UNIVERSITY OF TORONTO SCARBOROUGH

INTERDISCIPLINARY GRADUATE RESEARCH + DISCOVERY CONFERENCE

May 25-26

2023

AA 208

Art by Sophia Lavergne

IGRAD UTSC

Thursday, May 25th – AA 208

9:30 Registration

10:00 Keynote
Dr. Rene Harrison
Professor and Vice-Dean Graduate & Postdoctoral Studies
Microtubules from Manitoba to Mars

Session 1 | Student Talks | Moderator: Mohammed Said
Judging form: https://forms.gle/czotA27uxVsRyQng7

10:40 **Ratnajit Saha** | Arhonditsis Lab, Physical & Environmental Sciences
Extreme weather events influence soybean-specific agro-climatic indices and phenological changes in Ontario, Canada

11:00 **Adarshana Thapa** | Integrative Agroecology Lab, Physical & Environmental Sciences
Assessing farm health indicators to understand agroecological transitions

11:20 **Edina Ilyes** | Mandrak Lab, Physical & Environmental Sciences
Contemporary lacustrine fish communities in the Lake Agassiz basin: Legacy of a glacial lake

11:40 Break | Snacks and beverages provided in AA 204

Session 2 | Student Talks | Moderator: Ratnajit Saha
Judging form: https://forms.gle/czotA27uxVsRyQng7

12:00 **Mohammed Said** | Harrison Lab, Biological Sciences (CSB)
Cells to scale: An analysis of nuclear size scaling in multinucleated osteoclasts

12:20 **Andreea Bosorogan** | Gonzales-Vigil Lab, Biological Sciences (CSB)
Are you what you eat? Understanding how tomato specialized metabolites modulate the insect gut microbiome

12:40 **Beatriz Herrera** | Strong Lab, Physical & Environmental Sciences
Variability and trends of atmospheric ammonia: from the Arctic to megacities

13:00 **Jessica Hu** | Gonzales-Vigil Lab, Biological Sciences (CSB)
Modifying very-long chain fatty acid composition with 3-ketoacyl-CoA synthases from Populus trichocarpa

13:20 Lunch | Sandwiches and beverages provided in AA 204

14:30 **Workshop | Science Communication led by Jennifer Carpenter**

15:30 **Poster Session** | Refreshments provided

Emily Collins | Ito Limbic Lab, Psychology
Anxiety-like behaviour, approach-avoidance conflict biases, and the role of the ventral hippocampus-nucleus accumbens circuit in ethanol seeking in male and female rats

Danielle Downie | Mood and Addictions Research Lab, Psychology
Computer-based training for cognitive behavioural therapy (CBT4CBT): A mixed methods evaluation

Aswini Kuruparan | Gonzales-Vigil Lab, Biological Sciences (CSB)
Which is better? Exploring cuticular wax and trichome responses to heat and drought in bread wheat

16:30 End of Day

Friday, May 26th – AA 208

10:00 <u>Keynote</u>
Dr. Katie Stammler
Water Quality Scientist, Essex Region Conservation Authority
Water Quality in the Essex Region and Lake Erie: Research and partnerships outside of academia

Session 1 | Student Talks | Moderator: Edina Ilyes
Judging form: https://forms.gle/czotA27uxVsRyQng7

10:40 **Aqsa Zahid & Saleena Zedan** | TIP Lab, Psychology
Examining the effects of positive and negative symptoms of schizophrenia on social exclusion and stigmatizing attitudes

11:00 **Etinosa Oliogu** | Clinical Neuroscience Lab, Psychology
Navigating academia: A critical look at the Imani Black Academic Mentorship Program

11:20 Break | Snacks and beverages provided in AA 204

Session 2 | Student Talks | Moderator: Diwen Yang
Judging form: https://forms.gle/czotA27uxVsRyQng7

11:40 **Ratnajit Saha** | Arhonditsis Lab, Physical & Environmental Sciences
Quantify agricultural impacts on GHG emissions at major cash-crop farms in a changing climate in Ontario, Canada

12:00 **Myles Matundan** | Gazzarrini Lab, Biological Sciences (CSB)
Investigating the role of NAC transcription factors in Arabidopsis thaliana seed coat development

12:20 **Sarah Simon** | Murphy Lab, Physical & Environmental Sciences
Uptake of ozone by pollen

12:40 **Matthew Day** | Bench to Communities Lab, Physical & Environmental Sciences
Altered urinary concentrations of oxidative stress and antioxidant biomarkers in pregnant women exposed to oil and gas sites in Northeastern British Columbia

13:20 Lunch | Sandwiches and beverages provided in AA 204

14:30 **Workshop | Introduction to ArcGIS Online led by David Kwasny**
Please bring a laptop to follow along.

16:30 **Trivia and Awards**

17:30 End of Day

Judging form

Keynote Speakers

Dr. Rene Harrison, Professor

Vice-Dean Graduate & Postdoctoral Studies

Rene Harrison is a Professor in the Department of Biological Sciences at UTSC with graduate appointments in the Departments of Cell & Systems Biology, and Laboratory Medicine & Pathobiology at the St. George campus.
Professor Harrison is a cell biologist, and the goal of her research is to understand how specialized cells function in normal and diseased states. The expertise of her research lab is the cytoskeleton where they use advanced molecular and cell biology approaches to identify fundamental mechanisms driving cell specialization and disease. Professor Harrison is a well-respected scholar, very active in scientific research and in mentoring young researchers. Professor Harrison has supervised over 30 graduate students and postdoctoral fellows while at UTSC. Her research is supported by grants from the Canadian Space Agency, Canadian Institutes of Health Research (CIHR), and Natural Sciences & Engineering Research Council (NSERC), and has served as a panelist or external reviewer on grant review committees for these agencies. She has a strong record of high impact publications, invited seminars and presentations. She has been awarded a CIHR New Investigator award, an Ontario Early Researcher award and an Honoured Alumni of the Year award from the University of Manitoba.
Professor Harrison is now serving as Vice-Dean Graduate & Postdoctoral Studies at UTSC and oversees locally administered graduate programs and oversight on all graduate program reviews.

Dr. Katie Stammler, Water Quality Scientist

Essex Region Conservation Authority

Dr. Stammler completed her BSc in 2003 at the University of Windsor and her MSc in 2005 at the University of Guelph, where she studied fish assemblages in agricultural drains. She completed her PhD at the University of Western Ontario in 2011 where she examined the extent, characteristics and effects of stream burial in southwestern Ontario. She was a postdoctoral fellow at the University of Waterloo studying long term trends in stream water quality across all land use types. She has been with the Essex Region Conservation Authority as the Water Quality Scientist and Source Water Protection Project Manager since 2014. Locally raised in Windsor, Dr. Stammler is passionate about making a difference in our corner of the world through research, conservation, education and mentoring the next generation of conservationists.

Talk title & Abstract
Water Quality in the Essex Region and Lake Erie: Research and partnerships outside of academia
The Essex Region Conservation Authority (ERCA) covers most of Essex County in the extreme southwestern part of Ontario between Windsor and Leamington. The area is surrounding by water – from Lake St.Clair through the Detroit River to Lake Erie – and is dominated by agricultural land use and several town centres. Greenhouse agriculture is common in Leamington and Kingsville. Nutrient concentrations in all watersheds in the Essex Region are among the highest in Ontario, with greenhouse influenced streams having concentrations that are orders of magnitude above the Provincial Water Quality Objective for phosphorus. The Great Lakes Water Quality Agreement names the Leamington tributaries as a priority watershed to reduce harmful algal blooms in Lake Erie for this reason. This presentation will focus on research and monitoring projects conducted by ERCA in partnership with government and academic institutions and will also put this research into context with international effort to reduce phosphorus loads to Lake Erie.

Workshops

Dr. Jennifer Carpenter

EEB Science Communication Facilitator

For those I haven't met, my job in EEB is to support graduate students to communicate science. Alongside this, I work as a journalist and have reported for Science, Nature, Science Careers, BBC News, and the New Scientist. Before my journalism career, I trained in evolutionary genetics studying viral pandemics in fruit flies.
The workshop is short and sweet and highly interactive. I'll start by making the case that it is worth engaging with the media and public as a scientist. Then I'll get you thinking about how to communicate complex ideas clearly and persuasively to a non-specialist audience. And then I'll equip you with the skills to use your press office effectively and give successful interviews. Many of these skills will translate into techniques you can rely on when giving academic talks and elevator pitches.

David Kwasny, MLIS

Data and Digital Literacy Librarian

David is an experienced Information Science & Technology Librarian with a demonstrated history of working in the higher education. Working in web technologies for 15 years, and education for 9 years, he is skilled in Search Engine Optimization (SEO), PHP, WordPress, Drupal, Data Visualization, Archival Preservation, and Taxonomies. His primary area of research is Digital Archives, Digital Scholarship, Data & Information Science, and Broadcast Software as applied to Virtual Instruction.
David will guide us through the UTSC Library Digital Scholarship Unit's "Introduction to ArcGIS Online" course. The overall objective of the class: Discuss GIS basics and the concepts of map making; Explore some cool maps and discuss the data used and the story/analysis the maps are visualizing; Use an example topic to practice finding, adding, importing data and then use tools in ArcGIS to analyze the map; Create your own map by using a provided topic where you will be asked to find data, and analyze the map using ArcGIS tools.
Please bring a laptop to follow along!

Student Abstracts – Talks

Andreea Bosorogan | Gonzales-Vigil Lab, Biological Sciences (CSB)
Co-author: Eliana Gonzales-Vigil

Are you what you eat? Understanding how tomato specialized metabolites modulate the insect gut microbiome

From the first contact with plants, insects are targeted by plant antiherbivore defences including specialized metabolites. These can constrain insect development and reduce plant damage. Yet there is another biotic factor that can modulate plant-insect interactions – bacteria living inside the insect gut. However, there is little evidence on how plant defensive compounds affect the insect-gut bacteria; hence, a thorough exploration of the effect of specialized metabolites on the insect-gut microbiome is needed. In this study, we explore how the cabbage looper (*Trichoplusia ni*) gut bacterial communities are affected by plant defensive metabolites from tomato (*Solanum lycopersicum*). We reared cabbage loopers on several defence-deficient tomato mutants and their corresponding wildtype lines. Foliar biochemical profiles, larval weight, fatty acid profiles and insect-associated bacterial communities from both frass (insect feces) and leaf were analysed. Larval weight varied among plant hosts, confirming the effects of specialized metabolites on insect performance. Differences across the fatty acid profiles between leaf and frass samples indicate that frass contains key aspects of the digestion process. Comparisons of leaf and insect-associated bacterial communities also suggest that the insect microbiome is diverse and not acquired entirely from the host plant. Representatives of the Enterobacteriaceae and Pseudomonaceae families were widespread across all samples. However, insect bacterial community abundance and diversity substantially varied relative to plant genotype. Paired with foliar biochemical profiles, these results suggest that plant defensive metabolites can modulate herbivore insect-associated bacterial communities. This study provides a critical step in understanding gut bacterial communities as a component of plant-insect interactions.

Matthew Day | Bench to Communities Lab, Physical & Environmental Sciences
Co-authors: Yifan Wu, Coreen Daley, Marc-André Verner, Élyse Caron-Beaudoin

Altered urinary concentrations of oxidative stress and antioxidant biomarkers in pregnant women exposed to oil and gas sites in Northeastern British Columbia

Northeastern British Columbia is a hotspot for oil and gas extraction. Oil and gas sites often release volatile organic compounds (VOCs), which have been shown to increase oxidative stress, disrupt antioxidant enzyme activity, and increase the incidence of adverse pregnancy outcomes. This study aimed to 1) measure biomarkers of oxidative stress and antioxidant activity in urine samples of a cohort of pregnant women living in Northeastern British Columbia; 2) analyze the associations between indoor air VOCs, density and proximity of oil and gas wells and biomarker levels. Up to 7 urine samples were collected from eighty-five pregnant women living in Northeastern BC. Passive air samplers were installed in participants' residences to measure VOCs in indoor air. Density and proximity metrics of oil and gas wells were determined at 2.5km, 5km, and 10km radii around the participants' residences. Colorimetric and fluorescent assay kits were used to measure concentrations of catalase (CAT), superoxide dismutase (SOD), glutathione S-transferase (GST), total antioxidant capacity (TAC), 6-hydroxymelatonin sulfate (MS), malondialdehyde (MDA), 8-hydroxy-2′-deoxyguanosine (8-OHdG), and 8-isoprostane (8-IP). Associations between biomarker concentrations and exposure metrics were determined using multiple linear regression models with covariables adjusting for participant age, gestational week, smoking status, sample collection time, creatine content, and melatonin levels. Biomarker levels were compared between Indigenous and non-Indigenous participants. Urinary biomarker concentrations were not statistically different between Indigenous and non-Indigenous participants. Increased density and proximity of oil and gas wells were associated with a significant decrease in 8-OHdG. Proximity to unconventional oil and gas wells was associated with a significant decrease in both SOD and 8-OHdG. Elevated hexanal concentrations were associated with a significant decrease in MS and elevated 1,4-dioxane were associated with a significant decrease in MDA. No significant associations were found between TAC, GST, or 8-IP and our exposure metrics. These results may suggest that chronic exposure to oil and gas activity may impair protective oxidative stress pathways in pregnant women. More research is needed to elucidate the underlying mechanisms associated with changes in oxidative stress and to what degree these changes could affect birth outcomes.

Beatriz Herrera | Strong Lab, Physical & Environmental Sciences
Co-author: Kimberly Strong

Variability and trends of atmospheric ammonia: from the Arctic to megacities
Ammonia (NH3) is the most abundant alkaline compound of our atmosphere, and is involved in several reactions, including the neutralization of acids and the formation of particulate matter, with potential consequences to the environment and human health. NH3 is primarily emitted from agricultural sources, however, it is also present in urban and remote environments. This gas is very variable with a short lifetime and strong dependence of meteorological conditions such as temperature and moisture. Previous studies have used satellite measurements to assess the global variability of NH3; however, the interannual variability does not reveal clear trends and is not possible to determine the diurnal variability as a consequence of the limited satellite observations per day. The objective of this study is to determine and compare the temporal variability and trends of NH3 at urban and remote locations, mainly by using datasets of NH3 total columns retrieved from spectroscopic solar absorption measurements performed at sixteen ground-based Fourier transform infrared (FTIR) sites, of which seven are classified as urban and nine as remote. The sites are globally dispersed in both hemispheres from 45.04°S to 80.05°N, most of them part of the Network for Detection of Atmospheric Composition Change (NDACC). In addition, the FTIR data are compared with modeled NH3 from the GEOS-Chem chemical transport model and from the preliminary Tropospheric Chemistry Reanalysis (TCR-2) NH3 product, to provide additional insight into the global variability and trends of NH3.

Jessica Hu | Gonzales-Vigil Lab, Biological Sciences (CSB)
Co-authors: Jeff Chen, Eliana Gonzales-Vigil

Modifying very-long chain fatty acid composition with 3-ketoacyl-CoA synthases from Populus trichocarpa
Very-Long Chain Fatty Acids with more than 20 carbons are important for development and physiology in all eukaryotes including plants. VLCFA elongation is controlled by the fatty acid elongation complex (FAE), where the first enzyme 3-Ketoacyl-CoA synthase (KCS) has been shown to be the rate-limiting step and regulates the substrate specificity, in terms of length of products, degree of unsaturation and stereochemistry. In Populus trichocarpa (poplar), PtKCS1 was identified as a candidate gene for the biosynthesis of alkenes. By doing chimeric proteins between PtKCS1 and the related PtKCS2, two key regions that control substrate specificity in KCS have been identified. As part of these experiments, the chimeric proteins were shown to have increased activity towards saturated and unsaturated substrates. In this project, I will express PtKCS1, 2, Fusion and Fusion+ in yeast and plant systems to modify the VLCFA profile in order to solve the unknown of fatty acid elongation in plants.

Edina Ilyes | Mandrak Lab, Physical & Environmental Sciences
Co-author: Nicholas E. Mandrak

Contemporary lacustrine fish communities in the Lake Agassiz basin: Legacy of a glacial lake
Changes in climate can alter species' distributions and ranges and, in extreme cases, such as during continental glacial cycles, can result in latitudinal shifts of entire biomes. Freshwater fishes are especially vulnerable during such shifts because they rely on the presence of suitable lentic and lotic systems for dispersal and colonization. We examined the effects differential contact to the dispersal corridor of glacial Lake Agassiz had on the contemporary lacustrine fish communities of northwestern Ontario during the Wisconsinan deglaciation. Compositional dissimilarity increases with pair-wise differences in lake age, driven by turnover and nestedness and, in lakes outside of the spatial extent of Lake Agassiz, species composition is positively correlated with elevation. These patterns indicate variation in species present during the colonization process, likely driven by paleoenvironments of the glacial lake and dispersal abilities of species. Our study shows that postglacial colonization influenced contemporary lacustrine fish communities within the same geographical region. It underscores the importance of understanding the effects of historical drivers on contemporary assemblages, which can have implications for freshwater fish dispersal to suitable climatic conditions in the future, particularly in the absence of extensive freshwater connections such as those of the last glacial retreat.

Myles Matundan | Gazzarrini Lab, Biological Sciences (CSB)
Co-authors: Charlotte (Peijie) Zuo, Sonia Gazzarrini

Investigating the role of NAC transcription factors in Arabidopsis thaliana seed coat development

To combat the effects of changing environments, plants employ various strategies to optimize survival in tandem with growth. In *Arabidopsis thaliana* and other seed-bearing plants, the seed coat plays one of the first forms of physical and biochemical defence for the developing plant embryo. Seed coat functions include regulation of water and nutrient transport, defence against pathogens, and surveillance of conditions most suitable for germination. Seed coat development is controlled by genetic programs, in which transcription factors play a large role. The NAC transcription factors, in particular, belong to one of the largest plant-specific families, yet the specific functions of its members are largely uncharacterized. The objective of my project is to identify and characterize the function of NACs that are expressed in the seed coat. I have selected (3) NAC candidates, NAC-C, NAC-D, and NAC-E, using a variety of bioinformatic techniques and have begun to characterize their function in seed coat-related functions such as seed permeability, morphology, and viability. My data show that plants lacking NAC-D and NAC-E develop highly permeable seeds and dramatically disrupted seed coats. The results of this study will shed light on the role of NACs uncharacterized in seed coat development in *Arabidopsis*, which will help inform the role of seed coats in response to climate change, and the further optimization of seed storage.

Etinosa Oliogu | Clinical Neuroscience Lab, Psychology

Navigating academia: A critical look at the Imani Black Academic Mentorship Program

The Imani Black Academic Mentorship Program (IBAMP) is a University of Toronto Scarborough (UTSC) based program centred around empowering Black-identifying middle school, high school, and undergraduate students to pursue higher education through academic support and Afrocentric education. IBAMP emphasizes the importance of community building and creating a network of support to help Black students overcome the unique challenges they may face in academia. With community engagement as a pillar of the program, the goals of IBAMP are to increase access to post-secondary education and foster academic success, personal growth, and career development for Black students through mentorship, networking, and access to resources and support. In this program evaluation, the effectiveness of IBAMP in achieving its goals is examined.

Utilizing a mixed methods approach, the program's impact on several academic and career-related outcomes and the building of social capital was assessed among middle- and high-school students, their school liaisons, parents, and undergraduate students. Findings indicate that the program positively impacts academic outcomes at the high school level but not the middle school level. Middle school participants, on average, already have high academic performance, so Imani plays a secondary or reinforcing role. Additionally, middle, high school and undergraduate students reported feeling more connected to their school communities and experiencing a greater sense of belonging within the broader Black community that would have been less prominent.

The most important findings of the evaluation were areas of improvement and elevation. This included the need for greater program promotion and recruitment for specific demographic groups, the introduction of annual data collection efforts, comprehensive training for mentors at the high school level, and program expansion. These recommendations will work to enhance the program's effectiveness further and promote academic success and a sense of community amongst Black students across multiple levels of education. This evaluation highlights the importance of mentoring programs like the Imani Black Academic Mentorship Program in promoting equity and inclusion in higher education.

Ratnajit Saha | Arhonditsis Lab, Physical & Environmental Sciences

Co-author: George B. Arhonditsis

Extreme weather events influence soybean-specific agro-climatic indices and phenological changes in Ontario, Canada

Climate variability and timing of occurrence of extreme weather events in the crop growing season have a profound impact on crop phenological development stages. Study aims to examine extreme weather events influence soybean-specific agro-climatic indices and phenological changes in Ontario, Canada. Important factors were considered such as climatic parameters, observed and GCM RCP 4.5 & 8.5 scenarios, four-time frames, seeding dates, thirteen agro-climatic indices, group of indicators, major and cluster of development stages and agricultural regions in Ontario. GCM datasets were found good to predict and project the status of agro-climatic indices. Growing degree days (GDD) and non-growing degree days (NGDD) showed increasing and decreasing trends across Ontario in all datasets and timeframes. A higher GDD was observed in southern and central Ontario, whereas northern Ontario experienced a higher occurrence of NGDD. Heat stress (warm nights and extreme heat) influences reproductive stages, high-frequency occurrences were observed in southern, central, and eastern Ontario, and the frequency was projected to be increased in the future. However, cold stress influences vegetative and reproductive stages. Northern Ontario experienced very frequent cold stress in terms of cool nights and spring-killing frost; on the other side, southern and central Ontario would not observe cold stress in the recent and distant future for RCP 4.5 and 8.5 scenarios. Excessive wetness influences vegetative and early reproductive stages, where 1-2 weeks/year for poor seedling condition and 1 week/year for early flooding were found to be the most common across Ontario. Considering the trends of increasing, decreasing, and remaining the same for all agro-climatic indices, early seeding for soybeans could be suitable across Ontario in the recent and distant future for RCP 4.5 and 8.5 scenarios. The findings could contribute to appropriate adaptation strategies for soybean cultivation in a changing climate to optimize production.

Co-authors: Alexey Neumann, George B. Arhonditsis

Quantify agricultural impacts on GHG emissions at major cash-crop farms in a changing climate in Ontario, Canada

Canada has committed to the Paris Agreement to reduce greenhouse gas (GHG) emissions by 30% below 2005 levels by 2030 and net zero by 2050. Agricultural practice is a significant contributor to the GHG emission, and the extension of farms is being continued, especially in Ontario. GHG reduction from the field will aid in reaching the emission reduction target. Therefore, it is essential to determine the magnitude and uncertainty in GHG estimates and assess the net impact of agricultural farms on GHG emissions. Study aims to quantify agricultural effects on GHG emissions at major cash-crop farms in a changing climate in Ontario, Canada. The Holos model (version 4.0), an empirical farm-scale model developed by Agriculture and Agri-Food Canada, was used to calculate GHG (methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2)) emissions. Farms were selected from three locations in Ontario: northern (Kenora County), central (Parry Sound County), and southern (Chatham-Kent County). Large live-weight animals emitted the highest amount of GHG (Cow-Calf > Crop > Hog > Sheep/Lamb > Poultry). Enteric CH_4 was the largest contributing GHG (enteric CH_4 > direct N_2O > indirect N_2O > manure CH_4 > farm energy CO_2). In the crop fields, most frequent crop rotation contributed direct N_2O > indirect N_2O > farm energy CO_2 emissions. Total GHG emissions from agricultural farms were 159 to 514 Mg CO_2 eq in 2006, 198 to 897 Mg CO_2 eq in 2011, and 215 to 1238 Mg CO_2 eq in 2016. Overall, agricultural farms in southern Ontario contributed the largest amount of GHG followed by northern and central Ontario. The findings will contribute to provincial and national agricultural strategies to achieve “net zero carbon emission” and help to develop nature-based solutions for the carbon-smart ecosystem and be a part of the national index on agri-food sustainability.

Mohammed Said | Harrison Lab, Biological Sciences (CSB)
Co-author: Rene Harrison

Cells to scale: An analysis of nuclear size scaling in multinucleated osteoclasts

Background and Objectives:
Allometry is the study of biological scaling: how organelles change in size, activity and/or positioning as cells grow. Researchers have studied the scaling behaviour of nuclei in embryos and mitotic cells. However, the nuclear scaling properties of post-mitotic syncytia remains understudied. Osteoclasts (OCs) are the only syncytia that functionally degrade the calcified bone matrix. Thus, my proposal analyzes the nuclear scaling properties between multinucleated OCs and mononucleated pre-osteoclasts (pOCs).
Methodology:
To determine how nuclear size and activity scale in OCs as they increase in nuclear number (N) from pOCs, I investigated the scaling properties of nuclear volume (Vnuc) with cell volume (Vcell) across pOCs and OCs with N of 1, 2, 3, 4, 6 and 8. Day 4 and 5 OCs and pOCs were immuno-stained with DAPI (for nuclei), 5-ethynyluridine (EU, for transcriptional activity) and FM1-43FX (for the plasma membrane). For volumetric analysis, z-stacks were acquired of pOCs and OCs with a step size of 0.2um step size using spinning-disk confocal microscopy and analyzed using Volocity®. For nuclear activity scaling, the mean EU intensity and cross-sectional area per nuclei were also measured to derive volume-corrected EU densities per nucleus in OCs and pOCs.
Results:
Through spinning-disk confocal microscopy, Vnuc appears to sublinearly scale ($\beta<1$) with Vcell as N increases from mononucleated pOCs to multinucleated OCs. Temporally, sublinear scaling between Vnuc and Vcell remains consistent between Day 4 and 5 OCs. Overall, my research suggests sublinear scaling of nuclear volume with OC volume as N increases from fused pOCs.
Discussion:
With nuclear volume sublinearly scaling with osteoclast size, this finding suggests that as cell size increases, syncytia constrict the increase in their perinuclear domains, in support of the cytoplasmic-to-nucleus domain theory. Notably, these results conform with scaling models in mitotic cells like Saccharomyces cerevisiae through the limited components model wherein DNA content is expected to increase to a set-point of cellular volume. Overall, the sublinear scaling of OC nuclei sheds light on the subcellular changes that pOCs must undergo following fusion to form their highly specialized cell type in the dynamic human body.

Sarah Simon | Murphy Lab, Physical & Environmental Sciences

Uptake of ozone by pollen

Ground-level ozone is a highly reactive air pollutant, known to cause detrimental effects to plants. Recent studies show a link between high ozone events and increased allergic sensitivities to pollen due to the modification of the pollen. The reaction of ozone with pollen is important to investigate to determine the impact on allergenicity and understand the potential exposure of oxidized pollen in the atmosphere. We investigated the uptake of ozone to pollen for the common Canadian tree species: *Acer pseudoplantanus* (Sycamore Maple), *Acer negundo* (Box Elder Maple), *Alnus incana* (Grey Alder), *Betula pendula* (Silver Birch), *Cupressus arizonica* (Arizona Cypress), *Fraxinus pennsylvanica* (Ash), *Juniperus communis* (Juniper), *Morus rubra* (Red Mulberry), *Pinus strobus* (White Pine), *Populus nigra* v. italica (Lombardy Poplar), *Quercus rubra* (Red Oak), and *Quercus velutina* (Black Oak). By exposing pollen to atmospherically relevant levels of ozone (120 – 150 ppb) in small air chambers we measured the uptake coefficient of ozone to the pollen surface between 1.07 to 5.97 x 10-5 and the total adsorbed ozone during exposure was measured between 9.4 - 2200 ng O3 per mg of pollen. Using these experimentally determined values from the lab, we were able to model the extent of ozone uptake to pollen grains in the real atmosphere. The results suggest that the modification of pollen by ozone is dependent on the concentration of ozone, and high pollen and ozone days can result in higher exposure of polluted pollen to the public.

Adarshana Thapa | Integrative Agroecology Lab, Physical & Environmental Sciences

Assessing farm health indicators to understand agroecological transitions

Industrial agriculture has led to a decline in environmental and health conditions, resulting in a need for new agricultural methods that prioritize sustainability while maintaining productivity. Agroecology, which applies ecological principles to manage agroecosystems in order to improve social-ecological outcomes, is an approach that meets these requirements. Yet, transforming industrial farm systems into more biologically complex farms requires an “agroecological transition”, with multiple potential pathways, including replacing external inputs with biological processes and enhancing agrobiodiversity.

To address this gap in our understanding of effects of transiting to agroecological systems on social-ecological outcomes, this study analyzed agroecological transitions on small-scale farms transitioning to natural farming in central India. Farming practices were assessed across five phases on different types of farms, including conventional, newly established non-pesticidal, fully established non-pesticidal, newly established natural, and fully established natural farms. Soil health and farmer well-being indicators for 44 farms were investigated along an agroecological transition gradient across the five phases. Qualitative data was collected through interviews of 44 farmers on social, economic, and ecological aspects, as well as on dietary and farmer well-being.

Preliminary results showed that fully established agroecological farms have higher socioeconomic and ecological outcomes than conventional farms in the study region. Transitioning to natural farms led to an improvement in soil health parameters, including total soil nitrogen and carbon content, active carbon and macrofauna abundance. Experienced agroecological farmers had improved working hours, lower farm expenditure, higher reported crop productivity, household dietary diversity, and farmer well-being relative to conventional farmers.

The study demonstrated that agroecological practices such as enhancing crop diversity and replacing external inputs have a positive impact on both soil and human health. These combined findings suggest that agroecological farms can amplify the social and ecological functions of agroecosystems to achieve win-win outcomes following a transition period. The results of this research can support farmer decision-making and provide incentives for more risk-averse farms to undertake agroecological transitions, ultimately strengthening food systems.

Keywords: Agroecology, Agroecological transitions, Agroecosystems, Soil health indicators, Social-ecological systems, Farmer well-being.

Aqsa Zahid & Saleena Zedan | Therapeutic Interventions for Psychosis (TIP) Lab, Psychology
Co-author: Michael Best

Examining the effects of positive and negative symptoms of schizophrenia on social exclusion and stigmatizing attitudes

Background: Schizophrenia is one of the most highly stigmatized mental disorders. As a result of stigma, individuals may engage in socially excluding individuals with schizophrenia. Such social exclusion can be a response to the observation of atypical behaviours (resulting from symptoms of schizophrenia), and/or due to the knowledge of one’s diagnosis.

Methods: The purpose of the present study was to examine preference for social distance towards schizophrenia as a function of diagnosis awareness and the presence of negative and/or positive symptoms. Eight vignettes were developed of a student who either displayed/did not display positive symptoms of schizophrenia, displayed/did not display negative symptoms, and was either labelled / not labelled with schizophrenia. Each participant (N = 559) was randomly presented with one of the vignettes. Participants completed measures such as the Social Distance Scale (SDS) to determine their desire for social distance from individuals with mental disorders.

Results: A significant two-way interaction between positive and negative symptoms was found on the SDS, $F(1, 422) = 3.946$, $p = .048$, partial $n2 = .009$. The absence of negative symptoms significantly increased desire for social distance if positive symptoms were present and decreased desire for social distance if positive symptoms were absent, $p = .018$. Additionally, the absence of positive symptoms significantly increased desire for social distance if negative symptoms were present and decreased desire for social distance if negative symptoms were absent, $p = .049$. A significant two-way interaction between diagnostic label and negative symptoms was found on the SDS, $F(1, 422) = 4.831$, $p = .028$, partial $n2 = .011$. The knowledge of diagnosis significantly increased desire for social distance if negative symptoms were present and decreased desire for social distance if negative symptoms were absent, $p = .032$.

Conclusion: The presence of negative or positive symptoms elicit an increased desire for social distance from individuals. The presence of a diagnosis appears to play a helpful role in decreasing desire of social distance when atypical behaviours are displayed, however the presence of a diagnosis with the absence of atypical behaviours increases desire for social distance.

Student Abstracts – Posters

Emily Collins | Ito Limbic Lab, Psychology
Co-authors: Mahmoud Shaat, Tanner McNamara, Nisma Khan, Rutsuko Ito

Anxiety-like behaviour, approach-avoidance conflict biases, and the role of the ventral hippocampus-nucleus accumbens circuit in ethanol seeking in male and female rats

Alcohol use disorder (AUD) is characterized by chronic alcohol use and dependency and often occurs comorbidly with anxiety-related disorders. Although AUD has traditionally been most prevalent in men, this gender gap has been closing, with rates of AUD in women rising. Yet, females have been underrepresented in preclinical research, leaving unanswered questions regarding sex-specific dispositional risk factors and neurobiology underlying the condition. Aberrant approach avoidance conflict (AAC) processing has been implicated in psychiatric disorders such as AUD and anxiety-related disorders, and the relationship between AAC biases and AUD may be sex-dependent. AAC processing is arbitrated by the ventral hippocampus (vHC), while reward-seeking and other addiction-related behaviours are regulated by the nucleus accumbens (NAc). Thus, the vHC-NAc circuit offers a prime target for investigating the role of specific limbic circuits in ethanol seeking. This study used a mixed-sex sample of Long-Evans rats to measure baseline anxiety-like behaviour and AAC biases, then used DREADDs to selectively inhibit vHC-NAc during an operant cue-elicited ethanol drinking task to explore the role of this circuit in drinking-related behaviours. Notably, vHC-NAc inhibition delayed extinction of cued lever press responding for ethanol regardless of sex, but females were more resistant to extinction generally. AUD is the second most prevalent substance use disorder worldwide and poses enormous individual, societal, and economic costs. This study serves to advance our understanding of the dispositional risk factors and neural circuitry underlying drinking-related outcomes in a sex-representative rodent model of AUD.

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Computer-based training for cognitive behavioural therapy (CBT4CBT): A mixed methods evaluation

Background: Problematic substance use is a pervasive issue in Canada, with approximately 21% of the population meeting criteria for substance use disorder (SUD) in their lifetime. Many Canadians face challenges finding and accessing evidence-based high-quality care for support with substance use concerns. Computer-Based Training for Cognitive Behavioral Therapy (CBT4CBT), developed by Dr. Kathleen Carroll and colleagues at Yale, offers a low-cost and accessible method to provide high-quality CBT for individuals seeking help for problematic substance use. Randomized trials of CBT4CBT have examined this treatment as both an adjunct and a stand-alone treatment. The aim of the present study is to extend this evidence-based in a mixed methods investigation of the updated CBT4CBT program, focusing on positive indicators of health. Quantitative aims included the evaluation of change readiness, confidence, distress tolerance, and CBT skills change over 8 weeks of CBT4CBT in individuals with SUDs.
Methods: A total of 50 outpatients (68% female, 32% male) received CBT4CBT over eight weeks, and were followed over six months. Participants completed the Substance Dependence Scale, Change Assessment Inventory, Drug Taking Confidence Questionnaire, Distress Intolerance Index, and Change Strategies Inventory before and after treatment.
Results: Mixed effects models demonstrated that participants reported a significant decrease in SUD severity from week 0 to week 8 post treatment. Readiness for change, distress tolerance, and CBT skills all improved over 8 weeks; however, confidence did not demonstrate significant changes. Qualitative interviews identified information on benefits of this program and facilitators to care.
Discussion: Results suggest that CBT4CBT is associated with decreases in SUD symptoms and increases in several key positive indicators of health. These indicators are associated with resilience and strengths-based approaches in the field, and demonstrate the broader impacts experienced by users of this innovative digital health intervention. The current study is an important extension of the support for CBT4CBT within a Canadian clinical sample. Implications for this research could have broad impacts on future treatments of SUDs. CBT4CBT offers a cost-effective, online, accessible treatment option for individuals with SUDs and may be a viable opportunity for under-served individuals and communities to access care.

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Which is better? Exploring cuticular wax and trichome responses to heat and drought in bread wheat

Canada is one of the largest bread wheat (*Triticum aestivum L.*) producers in the world and the bulk of this production occurs in Western Canada. According to climate models, Western Canada will be particularly vulnerable to rising temperatures and drought events, posing a risk to wheat production. Because of this, there is a need for more drought and heat tolerant bread wheat varieties. One way plants can defend themselves from environmental stressors, such as heat and drought, is through responding with their cuticular waxes and trichomes. In response to heat and drought, these structures can lower leaf canopy temperatures, reflect light, and reduce non-stomatal water loss. Although there have been studies on the cuticular waxes and trichomes of wheat varieties outside of Canada, very little is known about the responses of Canadian bread wheat cultivars. To address this gap, the Canadian bread wheat variety AAC Tradition was subjected to a growth chamber heat and drought experiment. The results revealed that AAC Tradition produces significantly more wax and trichomes on the adaxial surface in response to drought. Interestingly, heat stress and heat in combination with drought did not significantly affect wax production. Instead, an increase in the abaxial trichome density was observed. Further research into these two responses, can help wheat breeders determine which responses to include, to help create new heat and drought tolerant varieties.

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