and angles to promote uniform flow and minimize shear stress. Gas channels are positioned above and below each blood layer, allowing oxygen and carbon dioxide exchange to occur through diffusion across a thin membrane. Devices were fabricated using 32 µm-resolution DLP 3D-printing with custom PDMS UV-curable resin formulations. Resin viscosity and post-cure flexibility were modified to improve print consistency, structural integrity, and device durability. In-vitro testing evaluated flow uniformity, pressure drop, mechanical stability, and gas transfer performance. Results demonstrated improved channel resolution and reduced deformations in printed devices. The multilayer flow distribution exhibited promising improvements in uniformity and pressure drops, thereby affecting hemodynamic performance compared to previous device iterations. Optimization of resin properties and microfluidic architecture enhances structural precision and flow dynamics in 3D-printed artificial lung devices. These advancements support the development of next-generation artificial lung technologies designed to reduce clotting risk, lower pressure drops, and improve long-term blood compatibility relative to conventional ECMO systems.

121. The Role of Actin Dynamics in Apicoplast Inheritance and Fission in Human Malaria Parasites

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Malaria, caused by *Plasmodium falciparum*, remains a major global health burden with over 234 million cases annually. (PMID: 40056919) Parasite survival depends on the apicoplast, a specialized organelle essential for growth and development. Proper inheritance of the apicoplast during cell division requires a dynamic actin cytoskeleton, yet the specific role of actin regulation in organelle segregation remains unclear. We hypothesized that disrupting actin dynamics would impair apicoplast and mitochondrial segregation during the parasite's asexual blood stage. To test this hypothesis, multinucleated NF54-Mev parasites were treated with two actin inhibitors: SZ-3, which blocks cofilin binding to filamentous actin and Cytochalasin D, which caps actin filament barbed ends (PMID: 33585284). Dimethylsulfoxide (DMSO) served as a negative control. Following drug treatment, parasites were analyzed using ultrastructure expansion microscopy to assess apicoplast and mitochondrial morphology and inheritance in developing merozoites. Control parasites displayed expected organelle remodeling prior to host cell rupture, with rounded apicoplasts and elongated mitochondria that properly segregated into daughter cells. (PMID: 34425697) In contrast, Cytochalasin D treatment disrupted organelle inheritance: although fission occurred, both the apicoplast and mitochondrion collapsed into the residual body and failed to segregate. SZ-3 treatment preserved apicoplast remodeling but altered mitochondrial morphology, producing a previously unobserved "mitochondrial looping" phenotype in which the mitochondrion tightly encircled the apicoplast. These findings demonstrate that actin dynamics are essential for proper organelle segregation in *P. falciparum* and reveal distinct roles for actin regulatory mechanisms in apicoplast and mitochondrial inheritance. This work advances understanding of parasite cell biology and highlights cytoskeletal regulation as a potential target for antimalarial strategies.

122. Sleep-Dependent Consolidation Enhances Second-Language Vowel Production Accuracy

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Sleep plays a critical role in consolidating newly learned information, including speech sound categories. The purpose of this study was to examine whether overnight sleep facilitates the consolidation and stabilization of newly learned non-native vowel contrasts in adult second-language learners. We hypothesized that participants who slept after training would demonstrate greater improvements in vowel production accuracy compared to participants who remained awake for an equivalent interval. Native English-speaking adults were trained on producing unfamiliar vowel contrasts during an initial learning session. Participants were then assigned to either a sleep condition, in which training was followed by overnight sleep, or a wake condition, in which training was followed by a comparable period of daytime wakefulness. Vowel production accuracy was assessed across multiple test sessions to evaluate changes in performance over time.Results revealed distinct learning trajectories between groups. Participants in the sleep condition demonstrated a marked improvement in vowel production accuracy at the morning test, and these gains were maintained at a subsequent midday session. In contrast, participants in the wake condition showed more gradual improvement across sessions, without the abrupt enhancement observed following sleep. A mixed-design analysis of variance revealed significant main effects of Group and Session, as well as a significant Group × Session interaction, confirming that sleep altered the trajectory of learning. These findings indicate that sleep supports the consolidation of newly learned vowel categories, leading to more rapid stabilization and improved production accuracy. The results suggest that sleep contributes to strengthening and reorganizing phonetic representations, facilitating more robust motor implementation of novel speech sounds. This work advances understanding of sleep-dependent learning mechanisms in second-language phonetic acquisition.

120. Synthesis and Evaluation of New Protein Aggregation Inhibitors for the Treatment of ALS

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Amyotrophic lateral sclerosis (ALS) poses a significant challenge due to its complexity and limited treatment options. Protein aggregation has been linked to the onset of ALS by inducing cellular stress and disrupting homeostasis. Patients often exhibit a loss in upper and lower motor neurons, leading to progressive weakness in muscles and death by respiratory failure [1]. Hence, the Silverman Group at Northwestern University has made strides in ALS treatment by the identification of cyclohexane 1,3-diones as potential chemicals for treatment. NU-9 has demonstrated promising outcomes by enhancing cellular integrity, reducing protein aggregation levels, and improving motor behavior in preclinical studies. The development of NU-9 (now AKV9) provides increased benefits compared to riluzole [2]. However, further enhancements are necessary to maximize its therapeutic potential. This project focuses on targeted modifications to the structure of NU-9 to improve its efficacy and anti-aggregation capacity. The approach involved retaining critical structural elements of NU-9 while focusing on modifying the chiral oxygen linker. Structures with varying levels of sterically hindering linkers were synthesized, forcing the molecule to adopt stabilized conformations. Initial compounds were tested in cellular models (PC12 cells) with ALS-associated gene mutations, such as SOD-1^{G85R}, to evaluate their impact on cellular survival and protein aggregation inhibition. Thus far, it has been observed that the introduction of bulkier, sterically hindered linkers lowers the ability of the molecule to decrease protein aggregation and increase cellular survival. However, the incorporation of a more rigid linker that limited the rotation capacity of the molecule increased the anti-aggregation capacity. Further, it is necessary to determine the molecules' ability to cross the blood-brain barrier and be delivered to the central nervous system (CNS) [3]. Additional molecules that provide potent capacity in the cellular models but have low permeability capability are currently being modified to increase permeability while retaining function.

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119. Electrochemical N(sp^3)–N(sp^3) Bond Formation via Hypervalent Nitrogen–Nitrogen Intermediates

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Nitrogen–nitrogen (N–N) bonds are relatively rare in nature, with only about 300 bioactive natural products containing this moiety [1]. Many clinically approved drugs, including antihypertensives, antidepressants, and antibiotics, also contain N–N bonds [2]. Despite the medicinal relevance of this motif, directly coupling two nitrogen atoms is fundamentally challenging because of the inherently electron-rich nature of nitrogen (polarity mismatch). As such, established methods often rely on the formation of transient electron-deficient nitrogen intermediates that can react with electron-rich nitrogen partners. While successful, these strategies require at least one sp^2 nitrogen source. N–N bond formation between two sp^3 nitrogen coupling partners is rare, with only a few reported examples and limited structural diversity. These methods often suffer from competing oxidative elimination due to weak adjacent carbon–hydrogen (C–H) bonds, leading to decomposition of N(sp^3) intermediates. To address these challenges, this project employs electrochemistry to generate an N(sp^3)-centered radical cation from quinuclidine, a nitrogen-containing bicyclic amine. Of note, this intermediate resists the typical decomposition pathway because the bicyclic structure disfavors elimination. We hypothesized that the electron-deficient N-radical cation could couple with nucleophilic quinuclidine to form N,N′-bisquinuclidinium (the N–N dimer). Optimized electrochemical conditions successfully produced the desired N,N′-bisquinuclidinium in high yield. We further demonstrated the synthetic utility of this transformation by performing ring-opening reactions on the N–N dimer with various oxygen-, nitrogen-, and sulfur-based nucleophiles to generate a wide array of nonsymmetrical N,N′-bispiperidines. Preliminary mechanistic studies suggest that N–N bond formation proceeds through polarity-matched hypervalent N(sp^3)–N(sp^3) intermediate formation between the N-radical cation and neutral quinuclidine. This represents a unique mechanism for bond formation between an N-radical cation and a nitrogen nucleophile, and potentially with other heteroatom nucleophiles such as sulfur and phosphorus.

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117. Bispecific Cargo-releasing Lipid Vesicles for Targeted Enhancement of NK Cell Immunotherapy

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Natural Killer (NK) cells mediate antibody-dependent cellular cytotoxicity through CD16 (FcγRIII) [1]. However, upon activation, CD16 is cleaved from the NK cell surface via the ADAM17 metalloprotease [2], reducing cytotoxic activity. Inhibition of ADAM17 via TNF Protease Inhibitor 2 (TAPI-2) has been shown to block shedding of CD16 and enhance NK cell function. However, as ADAM17 is present on many cell types, this approach lacks cellular specificity. We hypothesized that bispecific lipid vesicles encapsulating TAPI-2 could enable activation-dependent local inhibition of CD16 cleavage in addition to increasing cancer cell lysis. Vesicles were engineered with surface-conjugated CD16 and HER2 antibodies via SNAP and Halo tags to promote simultaneous engagement of NK cells and HER2+ cancer cells. We proposed that NK cell activation through CD16 engagement leads to perforin release, inducing vesicle membrane permeability and localized TAPI-2 release, therefore inhibiting ADAM17 mediated CD16 shedding. Using flow cytometry, we evaluated CD16 surface expression on NK cells following receptor activation in the presence of soluble TAPI-2 or TAPI-2 encapsulated bispecific vesicles. TAPI-2 presence significantly reduced CD16 shedding relative to controls. Ongoing studies are assessing the impact of TAPI-2 encapsulated bispecific vesicles on cancer cell lysis. This research introduces a vesicular platform to enhance NK cell cytotoxicity and activity, as well as increase cancer cell lysis, by coupling cancer-specific activation and localized inhibition of CD16 cleavage, proposing a novel synthetic biology strategy to enhance NK cell mediation cancer cell lysis.

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118. Exosomal Cargo of PDLSCs Stimulated with DMP1 Contain Osteoimmunomodulatory Factors

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MicroRNAs are the predominant exosomal cargo that can regulate a variety of cellular processes. Previously, we have shown that Dentin Matrix Protein 1 (DMP1) stimulated periodontal ligament stem cells (PDLSCs) release exosomes containing miRNA cargo that promoted osteogenic differentiation. In this study, we demonstrate that DMP1-stimulated PDLSC- exosomes carry miRNA-rich cargo that facilitates cytokine signaling.Exosomes from PDLSCs cultured with and without DMP1 were isolated using ultracentrifugation. A Qiagen miRNome PCR array was used to identify miRNA differentially expressed in exosomes of DMP1 treated PDLSCs. Predicted gene targets of differentially expressed miRNAs were evaluated using Gene Ontology to identify pathways related to cell differentiation, immune and inflammatory signaling. qRT-PCR was performed on the total RNA of PDLSCs to identify the expression of miRNA targets.Nanosight analysis of the isolated exosomes showed sizes in the 50-150nm range. Western blot analysis confirmed the presence of the exosomal marker CD63. The miRNA array showed 45 differentially expressed miRNAs. 5 miRNA were further analyzed including miR-106a-5p (fc = 0.33), miR-145-5p (fc = 0.22), miR-27a-3p (fc = 0.4), miR-92a-3p (fc = 0.32), and let-7a-5p (fc = 0.21). Gene Ontology analysis of these miRNA targets, with a predication score >90, demonstrated enrichment of MAPK and TNFα signaling pathways, cell differentiation and cytoskeletal alterations. qRT-PCR results of gene targets indicate a positive correlation between miRNA and gene target expression. Exosomal miRNAs enriched in DMP1 stimulated PDLSCs may function in cellular differentiation and paracrine immunomodulation via cytokine signaling. Future study on miR-106a-5p and its role in regulating targets, such as CTSK and DUSP10, could provide insight into the downstream effects of DMP1 on miRNA regulated immunomodulatory signaling in PDLSCs.

115. Scalable Low-Cost Supercapacitors via Waste-Derived Hierarchical Porous Carbon

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The onset of intermittent energy sources, e.g., wind and solar, requires a solution for energy storage that is both high in energy density and power density. While batteries are a reliable solution for high energy density, supercapacitors are at the forefront of research as a high power density energy storage solution. However, conventional supercapacitors still lack sufficient energy density for many off-grid applications. Here, we propose a framework utilizing agricultural waste to synthesize heteroatom (N and S) doped, MnO_2 functionalized, hierarchical porous carbon electrodes for high-performance supercapacitors. Biomass precursors including Spent Coffee Grounds (SCG) and Coconut Husks (CH) are pretreated with $ZnCl_2$ and undergo pyrolysis at 900°C. The resulting hierarchical porous carbon balances competing electrochemical pore functions: micropores maximize EDLC formation, while meso and macropores encourage ion transport. This explains why carbon-based supercapacitors exhibit extremely high electrical double layer capacitance (EDLC); nanoscale charge separation distances (~0.3-0.5 nm) and high surface areas enable specific capacitances approaching ~300 F/g. A key focus is identifying the threshold at which microporosity remains effective in improving capacitive performance. Following hydrothermal carbonization of the feedstock, Potentiostatic and Galvanostatic electrodeposition methods are actively being developed to deposit thin film MnO_2 coatings into the carbon structure. This approach utilizes both EDLC and pseudocapacitance from fast Mn^{3+}/Mn^{4+} redox reactions to maximize performance. Preliminary characterization of multiple feedstock-derived hierarchical porous carbon yielded a consistent specific surface area of ~1300 m^2/g. Given that specific capacitance is fundamentally dependent on accessible surface area available for double layer formation, this result is a strong predictor of high specific capacitance in the final device. This approach will simultaneously divert waste from landfills and reduce emissions for a sustainable energy storage solution.

116. Synthesis and Characterization of a Dizinc Scaffold to Model an Enzyme Active Site

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New Delhi Metallo-β-lactamase (NDM) is a protein with a di-zinc active site that hydrolyzes carbapenem and penicillin antibiotics. NDM is one route that bacteria use to become resistant to antimicrobials, and therefore NDM inhibitors would be valuable tools for fighting antimicrobial resistant pathogens. We set out to model the NDM active site using a small molecule to examine potential drug binding to the di-zinc core. A ligand scaffold, HL, for supporting two metals was synthesized using a microwave reactor and purified using extraction and crystallization. The microwave reaction was rapid and more efficient than standard synthetic methods. The ligand was then metalated with zinc acetate and sodium tetraphenylborate to generate the complex $LZn_2(OAc)_2]\ BPh_4$. This dizinc complex is being studied for interaction with potential zinc-binding drugs such as 8-hydroxyquinolin derivatives, to provide insight into how potential drugs interact with two zinc atoms.

113. Ecosystems of the Last Dinosaurs: Analysis of Lancian Food Web Examines Stability of End-Cretaceous Ecosystems

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The Cretaceous-Paleogene (K-Pg) mass extinction resulted in the extinction of all non-avian dinosaurs, consequently allowing for the rise of mammals. The prevailing hypothesis for the cause of this event is global climatic change resulting from an asteroid impact that struck the Yucatán peninsula 66 million years ago. More recently, however, studies have presented increasing evidence that ecosystems may have already been declining leading up to the impact event. This study aims to assess the stability of local, late-Cretaceous ecosystems preserved in the rocks of the Lance Formation. We use food web network analyses to evaluate whether these ecosystems were already in decline, resulting in an amplified event subsequent to asteroid impact. Microvertebrate fossil assemblages from the Lance Creek Formation of southeastern Wyoming capture a time-series of ecosystem diversity from a nearshore drainage of the Mesozoic intercontinental seaway, making it an ideal study system to test for ecosystem stability leading up to the K-Pg. Using over 300 identified vertebrate microfossils, we established a network highlighting an ecosystem through the latest Cretaceous. From this network, we tested metrics including connectedness, degree distribution, cliques, and diversity. Here, we present a single food web from one our ecosystems sites that will provide as the basis for upcoming research, where multiple networks will be created, analyzed, and compared against each other to evaluate Lance Creek's stability. This network exhibits a connectance of 0.118, an evenness of 0.455, a Shannon's diversity index of 1.59, and a Simpson's diversity index of 0.563, with nodes presenting varying levels of betweenness and degrees. Continued assessment of Lance Creek ecosystem stability will provide a localized perspective into ecosystem stability during this monumental chapter in vertebrate evolution. Furthermore, this research may provide insights into how modern biodiversity will react at the local scale to rapid global climatic change.

114. Controller to Cognition: Adolescent Video Game Experience and Spatial Ability

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Spatial cognition refers to how individuals think and reason about spaces, locations, and objects [1], relying on a set of spatial skills which are highly malleable and can be improved with training [2], as well as being strongly linked to success in science, technology, engineering, and mathematics (STEM) disciplines [1]. While playing action-related video games can significantly enhance spatial skills [3], there exists little work exploring how broader game genres and modalities (e.g., desktop, tablet, console) affect these skills. An initial survey was administered to undergraduate students enrolled in Introduction to Psychology (N = 193). The survey assessed participants' gaming history, playing contexts, and primary playing modality. The survey also included questions to assess participants' self-perceived spatial skills. Data from this survey, complemented by 17 follow-up interviews, were used to benchmark popular games and identify game components participants perceived as spatial. A second survey was administered (N = 64) to validate the initial findings with a standardized measure, achieved by including a mental rotation test—a common, standardized measure of spatial skills—as well as gaming tendencies, preferences, and typical weekly hours of play. On the first survey (N = 193), linear regressions showed that higher game frequency significantly predicted higher spatial scores overall ($p < .001$) and across all modalities: console ($p = .029$), mobile ($p < .001$), and PC/laptop ($p < .001$). The second survey (N = 64) replicated this; a simple linear regression showed that total weekly game hours predicted higher scores on a mental rotation test ($p = .005$). Video game experience, across genres and modalities, is linked to spatial skills, expanding existing research beyond specific genre foci. Given the link between spatial skills and STEM success, these results suggest that a wide variety of everyday video games may be powerful and accessible tools for developing spatial skills vital to STEM pipelines.

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111. Comparing Neuron Morphology and Thalamocortical Axon Development in Rorb-Cre and Nex-Cre Genotypes

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Autism Spectrum Disorder (ASD) is a complex, multigenic neurodevelopmental disorder that affects 1 in 36 people in the United States. ASD is characterized by differences in sensory processing and brain connectivity, which are thought to stem from disruptions in axon guidance and circuit formation. A neuron's morphology is postulated to be essential for proper circuit formation as it directly impacts its ability to form physical connections with other neurons, thus influencing connectivity. Our research aims to link changes in neuron morphology to disruptions in brain circuit wiring using a conditional deletion model of a clinically-relevant ASD gene in cortical pyramidal neurons. We employed genetic reporters to sparsely label neuron morphologies alongside a thalamocortical axon (TCA) reporter to visualize incoming circuits. Using *Neurod6-cre* to drive postmitotic deletion of our gene of interest specifically from cortical pyramidal neurons, we analyzed layer-specific neuron morphologies and compared TCA development in control and conditional knockout (cKO) mice via immunostaining and confocal imaging. Our analysis revealed that the morphologies of pyramidal neurons in cKO cortex were disrupted, with differences in polarity and less elaborate dendrites compared to controls. Interestingly, this change in morphology was accompanied by misrouting of TCAs and their failure to organize into distinct barrels within the somatosensory cortex of cKO mice. Additionally, we observed a reduction in the thickness of the upper layers of the cortex, which may be due to the observed reduction of dendritic branching. Together, these findings suggest that the acquisition of correct pyramidal neuron morphologies is essential for directing axonal connectivity, providing a potential cellular mechanism for the disrupted brain wiring seen in ASD.

112. Enlightened By Excrements: An Investigation of Parabasalid Diversity in the Gut Microbiome

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Within our gastrointestinal tract, a community of bacteria, archaea, viruses and protists work in tandem to digest nutrients, influence inflammation, and maintain overall health. However, despite protists' fundamental role in this biological ecosystem, they remain sorely understudied. As protists disappear from industrialized microbiomes, the need to study these microbes' mushrooms. Aiming to spearhead this eukaryotic blackbox, my project focuses on isolating novel protists from the Parabasalia phylum to expand a budding biobank. Importantly, although parabasalid protists have been lost in some populations, research has shown that human-associated parabasalid species are also found in animals such as nonhuman primates and ungulates. In collaboration with the Lincoln Park Zoo and The University of Illinois Chicago, we are isolating human-associated protists to establish a pure culture for downstream analysis. In addition to isolating novel protists, I am elucidating three characteristics: who are they, what do they eat, and how do they look. By identifying preferred carbon sources, I delve into what these organisms are consuming within the gut. Using *Tetratrichomonas buttreyi*, I performed growth curves in four unique medias and found that pectin is the preferred carbon source for these microbes. With continued carbon utilization research, I can further characterize the niches found in the order. To investigate morphology, I am performing immunofluorescence microscopy to highlight intracellular and extracellular features within the genus. After DNA extraction and 18s PCR sequencing, I identified a *T. buttreyi* as a commensal protist in Baboons. The phylogenetic tree elucidates this species is also found in pigs. I aim to continue molecular identification, thus growing the biobank and phylogenetic tree. Protists are fundamental to the world around us and the world of microbes within us; understanding them advances medicine, infectious diseases, and ecology.

109. Dancing in the Durbar: AHistory of Sex Work in Dogra-ruled Kashmir (1846-1947)

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Women have been major actors in the social and political history of colonial India. Yet their experiences have been erased from the archive. Kashmir, a princely state in colonial India, presents an interesting case of women's labour history. It was the only state in colonial India where prostitution was legal. In fact, under the monarchical rule of the Dogras, heavy taxation was levied on sex workers. Historians have viewed the presence of prostitution in a Muslim majority state through the lens of misgovernance. Some scholars have praised the British intervention to curb the "moral ill, while others viewed Dogra policies on prostitution a means to derive revenue While the extractive policies of the Dogras cannot be excused. The role of British colonial officials and Christian missionaries in changing the moral perception of sex workers is often overlooked. Sex workers in Kashmir were not merely women offering sex in exchange of money, they were singers, court dancers and performers. Present research has failed to look at sex workers in Kashmir through the lens of labour history. I use colonial, missionary and Dogra records to understand the lives of Kashmiri prostitutes, exploring their agency in a setting where being Kashmiri meant being exploited by both the Dogras and British. I explore the changes in their societal acceptance of prostitution as British morality seeps in and nationalist movement against the Dogras mobilises in the 1920s. The research concludes that the British discourse on prostitution in Kashmir was not only a way to morally police, women but also became a political tool to intervene and interfere with the Dogra court. The rise in Kashmiri campaigning against prostitutes in the 1920s also emerged from the spread of British moral understanding through British educational and medical missions.

110. Donor-Acceptor Stenhouse Adducts as Intrinsically Photoswitchable Dynamic Covalent Bonds

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Combining dynamic covalent bonds with photoswitches allows the kinetics and thermodynamics of exchange to be controlled with light. However, this two-component strategy introduces synthetic and compatibility challenges. We hypothesized that Donor-Acceptor Stenhouse Adducts (DASAs), a photoswitch that undergoes reversible isomerization between a conjugated open form and a polar, colorless closed form, could act as a dynamic bond in the open form.[1] Therefore, the material would be expected to undergo faster exchange and greater viscoelasticity in the dark and become more elastic upon irradiation. We discovered that open DASA isomers undergo dynamic covalent exchange of their amine donor via two pathways, reversible dissociation and conjugate transamination.[2] Exchange can then be arrested upon irradiation to form the closed DASA isomer, offering a handle to gate dynamic behavior. Consequently, incorporating DASAs as cross-linkers in PDMS-based networks yields covalent adaptable networks (CANs) with viscoelastic behavior that can be tuned by light. We also identify degradation pathways that limit the reversibility of this system under extended heating. Overall, DASA exchange represents a synthetically accessible platform for photocontrolled soft materials. Further research on different generations of DASAs would further our understanding of this exchange system. Similar strategies could be utilized for other photoswitches that could go through conjugated addition and elimination reactions. Light-responsive dynamic materials could be applied in drug delivery systems. By tuning the exchange reaction using DASA isomerization, the material could release therapeutics in a controlled manner based on the light responsiveness.[3]

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107. Bridging Survey Instrument Evolution in Longitudinal Studies: A Semantic Deep Learning Framework

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Longitudinal surveys are a crucial component of behavioral research. Such surveys, however, struggle to maintain analytical continuity when survey questions must change over time. Missing responses in longitudinal surveys lead to data sparsity issues, further restricting applicable modeling methods. Using a 15-wave vaccination survey as a testbed, we address these issues through a framework involving deep learning, LLM-derived semantic question embeddings, and wave-local cluster analysis. We leverage LLM-generated semantic embeddings of survey questions to encode question meaning, enabling a Deep & Cross Network used for imputation to jointly model responses across item semantics, individual characteristics, and temporal dynamics. This structure directly addresses survey evolution by operating in learned semantic space. To overcome data scarcity, we use cluster-informed synthetic data generation via hierarchical prompting that produces synthetic responses preserving distributional properties and empirical cluster structure. Our approach achieves a strong improvement in semantic gap tasks and 80-90% synthetic data fidelity, providing practical solutions for evolving longitudinal studies.

108. Shape-Dependent Antimicrobial Activity of Silver Nanomaterials Against Diverse Bacterial Strains

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The rapid rise of antimicrobial resistance (AMR) threatens the effectiveness of conventional antibiotics and necessitates alternative antimicrobial strategies. Silver nanomaterials (AgNPs) have emerged as promising candidates due to their broad-spectrum antimicrobial activity and multi-target mechanisms, which reduce the likelihood of resistance development. However, the role of nanoparticle physicochemical properties, especially particle shape, in modulating antimicrobial efficacy remains insufficiently understood. This study investigates how silver nanoparticle morphology influences antimicrobial activity against both Gram-negative and Gram-positive bacterial strains. Spherical, rod-shaped, and cubic silver nanoparticles were evaluated for their minimum inhibitory concentrations (MICs) using standard broth microdilution assays. Representative strains included Escherichia coli, Enterobacter cloacae, and Klebsiella pneumoniae (Gram-negative), as well as Staphylococcus aureus (Gram-positive). Nanoparticle suspensions were characterized for size distribution and concentration prior to biological testing to ensure consistent dosing across treatments. Preliminary results indicate that nanoparticle shape influences antimicrobial potency. Cubic and rod-shaped nanoparticles demonstrated lower MIC values than spherical nanoparticles in Gram-negative species, suggesting enhanced antimicrobial activity. Notably, exposure to 55 nm PVP-capped cubic AgNPs revealed species-specific susceptibility patterns: S. aureus and K. pneumoniae consistently exhibited greater susceptibility, whereas E. coli and E. cloacae displayed more variable responses. These differences may reflect variations in cell envelope architecture and nanoparticle-cell surface interactions. Overall, this work highlights the importance of nanoparticle morphology in shaping antimicrobial performance and contributes to ongoing efforts to address antimicrobial resistance through materials-based strategies.

105. Development of Sterically Hindered Alpha-3 Beta-4 Nicotinic Acetylcholine Receptor Inhibitors That Reduce Cocaine-Seeking Behavior

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Psychostimulant Substance Use Disorder (pSUD) remains a significant unmet medical need, with no approved pharmacotherapies that directly treat pSUD. Recent studies from the CDC have shown that from 2021 to 2024, Stimulant-Involved Overdoses have led to more than 180,000 deaths in the United States. The α3β4 nicotinic acetylcholine receptor (nAChR) subtype emerged as a promising target due to its role in neural circuits that *have* been linked to addiction-relevant behavior and aversive/reinforcing signaling. Modulating this specific receptor subtype may provide a pathway-focused strategy to reduce relapse without broad receptor blockades. Our lab's work has already reported that aristoquinoline, a natural product found in *Aristotelia chilensis*, and its derivatives inhibit α3β4 nAChRs and reduce cocaine-seeking behavior in a rat reinstatement model. In this project, the chemical focus involves the development of aristoquinoline-based analogues containing biaryl substituents. The immediate goal is to synthesize methylated biaryl analogues of this structure, introducing steric bulk near the biaryl bond, thereby hindering rotation. The implementation of steric bulk forces aryl rings to adopt a more twisted, non-coplanar conformation. This design is expected to influence how the aromatic region occupies the α3β4 binding pocket, with the goal of improving subtype selectivity and potentially potency. After synthesis, the methylated biaryl analogues will be purified and structurally confirmed by column chromatography, nuclear magnetic resonance, and liquid chromatography mass-spectrometry. Purified compounds will be tested in mammalian cell lines expressing the α3β4 nAChR to assess potency and in α4β2 and α7 cell lines to assess selectivity. Results from this project will guide the next round of analogue design to further develop compounds that may be clinically relevant.

106. Synthesis of a Curcumin Loaded Peptide-Based Nanoparticle

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Neuroblastoma is the leading cancer type within children under the age of 5. Neuroblastoma occurs when developmental nerve cells reach a stage of unregulated growth, resulting in a malignant tumor that typically localizes in the upper body. Symptoms of neuroblastoma range from fatigue and loss of appetite to a bulging eye or bump in the abdomen, neck, or chest. Within the low-risk stage of neuroblastoma, treatment is often off-set on the chance that the tumor may naturally remit. Nanoparticles are promising, minimally invasive treatments to the future of cancer treatment due to their enhanced ability for drug targeting, improved cellular uptake, and improved bioavailability [1]. In this study, two naturally derived compounds are utilized for their perceived anti-cancer and neuroprotective effects: Curcumin and powdered Protaetia brevitarsis seulensis larvae (PBSL) peptide [2]. To optimize the effects of nanoparticles, a particle with a diameter < 200 nm and surface charge between -25 to -40 mV was achieved [3]. Probe sonication and lyophilization techniques were utilized to dissipate aggregate particles and wash out sediment. Malvern's Zetasizer software was used to confirm the characteristics of the particle. To test the nanoparticle's effect in vitro L929 fibroblast cells were used along with thee SH-SY5Y neuroblast cell line. An alamar blue and scratch assay was also utilized to determine the particle's effect on cell viability and wound healing properties, respectively. Initial experimental resulted in desirable particle parameters (145 d. nm, -30 mV) and indicate the efficacy of the particle treatment in promoting healthy L929 cell growth across an area lacking cells. Additionally, promoted viability of healthy cells was achieved along with limited viability for compromised tumor cells. The trajectory of cell treatment indicates that the Curcumin-PBSL Peptide complex may bridge the gap between neuroprotective and anti-cancer effects.

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103. Developmental Mapping of Aldh1a1 Dopaminergic Neurons and Their Relationship to Aversion Related Striatal Circuits

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Midbrain dopaminergic (DA) neurons play central roles in motor control, motivation, and reinforcement learning, yet increasing evidence shows these neurons comprise multiple molecularly and functionally distinct subpopulations [1]. This heterogeneity challenges the classical view of dopamine as a uniform reward signal and instead supports specialized circuits involved in both reward and aversion processing. Recent studies have identified "aversion hotspots" within the striatum, including the ventromedial nucleus accumbens shell, where dopaminergic signaling can increase in response to aversive stimuli and predictive cues [2]. Understanding how molecularly defined DA neuron subtypes contribute to these circuit architectures remains an important question in systems neuroscience. Aldehyde dehydrogenase 1A1 (Aldh1a1) has emerged as a molecular marker distinguishing a subset of dopaminergic neurons enriched within substantia nigra circuitry [3]. However, the developmental organization and projection patterns of Aldh1a1-expressing neurons relative to aversion-associated striatal regions remain incompletely characterized. In this study, Aldh1a1iCreDatFlpAi65 reporter mice were used with tyrosine hydroxylase immunohistochemistry to identify Aldh1a1-expressing dopaminergic neurons. Their spatial distribution was examined across multiple midbrain subsections and bregma levels in adolescent (P14) and adult (P100) mice, focusing on substantia nigra and medial ventral tegmental area regions. Striatal axonal labeling patterns were also examined to explore projection relationships associated with this population. Preliminary observations suggest region-specific enrichment of Aldh1a1-positive neurons across substantia nigra subsections and distinct projection patterns within dorsal striatal territories. Ongoing analyses aim to clarify how this population contributes to the broader organization of midbrain circuits involved in aversion-related processing and striatal connectivity. Because dysfunction of dopaminergic pathways is implicated in disorders such as Parkinson's disease and maladaptive aversion processing, understanding the developmental organization of Aldh1a1-defined neurons may reveal circuit-level vulnerabilities underlying these conditions [2,3].

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104. Defining BCL-2 Family Protein Dynamics in *Ex Vivo* Expanding Human T Cells

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The BCL-2 family of proteins regulates the intrinsic mitochondrial pathway of apoptosis by balancing pro- and anti-apoptotic signals that determine cell survival or death. Beyond apoptosis, these proteins also play important immunomodulatory roles. The LaBelle Lab has shown that BH3 mimetics, which inhibit anti-apoptotic BCL-2 family proteins, enhance the tumor-killing capacity of expanding chimeric antigen receptor (CAR) T cells. However, the regulation and dynamics of BCL-2 family proteins during T cell expansion remain poorly understood. To address this gap, we characterized BCL-2 family protein expression in healthy human T cells during ex vivo expansion. Flow cytometry analyses revealed consistent temporal shifts in protein expression, with levels increasing during early activation, peaking, and subsequently declining. This pattern was observed across both pro- and anti-apoptotic proteins in helper and cytotoxic T cell subsets. In contrast, RT-qPCR analyses showed variable transcriptional trends, suggesting that transcription is not the dominant regulatory mechanism controlling BCL-2 family protein expression. Ongoing studies are validating these findings by Western blot and will examine how BH3 mimetics alter BCL-2 family expression, transcription, and protein interactions. These findings provide insight into the dynamic regulation of BCL-2 family proteins during T cell expansion and may inform strategies to modulate immune cell function and improve the efficacy of immunotherapies.

102. Engineering Pdu Shell Protein Co-Assemblies to Tune Material Morphology, Size, and Function

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Nanomaterials have vast potential in catalysis, drug delivery, and energy; however, it is difficult to engineer such materials with the necessary precision to implement at scale. Biotemplating offers a fine-tuned way to produce nanomaterials by allowing proteins to self-assemble into structures to be used for non-native purposes. The shell proteins PduA and PduJ from the Pdu (1,2-propanediol utilization) microcompartment (MCP) from *Salmonella enterica* Typhimurium LT2 are candidates for this purpose since they self-assemble into higher order structures when expressed in cell-free protein synthesis (CFPS). Though only different by 13 amino acids, PduA and PduJ form vastly different structures when expressed *in vitro*. Moreover, single amino acid substitutions vastly reshape morphology and size of these high order protein assemblies, creating structures ranging from tight packs of long fibrils to hexagonal disks coupled with ribbon clusters [1]. Previous work built Pdu materials by using single protein variants per assembly. Here, we aimed to fine-tune the morphology and size of these structures further through the incorporation of multiple Pdu subunits as building blocks. To that end, we expressed previously characterized PduJ-FLAG and PduA-FLAG mutants that form noticeably different structures (*e.g.* hexagons and fibrils) with each other to determine if their co-assembly led to a change in morphology compared to the individual components on their own. We found that co-assembly of PduA and PduJ mutants altered the size and morphology of the resulting structures. We also found that shell protein homologs from other organisms co-assemble with PduA and PduJ, opening doors for further fine-tuning assembly. Finally, we were able to engineer a mechanism to localize heterologous proteins to PduJ fibrils. These results pave the way for endowing new functionality to Pdu nanomaterials such as enzyme co-immobilization or biosensing in addition to further elucidating design rules that govern Pdu assembly.

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100. Automated Segmentation and Quantification of Uveal Melanoma from Ultrasonography Using Deep Learning

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Early detection and effective treatment of Uveal Melanoma (UM), one of the most common intraocular malignancies in adults, relies on accurate tumor measurement. Ultrasonography is the gold-standard for measuring choroidal tumors, but manual segmentation is highly operator-dependent, subject to inter- and intra-observer variability, and time-consuming. This study explores the potential of deep learning as a tool for automated tumor segmentation and measurement. A DenseNet-121 U-net model was trained to segment three classes on 114 B-scan ultrasound images. Ground-truth masks were annotated with tumor (green), inner retina (red), and inner scleral (blue) boundaries. The model was trained using a combined cross-entropy and Dice loss, and performance was evaluated using Dice score, Average Symmetric Surface Distance (ASSD), and 95th percentile Hausdorff Distance (HD95). The model achieved an average Dice score of 0.91 at the tumor margins, an ASSD of 3.5 pixels, and an HD95 of 17.8 pixels. The inner retinal lines were segmented with an ASSD of 1.7 pixels and an HD95 of 12.5 pixels, while the inner scleral boundary had an ASSD of 3.5 pixels and an HD95 of 19.9 pixels. This study shows that a deep learning model can accurately segment relevant anatomical layers and tumor boundaries in ultrasound images, as evidenced by the high Dice score and low boundary error in the tumor region. While the inner scleral boundary showed higher errors than the other structures, the overall segmentation performance remained strong. These findings suggest that deep learning based segmentation could support early detection of choroidal tumors, particularly in clinical settings with limited access to ocular oncologists. Further training with larger datasets and external validation will help confirm generalizability and support future clinical implementation.

101. Policies Supporting Historically Marginalized Groups May Lead Children to Discount Their Competence

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Social inequalities are ubiquitous in children's everyday lives. They not only experience these inequalities themselves, they also observe and reason about the inequalities experienced by others. Past research shows that children can recognize the structural barriers that lead to these inequalities [1]. Recently, institutions have begun to implement policies that provide systemic support for historically marginalized groups [2]. These strategies increased these groups' representations [3], but may have some unintended negative consequences. The present study seeks to understand how children reason about the success of historically marginalized groups following policy interventions. Five-to-ten-year-old children (N = 108) heard about a hypothetical competition in a far away town. Historically, one group (boys or girls; counterbalanced) was underrepresented in the competition. In the *No Change* condition, children will learn that this group remains underrepresented in recent years. In the *Change with Rule* condition, they will learn that this group's representation increased due to a rule. In the *Change without Rule* condition, they will learn that this group's representation increased, without hearing any other information. Children were tasked with inferring the ability of the historically underrepresented group and the fairness of the competition. We predicted children would infer that the historically underrepresented group's ability is lowest in the *No Change* condition, higher in the *Change with Rule* condition, and highest in the *Change without Rule* condition. We found that 7-to-8-year-olds did not distinguish between the *Change with Rule* and *Change without Rule* conditions, and 9-to-10-year-olds attributed lower ability and fairness to the *Change with Rule* condition compared to the *Change without Rule* condition. These findings suggest that learning about policies regarding marginalized group representation might lead children as young as 9-years-old to negatively evaluate these groups' competencies and perceive these policies as unfair.

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98. In-Situ Resistivity for Precise Control of Phase Transitions in Functional Oxides

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Precise control of oxygen stoichiometry is critical for stabilizing functional oxide thin films, as oxygen content strongly influences crystalline ordering, transport behavior, and phase stability. Conventional annealing studies often rely on ex-situ measurements, limiting insight into real-time property evolution during thermal processing. This work centers on the development of a versatile in-situ resistivity measurement and real-time data visualization platform designed to directly monitor thin film oxides during annealing. Controlled post-growth annealing is essential for stabilizing functional oxides, as oxygen stoichiometry strongly influences crystalline ordering and electronic properties. Uncontrolled annealing can lead to unwanted phase evolution and degradation, motivating real-time probes during thermal treatment. We report the development of an in-situ resistivity measurement and real-time plotting system integrated into a tube furnace, designed to operate at temperatures up to 400 °C under a variety of gas environments, including ozone. By monitoring resistivity during annealing, this approach enables identification of optimal processing conditions, provides insight into oxygen-driven phase transitions, and facilitates on-the-fly materials-by-design. Preliminary measurements on thin film transition metal oxides demonstrate reproducible resistivity evolution during thermal cycling. In addition, the effectiveness of capping layers in mitigating oxygen-loss-induced degradation is investigated, highlighting their role in controlling soft-chemistry-driven phase evolution. In the practice of investigating specific materials systems, the platform was applied to $SrFeO_3$ thin films capped with 4-unit-cells of $SrTiO_3$, which were stable up to 100 °C. The system has also been employed for precision annealing studies of $La_3Ni_2O_7$ in pursuit of stabilizing its superconducting phase. While superconductivity has not yet been achieved, the platform enables controlled thermal tuning and continuous feedback during phase optimization. Importantly, the architecture is material-agnostic and extendable to diverse thin film systems requiring controlled annealing environments. This work establishes a broadly applicable in-situ characterization framework for advancing oxide electronics and emergent quantum materials.

99. Isolation and Chemical Profiling of Soil-Derived Actinobacteria Targeting ESKAPE Pathogens

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In line with global public health needs, there is an urgent need to discover new bioactive compounds that can be developed into antibiotics against antimicrobial-resistant pathogens. *Mycobacterium tuberculosis*, non-tuberculous mycobacteria (NTM; such as *Mycobacterium abscessus*, *Mycobacterium avium*, and *Mycobacterium ulcerans*), and ESKAPE pathogens are clinically important organisms that are notorious for their multidrug resistance. Streptomycetes are known to synthesize a vast array of secondary metabolites and are therefore a valuable source of natural products with diverse biological activities. This study focuses on soil-derived Actinobacteria as a source of compounds for antimicrobial drug discovery.

Soil samples were collected from several locations around Chicago. Using sterile water, serial dilutions were prepared and plated on three different selective media for the isolation of Actinobacteria. Colonies appeared after incubation for 3 to 7 days and were streaked onto the corresponding agar plates to obtain pure cultures. Selected isolates were then fermented in various media for 7 days. After fermentation, extracts were prepared and subjected to preliminary biological screening against M. tuberculosis, NTM, and ESKAPE pathogens. A total of 39 isolates showed activity against one or more of the target pathogens. Isolates 2AD1, 3BC6, 2AD4, 4AR7, 1AK3, and 3BC9 showed notable activity against *Staphylococcus aureus*, as well as against *M. tuberculosis*, *M. ulcerans*, and *M. abscessus*. Activity was also observed against *Borrelia burgdorferi*, the causative agent of Lyme disease.

We are now working on identifying these isolates and purifying the active compounds for structure elucidation and determination of minimum inhibitory concentrations (MICs).

96. Evaluating Artificial Intelligence in Subjective Domains: The Impact of Source and Language on Trust in Fortune-Telling

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As artificial intelligence integrates into daily life, its role in traditionally subjective domains remains underexplored. This study examines how individuals evaluate fortune-telling claims depending on the perceived source (AI versus human) and linguistic complexity (astrology terminology versus mundane language). We hypothesize that AI-attributed messages will be rated higher in trustworthiness and yield greater positive changes in persuasion outcomes than human-attributed messages. We also predict a main effect for linguistic complexity, where technical, fortune-telling-specific language increases trust, alongside an interaction effect: human-attributed messages will be rated dissimilarly across linguistic complexity conditions, while AI-attributed messages will be rated more similarly. In this experimental design, adults who have consulted fortune-telling or astrology at least once in the past year read one of four randomly assigned fortune-telling messages. These messages manipulate source and language while preserving core content. We measure trustworthiness and calculate overall persuasion outcomes using pre-test and post-test change scores for behavioral intention and attitude. Preliminary descriptive data (N = 15) indicates a strong emerging main effect for linguistic complexity: messages using complex astrological terminology yielded substantially higher trustworthiness (M = 6.57) and positive persuasion changes (M = 0.57) compared to mundane language (M = 3.55 and M = -0.21, respectively). While overall trustworthiness was similar across AI (M = 4.43) and human (M = 4.38) sources, an unexpected interaction trend emerged: complex language increased trustworthiness and persuasion more drastically for AI-attributed messages than for human-attributed ones, diverging from our initial prediction. Consequently, these early findings suggest that in fortune-telling contexts, specialized terminology may be critical for lending credibility to artificial intelligence.

97. Solution Interactions of Aromatic Ketones and Iron(III) Chloride

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Lewis acids are used to activate carbonyls in a broad range of organic syntheses. In order to continue the development of novel reaction pathways and understand existing methods, it is necessary to determine the solution interactions between Lewis acids and bases, especially under catalytically relevant conditions. In this study, we performed in situ titrations coupled with in situ IR spectroscopy to observe Lewis acid/base equilibria, Lewis pairs, and aggregate complexes. Solution conductivity was also employed to measure the interaction of a range of acetophenones with iron(III) chloride. We observe data consistent with formation of iron(III)-centered complexes. Up to one equivalent of ketone, peak(s) consistent with the formation of a Lewis pair are observed. After one equivalent of ketone, peak(s) consistent with the formation of aggregate complexes are observed. Negligible conductance is observed when less than one equivalent of ketone is added to the system, consistent with a Lewis pair. Beyond one equivalent of ketone, we observe conductance which is indicative of aggregate formation. Our data show that acetophenones with electron-donating substituents on the ring are more likely to form aggregate complexes with the catalyst. We also observed how the incorporation of fluorine atoms to the alpha position of acetophenone disrupts the formation of these aggregates. This collection of observations is intended to assist the synthetic chemist in the design of new catalysts and methods.

94. Nano-Therapeutics Targeting Osteopontin in Tumor-Associated Myeloid Cells to Enhance Anti-Tumor Immunity in Glioblastoma

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Glioblastoma (GBM) is the most aggressive primary brain tumor, with patient median survival under 15 months despite standard therapy. Its therapy resistance is driven by a profoundly immunosuppressive tumor microenvironment (TME), in which tumor-associated myeloid cells (TAMCs) adopt an anti-inflammatory, tumor-promoting phenotype that suppresses antitumor immunity. Among the key mediators of this process is osteopontin (Secreted Phosphoprotein 1, SPP1), an immunoregulatory protein highly expressed in TAMCs and implicated in driving T cell exhaustion and immune evasion. Our single-cell RNA sequencing analysis validated high SPP1 expression in TAMCs in GBM models, suggesting that SPP1 may sustain the immunosuppressive polarization of TAMCs. Based on these findings, we hypothesized that silencing SPP1 in TAMCs may shift them toward a pro-inflammatory state, and thereby remodel the GBM microenvironment to enhance anti-tumor immune responses. To test this hypothesis, we have engineered lipid nanoparticles (LNPs) to deliver small interfering RNA (siRNA) against SPP1 in vitro. Knockdown kinetics revealed efficient transcription reduction, with qPCR showing rapid downregulation of SPP1 within 6 hours and nearly complete silencing within 24 hours. Functionally, SPP1 silencing reprogrammed TAMCs as characterized by upregulated expression of pro-inflammatory genes such as interferon beta (IFNβ) and C-C motif chemokine ligand 5 (CCL5). In addition, IncuCyte live-cell imaging revealed that SPP1-deficient TAMCs exhibited enhanced phagocytic activity, which may accelerate clearance of apoptotic tumor cells. When co-cultured with $CD8^+$ T cells, these reprogrammed TAMCs no longer exerted strong immunosuppressive effects and thus T cell proliferation was rescued, as demonstrated by flow cytometry. Altogether, these findings suggest that SPP1 inhibition via siRNA/LNP reprograms TAMCs from an immunosuppressive to a pro-inflammatory state, enhancing anti-tumor immune functions. This nanotherapy approach may offer a novel route to remodel the GBM microenvironment with translational potential to synergize with current standard-of-care treatments.

95. Classifying Blood Vessels Under Different Biological Conditions Using Chord-Length Distribution

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Classifying complex biological shapes is fundamental to numerous applications, from diagnosing diseases to interpreting cellular functions. Blood vessels are often characterized by highly fractal shapes, exhibiting intricate branching patterns. Research has shown that aging alters blood vessel structure, leading to features such as vessel dilation, tortuosity, microaneurysms, and reduced cerebral blood flow [1]. These structural differences suggest that blood vessels in aging individuals appear distinct from those in younger individuals. However, existing shape comparison methods often struggle to efficiently capture the features of these structures and, therefore, are unable to detect biologically relevant differences between shapes, such as the structural differences caused by aging and diseases. Inspired by the pioneering work of Levitz and Tchoubar on disordered porous solids [2], this project establishes a shape quantification method that utilizes chord lines, which are straight-line segments that connect two points within a shape such that no other point in between belongs to this shape. This computational method includes three stages: image segmentation, chord-length measurement, and distribution comparison. The method is tested on ten mouse retina images belonging to two distinct groups (controls and experiments). The testing revealed measurable differences between the statistical signatures of two groups. It showcases that by transforming complex shapes into statistical distributions, we are able to characterize them geometrically.

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92. Optical Coherence Tomography as a Tool for Mouse Skull Imaging

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Micro-computed tomography (micro-CT) is a commonly used imaging modality for three-dimensional visualizations of small animal models. This technique is highly regarded because of its ability to produce results with high spatial resolution, especially for the purpose of bone density visualization and structure reconstruction. However, micro-CT can be costly and has poor temporal resolution. Optical Coherence Tomography (OCT) is a non-invasive technique that allows for shorter imaging times while still maintaining a micron-scale resolution. The compact laser system offers a lower-cost option for imaging structural development of bone and tissue, and its utilization in imaging small animal models may provide sufficient structural information with minimal loss in spatial resolution. In this study, we evaluated OCT for producing cross-sectional images of bone structures in mouse skulls across age. Skull thickness, low-density area ratios, and attenuation coefficients were extracted to compare OCT-derived metrics with micro-CT and to assess OCT image quality with increasing depth. OCT skull thickness measurements showed close agreement with micro-CT and caliper measurements. Low-density area ratios derived from OCT differed in magnitude from micro-CT measurements but exhibited parallel age-dependent trends. Attenuation analysis demonstrated decreasing OCT signal quality with increasing skull thickness. These results demonstrate the feasibility of OCT as a complementary tool for comparative structural analysis of the mouse skull, however, they do not support OCT as a complete replacement for micro-CT imaging in small animal studies.

93. Targeted Restoration of SELENOF Translation in Prostate Cancer via RNA Decoy-Mediated eIF4a3 Inhibition

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Prostate cancer remains a leading cause of cancer-related mortality among men. SELENOF, a selenoprotein critical for protein quality control, is significantly reduced in prostate cancer, and its loss is linked to aggressive disease phenotypes. SELENOF translation requires UGA codon recoding mediated by the SECIS element in the 3'UTR of its mRNA. eIF4a3 is an RNA-binding protein involved in RNA splicing and translational control of selenoproteins like glutathione peroxidase 1 by binding onto its mRNA, a mechanism that also extends to SELENOF. Binding of eIF4a3 to SELENOF mRNA reduces its translation, leading to its low levels in cancer. Previous studies show eIF4a3 inhibition restores SELENOF levels, but global inhibition is cytotoxic and non-specific. This study introduces a novel strategy using synthetic RNA decoy oligonucleotides designed to selectively block eIF4a3 interaction with SELENOF mRNA without broadly interfering with its other biological functions. Using a dual-luciferase reporter system, we measured UGA readthrough efficiency in PC3, human prostate cancer cells, treated with RNA decoys. SELENOF protein and mRNA levels were measured by Western blotting and RT-PCR. Our results show that RNA decoys significantly increase luciferase activity and SELENOF protein levels in a dose-dependent manner, while mRNA levels remain unchanged, confirming post-transcriptional regulation. These findings support RNA decoys as a promising therapeutic approach to restore SELENOF levels and reverse cancer-associated phenotypes. Future studies will optimize decoy design and in vivo efficacy, paving the way for targeted RNA-based therapies in prostate cancer.

90. Engineering Vascularized Spinal Cord Organoids through Bioactive Peptide Amphiphile-Mediated HUVEC Integration

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Organoids are revolutionary miniature human tissue models made from pluripotent stem cells that replicate the native tissue structures and functions of human organs. However, organoids that lack a vascular system for gas and nutritional exchange will eventually experience necrosis or poor differentiation in the interior as they grow larger in size [1]. To address this diffusion limit, this project focuses on engineering vascularized spinal cord organoids (SCOs) by integrating human umbilical vein endothelial cells (HUVECs) using bioactive peptide amphiphiles (PAs). In this study, preliminary trials were conducted to determine the optimal concentration and type of bioactive PAs, designed to promote vascular growth (VEGF-A PA) and cell proliferation (IKVAV PA) [2]. Histology markers for proliferation, morphology, and phosphorylation of VEGF-A receptors (VEGF-A signaling) determined that the ideal treatment conditions consist of micelle-forming VEGF-A PAs and fiber-forming IKVAV PAs. Following these trials, a 3D co-culture system was established by introducing HUVECs to SCOs. To optimize endothelial cell integration and penetration into the organoid core, three distinct treatment timelines were examined: pre-treating SCOs with PAs two days before HUVEC introduction, simultaneous application of PAs and HUVECs, and delayed PA treatment following initial co-culture. Co-cultures were maintained between 3 to 14 days to monitor the rate of cellular integration and endogenous proliferation. Results will be evaluated through immunostaining and imaging to analyze HUVEC penetration and VEGF-A phosphorylation (signaling) within the SCOs. By leveraging the potent bioactivity of PAs, this project aims to use vascular engineering to develop *in vitro* models that more accurately replicate human tissue. These improved models will facilitate future studies of spinal cord injuries and the development of regenerative therapeutic strategies.

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91. Beyond International Status: Cultural Heterogeneity and the Masking Effect of Campus Culture on Mental Health Help-Seeking

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Mental health help-seeking among college students is shaped by a complex interplay of cultural background, institutional context, and individual experience. This study examines how cultural upbringing influences mental health perceptions, stigma, and help-seeking behavior among undergraduate students at a highly selective Midwestern institution, with particular attention to differences between East Asian international and domestic students.

Using a mixed-methods design combining a quantitative survey (N=53) and semi-structured interviews (N=10), I find that group differences were more limited than prior literature revealed. Quantitative analyses revealed no statistically significant differences between groups across ten thematic composites, including stigma, help-seeking likelihood, and campus climate attitudes. The one significant item-level finding was that East Asian international students more strongly endorsed the belief that mental health problems reflect personal weakness, consistent with prior literature on Confucian values and internalized stigma.

Qualitative analysis revealed that both groups described a shared campus culture that normalizes and glorifies academic stress. The institutional environment appeared to shape mental health attitudes across cultural backgrounds. At the same time, the underlying cultural frameworks differed: international students more often described mental health as simply absent from their upbringing, while domestic students from immigrant or minority households described it as recognized but dismissed. International students also faced distinct structural barriers to care, including insurance uncertainty and immigration-related stress.

Findings suggest that institutional culture and within-group heterogeneity play a larger role in shaping student mental health behavior than is typically captured by demographic groupings alone, with implications for campus programming and culturally responsive care.

88. Using Urban Mesopredators as Sentinels to Assess Lead Exposure in Chicago

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Lead (Pb) is a non-essential heavy metal that persists in the environment and bioaccumulates through air, soil, and water, posing long-term health risks to humans and wildlife. Urban environments, characterized by high anthropogenic activity, are particularly vulnerable to lead contamination. Under the One Health framework, this study investigated how lead concentrations in three urban mesopredator species, raccoons (*Procyon lotor*), opossums (*Didelphis virginiana*), and skunks (*Mephitis mephitis*), relate to urbanization across Chicago. Liver samples (n = 92) were collected between July and October 2022 from 56 sites on the North Side of Chicago and surrounding suburbs and analyzed for lead concentration (ppm). Lead concentrations were modeled as a function of species, age, sex, mass, and urbanization score, and results showed that urbanization was a significant predictor of lead concentration ($p < 0.05$). Raccoons consistently exhibited the highest mean concentrations, while opossums showed the lowest. An increase in urbanization score nearly doubled the odds of an individual exceeding the median lead concentration (3.19 ppm). These findings indicate that urbanization amplifies exposure risk and that behavioral differences among species influence lead accumulation. Overall, results support the use of urban mesopredators as bioindicators for assessing environmental contamination and highlight their value in guiding future One Health surveillance and mitigation strategies in metropolitan areas.

89. Honor-Based Violence and Symbolic Law in India (2006–Present)

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Honor-based violence exists in the unacknowledged intersection between a nation's promise of safety and society's retaliation against dishonorable acts. One of the biggest reasons this phenomenon is so challenging to change is that enforcing the law and protecting individuals from HBV are, more often than not, personal and local issues. Police often view and treat threats as "family disputes" and don't register cases or take signs of threats seriously. Community members pressure victims into retracting complaints or not registering one to begin with. Local officials often call for compromise and to let things go. Courts publicly condemn honor-based violence, but the everyday system leans towards reconciliation in practice. This results in a clear legal framework for addressing HBV cases, but an ambiguous operational reality at the local level. This results in various questions: if honor-based violence is so violent, why isn't it effectively addressed by the legal systems? The simple answer is that it isn't due to a lack of enforcement; a more acute explanation is that it's due to "weak enforcement." The deeper, often-overlooked issue is that legal condemnation can coexist with social acceptance; it allows institutions to enforce compliance without challenging the social systems that produce violence. This thesis focuses on examining India, starting from 2006 to the present, as the primary case study because it highlights significant contradictions; while the country has strong constitutional rights, assertive statements from the nation's highest courts, and visible attention to policy issues, there are persisting patterns of coercion and violence regarding "honor", primarily regarding the right to marriage choices. It is an argument that the law can be absorbed and ultimately be rendered symbolic when it isn't properly embedded, especially if the systems meant to enforce it are also embedded into the same honor systems they are intended to oppose. [1–3]

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86. Juvenile Regulatory T Cells Exhibit Decreased Capacity to Suppress Inflammation During Severe Influenza Pneumonia

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Healthy children are more likely than adults to develop severe viral pneumonia, which can lead to long-term impairments in cardiopulmonary function. Our group demonstrated that juvenile mice infected with influenza A virus (IAV) have equivalent viral clearance to adults but exhibit prolonged inflammation. In adults, regulatory T cells (Tregs) suppress inflammation and promote tissue repair, in part by limiting conventional T cell (Tcon) proliferation. Treg depletion in adult IAV infection exacerbates lung injury and inflammation. We hypothesize that juvenile Treg reparative function is impaired during IAV infection, contributing to prolonged inflammation and aberrant lung repair. To assess this, we compared the suppressive capacity of splenic Tregs from adult (8-14 weeks) and juvenile (25-28 days) mice using lymphocyte suppression assays. Juvenile FoxP3^{DTR} mice were infected with a sublethal titer of IAV intratracheally and treated with diphtheria toxin beginning 5 days post-infection (dpi) to deplete Tregs. Mice were monitored for daily weight loss. Quantification of bronchoalveolar lavage fluid (BALF) IL-6 and Amphiregulin (AREG) by enzyme-linked immunosorbent assay and enumeration of lung immune cells using flow cytometry occurred at 7 dpi. Lungs were assessed by H&E and immunofluorescent microscopy staining for lung injury and epithelial repair markers at 14 dpi. Juvenile Tregs demonstrated reduced suppression of Tcon proliferation compared to adult Tregs. Treg-sufficient and Treg-deficient juvenile mice failed to reach the growth potential of uninfected mice. Depleting Tregs did not alter BALF IL-6, lung neutrophil, or AREG levels. Treg-sufficient and Treg-depleted mice exhibited dense cellular infiltration, keratin 5 (Krt5^{+}) pods of disrupted alveolar epithelial architecture, and keratin 8 (Krt8^{hi}) cells indicating stalled alveolar epithelial cell differentiation. These findings suggest juvenile Tregs are insufficient to mitigate inflammation and promote repair during severe viral pneumonia. Further understanding of age-related differences in Treg-mediated repair may inform strategies to improve recovery for children with severe viral pneumonia.

87. RRM2 Inhibition Enhances Radiation Response in Breast Cancer Brain Metastasis

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Breast cancer brain metastasis (BCBM) is a lethal disease sequela that develops in up to 40% of breast cancer patients and is associated with a poor prognosis [1]. Therapeutic options remain limited because most systemic agents cannot cross the blood-brain barrier (BBB) [2]. Consequently, whole-brain radiation therapy (WBRT) remains the standard of care, despite its suboptimal outcomes and severe cognitive side effects [2]. Identifying radiosensitizing agents, which enhance the efficacy of WBRT, could improve clinical outcomes in patients with BCBM. This study investigates Triapine (3AP), an inhibitor of the RRM2 subunit of ribonucleotide reductase, as a potential radiosensitizer. RRM2 is a key enzyme in DNA repair and is associated with tumor resistance to DNA-damaging agents. Since radiation therapy (RT) induces double-stranded DNA breaks, inhibiting RRM2 may enhance radiation-induced cytotoxicity. BCBM cell line, MDA-MB-231-BR, was cultured and treated with control (Dimethyl sulfoxide (DMSO)), RT, 3AP, and a combination of 3AP and RT. Western blots displayed that γ-H2AX, a marker of DNA damage, increased in the combination subgroup compared to radiation. Colony formation and cell viability assays displayed decreased (BCBM) cell survival in the combination subgroup. Immunocytochemistry to assess DNA damage through γ-H2AX foci visualization showed an increase in the number of foci in the combination group in comparison to radiation alone. *In vivo* experiments were conducted where mice with intracranially implanted 231-BR tumors were treated with DMSO, 3AP, Radiation or a combination of Radiation and 3AP. Significant reduction in tumor volume and increase in survival were observed in the combination group in comparison to the radiation-only group. Preliminary results suggest that 3AP enhances RT-induced DNA damage by inhibiting RRM2, reducing BCBM cell survival. This approach offers a promising strategy to overcome therapeutic resistance in BCBM and may serve as a foundation for future clinical investigation of 3AP as a radiosensitizer.

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85. Development and Validation of a Method to Measure AETA in Human Cerebrospinal Fluid Using Liquid Chromatography/Mass Spectrometry

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Alzheimer's disease affects approximately 55 million individuals worldwide and is traditionally explained by the amyloid hypothesis, which states that amyloid-β (Aβ) accumulation initiates neurodegeneration [1]. Aβ is generated through β-secretase cleavage of amyloid precursor protein (APP) [2]. However, failed β-site APP-cleaving enzyme (BACE) inhibitor clinical trials suggest that additional APP processing pathways may contribute to disease progression. Recently, Dr. Michael Willem identified a new pathway, the η-secretase pathway, through analysis of human cerebrospinal fluid (CSF), producing AETA fragments that can be further cleaved into Aη-α and Aη-β [3]. Experimental evidence indicates that AETA fragments disrupt NMDA receptor signaling and impair memory-related processes, suggesting an alternative mechanism of toxicity. We hypothesize that characterizing AETA production and clearance kinetics in humans will clarify the role of η-secretase in Alzheimer's disease. To test this, Western blotting, immunoprecipitation (IP), and liquid chromatography/Mass Spectrometry were used to quantify AETA-α and AETA-β production and clearance in cell culture and human CSF using Stable Isotope Labeling Kinetics (SILK). Method development used ^{13}C-leucine–labeled H4APPwt cell media to optimize antibody selection, IP conditions, protease digestion, and mass spectrometry parameters. The validated workflow was then applied to unlabeled and labeled CSF samples from healthy older adults and individuals with Alzheimer's disease to generate kinetic curves. BACE inhibitor LY2886721 (3 μM) was successful in suppressing β-secretase–mediated APP cleavage compared to BACE inhibitor C3, with sAPPβ levels reduced to 3.02% and 0.58% at 1 μM and 3 μM, respectively. On the other hand, there were increases in sAPPα and AETA-α, which indicate an increase in α-secretase activity. These results are guiding optimization of the AETA kinetic analysis. Overall, this project advances understanding of APP metabolism beyond the classical amyloid pathway and may inform BACE inhibitor dosing strategies and development of early-stage Alzheimer's biomarkers.

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84. Automated and Quicker Processing Platform (*iECAna)* for Large-Scale Electrochemical Data with ML-Based Modeling: Next-Gen Corrosion Analysis and Diagnostic Application

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In recent years, rapid developments in electrochemical diagnostic methods, including corrosion analysis and biosensor assays, have led to the generation of large, complex datasets that surpass the practical limits of manual processing. This has accentuated the need for a tool capable of rapidly analyzing large volumes of potentiostat output files, such as the DTA, in an accurate and reproducible manner.

This work presents an innovative software development and desktop application (*iECAna*) that streamlines the processing and interpretation of substantial quantities of raw potentiostat data. The software allows users to analyze hundreds of experiments in seconds by extracting key electrochemical parameters and exporting results to Excel for further evaluation. The platform also contains an option to integrate and instantly train a customized machine-learning model to expedite workflows utilizing Support Vector Machines and neural-network architectures.

The software was validated on Electrochemical Impedance Spectroscopy (EIS) and Cyclic Voltammetry (CV) biosensor data from a protein calibration assay on the protein MMP-12, a biomarker with potential use in post-stroke analysis. The software produced results within a 5% margin of error when compared to traditional electrochemical analysis (Gamry Echem Analyst's Constant Phase Element fit) and manual CV interpretation, while the processing time has been significantly reduced, (typically spending 3 hours to 10 seconds). This demonstrates the practical value that this software has in high-volume electrochemical research through data-driven interpretation of potentiostat measurements. This new platform will have potential application for the Next-Gen corrosion analysis and Diagnostic tools in healthcare industry.

82. Network-Specific Functional Connectivity Reveals Differential Prediction of Mental Health Symptoms

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Functional connectivity studies have demonstrated that patterns of brain connectivity can predict individual differences in behavior. However, most prediction approaches rely on whole-brain connectivity, which may mask relationships that are specific to particular functional networks. This project tested the hypothesis that individual brain networks exhibit selective predictive relationships with distinct mental health dimensions. Resting-state fMRI data from 75 participants were analyzed using 13 functional networks defined through individual-specific parcellations. For each network, connectivity patterns were used to predict five clinical self-report measures: reward sensitivity (BIS/BAS), ADHD symptoms (SRADHD), depression (BDI), worry (PSWQ), and emotion regulation (ERQ). Kernel ridge regression with 50 iterations of cross-validation was implemented to generate stable prediction estimates while controlling for age. Distinct patterns emerged across networks. The Reward network most strongly predicted ADHD symptoms ($r = 0.40$) and worry ($r = 0.31$). SomatomotorLateral connectivity showed the strongest association with depression ($r = 0.25$), while the Dorsal Attention network demonstrated a moderate negative relationship with depression ($r = -0.27$). Single cross-validation iterations showed high variability ($SD = 0.05$-0.08), demonstrating that multiple iterations were necessary for stable estimates. These findings demonstrate that functional networks exhibit construct-specific predictive profiles rather than uniform predictive strength across behaviors. These network-specific profiles provide a foundation for developing targeted neurobiological markers, potentially enabling more precise identification and monitoring of specific mental health dimensions.

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83. From Scarcity to Solidarity: Mutual Aid as a Pathway to Food Sovereignty and Urban Resilience in Chennai, India

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In the Indian state of Tamil Nadu, 23.1% of the population is undernourished, according to estimates by the Global Hunger Index, despite Tamil Nadu's robust food security welfare programs [1]. In an urban area like Chennai, food insecurity is compounded by poverty, gender inequality, religious discrimination, and caste apartheid. Additionally, extreme weather driven by climate change has disrupted agricultural output and caused localized food shortages that disproportionately affect marginalized groups. In the face of these overlapping inequalities, mutual aid may be able to empower local people to reclaim their right to food produced through ecologically sustainable ways. Mutual aid refers to a collective exchange of resources between community members for reciprocal benefit. This presentation investigates how mutual aid networks in Chennai organize to create pathways to food sovereignty and urban resilience. Through interviews with members of grassroots organizations, including a climate justice non-profit, and urban farming initiative, and a food re-distribution network, this study unpacks how mutual aid can be understood in a South Asian context, specifically in relation to existing systems of oppression across South Asia, including caste apartheid, gender inequality, and religious discrimination. This study further examines how these networks engage with notions of reciprocity while challenging or reproducing charitable logics. Women's self-help groups (SHGs) and non-profit organizations were found to be a significant model of mutual aid in Chennai. These organizations use either the local production and/or distribution of nourishing food as a means of feeding communities. Such structures, in turn, support the creation of green spaces, the reduction of food waste, and the development of strong, inter-personal relationships between diverse groups. These systems of community care operate in largely democratic ways and actively work to resist existing inequalities in Chennai by empowering lower-income women and centering caste-oppressed and tribal communities in aid distribution efforts.

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80. Linking Niche Diversity to Phylogenetic Relatedness in Freshwater Bacteria Assemblies

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Aquatic bacteria aid in the cycling of nutrients and removal of pollutants in freshwater ecosystems and are critical to lake stability. Current methods of taxonomic classification rely on core functional genes to identify bacteria. However, the resulting observed changes in abundance and diversity of taxa mask phenomena like horizontal gene transfer, changes in gene copy number, and overall gene family presence. To better understand the relationship between traditional taxonomy, functional categorization, and niche occupancy, we use two decades of publicly available metagenome assembled genome (MAG) data from Lake Mendota in Madison, WI. Through a combinatorial approach of pangenome analysis and Topological Data Analysis (TDA), we look at the presence and absence of gene families in 10 large clusters of MAGs sharing Average Nucleotide Identity (ANI) of 98.5%. We compare the clusters based on two main distinctions: class delineation (Cyanobacteria, Bacteroidia, Planctomycetia, Alphaproteobacteria) and plasticity (open or closed pangenome). Preliminary findings indicate that clusters fall on a continuum of plasticity with a strongly conserved core gene section. Most interestingly, specific motility and phage related genes, which are expected to correspond to horizontal gene transfer, show differential presence patterns across open and closed pangenome clusters. TDA further indicates complicated dynamics in bacteria diversity through the presence of 1-dimensional holes in the data, possibly suggesting new interpretations of phylogenetic relatedness. Together, these results demonstrate that genetically identified clusters have different patterns in functional adaptability indicating a need for revision in the current taxonomy model. Future efforts will be needed to validate these data across a broader array of environments and with more accurate sequencing techniques.

81. High-Frequency Electrical Stimulation Promotes Functional Recovery of Nerve Conduction After Local Demyelination in Mice

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Many demyelinating disorders arise from complex pathological processes that damage axonal myelin. Loss of myelin disrupts saltatory conduction, preventing nodes of Ranvier from effectively propagating action potentials. Currently, no pharmacological treatment can fully restore nerve conduction in demyelinated axons. Consequently, most demyelination research focuses on promoting remyelination through approaches such as stem cell transplantation or small-molecule therapeutics, both of which have intrinsic limitations and potential adverse effects.

Emerging evidence suggests an alternative therapeutic strategy: restoring nerve conduction by directly enhancing excitability at nodes within demyelinated regions. Our computational modeling indicates that axonal conductance can be rescued through targeted electrical stimulation applied to the demyelinated segment.

In this project, we directly tested the hypothesis that increasing nodal excitability in demyelinated areas using high-frequency electrical stimulation can restore conduction deficits. To investigate this, we established a peripheral demyelination model in mice via sciatic nerve ligation. Electrophysiological characterization revealed that ligation induced focal demyelination and impaired nerve conduction, manifested as delayed and diminished compound nerve action potentials. Application of high-frequency electrical stimulation to the demyelinated region restored axonal conductance in a frequency-dependent manner.

These results provide strong evidence that electrical stimulation represents a promising alternative strategy to enhance axonal conductance following demyelination, with significant potential clinical implications. Moreover, the findings offer guidance for developing next-generation neurotechnology aimed at restoring impaired neural function through targeted electrical activation.

78. Restoration of Learning and Neural Function in a Mouse Model of Rett Syndrome Through IGF2R-Dependent Signaling

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Rett syndrome (RTT) is a progressive neurodevelopmental disorder primarily affecting females caused by mutations in the X-linked *MECP2* gene, a protein responsible for transcriptional regulation, resulting in impaired synaptic plasticity, motor dysfunction, seizures, and cognitive deficits [1]. Importantly, RTT reflects functional dysregulation of neuronal signaling rather than widespread neurodegeneration, suggesting that its symptoms may be partially reversible with targeted interventions. Trofinetide is currently the only FDA approved therapeutic for RTT; however, its modest efficacy and frequent gastrointestinal side effects underscore the need for more potent and better tolerated treatments. We hypothesized that NQ-13, an IGFBP2 derived peptide with high affinity for insulin-like growth factor 2 receptor (IGF2R), would restore behavioral and molecular deficits in RTT models through IGF2R-dependent signaling. Adult Mecp2 heterozygous mice were treated with NQ-13 and evaluated using assays measuring seizure threshold, motor coordination, respiratory function, circadian activity, and working memory. NQ-13 significantly increased seizure threshold, reduced paw dragging and paw slips, restored circadian amplitude, decreased abnormal breathing patterns, and improved Y maze working memory performance compared to vehicle treated RTT mice. To further contextualize the behavioral findings, molecular assays were performed to compare NQ-13 and Trofinetide at the level of IGF2R engagement and pathway activation. Notably, NQ-13 demonstrated greater efficacy at lower doses than Trofinetide. In vitro competition assays revealed that NQ-13 binds IGF2R with ~100-fold greater potency than Trofinetide. Pharmacological inhibition of sphingosine kinase attenuated NQ-13-mediated IGF2R signaling, suggesting a lipid-dependent pathway. Additionally, molecular analysis of medial prefrontal cortex tissue revealed increased MeCP2 protein replication in NQ-13 treated mice. Together, these findings demonstrate that NQ-13 reverses core molecular deficits in RTT models and engages IGF2R-dependent pathways that may restore activity-dependent plasticity. Further investigation will define MEK/ERK and CREB-dependent signaling pathways to clarify the molecular basis of NQ-13 mediated therapeutic rescue in RTT.

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79. The Debasement Channel: An Empirical Analysis of Exchange Rate Depreciation for Developed Currencies

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Currencies can depreciate against the US dollar without any traditional rationale to explain the episodes. Sometimes, government officials attribute this to capital outflows, but this logic is rather circular: exchange rates could depreciate when resident capital flows out. The relevant question then becomes why residents choose to move capital overseas.
This thesis examines whether global risk factors or concerns over the fiscal debasement channel better explain currency depreciation in modern floating-rate regimes, while recognizing that country-specific structural characteristics, such as political instability, may affect both channels. The global risk framework treats currencies as risk assets, whose returns are affected by US monetary policy and global risk sentiments. The fiscal debasement channel, empirically connected to the Fiscal Theory of the Price Level, argues that depreciation reflects forward looking evaluations of debt sustainability, which are transmitted through resident portfolio rebalancing. We test these two mechanisms using a panel of sixteen floating-rate currencies over the years 2001 to 2024. The empirical strategy includes cross-sectional analysis, panel regression with penalized variable selection using LASSO, threshold detection, and regime-switching estimation. The inflation differential between the US and the respective country emerges as the strongest predictor across different specifications. The lagged government debt indicator is positively associated with depreciation, and there is evidence of a nonlinear threshold near 78 percent of GDP in which the fiscal channel intensifies. The transmission of effects from fundamentals to exchange rates shifts across volatility regimes, as interest rate differentials and monetary policy conditions matter the most during periods of relative calamity, while global risk and fiscal structures become more important during periods of financial stress. These regime-dependent dynamics help explain why the relationship between macroeconomic fundamentals and exchange rate movements has appeared relatively unstable across our sample period coverage.

76. Cyberbullying Networks: Analyzing User Roles and Interactions on Instagram

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Cyberbullying continues to grow in prevalence and its impact is felt by thousands worldwide. This study seeks a Network Science perspective on cyberbullying interaction patterns on the popular social media platform, Instagram. Using a human-annotated cyberbullying dataset of 414 Instagram posts and 35,364 comments, we outline a set of heuristics for building Session Graphs, where nodes represent users and their cyberbullying roles, and edges represent their exchanged communications via comments.

Users within a comment thread embody four distinct roles: Bully, Victim, Defender, and Bystander. We ignore the Bystander roles as they don't directly engage in the discourse. The three active roles are differentiated as nodes with different shapes and colors in a Session Graph. Edge weights reflect the average severity of a comment, 1 for non-cyberbullying or mild, 2 for moderate, and 3 for severe.

Over these graphs, we compute the Bully Score, a measure of the net malice introduced by Bullies as they attack Victims (attacks minus pushback), and the Victim Score, a measure of the net support Victims receive from their Defenders (support minus attacks). In conjunction, these scores quantify the balance of power within each post. We find that a majority of posts have negative Victim Scores (attacks outweighing support), while the Bully Score distribution has a slight positive skew (attacks outweighing pushback). We believe this is the first study to explore granular cyberbullying network interactions using human annotations on Instagram at the post and comment levels. Our findings can help develop proactive moderation techniques to better tackle cyberbullying on social media.

77. Investigating the Role of Dynamin-Dependent Endocytosis in Trafficking Amyloid-Beta Oligomers in Neurodevelopmental Models

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Alzheimer's disease (AD) is an incurable dementia linked to memory loss and cognitive decline. Neurotoxic amyloid-beta oligomers (AβOs) have been found to accumulate in an AD-dependent manner in human brain tissue, CSF, and plasma, induce memory and learning impairment, and instigate key AD hallmarks such as synapse loss and neuronal cell death. Intriguingly, these same AβOs are transiently expressed in the developing CNS. This project focuses on the underlying trafficking mechanisms of AβOs in the developmental embryonic chick model. Recent experiments from the laboratory have found AβOs in extracellular vesicles (EVs) isolated from the embryonic retina, suggesting that EVs may have a role in transporting AβOs between cells during neurodevelopment. Here we show that dynamin-dependent endocytosis, a trafficking pathway for EV uptake, is a potential mechanism for cells to release or internalize developmental AβOs. We found that when dynamin-dependent endocytosis is inhibited by the drug Dynasore in embryonic retinal cell cultures, AβO fluorescence signal is distributed non-homogenously across groups of cells in later cell culture ages. Uneven signal distribution suggests that inhibition of dynamin-dependent endocytosis may cause AβO buildup in the cytoplasm by preventing exocytosis after their uptake into cells. Using neurodevelopmental models like embryonic chickens may provide insight into AD, as Aβ protein sequences found in embryonic chickens and AD humans are identical. Furthermore, experiments on AβO formation in neurodegeneration suggest that pathological AβOs, like developmental AβOs, may rely on EV-related trafficking pathways to spread and propagate pathology through cell-to-cell communication. We anticipate that these results may highlight key molecules and cell types that participate in developmental AβO trafficking. Understanding AβO trafficking in development would not only reveal novel insights into their role in neurodevelopment, but could potentially reveal underlying AβO trafficking mechanisms that can be therapeutically targeted during AD.

74. The Effects of Solution Conditions on Aqueous Reduction of Carbon Dioxide and Related Compounds

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Carbon dioxide (CO_2) reduction is an important step towards addressing climate change by converting one of the main harmful greenhouse gases into valuable liquid fuels such as formic acid and methanol. One promising approach includes using borohydride (BH_4^-), a cost-effective, air-stable, and simple hydride source, as a hydride reducing agent. Previous published work in the Grice laboratory has demonstrated that carbon dioxide can be reduced to formate (HCO_2^-) using sodium borohydride ($NaBH_4$) [1]. Since industrialization, atmospheric carbon dioxide (CO_2) levels have risen rapidly. The University Corporation for Atmospheric Research reports current concentrations of 424 ppm and growing at a rate of 2-4 ppm each year. [2,3] In this work, sodium and potassium borohydride were used to study the hydride transfer mechanism and to identify solution conditions that were able to reduce formamide and formate into methanol and urea into formate. Reaction completion and product yield were analyzed using ^1H nuclear magnetic resonance (NMR) spectroscopy. Further understanding this direct hydride transfer could provide insight into efficient CO_2 reduction and recycling.

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75. Congenital Central Hypoventilation Syndrome: Associations Between Clinical and Social Predictors and Neurocognitive Outcomes

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Congenital Central Hypoventilation Syndrome (CCHS) is an ultra-rare disorder of autonomic nervous system (ANS) regulation. Caused by mutations in the *PHOX2B* gene, CCHS manifests as hypoventilation with hypercarbia/hypoxemia, necessitating assisted ventilatory life-support asleep and sometimes awake. Individuals with CCHS demonstrate variably reduced neurocognitive functioning relative to population norms. Genotype and clinical predictors have not consistently predicted neurocognition in CCHS, and influence of social predictors has not yet been investigated. This study aims to determine a comprehensive set of predictors of neurocognitive variability in CCHS. 39 CCHS patients (3-46yrs) completed the NIH Toolbox® Cognition Battery (NTCB) measuring Fluid, Crystallized, and Total Cognition composites. 33 patients completed the Behavior Rating Inventory of Executive Function® (BRIEF) assessing executive functioning impairment scored via Global Executive Composite (GEC). Clinical variables hypothesized to influence neurocognition were collected. Participant zip codes were converted to Child Opportunity Index (COI) National score measuring neighborhood opportunity levels. Stepwise regressions identified the strongest predictors for the four composite outcomes. NTCB Fluid ($p<0.0001$) and Total Cognition ($p=0.002$) scores were downward shifted in CCHS. For the NTCB Fluid Cognition composite, *PHOX2B* genotype and COI National demonstrated significant associations ($p=0.005$ and 0.018, respectively), followed by cyanosis history as the next strongest predictor. For Crystallized Cognition, *PHOX2B* genotype and neural crest tumor showed the strongest directional effects. For Total Cognition, *PHOX2B* genotype and COI National emerged as significant predictors ($p=0.009$ and 0.033, respectively), followed by neural crest tumor history. For BRIEF GEC, neurodevelopmental disorders history and COI National accounted for the most explained variance. These findings demonstrate that neurocognitive functioning in individuals with CCHS is influenced by clinical *and* social factors. Identifying both clinical and social predictors highlights the need to integrate environmental context into patient care, providing a more comprehensive framework for targeted interventions with aim to optimize neurodevelopmental outcomes for CCHS patients.

72. Activity of SMC Complex ClsN at Varied Acidity and Temperature

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Structural Maintenance of Chromosome (SMC) proteins are essential in the regulation of chromosome structure and gene expression in eukaryotic cells. Some Archaea, like those of the Sulfolobus family, contain chromosomal features that show similarity to those of eukaryotic cells. SMC-like proteins help regulate the Sulfolobus chromosome, including Coalescin, or ClsN. Coalescin has been observed to form loops and condense Chromatin, helping produce A and B compartments. It has also been shown that Sulfolobus uses ClsN to achieve this. This series of experiments seeks to better understand how ClsN is activated to regulate chromosomal structure within Sulfolobus. Being a thermophilic and acidophilic organism, Sulfolobus, and therefore ClsN, is predicted to behave optimally at low pH and high temperature. The objective is to determine the critical force - the force that the protein produces - under acidic (pH 5.2) and high temperature (60 C) conditions. This is accomplished through the use of magnetic tweezers. A magnetic bead is attached to one end of a DNA strand, and the other end of the DNA strand is attached to the cover slip of a flow cell. A variable magnetic field is applied, and the extension of the DNA strand is observed through a microscope. Variance in DNA extension when introduced to ClsN and a ClsN-ATP mixture helps determine the force with which ClsN compresses and organizes DNA. The findings of this experiment are that Acidic conditions can somewhat regularly aid in the compression of DNA by as much as 10% at 0.7pN, and that high-temperature conditions without lowered pH do not allow ClsN to compress DNA.

73. Epigenetic Regulation of TFEB in Stress Resistance and Aging

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Epigenetic marks, such as post-translational modifications to histones, are regulators of aging and longevity. A decrease in trimethylated histone levels H3 on lysine 4, known as H3K4me3, is known to extend lifespan and increase stress resistance in *C. elegans*. Preliminary work from the Jakob lab has started to identify signaling pathways that link changes in H3K4me3 levels to lifespan, including the transcription factor helix-loop-helix 30 (HLH-30) and its mammalian ortholog transcription factor EB (TFEB). Knockdown of a protein involved in the deposition of H3K4me3, ASH-2, leads to lower levels of H3K4me3 and increased lifespan. We have observed that this increase in lifespan requires the presence of HLH-30/TFEB, as *C. elegans* mutants lacking HLH-30 no longer benefit from ASH-2 knockdown. We are interested in investigating the mechanisms underlying this H3K4me3-HLH-30 longevity axis, specifically how HLH-30/TFEB is regulated in *C. elegans* and mammalian cells when ASH-2 is knocked down and H3K4me3 levels are lowered. Preliminary data have indicated that mRNA/protein levels of TFEB are not altered by ASH-2 knockdown in HEK293 cells. TFEB activity is also regulated by subcellular localization, with TFEB being retained and inactive in the cytosol under normal conditions and translocating to the nucleus during stress conditions. We find that when HEK293 cells are subject to heat stress, more TFEB translocates to the nucleus in cells lacking ASH-2. These findings suggest that TFEB may be primed to be activated under stress conditions when ASH-2 is not present and H3K4me3 levels are lowered. We are further interested in studying whether ASH-2 knockdown increases TFEB presence in the nucleus compared to the cytoplasm under other TFEB-activating conditions, as with Torin-1. Our experiments are focused on the effects of heat stress and Torin-1 on TFEB levels, nuclear localization, and transcription of TFEB-dependent genes under normal and ASH-2 knockdown conditions.

70. Procedural Management of Gout in the Outpatient Setting: A Systematic Review

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Gout is a chronic metabolic disease characterized by acute, painful episodes and chronic tophaceous deposits. Although urate-lowering medications, like allopurinol and febuxostat, are mainstays for managing the chronic aspect of this condition, more curative treatment modalities may be desired. In this review, we aim to synthesize the existing literature on outpatient procedures utilized in managing gout. We conducted a systematic search of multiple databases using search terms relevant to gout, dermatology, and outpatient procedures. Of the 1312 studies identified in this search, 10 were included for extraction via screening by two independent reviewers using the Covidence software. 32 patients were included in these 10 studies, with an average age of 66.7 (+-17.6) and 68.8% (n=22) being male. The most common comorbidities were hypertension (9.4%), diabetes mellitus (6.3%), and dyslipidemia (6.3%). The majority of patients concurrently managed with medications, with allopurinol (78.1%) and colchicine (18.8%) being most common. Of outpatient procedures performed, surgical excision was the most common (68.8%), followed by curettage/sharp debridement (18.8%) and platelet-rich plasma (PRP) injection (6.3%). Outcomes differed across procedure types. PRP-based therapies were associated with complete healing in all treated patients (n=2, 100%). Curettage and sharp debridement resulted in complete healing or lesion resolution in 83.3% of patients (n=5), while cosmetic satisfaction without a defined clinical endpoint was reported in 16.7% (n=1). Surgical excision most frequently produced partial improvement (n=20, 90.9%), with complete healing observed in 4.5% (n=1). This review preliminarily highlights the potential for partial to complete improvement through a variety of outpatient procedures. Our study was limited by its small sample size and variation in outpatient procedures performed. Future studies should evaluate the efficacy of outpatient procedures compared to medical management.

71. Building Data Science Software for NLP in R (Tools for Journalists and Social Scientists to Generate Data on Elected Officials, Policymaking, and Advocacy from Semi-structured Texts)

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This project focuses on how to develop software, specifically R packages, that can most reliably extract references to different government agencies from a long and cluttered text. The aim of this project is to prevent repetition of tedious tasks related to sorting through text data by producing a natural language algorithm that is capable of returning references to any alias of a government agency (for example, both "DOJ" and "Department of Justice" return the same result). I tested and improved a hand-built agency lookup table provided to me by my mentor, listing government agencies and all known aliases/references and tested several approaches for pulling the data into an R environment and formatting it in a way that can be easily understood. After cleaning that data, I was able to use an R package developed by another member of my lab to develop my own package that extracts all references to government agencies from a text. Next steps for this project include submitting it for publication on CRAN and testing by researchers from other fields to determine whether the software works for other research tasks. This project will reduce the time and effort required for researchers to do their work, allowing them to cut out time spent on menial tasks and focus on the meaningful parts of their work.

68. Testing the Efficacy of Tactile Air Puff Stimuli in the iMRSIV VR Goggles System for Naïve Mice

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Virtual reality (VR) allows precise control over sensory inputs in experiments. Traditional mouse VR experiments rely mainly on visual stimuli. Using the Miniature Rodent Stereo Illumination VR mouse goggles (iMRSIV), looming objects, used to simulate overhead predation, elicited defensive freezing behaviors. However, real-life threats are often multisensory and include tactile stimuli that may alter defensive responses. In this study, we compared mouse defense behavior when exposed to a brief tactile air puff vs. visual looming stimuli. Mice received headplates for head fixation to the iMRSIV system. Before exposure to stimuli, naïve mice (n=5) were trained to run for water rewards within a linear VR track. Each mouse experienced a loom-only (2 s overhead looming object), air puff-only (0.25 s puff above the nose), and a combined loom+puff trial (randomized order). Running speed was aligned to stimulus onset and quantified within a 0–3 s response window. Across first exposures, tactile and multisensory stimuli produced faster reactions than loom-only. Latency to minimum speed (mean ± SD) was 0.833 ± 0.606 s for loom-only (n=4), compared with 0.400 ± 0.041 s for puff-only (n=5) and 0.353 ± 0.122 s for loom+puff (n=5). Deceleration was also stronger with air puff and combined, with mean slopes of velocity of −100.246 cm/s² (loom), −138.067 cm/s² (air), and −141.024 cm/s² (loom+puff). Freezing time (speed < 2.0 cm/s for ≥0.5 s) increased from 1.258 ± 0.551 s (loom) to 1.880 ± 0.866 s (air) and 1.767 ± 0.496 s (loom+puff). These results support the hypothesis that adding a tactile stimulus can enhance the ethological relevance of mouse VR, providing a potential framework for neuronal measurement of multisensory threat processing.

69. Exploring the Relationship between Adverse Childhood Experiences and the Development of Coping Strategies in Young Adults

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Adverse childhood experiences (ACEs) including neglect, physical, sexual, or emotional abuse, and household dysfunction, have been shown to have significant developmental consequences. Maladaptive coping strategies often emerge as early attempts to control chronic stress, but these behaviours may persist into adulthood and contribute to later psychopathology such as anxiety, depression, and interpersonal issues. Despite the importance of this research, few studies have investigated the manner in which ACEs shape coping in young adults and the factors that influence it. Identifying mechanisms that shape vulnerability and resilience and interventions that could promote beneficial coping strategies. The current study seeks to explore how adverse childhood experiences influence the development of coping strategies in young adults, and the role that protective factors (PCE) and personality traits play in this process.

Participants (N=378) completed measures of ACE exposure, coping behaviour PCEs, and personality traits. Regression analyses explored the associations between the 3 factors and coping behaviour. Participants were categorised into dominant coping styles to compare ACE exposure across coping styles.

Higher ACE scores significantly predicted greater use of avoidant coping. Chronicity and onset of behaviour were not independent predictors of coping. ACE exposure was associated with higher levels of neuroticism and lower conscientiousness and extraversion. Higher PCE scores were associated with lower avoidant coping; however, these did not moderate the association between ACEs and coping. Individuals with Mixed/Tied dominant coping styles reported significantly higher ACE exposure than those with problem or emotion focused coping. These findings suggest that ACEs relate to increased reliance on avoidant coping, but also to the broader organisation of coping behaviours with a possible disruption to the differentiation or stability of coping strategies. PCEs and personality appear to be independently associated with more adaptive coping. These results highlight how these factors shape stress responses and inform interventions.

66. Colonic Wnt Signaling Disruption in Response to Hydrogen Sulfide

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Hydrogen sulfide (H_2S) is present at high concentrations in the colon, and elevated levels are linked to diseases like colon cancer and inflammatory bowel disease. Research in our laboratory has shown that H_2S disrupts colonic Wnt signaling, which is necessary for maintaining colon stem cells. Since H_2S can react with disulfide bonds in proteins, we hypothesized that H_2S impairs Wnt signaling by disrupting essential disulfide bonds in Wnt ligands. To determine if reduction of disulfide bonds is sufficient to disrupt Wnt signaling, we treated HEK293 cells with the membrane-impermeable reductant, tris(2-carboxyethyl)phosphine hydrochloride (TCEP) and measured expression of the Wnt target gene *Axin2,* using quantitative polymerase chain reaction. We observed decreased *Axin2* expression in cells exposed to TCEP, which supports disulfide bond reduction as a mechanism for Wnt signaling disruption. Next, we investigated whether H_2S treatment reduces disulfides in the Wnt pathway ligands, WNT3a and RSPO, since previous data had shown that culturing HEK293 cells in H_2S-exposed medium was sufficient to decrease Wnt signaling. We monitored the cysteine redox status of RSPO in medium ±100 ppm H_2S exposure, followed by tagging with methyl-PEG maleimide. Changes observed by western blot analysis are currently being characterized. We are also investigating the effect of H_2S exposure on the cysteine redox status in WNT3a by Western blot analysis and complementing the study with a luciferase-based assay that reports on Wnt activity. Our current model for the effects of H_2S on Wnt signaling will be discussed.

67. The Aftermath of the Ban on Universal Injunctions on Chapter 15 and the U.S. Foreign Bankruptcy Court's Remedial Powers

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This research examines how a recent Supreme Court decision (Trump v. Casa, Inc.) affects cross-border bankruptcy proceedings. In Trump v. Casa, Inc., the Court held that federal courts in civil proceedings could not issue injunctions in favour of individuals not party to the case before the court ("non-party injunctions"). Although the court did not mention bankruptcy law, injunctions in favour of non-parties are widely used in cross-border bankruptcies filed under Chapter 15 of the United States Bankruptcy Code. The question we address is whether the bankruptcy court's power to issue those injunctions survives the Court's holding in *Trump v. Casa.*

Cross-border bankruptcy under Chapter 15 involves a company that, upon completing a foreign bankruptcy proceeding, seeks to enforce the same remedies in the U.S. When a foreign court has issued non-party injunctions in the original proceeding, United States bankruptcy courts commonly issue identical injunctions that are enforceable in the United States. They may also issue a *new* non-party injunction—one that was not issued by the foreign court—to support the foreign proceeding.

Our research analyses the history of bankruptcy statutes and cross-border proceedings to identify statutory grounds that enable bankruptcy courts to issue non-party injunctions in Chapter 15 cases. Our preliminary analysis suggests that the courts are prohibited from issuing *new* non-party injunctions to support foreign proceedings. Our conclusions are more tentative regarding injunctions identical to those issued by the foreign court. Our historical findings also suggest that Congress may have contemplated the practice when drafting Chapter 15.

64. Self-Stigma Towards Psychotropic Medications in the Deep South

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This study examined self-stigma towards seeking mental healthcare and stigma towards using psychotropic medications in the Deep South versus the rest of the US while also focusing on rural and urban areas. We hypothesized that attitudes toward seeking psychological help, and psychiatric medication use will differ between the Deep South and the rest of the U.S as well as rural and urban populations. An electronic cross-sectional survey was conducted via MTurk to evaluate participants' perspectives towards seeking professional help for mental health (MH) and taking psychiatric medications. The self-stigma associated with seeking psychological help survey was used to measure participants' self-stigma. Participants' attitudes towards and willingness to use psychiatric medications were measured with the General Social Survey (GSS) portion on psychiatric medications. The Wilcoxon rank-sum test and point-biserial correlation were used to measure differences between people residing in the Deep South versus other US states and rural and urban areas. Scores were measured on a 1–5 Likert scale. Both statistical tests showed that self-stigma was higher in rural areas compared to urban areas. Despite the lack of statistical significance, the results still suggest differences in attitudes towards mental health treatment and medication stigma between the Deep South and the rest of the US. Future research should explore the sociodemographic differences within the Deep South populations to reflect the realities of this demographic and how those factors influence self-stigma to improve future health interventions.

65. Evaluating Mathematical Models for Pairwise and Triple Genetic Interactions in *S. cerevisiae*

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Genetic interactions occur when mutations in different genes combine to produce unexpected effects on cellular fitness, revealing how genes cooperate within biological pathways and informing precision therapeutic strategies [1,2]. Despite large-scale mapping efforts in *Saccharomyces cerevisiae*, no consensus exists regarding the optimal mathematical definition for quantifying interaction scores from mutant fitness data. Current approaches rely on baseline models developed across evolutionary biology and population genetics, yet these definitions rest on distinct and sometimes conflicting assumptions about how independent mutations combine.

This project evaluates five quantitative models—Min, Product, Log, Additive, and Ising—for both pairwise and triple-gene interactions using high-throughput yeast datasets [3]. The first four models have been widely employed in biological contexts: the Product and Log models assume multiplicative independence, the Additive model assumes linear effects, and the Min model assumes that the more severe mutation masks the other. In contrast, we newly propose the Ising model, originally developed to describe interacting spins in disordered magnetic systems (spin glasses) in statistical physics, as a framework for capturing gene–gene coupling without assuming strict independence or masking. Each digenic model was generalized into link form and extended to trigenic interactions.

Model performance was assessed statistically by examining variance, bias, and residual error between observed and expected mutant fitness. Biological relevance was evaluated using precision–recall curves comparing interaction scores to protein–protein interaction networks and Gene Ontology co-annotation data. For pairwise interactions, the Product and Log models showed strong biological enrichment, while the Min model performed poorly. Notably, in triple-gene analyses, the Ising model produced interaction scores with reduced variance and bias while maintaining low residual error and strong predictive performance. These findings suggest that higher-order mutant data provide critical discriminatory power and support the Ising framework as a promising physics-inspired approach for modeling complex genetic interactions.

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61. Healthcare Access and The Persistent Racial Disparities in Low Birth Weight

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Low birth weight (LBW), defined as less than 2,500 grams, is an influential factor contributing to infant mortality in the United States, with significant racial disparities between Black and White mothers. This study examined whether access to medical care is associated with LBW and whether this relationship differs by race using data from 3,054 Black and White mothers from the 2018 National Health Interview Survey. The prevalence of LBW was 8.0%. Overall, mothers without a usual place of medical care had, on average, an 18% higher risk of LBW than those with a usual place (OR = 1.18, 95% CI: 0.80–1.74). For Black mothers, the prevalence of LBW was high regardless of access to healthcare, with rates of 14.0% among those with a usual source of care and 13.6% among those without (OR = 0.96, 95% CI: 0.44–2.12). In contrast, White mothers exhibited a lower overall prevalence of LBW, but those without a usual place of care had a higher rate (8.2% vs. 6.6%; OR = 1.26, 95% CI: 0.80–1.97). These findings highlight that racial disparities in LBW persist regardless of access to a regular place for medical care, suggesting that additional research is needed in order to identify specific factors that relate to LBW.

62. Effects of Time-of-Year on Biodiversity Estimates Using eDNA Sequencing

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A common issue in biodiversity studies is that the distribution and abundance of organisms can vary throughout time. Surveys completed at a single site multiple times during the year may yield different results. Quantifying this sample variation is important for designing conservation and restoration practices. Environmental DNA (eDNA) sequencing is one such method used to document fish diversity by detecting and identifying DNA shed by organisms into the environment. Compared to traditional methods, such as seining, trapping, electrical fishing, or netting, eDNA can be as or more cost-effective and efficient by detecting more species, including cryptic, invasive, or rare species. However, it is unclear how sensitive eDNA sequencing is to the time of year that samples are taken. To help address this question, in summer (June) and fall (October) 2025, eDNA filter samples were collected in the Fox River. Here, we present our eDNA results for fish communities, comparing diversity at the start and end of our sampling period, to test how time (and changes in water quality measured via YSI) affects diversity estimates. Fish spawning and nesting can extend from summer to fall, so we hypothesized that these seasons would have similar fish communities. By collecting 53 water samples across 5 sites, we found 73 fish species with eDNA in summer and fall. eDNA was effective in detecting fish species unique to each season. Additionally, fish communities were similar in both seasons, indicating that sampling in summer and fall yields comparable results.

63. Development of Glutamate Optical Sensor

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Glutamate is the primary excitatory neurotransmitter in the brain. Upon the arrival of an action potential, glutamate is released into the synaptic cleft. During this release event, the concentration of glutamate in the synaptic cleft reaches ≥1 mM and then rapidly returns to <20 nM within <10 ms due to uptake by neurons and glial cells. Dysregulation of glutamate levels in the synaptic cleft has been implicated in receptor-mediated excitotoxicity and is associated with numerous pathological conditions, including stroke, traumatic brain injury, glaucoma, and neurodegenerative disorders such as Alzheimer's, Huntington's, and Parkinson's diseases. The ability to accurately measure extracellular glutamate concentrations *in vivo* is critical for clarifying the role of glutamate in excitatory neuroplasticity and in the progression of these neurological disorders. Although numerous attempts have been made, reliable sensors capable of monitoring glutamate concentrations *in vivo* with high spatial resolution and in real time remain limited. To address this challenge, we aim to construct a glutamate-specific optical sensor based on a modified bacterial protein that undergoes a significant conformational change upon binding glutamate. In our design, this conformational change is translated into a change in fluorescent signal through Förster Resonance Energy Transfer (FRET). Two sites on the protein surface are selected such that the distance between them changes maximally upon glutamate binding. These positions are labeled with two different fluorophores: a FRET donor and a FRET acceptor. Binding of glutamate induces a conformational change in the protein, decreasing the distance between the donor and acceptor. This distance change modulates FRET efficiency and consequently produces a measurable change in the fluorescence intensity of the acceptor. In this research-in-progress report, we describe the development of two FRET-based sensor constructs, as well as the synthesis and purification of the fluorophore labels and the tetrazine-functionalized unnatural amino acid (UAA) fluorophore linker.

59. Applying Machine Learning to Identify Spatial Gene Expression Patterns in the Adult Mouse Medullary Reticular Formation at a Single-Cell Level

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The medullary reticular formation (mRF) of the brainstem contains neural circuits known to generate the rhythms controlling various orofacial behaviors such as breathing and swallowing [1]. Disruption of these circuits by injury, stroke, or neurodegenerative disease can disrupt these behaviors; a comprehensive understanding of these circuits is thus beneficial in addressing these conditions. However, the functional, spatial, and transcriptomic organization of the mRF is not well understood; a significant obstacle is a lack of molecular markers for distinct functional cell subpopulations within the mRF. We hypothesize that machine learning (ML) techniques applied to gene expression profile data for mRF cell populations can improve the definition of known subregions and identify new subregions involved in orofacial motor control. This research applies ML methods to the MERFISH imputed genes dataset of the Allen Brain Cell Atlas, a publicly available single-cell resolution spatial transcriptomics dataset from the Allen Institute for Brain Science that measures expression of ~8,000 genes across ~4 million cells in the whole adult mouse brain [2]. K-means clustering of 12,770 neurons mapped to the mRF by the Allen Institute's CCFv3 coordinate framework was performed using expression values for 5963 genes in the MERFISH dataset. This model generates several clusters spatially restricted to smaller subregions within the mRF, despite not including physical space as a variable. Additionally, the model isolates transcriptomically distinct motoneuron populations from other neuronal types, its clusters demonstrate compositional patterns related to neurotransmitter classes, and one cluster appears localized to the pre-Bötzinger complex (preBötC) which has been identified as the core breathing rhythm generator but has not yet been molecularly defined [3]. These results demonstrate the feasibility of this ML-oriented approach and its potential to identify candidate functional subregions of the mRF that can be further investigated using additional computational and experimental approaches.

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60. Nitrogen Limitation Impacts the Evolution of Tobramycin Resistance in Escherichia coli

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Antibiotic resistance inhibits the treatment of bacterial infections. Approximately 23,000 patients in the United States die each year due to antibiotic resistance, resulting in increased healthcare costs of over $20 billion [1]. Bacterial infections become increasingly difficult to treat as bacteria acquire beneficial mutations and evolve resistance to antimicrobial treatments. Therefore, to effectively utilize antibiotics, it is crucial to understand how common environmental characteristics, such as nutrient availability, affect the evolution of antibiotic resistance. We investigated the effect of nutrient limitation on the evolution of antibiotic resistance in *Escherichia* coli. We evolved *E.* coli for 24 days in nitrogen- or carbon-limited environments with and without tobramycin. Nitrogen-limited populations were less likely than carbon-limited populations to survive antibiotic treatment. We competed the evolved populations against the ancestor in their respective nutrient-limited environment with and without tobramycin. As expected, evolved populations were more fit than the ancestor when competed in their evolutionary environment. Surprisingly, our nitrogen-limited populations that evolved without tobramycin had an even larger fitness advantage when tobramycin was added, despite not having evolved in that environment. This trend was unique to nitrogen-limited populations and was not seen under carbon limitation. Our results suggest that carbon and nitrogen limitation had different pleiotropic effects on the evolution of tobramycin resistance. We saw an unexpected relationship between acquiring resistance to tobramycin and evolving under nitrogen limitation: When evolved with tobramycin, nitrogen-limited populations were less likely to survive; however, when evolved in the absence of tobramycin, the populations acquired greater fitness in environments with antibiotics. Our research suggests that adaptation to environmental conditions such as nutrient limitation could facilitate the evolution of tobramycin resistance.

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57. Family Income, Sex, and Adolescent Mental Health: Analysis of the UK Millennium Cohort Study

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Socioeconomic inequality is a major determinant of pediatric health, with family income playing a central role in shaping mental health. Children from lower-income families face greater exposure to stress, instability, and limited resources, increasing risks of emotional and behavioral difficulties. While the income–mental health gradient has been documented across countries, less is known about its persistence into adolescence—a stage of heightened vulnerability to psychological problems—or whether it differs for males and females across multiple aspects of mental health. This study investigates associations between family income and adolescent mental health at age 14 using data from the UK Millennium Cohort Study (MCS), a nationally representative longitudinal study of over 18,000 children born between 2000 and 2002. Analyses focused on approximately 7,500 adolescents (3,780 males; 3,736 females) who participated in the age-14 survey. Mental health was assessed using the Strengths and Difficulties Questionnaire (SDQ), measuring total difficulties, conduct, hyperactivity, emotional, and peer problems. Family income, reported at multiple sweeps of childhood, was averaged into permanent family income (PFI), and adolescents were classified into five income quantiles. Multivariable regression models tested associations between PFI and SDQ scores, adjusting for demographic and early-life factors, with analyses stratified by sex. Results revealed an inverse relationship between PFI and adolescent mental health difficulties. Higher income predicted lower total difficulties and fewer problems across all SDQ scales. For males, associations were strongest for hyperactivity (−0.74 vs. −0.58 for females) and conduct problems (−0.52 vs. −0.49), whereas for females they were strongest for emotional (−0.67 vs. −0.56 for males) and peer problems (−0.75 vs. −0.55). These findings contribute to research in developmental psychology and social epidemiology by clarifying how socioeconomic resources shape adolescent mental health and inform efforts to reduce mental health disparities.

58. Toward the Quantification of Redox Molecule Surface Coverage by Square-Wave Voltammetry

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Square-wave voltammetry (SWV) is one of the most sensitive electrochemical techniques, which makes it very popular for the detection of redox analytes in solution or adsorbed onto an electrode. Yet, in the latter case, there is no simple analytical relation between the current recorded in SWV and the amount of adsorbed redox analyte. This is why, despite the extreme sensitivity of SWV, another less sensitive technique, cyclic voltammetry, is still broadly used for estimation of analyte coverage. The purpose of this project is to develop a simple methodology to determine the coverage of adsorbate by SWV. To do so, we first created an experimental system that will be used to test our methodology. This experimental system consists of a self-assembled monolayer (SAM) of 11-(ferrocenyl)undecanethiol on gold electrodes. We characterized this redox-active SAM by cyclic voltammetry, a gold standard technique. We evidenced an ideal Nernstian behavior. Combining careful independent measurements of the electrochemically active surface area (ECSA), we are able to report the surface coverage of redox molecules on our gold electrodes.
Finally, additional measurements were performed by SWV on the same SAMs. We are now working on the establishment of a numerical model (by Finite Element Modeling) to analyze the shape of the SWV and correlate that shape to the surface coverage found in CV.

55. Ligand Effects on Metal/Carbonyl Interactions

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Ligand scaffolds may be utilized to facilitate reactions with metal catalysts to reduce the Lewis acidic nature of the metal center. The metal catalyst and ligand substrate may be altered with the intent to enhance the coordination of the metal and the substrate, adjusting solution properties. Using *in situ* IR spectroscopy, the interactivity of the ligand with a range of Lewis acid catalysts may be observed. In this examination, we observed a model substrate's solvent performance and solution outcomes with a variety of Lewis acid catalysts using our Titration-IR method. The catalysts we tested include $FeCl_3$, $Fe(OTf)_3$, $Sn(OTf)_2$, and $Cu(OTf)_2$ in toluene, MeCN, THF, DCE, and diethyl ether. The carbonyls have been observed up to three equivalents. Our data are inconsistent with previously reported mechanisms for Lewis acid-mediated carbonyl reactions. These data allow us to clarify how charged ligands contribute to solubility and reactivity of Lewis acids in catalysis and allow us to make recommendations about their application.

56. Optimizing SiO_2:C Content and Carbon Structure in Silica-Depleted Rice Hull Ash Anodes for Improved Specific Capacity and First Cycle Efficiency in Lithium-ion Batteries

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Rice hull ash (RHA) is an agricultural waste product produced when rice hulls are combusted for energy, which consists of high-surface-area SiO_2 (90 wt%) and carbon (10 wt%). Previous work found that RHA contains an amorphous structure of carbon known as hard carbon (HC). HC is a promising alternative anode material to graphite in lithium-ion batteries due to its high specific capacity (~320 mAh g^{-1}), though it may exhibit lower first cycle efficiencies (~65%). Our work aims to optimize the specific capacity and first cycle efficiency of silica-depleted rice hull ash (SDRHA) anodes in half-cells by adjusting silica content and heat treatment in N_2. RHA was depolymerized to form SDRHA, which was used to prepare electrodes and assemble Li/SDRHA half-cells. We found that 50 wt.% SiO_2 SDRHA half-cells showed the best combination of specific capacity normalized to carbon (300 mAh g^{-1} at 1 C) and first cycle efficiency (~41%). In addition, heat-treatment in N_2 at 800°C for 2 h increased first cycle efficiency (~50%) while maintaining similar specific capacities. This improvement can be attributed to heat-treatment restructuring of the HC, which reduces irreversible lithium loss. These results reveal that tuning silica content and carbon structure improves the electrochemical performance of SDRHA as a greener high-capacity anode material to replace graphite, which emits 5–10 tons CO_2 per ton produced.

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53. Psychiatric Traits Predict Individual Differences in Distractibility Across Self-Report and Task Performance in Non-Clinical Sample

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Sustained attention is the ability to remain focused on a task over time while resisting distraction, and people differ widely in this ability. This is especially true for individuals with mental health diagnoses like ADHD [1]. However, it is unclear whether variation in psychiatric symptom traits predicts distractibility among adults without a disorder diagnosis. We hypothesized that higher ADHD-related symptoms and schizotypal traits would predict greater distractibility, motivated by evidence linking ADHD to increased mind wandering [2] and schizophrenia-spectrum conditions to difficulties with rule selection and goal maintenance [3]. Eighty adults were recruited online and completed questionnaires assessing ADHD-related symptoms, anxiety, depression, impulsivity, and schizotypal traits. Participants also completed the Cognitive Functioning Questionnaire to measure self-reported distractibility in everyday life and a Switch Continuous Performance Task to measure objective distractibility during task performance. In the Switch CPT, participants responded to pairs of stimuli (trees, numbers, and letters) according to a current task rule (e.g., press the spacebar for consonants). The task was organized into blocks where the rule either stayed the same throughout the block (repeat blocks) or changed relative to the previous block (switch blocks; e.g., switching from consonants to even numbers). Objective distractibility was indexed by switch cost, which is calculated by the increase in error rate from repeat to switch blocks, which reflects interference from the previously relevant rule. We found that self-reported distractibility was significantly associated with psychiatric symptom measures. Unexpectedly, higher levels of anxiety and ADHD-related symptoms were associated with lower switch cost, defined as the increase in error rate from repeat to switch blocks. This pattern may indicate that individuals with these psychiatric traits can better switch between competing goals. More broadly, this work suggests that psychiatric traits may relate differently to task-based indices and subjective reports of everyday distractibility.

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54. Fishing for the Truth: DNA Barcoding Reveals Seafood Mislabeling in Retail Markets

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In the United States, it is reported that most of the fish bought is mislabeled 25 to 70 percent of the time. Because 84 percent of the fish consumed in the U.S. is imported and the FDA inspects only 2 percent of imports, seafood mislabeling remains a significant concern. Red snapper is one of the most popular fish that gets mislabeled. The purpose of this experiment was to test whether fish sold as red snapper, yellowtail, Alaskan cod, and catfish were accurately labeled. We hypothesized that a portion of the fish samples collected from sushi restaurants and grocery stores would be mislabeled. To test this hypothesis, DNA was isolated from fish tissue samples, and the mitochondrial COI gene was amplified using PCR. This was done to obtain enough DNA for gel electrophoresis and sequencing. Sequencing analysis using Geneious was then used to determine the species identity of each sample. Among the six fish samples examined, only two were accurately labeled, while the remaining four were identified as different fish species. These results indicate that seafood mislabeling occurred in the majority of samples tested. This finding suggests that while not all fish sold in the United States are necessarily mislabeled, mislabeling appears to be common. This study demonstrates how DNA analysis can be used to verify species identity and detect food mislabeling.

51. Developing Bilingual Maternal Health Education Materials for Spanish-Speaking Mothers

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Spanish-speaking Latina mothers are one of the fastest growing patient populations in the United States, yet language discordance and culturally mismatched communication still limit clear access to critical health information and timely care. These barriers are linked to delayed prenatal care and confusion during medical decision making, demonstrating a persistent gap in how culturally concordant health information is designed and delivered. This project documents the process of developing bilingual maternal health materials as part of a community engaged maternal health initiative in Detroit, Michigan. We conducted qualitative analysis of patient experiences from Spanish-speaking mothers who received care through a large health system and community-based clinic. Our analysis identified three primary communication barriers: difficulty understanding medical terminology, challenges navigating health system resources, and discomfort initiating questions with providers. These findings guided the creation of bilingual materials that use plain language, culturally familiar phrasing, and visual aids to explain care steps and increase patient comprehension and confidence in clinical interactions. The development process focused on comprehension, cultural relevance, and accessible layout and imagery. Final materials will be shared with community members for review and feedback. The translated materials provide structured guidance for prenatal and childbirth care and address common communication gaps. This framework can support implementation of bilingual doula and culturally concordant care programs and improve equitable access to maternal health information. Findings suggest that culturally concordant communication requires both accurate linguistic translation and structural explanation of care processes.

52. Bivalent Glucosylceramidase Spherical Nucleic Acids for Parkinson's Disease

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Parkinson's disease (PD) is a neurological disorder characterized by the loss of dopaminergic neurons resulting in movement disorders and dementia. A key contributor to disease progression is the aggregation of α-synuclein, which is exacerbated in some PD patients by mutations in the *GBA* gene that encodes for the Glucosylceramidase (GCase) enzyme. Mutations in *GBA* impair GCase function, resulting in lipid accumulation that accelerates alpha-synuclein aggregation and neuronal degeneration. Enzyme replacement therapy (ERT), which introduces functional proteins to restore enzymatic activity, can be a promising strategy. However, delivering protein to the brain is challenging due to the blood-brain barrier (BBB), which limits uptake of macromolecules. Protein spherical nucleic acids (ProSNAs), characterized by a dense shell of oligonucleotides on the surface, have shown promise in enhancing cellular uptake while maintaining protein function. Previous studies demonstrated that ProSNA with Transferrin (Tfr) aptamer enhanced protein uptake to the brain [1]. Given folate receptors are also abundant in the central nervous system (CNS), we hypothesized that dual targeting GCase protein with folic acid and Tfr would increase receptor mediated transcytosis. We synthesized four different GCase spherical nucleic acids (GCase-ProSNA) and tested their activity and uptake in different BBB cells. We found that the Tfr ProSNAs, and the bivalent ProSNAs showed highest uptake and enzymatic activity compared to other variants and controls. These findings indicate that GCase ProSNAs can be a promising strategy for enzyme delivery across the BBB, offering potential therapeutic benefit for PD and other neurodegenerative diseases.

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49. Coevolution and Structural Determinants of Functional Versatility in the Yeast Hsp40 Co-Chaperone Sis1

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Cellular proteostasis depends on molecular chaperones that recognize unstable protein intermediates, including "orphan" proteins that temporarily lack their normal binding partners and are therefore vulnerable to misfolding, aberrant condensation, and aggregation. In Saccharomyces cerevisiae, the Hsp40 co-chaperone Sis1 provides an early defense by capturing orphan-prone clients and promoting productive folding or transfer to the Hsp70 system. We sought to define structural principles governing Sis1-client recognition across diverse substrates and to test whether Sis1 preferentially engages surfaces that overlap with clients' native partner interfaces. Using AlphaFold Multimer, we modeled Sis1 in complex with candidates spanning distinct cellular pathways and aggregation/condensation liabilities (Cct3, Rps3, Tub2, Sup35, Rnq1, Tub1, Act1, Ubc9, and Rpl26a) [1]. We evaluated predicted complexes for consistent docking geometry and interface plausibility, then compared binding modes across clients to identify recurring contact regions and client-specific determinants [2]. The models indicate substrate-specific binding modes rather than a single universal interface, consistent with conformational adaptability that accommodates heterogeneous client surfaces [3]. Despite this diversity, a recurring pattern emerged: Sis1 frequently occupies an interface that coincides with the substrate's native binding-partner surface, consistent with a placeholder mechanism that shields assembly-critical regions during orphan windows until appropriate partners become available. Several substrates in the panel are known to form condensates when unchaperoned, aligning predicted Sis1 engagement with proteostasis-relevant risk states. Together, these structural predictions support a model in which Sis1 acts as a first-line anti-aggregation gatekeeper by flexibly recognizing multiple clients while preferentially masking partner-facing interfaces. The resulting interface map provides a practical foundation for targeted mutagenesis and future engineering of Sis1 variants with tuned client specificity to mitigate proteotoxic stress in experimental disease and aggregation models.

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50. Kawaii and Catholicism: Visual Representations of Gendered Religious Symbolism in Italy and Japan

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Both Catholicism in Italy and Shinto in Japan use visual, gendered religious symbols to inform sacred practice and public life. In Rome, Italy, the figure of Mary attracts high levels of interaction from devout Catholics, interested art students, and curious tourists alike. Across Japan, symbols related to women's issues draw interaction from women and girls of all ages. Although the churches and shrines which house these gendered religious symbols are considered sacred spaces, they are public spaces as well. Meaning, anyone can enter during visiting hours to pray and admire art in a Catholic church, or to buy religious talisman and be one with nature in a Shinto shrine. The existence of gendered religious symbols in these "sacred publics" extends the scope of who can interact with them. The barrier of entry to enter a sacred space and view gendered religious symbols (which were already low, save visiting hours), do not exist with such rigidity outdoors. Strongly reinforced sacred publics are visible in Rome, as well as Hirakata City, Kyoto, and Osaka, Japan. The existence of gendered religious symbols in the sacred publics of Rome, Italy, and cities across Japan led to an inquiry on how the ever-fluctuating nature these cities and the people (specifically women) have changed the visual representation of gendered religious symbols over time. Comprehensive analysis of historical and contemporary sources on the representation of Mary in Roman Catholicism, female figures in Shinto, and ethnographic fieldwork conducted in Rome and the cities of Hirakata City, Kyoto, Osaka, and Tokyo, Japan, shows that gendered religious symbols in Rome and across Japan demonstrate differing levels of visual change over time. Namely, a lack of visual change in Rome, Italy, and dynamic visual change in cities across Japan.

47. The Role of the DLK1-DIO3 Imprinted Domain During Human Neurodifferentiation

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Human brain development is a highly complex process which requires exquisite orchestration. Thyroid hormone (TH) is one of these key orchestrators, as suboptimal levels of TH during gestation leads to abnormal brain development and reduced IQ. TH has a known role in some cell type differentiation, its function in neuronal differentiation remains unknown. Our lab's previous work found that iPSC-derived neurons cultured with TH have higher maturation. Moreover, RNA-seq analysis showed that four of the most upregulated genes in the mature neurons were within the *DLK1-DIO3* imprinted domain. *DIO3* is a known repressor of TH signaling, and this result led us to hypothesize that genes within the *DLK1-DIO3* imprinted domain were playing a role in neuronal differentiation. To address this hypothesis, we cultured a new batch of iPSC-derived neurons and collected mRNA at D0, D10, D20 and D40 and performed RT-qPCR studies to identify the expression pattern of the *DLK1-DIO3* imprinted domain throughout neuronal differentiation. We also assayed DIO3 enzymatic activity at the different time points. Lastly, we cultured the neurons in excess TH to analyze whether excess TH presence causes differential gene expression of the locus. We found that mRNA transcript expression of all five genes we tested increased significantly throughout neuronal differentiation. Furthermore, DIO3 enzymatic activity increased by nearly 600% between D0 and D40. Lastly, mRNA transcript expression of two genes in the locus, DLK1 and DIO3, increased significantly in neurons cultured with excess TH. We conclude that the entire *DLK1-DIO3* imprinted domain is upregulated during neuronal differentiation and, in the case of *DIO3* specifically, this translates to an increase in enzymatic activity.

48. Extreme Heat in Chicago: An Analysis of EMS Calls

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Extreme heat can impair the body's ability to control its temperature, irritate the skin, cause dehydration, and much more, leading to heat-related illnesses like heat stroke as well as increasing the risk for other health issues like heart attacks [1,2]. Because of these dangerous impacts, it is critical that extreme heat be well understood. Recent studies in Chicago have analyzed the relationship between mortality and extreme heat, finding that extreme heat increases mortality rates, in particular for vulnerable populations [3]. However, the relationship between extreme heat and health problems beyond mortality is less certain. This project aims to address the gap in knowledge regarding the spatial and temporal effects of extreme heat on emergency medical services (EMS) calls, a novel understanding of extreme heat that considers health more generally. By aggregating EMS call data across Chicago community areas and utilizing Daymet 1km x 1km surface climatological variable data to identify extreme heat, this project will quantify the relationship between EMS calls and extreme heat. Preliminary modeling efforts have already identified a positive relationship between heat index and call volume, suggesting that call volume increases to some degree as heat index increases. Not only will these results identify the locations in Chicago suffering most from extreme heat but they will also reveal the strain extreme heat may have on the healthcare system. Thus, this project will generate a more robust understanding of the impacts of extreme heat on public health and the healthcare system in Chicago, results that can be generalized further as well.

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45. Commissioning of the Mobile Antineutrino Demonstrator and Background Characterization

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The Mobile Antineutrino Demonstrator (MAD) is a mobile detector for nuclear nonproliferation and reactor monitoring. MAD is a nonintrusive detector that will have the capability to travel to various nuclear reactors. The purpose is to monitor different nuclear reactors and ensure excess plutonium-239 is not being created inside those reactors. MAD is made up of two detectors, a 2D detector with ^{6}Li doped scintillator bars and a 3D detector with scintillator cubes separated by sheets of ^{6}LiZnS. ROADSTR is a predecessor of MAD and has been tested using ^{6}Li doped bars as well as ^{6}LiZnS wrapped bars to understand the background of test sites. Geant-4 software was used to simulate ROADSTR and compare the ^{6}Li doped bars with the ^{6}LiZnS wrapped bars. Analysis of simulation results showed the ^{6}LiZnS wrapped bars to have more total neutron captures and better resistance to fast neutrons. Distribution of ^{6}Li in each bar also showed to be influential to capture efficiencies of both thermal and fast neutrons.

46. Multi-Agent Reinforcement Learning for Markets of Limited Natural Resources

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California's Sustainable Groundwater Management Act (SGMA) was enacted to address groundwater overextraction and aquifer depletion, motivating the development of regulated groundwater markets among basin stakeholders. Building on the stochastic groundwater market framework, this research addresses the computational challenges inherent in solving Generalized Nash Equilibrium Problems (GNEPs), where multiple agents interact within a shared environment characterized by coupled physical and regulatory constraints [1]. Unlike standard Nash equilibria, GNEPs require agents to optimize their individual objectives while operating within feasible strategy sets that are directly influenced by the actions of others, often leading to highly complex and nonconvex solution spaces [2]. To navigate these dynamics, the model employs a Reinforcement Learning (RL) framework built around the Soft Actor-Critic (SAC) algorithm and its multi-agent extensions. By leveraging SAC's off-policy actor-critic architecture and maximum entropy objective, the framework promotes robust exploration and training stability, enabling the discovery of equilibrium strategies even in environments with intricate and interdependent constraints. The implemented system provides a modular and scalable architecture that progresses from single-agent optimization to sophisticated multi-agent coordination, supported by dedicated training pipelines and evaluation scripts. Through the systematic deployment of SAC-based agents in single-agent, two-agent, and larger multi-agent configurations, the framework enables empirical analysis of convergence behavior and constraint satisfaction across diverse resource-sharing scenarios. Compared to traditional equilibrium computation and numerical optimization methods, the proposed approach offers substantially improved scalability and computational efficiency. By providing a practical and high-fidelity computational tool for analyzing groundwater trading dynamics, this work supports policymakers in designing and evaluating sustainable groundwater management policies under SGMA and similar regulatory frameworks.

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43. Optimization of an Accelerated Aging Model for the Study of Postoperative Cognitive Dysfunction (POCD) in C57BL/6J Mice

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Postoperative cognitive dysfunction (POCD) is a significant clinical concern for elderly surgical patients. To investigate the mechanisms of this vulnerability, we sought to establish an accelerated aging phenotype in young adult mice using D-galactose (D-gal) and to evaluate the therapeutic potential of the α5-GABA-A receptor positive allosteric modulator, MP-III-002. Young adult male and female C57BL/6J mice (3 months old) were used across three experimental phases: Phase I: Oral D-gal (200 mg/kg/day) in drinking water for 8 weeks. Cognitive assessment included the Y-maze and trace contextual fear conditioning. Phase II: Dose escalation to 400 mg/kg/day D-gal (oral) with the addition of MP-III-002 administered 2 days prior to and during behavioral testing (OFT, Y-maze, Fear Conditioning). Phase III (Double-Hit): Exploratory laparotomy was performed on 400 mg/kg D-gal-treated mice to model the interaction of oxidative stress and surgical trauma. In Phase I, 8-week D-gal treatment did not alter body weight. Interestingly, spatial working memory deficits in the Y-maze were observed exclusively in female mice, while no changes were found in fear conditioning for either sex. In Phase II, increasing the dose to 400 mg/kg (with or without MP-III-002) failed to produce significant deficits in fear conditioning or OFT. Notably, even the combination of surgical stress and high-dose oral D-gal (Phase III) did not replicate the cognitive impairment previously observed in our lab using naturally aged (18-month-old) or diphtheria toxin-induced "pseudo-old" mice with partially ablated somatostatin-positive interneurons in the dentate gyrus hilus. These findings suggest that oral administration of D-galactose in drinking water provides insufficient or inconsistent bioavailability to reliably model the aging-related cognitive decline necessary for POCD research in young adult C57BL/6J mice. Consequently, we are modifying our protocol to utilize chronic subcutaneous (s.c.) injection of D-galactose for 8 weeks to ensure systemic oxidative damage and a more robust aging phenotype.

44. Two-Way Dialogues: A Revision to Encompass Local Contexts for TBA Trainings

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This poster examines how the International Confederation of Midwives (ICM) and World Health Organization (WHO) incorporated—or failed to incorporate—social determinants of health in maternal health initiatives during the 1970s, a period marked by global efforts to standardize the training for Traditional Birth Attendants (TBAs) to reduce maternal mortality. While these initiatives were unified efforts to address maternal health disparities, the intersection between maternal mortality and standardized care models is crucial yet remains understudied. This study examines whether local cultural contexts were effectively incorporated into the standardization of TBA training programs. I hypothesize that despite the institutional recognition of local customs and cultural practices, standardization efforts failed to effectively incorporate community-centered care into the program design. Drawing on archival records from the ICM and WHO, the study analyzes efforts to standardize TBA training and promote maternal health policies worldwide, while assessing the extent to which these international entities engaged in a two-way dialogue with local communities. Findings suggest that, although the ICM and WHO acknowledged TBAs' local customs, practices, and beliefs, their programs largely relied on a top-down, asymmetrical approach, with limited interaction between the trainers and community members. Instead, interventions were predominantly shaped by institutional frameworks and authorities. Such results reflect anthropologist Stacy Pigg's critique that maternal health initiatives often impose assumptions about local needs, thus highlighting a need for a two-way dialogue in which community-centered methods are co-created with TBAs and their communities.

41. Enhancing Pharmacokinetics and Selectivity of CPP-115: Rationally Designed Modifications for Optimized GABA-AT Inactivators

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γ-Aminobutyric acid (GABA) is an essential inhibitory neurotransmitter in the central nervous system. Low levels of GABA have been tied to a variety of neurological diseases, including epilepsy, neuropathic pain, Alzheimer's disease, Parkinson's disease, as well as other neurodegenerative diseases. GABA aminotransferase (GABA-AT) is the primary enzyme responsible for metabolizing GABA in the brain. Inhibiting GABA-AT can increase GABA concentrations, making it a valuable therapeutic target for treating neurological disorders. CPP-115 is a GABA-AT mechanism-based inactivator that has proven relatively effective in inhibiting GABA-AT activity. The goal of this study is to introduce a hydroxy group at the 5-position of CPP-115 to explore whether this modification enhances its activity towards GABA-AT and improves selectivity over a structurally similar enzyme, Ornithine aminotransferase (OAT). Docking studies showed that a 5-hydroxy analogue exhibited stronger interactions with GABA-AT than with OAT. The synthesis of this analogue was carried out and characterized using mass spectroscopy and NMR spectroscopy. The activity of the final compound was evaluated using a biological assay that quantified its rate of inhibition of GABA-AT and OAT. The biological assay showed that the 5-hydroxy analogue had very little GABA-AT inactivation activity. Therefore, the 5-hydroxy modification decreases the affinity and selectivity of CPP-115 to GABA-AT compared to standard CPP-115, making this analogue unsuccessful in improving CPP-115. These results inform future analogue syntheses, suggesting that the addition of hydrophobic groups at the 5-position of CPP-115, or modifications at other positions, could be more effective in optimizing CPP-115.

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42. CDCA-Derived NE3TA Conjugate for Liver-Selective Copper-64 PET Imaging

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Positron emission tomography (PET) is a highly sensitive and quantitative imaging modality that has been applied for noninvasive visualization of biochemical and metabolic processes *in vivo*. While PET has the potential to assess hepatobiliary function and transport, liver-selective PET tracers have not been successfully translated into clinical applications. Copper-64 (^{64}Cu) is a positron-emitting radionuclide that has been widely explored for PET imaging of bioactive molecules. We have developed an effective bifunctional chelator 3p-*C*-NE3TA that can securely and rapidly sequester ^{64}Cu under mild conditions. Herein, we report the synthesis and evaluation of a CDCA-derived chelator conjugate, 3p-*C*-NE3TA-chenodeoxycholic acid (CDCA), for potential applications in liver-selective PET imaging. The 3p-*C*-NE3TA-CDCA conjugate was efficiently radiolabeled with ^{64}Cu at room temperature. The resulting ^{64}Cu-labeled 3p-*C*-NE3TA-CDCA conjugate demonstrated high stability in human serum and prominent and selective hepatic uptake with favorable clearance, as evidenced by very low activity levels in blood and non-target tissues in healthy mice at 4 h post-injection. Taken together, these results show that ^{64}Cu-labeled 3p-*C*-NE3TA-CDCA exhibits excellent radiolabeling efficiency, high *in vitro* and *in vivo* stability, and marked liver-selective biodistribution. This CDCA-derived NE3TA conjugate is a promising bile acid-based PET tracer for further optimization and comprehensive evaluation in imaging of liver diseases.

39. The S1103Y Variation in Cardiac Sodium Channel Gene (*SCN5A*) Elevates the Risk of Atrial Fibrillation by Modifying the Late Sodium Current.

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Over 33 million people worldwide suffer with atrial fibrillation (AF), which can dramatically raise the risk of morbidity and death if treatment is not received. AF disproportionately affects minority groups, who frequently have more severe clinical effects. African Americans are more likely to have the common ancestry-specific mutation SCN5A-S1103Y, which has been linked to an increased risk of AF, sudden cardiac death, and sudden infant death syndrome. While previous research has demonstrated that SCN5A-S1103Y modifies sodium channel activity, little is known about how exactly it contributes to the pathophysiology of AF.

We hypothesize that the *SCN5A*-S1103Y variant increases AF risk by creating an altered electrophysiological (EP) substrate.

The *SCN5A*-S1103Y+/− iPSC was generated from an AF patient. Electrophysiological (EP) assessments included: Whole-cell patch clamp recordings to assess sodium current (INa) current. Contractility was recorded with IonOptix system. Optical voltage mapping was employed to measure Action Potential with the IonOptix system. Bulk RNA sequencing (RNA-seq) was performed on iPSC-acMs to identify transcriptomic changes. Downstream bioinformatic analysis included Ingenuity Pathway Analysis (IPA) to identify altered molecular pathways associated with the SCN5A-S1103Y variant.

SCN5A-S1103Y$^{+/-}$ iPSC-aCMs exhibited significantly increased beating frequency and late sodium current compared to wild-type (WT). Action potential duration was also significantly increased in *SCN5A*-S1103Y$^{+/-}$ in iPSC-aCMs, indicating heightened cellular excitability. RNA-seq analysis reveal Estrogen-Related Receptor Alpha (ESRRA) as central regulator atrial and ion channel remodeling.

The *SCN5A*-S1103Y variant predisposes to AF through increased late sodium current and enhanced sarcomeric contractility. Transcriptomic analysis using RNA-seq and Ingenuity Pathway Analysis (IPA) revealed ESRRA reveal ESRRA as a central regulator of *SCN5A* variant-linked AF. This study offers insight into AF mechanisms and may help identify novel therapeutic targets to improve outcomes.

40. Peer Attachment, Relational Aggression, and Popularity: A Cross-Cultural Longitudinal Moderated Mediation Model

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Popularity is an important aspect of adolescents' social life; however, findings indicate it promotes aggression and reduces friendship quality [1]. This study investigated the longitudinal effects of peer attachment on popularity among adolescents and the mediation process of relational aggression among juxtaposing cultural groups. The research participants included adolescents between the ages of 11 and 15 in the United States and China. The participants of this study included American (n = 569) and Chinese (n = 601) adolescents aging 11-15. Data collection occurred at three time points. The mediation was examined in SPSS PROCESS. There was a significant interaction effect between peer attachment at Time 1 to relational aggression at Time 2 ($B = .36$, $p < .001$). This simple slope was negatively significant for American adolescents ($B = -.31$, $p < .001$) but not significant for Chinese adolescents. Similarly, a significant interaction effect ($B = -.27$, $p < .05$) was found on the path from relational aggression at Time 2 to popularity status at Time 3. A simple slope for American adolescents showed increased relational aggression predicted higher popularity (Effect = -.22, $p < .01$), while no significant simple slopes were found for Chinese adolescents. The relationship between peer attachment at Time 1 and popularity status at Time 3 showed a positive interaction effect ($B = .21$, $p < .05$). This path had a negatively significant simple slope for American adolescents ($B = -.23$, $p < .01$) and no significant findings for Chinese adolescents. For American adolescents, the mediation pathway highlights social dynamics among attachment to popularity status via social behaviors like relational aggression. Contrastingly, no significant moderated findings were found for Chinese adolescents, uncovering how peer attachment and relational aggression may not be significant predictors of popularity.

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37. Measuring Accuracy and Similarity of Content Creation of Humans and Generative AI Platforms

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According to the McKinsey Global Survey [1], 60 percent of organizations regularly use generative artificial intelligence (GenAI) for at least one operational function and 22 percent of their employees regularly use GenAI tools to complete their work. Additionally, 40 percent of executives said their companies will increase their investment in GenAI-related tools by 20 percent annually. Thus, it is time for human-centered evaluation of GenAI *'content creation'* [2]. Human-centered evaluation assesses the *'accuracy' and 'inclusivity'* of GenAI output based on human experience, relevance and quality; rather than just technical metrics [3]. GenAI has been adopted unevenly in the U.S. with use clustered in sales and promotions [4]. Consequently, GenAI may be the next revolutionary tool for marketing professionals. The purpose of this project was to investigate the accuracy of a GenAI designed buyer persona (AIBP) by evaluating it and comparing it to a human designed buyer persona (HIBP). Subject matter experts (SMEs; n=20) were recruited to assess the *effectiveness* of both the AIBP and HIBP; based on their professional qualifications and industry representation. The SMEs used the Capital Pentagon assessment tool to assess the buyer persona *effectiveness* in 5-areas [5]. The results, based on TOST (Two one-sided T-test), indicate that GenAI tools are *ineffective* in designing buyer personas with significant differences in the areas of target market representation (TMR; HIBP 16 ± .4 ; AIBP 12 ± .9), market adaptation (MA; HIBP 16 ± .6 ; AIBP 10 ± .8), marketing campaign effectiveness (MCE; HIBP 19 ± .2 ; AIBP 11 ± .6) and sales strategy effectiveness (SSE; HIBP 16 ± .4 ; AIBP 10 ± .8). There was no significant difference for customer acquisition (CA).This research highlights the consequential differences between artificial intelligence and human intelligence. Thus, it is recommended that industry leaders continue to develop human-centered evaluation tools to establish the accuracy of GenAI *'content creation'*.

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38. Investigating the Mass Transfer Formation of Blue Straggler Stars in NGC 6819 with Bayesian Age and Mass Measurements

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Blue straggler stars (BSSs) present a challenge to traditional models of stellar evolution due to their unexpected location in the color-magnitude diagrams (CMDs) of star clusters. Their position, bluer and brighter than the main sequence turnoff, cannot be explained by standard single-star evolution. One channel of BSS formation involves mass transfer in binary systems. In this process, a donor star in a binary loses material that is accreted by its companion star, which becomes a rejuvenated, more luminous BSS.

In this work, we used the Bayesian analysis code BASE-9 combined with archival photometric and spectroscopic measurements to constrain the mass and time since formation of the BSSs in the rich, intermediate-age, open cluster NGC 6819. We used photometric data from *Gaia* DR3, 2MASS, and Pan-STARSS to construct a CMD of the cluster, and employed MIST stellar evolution models to determine preliminary by-eye masses for 19 BSSs in the cluster. We then applied a modified version of the Bayesian cluster analysis software package, BASE-9, to derive more robust posterior distributions for the masses and transformational ages for these BSSs based on photometric information from *Gaia* DR3, 2MASS, and Pan-STARRS. Using archival data collected from the WIYN Open Cluster Study, we also matched each BSS to radial velocity and barium abundance measurements. As barium is an s-process element that is enhanced during asymptotic giant branch (AGB) evolution, these abundances allow us to identify binary BSSs and which systems may have evolved through mass transfer from an AGB star.

By combining these measurements, we can identify specific formation channels for these BSSs and place new limits on the amount of mass accreted during binary mass transfer. With this work, we have established a methodology to evaluate BSS masses, ages, and formation channels, which we can extend to more open clusters in the future.

36. Development of a Biocompatible Core-Shell Nanoparticle Emulsion for Drug Delivery

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One major challenge in drug delivery system design is in the delivery of large biomolecular therapeutics such as proteins, peptides, plasmids and mRNA. The Teymour laboratory, in collaboration with the Papavasiliou laboratory, has developed a biocompatible nanoparticle emulsion (BCNE) produced through inverse emulsion polymerization. This platform is formed by dispersing hydrogel nanoparticles (NPs) in soybean oil, enabling a controlled and extended release of therapeutic agents. One issue regarding hydrogel-based nanoparticles is that it primarily relies on diffusion through a crosslinked polymer network. The transport of large therapeutics (30-300 kDa) requires less cross-linkage density, which significantly compromises mechanical integrity.

Previously, in related work within the Teymour laboratory, Solomon Etchu developed emulsions containing hydrophobic polymer/wax composite nanoparticles with a core-shell architecture, demonstrating enhanced particle stability. Building upon this foundation, the current project aims to develop an inverse-emulsion analog, producing hydrophilic core-shell nanoparticles. We hypothesize that introducing a mechanically reinforced polymer shell surrounding a tuneable hydrophilic core will decouple structural stability from molecular diffusivity, enabling encapsulation and controlled release of large therapeutics without compromising particle integrity.

Preliminary results demonstrate successful encapsulation of polyethylene glycol (PEG), a placeholder for the drugs, validating the feasibility of macromolecule loading. The first stage of the project focuses on optimizing emulsion stability by increasing ionic strength and adjusting surfactant concentration to improve particle formation and performance. Following these optimizations, the next stage will involve peptide loading and release kinetic experiments to evaluate the effectiveness and controllability of the release mechanism.

Early findings indicate that the core-shell architecture improves structural robustness under reduced cross-linking conditions compared to conventional hydrogel nanoparticles. By overcoming the mechanical limitations of traditional hydrogels and addressing the unique challenges of inverse emulsion systems, this research establishes a more robust and versatile platform for vaccine development, gene therapy, and future advances in nanomedicine.

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35. Investigating the Effect of Linguistic Labeling on Object Categorization and Memory in 7 and 12-Month-Olds: Evidence from a "Peek-a-Boo" Occlusion Task

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Current research suggests that infants can develop language categories as early as six months of age through listening to verbal communication in their environments [1]. However, it is unclear how language labels affect an infant's memory of object categories in more dynamic situations, such as with an occlusion task. It is also unknown how persistent language categories are with aging, especially in the complex newborn-infant stage of development. Therefore, two studies in 12-month and 7-month olds were conducted to investigate if naming objects with distinct language labels with a change-detection task positively impacted their object categorization skills. Infants were shown one 3-minute-long video, which included a learning phase with four trials. Stuffed animals were shown with verbal pseudowords (e.g. boff, dax, vep). In two test trials, a stuffed animal from the learning phase was shown and then covered with a blocker. After removing the blocker, the stuffed animal was either the same as before the blocker was placed or different. The infants' level of surprise, and therefore individuation of the animal as a separate object category [2], was determined from their average looking time after the blocker was removed. Participant videos were coded for eye movement through the platform Datavyu. As predicted, there was a significant increase in average looking time in the distinct naming Within Change condition in the 12-month-old study. This indicates that strong object individuation occurred, and that it persisted over the dynamic change-detection task. The 7-month-old study is currently ongoing, and preliminary findings show that more participants are needed to determine statistical significance and make final conclusions. We believe that linguistically naming objects can improve an infant's object categorization and memory skills, which may influence how caregivers interact with children to improve their overall language and cognitive development.

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33. The Impact of Stevia Leaf Extract on Transforming Growth Factor (TGF-β) Signaling in Cichlids

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The development of the vertebrate skeleton is controlled by several signaling cascades, including the TGF-β and BMP pathways, which are essential for bone growth, remodeling and craniofacial patterning [1]. These pathways play important roles in shaping phenotypic variation across fish and disruptions to them can produce dramatic morphological outcomes. Recent evidence from Lake Malawi cichlid fish has revealed how variations to TGF-β signaling can impact craniofacial morphology, with *smad7* identified as a candidate gene within a pleiotropic locus for oral and pharyngeal jaw shape that exhibits correlated expression between the two tissues [2]. We hypothesized that changes to TGF-β signaling during early development would produce changes in craniofacial morphology consistent with known macroevolutionary trends in cichlids. To test this, we exposed a cichlid species, *Labeotropheus fuelleborni*, to stevia leaf extract, a compound known to alter TGF-β signaling [3]. We reared juvenile (15 day) *L. fuelleborni* in stevia-infused water for 18 days, extracted RNA from body tissues, and utilized qPCR to assay TGF-β related gene expression. We observed a decrease in the inhibitory *smad7* and an increase in the activating *smad-2, -3, and -4*, indicating an increase in TGF-β pathway expression, consistent with an over-activation of the TGF-β signaling pathway. Long term treatments, with *L. fuelleborni* exposed to stevia for 5 weeks, exhibited shorter and wider jaws, a pattern that mirrors macroevolutionary changes in cichlid jaw shape. These morphological shifts are consistent with known patterns of jaw divergence across Lake Malawi cichlids, where variation in TGF-β signaling has been linked to differences in both oral and pharyngeal jaw morphology. Our findings suggest that stevia impacts TGF-β signaling in *L. fuelleborni*, potentially revealing a novel mechanism for modulating cichlid craniofacial morphology across the clade, and further implicating the TGF-β pathway as a key axis through which adaptive jaw shape diversity is generated.

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34. Comparing the Frequency of Non-Anthropocentric Rhetoric Behind Polish Vegans and Vegetarian Movements From Partition-Era to Post-Socialist Poland

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Vegetarians and vegans, in the present and for centuries globally, have had a myriad of reasons and ideological motivations behind their practices, including religious, disciplinary/ascetical, health-conscious, or ethical rationales. These motivating factors are not always distinct, and plant-based consumption often includes a plurality of these reasons. However, motivators can either be classified as 'human-centric' or 'animal-centric', with rationales derived from a desire to primarily improve oneself or a desire to prevent harm to animals. Vegetarianism and veganism in Poland arose in the late 1800s, with doctors and theorists like Konstanty Moes-Oskragiełło, Apolinary Tarnawski, and Józef Drzewiecki as influential pioneers, to name a few. Partition-era plant-promotion was often human-first within health-clinics and disciplinary movements. However, external-duty rhetoric was also emerging within ethical, literary, and spiritual circles.

A certain biocentric, ethical intensity exists in modern Poland, shown by groups like the Polish Party for Animal Protection (founded 2011, Otwarte Klatki (Open Cages, founded 2012), and Fundacja Viva! (Viva Foundation, founded 2000). These are vegetarian and vegan groups upheld by animal-first motivations. However, certainly in modern Poland, or the modern vegans or vegetarian spheres globally, plant consumption is still often promoted for health or discipline reasons. Thus, it is naive to just assume that proportionally, vegans and vegetarianism in Poland is more non-anthropocentric today than in previous eras. Polish vegans and vegetarians in key Partition-Era journals like Jarskie Życie (Vegetarian Life) used diverse argumentations, including biocentric, animal-first rhetoric by some. Through content analysis through a corpora of literature, journals, and activist statements from past and present, this study answers if there is a significant proportional frequency in animal-first rhetoric among modern Polish vegans/vegetarians compared to Partition-era Poland.

31. Altered Kinetics and Voltage Dependence of Activation in a Pathogenic KCNH1 Potassium Channel Variant

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Genetic variants in neuronal potassium channel genes are associated with epilepsy and neurodevelopmental disorders. Variants in *KCNH1*, which encodes the voltage-gated potassium channel $K_v10.1$, cause two closely related neurodevelopmental disorders: Temple-Baraitser syndrome (TBS) and Zimmerman-Laband Syndrome (ZLS). These disorders affect young children with epilepsy, developmental delay, intellectual disability, and other non-neuronal features. Despite this clinical association, the mechanisms by which disease-causing variants alter channel function remain poorly understood. We investigated the functional effects of R357Q, the most recurrent pathogenic *KCNH1* variant. Human embryonic kidney (HEK293) cells were transiently transfected with R357Q or wild-type *KCNH1* plasmids, and potassium currents were measured using whole-cell voltage clamp electrophysiology. This technique allows precise control of membrane potential while recording ion channel activity. Cells expressing the R357Q variant exhibited markedly faster channel opening (activation kinetics) and a leftward shift in voltage dependence compared with cells expressing wildtype (WT) channels. These findings indicate that the variant channel activates at more negative voltages and therefore opens more readily than the WT channel. We also investigate the hypothesis that strong pre-pulse hyperpolarization preceding channel activation slows channel kinetics in R357Q. We examined this effect using two alternatively spliced KCNH1 isoforms (isoform 1, isoform 2). Hyperpolarized pre-pulses significantly slowed activation of the R357Q variant in both channel isoforms. In WT KCNH1, the effect differed between isoforms; isoform 2 exhibited greater slowing of activation following hyperpolarized pre-pulses compared to isoform 1. Notably, isoform 2 contains a short deletion in the extracellular S3–S4 linker region, suggesting that structural differences in this region may influence voltage-dependent gating behavior. These findings suggest that altered voltage sensitivity and gating behavior contribute to channel dysfunction in TBS and ZLS. Understanding how specific mutations disrupt potassium channel function provides mechanistic insight into epilepsy pathogenesis and may inform future therapeutic strategies targeting channel gating dynamics.

32. Turbulence and Jupiter's Polar Vortex Lattice

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The atmospheric dynamics of gas giant planets differ dramatically from those on Earth, producing large, long-lived storms near their poles. Early observations of Saturn revealed a single dominant polar vortex (a circular flow), reinforcing the long-standing assumption that only one large-scale vortex can exist at each pole of a rapidly rotating gas giant[1]. However, subsequent observations of Jupiter by NASA's Juno mission revealed a striking departure from this picture: multiple vortices arranged in regular polygonal arrays, with eight vortices at the north pole and five at the south[2]. How such highly organized structures emerge and persist within a strongly turbulent atmosphere remains an open question in planetary science. In earlier work, I investigated whether these vortex arrays could arise from instabilities of an initially single polar vortex. Using a simplified mathematical model of fluid motion and systematically varying key physical parameters, I showed that this scenario is unlikely to reproduce the observed polar configurations on Jupiter. Currently, we are investigating whether polar vortex lattices can instead emerge through turbulent self-organization in a rotating atmosphere. Large-scale planetary flows are well approximated as two-dimensional, a regime in which turbulence exhibits an inverse energy cascade: energy injected at small scales is transferred to larger scales, promoting the spontaneous formation of coherent structures such as jets and vortices[3]. To test this hypothesis, I perform high-resolution numerical simulations of the Navier–Stokes equations—which govern the conservation of momentum in fluids—on a rotating sphere. By systematically varying the planetary rotation rate and the scale at which energy is injected, I identify parameter regimes in which stable, long-lived vortex lattices emerge. These results suggest that Jupiter's polar vortices may be a natural consequence of turbulent self-organization in a rapidly rotating atmosphere.

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29. Development of a Cell-Type Specific Neuroplasticity Sensor

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Structural neuroplasticity is the physical remodeling of synapses in the nervous system[1]. Key elements of structural plasticity are dendritic spines – small, compartmentalized membrane continuum of dendrites. Structural plasticity involves a dynamic change in the number, density, and morphology of these dendritic spines, which directly affect synaptic strength[1]. Neuroplasticity is central in neurodevelopment and learning, while aberrations are associated with a variety of neurological disorders[2]. Despite its importance, approaches for quantifying structural neuroplasticity are limited and face difficulties either in scalability or in capturing the nuances of plasticity networks[3]. To address this, the Kozorovitskiy lab has developed a genetically encoded, nanoluciferase-based neuroplasticity biosensor which reports activity-dependent structural remodeling in an accurate, direct, scalable, and highly efficient manner. However, the current sensor lacks the neuron subtype specificity required to analyze differences in neuroplasticity across neuronal subclasses.

This project focuses on creating and validating a next-gen cre-dependent version of the neuroplasticity biosensor, which would enable neuronal-subclass specific expression. We hypothesized that cre-dependent design of the biosensor would preserve the sensor's efficacy and range while enabling neuronal-subclass specific expression. After successfully inserting loxp sites around nanoluciferase and a V5 tag using Gibson assembly cloning, the new next-gen sensor was packaged in-house in an AAV (adeno-associated virus) and was validated using a variety of experiments in HT22 cells (mouse hippocampal cell line). The presence of the sensor was confirmed through immunocytochemistry and luciferase activity. Luminescence signals between the cre-dependent biosensor and the original biosensor were measured in response to known plasticity modulator, Forskolin, and DMSO as negative control and the sensor types were found to have comparable sensitivity and effectiveness. The next-gen sensor presents a unique opportunity to dissect plasticity across micro-circuit components in different neuromodulators and complex behaviors.

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30. Food Insecurity and Disordered Eating among Female College Students

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Food insecurity affects a substantial proportion of college students in the United States and has been linked to adverse mental health outcomes, including eating disorders. While the association between food insecurity and mental health conditions such as depression and anxiety has been explored, the specific relationship between food insecurity and eating disorders among college students remains underexamined. A recent meta-analysis found that adults experiencing food insecurity are 1.66 times more likely to develop eating disorders. To further investigate this relationship, this study analyzed trends in food insecurity and eating disorder prevalence among female college students using secondary data from the American College Health Association National College Health Assessment (ACHA-NCHA III). Ten-year reports from 2016 to 2025 indicate a gradual increase in the proportion of women diagnosed and treated for eating disorders, including anorexia and bulimia, rising from 2.8% in 2016 to 4.3% in 2025. Although the one-year prevalence of eating disorders remains below 1%, the overall prevalence among female college students is a significant concern. Since 2019, the ACHA has included food insecurity data, revealing an increase in prevalence among female college students from 46% to 47%, which is substantially higher than the 2024 US household prevalence of 14%. This presentation will also compare gender-based trends in eating disorders and food insecurity prevalence. Additionally, current campus initiatives, including the implementation of an AI-based application and collaborations with a local soup kitchen and on-campus organizations, to address food insecurity, will be discussed.

26. Neural Correlates of Spectral and Non-Spectral Perceptual Strategies in Music-in-Noise Performance

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Listening-in-noise requires listeners to extract precise auditory cues from a mixture of target sound streams and background noise. While music-in-noise perception has garnered recent interest as an assessment of auditory processing beyond speech, the neural mechanisms underlying individual differences in performance remain unclear. In particular, it is unknown whether variability in music-in-noise perception reflects distinct perceptual strategies that map onto neural encoding differences. This study aims to identify neural correlates of performance on the Music-in-Noise Test (MINT) by examining how music-in-noise perception is supported by different perceptual cues, and how these strategies relate to measures of auditory processing. Young adults aged 18-25 without extensive music experience (N = 20) completed the Music in Noise Test (MINT), which isolates performance based on pitch, rhythm, spatial, visual, and predictive cues. Principal component analysis of MINT subtests identified a single dominant component, separating pitch-based from more rhythm and visual performance strategies. Neural responses to music presented in quiet and noise were recorded using the Frequency-Following Response (FFR) and encoding strength at the fundamental frequency and harmonics was examined as a function of the behavioral strategy. Listeners with pitch-driven MINT performance exhibited stronger neural encoding of the fundamental frequency and harmonics in noise compared to those relying on non-spectral cues. These results demonstrate that behavioral strategies for music perception in noise are directly reflected in neural encoding of acoustic cues.

27. Application of Direct-to-Biology Approach to Accelerate Structure-Activity Relationships of Aristoquinoline Analogues

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Although the prevalence of substance use disorder (SUD) has declined in recent years, its complexity, driven by the difficulty of controlling illicit drug activity, continues to make it a persistent public health concern. In search of a treatment for SUD, aristoquinoline, an *Aristotelia* alkaloid, emerged as a promising candidate owing to its antagonistic activity at α3β4 nicotinic acetylcholine receptors (nAChR). Sub-desired selectivity and potency, however, required investigation into the structure–activity relationship (SAR). It has been through the design and application of a Direct-to-Biology (D2B) approach that the expansion of the aristoquinoline library for SAR studies has accelerated. Using this pipeline, >200 aristoquinoline analogues have been synthesized, quantified by NMR, and evaluated for antagonistic activity at the α3β4 nAChR subtype. Analogues identified as hits in the D2B approach were synthesized at a larger scale, purified, characterized, and reevaluated at the α3β4 nAChR to confirm antagonistic activity. This work demonstrated that this streamlined D2B pipeline successfully identifies SAR trends and led to a bigger aristoquinoline library for continuous SAR studies.

28. B-glucosidase B Mutant Gene Q19L Enzyme Modeling and Expression

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This project characterizes the structural and functional significance of the mutation Q19L in the β-glucosidase B (BglB) enzyme to add data concerning enzymatic efficiency and stability to the Design2Data (D2D) database, thus expanding the current knowledge on enzymes. We initially proposed that this mutation would decrease its enzymatic activity, expression, and thermal stability because of the significant increase in the energy score in Foldit and the change in the amino acid's polarity. The pET29b plasmid with the mutated gene was isolated and purified before it was sent for sequencing. The mutated plasmid was then transformed into BL21 (DE3) *E. coli* cells, and protein expression was induced. The mutant protein was then purified with chromatographic purification. SDS-PAGE and Western-Blot analyses were used to characterize the size and confirm the presence of the protein, respectively. Enzymatic and thermal-stability assays were employed to determine the efficiency and stability of both the mutant enzyme and wild type enzyme. The results indicate that the mutation Q19L enhances the catalytic efficiency significantly and thermal stability only slightly of BglB. Our findings raise questions on how significantly the amino-acid structure of an enzyme affects its activity.

24. Iron Regulates Fibroblast ACSL4 in Inflammatory Bowel Disease

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Inflammatory Bowel Disease (IBD) is a highly prevalent and debilitating chronic inflammatory disorder of the gastrointestinal tract with no definitive cure. Increased reactive oxygen species (ROS) levels are considered as a hallmark of IBD progression, however, broad antioxidant strategies limit the benefits of clinical usage. Lipid peroxidation is the fundamental mechanism underlying ferroptosis, an iron-dependent form of programmed cell death. Acyl-CoA Synthase long-chain family 4 (ACSL4) promotes the incorporation of polyunsaturated fatty acids (PUFAs) into membrane phospholipids, which are highly susceptible to lipid peroxidation. Increased ACSL4 expression was observed in IBD lesions, especially in fibroblast populations. Notably, our previous findings demonstrated that fibroblast ACSL4 is essential to IBD pathophysiology, as fibroblast-specific overexpression of ACSL4 worsened colitis progress, whereas fibroblast-specific deletion of ACSL4 preserved colonic homeostasis in murine models of colitis [1]. However, the mechanisms regulating ACSL4 expression in fibroblasts during IBD remain unclear. We examined factors relevant to IBD pathology, including inflammatory cytokines, hypoxia, and iron. Treatment with cytokines (e.g., IFNγ, TNFα, IL-1β, and IL-10) or exposure to hypoxia (2% O_2) did not induce ACSL4 expression in fibroblast cell lines or primary murine colonic fibroblasts, as assessed by Western blot and qPCR. In contrast, iron robustly induced ACSL4 gene and protein expression in a time- and dose-dependent manner, with ferric ammonium citrate (FAC, 100 μM) at 24 hours producing peak induction. Moreover, the iron chelator deferoxamine (DFO) abrogated FAC-induced ACSL4 expression, supporting an iron-specific regulatory mechanism. Given that IBD lesions are characterized by a robust tissue iron accumulation, we hypothesize that iron drives fibroblast ACSL4 expression, thereby contributing to IBD pathophysiology. These findings provide new mechanistic insight into IBD etiology and suggest potential therapeutic targets for further investigation.

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25. Latinas Who Care: Narrative Identity and Generativity Among Latina Activists

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Research on narrative identity indicates that highly generative adults in the United States often construct "redemptive" life stories in which an early sense of advantage becomes a central interpretive lens through which later adversity is understood as a catalyst for moral growth and prosocial engagement. Because this narrative pattern reflects historically and culturally specific story templates, it remains unclear whether similar narrative structures characterize moral exemplars operating in different sociocultural contexts. The present study examines how exceptionally generative Latina activists interpret experiences of adversity and construct narrative accounts that sustain moral commitment over time. In particular, the study examines whether generative narratives formed in contexts of chronic insecurity diverge from or converge with the redemptive life-story structure documented in U.S. research. Using an idiographic qualitative narrative design, the study analyzes publicly available long-form autobiographical interviews with ten Latina activists engaged in advocacy related to forced disappearance, Indigenous political participation, and gender-based violence. The sample includes internationally recognized leaders such as Rigoberta Menchú. Interviews were transcribed, translated, and analyzed inductively for narrative identity processes. Cross-case analysis identified a recurring narrative configuration that departs from the prototypical redemptive self. Rather than foregrounding early advantage or exceptional moral sensitivity, participants frequently foregrounded early disadvantage and described a turning point marked by the recognition that their suffering was not unique but part of a broader landscape of shared harm within their communities. Agency was articulated through departures from normalized violence or constraining social roles and was narratively integrated with communal obligation. Redemption was framed not as a resolved personal transformation but as an ongoing and collective moral project sustained through solidarity with others facing similar harms. These findings extend narrative identity research by identifying alternative forms of generative life stories that emerge in sociopolitical contexts marked by chronic insecurity, gendered violence, and collective resistance.

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23. Liposomal Spherical Nucleic Acid (LSNA) for the Treatment of Inflammation

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Chronic inflammatory diseases, such as systemic lupus erythematosus (SLE) or rheumatoid arthritis, arise when immune activation and inflammation are dysregulated. Common drug therapies, such as those based on steroids, effectively reduce acute inflammation, but bring high risks for severe side effects with long-term or high-dose usage needed for these diseases. To this end, recent studies have suggested that small inhibitory oligonucleotides (INH-ODNs) can serve as alternative therapies by inhibiting the initial activation of inflammatory responses and preventing symptoms from spreading.[1] These molecules bind to and inhibit the activation of a target immune receptor with high specificity, making them an ideal candidate for dysfunctional immune system signaling. However, nucleic acids are susceptible to rapid nuclease degradation and have poor cellular uptake, limiting their translation into clinical treatments. To address these challenges, we employ spherical nucleic acid (SNA) nanoparticles for the delivery of INH18 to investigate the hypothesis that a liposomal nanoparticle structure can act as an effective scaffold to improve nucleic acid uptake and delivery. We first construct an amphiphilic conjugate where 3'-thiol INH18 was conjugated to a phospholipid via the stable linker succininimidyl 4-(p-maleimidophenyl)butyrate (SMPB).[3] This amphiphilic conjugate was then anchored into a DOPC liposomal core to form the desired LSNA. This SNA treatment was tested against TLR9-activation-induced inflammation in an inflammation-reporter cell line stimulated with the TLR9 agonist CpG ODN.[2] These cells produce a secreted embryonic alkaline phosphatase (SEAP) signal as a reporter for the activation of the inflammatory pathway, which was measured using commercial assay. Inflammatory cytokine production were also evaluated using enzyme-linked immunosorbent assays (ELISAs). Our results indicate that the INH18 LSNA can effectively suppress both CpG-induced activation and pro-inflammatory cytokine secretion, laying the groundwork for synergistic dual-therapy strategies that combine upstream receptor inhibition by INH-ODNs with the downstream alleviation of inflammation by steroids.

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21. Chicago ZIP Code Linked-Area Deprivation Index as a Predictor of Dementia Diagnosis

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Dementia risk is influenced by biological and lifestyle factors as well as broader socioeconomic conditions; however, the extent to which socioeconomic deprivation creates structural exposures that affect cognitive aging remains unclear. In this study, we will examine whether a neighborhood-level, integrative measure of socioeconomic deprivation, the Area Deprivation Index (ADI), predicts dementia in the Chicagoland area using archival data from neuropsychological evaluations over a 22-year period. We predict that higher ADI will be associated with increased odds of dementia diagnosis, even after adjusting for individual-level demographic characteristics such as age, sex, race/ethnicity, and education. Significant findings may suggest that structural differences in socioeconomic context can uniquely contribute to dementia risk and must be considered when examining cognitive aging in urban populations.

22. Variable Cost of Tobramycin Resistance on Escherichia coli In Nutrient-Limited Environments Without Antibiotic

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Antibiotics are widely used in clinical settings to combat bacterial infections. When the antibiotics are removed from the environment, the resistant bacterial populations may experience a cost to fitness, resulting in a lower fitness than those evolved without antibiotics. We posed the following question: Do *E. coli* populations resistant to tobramycin pay a cost to fitness when antibiotic is removed from the environment? We evolved bacterial populations for 24 days under tobramycin selection in either nitrogen-limited or carbon-limited conditions. We then tested whether the evolved Escherichia coli lost fitness in their corresponding nutrient-limited environment in the absence of antibiotic. The evolved populations competed head-to-head against the ancestor for the limiting nutrient. The magnitude of fitness loss did not differ between carbon-limited and nitrogen-limited environments. Fitness of resistant populations varied, with some, but not all, showing a cost to resistance. This suggests that some resistant populations may persist in the absence of antibiotics, while others would be outcompeted by antibiotic-sensitive strains.

19. Government vs. Non-Government Influence in Federal Rulemaking: the Role of Comment Volume

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When a federal agency plans to create or revise a policy, it will publish an initial draft known as an Advance Notice of Proposed Rulemaking (ANPRM) to solicit public feedback. This research analyzes public comments to the Federal Transit Administration (FTA) regarding Docket FTA-2011-0056, which was a proposal to reform their Environmental Impact Statement (EIS) requirements and categorical exclusions in transit/transportation projects. The study evaluates the relative success of government-affiliated comments compared to those submitted by non-governmental entities, and measures the difference that the volume of comments makes. I hypothesize that collective mobilization, measured by comment volume, will be a stronger predictor of rule adoption than the institutional identity of commenters. This evaluation was conducted using a pre-established standardized coding framework. Each comment was grouped into coalitions based on shared policy requests. Comments were then coded according to their position on the ANPRM and the extent to which its asks were tangibly reflected in the final rule. To empirically compare influence of commenters in the rulemaking process, I modeled adoption rate as a function of actor type and comment volume. Non-government comments had a raw adoption rate of 58.7%, while the government comments raw adoption rate was 53.3%. However, when the volume of comments was factored into the success rate, regression analysis shows that the difference is negligible. Rather, comment volume was the strongest predictor of regulatory success (β=0.55, $p < 0.001$). These findings suggest that the level of organization and participation drives changes in FTA rulemaking more than the actor type behind the comment.

20. Design and Test Novel EEG Electrodes Attachment for Type IV Hairstyles

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Electroencephalography (EEG) is widely used to study brain activity in clinical and rehabilitation settings [1]. For EEG to work effectively, the electrodes must sit firmly against the scalp to minimize impedance and improve signal to noise ratio (SNR). In individuals with dense, Type IV hair, conventional EEG caps often limit scalp contact and reduce signal quality. [1,2]. Consequently, Black participants remain underrepresented in EEG research, limiting the generalizability of findings. [1,2]. This study focuses on the development of 3D-printed electrode attachments designed to work for Type IV hairstyles, targeting natural and braided hair configurations. The attachment features a circular housing ring with lateral stabilizing wings that anchor through hair strands to secure the electrode and maintain scalp contact during movement. Attachments were fabricated using a resin printer (Anycubic Mono 7). A 32-chanel configuration was tested, comparing conventional cap electrodes on the left scalp with the novel attachment on the right. Participants completed resting and walking recordings while impedance, gel volume, electrode to scalp distance, and signal to noise ratio (SNR) were measured. Data collection is ongoing with a target enrollment of 10 participants; however, data from two participants (n=2) demonstrated differences between the cap and the novel attachment. Impedance measurements ranged from 0-110Kohm with the conventional cap (distance to scalp: ~2.0-3.5cm; ≤1.5mL gel), while the novel attachment ranged from 0-23Kohm (distance to scalp: ~0.6-1.6cm; ≤1.1mL gel). At rest, the novel attachment demonstrated superior signal quality with SNR values ranging from 2.1 to 10.1 dB, significantly outperforming the conventional cap's lower range of -0.5 to 4.5 dB. [3]. These findings suggest the novel electrode design improves scalp contact, reduces conductive gel usage, and enhances signal quality across channels, supporting more inclusive data collection for individuals with Type IV hair. Ongoing recruitment (n=10) will further evaluate performance across hairstyle conditions.

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17. Spatial Functional Genomics Identifies Key Cytokine Signaling Promoting Ovarian Cancer

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Ovarian cancer remains one of the most lethal gynecologic malignancies, with most cases diagnosed at advanced metastatic stages. Although the standard treatment, including surgery and chemotherapy, is effective initially, the benefits are short-lived, resulting in a dismal five-year overall survival rate of 20-30%. This highlights the need for more effective therapeutic strategies, including immunotherapies, which have so far shown very poor efficacy in clinical trials. The presence of tumor-infiltrating lymphocytes, particularly T cells, correlates with improved clinical outcomes, emphasizing the critical role of anti-tumor immune engagement in controlling disease progression and treatment response. However, the molecular mechanisms underlying the exclusion and suppression of immune cells from the tumor microenvironment remain poorly understood. Cytokines mediate intercellular signaling to regulate various aspects of tumor immunity, including immune cell recruitment and activation. Hence, a better understanding of multifaceted cytokine signaling in the tumor microenvironment can identify strategies for improved immunotherapies. To investigate the regulation of T cell infiltration and function in ovarian cancer, we developed a spatial functional genomics screen encompassing 35 genes significantly associated with T cell infiltration in malignant human ovarian tumors, including many cytokine signaling molecules. Our in vivo spatial CRISPR screen identified that the loss of a key cytokine receptor family significantly delays tumor growth. Our spatial as well as single-cell transcriptomics analyses will define how the perturbation of this signaling axis alters the tumor immune microenvironment. We will also test whether this pathway regulates the sensitivity of ovarian tumors to immune checkpoint blockade. Ultimately, this study will uncover key regulators and mechanisms of immune infiltration and function in the ovarian tumor microenvironment with the potential to improve immunotherapy outcomes.

18. Maladaptive Sleep Cognitions Are Associated with Poorer Sleep Quality in African American Pregnant Women

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Dysfunctional beliefs and attitudes about sleep (DBAS) contribute to sleep disturbance. African American pregnant women (AAPW) experience disproportionate sleep disturbances and pregnancy complications, yet the role of maladaptive sleep beliefs in this population remains underexplored. This study examined whether DBAS predicts global sleep quality. Baseline data from 108 AAPW enrolled in the BETTER lifestyle counseling study (NCT05234125) were analyzed. Global sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), with higher scores indicating poorer sleep. Dysfunctional sleep beliefs were measured using the DBAS-28 total score (score 0-100). Linear regression evaluated whether DBAS predicted PSQI scores, adjusting for age, body mass index (BMI), education, and income. Robust HC3 standard errors accounted for heteroskedasticity. Participants had a mean age of 28.8 years (SD = 5.59) and mean BMI of 33.2 kg/m² (SD = 5.79). Higher DBAS scores were significantly associated with poorer sleep quality ($\beta = 0.12$ per DBAS point, 95% CI: 0.08–0.16, $p < 0.001$). Age, BMI, education, and income were not significant predictors. The model explained 39% of the variance in PSQI scores ($R^2 = 0.39$, $F(12,95) = 4.03$, $p < 0.001$). Maladaptive sleep beliefs are a strong, independent predictor of poorer sleep quality among African American pregnant women. These findings highlight maladaptive beliefs and attitudes about sleep as a potential target for culturally tailored cognitive-behavioral sleep interventions during pregnancy.

15. "Google Says...": Content Analysis of Representations of Black Women in Google Images

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Stereotypes about Black women, while deeply rooted in history, continue to shape portrayals of Black womanhood through media. This study investigates how Black women are visually represented through Google image search results of "Drawings of Black women" and whether online content reinforces cultural stereotypes about Black womanhood. A coding system was developed to assess how often specific racialized features or combinations of features (e.g. hair texture, nose, lips) appeared within a sample (N=100) of the first images provided by the Google search engine. Analyses provided qualitative thematic information and quantitative frequency counts. Trained coders independently rated each image, and interrater reliability was assessed using Cohen's Kappa. Consensus was reached through discussion. Hypotheses include: (1) Images of Black women with natural hair will be more prevalent than those with straight hair, and (2) when natural hairstyles are depicted, they will more frequently co-occur with other stereotypical features (e.g., fuller lips, larger noses) when compared with straight hairstyles. This research is grounded in existing literature on media representation, stereotype formation, and implicit bias. Preliminary findings indicate natural hair occurs with greater frequency than straight hair, supporting the first hypothesis. There was no noticeable difference in frequency of broad versus narrow noses with the natural hair category. However, within the straight hair category narrow noses occurred with higher frequency than broad noses. Further analysis will examine the frequency of additional features (e.g. lips) across natural and straight hair categories. This research could inform interventions at the educational and policy level, especially within the context of promoting and affirming balanced representations of black girls and women. In examining a popular and widely used search platform, this study aims to highlight the subtle ways that stereotypes not only travel through digital spaces but are maintained and circulated.

16. Development of Water Soluble, Near-Infrared Molecules for pH Sensing That Operate Via Photo-Induced Electron Transfer

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Cytosolic pH plays a critical role in the normal function of cells, enzymes, and metabolic processes, as disruptions in pH have been proven to be correlated with neurological diseases, protein degradation, abnormal growth, and cancers. The synthesis of fluorescent pH sensors would provide a method for visualizing and quantifying pH disturbances, revealing major physiological issues and impaired cellular function in living organisms. Recent research has identified BODIPY compounds as excellent probes for biological sensing due to their high absorption coefficients and adaptability. Previously, our laboratory developed a series of new dibenzo-fused BODIPY compounds that exhibit bright emissions in the near-infrared "tissue-transparent" spectral region. These properties make them promising candidates for the development of optical sensors suitable for in vivo imaging applications. The primary objective of this project is to design a water-soluble, near-infrared BODIPY-based pH sensor that operates via a photoinduced electron transfer (PET) mechanism. The sensor design consists of a fluorescent dibenzo-BODIPY chromophore covalently linked to a pH-sensitive N,N-diethylamino aniline moiety. In previous work, our laboratory synthesized a series of such compounds in which the chromophore-to-receptor distance and the substituents on the N,N-diethylamino group were systematically varied. All compounds exhibited increased fluorescence intensity upon protonation of the diethylamino group with trifluoroacetic acid in organic solvents. The compounds that showed the most pronounced differences in fluorescence intensity between their protonated and non-protonated forms were selected for further modifications. In this research-in-progress report, we describe our efforts to modify functional groups on the dibenzo-BODIPY core and to introduce polyethylene glycol (PEG) linkers in order to improve the water solubility of the sensor.

13. Gay(er) Paree: *Victor/Victoria* (1982) Analyzed by Recuperative Critique

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An initial viewing of Blake Edwards' *Victor/Victoria* gives the distinct impression of gayness, however, the more than four-decade academic consensus is one of contrarily failed gayness, or even homophobia depending on the author [1]. This is due to an unacknowledged expiration of methodology, constant deconstruction that has left the landscape of critique barren of anything new to add. Such a failure stems from the form of movies, where the subject of the viewer, instead of creating the story in their head, is instead made to inactively consume the story, preventing even critics from making something new of what they've been given [2]. In order to actually get this something new out of critiquing *Victor/Victoria* then, we will have to *create* its story instead of consuming it, and in doing so, *create* new possibilities that can spring forth from it. This mode, coined Recuperative Critique by the presenter's advisor, is not a refutation of deconstruction, but rather an inversion of it. By recognizing that the work in question has been adequately deconstructed, to the extent that there is little if any to be gained from the current line of deconstructive analysis, the constituent parts of the work may be taken, evaluated, and if desired built into something new. In short, having been presented with all the ways and means by which *Victor/Victoria* failed to be gay enough, the object of any further critique then is to make it even gayer.

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14. Identification of Evolutionarily Conserved Regulatory Elements of the Zebrafish col2a1b Gene

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Type II Collagens are an essential protein family that provide structure and flexibility in vertebrate structures. Type II collagen plays a particularly crucial role during development because it supports hyaline cartilage, a type of cartilage found in many places, such as the fetal skeleton, joints, and retina. It allows these structures to withstand stress without breaking. Cartilage is composed of two cell types: chondrocytes and perichondrium cells. Chondrocytes make up the majority of cartilage, while the perichondrium is essential for maintaining chondrocytes by providing nutrients and repair factors to the chondrocytes. Currently, much is known about the regulation of Type II collagen alpha 1 (*col2a1*) genes in chondrocytes, while little is known about its regulation and secretion in perichondrium cells. In our laboratory, we utilize *Danio rerio*, the common zebrafish, to study the genetic regulation of the genetically conserved *col2a1* gene. *Danio rerio* have two paralogs to terrestrial vertebrates single *col2a1* gene; in this study, we focus on *col2a1b*, which previous research shows is only expressed in perichondral cells [1]. Previously, our laboratory annotated *col2a1b* and found potential genetic regulatory transcription factor binding sites [2]. We identified these sites as being conserved across teleost fish and in our gene's paralog. We hypothesize that the genetic regulation of *col2a1b* is conserved across teleost fish and its paralog. To test our hypothesis, we created reporter plasmids that contain a fluorescent reporter under the control of each isolated potential transcription factor binding site. The expression patterns produced by our reporter constructs support the hypothesis that *col2a1b* and its paralog have conserved genetic regulation. Our findings provide insight into the regulation of *Type II collagen* genes in the perichondrium. Additionally, these findings may potentially aid in the development of therapeutic strategies related to human *Type II Collagen alpha 1* genetic disorders.

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11. Targeting Distinct Survival Pathways in Breast Cancer Through Combination Therapy

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Breast cancer cells often depend on multiple survival pathways, which can limit the effectiveness of single-drug treatments. MEK inhibitors target the MAPK signaling pathway, but resistance commonly develops when they are used alone. To improve therapeutic response, our lab investigates combination treatments that simultaneously target complementary survival mechanisms.Preliminary combination drug screening revealed subtype-specific synergy patterns in inflammatory breast cancer (IBC) and non-IBC cell lines. Using combination index models to quantify drug interactions, we observed strong synergy between MEK and BCL-2 inhibitors in IBC models, while MEK and HDAC inhibitors demonstrated significant synergy in non-IBC cell lines. In both cases, combination treatments reduced cell viability more effectively than either drug alone, with combination index values below 1 across multiple dose levels, indicating synergistic interactions.These findings suggest that IBC and non-IBC subtypes rely on distinct survival pathways, making them differentially sensitive to targeted drug combinations. Building on these preliminary results, our current work tests whether these vulnerabilities persist when the inhibitor pairings are reversed (MEK plus BCL-2 in non-IBC and MEK plus HDAC in IBC). Ongoing screening will determine whether synergy is conserved or subtype-specific.Overall, this study advances understanding of how breast cancer subtypes respond to rationally designed combination therapies. Identifying consistent and subtype-dependent drug synergies may help guide more effective, precision-based treatment strategies and improve therapeutic outcomes.

12. Application of the Lambda Red Recombineering System to *Klebsiella aerogenes* to Remove Ampicillin Resistance Genes

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Klebsiella aerogenes, formerly identified as *Enterobacter aerogenes*, is a ubiquitous and opportunistic pathogen that is known to infect the respiratory tract, the urinary tract, and the bloodstream. It is the cause of many ICU-acquired infections and is one of the most common causes of UTIs aside from *E. coli*. *K. aerogenes* has demonstrated antibiotic resistance to commonly prescribed antibiotics, leading to the emergence of multidrug resistant strains and even pan-drug resistant strains in its most severe form. Additionally, there has been an increase in the number of infectious cases caused by extended-spectrum beta-lactamase (ESBL)-producing *Enterobacterales*, including *K. aerogenes*. To combat this, carbapenems have been used as a common antibiotic therapy against ESBL-pathogens, leading to the emergence of carbapenem-resistant *Enterobacterales* (CRE) strains [1]. Thus, the difficulty of treating infections caused by *Klebsiella aerogenes* makes it a global priority for the development of new treatment options. One of the main mechanisms by which *K. aerogenes* demonstrates resistance to carbapenems is through a chromosomal overexpression of AmpC β-lactamase [2]. In this study, the lambda Red recombination system was used in a laboratory strain of *Klebsiella aerogenes* to precisely delete two AmpC genes conferring ampicillin resistance [3]. Successful recombination events were confirmed using PCR analysis, showing deletion of both AmpC genes and integration of the kanamycin cassette at the target locus. Genomic DNA was subsequently purified from the mutant strain, and PCR amplification showed a distinct difference between the wild-type and mutant genomes consistent with the targeted deletions. The results establish a system to use *Klebsiella aerogenes* to express plasmids without the need for carbenicillin. This platform may enable future protein expression studies using *Klebsiella* aerogenes as a vector system for proteins that would be difficult to express in other bacterial hosts.

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9. Cognitive Effort Discounting and Its Relationship to ADHD, Depression, and Anxiety

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People often prefer less demanding tasks over more rewarding but cognitively demanding ones, a phenomenon known as effort discounting. Effort discounting reflects the tendency to devalue rewards as required cognitive effort increases. Although individual differences in effort discounting are well-documented, it remains unclear how they relate to clinically relevant phenomena such as ADHD symptom severity, depression, and anxiety. Here, we examine whether self-reported psychopathology predicts cognitive effort discounting in a large online sample. We collected data from N = 674 individuals (mean age = 25, 361 females) who completed the Cognitive Effort Discounting (CogED) task, in which participants choose between completing varying levels of n-back working memory demand for different monetary rewards. Overall, participants showed a clear preference for lower-effort options, accepting lower monetary rewards to avoid higher cognitive loads. Individual differences in effort discounting were quantified using area under the curve (AUC), where higher values reflect reduced discounting and lower values indicate steeper devaluation under increasing cognitive demand. Participants also completed the Conners' Adult ADHD Rating Scale (CAARS), the PHQ-9, and the GAD-7. Contrary to expectation, AUC showed no significant correlation with ADHD symptoms ($r = 0.000$, $p = 0.998$), depression ($r = -0.018$, $p = 0.643$), or anxiety ($r = -0.023$, $p = 0.559$). However, demographic variables predicted both psychopathology and AUC. Females reported higher symptoms across all three measures (all $p < 0.001$) and lower AUC than males ($p = 0.007$). Higher education and income were associated with lower psychopathology (all $p < 0.001$), and income was a small but significant predictor of AUC ($r = 0.085$, $p = 0.028$). These findings suggest cognitive effort discounting is largely independent of self-reported psychopathology, and contribute to a growing literature on motivational and cognitive mechanisms underlying ADHD and related conditions.

10. Gender's Role On the Interplay Between Perfectionism, Parental Overinvolvement, and Youth Depressive Symptoms.

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Large and increasing differences in depression risk emerge in early adolescence, with girls showing greater prevalence than boys (Breslau et al., 2017). Additionally, both youth perfectionism and parental emotional overinvolvement (EOI) can differentially impact the well-being of boys and girls (e.g. Bradley et al., 2025; Chen et al., 2019). The present study addresses a gap in the literature by examining whether the association between perfectionism and depression symptoms depends on parental levels of EOI, and whether this relationship differs for boys and girls. The sample includes 269 early adolescents of predominantly ethnic minority backgrounds (M_{age} = 11.6). Analyses included a moderated moderation model using the PROCESS macro in SPSS. It was hypothesized that higher perfectionism would be associated with higher depression symptoms, particularly at higher EOI levels, with girls showing greater vulnerability to the impact of EOI.

As predicted, a significant three-way interaction effect was found (ß = -.06, $p < .05$), indicating that gender moderated the moderating effect of EOI on the association between perfectionism and depression. Among girls, a significant moderation effect was found (ß = -.04, $p = .02$) such that higher perfectionism was associated with higher depression among those with medium and low levels of parental EOI. In contrast, for boys, the moderation effect was not present (ß = .02, $p = .40$). Girls with high parental EOI reported the highest levels of depressive symptoms, regardless of perfectionism levels.

These findings emphasize the importance of considering both individual and family characteristics in early adolescent depression risk. EOI appears to alter how perfectionistic tendencies translate into depressive symptoms, but in different ways for boys and girls. Additional analyses will be conducted to further uncover the nature of these differences. Clinicians working with early adolescents may benefit from exploring and incorporating skills that help adolescents cope with cognitive and family/interpersonal processes.

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7. Characterization of Nanoparticle-Based Radiopharmaceuticals Through Dynamic Light Scattering and Electrophoretic Light Scattering

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Atherosclerosis is the buildup of plaques in the arteries, with the potential to lead to peripheral artery disease, heart attack, and/or heart failure. Discovering vulnerable plaques is crucial to patient prognosis and planning, as rupture could occur. Radiopharmaceuticals play a unique role in patient care, utilizing a radiolabeled molecule to image, diagnose, and/or treat disease. This project involves characterizing the dendrimeric agents targeting CD206, the mannose receptor, that is upregulated in atherosclerotic plaques. In a previous study, the nanoparticle-based radiopharmaceutical showed increased contrast compared to the clinical standard, DOTAREM, but had increased uptake in the kidney. In contrast, after capping the free amine groups on the PAMAM dendrimer with acetate, the molecule shows decreased kidney and adrenal gland uptake while maintaining contrast. This project quantifies this observation by finding the synthesized molecule's hydrodynamic size and zeta potential using dynamic light scattering (DLS) and electrophoretic light scattering (ELS), respectively. The results show that with increased functionality, there is a decrease in hydrodynamic size due to the decrease in available free amine groups on the nanoparticle, as indicated by the zeta potential. This characterizes the behavior of each molecule and is consistent with decreased uptake in organs like the kidneys and adrenal glands. This will help future research as it shows how capping the free amine groups in PAMAM dendrimers changed hydrodynamic size and surface charge, and its associated decrease in off target uptake.

8. Coalition, Contradiction, and Simultaneity: Boundary-Making in Chicago's Liberation Movement Press

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The liberation movements of the 1970s were marked by both radical solidarity and moments of intense conflict and schism. These dynamics were especially visible in the understudied context of Chicago, where a racially diverse population and distinctive local political conditions created fertile ground for activists and new social movement organizations. This study examines how Chicago-based liberation organizations constructed both schism and solidarity within a shared political environment. Building on scholarship in resource mobilization and organizational infrastructure [1], collective identity and framing [2], and organizational dynamics of solidarity and schism [3], I employ a comparative content analysis of historical movement publications. I identify three organizational dynamics—coalition, schism, and simultianeity—and find that schism and solidarity often occurred simultaneously through processes of boundary enforcement. Coalition and schism therefore co-produced organizational strategies for managing movement boundaries, demonstrating that unity and fragmentation are not opposing outcomes of social movements but intertwined processes through which organizations negotiate collective identity and political boundaries.

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5. Evaluating Drivers of Change in Global Disease Burden Using Piecewise Structural Equation Models

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Changes in environmental variables (e.g., temperature, precipitation, and biodiversity) can enhance or dilute disease depending on transmission modes. Given that variables can interact with each other and are often correlated, linear modelling is unsuitable. As an alternative, piecewise Structural Equation Models (SEMs) allow us to account for these dependencies. As such, this project aimed to evaluate potential drivers of change in disease burden using piecewise SEMs. To this aim, we gathered data on Disability-Adjusted Life Years (DALYs) for 27 diseases across 10 countries and associated environmental and socioeconomic (e.g., wealth, population density, urban population) variables. DALYs were used as a metric for disease burden since they provide higher sensitivity for diseases with sublethal effects. Among the environmental variables, results suggest that DALYs from directly-transmitted diseases are affected by temperature, precipitation, forest cover and biodiversity. DALYs caused by vector-borne diseases (i.e., dengue) were only impacted by precipitation, while DALYs from helminths (i.e., cysticercosis and hookworm disease) were impacted by both temperature and precipitation. DALYs caused by hookworm disease were additionally impacted by biodiversity changes. Results provide essential knowledge on disease ecology in the context of global change, which can help policymakers and managers to tailor strategies to decrease disease burden.

6. Interaction Between Systemic Inflammation and Post-Traumatic Stress Disorder History in Predicting Glycemic Risk: Findings from the Add Health Wave V Biomarker Study

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Post-traumatic stress disorder (PTSD), which can result from exposure to severe trauma, has been linked to heightened systemic inflammation and increased risk for metabolic disorders in adulthood [1]). Individuals with PTSD often exhibit dysregulated immune responses, including higher concentrations of inflammatory biomarkers such as high-sensitivity C-reactive protein (hsCRP). Systemic inflammation is associated with impaired glucose regulation and higher glycated hemoglobin (HbA1c), a biomarker of long-term glycemic control [2]. However, few studies have examined whether PTSD history strengthens the association between inflammation and glycemic risk in adulthood. This study aims to investigate whether the association between systemic inflammation (hsCRP) and glycemic control (HbA1c) was moderated by a history of PTSD diagnosis. Data were analyzed from the "National Longitudinal Study of Adolescent to Adult Health (Add Health)" dataset (n = 12,297, 56.5% female). The mean HbA1c level was 5.37% (SD= 0.91), while the mean hsCRP level was 4.06 mg/L (SD=6.33). PTSD history was not significantly associated with hemoglobin A1c (HbA1c; $r = .007$, $p = .610$) or high-sensitivity C-reactive protein (hsCRP; $r = .004$, $p = .775$). Hierarchical regression analyses controlling for race and gender similarly showed no significant main effects of PTSD on HbA1c ($b = .026$, $p = .605$) or hsCRP ($b = .089$, $p = .801$). However, hsCRP was positively associated with HbA1c ($b = .029$, $p < .001$), indicating that higher levels of systemic inflammation were related to poorer glycemic control independent of PTSD status. A moderation analysis controlling for race and gender testing whether PTSD history moderated the association between hsCRP and HbA1c was not statistically significant ($b = -.354$, $p = .324$). Future longitudinal research should examine how trauma exposure, inflammation, and metabolic health interact over time, including the timing, severity of PTSD symptoms, to inform interventions that target inflammation to reduce long-term cardiometabolic risk among trauma-exposed populations.

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3. Characterization of Two Retinoic Acid Receptor Alpha Conditional Knockout Mouse Models

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The ovaries are the primary endocrine and reproductive organs in females. The ovarian follicle is the basic structural and functional unit of the ovary. When there is abnormal development in ovarian follicles, infertility and reproductive diseases such as polycystic ovarian syndrome (PCOS), premature ovarian failure (POF), and ovarian cancers may occur. Retinoic acid (RA), a biologically active derivative of vitamin A, is a signaling molecule that plays a vital role in various physiological processes, including embryonic development, tissue differentiation, and reproduction. We have previously shown that RA stimulates granulosa cell proliferation through a cell signaling cascade involving Retinoic Acid Receptors (RARs), which have three isoforms alpha, beta, and gamma, in which alpha is the most predominant in the mouse ovary. In this study, we characterized two retinoic acid receptor alpha conditional knockout (RARA KO) mouse models with RARA deleted in granulosa cells during embryonic development using the Cre-Lox system. The uterus weights of the NC/FR RARA KO mice were decreased at both week 7 and week 15 and the body weight was increased at week 15. The NC/FR KO and UIC/FR KO animals were either sub-fertile or infertile. In addition, a variety of ovarian pathologies were observed in the NC/FR KO mice, including the presence of multi-oocyte and atretic follicles, decreased mature follicles, and overall abnormal follicle counts compared to control mice. Overall, this study provides evidence of the involvement of retinoic acid signaling, mediated by RARA, in normal ovarian development and fertility. This study will help better understand the prevention and treatment of ovarian diseases.

4. Creating the Sanctuary City: How Mutual Aid Networks and Nonprofits Supports Recently Arrived Immigrants in Chicago

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Our research project examines how nonprofit organizations and mutual aid groups support asylum seekers and recently arrived immigrants in Chicago. In recent years, the city has experienced an increase in newly arrived migrants, placing significant pressure on community-based organizations to provide support where formal institutional systems are limited. To better understand these efforts, we conducted ten semi-structured, in-depth interviews with volunteers and nonprofit workers actively involved in asylum seeker assistance. Interviews explored participants' motivations for involvement, the services they provide, the challenges they encounter, and how political and social changes have shaped their work. Data was collected through interviews conducted both online and in person. Using qualitative coding and thematic analysis, three major themes emerged across participant experiences: limited resources, increasing demand for assistance, and organizational adaptation to local needs. Participants consistently described shortages of legal assistance, employment opportunities, housing access, and essential supplies. Many interviewees emphasized uncertainty surrounding work authorization and access to stable services, which increased vulnerability among newly arrived immigrants. Participants also described a growing demand for transportation coordination, food distribution, youth programming, and protection from discrimination. In response to these challenges, nonprofit and mutual aid groups demonstrated flexibility and innovation. Organizations adapted by shifting toward home delivery systems, organizing rapid grassroots fundraising initiatives, and using virtual communication tools such as WeChat to coordinate services and maintain communication with immigrant families. These findings align with existing research on immigrant precarity, community resilience, and grassroots organizational responses to structural gaps left by formal institutions. Our interviews suggest that horizontal organizing practices and consistent communication strengthen trust between volunteers and immigrant communities. Overall, the study highlights the essential role nonprofit and mutual aid networks play within Chicago's asylum seeker support system while emphasizing growing pressures as community needs continue evolving.

POSTER PRESENTATIONS

1. Future of the U.S. Labor Market: The Gig Economy

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The gig economy is activity where people earn income providing on-demand work, services or goods through a digital platform (e.g., website, App) [1]. The peer-to-peer (P2P) sharing economy will experience continued growth and be valued at $793.6 billion (at a CAGR of 32.01%) by 2030 [2]. The newest and fastest growth sectors in the U.S. will be shared items, education and health services. Companies such as Uber, Airbnb and Upwork have changed and improved their respective industries for both the workforce and consumer. Based on the CDC's national health survey, professionals in the hospitality, healthcare, construction, retail and education industries are frequently overworked, undervalued and underpaid [3]. The median annual income range for these occupations is $31,040 to $63,100 [4]. Additionally, health workers have reported their intention to find a new job due to feeling harassed and burnt out [5] while their customers have reported dissatisfaction with overall costs, wait periods, communication and insurance inequities [6]. The purpose of this project was to investigate the potential impact of a P2P platform on healthcare services. A total of 698 participants (age = 38 ± 9 years; 322 males, 376 females) completed a 58-item questionnaire [7] online to measure their 1) satisfaction with the U.S. healthcare system and *'demand'* for the P2P service, 2) outcome expectations of the P2P platform and 3) buyer behavior and usage of gig economy services. The results indicate consumers' interest in P2P healthcare services with 68% prepared to purchase them and 80% compelled to recommend them to a friend. It is recommended that future research examines the demand for a P2P healthcare platform from the *'healthcare provider'* perspective. Also, it is recommended that industry leaders change and improve their *'best practices'* with innovative methods and new technologies to improve *healthcare provider* retention *and patient* customer satisfaction.

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2. Role of the Anterior Insular Cortex in Ethanol-Induced Conditioned Taste Aversion

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Ethanol (EtOH) produces rewarding and aversive effects that influence drinking behavior, yet mechanisms underlying its aversive properties are not well defined. The anterior insular cortex (AIC) processes interoceptive signals and its disruption impairs aversive responding, suggesting a role in encoding the negative internal effects of EtOH. The AIC also sends direct input to the rostromedial tegmental nucleus (RMTg), a GABAergic nucleus that encodes aversive stimuli, suggesting a pathway mediating EtOH's aversive properties. To examine this, we used a chemogenetic approach to temporarily inactivate the AIC during conditioned taste aversion (CTA) – a preclinical paradigm used to measure the aversive properties of drugs. Male and female Long-Evans rats received bilateral injections of a viral vector expressing either GFP or Gi-coupled DREADD into the AIC. Following recovery, rats underwent CTA training in which a 0.1% saccharin solution was paired with an injection of saline, EtOH (1.5 g/kg), or LiCl (31.75 mg/kg) across three conditioning sessions. On test day, rats were given saccharin without a drug injection. The effect of AIC inactivation on CTA was assessed in separate groups that received clozapine-N-oxide (CNO; 1 mg/kg, i.p.) 30 minutes before saccharin. Inactivating the AIC on test day did not affect CTA expression for any drug ($p>0.05$). However, DREADD-expressing rats in the EtOH group that received CNO during conditioning trials drank significantly more saccharin compared to GFP controls (*$p<0.03$). AIC inactivation during conditioning had no effect on LiCl-induced CTA ($p>0.05$). These findings suggest that AIC activity is required for learning to associate EtOH's aversive interoceptive effects with the saccharin cue but is not necessary for the expression of this association when AIC activity is undisturbed during conditioning. Ongoing experiments explore whether selective inactivation of RMTg-projecting AIC neurons produces a similar effect. These data will provide evidence for a circuit-level mechanism integrating interoceptive processing with aversive signaling.

11. Evaluating the Efficacy of Graph Neural Network Unlearning Methods through Membership Inference Attack Auditing

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As artificial intelligence systems are increasingly trained on sensitive personal data, regulations such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) have established the legal "right to be forgotten," granting individuals the right to request data deletion. Machine unlearning has emerged as a solution to remove specific data influence from trained models without costly full retraining, addressing both individual privacy rights and organizational needs to remove corrupted or biased data that may compromise model performance. However, it remains unclear whether existing methods truly eliminate data influence, particularly in Graph Neural Networks (GNNs), where interconnected structures cause information to propagate across nodes through neighborhood aggregation. This study hypothesizes that current approximate graph unlearning methods fail to completely remove targeted data, leaving residual information detectable through privacy auditing. To test this, we applied multiple state-of-the-art graph unlearning methods—including node and edge unlearning approaches—to benchmark graph datasets and evaluated each method's completeness using tailored membership inference attacks (MIAs), which attempt to determine whether specific data points were part of the original training set. Our preliminary findings reveal that across all tested methods, MIAs consistently detect traces of supposedly removed data at rates significantly above random chance, indicating persistent information leakage. No approximate method achieved the privacy guarantees of full retraining from scratch. These results suggest that current graph unlearning techniques are insufficient for genuine regulatory compliance and pose ongoing risks to both individual privacy and model integrity, as residual data continues to influence predictions in sensitive domains including healthcare, finance, and social networks. This work contributes to the broader fields of AI governance and trustworthy machine learning by establishing membership inference attacks as a critical auditing framework for evaluating unlearning efficacy and highlighting the urgent need for more robust, verifiable unlearning methodologies.

Panel III. The Future is Now: Smart Machines, Smarter Solutions

9. Early Detection of Pedicle Screw Loosening Using a Tri-Axial Smart Fixation System

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Spinal fusion is one of the most commonly performed procedures in modern healthcare while continuing to have a high failure rate that can lead to serious neurological complications: when implants fail, spinal stability can worsen and nearby nerves may become compressed, causing pain and functional impairment. During spinal fusion, pedicle screws (threaded metal implants) are placed into the vertebrae to stabilize the spine and are connected across levels using titanium rods. This approach is intended to support proper alignment and promote bone healing. However, repeated mechanical loading over time can cause the screws to loosen, leading to micromotion at the interface between bone and implant. This loosening can accelerate bone damage and increase the risk of nerve injury for individuals. In this study, we demonstrate the feasibility of a tri-axial instability detection system using a benchtop validation of an intelligent pedicle screw design that incorporates inertial measurement units (IMUs) that compare positional deviation between multiple sets of pedicle screws in a vertebral column. The system allows for early identification of screw loosening by continuously tracking small positional changes of the implant along three spatial axes, before clinical symptoms appear. To validate this approach, a smart capacitor model was developed that combines a ring-shaped capacitor where height was determined by the locking force of the pedicle screw with an inductor to create a passive, wireless inductor-capacitor (LC) circuit: changes in screw locking force produced measurable shifts in the circuit's resonant frequency. In addition, bone loss caused by repeated loading showed a strong correlation when measured using both volumetric and gravimetric-based methodologies. These results support the development of smart spinal fixation systems capable of continuous mechanical monitoring, enabling early intervention to help preserve spinal cord and nerve root function.

10. Steam Trap Monitoring (STM) System and Making Use of a Low-Cost Polylactic Acid (PLA) Containment Unit

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Steam heating systems remain widely used in older buildings, especially in colder regions, relying on steam traps to regulate steam and condensate flow [1]. Monitoring these traps is often limited because existing diagnostic methods require specialized equipment and trained personnel [1]. This project tests the hypothesis that a compact, 3D-printed containment unit housing a thermoelectric sensor (converts heat to electrical signals) and Wi-Fi can provide low-cost, automated monitoring of steam traps. Field testing was conducted using separate piezoelectric devices (vibration sensors) attached to trap lines with glass-fiber reinforced PA6-GF, left operational for days to months. Thermal imaging cameras measured ambient heat and pipe temperatures, revealing high baseline conditions in older basements and critical high-pressure lines operating between 216 °F and 280 °F [2]. Data on heat usage and trap performance were collected via Grafana dashboards and analyzed to detect operational patterns. The system successfully identified the two main failure modes: traps failing to open, causing pressure buildup and water hammer, and traps failing to close, resulting in continuous steam loss and cavitation [2]. The containment unit is small, durable, and adaptable to various trap configurations, enabling broad deployment. Testing shows that the STM can accurately detect both failure modes while maintaining low energy consumption. By integrating a compact, versatile containment unit with automated monitoring, the STM supports energy conservation, reduces operational inefficiencies, and enhances the reliability of steam heating infrastructure in residential, institutional, and industrial buildings. This scalable approach provides a practical solution for improving energy management and maintenance practices in aging steam systems [1][2].

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7. Controlled Nanoparticle Electrodeposition via Cathodic Corrosion at SECM Ultramicroelectrode Tips

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Cathodic corrosion is the degradation or dissolution of a metal at high negative potentials, and poses both a technological and conceptual challenge in electrochemistry. Despite its prevalence, the underlying mechanisms driving cathodic corrosion remain incompletely understood. This study exploits cathodic corrosion at the tip of a scanning electrochemical microscopy (SECM) probe, a technique that uses a small electrode to interact with surfaces at the microscale, to achieve controlled deposition of metal nanoparticles. We hypothesize that high current densities at the electrode tip drive hydrogen evolution reactions (HER), generating hydrogen intermediates that destabilize the metal surface and release metal species into the small gap between the probe tip and the substrate. These released metal species then nucleate and deposit as nanoparticles on the underlying surface. To test this, ultramicroelectrodes (UMEs) with diameters on the order of micrometers composed of varying metals including platinum (Pt), palladium (Pd), gold (Au), and silver (Ag) are fabricated and positioned in close proximity to substrates in aqueous electrolyte solutions. Deposited nanoparticles are characterized both morphologically and compositionally using standard microscopy and analytical techniques. This study aims to quantitatively analyze nanoparticle deposition, better comprehend the chemical principles governing cathodic corrosion and hydrogen evolution, and advance SECM-based techniques using ultramicroelectrodes. Ultimately, this work seeks to use the electrochemical process as a controllable tool for precise nanoscale material fabrication.

8. New Maastrichtian Microsites Update Squamate Diversity and Biogeography of the Lance Creek Formation

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The Lance Creek Formation in Wyoming provides a wide array of vertebrate microfossils allowing for the assessment of biodiversity dynamics leading up to the Cretaceous-Paleogene (K-Pg) Mass Extinction. The lizards of the Late Cretaceous are often described solely in broader studies that combine data from multiple rock formations. As a result, a herpetofaunal assessment of the Lance Creek Formation is missing. In turn, this study can reveal how lizards in an individual ecosystem responded to the lead up to the K-Pg Mass Extinction as well as describe the current taxonomic composition of Lance Creek. Here, we present a sample of lizard jaws collected in 2023-2024. The groups Polyglyphanodontia, Teiidae, Xenosauridae, Varanidae, and Necrosauridae were present at Lance Creek. There is remarkable taxonomic overlap in lizards within the Maastrichtian age formations including Lance Creek, Hell Creek, Scollard, and Frenchman. The Lance and the Hell Creek Formations contain almost identical occurrences in the current sample with two exceptions, *Socognathus* and *Gerontoseps*. This *Socognathus* represents the southernmost distribution of the genus currently reported. Additionally, our findings of *Socognathus unicuspis* and *Gerontoseps irvinensis* have previously only been found at the Campanian aged Oldman Formation. Their occurrence in the Lance Creek thus extends their range in time. High-resolution micro-computed tomography (CT) scans and 3D segmentation provide insight into the internal anatomy of the jaws included in this sample. Structures such as internal canals, and dentition related details like replacement and tooth attachments are revealed, adding additional anatomical data to these lizard groups that can help to identify more fragmentary jaw pieces. Continued descriptions and collections of Lance Creek lizard faunas will further our understanding of the biogeographic links between Late Cretaceous localities as well as our understanding of the morphologies of these lizard groups.

Panel II. Cells, Genes, and Everything in Between: Insights into Living Systems

5. Investigating How Local Mechanical Interactions Impact Pattern Formation in the Drosophila Retinal Epithelium

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The function of a mature organ is dependent on the proper development of its structure, which stems from the correct organization of its cell types into specific patterns. While much is understood about the genetic pathways that determine the fate of specific cell types, how cells organize in the specific spatial patterns that are integral to tissue function remains an open question. The developing Drosophila eye is an ideal model to address this gap in understanding. Each compound eye is made of ~750 units called ommatidia, each consisting of a core of photoreceptor neurons surrounded by supportive interommatidial pigment cells (IOPCs). During development, interactions between IOPCs organize each ommatidium into a precise hexagonal shape. Motivated by prior work from the Rebay lab suggesting that IOPCs form a mechanically coupled network that spans the entire retina, the broad goal of my project is to understand how physical interactions within this network influence ommatidial patterning. My hypothesis is that patterning in the retina is influenced by non-autonomous interactions between neighboring cells. To test this, I am using genetic tools available in Drosophila to locally disrupt patterning and then investigate how these induced defects affect the shape and organization of the surrounding cells. I have identified that the regional over-expression of AKT, a serine/threonine kinase that regulates cell division and growth, leads to an increase in the apical area of IOPCs and defects in the geometry of ommatidia in the mutant region. My preliminary results demonstrate that the geometry of genetically wildtype ommatidia may be impacted by the patterning disruptions of the adjacent mutant ommatidia, and furthermore, that mutant ommatidia closer to genetically wildtype ommatidia may exhibit some rescue of the AKT mutant phenotype, suggesting that long-range cell-cell interactions may play a significant role in ommatidial patterning.

6. Structure-Switching Aptamers for Continuous Monitoring of Small Molecule Circadian Rhythm Biomarkers

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Electrochemical sensors offer a novel instrument for continuous monitoring of biomarkers with physiological precision, while offering alternatives to invasive lab testing in clinical environments. Circadian rhythms (CR) are innate 24-hour cycles that regulate the timing of biological systems to coordinate daily rhythms of sleep/waking hours, body temperature, and secretion of various hormones, such as melatonin and cortisol. Our aim is to develop a noninvasive, wearable sensing platform for continuous monitoring of relevant biomarkers in interstitial fluid (ISF) to facilitate control over biological clocks through pharmacological interventions. Physiological monitoring (i.e., vitals, heart rate) is a key part of this endeavor; however, biochemical monitoring would enable high-precision monitoring for the monitoring of pharmacological treatments, particularly for sleep dysregulation such as insomnia or sleep apnea.
The nanomolecular pendulum (NMP) enables a reagentless sensing approach for molecular analytes to be analyzed in situ absent external sample preparation. This technology utilizes field-induced diffusion of analytes and electrochemical reporters to the electrode surface to recognize sensitive, time-resolved changes in electrical current to monitor bound and unbound states. Small molecule analytes such as melatonin and cortisol necessitate smaller analyte receptors to enable precision measurements. Traditional modalities such as antibodies are prohibitively large, so structure-switching aptamers, which undergo measurable conformation changes upon target binding, are used to produce changes in hydrodynamic radii (as measured by dynamic light scattering methods). Chronoamperometry allows for the detection of melatonin concentration-dependent current increases, validated in 1x PBS buffer, simulated human ISF, and 10% whole blood. The success of this project offers potential for the further development of a living pharmacy, which can deliver CR-regulating therapies in response to real-time dysregulation. Furthermore, the success of switching aptamers for small-molecule detection will allow the NMP to be employed for diverse small-molecule sensing needs in a variety of biosensing contexts for medical applications.

3. The Alabama Opioid Crisis: A Data-Driven Analysis of the Impact of COVID-19 and Policy Responses

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Alabama has been severely impacted by the opioid crisis in the last decade as evidenced by high prescribing rates, rampant opioid-involved overdoses, and increasing treatment admissions. Within this study, a calibration of a time-dependent set of ordinary differential equations is presented and applied to model Alabama opioid data from 2015 through 2023 to investigate the dynamics of opioid use pre- and post- COVID-19. After simulating the crisis for those years, we predict the trajectory of the crisis from the beginning of 2024 to the beginning of 2028. We find that opioid use disorder and opioid-related deaths are expected to increase, with heroin and fentanyl use disorder ramping up while prescription opioid use disorder slows down. We briefly investigate the efficiency of different policy approaches, finding prescription-related policy to be highly impactful within our model. We then examine the impact of policy related to long-term recovery, relapse prevention, and overdose-reversal separately and together, finding key dynamics related to the heroin and fentanyl use disorder class indicating for it to be vital that these reactionary policy measures be implemented in tandem, with unintended consequences resulting otherwise. In the case implementing the policies simultaneously, we estimate threshold values key to epidemic outcomes in Alabama to inform policymakers on tangible goals to combat the crisis.

4. Between Belongingness and Unbelongingness: The Experiences of Autistic-Identifying Young Adults at Elite Higher Education Institutions

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As the social, psychiatric, and personal boundaries defining autism shift in our current socio-political climate, so, too, do the experiences of autistic young adults. This research considers how autistic-identifying college students actively navigate their own belongingness within the unique social context and mythos of the elite higher-education institution. I draw upon 11 semi-structured qualitative interviews with autistic-identifying college students/recent graduates to address (a) how belongingness is construed, understood, and experienced by autistic college students and (b) how prior experiences with (un)belongingness impact the ways autistic young adults perceive themselves, autism, and their past/present experiences. By focusing on "autistic-identifying" students, this research aims to contribute to the anthropological and disability justice-centered move to look beyond purely medicalized and institutionally-determined categories of diagnosis and identity validation. Instead, I focus on lived experience, belongingness, and identity formation within the particular social milieu of the elite Midwestern higher education institution. Examining "belonging" as a dynamic concept and my primary thematic lens, I explicitly locate my research questions within the current socio-political context of today whilst also addressing how intersectional experiences (with gender, class, race, etc.) inform meaning making and the negotiations of both identity and community. Three main themes emerge from my interviews as variables influencing the degree of belongingness experienced: 1) the acceptance and identification with autism as a label, 2) the university as a space of potential transformation, and 3) the interpersonal and personalized element of belonging as a social activity. While none of these factors on their own are enough to determine belongingness, it is the interaction between these variables and each person's deeply individualized experiences that create spaces where belonging can be felt and enacted.

ORAL PRESENTATIONS

Panel I. From Facebook to Fentanyl: Exploring Identity, Policy, and Social Change

1. Scrolling Into the Future: Social Media and Gen Z Men's Education and Career Pathways

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For Gen Z men coming of age today, the familiar script that "college is the surest path to success" feels less certain, while social media has become a major place where ideas about work, money, and status circulate. This project asks How does social media inform Gen-Z males' career aspirations and education choices, and how does it shape perceptions of college, trades/alternative credentials, and entrepreneurship?
Data collection uses a qualitatively driven mixed-methods design. I recruit U.S. men ages 18–25 primarily from two contrasting contexts (Northwestern University and Chicago's southwest suburbs), administer an online eligibility screener and pre-interview survey, and then conduct ~30 semi-structured interviews (roughly 8–12 per pathway). Interviews include a brief projective vignette exercise contrasting educational and career paths, and transcripts are analyzed using grounded theory-inspired thematic coding (iterative open coding of transcripts, clustering codes into themes through constant comparison, and refining a small set of core categories that explain how participants link social media content to pathway beliefs and decisions). Preliminary exploratory conversations used to refine recruitment and the interview protocol suggest that participants naturally organize "what to do after high school" around three competing pathways: four-year degree-to-employment, trades/alternative credentials, and entrepreneurship/self-employment. The study examines when and how algorithmically curated content is described as legitimizing, stigmatizing, or reshaping these pathways, alongside influences from families, schools, and local opportunity structures, including masculinity/status "scripts" about being a "real man." Findings will contribute to research on social media, education-to-work transitions, and gendered expectations of "success," with practical implications for educators and career advisors aiming to offer more realistic and credible guidance.

2. Labor Market Effects of Removing Prior Authorization for Buprenorphine in Medicaid Programs

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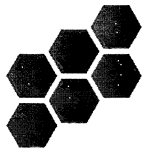
This paper evaluates how the removal of prior authorization requirements for buprenorphine affects labor market outcomes among Medicaid enrollees. Buprenorphine is a treatment used for opioid use disorder, yet prior authorizations often delay prompt access and act as barriers to receiving care. Using IPUMS USA data merged with a state-level dataset documenting prior authorization policies between 2015 and 2019, this study analyzes whether state-level Medicaid prior authorization removal for buprenorphine translates into changes in labor force participation, employment, hours worked, and total personal income. The analyses utilizes state and year fixed effects while controlling for demographic characteristics, and further estimates heterogenous effects across age, race, and sex subgroups. Results for this analysis suggest small but statistically meaningful improvements in labor force participation, usual hours worked, and income upon removal of prior authorization, while employment rates show no significant change. Demographic patterns reveal uneven effects, with certain subgroups, in particular young men of other racial backgrounds, experiencing pronounced shifts in labor outcomes. Overall, the findings suggest that reducing institution and administrative barriers to buprenorphine access may modestly improve labor market outcomes among Medicaid enrollees, though the magnitude varies across populations.



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