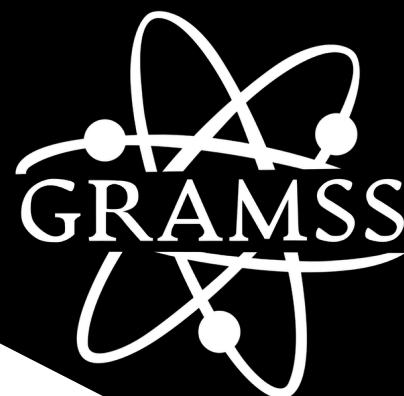
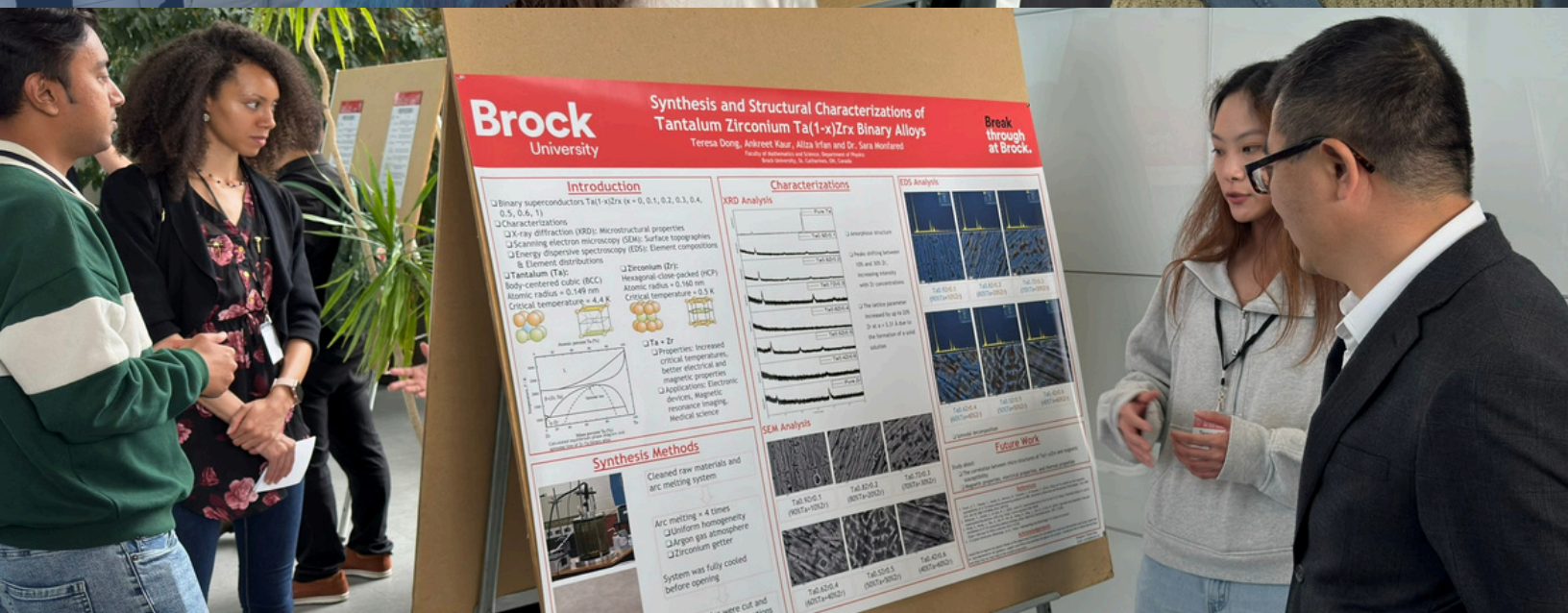


2026

FMS GRaD Conference



Presented by:

GRAMSS

**Faculty of
Mathematics & Science**

**Brock
University**



FMS GRaD Conference 2026 Program

Thursday, October 1st, 2026
Brock University

Hosted by:

The Graduate of Mathematics and Science Students (GRAMSS) Society
Faculty of Mathematics & Science

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Welcome to the FMS GRaD Conference 2026!

Welcome to the fifth annual Faculty of Mathematics and Science Graduate Research Day: FMS GRaD Conference at Brock University! This event was established in 2022 to showcase the remarkable research being conducted by graduate students in the Faculty of Mathematics and Science (FMS), and beyond, while providing opportunities for students to network with professional researchers within the Brock University community. Furthermore, we want to celebrate students' academic achievements and encourage a sense of community among the FMS graduate students.

This year, the FMS GRaD Conference takes place on Thursday, October 1st, which will consist of a day full of research talks given by inquisitive graduate students, highlighting the innovative research being conducted at Brock University. We are excited to have our keynote speaker Dr. Rahnema Islam Nishat join us this year, an Assistant Professor from the Department of Computer Science.

The Graduate of Mathematics and Science Students (GRAMSS) Society would like to thank our funders, the Faculty of Mathematics and Science and the Office of the Vice President of Research, at Brock University. Thank you to Norgen Biotek Corp for their continued sponsorship and providing the Norgen Rising Star Awards. Lastly, thank you to 8Trees for their continued support.

Follow us on social media [@GRAMSSBrockU](#) on X (Twitter), Instagram, Threads, Bluesky and Facebook! We encourage you to use [#FMSGRaD2026](#) to share comments and interesting quotes you learned with your followers!

We hope you enjoy your experience at the FMS GRaD Conference 2026!



Location Information

Main gathering: Pond Inlet, 2nd floor of J-block in the Mackenzie Chown Complex

- All participants will visit this room for registration at the start of the day
- Opening/closing remarks, Dr. Nishat's keynote talk, and social events will be held here

Oral presentations: Rankin Family Pavilion, Thistle, and Schmon Tower

- Rooms: RFP 214-215, TH 246, TH 240, ST 108
- Accessible through elevator or stairway
- Sitting area nearby
- Additional seating provided where necessary

Poster presentations: Cairns Atrium

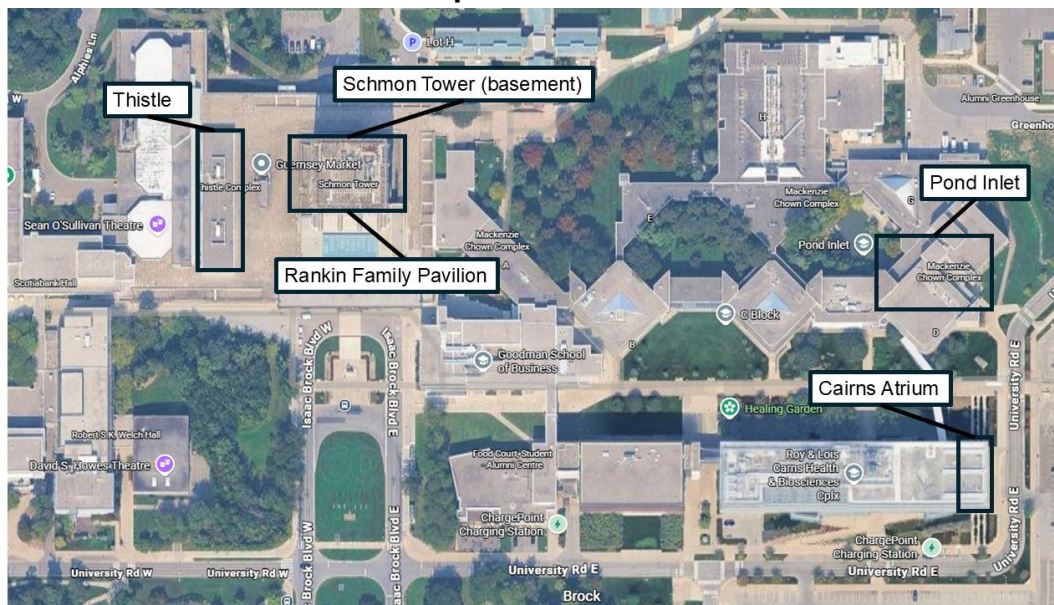
- Sitting area nearby

Lunch: Pond Inlet, 2nd floor of J-block in the Mackenzie Chown Complex

- Buffet-style lunch

Please note that seating options are also available among these locations for those with accessibility concerns. Suggested seating locations and shortest routes are identified by signage.

Map of locations



Remarks from the Faculty of Mathematics and Science Dean's Office



Dr. Peter Berg, Dean, Faculty of Mathematics and Science

On behalf of the Faculty of Mathematics and Science (FMS), it is my pleasure to welcome you to the FMS GRaD Conference on **October 1, 2026**, at **Pond Inlet**. Today we celebrate the excellence and ambition of our graduate community, whose diverse research spans multiple disciplines and advances knowledge across our Faculty and beyond.

This event was created by our colleagues in **GRAMSS** and is hosted in partnership with FMS, with generous support from **Norgen Biotek** and campus partners; we are deeply grateful to the many volunteers whose efforts make this day possible.

I encourage you to explore the full program — oral presentations and posters that reflect the **range and depth of inquiry** undertaken by our students — and to let the conversations you start here inspire your next questions. We are honoured to feature **Dr. Rahnuma Islam Nishat from the Department Computer Science** as our keynote speaker, exemplifying the calibre of scholarship that distinguishes FMS. Congratulations to all presenters and award nominees; your dedication and achievements enrich the Brock community.

Thank you to our sponsors and partners, including the **Faculty of Mathematics and Science, Office of the Vice-President, Research**, and **Norgen Biotek**, for championing graduate research and student success. I wish you an inspiring, collegial, and rewarding conference.

Warm regards,

Peter Berg

Dean, Faculty of Mathematics and Science

Conference Code of Conduct

The GRAMSS Society is committed to providing a safe and positive environment for all participants of the FMS GRaD Conference and other events. We strongly prohibit any form of harassment or discrimination. We request that all participants be respectful of the [Inclusion, Diversity, Equity, and Accessibility](#) values, and support a positive exchange of ideas during the event. Graduate and undergraduate students are also expected to abide by Brock University's [Student Code of Conduct](#) during the conference. Anyone that violates these rules will be requested to leave the event.

Expected Behaviour for All Participants

1. Treat everyone with respect, dignity, and consideration, valuing a diversity of views and opinions.
2. Be mindful of everyone's safety and considerate of others' physical space.
3. Be professional, courteous, and collaborative.
4. Refrain from using any harassing, demeaning, or discriminatory behaviour or speech.
5. Refrain from interrupting or distracting presenters and audience members during the workshop, keynote talk, and graduate student talks.
6. Respect presenters' requests to refrain from sharing contents of their talk on social media or other public platforms. Presenters that wish to opt-out of media dissemination are encouraged to indicate their wishes verbally or by including a [logo](#) on their presentation or poster.
7. Respect and follow any instructions given by volunteers, GRAMSS executives, and Brock University staff to ensure everyone's safety.
8. Inform the volunteers, GRAMSS executives, and Brock University staff of any suspected inappropriate behaviours, dangerous situations, or persons in distress immediately.

Unacceptable Behaviour

1. Harassment involving any unwelcome or offensive comments, gestures, physical displays, or physical contact with any participant that would reasonably be considered offensive, humiliating, or intimidating to the other person.
2. Discriminatory conduct or comments based on race, gender identity or expression, sex, sexual orientation, disability, ethnicity, political affiliation, marital status, etc.
3. Behaving in a disruptive or unprofessional manner that puts the health, mental well-being, or safety of yourself or others at risk. This also includes making loud noises, talking over others, talking on your phone, etc., during presentation sessions, group activities, social events, and important announcements.

4. Failing to comply with the instructions of conference volunteers, GRAMSS executives, or Brock University staff.
5. Retaliation or threats directed against participants reporting any activity or situations reasonably considered to be in violation of this Code of Conduct.
6. Falsely reporting violations of this Code of Conduct in bad faith.

Rules for Presenters

To ensure a positive and cohesive experience, presenters of the FMS GRaD Conference are expected to:

1. Arrive prepared for your assigned presentation session at least 10 minutes in advance.
2. Refrain from exceeding your presentation time limit.
3. Refrain from switching between presentation rooms (or posters) during your assigned session.
4. Be respectful towards other presenters and audience members.
5. Respond to audience members' and judges' questions in a professional and courteous manner.

Reporting Unacceptable Behaviour

If you suspect someone is violating this Code of Conduct, please promptly report your concerns to the nearest conference volunteer or GRAMSS executive. If you are not comfortable reporting a complaint/concern to a volunteer or executive onsite, please reach out to us at gramss@brocku.ca or Alex Wilder at aw21sm@brocku.ca for an immediate response or immediate assistance onsite.

If you or someone else is in immediate danger, or if you would like to report an emergency, please contact Brock's Campus Security at 905-688-5550 x3200.

Land Acknowledgement

Brock University acknowledges the land on which we gather is the traditional territory of the Haudenosaunee and Anishinaabe peoples, many of whom continue to live and work here today. This territory is covered by the Upper Canada Treaties and is within the land protected by the Dish with One Spoon Wampum Agreement.

Today this gathering place is home to many First Nations, Métis and Inuit peoples and acknowledging reminds us that our great standard of living is directly related to the resources and friendship of Indigenous people.



Peer Judging

This year, the FMS GRaD Conference will involve Peer Judging! This means that any registrant of the conference can participate in peer judging the oral presentations, poster presentations, and proposal presentations! ALL registrants can judge, and this includes all graduate students!!!

The website for judging is: <https://www.gramssjudging.com/>



For oral presentations, poster presentations, and proposal presentations, you will see a code in the schedule and program. Enter the appropriate code and judge the presentation! A rubric is also included in the website. Your participation is essential to this process, and you are warmly invited to judge everything you see!

Login: Your login name is the first and last name you registered at the conference with, all lower case, and no space in between the names.

Password: Your password is gramssjudge.

If you have problems logging in, please come to registration or if you are in a presentation, please speak to the moderator who can contact registration to confirm your login and password.

Conference Schedule

Thursday, October 1st, 2026

Locations: Pond Inlet, Cairns Atrium, Rankin Family Pavilion, Thistle, Schmon Tower

Time	Pond Inlet	Cairns Atrium	RFP214-215	Th 246	Th240	Schmon Tower 108
8am-9am	Registration					
9am-9:30am	Opening remarks					
9:30am-9:40am	Break to go to sessions					
9:40am-10am			T1 Presentation	T3 Presentation	T6 Presentation	T8 Presentation
10am-10:20am			T2 Presentation	T4Presentation	T7 Presentation	T9 Presentation
10:20am-10:40am			PR1 Presentation	T5 Presentation	PR2 Presentation	T10 Presentation
10:40am-11:20am	Coffee Break					
11:20am-11:40am			T11 Presentation		T13 Presentation	T16 Presentation
11:40am-12pm			T12 Presentation		T14 Presentation	T17 Presentation
12pm-12:20pm			PR3 Presentation		T15 Presentation	T18 Presentation
12:20pm-2pm	Lunch					
2pm-3pm	Plenary					
3pm-3:45pm		Poster Session PR4, P2, P4, P6, P7, P9, P11, P13, P15				
3:45pm-4:30pm		Poster Session P1, P3, P5, PR 5, P8, P10, P12, P14				
4:30pm-5pm	Coffee Break					
5pm-6pm	Awards and Closing Ceremony					

Keynote Speaker: Dr. Rahnuma Islam Nishat, Brock University

Friday, October 1st, 2:00 PM–3:00 PM, Pond Inlet



Dr. Rahnuma Islam Nishat is an Assistant Professor in Brock University's Department of Computer Science. Her research lies at the intersection of mathematics and computer science, exploring algorithmic and geometric problems with real-world applications. Her work spans graph drawing and visualization, computational geometry, graph theory and combinatorics, path and cycle reconfiguration, additive manufacturing, and data mining. Her research program is supported by an NSERC Discovery Grant.

Dr. Nishat earned her PhD and MSc in Computer Science from the University of Victoria and her Bachelor of Science in Computer Science and Engineering from the Bangladesh University of Engineering and Technology (BUET). Prior to joining Brock University, she held postdoctoral appointments at the University of British Columbia Okanagan, Toronto Metropolitan University, and the University of Victoria.

An active leader in the computational geometry and graph drawing communities, Dr. Nishat serves as Organizing Co-Chair of the 34th International Symposium on Graph Drawing and Network Visualization (GD 2026) and has held numerous program and steering committee roles for major international conferences. Her contributions to research have been recognized with awards, including the Wilkes Award for outstanding publication..

Keynote Speaker: Dr. Rahnuma Islam Nishat, Brock University

Friday, October 1st, 2:00 PM–3:00 PM, Pond Inlet



Title: Graphs Give You Power: Discovering, Understanding, and Visualizing Graphs

Abstract: Graphs serve as one of the most versatile and powerful mathematical structures in computer science, providing a unifying framework to discover structural properties, understand complex systems, and visualize relational data. In this talk, we explore some problems spanning graph drawing and network visualization, computational geometry, and combinatorial reconfiguration. While these areas address distinct theoretical and applied challenges, they are bound together by a common element: graphs. By tracing the connections among these domains, we demonstrate how deep expertise in graph-theoretic principles can be leveraged to tackle problems far beyond their original scope. Ultimately, this talk illustrates how mastering a core tool set equips researchers with the power to "bring their element" to new disciplines, uncover unexpected cross-domain insights, and transform complex theoretical ideas into clear visual representations

Oral Presentation Sessions Schedule

Session 1	What's the Matter? RFP 214-215	Let's Get Making Thistle 246	Learning About Learning Thistle 240	Ecology and Behaviour Schmon Tower 108
9:40am	Early Martian crustal formation mechanisms inferred from feldspathic units in Jezero Crater, Mars G. E. White Code: T1	Exploring Molybdenum Carbide MXene for Sustainable Hydrogen Production Kevin Stefanchuk Code: T3	Post Shrinkage Estimation for Graph Neural Networks: A Statistical Learning Framework Elfreda Narthey Code: T6	Metal Contamination Across Water, Sediment, and Benthic Organisms in Agriculturally Impacted Aquatic Ecosystems Natasha Hearn Code: T8
10am	Structural Stability and Magnetic Tuning through Sm Substitution in La₂CoMnO₆ Double Perovskites Jia Xu Code: T2	Phase-Engineered Cobalt Selenide for Stable High Current Density Alkaline Water Electrolysis Pritish Kumar Behura Code: T4	Center-based Sampling in Optimization and Machine Learning: A Theory and Review Rasa Khosrowshahli Code: T7	Evidence of olfaction and olfactory communication in Humboldt penguins Alex Wilder Code: T9
10:20am	Examining an Incautious use of Simulations for Yb₂Te₅O₁₃ - Hazel Gifford - Proposal Code: PR1	An analytical framework for humidity-dependence in polymer-polymer triboelectric nanogenerators Gurmeet Singh Code: T5	Structure-Aware Semantic Code Segmentation Across Programming Languages and Software Domains in the LLM Era - Nurbek Imangazin - Proposal Code: PR2	Being prosocial in STEM: How compassionate goals benefit graduate student wellbeing Estera Houshang Code: T10
10:40	Coffee Break			

Session 2	DNA and Physiology RFP 214-215		AI for Humanity Thistle 240	Stop Bugging Me Schmon Tower 108
11:20am	Beyond the Pellet: Rethinking What “Better” Means in DNA Recovery Giovanna Costa Code: T11		AI Drug Design to Fight The Opioid Epidemic Karl Grantham Code: T13	From contact to colonization: A model of natural locust infection by <i>Metarhizium acridum</i> Isabela Fetter Code: T16
11:40am	How do neuronal growth cones integrate opposing guidance cues? Alicia Piazza Code: T12		Scoping Review: Equitable Use of Artificial Intelligence for the Early Detection of Sepsis Hasan Rana Code: T14	Effects of hydroxyl-radical treatments on survival and reproduction of Multi-coloured Asian lady beetle (<i>Harmonia axyridis</i>), a contamination pest in Ontario's vineyards Harmandeep Singh Code: T17
12pm	Repeated Hot Water Immersion: Effects on Females with Postural Orthostatic Tachycardia Syndrome - Lindsay Miller - Proposal Code: PR3		Common to Whom? Regional Cultural Commonsense and LLM Bias in India. Sangmitra Madhusudan Code: T15	Maternal and Developmental Influences on Thermal Tolerance in Small Carpenter Bees Joseph Armstrong Code: T18

Poster Presentation Sessions Schedule

Session 1 (3:00 PM–3:45 PM)	PR4	Parth Chauhan	Reconfiguration of Spanning Trees of Triangulated Graphs Rotations, Edge Slides, and Face Slides
	P2	Elham (Ellie) Rezaee	An Impedimetric Immunosensor for Progranulin Detection Using Streptavidin-Biotin Conjugation on Carbon Screen- Printed Electrodes
	P4	Subrat Kumar Sethy	Electrostatic Tuning of Photosystem I Cofactors under Far-red Light
	P6	Chyenne Panetta	Impact of HOP-C on Anxiety, Depression & Stress in Post- Secondary Students with Mental Health Challenges
	P7	Noah Rhoden	Impacts of Developmental Exposure to Urban Stressors on Eastern Gray Treefrogs (<i>Dryophytes versicolor</i>)
	P9	Holly Eaton	Optimizing Production Methods for Low-Alcohol Wine Using Fungus-Resistant Grape Varieties and Ontario Yeast Strains
	P11	J.E. Schumacher	Analysis of Fe-Phosphates in Sedimentary and Igneous Analogues to Constrain Formational Environment of Fe- Phosphates Found in Jezero Crater, MARS
	P13	Nanhua Bu	Structural and Magnetic Study of Nd-doped La2CoMnO6 Double Perovskites in Bulk and Thin-Film Forms
Session 2 (3:45 PM–4:30 PM)	P1	Gideon Oludeyi	Genetic Algorithms for Optimized Routing and Scheduling in Stochastic Home Health Care
	P3	Krishna Patel	A new side to an old photoacid: does HPTS have a secret?
	P5	Lucy Teminski	Rasping to remember: will the younger generation ever learn?
	PR5	David Justinico-Castro	Effects of Environmental Temperature on Parental Care and Offspring Thermoregulatory Development in Degus (<i>Octodon degus</i>)
	P8	Rachel Ciccone	Hormone and Metabolite Profile of Merlot Buds Treated with Tetralone Absciscic Acid
	P10	Nicholas Benton	Pathogen prevalence within populations of <i>Ixodes scapularis</i> (Ixodida : Ixodidae) surrounding a university campus in the Niagara Region, Ontario, Canada
	P12	Samuel Long	Fabrication and Structural Analysis of (La_(1-x) Sm_x)_2 CoMnO6 Thin Films on SrTiO3 (100) Substrates Using Pulsed Laser Deposition

Oral Presentation Abstracts

Oral Presentation Session 1 (9:40 AM–10:40 AM)

What's the Matter (RFP 214-215)

G. E. White¹, M. E. Schmidt¹, Y. Liu², A. H. Treiman³, J. A. Hurowitz⁴, J. I. Simon⁵, V. Payré⁶

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⁶ School of Earth, Environment, and Sustainability, University of Iowa, Iowa City, IA

T1: Early Martian crustal formation mechanisms inferred from feldspathic units in Jezero Crater, Mars

Keywords: Mars, Perseverance Rover, Geochemistry, Crustal Formation

Feldspathic igneous rocks provide insight to planetary crustal growth and dynamics, including lunar anorthositic crust (formed by solidification of a magma ocean) and the terrestrial Archean-age tonalite-trondhjemite-granodiorite (TTG) (formed by magmatism associated with early plate tectonics and/or stagnant lid regime). The Mars 2020 Perseverance rover has identified a series of coarsely crystalline (grains up to 2 - 3 mm), feldspar-rich rocks within the crater rim representing ancient crustal material. This is the first instance of such intrusive rocks having been examined in situ on Mars. Planetary Instrument for X-ray Lithochemistry (PIXL) observations have been conducted on both natural surfaces and 5cm abrasion patches across the Jezero crater rim region with 22 individual scans over 11 targets. Many of these targets are norites (gabbroic rocks with low-Ca pyroxene (LCP), though variable high-Ca pyroxene (HCP) is present in some scans. Some targets are anorthosites, such as Knapsack Pass and Tanda Tula with some targets containing olivine such as at Cat Arm Reservoir. Martian crustal material is distinct from both lunar and terrestrial examples, though these Martian samples are not widely distributed on Mars, which could impose a local bias. As a proxy for LREE/HREE (i.e., La/Yb, which PIXL cannot detect), K/Ti in Martian feldspathic rocks is typically low compared to terrestrial samples. Lunar anorthosite also have low K/Ti, but higher Ca# (>95). These observations are consistent with a petrogenesis involving fractional crystallization of a high-degree mantle melt with limited involvement of K-mobilization by H₂O-rich fluids for the Martian feldspar-rich lithologies.

Jia Xu

T2: Structural Stability and Magnetic Tuning through Sm Substitution in La₂CoMnO₆ Double Perovskites

Keywords: La₂(1-x)Sm_{2x}CoMnO₆, lattice distortion, magnetic properties, superexchange interaction

In La₂(1-x)Sm_{2x}CoMnO₆ double perovskites, competition between 3d transition-metal (Co/Mn) and 4f rare-earth (Sm³⁺) sublattices—driven by antiparallel 3d-4f exchange coupling—leads to complex magnetic behaviors. In this work, bulk polycrystalline La₂(1-x)Sm_{2x}CoMnO₆ (x=0, 0.2, 0.4, 0.6, 0.8, 1.0) samples were synthesized via solid-state reaction. X-ray diffraction confirms the formation of single-phase double-perovskite structures across all compositions, where substituting larger La³⁺ with smaller Sm³⁺ systematically induces lattice distortion, unit cell contraction, and modifications to the Co-O-Mn bond angles. Scanning electron microscopy and

energy-dispersive spectroscopy verify dense, uniform grain morphologies and target elemental stoichiometry across all compositions. DC magnetization measurements demonstrate that the Curie temperature (T_C) systematically decreases with increasing Sm content, primarily driven by octahedral tilting that weakens the ferromagnetic 3d-3d (Co^{2+} -O- Mn^{4+}) superexchange. Zero-field-cooled curves reveal low-temperature negative magnetization and magnetic compensation, well-described by Néel's two-sublattice model through antiparallel coupling between the 3d Co/Mn network and the Sm^{3+} sublattice. Low-temperature (3K) magnetic hysteresis (M-H) loops display non-saturating behavior across the series, accompanied by remanence suppression and a marked enhancement in coercivity driven by strong single-ion anisotropy of Sm^{3+} . Furthermore, AC magnetic susceptibility measurements identify two distinct magnetic transition temperatures and probe spin-glass behavior. Together, these results demonstrate how progressive La-site substitution by Sm^{3+} drives coupled structural and magnetic evolution in $\text{La}_2(1-x)\text{Sm}_2x\text{CoMnO}_6$ double perovskites, offering insight into the design of compensated ferrimagnets with tunable transition temperatures

Examining biological structures and reaction kinetics in a simulated cytoplasmic fluid

Hazel Gifford

Proposal

PR1: Examining an Incautious use of Simulations for $\text{Yb}_2\text{Te}_5\text{O}_{13}$

Keywords: condensed matter physics, neutrons, experimental physics

$\text{Yb}_2\text{Te}_5\text{O}_{13}$ has been proposed as a possible quantum spin liquid (QSL), as it has been shown not to magnetically order or undergo spin freezing down to 0.044 K, but its magnetic behavior remains unknown, as simulation yields a nearest-neighbor exchange two orders of magnitude above the expected value for a rare-earth oxide. The research proposed here has the goals of experimentally determining the magnetic energy scale and the nature of the quantum ground state of $\text{Yb}_2\text{Te}_5\text{O}_{13}$. This experiment is critical to determine whether the large exchange reflects strong frustration, an inaccurate microscopic model, or a qualitatively different ground state. The proposed measurements will resolve the magnetic energy scale of $\text{Yb}_2\text{Te}_5\text{O}_{13}$ by directly measuring the energy- and momentum-dependent spin correlations. This would simultaneously provide a spectrum that would reveal whether $\text{Yb}_2\text{Te}_5\text{O}_{13}$ exhibits excitations aligning with either a conventional singlet system, or a possible QSL. Either outcome will resolve the disputed interaction scale and establish whether $\text{Yb}_2\text{Te}_5\text{O}_{13}$ hosts a genuinely unconventional ground state, providing a clear basis for single-crystal spectroscopy and microscopic modelling.

Let's Get Making (TH 246)

Kevin Stefanchuk

T3: Exploring Molybdenum Carbide MXene for Sustainable Hydrogen Production

Keywords: Molybdenum carbide, MXene, Hydrogen evolution reaction, Electrocatalysis

The growing global demand for renewable energy, coupled with rising emissions, has intensified the search for carbon-neutral fuels. Hydrogen is a promising clean energy carrier; however, its carbon-neutral production remains a significant challenge. This research investigates molybdenum carbide (Mo₂CTx) MXene as a lower-cost electrocatalyst for the hydrogen evolution reaction (HER), with the broader aim of reducing reliance on precious-metal-based catalysts for alkaline water electrolysis. Mo₂CTx MXene is synthesized from a molybdenum gallium carbide (MoGa₂C) MAX-phase precursor using a fluoride-free hydrothermal etching approach. The MAX phase is treated hydrothermally to selectively remove gallium and produce the layered MXene structure. Structural and compositional changes associated with the MAX-to-MXene transformation are investigated using X-ray diffraction (XRD) and scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM/EDS). The resulting unexfoliated MoCT is deposited onto conductive nickel foam and evaluated as an electrocatalyst for HER in alkaline media. Preliminary electrochemical testing demonstrates promising activity, achieving an overpotential of approximately 343 mV at a current density of 100 mA cm⁻². Further exfoliation and optimization of the material are expected to increase accessible active sites and improve electrocatalytic performance. This work demonstrates the potential of fluoride-free synthesized Mo₂CTx MXenes as tunable electrocatalytic materials for lower-cost and more sustainable hydrogen production.

Pritish Kumar Behura, Peter Berg*, and Jasneet Kaur*

Department of Physics and Yousef Haj-Ahmad Department of Engineering, Faculty of Mathematics and Science, Brock University

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T4: Phase-Engineered Cobalt Selenide for Stable High Current Density Alkaline Water Electrolysis

Keywords: Transition metal chalcogenides, HER, OER, Water Electrolysis, Phase Engineering

The development of active and stable electrocatalysts for overall water splitting is essential for advancing efficient alkaline electrolysis and sustainable hydrogen production. Transition metal selenides have attracted considerable interest owing to their favorable electrical conductivity and tunable catalytic properties. However, their activity and operational stability at practically relevant current densities remain challenging. In this work, we report a facile electrochemical deposition strategy for constructing binder-free ruthenium-engineered cobalt selenide (Ru-CoSe) nanostructures directly on nickel foam, producing a self-supported bifunctional electrode for alkaline water splitting. Incorporation of Ru induces structural and electronic modulation of the cobalt selenide phase while generating a porous morphology that facilitates electrolyte access, charge transport, and exposure of active sites. The optimized Ru-CoSe electrode exhibits enhanced HER and OER performance, requiring overpotentials of 148 and 340 mV to deliver 100 mA cm⁻², respectively. When employed as both electrodes in a two-electrode alkaline electrolyzer, the Ru-CoSe electrode achieves cell potentials of 1.75, 2.02, and 2.23 V at 100, 500, and 1000 mA cm⁻², respectively. The cell also demonstrates sustained electrochemical stability during prolonged operation for 350 hours at high current density (1 A cm⁻²). While maintaining the pristine structure and elemental composition. These findings demonstrate the potential of Ru-engineered cobalt selenide as a robust bifunctional electrode for high-current-density alkaline water electrolysis.

Gurmeet Singh^{a,b}, Euna Jung^{c,d}, Jae-Hyun Leed^{d,e,f}, Jihun Mun^c, Hassan Askari^{a,b}, Jasneet Kaura^b

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T5: An analytical framework for humidity-dependence in polymer-polymer triboelectric nanogenerators

Keywords: triboelectric nanogenerators, humidity-dependence, relative permittivity, surface charge density

Triboelectric nanogenerators (TENGs) convert mechanical motion into electricity, but their output collapses in humid air. The loss ranges from tens of percent to more than two orders of magnitude, and no single material property explains that spread. We present an analytical framework in which humidity reaches the device output through two measurable descriptors. The effective permittivity follows from a three-phase Bruggeman relation separating bound water from free water, so that high water uptake does not imply high permittivity. The surface charge density follows from treating moisture as removing charge already separated rather than preventing separation, placing that removal at contact, where a mobile water film short-circuits the two charged faces. How much is lost depends on whether the wetted regions connect across the interface, making the threshold a property of the pair, not of either film. Applied to sixteen polymer pairs, the framework predicts retention of open-circuit voltage between 10 and 90 percent RH spanning 0.7 to 65 percent, with the ranking of pairs inverting between dry and humid operation. Measurements on five pairs place the half-points at 56 to 75 percent RH, against 57 to 77 percent predicted. Temperature acts on the device through the same two descriptors, and deployed harvesters and sensors rarely hold either variable fixed. Our earlier temperature-dependent model for this device family (Nano Energy 153, 111942, 2026) routes thermal effects the same way, so the two frameworks can be combined into a single environment-aware description. That coupling is the next step.

Learning about Learning (TH 240)

Elfreda Nartey

T6: Post Shrinkage Estimation for Graph Neural Networks: A Statistical Learning Framework

Keywords: Graph Neural Networks, Post-Shrinkage Estimation, High-Dimensional Statistical Inference and Regularization and Variable Selection

Graph neural networks learn from node features, connectivity and, depending on architecture, edge features. However, regularization creates a statistical dilemma: inclusive models may retain unnecessary variability, whereas parsimonious models may discard weak but informative components. This research develops a post-shrinkage estimation framework that adaptively reconciles these competing estimators. The framework operates at three complementary levels. Structural post-shrinkage combines row-centred logits, avoiding ambiguities associated with comparing raw neural-network parameters. A layer-wise surrogate formulation distinguishes strong, weak, and null contributions within graph-propagated representations. An end-to-end formulation treats the trained network locally as a graph-dependent penalized M-estimator, with parameter comparisons restricted to a common identifiable representation. Across these levels, a positive-part shrinkage rule restores a data-dependent proportion of the discrepancy between inclusive and parsimonious estimators. Calibration accounts for graph dependence and the cross-covariance induced by fitting both estimators to the same data. Evaluation examines estimation error, weak-signal retention, and shrinkage behaviour. In an illustrative Erdős–Rényi scenario with 500 nodes and 500 Monte Carlo replications, structural post-shrinkage reduced mean squared logit error by approximately 7.2% relative to the inclusive estimator. With oracle support and covariance, post-shrinkage retained weak contributions while reducing parameter estimation error relative to the inclusive fit. The parsimonious estimator nevertheless achieved lower error in this scenario, underscoring that improvement depends on the signal regime and estimation target. These findings support post-shrinkage as an adaptive approach to weak-signal uncertainty, providing a statistical framework for investigating when partial restoration of excluded information offers a useful compromise between estimation variability and omitted-signal bias.

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T7: Center-based Sampling in Optimization and Machine Learning: A Theory and Review

Keywords: High-dimensional search space, center-based sampling, optimization, machine learning

High-dimensional optimization and machine learning (ML) pipelines frequently rely on randomized proposals inside box-constrained domains, yet it is often unclear when concentrating proposals near the box center improves the chance of generating useful candidates. We study center-based sampling (CBS) in the D -dimensional unit hypercube, where candidates are drawn from a central subcube rather than uniformly from the full box. Under a simple single-draw model, we prove that CBS reduces expected squared distance to an independent target by a fixed per coordinate amount, so the total reduction grows linearly with the dimension. When the target is uniform on the hypercube, this means advantage upgrades to a high probability regime in which the probability that a center draw is closer than a uniform draw converges to one exponentially fast in D , with explicit Hoeffding and Bernstein guarantees and an accurate central limit theorem (CLT) approximation. The expectation comparison also extends beyond the uniform target model to any independent target with finite second moment, for which the mean advantage is unchanged because the uniform and CBS samplers share the

same center while CBS has smaller variance. We complement the theory with same budget random search experiments on shifted Sphere, Rastrigin, and Ackley functions over box-constrained domains where CBS consistently improves the best objective under a fixed sample budget, with the strongest gains when the optimum is centrally located. These results position CBS as a useful geometric baseline for box-constrained randomized search while clarifying that the concentration theorem is specific to the uniform target cube model.

Nurbek Imangazin

Proposal

PR2: Structure-Aware Semantic Code Segmentation Across Programming Languages and Software Domains in the LLM Era

Keywords: Semantic code segmentation, Structure-aware code analysis

This research investigates structure-aware semantic code segmentation across programming languages and software domains in the LLM era. Its goal is to divide source code into meaningful semantic blocks that reflect functional changes in the code, rather than treating code as a flat sequence of lines, tokens, syntactic nodes, or fixed-size chunks. Recent work shows that code chunking and semantic segmentation remain important because LLM-based tools depend on the quality of the code context they receive. This research combines manually audited benchmarks, weakly labeled training data, structural/code-aware features, and machine-learning models to study segmentation across Python, JavaScript, Java, and planned domain-specific datasets in security, AI/ML, and networking. The expected contribution is a reusable dataset, improved segmentation methods, and evidence of whether semantic code blocks can support downstream code-intelligence tasks such as summarization, search, vulnerability analysis, retrieval-augmented generation, and LLM-based software engineering.

Ecology and Behaviour (Schmon Tower 108)

Natasha Hearn

T8: Metal Contamination Across Water, Sediment, and Benthic Organisms in Agriculturally Impacted Aquatic Ecosystems

Keywords: Contamination, Agriculture, Aquatic Ecosystem

Metal contamination in agricultural watersheds varies across water, sediments, and aquatic organisms, yet water patterns do not necessarily reflect contaminant concentrations retained in sediments or found in benthic organisms. Whether these differences reflect location, environmental medium, or biological group remains unclear, especially in agriculturally impacted ecosystems. In this study, we examined ten metals across water, sediment, and benthic macroinvertebrates across six sites in an agricultural watershed from April–November 2025. Metal concentrations in water, sediments, and benthic macroinvertebrates were measured by ICP-MS. Kruskal-Wallis tests with Bonferroni-adjusted comparisons assessed site and functional feeding group (FFG) patterns, while principal component analysis compared profiles across sample types. Water concentrations varied significantly among sites for eight of ten metals. Copper and nickel ($p < 0.001$) showed strong spatial patterns, with a municipal drain (WD), distinct from the other sites for both metals. Sediment concentrations showed an even stronger spatial pattern, with all ten metals varying significantly among sites; lead and nickel ($p < 0.001$) differed significantly across nearly all site comparisons. In contrast, none of the ten metals differed significantly among FFGs. A PCA showed clearer separation between water and sediment profiles than among sites. Sediment provided the clearest picture of spatial metal enrichment, while water and benthic metal patterns did not show the same consistent site or FFG patterns. This suggests that identifying where metals are concentrated is only part of understanding ecological exposure, as environmental hotspots do not necessarily predict metal accumulation in the organisms living there.

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T9: Evidence of olfaction and olfactory communication in Humboldt penguins

Keywords: Animal Communication, Ecology, Chemical communication, Conservation

Animals use a variety of signals to communicate, including visual, auditory, and chemical signals. However, many penguin species have reduced olfactory bulbs and fewer olfactory receptors, suggesting limited use of olfactory signalling, and the importance of olfaction is highly debated in penguins. Humboldt penguins (*Spheniscus humboldti*), colonial seabirds of conservation concern, are commonly kept under human care in breeding programs. Interestingly, Humboldt penguins can use preen oil—a waxy secretion primarily used for feather maintenance and waterproofing—as a scent signal to discriminate between kin and non-kin. We hypothesized that Humboldt penguins rely more on olfactory cues than previously thought and use preen oil as a scent signal to identify mates. Penguins at the Calgary Zoo were exposed to scent cues from their mates versus non-kin, non-mate colony members, and their behaviors were observed. Initial results indicate that penguins identify non-mate scents and show adverse responses to non-kin, non-mate stimuli. Penguin preen oil samples have also undergone GC-MS analysis to determine individual scent profiles as well as search for sex, age, and temporal

variation. These findings enhance our understanding of scent signalling in penguins and offer conservation managers novel strategies for penguin management and remediation.

Estera Houshang

T10: Being prosocial in STEM: How compassionate goals benefit graduate student wellbeing

Keywords: Prosociality, STEM education, graduate student wellbeing

Graduate students in STEM face many pressures that can leave them feeling overwhelmed and isolated, impacting both their mental health and their academic experience. Although scientific research culture sometimes prioritizes individual achievement and independence over helping others, previous research suggests that STEM students can reap a variety of benefits from acting prosocially (e.g., mentoring undergraduates, supporting labmates). We hypothesized that STEM graduate students who are prosocially motivated by compassionate goals (caring intentions to be helpful to others in their academic environment) will experience enhanced academic wellbeing, through support-giving actions and a sense that their work is meaningful to self and valuable to others. In two cross-sectional studies with graduate students in Engineering, Physics, and Computer Science ($N = 517$) and Biology and Earth & Environmental Sciences ($N = 288$), and an experience sampling study surveying STEM graduate students for 10 consecutive weekdays in winter term ($N = 194$), participants reported their prosocial motives (compassionate goals) and actions (support-giving) towards people in their graduate program. Two forms of support-giving were measured: socio-emotional and practical support. Participants then completed measures of academic wellbeing (e.g., research engagement and burnout). Multiple regression and mediation analyses revealed significant relationships between compassionate goals and academic wellbeing outcomes, through practical support-giving (Study 1 & 2) and perceived personal meaning and social value of work (Study 2 & 3). Multilevel modeling analyses revealed same-day effects of compassionate goals on academic wellbeing, through perceived meaning and value of work (Study 3). Implications of these findings are discussed.

Oral Presentation Session 2 (11:20 AM–12:20 PM)

DNA and Physiology (RFP 214-215)

Giovanna Costa

T11: Beyond the Pellet: Rethinking What “Better” Means in DNA Recovery

Keywords: DNA - Precipitation - Co-precipitants – Recovery

DNA precipitation is a routine technique in molecular biology, yet DNA loss during the process is often overlooked. These losses become particularly important at low DNA concentrations, where reduced recovery can compromise subsequent analyses. Established co-precipitants can minimize DNA loss, but materials not traditionally used for this purpose may offer alternative strategies for improving recovery. Five materials with distinct physicochemical properties – polyethylene glycol (PEG), linear polyacrylamide (LPA), glycogen, dextran, and bovine serum albumin (BSA) – were compared during ethanol precipitation of short DNA. Recovery was evaluated across different initial DNA concentrations and two co-precipitant concentrations, allowing established and alternative co-precipitation strategies to be assessed under the same conditions. Co-precipitant selection significantly influenced DNA recovery, whereas increasing co-precipitant concentration did not produce an overall improvement. Recovery was also strongly dependent on the initial amount of DNA, and the relative performance of the tested materials changed across DNA concentrations. At lower DNA inputs, several materials substantially improved recovery compared with precipitation alone, while these advantages became less pronounced as DNA input increased. PEG achieved near-complete recovery under the most favorable conditions, while the other materials displayed distinct DNA-dependent recovery profiles. Overall, these findings demonstrate that effective DNA precipitation depends not simply on adding more co-precipitant, but on selecting the appropriate material for the amount of DNA being recovered. By looking beyond conventional co-precipitants, this study expands the strategies available for improving DNA recovery when every molecule counts.

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T12: How do neuronal growth cones integrate opposing guidance cues?

Keywords: Guidance cues, Growth cone, microRNAs, Regeneration

Growth cones, located at the tip of growing axons, can sense and interpret cues (repulsive or attractive), which facilitate their guidance during axonal pathfinding, a process important in both brain development and regeneration. Growth cones must travel long distances to contact their appropriate target cells and form functional connections. During this trip, they often encounter opposing cues (repulsive and attractive), which they must integrate into a proper response. Retinoic acid, the metabolite of Vitamin A, is an important guidance cue required for brain development and regeneration in many species. Utilizing regenerating molluscan neurons (brain cells), we have shown that retinoids induce attractive growth cone turning and that this response requires new protein synthesis and microRNA, miR-124. We show that exposure to multiple guidance cues affects growth cone behaviour and examined the underlying molecular pathways. Growth cones show diminished responses to retinoic acid immediately following their exposure to a repulsive cue. We have determined the role of a Rho-associated protein kinase ROCK (a downstream effector of RhoA-GTPases and target of miR-124) in both attractive and repulsive growth cone behaviors and examined how the integration of signaling to the different guidance cues affects the spatial and temporal expression of miR-124. These experiments provide insights into the signaling pathways involved in cue integration during axon pathfinding.

Lindsay Miller

Proposal

PR3: Repeated Hot Water Immersion: Effects on Females with Postural Orthostatic Tachycardia Syndrome

Keywords: Postural Orthostatic Tachycardia Syndrome (POTS), Thermoregulation, Heat Acclimation, Hot Water Immersion

Postural Orthostatic Tachycardia Syndrome (POTS) is an autonomic disorder characterized by excessive increases in heart rate during upright posture, often accompanied by presyncope, fatigue, and thermoregulatory disturbances. Heat exposure can exacerbate symptoms and limit quality of life. Although POTS pathophysiology is not fully understood, hypovolemia, impaired vascular regulation, and altered autonomic control are implicated. Heat acclimation (HA) induces plasma volume expansion, improves thermoregulatory function, and reduces cardiovascular strain in healthy individuals, but its effects on individuals with POTS remain unexplored. This study examines whether repeated hot water immersion (HWI) improves cardiovascular, orthostatic, and thermoregulatory responses in females with POTS. Females (20–35 years) diagnosed with POTS will complete six laboratory visits: screening, four consecutive HA sessions, and a 72-hour recovery assessment. Testing will occur during the early follicular phase when possible, with menstrual cycle phase otherwise standardized within participants. Each HA session will involve 40 minutes of HWI at 40°C. Participants will initially be immersed to neck depth until core temperature reaches approximately 38.6°C, after which immersion depth will be adjusted to maintain core temperature. Outcomes include heart rate, blood pressure, core and mean skin temperature, plasma volume, and subjective measures. HWI is expected to induce HA adaptations, including plasma volume expansion, improved thermoregulatory function, reduced cardiovascular strain, and improved orthostatic and heat tolerance. This study will provide preliminary evidence for repeated HWI as a non-pharmacological intervention for POTS and may inform future therapeutic strategies.

AI for Humanity (TH 240)

Karl Grantham

T13: AI Drug Design to Fight The Opioid Epidemic

Keywords: Machine Learning, AI for public health, Drug Design, Computer Science

Drug design is a complex, expensive, and time consuming task. It can take up to 15 years and \$2 billion USD to develop a single drug. At the same time, new public health concerns are increasing in their severity, thus further increasing the need to speed up drug development. One such concern is the worsening opioid epidemic. Here, newer, more powerful opioid antagonists are needed to combat ever-increasingly potent narcotics. AI-powered drug design is a promising new technique to assist in designing promising new compounds. Before this design can take place, such algorithms need to learn the chemical syntax and the interaction between chemical structure and predicted properties. These AI models have the ability to inform manual drug design, by leading researchers to areas of high interest, but can also integrate into larger AI systems to inform de-novo drug design. This work seeks to develop an AI molecular property predictor for designing opioid antagonists which utilizes transfer learning to improve the learning efficiency of a multi-task transformer model. Various approaches to find synergies between the conflicting objectives are explored to find the optimal approach.

Hasan Rana

T14: Scoping Review: Equitable Use of Artificial Intelligence for the Early Detection of Sepsis

Keywords: Sepsis, Equity, AI

Artificial intelligence (AI) is increasingly being used to support early sepsis recognition in hospital settings, with evidence suggesting improved predictive performance compared to traditional approaches. However, concerns remain regarding the equitable development, evaluation, implementation, and governance of AI-enabled approaches, particularly for populations historically underserved by health systems. Although previous reviews have synthesized evidence on the effectiveness of AI for sepsis recognition, the extent to which equity considerations have been incorporated into this rapidly growing field remains unclear. This scoping review aims to map the peer-reviewed literature on AI-enabled approaches to sepsis recognition in hospital settings and examine how equity has been conceptualized, operationalized, and addressed within the field. This protocol follows the Joanna Briggs Institute (JBI) methodology for scoping reviews, and findings will be reported in accordance with the PRISMA Extension for Scoping Reviews (PRISMA-ScR). Electronic searches will be conducted in MEDLINE (Ovid), Embase (Ovid), Scopus, and CINAHL, supplemented by hand searching the reference lists of included review articles and seed papers. Four reviewers will independently screen studies according to predefined eligibility criteria. Data will be extracted using a standardized form and synthesized using complementary quantitative and qualitative approaches. This review is designed to provide a comprehensive overview of how equity has been considered within the literature on AI-enabled sepsis recognition. The findings will identify knowledge gaps and priorities for future research and may help inform the equitable development, implementation, and governance of AI-enabled approaches to sepsis recognition.

Sangmitra Madhusudan

T15: Common to Whom? Regional Cultural Commonsense and LLM Bias in India.

Keywords: NLP, cultural commonsense, benchmark dataset

Existing cultural commonsense benchmarks treat nations as monolithic, assuming uniform practices within national boundaries. But does cultural commonsense hold uniformly within a

nation, or does it vary at the sub-national level? We introduce INDICA, the first benchmark designed to test LLMs’ ability to address this question, focusing on India—a nation of 28 states, 8 union territories, and 22 official languages. We collect human-annotated answers from five Indian regions (North, South, East, West, and Central) across 515 questions spanning 8 domains of everyday life, yielding 1,630 region-specific question-answer pairs. Strikingly, only 39.4% of questions elicit agreement across all five regions, demonstrating that cultural commonsense in India is predominantly regional, not national. We evaluate eight state-of-the-art LLMs and find two critical gaps: models achieve only 13.4%–20.9% accuracy on region-specific questions, and they exhibit geographic bias, over-selecting Central and North India as the “default” (selected 30-40% more often than expected) while under-representing East and West. Beyond India, our methodology provides a generalizable framework for evaluating cultural commonsense in any culturally heterogeneous nation, from question design grounded in anthropological taxonomy, to regional data collection, to bias measurement.

Stop Bugging Me (Schmon Tower 108)

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Title: From contact to colonization: A model of natural locust infection by *Metarhizium acridum*

Metarhizium is a genus of entomopathogenic fungi comprising species that range from broad host generalists to highly specialized pathogens. *Metarhizium acridum* infects insects exclusively within the family Acrididae (locusts and grasshoppers), yet the ecological methods of locust encounter remain poorly resolved. We investigated infection pathways of *M. acridum* across the lifecycle of *Locusta migratoria*. Laboratory experiments were conducted using sterile soil-vermiculite (50%), inoculated with conidial suspensions (1×10^7 conidia mL⁻¹) of labeled *M. acridum* (GFP) and the generalist *Metarhizium robertsii* (mCherry). Locust pairs were allowed to oviposit in treated substrates over a 10-day period. Mortality of adults and nymphs was recorded, and fungal infection was confirmed using fluorescence microscopy and sporulation assays. Adult mortality did not differ among treatments, however, *M. acridum* exhibited higher sporulation in females ($\chi^2 = 10.438$, $p = 0.005$) and was the only observed to sporulate on males. Nymph mortality was higher in *M. acridum*-treated soil, reaching 69.5% ($\chi^2 = 66.914$, $p < 0.001$) and sporulation of 40% ($\chi^2 = 22.565$, $p < 0.001$). These findings demonstrate that *M. acridum* can infect locusts via soil-mediated transmission during oviposition, mating, and nymph emergence, highlighting an ecological pathway for host encounter and infection in entomopathogenic fungi.

Harmandeep Singh

Title: Effects of hydroxyl-radical treatments on survival and reproduction of Multi-coloured Asian lady beetle (*Harmonia axyridis*), a contamination pest in Ontario's vineyards

Keywords: Lady beetle, Clean works, wine taint, pest management

Multi-coloured Asian lady beetle (*Harmonia axyridis*), is a contamination pest in Ontario's vineyards. When grapes are harvested for wine processing, beetles are crushed, releasing isopropyl methoxypyrazine. This alters wine taste and quality, leading to "ladybug taint". Insecticides are used to manage this pest in vineyards, however a sustainable alternative is needed. Clean Works Inc. (CW) developed a technology that generates hydroxyl-radicals, using UV-C light, hydrogen peroxide and ozone. Four different hydroxyl-radical treatments were applied to adult beetles in laboratory conditions to determine which of the treatments lowered the survivorship of the beetles compared to the untreated beetles. We observed that none of the treatments made any significant difference in lowering the survivorship. Fecundity, fertility and development time of the progeny of the treated beetles was also observed post CW treatments. No significant differences were observed in any of the measured parameters between the treated and untreated beetles.

Joseph Armstrong

Title: Maternal and Developmental Influences on Thermal Tolerance in Small Carpenter Bees

Keywords: Bees Thermal Tolerance

Thermal tolerance is an important determinant of bee fitness in increasingly variable climates, yet the relative contributions of maternal inheritance and developmental temperature to thermal tolerance in small carpenter bees (*Ceratina* spp.) remain poorly understood. During the spring and summer of 2026, local *Ceratina* were provided with nesting substrates of raspberry (*Rubus* spp.), teasel (*Dipsacus* spp.), and rose (*Rosa* spp.), resulting in the establishment of 242 nests.

Nest development was monitored in the field until harvest, and 64 nests were selected for study. *Ceratina* foundresses were assessed for critical thermal maximum (CT_{max}) as a measure of adult thermal tolerance. Offspring from each nest were reared under standardized laboratory conditions until pupation, after which they were randomly assigned to one of two developmental thermal regimes: a constant-temperature treatment or a daily fluctuating-temperature treatment. Following adult emergence, offspring CT_{max} was measured to evaluate the effects of pupal thermal environment on thermal tolerance. By comparing CT_{max} between foundresses and their offspring, we examined the relative contributions of maternal phenotype and developmental thermal environment to thermal tolerance in *Ceratina*. These findings provide insight into the capacity of solitary bees to respond to changing climatic conditions.

Poster Presentation Abstracts

Poster Session 1 (3:00 PM–3:45 PM)

Parth Chauhan and Rahnema Islam Nishat

PR4: Reconfiguration of Spanning Trees of Triangulated Graphs Rotations, Edge Slides, and Face Slides

Keywords: Reconfiguration, Spanning Trees, Plane embedded graph, local operations

Reconfiguration problems study how to transform one feasible combinatorial configuration into another using a sequence of local operations, such that each intermediate step is a valid configuration. In this thesis, we study the reconfiguration of spanning trees of planar triangulations using three different flip operations: unconstrained rotations, edge slides, and face slides. The flip graph has each valid configuration as a vertex, and two vertices are connected if they can be converted to each other by a single flip. We present some results, including the connectivity of the rotation flip graph. We present an algorithm that preserves happy edges; the edge (u, v) is present in both the input tree T_{in} and the target tree T_{tar} , using safe-face routing. Finally, we study the connectivity and diameter of the constrained edge-slide and face-slide reconfiguration graphs, as well as how happy-edge preservation can be achieved under these operations.

Elham (Ellie) Rezaee

P2: An Impedimetric Immunosensor for Progranulin Detection Using Streptavidin-Biotin Conjugation on Carbon Screen-Printed Electrodes

Keywords: Alzheimer's | breast | dementia | electrochemical sensors | GP88 | kidney cancer biomarkers | liver | lung | ovarian | progranulin | prostate

Glycoprotein 88 (GP88), also known as progranulin, is a secreted biomarker that is overexpressed in several cancers and is also associated with neurological and inflammatory diseases. In this study, we report the first disposable electrochemical immunosensor for GP88 detection using a screen-printed carbon electrode modified with carboxylated multi-walled carbon nanotubes. We activated surface carboxyl groups via EDC/NHS chemistry, then covalently immobilized streptavidin to capture a biotinylated anti-GP88 antibody. After exposure to GP88, the immunosensor showed a 19% increase in charge-transfer resistance, which served as the analytical response and indicated successful antigen-antibody binding at the electrode surface. The fabrication procedure showed good reproducibility, with a relative standard deviation (RSD) of 4.05% across replicate measurements. The sensor provided a linear response over a GP88 concentration range of 25–500 ng/mL, with an estimated limit of detection of 52 ng/mL. Sensor specificity was evaluated using human serum albumin as a nonspecific protein control, which produced negligible signal changes compared with GP88. Additionally, the results showed that maintaining streptavidin hydration during bio-electrode fabrication is essential to preserve its biotin-binding activity and prevent undesirable changes in electrochemical response. Overall, this work establishes a simple and disposable electrochemical platform for direct GP88 quantification and

provides a foundation for further optimization toward sensitive, selective, and practical electroanalytical detection of GP88 in clinically relevant samples. The proposed platform combines low-cost electrode fabrication, straightforward surface functionalization, and label-free impedance measurements, offering potential for future development of portable assays for GP88 monitoring in point-of-care applications.

Subrat Kumar Sethy

P4: Electrostatic Tuning of Photosystem I Cofactors under Far-red Light

Keywords: MCCE; Electrostatics; Photosystem I; FarLip

Photosystem I (PSI) can efficiently separate charge under different light conditions. However, how the protein environment tunes the redox properties of PSI during far-red light acclimation is still not fully understood. In this work, we used Multi Conformation Continuum Electrostatics (MCCE) to study the electrostatic environment of PSI on both the acceptor and donor sides. On the acceptor side, we calculated the midpoint potentials of the three iron-sulfur clusters, F_X , F_A , and F_B , in PSI from *Thermosynechococcus elongatus*, *Halomicronema hongdechloris*, and *Fischerella thermalis*. Although the overall arrangement of these cofactors is highly conserved, their calculated redox potentials show differences between species and light acclimation states. In *H. hongdechloris*, the F_X potential changes from -770 mV in the white light structure to -822 mV in the far-red structure, while F_A and F_B change from -610 to -572 mV and from -589 to -514 mV, respectively. On the donor side, we studied the special pair chlorophylls P_A and P_B in white and far-red light *H. hongdechloris*, with *T. elongatus* and *Chroococcidiopsis thermalis* as reference structures. The calculated P_A/P_B potentials increase by about 82/70 mV from white to far-red light. Mean-field analysis shows that these changes mainly come from differences in the surrounding protein and cofactor electrostatics, while the reaction-field contribution changes only slightly. These results together demonstrate that exposure to far-red light causes a change in the local electrostatic environment around the cofactors on both the donor and acceptor sides, without altering the overall structure of PSI.

Chyenne Panetta

P6: Impact of HOP-C on Anxiety, Depression & Stress in Post-Secondary Students with Mental Health Challenges

Keywords: Honest, Open, Proud - College, Mental Health, Stigma, DASS-21 Scale

Stigma is believed to contribute greatly to the existing stressors of having mental health challenges (Corrigan et al., 2016). Self-stigma of mental illness is one facet that has been associated with depression, anxiety, and overall stress (Pescosolido & Martin, 2015). Honest, Open, Proud-College (HOP-C) is a peer-led invention program that is designed to help those with mental health challenges overcome the symptoms associated with self-stigma of mental illness (Corrigan et al., 2015). Previous research on the HOP-C program has shown that it was successful in reducing stigma related stress and had moderate effects on depression following completion (Mulfinger et al., 2018; Rüscher & Kösters, 2021). This study examined the change in depression, anxiety, and stress before and after program participation for both groups, using the DASS-21

scale. My hypothesis is that those who did participate in the intervention will show a reduction in depression, anxiety, and overall stress compared to those who did not participate. The HOP-C sample ($n=32$) and waitlist control sample ($n=31$) both completed the questionnaire at baseline, before participants were randomized, and after completing the intervention. Individuals who completed the HOP-C program showed a reduction in anxiety ($p=0.18$) and depression ($p=0.27$) compared to those who did not. However, there was no significant reduction in stress for the HOP-C group compared to the waitlist group ($p=.146$). These results imply a therapeutic impact of HOP-C that may extend to non-clinical samples.

Noah Rhoden

P7: Impacts of Developmental Exposure to Urban Stressors on Eastern Gray Treefrogs (*Dryophytes versicolor*)

Keywords: Urban, Ecology, Temperature, Amphibian

Urbanization exposes wildlife to environmental stressors, including elevated temperatures associated with urban heat island effects and artificial light at night (ALAN). Amphibians may be particularly vulnerable due to their ectothermic physiology, permeable skin, and complex life cycles. However, the interactive effects of urban stressors on amphibian development and post-metamorphic performance remain poorly understood. This study investigates how developmental exposure to warming and ALAN influences growth, metamorphic traits, and post-metamorphic behavior in the Eastern Gray Treefrog (*Dryophytes versicolor*). Tadpoles collected from southern Ontario were reared in a 2x2 factorial experimental design manipulating water temperature and nighttime light exposure, resulting in four treatments: control, warming, ALAN, and combined warming and ALAN. Survival and developmental progression will be monitored throughout the larval period. Preliminary findings indicate that ALAN significantly increased tadpole mortality and delayed time to metamorphosis. These findings suggest that the increase in ALAN near vernal pools could have negative effects on yearly survival and recruitment of local amphibians' species. By examining developmental carryover effects across metamorphosis, this study will improve our understanding of how urban stressors influence amphibian development and behavior. Findings will contribute to amphibian conservation and urban ecology by providing insight into the potential long-term consequences of environmental change for wildlife inhabiting urban wetlands.

Holly Eaton

P9: Optimizing Production Methods for Low-Alcohol Wine Using Fungus-Resistant Grape Varieties and Ontario Yeast Strains

Keywords: Fermentation, wine, low-alcohol, yeast

Recent shifts in alcohol consumption trends have led to an increase in demand for low- and non-alcoholic beverages. In Ontario, Canada, consumers are seeking wines that are lighter, fruitier and contain lower alcohol. In this study, we are investigating different methods to reduce alcohol in wine, with a focus on grape variety selection and the use of locally isolated yeast strains for fermentation. Sustainable Fungus-Resistant Grape

(FRG) varieties have recently been introduced to Ontario with favourable properties for enhancing resilience in the grape and wine sector, including potential for producing high-quality wines with reduced alcohol. Pre-harvest data was collected over the 2025 ripening season for the Soreli and Cabernet Volos varieties that demonstrate different ripening patterns when compared to *Vitis vinifera* varieties. To assess the potential of FRG varieties for low-alcohol wine, Soreli (white) and Cabernet Volos (red), were fermented with either a commercial *Saccharomyces cerevisiae* yeast as the control or a locally isolated *Saccharomyces uvarum* strain (CS-6). Across all the fermentations, wines produced with CS-6 had significantly lower ethanol content when compared to the control wines. In addition, wines fermented with *S. uvarum* had higher glycerol content, higher favourable volatile aromas and generally trended towards reduced acetic acid production. Collectively, these results demonstrate a practical framework for producing lower-alcohol wines by combining variety selection and regionally derived yeast.

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³Palermo Mine No. 1, New Hampshire, USA

P11: Analysis of Fe-Phosphates in Sedimentary and Igneous Analogues to Constrain Formational Environment of Fe-Phosphates Found in Jezero Crater, MARS.

Fe-phosphate minerals in sedimentary rocks analyzed by the M2020 Perseverance rover in Jezero crater, identified in a polyolithic conglomerate on top of the delta and a mudstone in the inlet channel, represent important astrobiological targets as indicators of a habitable environment and components of a “potential biosignature”. These minerals include vivianite, metavivianite, (ferro)beraunite, ferrolaueite, santabarbarite, and other Fe-phosphates that are not distinguishable at PIXL’s resolution. Their formational environment remains somewhat unconstrained, with non-biogenic origins in both aqueous and igneous environments under consideration. Here, terrestrial analogues are analyzed from sedimentary (aqueous) and igneous occurrences to further constrain their origin and determine whether their formational environment was habitable. On Earth, Fe-phosphates often precipitate in aqueous environments or as authigenic minerals associated with organics, but they can also form in igneous environments, such as highly evolved, fluid-rich pegmatites, and may occur as detrital minerals in Jezero sediments. Terrestrial analogue samples were collected from a phosphate-rich marl in Monmouth County, NJ; Palermo No. 1 Mine, a pegmatite in NH; and Midvale, Rockbridge County, VA. Initial mineral identification used Raman spectroscopy (ROM) and SEM (Brock University). Palermo samples contain vivianite-group minerals as thin intergrowths in cleavage of triphylite, siderite, hagendorffite, sulfides, montebasite, ludlamite, and mitridatite. Samples from My Creek contain Ca-phosphates, glauconite, and sulphides. Midvale samples do not contain relevant minerals. Samples will be further characterized using a PIXL-analogous wavelength-dispersive XRF spectrometer (Stony Brook University) from which, when compared to results from PIXL, we can learn about mixing relationships and textures in Martian rocks.

Nanhua Bu

P13: Structural and Magnetic Study of Nd-doped $\text{La}_2\text{CoMnO}_6$ Double Perovskites in Bulk and Thin-Film Forms

Keywords: Double perovskites, Nd substitution, Thin films, Magnetic properties

Double perovskites exhibit a strong correlation between crystal structure and magnetic properties. Substitution of La by Nd can modify both the crystal structure and magnetic behavior because of the difference in A-site ionic size. In this work, $\text{La}_2\text{CoMnO}_6$, $\text{Nd}_2\text{CoMnO}_6$, and $(\text{La}_{1-x}\text{Nd}_x)_2\text{CoMnO}_6$ with $x = 0.2, 0.4, 0.6$, and 0.8 were investigated in both bulk and thin-film forms. Bulk samples were prepared by the solid-state reaction method, while thin films were deposited by pulsed laser deposition. X-ray diffraction was used to characterize the crystal structure of bulk samples. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) were employed to examine their surface morphology and elemental composition. The magnetic properties of the bulk samples were investigated under zero-field-cooled (ZFC) and field-cooled (FC) conditions at applied fields of 200 Oe and 5000 Oe. The results reveal a systematic evolution of magnetic behavior with increasing Nd substitution, including a decrease in the magnetic transition temperature from approximately 215 K to 180 K. The corresponding thin-film samples were also characterized by high-resolution parallel-beam X-ray diffraction to examine their structure and preferred orientation. Rocking curve measurements were used to evaluate the crystalline alignment and film quality. X-ray reflectivity was employed to estimate film thickness and surface roughness. Overall, the results demonstrate that Nd substitution significantly influences the structural and magnetic properties of the $\text{La}_2\text{CoMnO}_6$ -based double-perovskite system, while the thin-film measurements provide additional insight into the structural quality and growth behavior of the deposited films.

Poster Session 2 (3:45 PM–4:30 PM)

Gideon Oludeyi, Beatrice Ombuki-Berman

P1: Genetic Algorithms for Optimized Routing and Scheduling in Stochastic Home Health Care

Keywords: "Genetic Algorithms", "Simulation", "Healthcare", "Optimization"

Home healthcare has emerged as a viable alternative to traditional healthcare delivery, offering personalized services to aging and homebound populations. However, planning caregiver routes and schedules remains a challenging optimization problem due to uncertainty in travel times and service durations caused by traffic conditions, weather, and other disruptions. This challenge, known as the Stochastic Home Healthcare Routing and Scheduling Problem (SHHCRSP), is further complicated by caregiver-patient incompatibilities and synchronized visits that require multiple caregivers to perform tasks simultaneously. We consider a multi-objective formulation that minimizes transportation costs, expected patient tardiness, and expected caregiver overtime. To address this problem, we develop genetic algorithm approaches that incorporate route-based crossover operators adapted from the vehicle routing literature. In addition, we introduce two novel crossover operators. The first, Consensus-Based Crossover (CBX), preserves patient-caregiver assignments shared by both parent solutions while reconstructing conflicting assignments through heuristic repair. The second, Neural Route Inheritance Crossover (NeuRIX), employs a neural scoring model to identify and inherit high-quality routes from parent schedules. Both operators use a cheapest insertion heuristic to repair infeasible solutions and maintain feasibility with respect to problem constraints. The proposed methods are evaluated under both a priori and a posteriori multi-objective optimization frameworks. Computational experiments on benchmark instances demonstrate that the proposed crossover operators achieve competitive performance relative to established genetic algorithm approaches, highlighting their potential for improving decision support in stochastic home healthcare operations.

Krishna Patel

P3: A new side to an old photoacid: does HPTS have a secret?

Keywords: Photoacid, HPTS, Radical generation, DNA damage

This work is an examination of the light-induced generation of radicals by the photoacids pyren-1-ol and trisodium 8-hydroxypyrene-1,3,6-trisulfonate (HPTS). PhotoNMR revealed broadening of aromatic signals of pyren-1-ol upon exposure to purple light (385 and 410 nm). Electron paramagnetic resonance (EPR) spectroscopic experiments showed the generation of radicals by both pyren-1-ol and 8-hydroxypyrene-1,3,6-trisulfonate exposed to purple light but not by white light ($\lambda > 400$ nm). The g-value and hyperfine coupling constants of the EPR spectrum of irradiated HPTS are consistent with density functional theory calculations of the oxy radical produced by cleavage of the O–H bond of the 8-hydroxy group. Thiobarbituric acid reactive substance assays confirmed the generation of malondialdehyde when 1-palmitoyl-2-arachidonoyl-sn-glycero-3-phosphocholine (PAPC) and HPTS were exposed to purple light irradiation. On the other hand, no DNA damage was observed when single stranded DNA was exposed to purple light in the presence of HPTS.

Lucy Teminski and Gaynor Spencer

P5: Rasping to remember: will the younger generation ever learn?

Keywords: Snails, Learning, Memory, Retinoids

The feeding (rasping) behavior of the mollusc, *Lymnaea stagnalis*, is widely used to study the mechanisms of learning and memory due to its well characterized neural circuitry and conserved

signaling pathways. For example, the vitamin A metabolite, retinoic acid, which plays an important role in memory formation in mammals, is also required for longterm memory following classical conditioning of the feeding behavior in *Lymnaea*. However, it has been previously shown that juvenile *Lymnaea* cannot form long-term memory to the same extent as adults. As such, we are currently examining whether retinoic acid plays a role in this differential learning ability between juveniles and adults. We first examined whether increasing the number of training sessions would induce memory in juveniles. Whereas adult animals exhibited memory after 1 training session, juvenile animals did not, and required 3 training sessions to show 24-hour memory. However, this memory did not extend to 48 hours. Previous studies in adults indicated that applying synthetic retinoids to adult *Lymnaea* could extend their long-term memories (from 24 hours to 60-hours). We are now determining whether similar retinoid treatments might also have the same ability to induce or prolong memory in juveniles. These studies will shed light on differences in memory formation with age, as well as the differential signaling pathways that might lead to these differences.

David Justinico-Castro

PR5

Title: Effects of Environmental Temperature on Parental Care and Offspring Thermoregulatory Development in Degus (*Octodon degus*)

Keywords: Parental care, environmental temperature, thermoregulation, phenotypic plasticity

Parental care is any parental behaviour that enhance offspring survival or success, often at a cost to the parents' fitness. Fluctuations in environmental temperature can alter caregiving behaviour and, in turn, influence offspring growth and development. Parental behaviour may also modify the thermal environment experienced by offspring, potentially contributing to developmental plasticity and evolutionary diversification. Degus (*Octodon degus*), a semifossorial rodent native to central Chile, exhibits diverse forms of parental care, including maternal, biparental, and alloparental care. Females may nurse and care for their own and other pups within communal nests, while males contribute to offspring rearing through behaviours such as building the nest, pup-licking, grooming, and huddling. Although the behavioural effects of parental care have been studied in degus, the thermal conditions that influence paternal care and subsequent offspring thermophysiological development remains poorly understood. This study aims to determine how variation in ambient temperature affects parent-offspring interactions and whether these interactions influence offspring thermoregulation. We hypothesize that elevated ambient temperature reduces parent-offspring contact and shifts caregiving toward lower-contact postures. To test this, mothers, parent pairs, or mothers with an alloparent female and their offspring will be acclimatized in separated cages to 15°C or 30°C during the first 28 days after offspring birth. Parental care behaviours will be recorded and quantified using standardized ethograms, while surface temperatures of parents and offspring will be measured using thermal imaging. We will assess how thermal conditions shape caregiving behaviour and whether variation in parental care is associated with offspring thermoregulatory responses.

Rachel Ciccone

P8: Hormone and Metabolite Profile of Merlot Buds Treated with Tetralone Absciscic Acid

Keywords: cold hardiness, tetralone absciscic acid, viticulture

Cold hardiness is a plant's ability to withstand cold temperatures and prevent primary bud death for spring bud break. A major aspect of Canadian cultural practices is to minimize this damage during the winter months. This is achieved through pruning and thermal blankets, alongside plant growth regulators, such as phytohormone analogues. Absciscic acid (ABA) is a plant

phytohormone involved in dormancy, cold, salinity, and drought. However, normal ABA is short lived. To combat this, analogues are designed to prevent degradation. This analogue is tetralone ABA. The tetralone ring prevents cyclization after the oxidation of the 8'-methyl group, to allow the compound to persist in plant tissue. This may induce a downstream effect in the metabolite and hormone profile of treated *Vitis vinifera*. This is measured via untargeted metabolomics (UTM) and hormone profiling (HMP) studies. HMP studies the levels of ABA catabolites, including tetralone ABA, while UTM studies the overall bud metabolite profile. This was measured during the 2023-2024 dormancy period in Merlot two different rates: 0.50 g/L and 1.00 g/L, with an additional 1.00 g/L rate applied pre-harvest. It was found that phaseic acid (PA) and dihydrophaseic acid (DPA) levels were significantly different on 2023-11-20, while bud water content (%) increased on that day. This may suggest more dissolved solutes in the buds as osmoprotectants. Additionally, metabolites in the phenylpropanoid pathway, such as monoterpenes glycosides, p-coumaroyl flavonoid glycosides, and flavonoid dimers, were differently expressed. These metabolites produce many natural products, such as p-coumaroyl derivatives, flavonoids, and monoterpenes present in wine.

Nicholas Benton

P10: Pathogen prevalence within populations of *Ixodes scapularis* (Ixodida : Ixodidae) surrounding a university campus in the Niagara Region, Ontario, Canada

Keywords: Tick, Pathogen, trail, Lyme

Ixodes scapularis is a notable vector of multiple tick-borne pathogens in eastern North America. Commonly, *I. scapularis* is associated with the bacteria *Borrelia burgdorferi*, the primary causative agent of Lyme disease. The continual northward range expansion of *I. scapularis* has raised concerns of increased tick-borne pathogen prevalence in Ontario, particularly in southern municipalities such as the Niagara Region. However, recent surveys of tick populations and tick-borne pathogens in Ontario remain scarce, leaving gaps in identifying the risk tick vectors pose to the public. Thus, we seek to identify the occurrence of *I. scapularis* populations and any associated pathogens circulating in a popular recreational area of the Niagara Region. From May through October of 2026, tick surveillance is being performed around Brock University by tick dragging on six routes along popular walking trails comprising the Bruce Trail and Glenridge Quarry Naturalization Site. Ticks are being collected, identified, and *I. scapularis* nymphs and adults are tested for the presence of six different pathogens using a multiplex Polymerase Chain Reaction (PCR) analysis. From May 5th to July 6th, 62 *I. scapularis* nymphs and adults were collected from all six routes. In total, 16 individuals (26%) tested positive for *B. burgdorferi* and one individual (2%) tested positive for *Borrelia miyamotoi*, the causative agent of *Borrelia miyamotoi* disease. Furthermore, one individual (2%) tested positive for both pathogens. Collected *I. scapularis* will continue to be tested throughout the season to provide insight into the risk *I. scapularis* populations pose to communities in Niagara and southern Ontario.

Samuel Long

P12: Fabrication and Structural Analysis of $(\text{La}_{1-x}\text{Sm}_x)_2\text{CoMnO}_6$ Thin Films on SrTiO_3 (100) Substrates Using Pulsed Laser Deposition

Keywords: Thin Film, Double Perovskite, PLD, X-ray Diffraction Analysis

Double perovskite is a class of material with the general chemical formula $\text{AB}_2\text{B}'\text{O}_6$, exhibiting great potential for magnetic and spintronic due to their functional properties. Thin-film samples can exhibit properties different from those of bulk materials because growth on a substrate can introduce epitaxial strain into the perovskite lattice. In this work, double perovskite thin films were prepared on the SrTiO_3 (100) substrates using pulsed laser deposition technique, with a

series of Sm-substituted $\text{La}_2\text{CoMnO}_6$ compositions subjected to preliminary structural characterization. High-resolution parallel-beam X-ray diffraction was utilized to investigate the crystallite structure and preferred orientation of the films. Rocking curve measurement were used to evaluate crystalline alignment of the films. In addition, X-ray reflectivity measurements were used to determine the film thickness and characterize the surface properties. These preliminary measurements provide an initial evaluation structural quality and characteristics of the thin films.



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