FOURTH ANNUAL

INTERNATIONAL GRADUATE STUDENT SHOWCASE

APRIL 29, 2026

THE INTERNATIONAL GRADUATE STUDENT RESEARCH SHOWCASE IS ORGANIZED IN PARTNERSHIP WITH

URI GRADUATE SCHOOL
&
THE OFFICE OF GLOBAL INITIATIVES

SHOWCASE PROGRAM

9:00 AM	Opening Ceremony
9:15AM	Poster Session
9:30 AM	Virtual Presentations
11:30 AM	Closing Ceremony & Awards

Thank you for joining the Fourth Annual International Graduate Student Research Showcase at the University of Rhode Island. The purpose of this Showcase is to celebrate the excellence, innovation, and breadth of international graduate student scholarship across the University. In addition, this event highlights the perspectives, experiences, and global knowledge that enrich our campus community. Today, more than 300 international graduate students from over 60 countries are pursuing Ph.D., master's, and professional degrees across a wide range of disciplines at URI.

This year's presentations reflect the remarkable breadth of student research, with projects spanning public health, biomedical sciences, engineering, artificial intelligence, environmental resilience, food systems, and global social change. Topics include wearable biofeedback for opioid use disorder, coastal flood risk in Rhode Island communities, election system security, pregnancy-related liver disorders, marine conservation in Indonesia, machine learning applications in neuroscience, and innovations in food safety and manufacturing processes.

Conversations with student presenters offer an opportunity not only to learn about the technical and scholarly significance of their work, but also to gain a broader understanding of how research can address challenges and opportunities both locally and globally. Their scholarship demonstrates the vital role international students play in advancing discovery, innovation, and cross-cultural understanding at URI and beyond.

Enjoy the Showcase!

Projects

Occupational Constraints and Quit Readiness among Bidi Smokers: Evidence from Informal Labor Contexts

Mariyam Abbas
Psychology, Ph.D.

Poster Number: 02

Abstact:
Purpose: Smoking cessation research typically focuses on individual-level processes such as self-regulation and nicotine dependence. However, behavior change also unfolds within structural environments that shape stress exposure, autonomy, and behavioral control. Guided by the Job Demand-Control model (Karasek, 1979), the Social-Ecological Model of Health Behavior (Sallis et al., 2008), and the dependence syndrome framework (Edwards & Gross, 1976), this study examined whether occupational conditions function as structural determinants of quit readiness among underserved bidi smokers in India. Specifically, we tested whether work conditions predict quit readiness beyond nicotine dependence.

Methods: Participants were 149 adult daily bidi smokers recruited from informal labor sectors in urban India. Quit readiness was measured on a five-level ordinal scale. Occupations were categorized into four theory-informed groups reflecting work demands and behavioral autonomy: manual construction labor, transport labor, street-based selfemployment, and marginal work. Nicotine dependence was indexed using time-to-first bidi, difficulty refraining from smoking, and smoking while ill. Cumulative link (ordinal logistic) models examined associations between work conditions and quit readiness while adjusting for age, education, and dependence severity.

Results: Street-based self-employment was associated with higher quit readiness compared to manual construction labor (OR = 2.08, p = .07), and higher education showed a similar positive trend (OR = 1.79, p = .09). Greater nicotine dependence significantly predicted lower quit readiness (OR = 0.63, 95% CI [0.46, 0.86], p = .003) and improved model fit ($\Delta\chi^2$ = 8.75, p = .003), partially attenuating occupational effects.

Conclusion: These findings indicate that quit readiness reflects the combined influence of occupational constraints and dependence severity, extending health psychology models to informal labor settings and emphasizing the importance of integrating dependence treatment with workplace-sensitive cessation strategies for marginalized workers.

Determine the Role of Mitochondrial Dysfunction in Age-Associated Sarcopenia

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Poster Number: 03

Abstact:

As global life expectancy increases, the prevalence of age-related diseases such as sarcopenia continues to rise. Although the cellular mechanism of aging is not fully understood, gerontologists have identified several major hallmarks of aging including epigenetic alteration, chronic inflammation and mitochondrial dysfunction. Among these, mitochondrial dysfunction is a key hallmark of aging, characterized by cellular and tissue damage, increased reactive oxygen species, and impaired glucose metabolism. Age-associated glycogen accumulation has been observed in various aging cell types, including neurons, astrocytes, and muscle cells. In this study, we investigated glycogen accumulation in association with mitochondrial impairment using the mtDNA mutator (PolgAD257A/D257A) mouse, a model of accelerated aging caused by systemic mitochondrial dysfunction due to increased mitochondrial DNA (mtDNA) mutations and deletions. Histological analyses with Periodic Acid-Schiff (PAS), diastase-PAS (dPAS) staining and colorimetric glycogen quantification analyses revealed that mitochondrial dysfunction promotes free glycogen deposition in skeletal muscle and to some extent cardiac tissue. These findings suggest that mitochondrial dysfunction disrupts glycogen metabolism, leading to abnormal glycogen processing and free glycogen accumulation in metabolically active tissues. We propose that this glycogen buildup may impair contractile and metabolic functions, thereby contributing to sarcopenia, the age-related loss of muscle mass and strength. Future studies will further investigate the relationship between glycogen accumulation and age-associated sarcopenia using a muscle-specific mitochondrial dysfunction mouse model, as well as determine whether interventions such as exercise can mitigate these effects by enhancing oxidative metabolism and promoting efficient glycogen utilization. Together, these findings identify disrupted glycogen metabolism as a potential biochemical hallmark linking mitochondrial dysfunction to systemic aging and muscle decline.

MINDER: Wearable Biofeedback for Opioid Use Disorder

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Poster Number: 21

Rejection hurts, but when it comes to your ballot, there is a Cure!

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Poster Number: 15

Abstact:
Vote-by-Mail can make the voting process more convenient by allowing voters to fill out their ballots from anywhere and mail them in. In eight states and Washington, D.C., every registered voter receives an absentee ballot by mail and has the option to return their ballot via the postal service, drop boxes, or in person at a designated polling location. The remaining states allow absentee voting either with or without providing an excuse. Thirty-two states implement some form of Signature Verification in their mail ballot process prior to the removal from the return envelope and counting. Certain states that employ Signature Verification provide voters with the opportunity to "cure" the signature in cases where it cannot be matched during processing or is absent. The curing process allows voters the chance to resolve the signature discrepancy, so that their vote can be counted. The timeframe for curing varies by state and may range from the day before Election Day to several days before the election certification deadline. This research creates and compares timeline visualizations from the earliest start time allowed for processing mail ballots and the signature-curing deadline across more than thirty states. It highlights the brief window for curing in some states, as well as signature requirements and the matching process that can result in voter disenfranchisement. The findings can encourage a discussion about evaluating the effectiveness of cure rules to ensure voters have a reasonable period to cure their signatures and have their ballots counted in the election.

Enhancing Food Safety Compliance in Rhode Island's Small-Scale Processors: A Training Evaluation Case Study for Sustainable Implementation.

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Poster Number: 07

Abstact:
Small-scale Food producers face barriers to accessing targeted food safety training, creating gaps in compliance with the FDA Preventive Controls for Human Food (PCHF) Rule and potentially increasing food safety risks. A survey was conducted to identify specific training needs, and a tailored training program was developed to address them. The objective of this study was to observe food safety practices and conduct PCHF audit at small-scale food manufacturing facilities. A pre-training onsite food safety audit was conducted to identify opportunities for targeted technical assistance at a fresh-cut produce and an ice cream facility, using a standardized checklist. Survey results identified training needs in conducting hazard analysis and developing preventive control strategies. The on-site audit and pre-training facility observations revealed need for technical assistance in developing an environmental monitoring program (fresh-cut produce) and improvement of food safety documentation management and standard operating procedures (ice cream manufacturing). Respondents were observed managing multiple operational responsibilities in addition to food safety requirements and they demonstrated a positive attitude toward food safety compliance but reported low confidence in their status.

Texture-dependent variation in inter-bite pauses and their relation to eating rate and food intake

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Poster Number: 01

Abstact:
Inter-bite pauses differ across food textures, but their relevance to total food intake is uncertain. This study tested whether mean inter-bite pause duration (IBPD) predicted total food intake during a four-course meal and whether effects differed for hard (HF) versus soft foods (SF) or if they varied by chewing, sex, or BMI.

Thirty adults (age=27.1±7.8y; BMI 18.3–38.9 kg/m^2; 63.3% female) individually consumed a standardized laboratory lunch that was video-recorded for detailed analysis of oral-processing behaviors. Frame-by-frame coding captured bites, chews, chews-per-bite, IBPD (seconds, s), eating rate (g/min), and total meal duration (TMD, min). Foods were weighed before and after consumption to determine total food intake. IBPD was computed at the individual level for the full meal and separately for HF and SF. Hierarchical regressions, with covariates entered in a priori blocks (chews-per-bite, eating rate, TMD, sex, BMI), tested whether IBPD predicted TFI. Additional models examined texture-specific inter-bite pause effects and pause×BMI interactions.

IBPD was significantly longer for SF than HF (SF=18.8s, HF=13.4s), $t(29) = -5.35$, $p<.001$. Across all models, eating rate ($B \approx +11$–12, $ps<.001$) and TMD ($B \approx +11$, $ps<.001$) were strong positive predictors of total food intake, explaining over 90% of variance ($R^2 \approx .91$). IBPD, chews-per-bite, and sex did not significantly predict total food intake in any of these models, nor did pause×BMI interactions.

In summary, SF produced longer IBPD than HF, but IBPD did not independently predict food intake once eating rate and TMD were controlled. Total food intake was driven by how fast and how long participants ate, not by how long they paused. IBPD is texture-sensitive, but it was not related to food intake in this context.

Coastal Flood Risk to Onsite Wastewater Treatment Systems: A GIS-Based Study in Charlestown, Rhode Island

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Poster Number: 20

Abstact:
Coastal communities such as Charlestown, Rhode Island rely heavily on onsite wastewater treatment systems (OWTS), which are increasingly vulnerable to sea-level rise (SLR) and coastal flooding. This study aims to evaluate the exposure and risk of OWTS to surface flooding under present and future SLR scenarios, and to compare differences between model-based and observation-based approaches for estimating extreme water levels.

A GIS-based framework was developed to integrate OWTS location data with flood predictions derived from STORMTOOLS Design Elevation (SDE) rasters and historical water level variability from NOAA's Coastal Ocean Reanalysis (CORA). Flood depth and exposure were calculated for multiple SLR scenarios (0–10 ft), and a generalized extreme value (GEV) analysis was applied to characterize extreme coastal water levels from long-term observations. Spatial patterns and differences between methods were then assessed.

Results show that OWTS flooding increases noticeably with higher SLR scenarios, with the greatest impacts concentrated in low-lying coastal areas while inland regions remain largely unaffected. Both SDE and GEV approaches identify similar high-risk zones, suggesting consistent spatial patterns, but they differ in magnitude. SDE generally predicts higher flood depths due to the inclusion of wave and surge processes, whereas GEV provides lower, observation-based estimates. These differences become more noticeable under higher SLR scenarios, reflecting growing uncertainty in future flood risk and the need to use multiple approaches when assessing the vulnerability of coastal wastewater systems.

Barriers of oncology nurses to provide cancer pain management for hospitalized patients: an integrative review

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Poster Number: 19

Abstact:
Cancer pain is a major concern for patients and presents challenges for oncology nurses in providing effective care. This integrative review aimed to explore and synthesize the barriers nurses face in managing cancer pain, using the Behavior Change Wheel (BCW) and its COM-B model (Capability, Opportunity, Motivation, and Behavior) as a guiding framework. Following Whittemore and Knafl's integrative review method, 21 studies published between 2010 and 2025 were selected from CINAHL, Scopus, Web of Science, and PubMed, and critically appraised using Hawker's quality assessment tool. The review identified four main barriers: (1) limited knowledge, skills, and clinical competence; (2) heavy workloads and time constraints; (3) patient and family-related challenges; and (4) professional role boundaries and differences. Mapping these barriers onto the COM-B components showed that gaps in capability, opportunity, and motivation affect nurses' ability to provide consistent and effective cancer pain management. Among these, limited knowledge and clinical competence were the most significant obstacles. The findings suggest that improving cancer pain care requires a combination of targeted education, organizational support, and stronger interprofessional collaboration. Enhancing nurses' knowledge, skills, and autonomy, while addressing systemic and patient-related factors, can help create a more supportive environment for high-quality, patient-centered pain management. This review provides valuable insights for healthcare leaders, educators, and policymakers to support oncology nurses in delivering effective and compassionate care.

Bridging the Implementation Gap: Roles and Worldviews of NGO staffs in the Indonesian Marine Conservation Sector

Nara Wisesa
Marine Affairs, Ph.D.

Poster Number: 23

Abstact:
Global marine conservation policies increasingly integrate social equity and empower community-based governance. In practice, however, conservation initiatives frequently encounter challenges in achieving these socio-ecological outcomes. This study investigates this implementation gap within Indonesia's marine conservation sector by analyzing how governance actors across strategic, managerial, and field-level tiers interpret the concept of conservation. Subsidiarity theory suggests that field-level practitioners, operating in close geographic proximity to coastal communities, will naturally adopt socio-centric worldviews. I used a mixed-methods survey (n=53) to map operational scope and evaluate the conceptual alignment of conservation worldviews across the institutional hierarchy. The results demonstrate consistent institutional parity rather than divergence. Field-level staff do not exhibit a distinct localized worldview. Instead, they share the technocratic paradigm of their strategic leaders. Operating primarily within non-governmental organizations that function as surrogate field-level bureaucrats, these frontline practitioners use their natural science training and technical worldviews as cognitive filters. Pressured by state technocratic frameworks and donor-driven audit cultures, they "render technical" their operations, defaulting to measurable ecological targets while inadvertently marginalizing unquantifiable social equity outcomes. This study concludes that physical proximity to communities does not guarantee a community-based conservation ideology. To address this implementation gap, conservation organizations should revise project evaluation metrics to reward trust-building, recruit social science professionals to enhance community facilitation, and formally acknowledge the surrogate bureaucratic roles they assume to proactively support genuine bottom-up governance.

From AI Use Stigma to Ethical Agency: Moral Meaning-Making Process in AI Use among Iraqi Women Professionals

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Poster Number: 06

Abstact:
This study examines how Iraqi women professionals interpret and navigate the moral implications of artificial intelligence (AI) use in their daily work. While existing research on AI in organizations focuses on governance, ethics framework, and regulatory principles, it often overlooks the lived moral experiences of employees using AI in contexts where formal guidance is limited. We introduce the concept of AI use stigma, defined as the moral unease and perceived personal and institutional disapproval surrounding AI use, even when its practical value is recognized. Drawing on 40 in-depth, semi-structured interviews with women professionals across multiple sectors in Iraq, this study adopts an interpretive, inductive qualitative approach grounded in the Gioia methodology. Our analysis identifies a dynamic moral meaning- making process through which individuals navigate AI use, consisting of five interrelated dimensions: (1) meaning and use of AI, (2) AI use stigma, (3) moral legitimacy work, (4) ethical upskilling, and (5) reflective digital agency. Findings show that participants move from initial uncertainty and stigma toward more confident and reflective forms of ethical agency. This process is shaped by cultural norms, gendered expectations, organizational ambiguity, and performance pressures. The study contributes to research on AI and work by shifting attention from formal ethics frameworks to everyday moral sensemaking and by highlighting how gender and context influence the development of ethical AI use practices.

In Situ Study of Electron-Tunneling through Dynamic Interface at Individual Nanoemulsions by Multimodal Single-Entity Electrochemistry

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Poster Number: 09

Abstact:
We newly demonstrate multimodal single-entity electrochemistry (MSEE) i.e., amperometric SEE coupled with voltammetry to in situ study electron-tunneling through the dynamic interface at intact, individual nanoemulsions (NEs) and explore dynamic interfacial structures of genuine NEs. To overcome critical challenges in modern drug delivery, lipid nanocarriers such as NEs have emerged and significantly progressed. The advance in nanotechnology enables to control the size and structure of NEs at the molecular level to serve as superior drug carriers. Desired functionality of NEs, however, cannot be straightforwardly controlled, since it is often determined by dynamically or statically formed interfacial structures. Problematically, the interfacial structure and the structure-related functionality cannot be easily revealed by either ex-situ bulk analysis or electron microscopy. Herein, we synthesized a series of highly monodisperse NEs formulated with food-grade components with varying amounts of Pluronic block copolymer surfactant and investigated in situ interfacial electron transfer (ET) at discrete NEs by MSEE. Interestingly, ET through NE interface shows behavior predicted by Marcus-Hush theory. We could determine the effective interfacial thickness, tunneling-distance decay constant, ET rate constants and a transfer coefficient, thereby differentiating dissimilar interfacial structures and the structure-relevant charge-transfer behavior among a series of NEs beyond their morphological size difference. Our approach provides a noteworthy electrochemical analysis, which could be broadly applied to address the relationship between nanostructure and function of various lipid nanocarriers, especially for controlling and optimizing desired functionality such as delivery efficiency, release kinetics, and carrier stability.

Proteomics analysis reveals ETC assembly and mitochondrial proteostasis pathways are more deranged in the RV than LV and associate with degree of dysfunction in explanted failing human hearts

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Poster Number: 16

Abstact:
RV dysfunction associated with group II pulmonary hypertension significantly increases mortality in left heart failure. However, signaling changes associated with progression of RV dysfunction remains poorly understood. We performed a DIA proteomic analysis of explanted left-heart failure patient RV and LV tissue and compared patients with mild and severe RV dysfunction to unused donor hearts. Explanted transplant hearts (n=22) were obtained at transplant and unused donor hearts (controls) (n=16, 7M/7F) were provided by the Gill Cardiovascular Biorepository, University of Kentucky. All transplant patients exhibited left heart failure and pulmonary hypertension. Right atrial pressure to pulmonary wedge pressure ratio (RAP/PCWP) from right heart catheterization defined RV mild (RAP/PCWP<0.4, n=11, 7M/4F) and severe dysfunction (RAP/PCWP>0.55, n=11, 7M/4F). Total protein was isolated for DIA-MS analysis and mitochondria for isolated frozen mitochondrial respiration assessment. DIA-MS analysis reliably measured ~4000 proteins/group. Mild RV dysfunction showed 221 up- and 213 downregulated proteins versus donors; severe dysfunction had 319 up- and 254 downregulated proteins (B-H adj P <0.05). LV changes were less pronounced. Enriched pathways downregulated in RV included mitochondrial translation, respiratory electron transport, oxidative phosphorylation, complex I biogenesis, and complex IV assembly, with greater enrichment in severe dysfunction. LV tissue showed minimal changes in these cascades but increased inflammatory signaling. 302 RV proteins correlated with CI-dependent and 532 with CIIdependent respiration, enriched for oxidative phosphorylation, RV cardiomyopathy, and mitochondrial disease signatures. Our findings show significant downregulation of mitochondrial proteostasis pathways and ETC assembly in the RV compared to LV of left heart failure patients and these changes associated with impairment in respiration and disease severity. This highlights a heightened bioenergetic vulnerability in the RV vs LV in HF.

Machine Learning-based Identification of tES-treatment Neurocorrelates

Anna Della Calce
Biomedical Engineering, Ph.D.

Poster Number: 05

Abstact:
This study presents a Machine Learning-based identification of electroencephalographic (EEG) features related to transcranial Electrical Stimulation (tES) in Multiple Sclerosis (MS) patients. The contribution is a first step toward an automated system capable of adjusting electrical stimulation according to the EEG feedback (EEG-based adaptive tES). Five MS patients underwent both tES or sham treatments and a Theory of Mind (ToM) training, and the EEG signal before and after treatments was acquired both in Eyes-Open (EO) and in Eyes-Closed (EC) condition. tES was administered by fixed cathode electrodes on the right deltoid muscle. Power differences between post and pre tES treatment in six bands of interest were explored. Support Vector Machine classifier achieved 92.5% and 100.0% accuracy in classifying a subject treated with tES, by exploiting power differences within high beta in T3 and gamma in T3 and P3 in EO condition and power differences within gamma in T3, Pz, Cz in EC condition, respectively. In particular, absolute power in gamma band was reduced after the treatment. The result is clinically significant due to the tendency of MS patients to have high values in this band, caused by the compensation determined by the neurons as a result of the demyelination process.

Analysis and Optimization of the Forging Process for a Rocker Arm and Bracket Made of AISI 5115 (16MnCr5)

Kevin Perri
Mechanical Engineering, M.S.

Poster Number: 17

Abstact:
This paper presents the analysis and optimization of the manufacturing process for a rocker arm and its bracket, both made of AISI 5115 (16MnCr5) steel. The components, designed for internal combustion engine valve systems, are produced through a multi-stage industrial process starting with hot forging in semi-closed dies.

A core focus of the research is achieving specific metallurgical properties through dynamic recrystallization (DRX). Using Zenner-Hollomon and Hall-Petch models, the study determines process parameters—such as a 900°C initial billet temperature and specific strain rates—to ensure a grain size below 10 µm in high-stress areas, guaranteeing a yield strength of 900 MPa.

Following forging, the parts undergo hydraulic trimming at 360°C to remove flash, guided by Cockroft & Latham fracture models. The process continues with heat treatments (austenitization, followed by controlled cooling to achieve 90% perlite/10% bainite for the bracket and vice versa for the rocker arm) and thermochemical carburizing to reach a surface hardness of 64-65 HRC. Final dimensions and IT06 tolerances are achieved via 5-axis CNC milling.

The study highlights that high precision requirements (IT06) account for approximately 70% of total production costs due to increased mold and tool wear.

Analyzing Physical Adversarial Example Threats to Machine Learning in Election Systems

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Poster Number: 10

Abstact:
Developments in the machine learning voting domain have shown both promising results and risks. Trained models perform well on ballot classification tasks (> 99% accuracy) but are at risk from adversarial example attacks that cause misclassifications. In this paper, we analyze an attacker who seeks to deploy adversarial examples against machine learning ballot classifiers to compromise a U.S. election. We first derive a probabilistic framework for determining the number of adversarial example ballots that must be printed to flip an election, in terms of the probability of each candidate winning and the total number of ballots cast. Second, it is an open question as to which type of adversarial example is most effective when physically printed in the voting domain. We analyze six different types of adversarial example attacks: l∞-APGD, l2-APGD, l1-APGD, l0 PGD, l0 + l∞ PGD and l0 +σ-map PGD. Our experiments include physical realizations of 144,000 adversarial examples through printing and scanning with four different machine learning models. We empirically demonstrate an analysis gap between the physical and digital domains, wherein attacks most effective in the digital domain (l2 and l∞) differ from those most effective in the physical domain (l1 and l2, depending on the model). By unifying a probabilistic election framework with digital and physical adversarial example evaluations, we move beyond prior close race analyses to explicitly quantify when and how adversarial ballot manipulation could alter outcomes.

AlkB-family Enzymes Catalyzed Oxidation of Exocyclic Dimethyl RNA Nucleobases: Kinetic and Computational Insights

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Poster Number: 04

Abstact:
Exocyclic dimethyl RNA nucleobase modifications, including N6,N6-dimethyladenosine (m6,6A), N2,N2-dimethylguanosine (m2,2G), and N4,N4-dimethylcytidine (m4,4C), are biologically important marks linked to ribosome maturation, mitochondrial translation, tRNA function, and viral RNA biology. Although some AlkB-family Fe(II)/2-oxoglutaratedependent dioxygenases have been reported to act on di-methylated nucleobases, how these bulky substrates are processed and how their reactivity compares with corresponding monomethyl modifications remain unclear. Here, we used Escherichia coli AlkB as a model enzyme and integrated comparative kinetics with computational analysis to define the oxidation behavior of exocyclic dimethyl nucleobases.

Site-specifically modified oligonucleotides containing m6,6A, m2,2G, or m4,4C were synthesized and examined in matched single- and double-stranded contexts. In vitro assays showed that AlkB efficiently oxidizes all three dimethyl substrates, whereas some mammalian homologs showed substrate- and strand-dependent activity on selected modifications. Similar observations were made from in vitro assays using total RNA isolated from HeLa cells. Time-course analyses revealed a sequential biphasic pathway, with rapid first demethylation to the monomethyl intermediate followed by slower second demethylation to the unmodified base. Surprisingly, all three dimethyl substrates were processed more efficiently than their corresponding monomethyl counterparts in both strand contexts. Computational analyses showed that it is because dimethyl substrates bind more favorably in the AlkB active site, sample more catalytically competent conformations, and has stabilized reaction-intermediate without necessarily a better transition-state barrier.

Together, these findings establish exocyclic dimethyl RNA-type nucleobases as efficient AlkB-family substrates and provide a mechanistic framework for dimethyl substrate selectivity, with implications for RNA modification biology, repair-dependent sequencing, and enzyme engineering.

Molecular Mechanisms and Therapeutic Targets of Bile Acid Dysregulation in Pregnancy Complications Associated with Liver Disorders

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Pharmaceutical Sciences, Ph.D.

Poster Number: 18

Abstact:
Nonalcoholic fatty liver disease (NAFLD) is an increasingly prevalent metabolic disorder that has recently been implicated in adverse pregnancy outcomes. Intrahepatic cholestasis of pregnancy (ICP) is a pregnancy-specific liver disorder characterized by impaired bile acid homeostasis and is strongly associated with preterm birth (PTB) and stillbirth. In our preliminary analysis of a cohort of 36,755 pregnant women, individuals with NAFLD demonstrated a markedly higher prevalence of ICP, with 14.1% of NAFLD patients developing ICP compared to the general population incidence of 1.37%. Moreover, women diagnosed with both NAFLD and ICP exhibited significantly elevated risks of PTB and stillbirth. Both NAFLD and ICP were associated with dysregulated bile acid metabolism, as indicated by increased serum total bile acid (sTBA) levels and reduced expression of the bile salt export pump (BSEP), a critical transporter responsible for bile acid excretion. Based on these observations, we hypothesize that early-stage NAFLD, specifically nonalcoholic fatty liver (NAFL), predisposes pregnant women to ICP and its associated complications through impaired BSEP-mediated bile acid clearance and subsequent bile acid accumulation. This study aims to elucidate the molecular mechanisms linking NAFL to ICP, with a particular focus on bile acid transport dysregulation and hepatocellular signaling pathways. Understanding these mechanisms may reveal novel therapeutic targets and inform preventive strategies for managing pregnancy complications in women with underlying liver disorders.

Phytochemical Profiling and Biological Evaluation of Peppermint (Mentha x piperita) Leaf Extracts for Cosmeceutical Applications

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Poster Number: 08

Abstact:
Peppermint (Mentha × piperita) is widely used in cosmetic formulations, primarily in the form of essential oils, while the bioactive potential of peppermint leaves remains comparatively underexplored. Leaf-derived extracts are rich in phenolic and flavonoid compounds with reported antioxidant and anti-inflammatory properties; however, their fraction-specific chemical composition and relationship to skin-relevant bioactivity are not well defined. In this study, peppermint leaves from garden-harvested and commercial sources were extracted and partitioned into ethanol, hexane, ethyl acetate, and aqueous fractions to obtain chemically distinct components. Phytochemical profiles of each fraction were analyzed by HPLC and compared against selected reference standards, including rosmarinic acid, pebrellin, gardenin B, wedelolactone, and eriodictyol-7-O-glucoside. Distinct chromatographic patterns were observed across fractions, with several peaks corresponding to putative phenolic markers such as rosmarinic acid and eriodictyol-7-O-glucoside. A major unknown constituent is being further characterized by LC-MS analysis. Preliminary Folin-Ciocalteu assay results showed that ethyl acetate fractions contained the highest phenolic content, followed by aqueous and ethanol fractions, compared to non-polar hexane fractions. The anti-inflammatory potential of each fraction and selected standards is being evaluated using an optimized lipoxygenase (15-LOX) inhibition assay with NDGA as positive control and quercetin as reference inhibitor. These findings highlight peppermint leaves as a promising and underutilized source of bioactive compounds and provide a phytochemical and functional basis for their development in cosmeceutical applications.

Psychiatric Outcomes Associated with GLP-1 RA Use among Patients with Type 2 Diabetes Mellitus: A Target Trial Emulation

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Poster Number: 24

Abstact:
The utilization of Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) has dramatically increased in the United States (U.S.) recently. However, the association between GLP-1 RAs use and psychiatric disorders, such as depression, anxiety, and suicidality, remains inconsistent.

To evaluate the association between GLP-1 RA and psychiatric outcomes compared with dipeptidyl peptidase-4 inhibitors (DPP-4i) or sodium-glucose cotransporter-2 inhibitors (SGLT2i) among patients with type 2 diabetes mellitus (T2DM) by implementing a target trial emulation framework.

Target trial emulations were conducted using a U.S. administrative claims database. The primary outcome was a composite of major depressive disorder, anxiety disorder, and suicide attempt or ideation. Propensity score fine stratification was applied to balance baseline covariates. Cox proportional hazards models with robust sandwich variance estimators were used to estimate adjusted hazard ratios (HRs) and 95% confidence intervals (CIs). Sensitivity and subgroup analyses were conducted to evaluate the robustness of the results.

A total of 8,143 patients were included, of whom 3,638 were treated with GLP-1 RAs, 2,115 with DPP-4i, and 2,390 with SGLT2i. GLP-1 RAs initiation compared with DPP-4i or SGLT2i was associated with a higher risk of any psychiatric event (HR: 1.48; 95% CI 1.27-1.73), as well as major depressive disorder (HR:1.55; 95% CI 1.26-1.90) and anxiety (HR:1.58; 95% CI 1.32-1.89). In agent-specific analyses, dulaglutide and liraglutide were associated with elevated hazards of major depressive disorder and anxiety; exenatide with major depressive disorder and suicide attempt or ideation; and semaglutide with anxiety.

GLP-1 RA initiation was associated with higher hazards of psychiatric disorders compared with alternative antidiabetic therapies. These findings highlight the importance of monitoring psychiatric outcomes following treatment initiation, although the results should be interpreted in light of potential residual confounding. Further research is warranted to clarify causality and identify patients at greatest risk.

Metabolic Reactivation of Dormant Uropathogenic Escherichia coli Reveals Thiamine-Dependent Quiescence Exit

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Poster Number: 14

Abstact:
Recurrent urinary tract infections (UTIs) are frequently caused by uropathogenic Escherichia coli (UPEC) that persist in a dormant, quiescent state. Quiescent bacteria exhibit reduced metabolic activity and antibiotic tolerance, contributing to treatment failure and infection recurrence. While prior studies have characterized mechanisms governing entry into and exit from bacterial quiescence, experimental approaches to identify dormancy-reversing molecules have relied largely on agar-based assays. To address this gap, we developed a novel, high-throughput, fluorescence-based quiescence reversal assay. This platform enables sensitive, quantitative measurement of metabolic reactivation, supports rapid determination of concentration–response relationships and EC_{50} values, and provides improved statistical power for compound screening. Using this assay, 130 compounds, including TCA cycle metabolites, amino acids, and small molecules, were screened for their ability to restore metabolic activity under quiescent conditions, with known quiescence-reversing metabolites validating assay performance. Only a limited subset of screened metabolites induced reversal of quiescence, with activity observed predominantly at micromolar to millimolar concentrations. However, thiamine HCl (vitamin B1) exhibited exceptional potency, with sub-nanomolar activity (EC50 = 0.287 nM). Thiamine is an essential cofactor for pyruvate dehydrogenase and α-ketoglutarate dehydrogenase, enzymes that regulate carbon entry and flux through the TCA cycle. Consistent with prior evidence linking TCA cycle flux to bacterial exit from quiescence, these findings identify thiamine HCl as a highly potent chemical driver of dormancy reversal and highlight metabolic cofactors as tractable intervention points for targeting persistent UPEC. Ongoing work will investigate the contribution of TPP-riboswitch-regulated pathways to thiamine-induced resuscitation in dormant UPEC.

Spectral Confusion in Learned Deconvolution of Satellite Sea Surface Temperature Fields

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Poster Number: 12

Abstact:
AMSR-E provides global all-weather sea surface temperature (SST) measurements but with a large (~56 km) footprint that blurs mesoscale ocean features. Deconvolution using deep learning promises to recover high-resolution SST from these blurred observations. However, we identify a fundamental barrier: the structured instrument noise in AMSR-E has its spectral power concentrated at the same spatial frequencies (~50-64 km wavelengths) where the deconvolution model must recover attenuated ocean signal. We term this spectral overlap "spectral confusion." Using paired AMSR-E/MODIS observations and LLC4320 ocean model simulations, we demonstrate that: (1) models trained on noise-free simulated data degrade by 19× on real AMSR-E observations due to this structured noise; (2) at matched amplitude, models handle white noise 2× more effectively than structured noise, proving that noise structure—not amplitude—is the barrier; (3) over 20 distinct approaches spanning U-Net variants, physicsinformed methods, self-supervised decomposition, and noise-constrained training all plateau between 0.56-0.60 ◦ C RMSE, while noise-free deconvolution achieves 0.14 ◦ C; and (4) this spectral confusion phenomenon generalizes to natural image deconvolution (CIFAR-10, STL10), confirming it is domain-independent. Per-patch analysis reveals that model performance is governed by the local signal-to-noise ratio, with the model failing systematically on noisedominated patches. These findings establish that the performance ceiling is an informationtheoretic barrier inherent to single-observation deconvolution under structured noise, motivating multi-temporal and swath-level approaches for future SST retrieval.

Investigating pathways of renal ischemia-reperfusion injury (IRI) and the efficacy of treprostinil in reducing renal IRI

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Poster Number: 13

Abstact:
Renal ischemia-reperfusion injury (IRI) is a significant contributor to acute kidney injury and delayed graft function post-kidney transplantation, with no treatment available. We previously demonstrated the efficacy of treprostinil (Remodulin®), an FDA-approved prostacyclin (PGI2) analog, in reducing renal IRI in vivo. This study investigates novel biomarkers and reno-protective mechanisms of treprostinil during renal IRI in vivo. Male Sprague Dawley rats were randomly divided into sham, placebo, treated groups, and subjected to bilateral renal IRI (45 mins) followed by reperfusion (1-48 hrs). Treprostinil was administered subcutaneously and serum and kidney tissue were collected for biochemical and proteomic analyses. Treprostinil reduced peak serum creatinine levels by 52% ($P<0.05$), and histology showed reduction of necrotic tubules of kidney tissues by ~50% vs. placebo ($P<0.01$) at 24 hours postreperfusion. Proteomic profiling in renal tissues detected 2931 proteins, with a total of 91, 58 and 60 differentially expressed proteins (DEPs) at 6, 24, and 48 hrs post-reperfusion, respectively (>1fold at $p<0.05$). A correlation between DEPs was observed using STRING and GO to regulate molecular functions, e.g., oxygen, heme, protease and complement binding; biological processes, e.g., acute phase response, stress, involving cellular components of the extracellular space, cytoplasm and some apical parts of the cell. In conclusion, IRI and treprostinil therapy alter renal and serum protein expressions as early as 6 hrs and up to 48 hrs post-reperfusion. These findings identify specific proteins regulated during renal IRI which provide mechanistic insight to identify novel biomarkers involved in IRI and therapeutic targets of treprostinil.

The Human-Nature Connection: Measuring Ecoliteracy and Environmental Attitudes

Yvonne Wingard
Master of Evironmental Science and Management

Poster Number: 22

Abstact:
In our increasingly urbanized, modernized, technology-dependent world, societies are rapidly losing a connection to the earth. This is seen not only in the direct loss of pristine habitats due to fragmentation and urban development, but also in the very loss of words, meanings, and significance that the land holds to people. The loss of ecological literacy is at the core of the human-nature disconnection. Ecological literacy, also referred to as ecoliteracy, is defined as "the ways in which humans understand their interconnectedness to biotic and abiotic communities" (Ortoleva, 2013) and refers to one's understanding of, or ability to understand, the natural systems and processes that make life on earth possible. This paper provides an exploratory analysis of how researchers seek to conceptualize and measure individuals' connection to nature as a potential driver of pro-environmental behavior.

Machine Learning in Sensors: Feature Learning from Complex Spectra in mmWave Radar Signals

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Poster Number: 11

Abstact:
This work discusses how to directly extract features from complex-valued spectra using an energy-based probability distribution that represents complex-valued data. As an extension of the well-known restricted Boltzmann machine (RBM), the proposed model, the complexvalued restricted Boltzmann machine (CRBM), is made to deal with complex-valued visible units. With the use of contrastive divergence (CD) or Gibbs sampling, the CRBM, like the RBM, develops a grasp of the relationships between visible and hidden units without requiring connections between units in the same layer. We propose new in-sensor computing architecture that can dramatically reduce the amount of data transferred from the sensing board to the DRAM of the main computing system, giving rise to improved performance and energy efficiency. The sensing board investigated here is mmWave (millimeter Wave) radar that generates and transfers the Inphase(I) and Quadrature(Q) data to the central ADAS (Advanced Driver-Assistance System) computing platform for object detection and recognition in autonomous driving systems. Rather than transferring raw I/Q data, our new architecture performs initial stages of machine learning computation on the sensor board and transfer partial results to ADAS computing system, leading to decreased latency and energy consumption while still maintaining the data accuracy. We present an energy based probabilistic graphical model, CRBM (Complex-valued Restricted Boltzmann Machine), a generative model to reduce the raw data size to be transferred to the ADAS computing platform.