UVic Postdoc Research Day 2025

May 6, SUB Upper Lounge

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

UVic Postdoc Research Day 2025 Schedule

8:30 am	Registration
9:00 am	Welcome remarks
9:15 am	Research talks session 1
10:30 am	Coffee break
11:00 am	Research talks session 2
12:15 pm	Lunch break
1:15 pm	Research talks session 3
2:30 pm	Academic Careers Panel
3:30 pm	Awards and close
4:00 pm	Social at Grad House

Research talks at a glance

Research talks session 1

- Reaping What We Sow: Understanding Opportunities for Environmental Accountability in Canada’s Food Commodity Imports
- Alcohol consumption and mortality among Canadian drinkers: A national population-based survival analysis (2000–2017)
- Continuous Addition Kinetic Elucidation: a Method for Determining Catalyst Effects and Reaction Rates from a Single Experiment
- Networked System for Accelerating Distributed AI Training
- Exchange of Water Between the Shelf and the Open Ocean in the Western South Atlantic
- Searching for neutrinos in the oceans depths
- Secreted protein acidic and rich in cysteine (SPARC): From Exercise-Induced to Potential Exercise Substitute with Therapeutic Possibilities
- The effects of noise on the quality and availability of a common forage fish
- Decarbonization through District Energy Development: The Climate Housing Nexus
- Diazirines in a New Light: Visible and Near-IR Activation for Extended π-System Diazirines
- Sex Differences in the Response of Microglia to Cannabis Exposure

Research talks session 2

- A comparison of neural and mesenchymal stem cell-derived extracellular vesicles as modulators of blood brain barrier function in Alzheimer’s disease
- Decoding tidal wetland change and resilience for the sustainable coastal environment
- Solidarity Education: Starting an Organizing Language School in Vancouver's Chinatown
- Advancing Ubiquitous Intelligence Through Collaborative Learning and Intelligent Data Trading
- Waves inside stars
- The Interplay between COVID-19, Sex, and Parkinson’s disease: Early Evidence
- Supply chain serviceability under climate change with application in the Arctic
- Elucidating the Role of Hydrazine Hydrochloride Derivatives in Tin-Based Perovskites for Stable and Efficient Solar Cells
- 3D bioprinted neural tissues as an effective drug screening technique for Alzheimer’s disease therapies: Designing appropriate bioinks.
- Using Passive Acoustic Monitoring to Listen in on the Conservation Challenges Faced by Bowhead Whales
- Time, place, and STEM as place

Research talks session 3

- Sedimentary DNA and Indigenous Knowledge reconstruct natural and anthropogenic disturbances to a freshwater lake in the Oil Sands Region of Alberta, Canada
- Advancing Sensing Technologies for Enhanced Detection in Environmental Applications
- How to measure a fundamental building block of the universe
- Performance Optimization of a Hybrid Offshore Wind-Wave Energy Platform
- A CARE Assembly: Co-Creating Equity-Informed Emergency Planning and Policy with Affected Communities to Address Extreme Weather Events in British Columbia
- Old Cells, New Mutations: The Aging Cell’s Struggle to Maintain Genomic Integrity
- Safe Green Alternatives for Biofouling Prevention: Optimizing Desalination Technology to Promote Water Conservation and Equitable Clean Water Access
- Incorporating conservation genomics perspectives into kelp forest restoration
- Leveraging Financial News Semantics for More Accurate Freight Rate Forecasting
- Electron microscopy: brains, microglia and smaller things

Welcome remarks

9:00 am – 9:15 am

Dr. Fraser Hof

Associate Vice-President Research, Professor in the Department of Chemistry

Fraser grew up in Medicine Hat, Alberta. He was educated at the University of Alberta, The Scripps Research Institute (California), and ETH Zurich (Switzerland). He joined UVic as a chemistry professor in 2005. He was the Director of UVic's interdisciplinary Centre for Advanced Materials and Related Technology from 2020–2022. He became Associate Vice President of Research at UVic in July 2022.

Fraser's scholarly work has explored the interface of the physical sciences, life sciences, and health research. He has collaborated extensively with academic and private sector partners from many disciplines.

Major recognitions of his research impact include a CIHR New Investigator Award, an NSERC Canada Research Chair, and the Canadian Society for Chemistry's award for excellence in medicinal chemistry.

Fraser is active in campus-wide initiatives that aim to grow UVic's success in research, partnerships, and innovation. Outside of work, Fraser takes his greatest pleasures from family, strong coffee, the great outdoors, and soccer.

Research talks session 1

9:15 am – 10:30 am

Session Moderator: Ifeoluwa Awogbindin, Division of Medical Sciences

Reaping What We Sow: Understanding Opportunities for Environmental Accountability in Canada's Food Commodity Imports

Rachel Friedman; Sophia Carodenuto; Emma Bowick

Department of Geography

When we settle in for a nice cup of coffee, or enjoy the richness of a piece of chocolate, the social and environmental impacts of producing those items may not be the first things on our minds. Yet in Canada, commodities like coffee and cocoa are imported goods, with a wide range of social and environmental standards governing production. Increasingly, governments are being called on to take responsibility for the deforestation, biodiversity loss, and social injustices that arise along the supply chains of the commodities they import. In Canada, discussions on policy instruments to improve foreign corporate accountability are now taking place, but many questions remain about what this will look like in practice. Canada has made some progress on corporate accountability for social transgressions in global supply chains, particularly in relation to forced and child labour; however, no comparable policy mechanisms exist to combat deforestation and other environmental impacts associated with Canadian consumption. This talk will cover ongoing research aiming to develop a clearer picture of what policy mix in Canada would be most feasible and effective at reducing the environmental impacts in imported food supply chains. Specifically, we ask:

What combination of domestic policy instruments could Canada implement to reduce or eliminate supply chain environmental impacts overseas?

What actors and associated interests have the most influence in the negotiation processes behind these policy instruments?

The results will help us inform on-the-ground efforts to progress the formulation of these policy instruments.

Alcohol consumption and mortality among Canadian drinkers: A national population-based survival analysis (2000–2017)

James M. Clay, Russell C. Callaghan, Adam Sherk, Timothy S. Naimi, Tim Stockwell, Mark Asbridge

Canadian Institute for Substance Use Research

Introduction

Alcohol contributes significantly to global disease burden. Over 50 countries, including Canada, have established low-risk drinking guidelines to reduce alcohol-related harm. Canada's Guidance on Alcohol and Health (CGAH) was released in 2023. This study examines the relationship between weekly alcohol consumption, CGAH risk zones and mortality patterns among Canadian drinkers aged 15 and older.

Methods

A retrospective cohort study was conducted using data from three cycles of the national, population-based Canadian Community Health Survey (2000–2006) linked to mortality data up to 2017. The sample included 145,760 respondents aged 15 and older who reported alcohol consumption in the past week. Average weekly alcohol consumption was assessed using the Timeline Followback method (i.e., 7-day recall). Outcomes included all-cause mortality, alcohol-related mortality and mortality from conditions with an alcohol-attributable fraction ≥15%.

Results

Alcohol consumption was significantly positively associated with increased risks of all-cause (hazard ratio = 1.01, $p < 0.001$), alcohol-related (hazard ratio = 1.01, $p = 0.001$) and alcohol-attributable fraction-related mortality (hazard ratio = 1.02, $p < 0.001$). Each additional standard drink per week raised mortality risk, with women experiencing a greater increase in risk compared to men.

Discussion and Conclusion

The findings support the CGAH recommendations, highlighting the importance of lower alcohol consumption limits to reduce health risks. Public health efforts should focus on increasing awareness and adherence to these guidelines, particularly among women who face greater mortality risks at higher consumption levels. Ongoing monitoring of alcohol consumption is critical for tracking and evaluating low-risk drinking guideline effectiveness in reducing alcohol-related harm.

Continuous Addition Kinetic Elucidation: a Method for Determining Catalyst Effects and Reaction Rates from a Single Experiment

Peter J. H. Williams, Charles Killeen, Ian C. Chagunda, Brett Henderson, Sofia Donnecke, Wil Munro, Jaspreet Sidhu, Denaisha Kraft, David A. Harrington*, and J. Scott McIndoe*

Department of Chemistry

Understanding how fast chemical reactions occur and what factors influence them is crucial for designing better catalysts and improving industrial and pharmaceutical processes. However, traditional methods for studying reaction speeds (kinetic analysis) often require multiple experiments and precise control over conditions, making them difficult and time-consuming. We introduce Continuous Addition Kinetic Elucidation (CAKE) — a technique that simplifies this process by continuously adding a catalyst while monitoring how the reaction progresses over time. This approach generates a unique pattern that can be analyzed using freely available software we have provided, revealing key details such as how the catalyst affects the reaction and the reaction's speed. We validated CAKE by applying it to well-understood chemical reactions and comparing our results with established data, demonstrating its accuracy and reliability. Because CAKE requires only a single experiment, it significantly reduces the effort needed for kinetic analysis, making it more accessible for researchers who might otherwise neglect performing kinetic studies.

Networked System for Accelerating Distributed AI Training

Wenjun Yang

Department of Computer Science

When confronted with increasingly complicated training tasks, e.g., ChatGPT, the framework of distributed learning is more desirable. However, distributed learning necessitates frequent communication between different computing nodes, especially the mixture-of-expert (MoE) based large AI models, where all-to-all communication can dominate the overall training time. Consequently, networked systems often emerge as critical bottlenecks that limit the scalability and efficiency of these systems. In this poster, we will introduce proper effective job scheduling mechanisms including both intra-job and inter-job scheduling, aiming at mitigating communication delays and significantly reducing overall training time.

Exchange of Water Between the Shelf and the Open Ocean in the Western South Atlantic

Giuliana Berden, Alberto Piola, Elbio Palma

School of Earth and Ocean Sciences

The continental shelf of the western South Atlantic hosts one of the most productive marine ecosystems in the Southern Hemisphere, due to the nutrient supply from continental discharge, shelf currents, and sources from the open ocean. The export of productive shelf waters modulates primary productivity on the shelf and has a significant biogeochemical impact on the open ocean. The Brazil and Malvinas Currents flow in opposite directions along the shelf break and meet near 37.5°S, forming the Brazil/Malvinas Confluence (BMC). These strong currents act as barriers to exchanges between the adjacent shelf and the open ocean. However, in situ and satellite data, as well as numerical models, suggest the existence of intense water outflows from the continental shelf to the open ocean near the BMC. In this study, a high-resolution global ocean reanalysis is used to investigate the export of shelf waters to the open ocean between 30–40°S during the period 1993–2018. The model indicates two favorable export pathways, with a time-averaged net offshore transport of 2.09 Sv (1 Sv = 1×10^6 $m^3 \cdot s^{-1}$). The export exhibits weak seasonal variations, with a maximum during austral summer, and high variability at subannual and weekly time scales, primarily associated with local winds. Positive extreme export events are more frequent in autumn and spring, reaching a maximum transport of 9.45 Sv and typically lasting less than two days. Negative events are more common in June–July, with a minimum transport of -5.56 Sv, and usually last less than four days.

Searching for neutrinos in the oceans depths

Caleb Miller

Department of Physics and Astronomy

The P-ONE experiment is a planned neutrino observatory which will instrument a cubic kilometre of ocean water with photosensitive detectors. Placing highly sensitive equipment in the depths of the ocean comes with a lot of of surprising and unsurprising challenges. Join my talk for a lightening overview of how we're tackling some of these problems.

Secreted protein acidic and rich in cysteine (SPARC): From Exercise-Induced to Potential Exercise Substitute with Therapeutic Possibilities

Abdelaziz Ghanemi, Mayumi Yoshioka, Jonny St-Amand

Department of Mechanical Engineering at UVic and Laval

Background

We have previously shown that secreted protein acidic and rich in cysteine (SPARC) is an exercise-induced gene/protein both in mice and humans.

As those studies were performed over months, they reflect chronic effects of SPARC. In this study we investigated the acute effect of SPARC injection in mice.

Hypothesis:

SPARC is the mediator/inducer – at least in part – of the exercise benefits.

SPARC would improve the metabolic profile as well as the muscle performance as well as impact ageing.

Methods

We did three independent experiments using C57BL/6J mice.

First, SPARC KO C57BL/6J mice (both old and young) were trained (12 weeks) and comparer to trained wild-type mice.

Second, SPARC overexpression by genetic modification (gene insertion) in C57BL/6J mice without any exercise and the phenotype was explored compared to wild-type mice.

Third, SPARC was injected to mice and muscle metabolic patterns were explore 4 hours post-injection (acute effects) compared to mice injected with saline.

Results

Compiling the results shows that SPARC increase (by injection or overexpression) lead to a phenotype similar to exercise whereas SPARC KO both limits exercise benefits and accelerate ageing as well as reducing the metabolic and muscular performance.

Conclusions and perspective

Our results point direct and indirect benefits SPARC could have at the metabolic and functional levels that can help identify new pathways, therapies and therapeutic targets for various disease and health problems in which exercise can be beneficial such as obesity, diabetes, ageing, physical disability, etc.

The effects of noise on the quality and availability of a common forage fish

Nora V Carlson, Meredith AV White, Patrick D O'Hara, Jose Tavera, Matthew R Baker, Douglas F Bertram, Adam Summers, David A Fifield, Francis Juanes

Department of Biology

Anthropogenic noise is garnering more and more attention as our oceans and waterways continue to increase in volume every year. While we know that this noise negatively affects many species in a variety of ways from altering anti-predator response, schooling behavior, movement patterns, and overall stress and condition, the potential consequences of these effects on interspecific interactions often remain of secondary importance. In our experiments, we asked how effects of noise on a common forage fish, Pacific sand lance (Ammodytes personatus) would affect their quality and availability to their predators, centering these interspecific relationships in our approach. Our findings suggest that noise may reduce availability and quality as fish in noisy conditions spend more time in the sand and are less energy dense. This highlights that noise may be impacting important prey species in a variety of different ways that may impact their relationships with the predators that rely on them.

Decarbonization through District Energy Development: The Climate Housing Nexus

Zachary Gould

Accelerating Community Energy Transformation (ACET) and Institute for Integrated Energy Systems (IESVic)

Shifting political climates have recently shifted institutional focus from decarbonization toward affordability and abundance. In order to tackle climate goals in the coming years it may be essential to couple emissions reductions initiatives with other politically palatable development strategies. In the current work, a conceptual district energy network in Cumberland BC is used as a case study to explore the demand side dynamics of hyper efficient buildings acting as net carbon-negative sinks. The proposed system will use warm water from abandoned mines beneath the Village to run ground source heat pumps and will optimize heating efficiencies through mixed-use load diversification. The buildings themselves are explored from hardware (construction materials and components) and software (distributed energy resource management) perspectives and several pathways toward possible project development are proposed.

Diazirines in a New Light: Visible and Near-IR Activation for Extended π-System Diazirines

Seerat Virk, Jeremy Wulff

Department of Chemistry

Diazirines are vital carbene precursors widely used in chemical biology for biological target identification, yet their activation by UV light (ca. 365 nm) limits their applications in living organisms due to cellular damage and limited tissue penetration. Here, we redefine the electronic structure of diazirines, demonstrating that their central carbon is sp^2-hybridized, enabling effective conjugation to extended π-systems.

We synthesized a trifluoromethyl diazirine-fluorene conjugate capable of photoactivation with visible light (>450 nm) and even two-photon activation using near-IR light. Spectroscopic and computational data confirmed electronic communication across the chromophore, supported by X-ray crystallography and UV/Vis absorption studies. Remarkably, we achieved efficient carbene-mediated C–H insertion in cyclohexane, providing the first example of a trifluoromethyl aryl diazirine activated beyond the UV range without additional sensitizers.

This work paves the way for diazirine-based tools optimized for deep tissue biological applications, expanding their use in live-cell studies and beyond.

Sex Differences in the Response of Microglia to Cannabis Exposure

Haley Vecchiarelli*, Hayley Thorpe, Sophia Loewen, Colin Murray, Colby Sandberg, Hayan Kayir, Jibran Khokhar, Marie-Ève Tremblay

Division of Medical Sciences

Background: Microglia are the brain's resident immune cells—they actively maintain brain health via their many physiological roles across the lifespan. They possess cannabinoid receptors and respond to cannabinoids, such as the major phytocannabinoids in cannabis plants, including delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). Many studies have shown that THC and CBD modulate inflammation mediated by microglia but this is highly dependent on the duration and route of administration (e.g., injection or in vitro) as well as the compounds administered (i.e., isolated THC and/or CBD). However, the effects of a highly translationally relevant type of exposure, inhalation, on the physiological functions of microglia that could modulate the brain inflammatory balance, but also promote neuroprotection and neural circuit integrity, remain unexplored, particularly across sexes.

Methods: Whole cannabis plant was administered to young adult, male and female, C57BL/6J mice for 15 min (one 15 second puff every 5 min; 3 puffs total; 0.15 g flower/puff). Four groups were utilized, mice that received control air vapor, and mice that were exposed to either: high CBD/low THC [CBD], high THC/low CBD [THC], or balanced THC/CBD [Balanced] cannabis chemovars. Brains were isolated 30 min post-cannabis administration onset, when THC levels peak in the brain. IBA1+ microglia were assessed in the prefrontal cortex. Results: We find an effect of brain region and sex

on microglial cell density and distribution. Within the prefrontal cortex, in males, but not females, there was a reduction in the nearest neighbour distance of IBA1+ cells in the prelimbic region with exposure to all cannabis chemovars—indicating a difference in microglial distribution in this brain region. Additionally, we have found that in the prelimbic area, there was a change in microglial morphology in males but not females.

Conclusions: Our preliminary data indicates that acute cannabis exposure modifies microglial distribution and morphology in the prelimbic cortex, particularly in males. Ongoing work is using cutting edge scanning electron microscopy to investigate potential changes in microglial organelles and interactions with other cells in the brain (e.g., neurons). This work will lay the foundation for understanding how vaporized cannabis exposure alters microglial form and function and how this impacts behaviour. Future work will focus on the duration of these changes as well as the outcomes following chronic exposure.

Research talks session 2

11:00 am – 12:15 pm

Session moderator: Rachel Friedman, Department of Geography

A comparison of neural and mesenchymal stem cell-derived extracellular vesicles as modulators of blood brain barrier function in Alzheimer's disease

Jolene Phelps, Katherine Elvira, Stephanie Willerth

Department of Mechanical Engineering and Division of Medical Sciences

Stem cell-derived extracellular vesicles (EVs) reduce neurodegeneration and cognitive deficits in Alzheimer's disease (AD). In AD, cells of the blood-brain-barrier (BBB), brain microvascular endothelial cells (BMECs), exhibit impaired barrier properties. EV therapeutic benefits may in part be due to their ability to restore BMEC function. The aims of this study are to determine if EVs can improve BBB function in AD, and to compare neural stem cells (NSCs) and mesenchymal stem cells (MSCs) for EV production.

AD and control BMECs will be generated by differentiating induced pluripotent stem cells (iPSCs) expressing the PSEN2 mutation (familial AD variant) and isogenic controls. Permeability will be assessed using a transwell assay. BMECs will be inoculated onto transwell inserts, and once a monolayer is established, permeability will be measured for different cases (control, AD, AD+EVs) by adding fluorescein to the apical chamber and sampling the basolateral chamber. To produce EVs, control iPSCs will be differentiated to NSCs and MSCs and EVs will be isolated from culture media. EVs will be added to BMECs during monolayer formation. BMEC function will be characterized by permeability, expression of tight junction proteins, and secretion of Aβ42/40.

It is hypothesized that 1) AD BMECs will exhibit higher permeability, reduced expression of tight junctions, and increased Aβ42/40, 2) EVs will restore AD BMEC function, and 3) NSC-EVs will perform better than MSC-EVs. Reduced BMEC function could play a role in AD pathogenesis. Stem cell-derived EVs represent a promising approach as a cell-free therapy for AD and other neurodegenerative conditions.

Decoding tidal wetland change and resilience for the sustainable coastal environment

Xiucheng Yang

Department of Biology

Tidal wetlands are vital ecosystems facing increasing threats from climate change. Here, we employed a novel remote sensing approach to characterize tidal wetland changes and their associated drivers across the conterminous United States from 1985 to 2023. Despite extensive protection policies in the US, we found the acceleration of tidal wetland loss, with migration and restoration failing to offset declines. The primary drivers of this loss were press disturbances and extreme weather events. Our analysis reveals while sea level rise accounts for most total losses, extreme weather events are driving the acceleration of this loss, exceeding the impact of press disturbances by 1.4 times. This highlights the urgent need to incorporate extreme weather events into wetland conservation strategies to mitigate the escalating risks to these critical ecosystems.

Solidarity Education: Starting an Organizing Language School in Vancouver's Chinatown

Yi Chien Jade Ho

School of Public Health and Social Policy

This talk will report and reflect on the collective effort of starting a language school that focuses on cultivating capacity and skills to organize for housing justice and building solidarity between precariously housed Chinese tenants and Indigenous residents in Vancouver's Chinatown and Downtown Eastside. Recognizing that language is a key site of colonial domination, the school gives community members and youth organizers the opportunity to reconnect with their own cultures while building capacity for cross-cultural coalitions to facilitate further organizing in the neighborhood. This project shows the radical potential to cultivate collective power through approaching organizing as resistance and solidarity education.

Advancing Ubiquitous Intelligence Through Collaborative Learning and Intelligent Data Trading

Lei Zhao, Lin Cai, Wu-Sheng Lu

Department of Electrical and Computer Engineering

The emergence of ubiquitous intelligence, where smart devices collaborate seamlessly to make adaptive, context-aware decisions, relies on leveraging vast, distributed data generated across diverse environments. However, privacy concerns, ownership rights, and communication

constraints pose fundamental barriers to harnessing this data effectively. We introduce a dual-framework solution that integrates Federated Learning (FL) with a structured data trading market. FL enables collaborative learning across decentralized devices while preserving data privacy, and the data market facilitates secure and efficient exchange of both direct data products and innovative data derivatives, e.g., data options. These derivative contracts allow AI agents to secure timely access to valuable data resources with guaranteed delivery at fixed costs, supporting real-time decision-making in dynamic environments. Together, this approach addresses the foundational challenges of scalable learning, data liquidity, and privacy-aware collaboration in the AI-driven era.

Waves inside stars

Simon Blouin

Department of Physics and Astronomy

Just as ocean waves mix materials, hidden internal waves stir elements deep within stars. Understanding this stellar mixing is crucial—it governs how stars evolve and forge the elements needed for planets and life. Cracking this puzzle demands immense computing power; our research harnesses hundreds of thousands of CPU cores for cutting-edge 3D stellar simulations. We've recently discovered how a star's spin dramatically boosts this wave mixing in red giants, solving a decades-old mystery about their surface chemistry.

The Interplay between COVID-19, Sex, and Parkinson’s disease: Early Evidence

Ifeoluwa Awogbindin, Bourque M., Morissette M., Hamelin M., Rhéaume C., VanderZwaag J., Patel D., Boivin G., Di Paolo T. and Tremblay M.

Division of Medical Sciences

Infections are now considered a principal environmental gateway to neurodegenerative disorders, including Parkinson’s disease (PD). SARS-CoV-2 infection and associated COVID-19 resulted in myriads of neurological symptoms, but the extent of its neurodegenerative risk is yet unknown. Using a double-hit model with a moderate dose of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) dose, recapitulating early PD, and subsequent mild COVID-19, we show a plausible link between SARS-CoV-2 and susceptibility to PD in transgenic mice expressing the human receptor angiotensin-converting enzyme 2 (K18-hACE2), discovering sex-related patterns. The preliminary data shows in MPTP mice that COVID-19 aggravates dopaminergic (DA) metabolic dysregulation and loss/impairment of brain DA neurons with more inflammation than either MPTP or COVID-19 single exposure, which was more pronounced in male mice. Our study provides insight into the prognosis of early PD after surviving a mild secondary COVID-19. The ongoing project is supported by Parkinson Canada, Health Research BC, and Parkinson Society BC with the invaluable

contribution of Prof. Guy Boivin and the mentorship of Prof. Marie-Eve Tremblay and Prof. Therese Di Paolo.

Supply chain serviceability under climate change with application in the Arctic

Behrooz Khorshidvand

School of Business

This study evaluates the resilience of Arctic supply chains to climate change by introducing the concept of supply chain serviceability. We define serviceability as a function of vulnerabilities in transportation nodes and modes under disruption threats, focusing on climate change impacts. Using climate data from Northern Canada, we assess serviceability under three Shared Socioeconomic Pathways (SSPs): SSP1-2.6 (low emissions), SSP2-4.5 (moderate emissions), and SSP5-8.5 (high emissions). We use Monte Carlo simulations to predict climate-induced impacts on six airports and three aircraft types. The detailed analysis of Yellowknife and Iqaluit airports and military aircraft validates our methodology. Our findings indicate average serviceability index declines of up to 51 permafrost degradation, extreme weather events, and infrastructure vulnerabilities. Our study provides actionable managerial insights and theoretical contributions to support supply chain resilience initiatives.

Elucidating the Role of Hydrazine Hydrochloride Derivatives in Tin-Based Perovskites for Stable and Efficient Solar Cells

I Teng Cheong, Yafeng Xu, Lijie Wang, Lisheng Zhang, Dongyang Zhang, Huifang Li, Hong Li, Makhsud Saidaminov, Jean-Luc Bredas, Omar F. Mohammed

Department of Chemistry

Perovskite solar cells are a promising alternative to traditional silicon ones because they are cheaper to make and easier to process. Tin-based perovskites, in particular, are attractive due to their lower toxicity and broad solar absorption. However, they often suffer from degradation and uncontrolled crystallization, leading to defects and reduced performance. While solvent and additive engineering of precursor solutions have been largely exploited to improve the Sn and Sn-Pb perovskite solar-cell performance, the exact working mechanisms at the molecular level remain ambiguous. In this study, we combined computer modeling and experiments to show how an additive called benzylhydrazine hydrochloride (BHC) helps stabilize the material and guide better crystal formation for more efficient and stable solar cells. Our findings contribute critical insights into the design of perovskite additives for high-performance photovoltaic applications.

3D bioprinted neural tissues as an effective drug screening technique for Alzheimer’s disease therapies: Designing appropriate bioinks.

Amanda Orr*, Stephanie Willerth

Department of Mechanical Engineering

Alzheimer's disease (AD) is the most common form of dementia and continues to affect more people globally due to the aging population. Treatment options for AD have limited improvement in cognitive decline or memory loss, rendering the discovery of new therapies of high importance. 3D bioprinting can be used to produce functional neural tissue models that can mimic the disease pathology of the AD brain and be used to screen drug therapies for this devasting disease. Achieving effective 3D bioprinted models relies on carefully evaluating bioink performance at various stages of the bioprinting process to ensure mechanical relevance. This presentation will discuss the design of hydrogel-based bioinks composed of fibrin, alginate, and transglutaminase (TG) that was characterized to understand the performance at different stages of bioprinting. The reaction conditions varied based on the type of TG, concentration, buffers, and pH level. To assess the mechanical relevance of our bioink, rheology, scanning electron microscopy (SEM), and Fourier transform infrared spectroscopy (FT-IR) analyses were performed. In addition, printability, swelling tests and degradation tests were conducted to evaluate the select bioink compositions with an extrusion-based bioprinter. The presented research provides fundamental information on the performance of the bioink for 3D bioprinting and informs polymer selection for further investigation of cell viability and function. This examination is crucial for designing bioinks that facilitate neural tissue engineering capable of supporting multi-cell survival, growth, and differentiation to model AD effectively.

Using Passive Acoustic Monitoring to Listen in on the Conservation Challenges Faced by Bowhead Whales

Alexander J. Hare, William D. Halliday, Stan E. Dosso, and Stephen J. Insley

School of Earth and Ocean Sciences

Climate change is driving shifts in the Arctic marine environment towards being completely ice-free during the summer, facilitating increased vessel traffic. Underwater noise produced by vessels has the potential to significantly disrupt acoustic communication between marine mammals such as Bowhead Whales (Balaena mysticetus) through a process called acoustic masking. Despite the negative impact that increased vessel noise will likely have on this listed species, we still have a poor understanding of how bowheads will respond. In order to address this gap, we have deployed 13 year-round passive acoustic monitoring (PAM) hydrophones throughout the Beaufort Sea, producing multi-year longitudinal data on the Arctic marine acoustic environment. The data collected through these PAM stations allow us to quantify how the marine soundscape of the Arctic is changing and explore how Bowhead Whale acoustic behaviour is impacted by anthropogenic acoustic masking. I will present preliminary results on seasonal, and multi-year trends in ambient

underwater sound, highlighting significant changes within the frequency bandwidths most commonly used by bowheads for communication. In addition, I will present our current progress at developing a statistical classification model for bowhead social calls. The classification of these calls lays important groundwork for examining how bowhead vocal behaviour changes in response to vessel traffic, furthering our understanding of social communication and assessing the impacts of acoustic masking on this species.

Time, place, and STEM as place

Meredith Lemon along with research team Dr. Jennifer Thom, Dr. Cynthia Nicol, Dr. Florence Glanfield, and Dr. Ed Doolittle

Curriculum and Instruction

Recently, as the underlying purposes of STEM are being questioned, new conceptions of STEM emerge. This talk features authors' conceptualization of STEM as place and further considers humans learning to live here for the long haul with Earth as first teacher. In doing so, we take up curriculum scholars' calls to "reorient education in ways that align learning with today's environmental challenges" (Flinders, 2022, p. 12) by considering conceptions of time vital to answering this call. To the eternal curriculum studies question "What should we teach?", this curricular inquiry adds 'at this time and in this place'. At this time, when considering the well-being of students (today and those not yet born), how are educators to understand STEM vis-a-vis the ecological crisis? In this talk, the authors flip these questions and ask "What might we learn, in this place, and at this time, for generations of all beings to flourish?" How cultures conceive of and enact time proves central to the kind of place and the types of STEM that occur in and as that place. Four kinds of time are explored to show how re-cognizing time is necessary for revitalizing our culture-language-thought patterns and renewing relationships with Earth, our first teacher.

Research talks session 3

1:15 pm – 2:30 pm

Session moderator: Peter Williams, Department of Chemistry

Sedimentary DNA and Indigenous Knowledge reconstruct natural and anthropogenic disturbances to a freshwater lake in the Oil Sands Region of Alberta, Canada

Mark Louie D. Lopez, Ave Dersch, Paul Drevnick, Erin Ussery, Mark E. McMaster, Matthew A. Lemay, and Caren C. Helbing

Department of Biochemistry and Microbiology

Sedimentary DNA (sedDNA), a form of environmental DNA (eDNA) shed by aquatic organisms and preserved in sediment, is crucial for reconstructing historical community compositions in aquatic ecosystems. In Cowpar Lake (Dene name: Doghostú), Alberta, a significant landslide event in the early 1940s CE impacted the lake's geochemistry and fish populations, as documented by Indigenous Knowledge from the Chipewyan Prairie First Nation and corroborated by targeted fish sedDNA analyses. The present study used 18S rRNA and cytochrome oxidase I (COI) genes for DNA metabarcoding of the sediment core from Cowpar Lake to assess the effect of the documented landslide and reconstruct the historical community composition of eukaryotic functional trophic groups, including photoautotrophs, mixotrophs, parasites, and consumers. Between 1948 and 1956 CE, a notable shift in community composition occurred, with a decline in the alpha diversity of eukaryotic amplicon sequence variants. The increased primary productivity and terrestrial organic input post-1950 caused an increased diversity of phototrophs and mixotrophs, suggesting potential algal blooms. While parasite diversity remained stable, consumer diversity declined, likely due to increased microbial respiration of organic matter, reducing oxygen levels and making the lake less hospitable for consumers like whitefish, which eventually disappeared in the lake. The reconstructed eukaryotic community profiles from sedDNA were consistent with Indigenous Knowledge of natural changes around the lake. The present study highlights the potential of braiding sedDNA data with Indigenous Knowledge to reconstruct long-term changes in aquatic communities, offering high-resolution baseline data for environmental monitoring and a deeper understanding of how freshwater systems respond to natural and human-induced impacts.

Advancing Sensing Technologies for Enhanced Detection in Environmental Applications

Somayeh Fardindoost, Abbas Motalebizadeh, Mina Hoorfar

Department of Mechanical Engineering

Microplastics, defined as plastic particles less than 5 mm in diameter, have become pervasive pollutants in marine and terrestrial environments and pose significant environmental and health risks, necessitating effective detection methods. The selective detection of these tiny particles is challenging due to the complexity of the matrices of marine water. This presentation explores the significant advancements and applications of microplastic-binding peptides, underlining their potential as a novel approach for microplastic detection and highlighting their specificity, sensitivity, and potential applications. The progress in microplastics-binding peptide research has been driven by advances in protein engineering, computational techniques, and analytical methodologies, enabling the design of plastic-specific peptides with fine-tuned binding properties. We discuss the current state of research, challenges, and future directions in this emerging field.

How to measure a fundamental building block of the universe

Philipp Horak

Department of Physics and Astronomy

The standard model is the most fundamental description of our universe, but it fails to describe crucial observations such as the abundance of matter over antimatter. To find problematic areas of the standard model we have to measure its properties at unprecedented precision. At Belle II, a particle collider facility in Japan, we aim to improve upon the worlds most precise measurements

Performance Optimization of a Hybrid Offshore Wind-Wave Energy Platform

Fares Mzoughi, Curran Crawford, Aitor J. Garrido, Izaskun Garrido

Department of Mechanical Engineering

Floating Offshore Wind Turbines (FOWTs) have gained significant attention in recent years as a viable solution for harnessing wind energy in deep waters. They offer a sustainable power source for densely populated coastal nations with access to deeper offshore areas. However, the primary challenge with FOWTs lies in their stability, as excessive platform motion negatively impacts aerodynamic efficiency, complicates rotor aerodynamics and control, and increases structural loads. Such motions induce additional stress on key components, including the rotor blades, shaft, yaw bearing, and tower base, potentially reducing their operational lifespan. To ensure optimal performance, platform movements in pitch, roll, and heave must be kept within acceptable limits.

Some studies suggest that improving platform stabilization could minimize the need for additional structural reinforcements such as increased steel mass, active ballast systems, or taut mooring lines.

Our research project seeks to address these challenges by integrating Oscillating Water Columns (OWCs) into a barge-based FOWT. This innovative concept enables both wind and wave energy harvesting while simultaneously enhancing platform stability through active structural control. A Machine Learning (ML)-based control strategy will be implemented to regulate the Power Take-Off (PTO) systems of multiple OWCs simultaneously. Given the complexity of controlling multiple OWCs under varying environmental conditions (wind speed, wave speed, wave height, etc.), ML techniques will be utilized for predictive modeling and real-time adjustments. Previous research has demonstrated the effectiveness of ML in FOWT applications, making it a promising approach for enhancing stability and efficiency in hybrid offshore wind-wave platforms.

A CARE Assembly: Co-Creating Equity-Informed Emergency Planning and Policy with Affected Communities to Address Extreme Weather Events in British Columbia

E. Lorann Nuckols

School of Public Administration

Floods, droughts, storms, and heat waves are all on the rise as extreme weather events due to climate change are becoming commonplace. Such crises have caught many governments off-guard, resulting in significant negative policy outcomes. Through a mixed methods study this study asks: what barriers prevent access to public space for vulnerable communities during extreme weather events and how can they be addressed? This study connects the stories and lived-experiences of B.C. community leaders (i.e. Emergency Coordinators) to policy-makers and policy-making processes through an intersectional policy lens and engagement with scholarship on the politics of care and design justice (Costanza-Chock 2020; Hankivsky & Jordan-Zachery, 2019; Hoogeveen et al., 2021; Tronto, 2013). The results of this research were gathered through a collaborative design and policy implementation process (Costanza-Chock 2020; Hadorn 2024). We suggest that the connection between those with relevant lived-experiences and policy-makers can advance the scholarship and practice of "radical policy futures" (Cattapan, 2020). Specifically, the co-authors explain how CARE Assemblies (Community Actions and Responses to Extreme weather events) can hold space for the co-creation of policy-oriented outputs for decision-making, positioning the policy-makers as 'policy listeners.' A CARE Assembly can be understood as a "mini-public," a space for democratic deliberation that directly engages the voices, perspectives, and knowledges of those most directly affected by a particular policy problem (Fung, 2007). This design justice-informed research aims to support governing bodies and service providers to better understand the lived-experiences of extreme weather events and design better policies and programs to help vulnerable residents prepare for, respond to and recover from these events.

Old Cells, New Mutations: The Aging Cell's Struggle to Maintain Genomic Integrity

Maria Laura Sosa Ponce, Disha Patel, Jennifer Cobb

Department of Biochemistry and Molecular Biology

Aging is the single greatest risk factor for cancer, and a major contributor to this risk is the gradual buildup of mutations in our DNA over time. The cellular response to double-stranded breaks (DSBs), a particularly deleterious form of DNA damage, has been extensively studied in healthy, young cells. Exposed DNA ends are bound quickly by repair factors, recruiting protein kinases which in turn activate the cell cycle checkpoint until the damage can be repaired. How these repair pathways change with age and lead to genomic instability in old cells has not been deeply studied, mostly due to experimental limitations in obtaining aged cells. Using a recently published method for old cell enrichment from our lab, we looked at the recruitment of the master DNA damage response (DDR) regulators in yeast, Tel1 and Mec1, to induced DSBs. We find that recruitment of these factors and phosphorylation of their targets changes with age, impacting cell cycle progression and DSB repair. These findings contribute to our understanding of DSB repair in aged cells, and may shed light on the increased risk of mutation and malignancy in older cells.

Safe Green Alternatives for Biofouling Prevention: Optimizing Desalination Technology to Promote Water Conservation and Equitable Clean Water Access

Luiz Henrique Da Silva Correa

Department of Civil Engineering

Biofouling is a significant technical barrier to the widespread application of reverse osmosis (RO) technology in addressing global water scarcity. This challenge leads to reduced permeate production, increased energy demands, and heightened environmental impacts. To mitigate these issues, a platform was developed to select and evaluate safe, green anti-biofouling agents for use in drinking water RO system applications.

The platform assessed nine candidate chemicals (MIT: 2-methyl-4-isothiazolin-3-one; DBNPA: 2,2-dibromo-3-nitrilopropionamide; SBS: sodium bisulfite; SB: sodium benzoate; PE: phenoxyethanol; LAE: ethyl lauroyl arginate; PHMGH: polyhexamethylene guanidine hydrochloride; BDMDAC: benzyldimethyldodecyl ammonium chloride; SNP: sodium nitroprusside) for their potential to prevent biofouling in potable water RO applications. This process involved three phases: a comprehensive review, antibiofouling testing, and polyamide membrane compatibility testing.

Among the tested chemicals, LAE emerged as the only biocide that successfully passed all phases of the protocol. LAE demonstrated excellent antibiofilm performance, achieving over 98% prevention of biofilm formation and removing more than 99% of existing biofilms from RO membranes.

Importantly, rapid membrane degradation tests confirmed that LAE did not cause morphological or chemical damage to polyamide membranes.

This platform for assessing anti-biofouling agents highlights the potential for greener, more effective alternatives to address membrane biofouling in RO systems used for potable water treatment. By identifying LAE as a promising candidate, this work contributes to enhancing the sustainability and efficiency of RO technology for providing reliable, safe, and secure water supplies to municipalities, industries, marginalized communities, remote work sites, and Indigenous populations.

Incorporating conservation genomics perspectives into kelp forest restoration

Jordan Bemmels, Greg Owens

Department of Biology

Kelp forests are declining in many regions of the world, fuelling rapidly growing interest in kelp forest restoration. Conservation practitioners wish to ensure that restored populations will be a good genetic match to their environments, will not place remnant local populations at risk, and will be able to adapt to future challenges. To help inform restoration strategies, we sequenced the genomes of several hundred bull kelp and giant kelp from across BC and Washington. We identified six to seven genetically distinct groups in each species, which could help guide decisions about geographic transfer of genetic material. We then assessed genetic health of individual populations, and found that some populations face multiple risks including small effective population size, low genetic diversity, and high rates of inbreeding, including self-fertilization. Evolutionary theory suggests that increased inbreeding may cause natural selection to remove harmful genetic variants that contribute to inbreeding depression, but we found no evidence that this is happening in kelp. Instead, small inbreeding populations are experiencing strong genetic drift, i.e., pronounced random fluctuations in the frequencies of genetic variants, including potentially harmful variants. Understanding how genetic drift is affecting kelp implies several strategies for optimal population sourcing and highlights how crossing populations could be a potential restoration tool. Overall, by considering the genetic distinctiveness of different geographic regions and the multiple health risks associated with genetic drift in small populations, conservation practitioners can increase the chances that restored populations will be able to thrive now and into a changing future.

Leveraging Financial News Semantics for More Accurate Freight Rate Forecasting

Shima Kamyab, Prof. Fayez Gebali

Department of Electrical and Computer Engineering

Freight rate forecasting is a critical component of global supply chain management, enabling stakeholders to make informed decisions regarding pricing, budgeting, and risk management. Given the volatility of shipping costs, an accurate predictive model can provide a significant competitive advantage to businesses operating in this space.

Incorporating the semantics of financial news into shipping freight rate forecasting offers a powerful means of capturing market signals that traditional numerical models may overlook. Financial news often contains early indicators of global economic shifts, geopolitical events, trade policy changes, or disruptions in supply chains that can significantly influence freight rates. By leveraging natural language processing techniques to extract and quantify sentiment, topic trends, and key event mentions from financial news, forecasting models can gain a deeper contextual understanding of the factors driving price movements. We are actively working on integrating this semantic information into our freight rate prediction models, aiming to enhance their responsiveness to unexpected fluctuations and improve forecasting accuracy, especially in volatile or data-limited scenarios.

Electron microscopy: brains, microglia and smaller things

Fernando González Ibáñez, Jared VanderZwaag, Lisa Julian, Marie-Ève Tremblay

Division of Medical Sciences

I am a postdoc in the Tremblay Lab. My research focuses on the study of microglia, resident immune cells of the brain. They are required for proper brain maturation and function. These cells are mainly known for their roles in clearing toxic debris, removing dysfunctional or degenerating cells, pathogens, and for mediating inflammatory responses. I use electron microscopy to study microglia in contexts of health and disease. Electron microscopy allows me to detect changes in their interactions with other brain cells and perform ultrastructural analysis with the goal to study their organelles, both their structures and alterations. Features of cellular stress in organelles hint to organellar malfunction associated with a compromised cell homeostasis. Our technique involves 2D and 3D electron microscopy which allows us to create 3D models of our cells and their organelles with nanometric resolution. My work has contributed to the study of different diseases like Alzheimer’s disease, psychological stress, spinal cord injury, multiple sclerosis to mention a few. My current project is on brain organoids, which are a group of neuronal cells that can be used to create a small version of a brain.

Academic Careers Panel

2:30 pm – 3:30 pm

Session moderator: E. Lorann Nuckols

Dr. J. Matthew Huculak

Director of the KULA Library Futures Academy

Matt Huculak is Director of the Kula Library Futures Academy at the University of Victoria Libraries. He holds a PhD in English Language & Literature and an MLIS. His research focuses on libraries, modernism, book history, and periodicals. He has served as Editorial Assistant on the James Joyce Quarterly, Designer & Managing Editor of Modernism/modernity's Print Plus platform (winner of the Association of American Publishers 2019 PROSE Awards in the "Innovation in Publishing" category), and Advisory Board Member of Project Muse. He is the former Director of the Modernist Versions Project and Co-Director of Open Modernisms.

Dr. Tamara Krawchenko

Associate Professor in the School of Public Administration and Associate Director of the Institute for Integrated Energy Systems

Dr. Tamara Krawchenko is an Associate Professor in the School of Public Administration, Associate Director of UVic's Institute for Integrated Energy Systems, a Strategic Research Area Lead for the Accelerating Community Energy Transformation Initiative, a core team member of the Coastal Climate Solutions Leaders program and Chair of the Local Governance Hub. She is an expert in comparative public policy, regional development and sustainability transitions.

Dr. Stephen Tuffs

Assistant Professor in the Department of Biochemistry and Microbiology

My work is focused on understanding how pathogens such as Staphylococcus aureus trigger and utilize inflammatory mechanisms in the host to promote its lifecycle. I am particularly interested in pro-inflammatory toxins such as the superantigens, which target T cells and can force their activation. I utilize a range of bacteriological, immunological, and biochemical techniques to assess how toxins like these can attack their targets and what the impact of the resulting downstream inflammation is for both the host and the bacteria.