Poster Number	First Name	Last Name	Who is(are) your supervisor(s)?	Enter the title of your work	Enter your abstract (150 word maximum)
1	Nourhan	Almasri	Dr. Roberto J Botelho	The Effects of PIKfyve Inhibition on ER Hitchhiking	Phosphoinositide 5-kinase (PIkfyve) is a lipid kinase that mediates the phosphorylation of PI(3)P to PI(3,5)P2 found in lysosomes. Inhibition of PIKfyve causes lysosome coalescence, reducing their number while swelling lysosomes. Interestingly, lysosomes form membrane contact sites with the endoplasmic reticulum (ER), which helps sculpt the fine, tubular, and reticulate ER network. In fact, when we inhibit PIKfyve, we now know that the ER network becomes less dynamic and collapses. To understand how PIKfyve inhibition disrupts the ER network, we hypothesized that PIKfyve inhibition disrupts ER hitchhiking, a process that helps form ER membrane tubules by pulling the ER membrane on motile lysosomes. To test this, we are labelling the lysosomes and ER in Cos7 cells treated with PIKfyve inhibitors. We then measure ER hitchhiking events by super-resolution live-cell imaging. Once this is completed, we will have a deeper understanding of how the ER dynamics are affected.
2	Huzaifa	Almohimed	Dr. Lesley Campbell	Optimal Foraging Theory in Industrial Agriculture	Before visiting your garden, do you quickly scan to see if there is enough food in your garden to harvest? By scanning to see how much of the vegetation in your garden is food vs the rest of the plant (a ratio called the Harvest Index) and determining there is enough for you to spend time gathering, you save time and effort. Many animals do the same and the internal calculations they do to determine whether to forage or not can be worked out with a well tested algorithm - the optimal foraging model. However, until our work, farmers with industrial-sized farms have not used this approach to determine when to stop returning to harvest iteratively produced crops like tomatoes or raspberries and instead focus their labor on other crops. In our poster, we demonstrate how to calculate the harvest index of indoor grown raspberries and then to determine when a farmer should stop harvesting raspberries and switch to growing a new crop of raspberries by co-opting a traditional optimal foraging model found in animal behavioral ecology. Through the application of the Harvest Index, farmers can effectively strategize their cultivation efforts, improving crop yield and economic return, while contributing to sustainable agriculture.

3	yoana	angelova	Lesley Campbell	Let There Be Light! Exploring Whether Exposing Plants to Light at Night Can Increase Productivity Citation: Yoana Angelova* and Simran Kaur*, S. Sbrizzi, A. Bazangeya, S.K.P Druif, H. Almohimed, L.G. Campbell *Co-First Authors.	To the untrained eye, the life of a plant can seem rather uneventful, however, beneath the sessile exterior is a sea of complexity: these organisms respond to stimuli using hormones, carry electrical impulses, and have circadian rhythms just like us. This experiment hones in on the circadian rhythm aspect–by manipulating the day and night cycles of raspberry plants, we aim to optimize their ability to produce fruit, leading to an earlier and larger harvest yield, resulting in a lower carbon footprint for agriculture. Similar studies have suggested that by exposing plants to light at night, they are able to increase their efficiency and productivity due to the change in circadian rhythms. Our experiment compares raspberries grown under 18 hours of light to raspberries grown under similar conditions but with a 3 hour light interruption at night by measuring plant floral development. Preliminary results will be presented at the conference.
4	Kenneth Gabriel	Antenor	Dr. Mojca Mattiazzi Usaj	Analyzing the effect of replicative ageing on the dynamics of clathrin-mediated endocytosis	Clathrin-mediated endocytosis (CME) facilitates cellular uptake of nutrients, membrane proteins, and other molecules in eukaryotes. It plays a crucial role in several biological processes, as well as in disease pathogenesis. While the genetic regulation of CME has been studied extensively, less is known on how non-genetic factors, such as cellular ageing, affect its dynamics. In this project, we aim to determine the mechanistic relationship between replicative ageing and CME dynamics in the model organism budding yeast. We used live-cell fluorescence microscopy to analyze the age-dependent recruitment and colocalization dynamics of CME modules, and to evaluate the effect of cellular age on cargo uptake. Next, we employed high-content screening to extract quantitative data, such as abundance and cellular distribution of CME proteins, for young and old cells. Overall, these results will help us understand how cellular ageing impacts CME and other related bioprocesses at the molecular level.

5	Angie	Awadallah	Dr. Dustin Little	Tyrosine phosphorylation as a post-translational regulatory mechanism of O-antigen biosynthesis	Enterohemorrhagic Escherichia coli O157:H7 (EHEC O157:H7) is a significant gastrointestinal pathogen transmitted primarily through the oral-fecal route. O-antigen, a core component of the outer membrane lipopolysaccharide (LPS), is essential for the successful colonization of the host by providing a variety of functions, such as defense against antimicrobial peptides and masking of host innate immune cell targets. The study characterizes tyrosine phosphorylation as a post-translational regulatory mechanism for the biosynthesis of O-antigen, an essential component of a fully functional LPS molecule. Utilizing a combination of genetics, enzymatics, and biochemistry, the phosphorylation status of PerA has been demonstrated to have an effect on the O-antigen banding pattern, representative of a change in EHEC O-antigen chain length. The results indicate reduced phosphorylation levels in PerA variants, suggesting a potential regulatory role in LPS biosynthesis. Ongoing investigations aim to identify the kinase-phosphatase pair responsible for PerA phosphorylation and elucidate the effects of PerA mutations on EHEC pathogenicity. This research provides valuable insights into the molecular mechanisms underlying EHEC pathogenesis and offers a foundation for the development of targeted prevention and control strategies.
6	Anna	Bazangeya	Dr. Lesley Campbell	Sweet Success: Maximizing Fruit Productivity of Red Raspberries (Rubus Idaeus) Grown in Indoor Hydroponics	Canada produces a large amount and a wide variety of fruits and vegetables however, Canada’s short growing season and reliance on fresh produce imports increases food system vulnerability. Using controlled indoor agriculture systems as a means of food production presents an opportunity for sustainable, year-round growth! Raspberries have not been extensively studied in controlled, indoor hydroponic systems. To determine the optimal growing conditions of raspberries in these systems I grew raspberries at three temperatures and fertilizer treatment combinations. Raspberries grown at 21°C were significantly larger than berries grown at 23°C and 25°C, respectively. Additionally, heavier fruits were produced earlier in the growing season and weight generally decreased through time. Moreover, both time and temperature significantly influenced fruit biomass such that plants growing in August at 21°C produced the largest fruit. While implementing this optimal recipe, future work should focus on optimizing organic fertilizers currently being studied in the Campbell lab.

7	Sarah	Birstonas	Dr. Dustin J. Little	Regulation of Effector Secretion by the Type III Secretion System Chaperone CesT	Enteropathogenic Escherichia coli (EPEC) is a human intestinal pathogen that infects the small intestine. EPEC utilizes the type III secretion system (T3SS) to deliver effector proteins into host cells during infection. CesT is a chaperone protein that is required for secretion of many T3SS effectors. Moreover, CesT controls the release of its cognate effectors in a hierarchal manner. We hypothesize that CesT controls secretion of effectors by differentially recognizing the chaperone binding domains (CBDs) of each effector. Thus, to test our hypothesis we sought to characterize other T3SS effectors that require CesT for secretion, such as EspJ. We have shown that EspJ directly interacts with CesT at a single N-terminal CBD, and we are in the process of solving the crystal structure of this interaction. Additionally, we have conducted real-time host cell translocation assays to monitor the efficiency of various CBDs. This work will allow for a deeper understanding of the mechanisms that control effector secretion dynamics.
8	Clive	Boateng Ameyaw	Dr. Marc Adler	Meso-Arylated Porphyrin Silanes: Substituent Effects and Axial Reactivity on Silicon Center	Porphyrins are tetrapyrrole macrocycles that form metalloporphyrins by encapsulating various metal ions (i.e., heme). Transition metal porphyrins have been greatly studied, whilst studies on Group 14 metalloporphyrins have been sparse, including hexacoordinated silicon (IV) porphyrins or porphyrin silanes, despite silicon's high abundance. These porphyrins are of interest due to their robust aromatic structure and potential for modification through peripheral substituents and axial substitutions. These modifications alter their properties, such as their solubility and planarity. However, to date, the mechanism and effect of these changes to silicon are not well-defined. Thus, our research aims to determine the mechanism and distribution of electron density on the central silicon atom as a function of the macrocyclic peripheral groups, influence of the axial leaving group and nucleophilic ligand, and the effect of solvent polarity on axial substitution. Ultimately, these influencing effects are fundamental to developing new porphyrin-based materials with customizable chemical and physical properties.

9	Anastasiia	Bondarchuk	Darius Rackus	An Electrochemical Biosensor for (S)-Reticuline	(S)-reticuline serves as a vital intermediate in the pathways of benzylisoquinoline alkaloids, which are precursors for many therapeutic compounds. Strains of yeast have been engineered to produce this high-value compound from cheap starting materials (i.e., glucose), yet these pathways are not yet optimized. High-throughput screening of many combinations of experimental conditions is needed and will require sensitive, non-destructive analysis. Electrochemical sensors offer real-time quantification of (S)-reticuline and are compatible with microfluidic screening platforms. Here, we present efforts towards developing an electrochemical biosensor for (S)-reticuline based on reticuline oxidase. The biosensor had a linear performance over 6.75×10-5 and 27.0×10-5 mM and a limit of detection of 0.0716mM. To improve the sensitivity of the biosensor, we explored modifying the electrode with CuO nanoparticles. Synthesis and characterization of the CuO particles is described. Overall, we demonstrate this proof-of-concept which could be used for real-time monitoring of (S)-reticuline synthesis.
10	Liam	Brennan	Dr. Daniel Foucher	Alkyl Phosphonate Anchored Phosphoniums and Sulfonamides to Combat Microbial Contamination on Surfaces	Nosocomial infections are a class of infectious diseases that arise upon a patients admittance to a hospital or other clinical setting. From 2012 to 2013 alone, treating Clostridioides difficile cost the Canadian healthcare system $281 million. To address this threat, a series of phosphonate anchored quaternary sulfonamide and phosphonium antimicrobials have been synthesized, characterized and coated onto textile surfaces (cotton t-shirt, organic cotton). These coatings have been achieved via the thermal curing of samples.
11	Rachele	Carafa	Daniel Foucher and Guerino Sacripante	The Functionalization of Lignin Products for Sustainable Resins	Lignin, a waste product in the pulp and paper processing of cellulosic fibers, is comprised of a partial aromatic structure. Modified lignin materials with good mechanical and thermal properties can be repurposed for products made from renewable sources. Lignin can also be depolymerized through fast pyrolysis into phenolic by-products as monomer precursors for further functionalization and polymerization. The main objective of our research is to make sustainable resins from these lignin by-products, particularly polyurethanes as they are some of the most prevalent polymers that can be made from bio-based materials. The first step towards this goal is to convert the lignin by-products into diols, which was done by reacting various lignin by-products with either glycerol carbonate or ethylene carbonate. Thermoplastic polyurethanes were then synthesized by reacting the diols with one of two different diisocyanates (one petroleum-based, one bio-based) to compare their thermal and chemical properties.

12	Jayde	Casimir-Powell	Costin Antonescu, Michael Sugiyama	The Role of Tetraspanins in EGFR confinement and Signalling	Triple Negative Breast Cancer (TNBC) is the most difficult form of breast cancer to treat due to a lack of druggable targets. TNBC cells often overexpress Epidermal Growth Factor Receptor (EGFR) and this aberrant EGFR signalling can lead to tumor growth and metastasis through the activation of several proliferation and migratory signalling pathways, such as PI3K/Akt and RAS/ERK.. EGFR is activated at the plasma membrane, where its residence in distinct nanodomains regulates ligand binding and signalling. One key plasma membrane nanodomain known to be involved in cell signalling and mobility are tetraspanin nanodomains. Currently, there is a lack of mechanistic insight into how tetraspanin nanodomains regulate EGFR signalling or whether altered EGFR/tetraspanin engagement contributes to EGFR-targeted therapeutic resistance. We recently uncovered that CD81 is critical for regulation of ligand binding, which precedes EGFR activation and signaling, a phenomenon we termed EGFR 'signal licensing'; however, the molecular mechanism of the tetraspanin-dependent regulation of EGFR signal licensing remains poorly understood. NRP-1, a protein which may interact with both EGFR and CD81 is a novel candidate, as previous studies have identified it as a putative EGFR-regulating protein. The current study examines the functional role of tetraspanins and NRP-1 in EGFR signalling in both non-cancerous and TNBC cells, and how this relationship changes upon the development of EGFR tyrosine kinase inhibitor (TKI) resistance. We hypothesize that tetraspanins and NRP-1 uniquely interact with EGFR to mediate signal licensing, and that this regulatory phenomenon is altered upon the development of resistance to EGFR-targeted TKI therapies. To answer these questions, we used automated imaging of cell populations to measure cell proliferation following
13	William	Chen	Darius Rackus and Roxana Suehring	Microfluidic Separation of Microplastics and Interfacing with Laser Direct Infrared (LDIR) Spectroscopy	Microplastics have been an emerging issue in wildlife and humans, however sampling and characterization times are tedious and inefficient for marine environments. Herein, we develop microfluidic platforms for the rapid separation of reference microplastics that is integrated with laser directed infrared spectroscopy (LDIR) for rapid identification ranging from 10-50 µm. Two types of microfluidic platforms based on deterministic lateral displacement and pinch flow fractionation are used for their separation, where sorted microplastics are collected at reservoirs enabling quick identification using LDIR and placed into a spectral library. As microplastics comprise of varying sizes, shapes, and compositions, we developed microplastics standards that better reflect the complexity of aquatic microplastics contamination and evaluate our microfluidic platforms for separation and recovery efficiency.

14	Rahmi	Chowdhury	Roxana Suehring	ORGANOPHOSPHATE ESTERS IN 3 ARCTIC SEABIRD EGG SPECIES IN THE CANADIAN ARCTIC	Organophosphate Esters (OPEs), arising from anthropogenic emissions, exhibit mutagenic, carcinogenic, and neurotoxic properties. OPEs have been detected in Arctic environments, in Arctic seabirds and possibly in seabird eggs, indicating their persistence and potential for long-range transport. One mode to explain the possible presence is organism-enabled transport. The idea being if seabirds could ingest and absorb OPEs, could they pass them on to their eggs? This study analyzed 35 OPEs in the eggs of three Arctic seabird species (Common Eider, Great Black-backed Gull, Black Guillemots) from the Canadian Arctic using HPLC-QToF-MS. Results showed 29/30 OPEs were detected. Mean concentration across all species for the 30 native OPEs were 2.7 ± 2.1x 102 [ng/g ww]. Most commonly detected OPE was Tris (3-tert-butylphenyl) phosphate (T3tBPP) and the Bis(2,4-diisopropylphenyl) phenyl phosphate (B24DIPPPP) family of OPEs. The highest OPE by mean concentration was Tris(2-butoxyethyl) phosphate (TBEP) with a concentration of 2.8 x102 [ng/g ww].
15	Prabha	Chuphal	Dr. Aidan Brown	Impact of mitochondrial dynamics on spatial organization of proteins	Mitochondria form highly dynamic networks and maintain their morphology via continuous fission into distinct mitochondria and fusion into connected mitochondria. By adjusting the levels of fission and fusion, mitochondria can modify their network structure to be either more or less connected. Mitochondria fission and fusion dynamics are thought to be important to maintaining mitochondrial health and function. The functional role of mitochondria varies from cell to cell depending on the cell types and different cell conditions, which often manifests as corresponding variation in mitochondrial connectivity. Mitochondrial shapes and dynamics are also finely tuned by fission and fusion processes. The connected network of mitochondria allows proteins to be shared between them and directly coupled to respond to cellular needs and the metabolic state of a cell. In order to understand the complex dynamics of mitochondrial networks and proteins spread throughout these networks, we have developed a quantitative model of mitochondrial fission and fusion dynamics, as well as protein spread through the network. Using the Gillespie algorithm, we stochastically simulate the model to explore how variation in fission and fusion impact the protein diffusivity and search time in the network.

16	Eleanor	Cloves	Antonescu, Karshafian, & Botelho	Investigation into the Effects of Ultrasound and Microbubbles on Triple Negative Breast Cancer Mitochondrial Morphology	Triple negative breast cancer (TNBC) occurs in approximately 10-15% of all breast cancer cases and is particularly difficult to treat. Ultrasound in combination with microbubbles (USMB) is a promising approach for the development of more effective therapies for TNBC and other solid tumours. USMB has important biological effects such as sonoporation, improved fluid permeation, and drug delivery. In the MDA-MB-231 TNBC cell line, USMB treatment alone results in death of 30-50% of the cell population and triggers metabolic stress due to sonoporation and leakage of cytoplasmic material. Thus, we hypothesize that mitochondria in MDA-MB-231 cells exposed to USMB may exhibit significant changes as an attempt for cells to adapt to this stress. We observed that USMB seems to affect mitochondrial morphology and their distribution within cells. Alterations in mitochondrial morphology and metabolism may occur in cells that survive USMB, and targeting mitochondrial function or metabolism alongside USMB could be a combined strategy for the development of improved cancer therapies.
17	Emma	Dennis	Dr. Bryan Koivisto	The implementation of redox-stable bis-triphenylamine dyes in electrospun polymers as a light-harvesting material in hybrid organic/dye-sensitized solar cells	Interest in organic photovoltaic materials has grown in recent years owing to their tunability, integrability with existing structures and wide elemental availability. However, the full potential of next generation solar cells; organic solar cells (OSCs) and dye-sensitized solar cells (DSSCs) has not yet been realized. One of the main issues effecting efficiencies in OSCs is exciton dissociation; this can be improved upon by increasing the surface area between active area and electron transport/hole transport materials. Our research looks at the design of bis-triphenylamine derivatives and their incorporation into coaxially electrospun polymer fibres. By controlling the polymer type and processing conditions as well as the substituents on the triphenylamine rings, we hypothesize that we could align the donor and acceptor ends of the dye controllably at the interface of the core and shell, ultimately providing a boost to exciton dissociation in this hybrid DSSC/OSC architecture.

18	Samuel	Druif	Lesley Campbel	Antisocial seeds: Hemp seeds don't care about their neighbors	Many plant species are involved in both intra and interspecific interactions that influence germination rate through mechanisms such as mutualism or competition for resources. With over 315 million m2 of licensed hemp produced in Canada over the last two years, increasing germination rate of Cannabis sativa is crucial for efficient production of this economically important crop. Hemp seeds were germinated along with increasing sowing densities of hemp and common bean (Phaseolus vulgaris) seeds or leachate from P. vulgaris to determine whether C. sativa responds to chemical signals of neighbouring seeds. Hemp germination date and proportion of germinated seeds was recorded over 14 days. Results found germination rate and frequency was independent of neighbouring seed presence in all species, and there was no significant germination response to leachate. This work demonstrates that germination behavior of C. sativa is independent of social dynamics and might be influenced by other external abiotic conditions.
19	Nicholas	Duong	Aidan Brown	Modelling EGF Receptor Activation and Confinement on the Cell Membrane	The EGF receptor is a central regulator of cell physiology and its activity can drive cancer tumour progression. While EGFR signaling is a longstanding and active research area, a comprehensive understanding of how various processes contribute to EGF signaling remains elusive. Recent work by collaborators, the group of Dr. Costin Antonescu, has demonstrated that EGF receptors are likely to be activated when confined to tetraspanin-nanodomains on the cell membrane. The goal of this project is to build on the recent experimental results (Antonescu) and the computational modeling results (Brown). This project will describe how tetraspanin nanodomain activation of EGFR controls the concentration-dependent response to EGF ligands, the speed at which signals are propagated through the EGFR signaling pathways, and how activation via nanodomains affects the response capacity for future stimulation changes. This work will demonstrate that EGF receptor visits to tetraspanin-nanodomains are essential to understanding EGF signaling behaviour.

20	Shahnaz	Elihaei	Dr. Roxana Suehring	CHY 434, Investigation of Heavy Metals in Rice	A two-week intensive course Supervised by Dr. Roxana Suehring in analytical chemistry, CHY 434, was completed during the period of May 01-11, 2023. The purpose of this research was to investigate the presence of heavy metals in rice and to determine the food safety, specifically rice, in Canada and to determine if it complies with the regulation imposed by the government. The research mainly focused on the levels of arsenic in rice but also examined the presence of other trace metals such as copper, lead, and cadmium. Based on this research, it was found that the samples under investigation agreed with the Canada regulation.
21	Lila	Elliott	Dr. Roxana Sühring	An Evaluation of Toronto's Wastewater Treatment at Removing Polybrominated Diphenyl Ethers and Organophosphate Esters in the Don Valley River	Polybrominated diphenyl ethers (PBDEs) and organophosphate esters (OPEs) are widely used as flame retardants. Both are linked to environmental and health concerns, but OPEs remain unregulated. This study aims to determine how effective Toronto's wastewater treatment is at removing PBDEs and OPEs. Water and sediment samples were taken from three locations along the Don Valley River near the North Toronto Wastewater Treatment Plant. After preparation, samples were analyzed using GC-MS with selected ion monitoring (SIM). PBDE 28 and PBDE 85 were found at 4.25 ng/g and 14.9 ng/g of wet sediment before treatment; these concentrations decreased by 120%, and 104% after treatment. The concentration of PBDE 85 remained above regulation after treatment. Three types of OPE's (TCPP, TEHP, and TPP) were found at concentrations of 51.8 ng/mL, 171.7 ng/mL, and 3.94 ng/mL before treatment and decreased by 84%, 134%, and 93% after treatment.

22	Thomas	Esmond	Dr. Dustin Little	Tyrosine-Phosphorylation as a regulatory mechanism of O-antigen biosynthesis in gram-negative bacteria	Lipopolysaccharide (LPS plays an important role in bacterial physiology and survival by providing the outer membrane of Gram-negative bacteria with structural integrity, allowing the bacteria to withstand attack from antimicrobial agents, and withstanding environment perturbations. Proteins involved in the production of O-antigen of enterohaemorrhagic Escherichia coli (EHEC) are targets for tyrosine phosphorylation, however, the mechanism by which tyrosine phosphorylation regulates LPS biosynthesis and export in EHEC is completely unexplored. PerA is a key enzyme in the GDP-N-acetyl-D-perosamine biosynthetic pathway, which is a sugar that is part of the O-antigen repeat unit of EHEC LPS. Thus, our guiding hypothesis is that tyrosine phosphorylation post-translationally regulates the enzymatic activity of PerA, thereby modulating LPS composition by altering O-antigen biosynthesis. Using a combination of genetics, enzymology, and biochemistry, we have shown that PerA is phosphorylated at amino acid Y7 and Y218, and that when this site cannot be phosphorylated LPS production is upregulated. This work contributes to the understanding of how bacteria regulate surface polysaccharide production in response to changing environmental or host colonization.
23	Josh	Ferguson	Roberto Botelho	Adaptor protein complexes are involved in phagosome maturation and resolution.	Phagocytosis is a dynamic process characterized by the engulfment and destruction of particulate matter, which is carried out in three distinct stages: phagocytic uptake, phagosome maturation, and phagosome resolution. The first two stages have been thoroughly investigated, however, little is known about the cellular mechanisms underlying phagosome resolution. For decades, the assumed model for phagosome resolution was that digested particles were excreted from cells. Recent research has supplanted this model, revealing that phagosome resolution is the result of multiple fission events that culminate in the complete recycling of phagosomes. Our lab has demonstrated the involvement of clathrin in phagosome resolution. Given this discovery, we aim to investigate the role of adaptor proteins in clathrin recruitment during phagosome resolution. Using a variety of methods including siRNA knockdowns, immunoprecipitation, and proximity ligation assays, we are currently investigating whether the adaptor proteins AP-1, AP-2, and AP-3, mediate the recruitment of clathrin to phagolysosomes during phagosome resolution.

24	Brigida	Fernandes	Dr. Sacripante, Dr. Foucher	Preparation and characterization of diols from aldehyde-containing lignin derived monomers	Lignin, a waste product of the paper industry, has potential as a renewable source for the preparation of biobased polymers. This complex macromolecule is characterized by its aromaticity and its ester and carbon-carbon linkages. Lignin can be broken down into p-hydroxyphenyl (H), guaiacyl (G) and syringyl (S) type monomeric subunits, which can be converted to diols through a one-pot synthesis with glycerol-1,2-carbonate and potassium carbonate. From there, the diol can be polymerized to form polymers such as polyesters, polyurethanes, etc. Vanillin (G type) is known to self-polymerize using the one-pot synthesis method due to the presence of the aldehyde functional group. This raises the question if other lignin derived monomers containing the aldehyde functionality will self-polymerize
25	Julien	Gagnon	Stefania Impellizzeri	Photochrome-Encapsulated Metal Organic Framework for Reversible Fluorescence Photoswitching	Photochromic diarylethenes are promising candidates for applications in molecular memory systems, optical recording, sensing and bioimaging. Photochromic compounds switch under light irradiation reversibly between isomers with distinct absorption spectra, typically from colorless to a visible color using ultraviolet light and back to colorless under visible light. We sought to determine if diarylethenes could be efficiently encapsulated in a metal-organic framework (MOF) to create a novel nanocomposite material with increased photostability and ability to switch at the solid state. The zeolitic imidazolate framework ZIF-8 was chosen as the host MOF and the photochromic 1,2-bis(2-methyl-1-benzothiophen-3-yl)perfluorocyclopentene (BTF6) and its sulfone derivative (BTFO4) were selected as the guest molecules. BTF6 and BTFO4 undergo isomerization under UV light at 254 nm and revert back
26	Kseniia	Golik	Bryan Koivisto	Preparation of Coaxial Starch and Polycaprolactone Electrospun Fibres for Controlled Fluorescent Agent Delivery	This paper explored the use of electrospinning to produce nanofibres from biodegradable polymers for the purpose of controlled agent release. The polymers of interest, starch and polycaprolactone (PCL) were electrospun with boron dipyrromethene (BODIPY) and rhodamine as fluorescent proxy agents embedded in a core-shell and monoaxial structure. The produced combinations had unique hydrophobicity/hydrophilicity profiles that could affect the release of agents. For the first time in literature, evidence of starch@PCL fibres was observed using spinning disk confocal microscopy (SDCM). Monoaxial samples of starch and PCL were analyzed for agent release of BODIPY and rhodamine. The obtained release profiles showed that under favourable solubility conditions for the agent, a hydrophilic agent incorporated in hydrophobic fibre exhibits a faster release rate compared to a hydrophilic agent incorporated in a hydrophilic fibre. Breakthroughs in this area could affect numerous industries where the controlled release of a small molecule is desired, including, medical, agricultural, and cosmetics.

27	Kate	Henderson	Dr. Andrew Laursen and Dr. Vadim Bostan	Measuring Redox Dependent Phosphorous Fluxes in Freshwater Microcosms in the Presence of an Electromagnetic Field	Internal loading of phosphorous from sediments back into the water column associated with hypoxia plays a key role in eutrophication. Oxygenation systems prevent internal loading of phosphorous from sediments and improve overall water quality. Low strength electromagnetic field (EMF) transducers present a cheaper, lower maintenance alternative to existing water oxygenation methods used to reduce hypoxia and limit phosphorous loading from sediments. A ten-week field study comparing nutrient cycling and water-sediment conditions across EMF treated and non-EMF treated microcosms was conducted. Water samples were analyzed using standard methods for phosphorous, nitrogen and carbon fractions. Additionally, an eight-week laboratory study was conducted comparing phosphorous retention in spiked sediments across EMF treated and non-EMF treated microcosms. Within the scope of this study, understanding how EMF may be used as a more favourable oxygenation method to mitigate hypoxia and internal phosphorous loading may provide a promising pathway towards eutrophication remediation.
28	Osemudiamen	Ibazebo	Dr. Costin Antonescu & Dr. Stefania Impellizzeri	Silica Nanoparticles as a Means of Resolving a Common Endocytic Mechanism	Clathrin-Mediated Endocytosis (CME) is the major mechanism through which mammalian cells internalize particles. Resolving the different factors that influence CME will better inform this essential eukaryotic mechanism and provide insight into host-pathogen interactions. CME involves >50 accessory proteins, EAPs which, upon cell-surface recognition , result in the formation of clathrin-coated pits, CCPs. The mechanism behind efficient assembly into CCPs remains a mystery. The inner diameter of a typical CCP ranges from 30 to 50 nm; its ability to internalize larger particles, implies dynamic adaptation of CME. This work seeks to determine how CME adapts to different particle sizes, as well as how EAPs might be involved in the internalization of larger cargo. We designed a novel receptor-ligand model that is based on functionalized silica nanoparticles (SiNP); allowing for the systematic manipulation of different parameters that influence CME. This project applies elements of cell and molecular biology and materials and organic chemistry.

29	Nicala	Jenkins	Dr. Roberto Botelho	PIKfyve inhibition causes significant distortion to the endoplasmic reticulum morphology and dynamics.	PIKfyve is a lipid kinase that phosphorylates PI(3)P into PI(3,5)P2 on endo-lysosomes, modulating their morphology, flow of membrane trafficking, and metabolic response. The most visually striking phenotype of PIKfyve inhibition is the enlargement of endo-lysosomes due to coalescence, stemming from reduced fission. Given the enlarged endo-lysosomes, we postulated that this may disturb the endoplasmic reticulum (ER) which presents an extensive and fine reticulate organization. We also considered this as the ER and lysosomes form extensive contact sites. Our results suggest that in fact PIKfyve inhibition reduces the motility of the ER network and distorts its organization. To understand the mechanism behind PIKfyve inhibition, we hypothesize that PIKfyve activity may modulate ER-lysosome contact sites. We also wondered if lysosome coalescence during PIKfyve inhibition may be due to failed ER contacts, which were previously shown to mediate endosome fission. Overall, our work has established that PIKfyve inhibition significantly disturbs ER properties and we are working to understand the mechanism and functional implications.
30	Essam	Karam	Dr. Sarah Sabatinos	Expression levels of the ATR kinase affect drug sensitivity of cancer cells.	Gemcitabine is a drug given to many pancreatic cancer patients which inhibits DNA synthesis and kills cancer cells. Ataxia telangiectasia and Rad3-related kinase (ATR) is a checkpoint kinase that responds to DNA replication stress. Traditionally, ATR is thought of as solely a tumour suppressor. Our lab and others found that decreased ATR increases cell sensitivity to gemcitabine. However, a small number of cells survive and become resistant to gemcitabine, enabling them to survive future exposures to the drug. Intriguingly, ATR is often increased in pancreatic cancer, not lost. We hypothesize that increased ATR may enhance the potential to survive replication instability drugs, causing mutations and drug resistance. These negative roles of ATR overexpression are novel and not understood. Our project assesses how levels of expression of the ATR protein affect the development of cancer and the sensitivity of cancer cells to chemotherapeutics.

31	Simran	Kaur	Dr. Lesley G. Campbell	Let There Be Light! Exploring Whether Exposing Plants to Light at Night Can Increase Productivity Citation: Yoana Angelova* and Simran Kaur*, S. Sbrizzi, A. Bazangeya, S.K.P Druif, H. Almohimed, L.G. Campbell *Co-First Authors.	To the untrained eye, the life of a plant can seem rather uneventful, however, beneath the sessile exterior is a sea of complexity: these organisms respond to stimuli using hormones, carry electrical impulses, and have circadian rhythms just like us. This experiment hones in on the circadian rhythm aspect–by manipulating the day and night cycles of raspberry plants, we aim to optimize their ability to produce fruit, leading to an earlier and larger harvest yield, resulting in a lower carbon footprint for agriculture. Similar studies have suggested that by exposing plants to light at night, they are able to increase their efficiency and productivity due to the change in circadian rhythms. Our experiment compares raspberries grown under 18 hours of light to raspberries grown under similar conditions but with a 3 hour light interruption at night by measuring plant floral development. Preliminary results will be presented at the conference.
32	Maëlle	Kefif	Stanley Vasconcelos, Russell Viirre	Design and Synthesis of Novel 7-Azaindole-Based Inhibitors for MRCKβ Kinase	M.L. Kefif, S.N.S. Vasconcelos, V. Ruscetta, T. Seaton, R.D. Viirre, M.F. Olson, M.J. Adler Human CDC42-binding protein kinase MRCKB is a serine/threonine kinase involved in the regulation of actin-myosin cytoskeleton via phosphorylation of myosin light chain-2 (MLC-2), required for the process associated with cancer cell invasion and metastasis. The high degree of homology among the MRCK kinases and their limited structural information becomes a challenge for the development of a potent inhibitor to modulate the MRCKB selectively. Less than a decade ago, BDP9066 was disclosed as being the most potent and selective MRCKB inhibitor to date, with a therapeutic effect on skin cancer, using in vivo models. Despite a promising discovery, BDP9066 demonstrated a relatively rapid clearance due to structural instability in presence of mouse liver microsomes, which is not desired for prolonged treatments. Guided by a structure-activity relationship of MRCKB inhibitor, previously synthesized and molecular docking-aided studies, we explored the design and synthesis of novel 7-azaindoles-based inhibitors for MRCKB to circumvent the current BDP9066 metabolic instability while maintaining target druggability.

33	Armaghan	Khosravi	Dr Stefania Impellizzeri	Synthesis and Characterization of Silver Nanoparticle-decorated Urea Metal-Organic Frameworks	We synthesized two kinds of urea-based organic ligands which, in combination with commercially available pillaring linkers, were used to construct four metal-organic frameworks (MOFs)–namely, TMU18, TMU19, TMU31, and TMU32. The structure and morphology of all MOFs were characterized using Fourier-transform Infrared Spectroscopy (FTIR), Powder X-Ray Diffraction (PXRD), Scanning Electron Microscopy (SEM), and Brunauer-Emmett-Teller (BET). We then attempted the in-situ functionalization of the TMU-series with silver nanoparticles (AgNP) to fabricate novel materials with the potential for heterogenous catalysis, drug delivery, and as antibacterial/antimicrobials. AgNP were prepared using a photochemical method. The metallic nanoparticles were either mixed with pre-formed TMU MOFs or photochemically synthesized in situ in the presence of the 'bare' frameworks. In parallel, we also investigated if the presence of pre-formed AgNP could affect MOFs' crystallization. Future work will focus on exploring the performance of these nanocomposites for catalytic and biomedical applications.
34	Vedaant	Kumar	Dr. Robert Gossage	Aliphatic Addition Synthesis of a Novel Ferrocene-Derived Azole Ligand.	Following its discovery in 1951 by Pauson and Kealy, ferrocene has been applied in a number of industries such as pharmaceutical, aerospace, and biotechnology. Laying the foundation of organometallic chemistry, ferrocene belongs to a class of compounds known as metallocenes. Metallocenes are organometallic compounds where a metal is 'sandwiched' between two organic fragments: in the case of ferrocene, and Fe^{2+} ion is held between two cyclopentadienyl anions. The goal of the Gossage research group is to synthesize novel transition metal complexes from multidentate ligands for potential applications in catalytic transformations and biological roles. Due to the aromatic cyclopentadienyl rings present on ferrocene, traditional aromatic substitution reactions have had success in creating ferrocene analogues of previously synthesized aromatic azole ring-containing ligands. The proposition of this group is to create a novel bidentate or tetradentate ligand using acetylferrocene and an azole molecule.

35	Christele Mariz	Ladores	Dr. Daniel Foucher	Antimicrobial Activity of Self-Assembled Sulfonamide Quaternary Ammonium Organophosphonates on Cotton & Titanium	Contaminated inanimate surfaces can be a source of transmission for weeks, posing threats of hospital-acquired infections (HAI) and antimicrobial resistance (AMR) to the health of Canadians. This project explores the application of synthesized sulfonamide-based quaternary ammonium organophosphonates that increase in aromatic steric bulk (phenyl, mesityl, naphthyl, and dansyl) bonded to cotton and titanium. Surface-treated samples were characterized by UV-VIS using anionic dye, fluorescein sodium salt, which produced a surface charge at approximately 10 C • nm−2. Microbiological testing was performed on triplicates of treated and control samples using the developed Large Droplet Inoculum Protocol at solid/air interfaces. All treated samples showed partial reduction of viable Glutamicibacter soli and Pseudomonas aeruginosa after 5 and 15 hours of contact time. Results show optimistic efforts to prevent HAI and AMR as it introduces rival concepts to known anti-infective surface coatings on fabrics and metals in the commercial market.
36	Kathy	Ly	Dr. Darius Rackus	Electrochemical detection for droplet microfluidics	Microfluidic technologies are paving the way for quicker biological and chemical analysis, as it allows for smaller reagent volumes, multiplexed measurements, and high-throughput analyses. Most microfluidic devices are made from polydimethylsiloxane (PDMS) and electrochemical sensors can be miniaturized and integrated with these devices to make chemical measurements. We fabricated inexpensive electrodes by doping PDMS with carbon black to form conductive-PDMS (C-PDMS). These electrodes were formed by applying C-PDMS paste to PDMS-based moulds having electrode patterns. Moulds were fabricated using standard photolithography and replica moulding techniques. C-PDMS was prepared by dispersing carbon black in isopropyl alcohol, then mixing with PDMS pre-polymer and a cross-linking agent. Final carbon compositions were 12-20% (w/w). Electrochemical performance was tested using cyclic voltammetry (CV) of Ru(II)/(III) oxidation/reduction, in which 20% (w/w) C-PDMS electrodes showed reproducible CVs with high Faradaic currents and followed Randles-Sevcik behaviour. Electrodes were integrated with a droplet generator and amperometry was used to measure analyte concentrations in single droplets. Moving forwards, we will use this device to measure alkaline phosphatase (ALP) activity through the use of the substrate p-aminophenol phosphate. Hydrolysis by ALP produces p-aminophenol, which can then be detected electrochemically.

37	Senthuran	Mahendradeva	Dr. Dustin Little	Elucidating the structure of the CesT-EspJ complex and its implications in type III secretion system effector hierarchy.	Enterohemorrhagic Escherichia coli (EHEC) and enteropathogenic E. coli (EPEC) require the action of a type III secretion system (T3SS) during infection. The T3SS is a needle-like protein injectisome delivering effector proteins into host cells that manipulate various host signalling pathways to promote infection. The T3SS chaperone CesT mediates the release of many T3SS effectors into the host cell, yet the underlying hierarchical mechanism behind this remains unclear. In this study, we investigated the functional and structural basis of CesT binding to EspJ, one of the T3SS effectors released by CesT. By utilizing affinity-pulldown chromatography and crystallographic methods, we delineated the minimum CesT binding region on EspJ to residues 19-82 and determined a partial CesT-EspJ crystal structure to ~3 Å. Our findings shed new light on the regulation of EspJ secretion by CesT, which may pave the way for developing antimicrobial drugs to treat T3SS-dependent EPEC/EHEC infections.
38	Mélanie	Mansat	Dr Botelho	Adaptor protein complexes involvement in phagosome maturation and resolution	Macrophages are a diverse group of immune cells that play a major role in eliminating dangerous particles. They do this by recognizing, binding to, and then engulfing these particles through phagocytosis. This multistep process starts with the uptake of the particle and phagosome formation, and phagosomes subsequently mature into phagolysosomes wherein the particle is digested. Phagosomes then fragment to recycle membranes and reform lysosomes, ensuring the macrophages can undergo additional rounds of phagosome maturation. This final step of phagocytosis is called phagosome resolution. Even if the first steps have been extensively studied and are now well understood, the mechanisms underlying phagosome resolution remain unclear. Recently, we demonstrated that clathrin, a protein usually characterized by its role in endocytosis at the plasma membrane, is involved in phagosome fragmentation and lysosome reformation. This raised the hypothesis that other membrane fission proteins such as the adaptor proteins (AP) complexes could be involved in the recruitment of clathrin on phagosomes and phagosome resolution. Using transient genetic manipulation in macrophages cell lines to knock-down AP complexes, confocal microscopy and biochemistry, our data revealed a role of the different AP complexes in phagocytosis, from the uptake to phagosome resolution. AP-1 silencing impacted phagosome maturation whereas AP-2 and AP-3 silencing reduced the phagocytic uptake. Both AP-2 and AP-3 silencing influence phagosome resolution, but AP-2 had a stronger effect on clathrin- dependent resolution. We are currently pursuing the hypothesis of the involvement of a lysosomal protein in the recruitment of AP-2 and subsequently clathrin to induce phagosome fragmentation. We will present here our last results concerning the understanding of the mechanism behind

39	Aaron	McQuaid	Dr. Roxana Suehring	Organic Contaminants in the Northern Arctic: Concentrations and Fates	Organic contaminants are critically important issue to be studied for Arctic communities. Currently, there are limited local sources that are sources of these contaminants and are unable to explain the quantity found in different Arctic environments. Current research is building off past data found in the Emerging Contaminants Lab where Arctic seabirds were shown to excrete contaminants near their colonies into Arctic communities. This research will solve a scientific gap regarding concentrations of organic contaminants in Arctic waters in relation to previous studies showing Arctic seabirds as source vectors for these contaminants. Determining if these contaminants are found in surface waters will be an important step in determining the ubiquitous nature of these contaminants in the Arctic. With a focus on Organophosphate Esters (OPEs) (A flame retardant and plasticizer) and perfluoroalkyl substances (PFAS) (food packaging materials and oil repellent) a key issue to these areas.
40	Ayshin	Mehrabi	Costin Antonescu	Protocol for accurate and unbiased analysis of cell migration dynamics: Unveiling the role of AMPK	Many cancer cells adapt their metabolic activity to survive and proliferate in environments with inadequate levels of nutrients and oxygen. To sense and respond to nutrient cues, cells rely on a protein called AMP-activated protein kinase (AMPK) that functions as a “fuel gauge”. Once activated, AMPK regulates numerous processes including cell migration, in part by regulating membrane traffic of β1-integrin. Integrin-dependent cell migration is energy consuming and it involves regulation of β1-integrin internalization by clathrin-mediated endocytosis (CME). Current methods of cell migration analysis, such as wound healing assays, are limited in their ability to distinguish between cell proliferation and migration therefore, there is a need for an unbiased approach. To address this, we developed an automated cell migration analysis protocol using TrackMate coupled to a cell permeable DNA stain to track the movement of cell nuclei to assess migration parameters. We assessed the impact of AMPK activation and a novel signalling pathway to ensure the importance of certain proteins in the AMPK-dependent regulation of cell migration. We believe that this technique has the possibility to advance our knowledge in the field of cancer metastasis and contribute to the development of novel therapeutic techniques.

41	Jocelyne	Mendez-Guzman	Dustin Little	Exploring the Role of CesT Phosphorylation in Modulating Effector Secretion Dynamics of the Type III Secretion System in Enteropathogenic E. coli	Many Gram-negative bacteria utilize a self-made syringe called the type III secretion system to deliver toxin proteins (effectors) into host cells. These effectors manipulate cell signalling to increase bacterial attachment and colonization. Certain strains of Escherichia coli have a type III secretion system comprising 20-40 proteins and secreting up to 50 effectors. However, the mechanism by which the system recognizes, transports, and manages the secretion of multiple effectors remains poorly understood. Recent evidence indicates that tyrosine phosphorylation targets E. coli's type III secretion system protein CesT, but the effect on its function is unknown. Because CesT transports proteins to the system and chaperones the release of up to ten effectors, our study investigates the impact of CesT phosphorylation on effector secretion. Through GFP-reporter assays comparing WT and kinase deletion strains, we identify potential CesT kinases and observed their influence on effector secretion. Additionally, Surface Plasmon Resonance was used to explore how CesT phosphorylation affects its interaction with CsrA - a protein involved in effector secretion.
42	Eshan	Merali	Dr. Aidan Brown	Modeling selection mechanisms for quality control of mitochondrial DNA	Mitochondrial DNA, known as mtDNA, have many copies per cell and limited repair mechanisms. However, observed mutation levels remain low, suggesting that there exist quality control mechanisms to reduce mutations. Recent work has shown that during the quality control window mitochondria fragment from a large network structure into smaller mitochondria, isolating mtDNA copies. Primary mitochondrial processes, such as fission, fusion, and mitophagy are thought to be linked to quality control, but the exact mechanisms remain unknown. In this study, we utilize stochastic simulations to investigate different mechanisms that have been proposed to reduce mutant mtDNA levels. We incorporate experimental data predicting the loss of mutant mtDNA over several generations. We find that few mitophagy events are needed to distinguish between mitochondria with wildtype and mutant mtDNA, and that the predicted mutation levels over generations are consistent experimental measurements.

43	John	Mulawka	Dr. Marc Adler	Identification of Peptidic Based Ligands For The Rational Design of Chimeric Inhibitors	Chimeric molecules offer a promising approach in drug design combining components for target selectivity and pharmacological effect. Peptides are desirable for high affinity target selectivity due to high specificity, and low toxicity. Using solid phase peptide synthesis (SPPS) and the split-and-pool procedure, diverse combinatorial libraries may be rapidly generated. Libraries can identify protein-binding ligands through affinity selection, bead picking, and sequencing. High affinity peptide ligands can subsequently be connected to an electrophilic functional moiety enhancing selectivity and binding affinity. This study explores high affinity peptidic protein binders through combinatorial peptide libraries and covalent warheads. Combinatorial libraries included 15 variable natural and non-proteogenic amino acids to increase diversity and potency. Library screening against SARS CoV-2 spike receptor-binding domain (RBD) identified 151 high affinity non-covalent binding peptides. Hit sequences were linked to a non-selective electrophilic covalent moiety to change protein activity. Isolated hit sequences were identified using partial Edman degradation (PED), resynthesized, and characterized by LC/MS.

44	Amin	Nooranikhojasteh	Dr. Michael Olson	Exploration of gene expression changes in cisplatin-resistant high grade serous ovarian cancer.	Ovarian cancer is one of the most dangerous cancers for women, with only 20-30% survival 5 years after diagnosis of late-stage cancer. Late-stage ovarian cancer is particularly problematic due its tendency to spread to important nearby tissues such as intestines, liver and lungs. Surgery is commonly used to remove the majority of the cancerous growths, with additional drug therapy to kill tumour cells that have spread to distant sites. Options for drug treatments are limited, being largely restricted to non-selective toxic compounds such as cisplatin. A major limitation to the efficacy of cisplatin chemotherapy is the development of drug resistance in many patients. In this study, our objective was to analyze patterns of gene expression in drug naïve and cisplatin-resistant High-Grade Serous Ovarian Cancer (HGSC) cell lines.Through differential gene expression analysis, we identified significant patterns of gene expression changes. Pathway analysis revealed enriched biological processes and pathways, consistent with important functional implications of these gene expression changes. Notably, our analysis identified the smooth muscle actin gene ACTA2 as a one of the most profoundly affected gene expression changes. ACTA2 is a component of the actin cytoskeleton, suggesting that changes in cytoskeleton organization could play a contributory role in cisplatin resistance. Western blotting and fluorescence activated cell sorting (FACS) validated the increased expression of ACTA2 protein in cisplatin-resistant cells. We are now conducting experiments to explore the role of ACTA2 in modulating cytoskeletal dynamics

45	Dhruvi	Patel	Imogen Coe and Michael Kolios	Endocytosis of Nanobubbles in BXPC3 Tumor Cells	Nanocarriers show tremendous potential in clinical applications, specifically in aiding with the localization of anti-cancer drugs when coupled with ultrasound. Nanoparticles are generally internalized via the process of endocytosis, but this process has not been exclusively studied with nanobubbles.[2] Endocytosis is the process of internalization of macromolecules and particles from the extracellular space, and can occur in one of two ways.[1] Receptor mediated endocytosis allows for selective uptake via receptors located on the plasma membrane, while fluid-phase endocytosis refers to the uptake of fluid without the use of the receptors.[1,3]Preliminary data regarding the rarely studied shell engineered stable nanobubbles and tumor cells shows that tumor cells uptake the nanobubbles in approximately 10 minutes. The underlying mechanism behind the endocytosis of the nanobubbles is unknown and this study aims to investigate the method of uptake as well as to quantify the duration of the uptake. [1]Cooper GM.(2000) The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates. Endocytosis. https://www.ncbi.nlm.nih.gov/books/NBK9831/ [2]Mazumdar, S., Chitkara, D., & Mittal, A. (2021b). Exploration and insights into the cellular internalization and intracellular fate of amphiphilic polymeric nanocarriers. Acta Pharmaceutica Sinica B, 11(4), 903–924. https://doi.org/10.1016/j.apsb.2021.02.019 [3]Pavelka, M., Roth, J. (2010). Fluid-Phase Endocytosis and Phagocytosis. In: Functional Ultrastructure. Springer, Vienna. https://doi.org/10.1007/978-3-211-99390-3_54
46	Aaliya	Pathan	Dr. Darius Rackus	Working Towards a No-Wash Electrochemical Immunoassay for Free Vitamin D3	Vitamin D3 is an essential steroid hormone that plays a vital role in maintaining good health and has been correlated with the prevention and management of various critical diseases and frequent monitoring in patients is essential for promoting good health. Yet, the current techniques for measuring vitamin D3 have limitations. I aim to develop a wash-less competitive electrochemical immunoassay which measures the free vitamin D3 levels without needing to wash, making it simpler and faster. Using an electrochemical detection method, we observed that an increase in free vitamin D3 concentration led to an increase in current. A calibration curve was generated that indicated we developed a relatively sensitive detection system with an LOD measuring 30ng/mL with a scope for enhancement. We plan to improve the assay sensitivity by maximizing binding of the analyte to the antibody using protein A and/or explore the use of an aptamer to bind to vitamin D. In conclusion, creating this point of care assay displays the potential to advance vitamin D3 testing, aid clinical diagnosis and enhance research on related diseases.

47	Damini	Payidiparty	Dr.Rackus	An Electrochemical Biosensor for (S)-Reticuline.	(S)-reticuline serves as a vital intermediate in the pathways of benzylisoquinoline alkaloids, which are precursors for many therapeutic compounds. Strains of yeast have been engineered to produce this high-value compound from cheap starting materials (i.e., glucose), yet these pathways are not yet optimized. High-throughput screening of many combinations of experimental conditions is needed and will require sensitive, non-destructive analysis. Electrochemical sensors offer real-time quantification of (S)-reticuline and are compatible with microfluidic screening platforms. Here, we present efforts towards developing an electrochemical biosensor for (S)-reticuline based on reticuline oxidase. The biosensor had a linear performance over 6.75×10 -5 and 27.0×10 -5 mM and a limit of detection of 0.0716 mM. To improve the sensitivity of the biosensor, we explored modifying the electrode with CuO nanoparticles. Synthesis and characterization of the CuO particles is described. Overall, we demonstrate this proof-of-concept which could be used for real-time monitoring of (S)-reticuline synthesis.
48	Manon	PERAGUT	Dr Daniel FOUCHE R	development of a new series of quaternary ammonium small molecules	My work involves the development of a new series of quaternary ammonium small molecules built using click chemistry methodology that can be grafted to surfaces, using Azide coupling pairs leading to quaternarized triazine structures, Once sufficient quantities of these materials have been prepared they will be grafted onto textiles or plastics and their antimicrobial properties evaluated using established microbiology in our laboratory.
49	Michelle	Pham	Dr. Lesley Campbell	It's in Your Roots: An Exploration of Nitrogen-Fixing Anabaena on Monstera deliciosa Growth	Anabaena is a type of nitrogen-fixing cyanobacteria that has been proven to be extremely effective in increasing plant fertility and production, more so than synthetic nitrate fertilizers. The objective of the experiment was to determine the effectiveness of the cyanobacteria on smaller-scale plants and in a controlled environment. Monstera (Monstera deliciosa) were used due to their ability to grow quickly which would yield efficient results. By observing what conditions yield the best results, it is believed that this knowledge can be applied to a larger scale, such as Canadian production of various fruits and vegetables. Anabaena was to be cultured to produce a large population to conduct two sets of experiments in the Campbell Lab. The primary would be the application of the Anabaena directly on the hydroponic roots of a set of Monstera. The second experiment was to see propagated Monstera nodes grow directly in Anabaena culture.

50	Clara	Repiquet	Dr Foucher	biobased polymers	Summer project for an internship of 3 months : The main objective of the project is to find alternative ways to convert vanillin and other compounds containing aldehyde groups into a functional diol, which can then be used for polymer synthesis. The target molecules will be synthesized in 2 different ways based on a reduction of an aldehyde group and a substitution.
51	Pierre	Rouanet	Dr. Wylie and Dr. Foucher	DFT Modeling of Organotin(IV) Hypercoordinate Monomers in Solvent with Comparison of Computational and Experimental 119 Sn NMR as a Performance Indicator	Polystannes could find application as novel, cost-effective alternatives to PEDOT:PSS in printed thin film electronics, biomedical devices and quantum wiring. Organotin(IV) monomers would need to be developed into light and moisture resistant polystannanes through added stability provided by hypercoordinate interactions between the Sn(IV) center and ligands containing electron donating groups (N, O, P, S). DFT (Density Functional Theory) was initially applied as a quantum chemical approach to predict the Sn(IV) monomer geometry and the dative/electrostatic effects of the hypercoordinate interaction. Computational methodology was optimized by comparing the predicted geometry and 119Sn NMR shifts to post-synthesis XRD and 119Sn NMR characterization data, respectively. With this methodology it is possible to model and compare a number of pincer ligands allowing for the realization of dual hypercoordinating organotin pincer complexes which can then be converted to dihydride monomers for synthesis of moisture and light resistant polystannanes.
52	Rebecca	Scenna	Dr. Bryan Koivisto	Investigating hydrophobic interactions in coaxially electrospun polystyrene nanofibres	Plastic use and its resulting pollution is growing each and every year around the globe.As a result of the growing concern, solutions are necessary for mitigation and solutions. Non-biodegradable, hydrophobic polymers will be used to create oil and water filtration mats from commonly used plastics. Oil and water filtration mats will be fabricated by the method of electrospinning, a cost-effective and efficient method of creating polymeric microfibre and nanofibre films. With the use of hydrophobic polymers as membrane materials, it is hypothesized that hydrophobic interactions will allow a robust filter that is able to withstand the solvent being filtered through.

53	Breanna	Seto	Marc Adler	Covalent Peptidomimetic Library for the Discovery of COVID Therapeutics	Alpha helices are the most common type of protein secondary structures and modulate protein function. As an example, the binding of ACE2 N-terminal helix to SARS-COV-2 spike RBD which mediates the viral cell entry and infection. As such, mimicking alpha helices is of great importance to achieve selective targeting and high affinity binding to the protein of interest (POI). In this work, we design a library of chimeric α-helix mimetics (oligobenzamides) with a covalent warhead to selectively target the POI and covalently bind to nucleophilic residues in a proximity to the binding motif. To achieve this, first, we synthesize various building blocks based on 4-amino-3-O(alkyl)-benzoic acid scaffolds in a 5-step synthetic route. Second, we will utilize solid phase Fmoc based chemistry to synthesize the oligobenzamide library. The synthesized library will be screened against the POI to identify the hits which will then be resynthesized and subjected to in vitro assays to evaluate their biological function.
54	Nojan	Shishechiha	Dr. Ben Gilbert and Dr. Megan Bontrager	Unveiling Decomposition Factors: Contrasting the Characteristics of an Old Forest and a New Forest	Forest decomposition is the process through which the dead tissues disintegrate and change into more basic organic forms. Numerous factors affect forest decomposition such as soil moisture, biodiversity temperature, pH levels, scavenging rates, and canopy coverage amongst others. The rate of decomposition and its contributing factors are a crucial determinant of the viability of the forest ecosystem as well the survival of the organisms in that region. Current studies have established a difference on the decomposition portfolio of old aged forests compared to newly formed forests however little information is known about the causative factors. This study aims to demonstrate ecosystem elements including canopy coverage, soil moisture, litter height, and species richness to identify the discrepancies between two differently aged forests. We show promising evidence regarding the disparities of the active decomposition cycle in old forests compared to new ones, rendering them more viable for speciation, and organisms life support. This allows us to understand how the decomposition of an organism is related to its ecosystem and what are the effects of that on the growth of the ecosystem itself.

55	Aniela	Singh	Dr. Roxana Suehring	Comparative Analysis of Heavy Metal Concentrations in Tap Water Samples from the Greater Toronto Area (GTA) and the Ganga River, Gangotri Valley, India.	The experiment analyzed heavy metal concentrations of arsenic, cadmium, chromium, nickel, and lead in tap water samples from the Greater Toronto Area (GTA) and the Ganga River in India. Using the standard addition method during sample preparation, Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) measured concentrations of the targeted metals in parts per million (ppm). Varying contamination levels were observed. The mean concentrations in the GTA tap water samples were: arsenic (1.02 x 10-2 ppm), cadmium (2.37 x 10-2 ppm), chromium (1.95 x 10-2 ppm), nickel (1.72 x 10-2 ppm), and lead (5.65 x 10-2 ppm). Cadmium and lead exceeded the Ontario Drinking Water Standards. In contrast, the Ganga River sample had significantly increased contamination levels. Mean concentrations in the river water were: arsenic (9.02 x 10-2 ppm), cadmium (3.62 x 10-3 ppm), chromium (5.42 x 10-2 ppm), nickel (5.34 x 10-2 ppm), and lead (4.61 x 10-2 ppm). Arsenic, nickel, and lead surpassed recommended limits, indicating notable contamination.
56	Esther	Tang	Dustin Little	Characterization of a Putative Bacterial Tyrosine Phosphorylation System in Escherichia coli	Enteropathogenic and Enterohemorrhagic Escherichia coli (EPEC and EHEC) are pathogens involved in gastrointestinal diseases that utilize a key virulence factor, the type 3 secretion system (T3SS), for infection. The T3SS enables bacterial effector proteins to be secreted into host cells, aiding in host cell intoxication and colonization. A key protein involved in effector secretion is the molecular chaperone CesT, which regulates their delivery in a hierarchical manner. Recent evidence suggests that CesT can be tyrosine phosphorylated, and we hypothesize phospho-CesT regulates effector secretion. In this study, in vitro phosphorylation assays on CesT were conducted with two known tyrosine kinases, Etk and Wzc. Purified proteins were monitored for phosphorylation using Western Blot and Phos-Tag gel analysis, showing that Etk and Wzc demonstrate kinase activity on CesT during long incubation periods. Next steps include demonstrating this activity in vivo, and to better understand this potential virulence mechanisms employed by enteric pathogens.

57	Rebecca	Yan	Marc Adler	Simple and Cost-Effective Method for Deuterium Incorporation of Electron-Rich Arenes Using Microwave Chemistry	A common and long-standing method to deuterate compounds, particularly arenes, is through acid-catalyzed hydrogen-deuterium exchange. However, they often employ harsh reaction conditions that can lead to poor functional group tolerances. Given our ongoing interest in organosilicon chemistry, we developed a method using commercially available $SiCl_4$ with D_2O to incorporate deuterium at aromatic proton sites. We found there to be thermal benefits under microwave irradiation @ 120°C that promoted high deuterium incorporation (up to 100%). Using the optimized reaction conditions, a wide substrate scope was carried out on classifications of electron-rich arenes (biomolecules, nucleic bases, pharmaceuticals, proteins, etc.) to test the limitation of this method. Additionally, water-insoluble substrates were explored under perdeuteration using a green co-solvent, heptanes. Achieving selective deuterium incorporation is an area of further research with this method.
58	Dariia	Zadorozhniuk	Dr. Rackus	A microfluidic device for measuring enzyme kinetics by electrochemistry	Enzymes can be engineered through targeted and stochastic approaches to generate more efficient catalysts needed for biomanufacturing processes. Either approach requires screening thousands of possible enzymes for the desired performance, which can require a lot of reagents and time. Miniaturization through microfluidics offers an opportunity to decrease reaction volumes thus reducing reagent consumption and increasing the throughput of screening experiments. Electrochemical sensors can be integrated with microfluidic devices for quantitative measurements. Here, we describe a microfluidic device integrated with a three-electrode setup to measure the kinetics of the enzyme alkaline phosphatase (ALP). ALP hydrolyzes p-aminophenyl phosphate (pAPP) to p-aminophenol, which can be electrochemically measured. ALP and pAPP are mixed on-chip and delivered to the electrodes after an incubation period. We present data characterizing the performance of the device and on-chip measurements of enzyme kinetics. In future, this device could be coupled with droplet microfluidics for high-throughput screening applications.

TALKS				
1	Fatima	Ahmed	Analyzing the Potential of Wastewater Microorganisms to Degrade or Deteriorate Microplastics in the form of Synthetic Microfibers	The most prevalent microplastics contaminating waterways are synthetic microfibers (SMs) released from washing clothing, which are then carried into wastewater treatment plants (WWTPs), and subsequently discharged and accumulated in water bodies. Studies have examined individual microbial strains involved in biodegradation of microplastics, but have yet to examine what mixtures of microbes form biofilms on SMs and potentially degrade them. A WWTP process was simulated using synthetic wastewater with and without a carbon source, and activated sludge as inoculum in flasks containing either cotton or polyester microfibers. SMs retrieved from the flasks were observed microscopically. After 24 days, cotton fibers were not detected, while polyester fibers persisted indicating that cotton fibers degraded significantly faster than SMFs. More biofilm growth was observed when carbon sources were present. Our studies will generate insights towards the potential for biodegradation of SMs in WWTPs.
2	Stefania	Conforti	Investigating the Impact of Silver-Stabilized Hydrogen Peroxide on Host-pathogen Interactions in Drinking Water Systems	Bacteria may survive drinking water disinfection through survival and protection within eukaryotic host species, such as Acanthamoeba species. This work investigates the impact of alternative disinfectants (silver-stabilized hydrogen peroxide; SSHP) on the uptake of Salmonella enterica serovar Typhimurium (S. Typhimurium) into, and ability to survive and replicate within, Acanthamoeba castellanii, a common eukaryotic host in drinking water systems. The minimum inhibitory and minimum bactericidal concentrations (MICs and MBCs, respectively) of SSHP, hydrogen peroxide (H2O2), and sodium hypochlorite (NaOCl) for S. Typhimurium were established. SSHP and H2O2 had lower MICs and MBCs than NaOCl in 10% tryptic soy broth (TSB). Preliminary results suggest that SSHP negatively impacts the intracellular growth of S. Typhimurium within A. castellanii. Our work aims to shed light on SSHP as a promising alternative disinfectant in the secondary disinfection of drinking water.

3	Zoe	Cristante	Levels of chemical screams: Trait-mediated indirect effects of plant-infecting nematodes and herbivore damage on their neighbours	When plants are damaged by herbivore predation, they can release volatile organic compounds (VOCs) that may trigger defensive responses in other portions of the injured plant as well as undamaged neighbours. However, plants face multiple natural enemies. Notably, it's unknown whether additional damage from parasites, specifically root-knot nematodes (RKNs), causes extra VOC release. RKNs are of agricultural importance given their ubiquity and high damage costs. Our study questions are thus: (1) Will multiple sources of damage increase VOC release? (2) Do plants (Phaseolus lunatus, lima beans) with two types of damage (roots via RKNs and leaves via hole punches to simulate herbivory) cause greater morphological changes in intact conspecifics compared to those with only root damage? Plant stem diameter, height, and bean production will be measured to determine any cost of defence initiation, as well as VOC measurements at various times. Preliminary results of this ongoing study will be presented.
4	Zoe	Lebel-Pantazopoulos	Radical-Induced Cationic Frontal Polymerization of Epoxy Monomers	Radical-induced cationic frontal polymerization (RICFP) is a recent method of rapidly curing epoxy monomers into a hardened resin. When UV radiation or heat are applied to a mixture of an epoxy monomer, a diaryliodonium salt, and a radical thermal initiator, it creates an autocatalytic front that propagates through the resin with only a localized application of the initiating stimulus. Our research aims to use the RICFP method to create an industrial epoxy polymer that is time, energy, and cost effective. After testing several formulations, we have successfully created a mixture whose front can be initiated with heat and propagate at least 22 inches. We are continuing to examine the viability of UV initiation as well as options to extend the mixture's longevity in storage.

5	Manh Huy	Nguyen	The Use of Computational Fingerprinting Techniques to Distinguish Sources of Accelerants Used in Wildfire Arson	Wildfires or forest fires are economically costly and hazardous to human health and the ecosystem. Forensic investigation of arson wildfire cases often has a low prosecution rate because the traces of evidence, i.e., ignitable liquid residues (ILRs), which are often in low concentration after burning, are heavily mixed with highly abundant and complex soil and vegetation matrix of the forest. As a result, it is necessary to develop a chemometric method to effectively identify important traces of evidence, ILRs, from a complex fire debris chemical mixture. Chemometrics, which utilizes mathematical and statistical operations, has widely analyzed large and complex chemical and biological datasets across multiple disciplines. In this study, a chemometric workflow was developed including data reduction, data normalization, univariate (Wilcoxon test), and multivariate analysis (PCA) for the investigation of ILRs analyzed by two-dimensional gas-chromatography coupled with time-of-flight mass spectrometry (GCxGC-ToF-MS). The chemometrics workflow was developed and validated on neat fuel data to (1) distinguish between gas and diesel fuels and (2) between gas stations. The validity of the workflow was examined based on its ability to robustly distinguish between the different ILRs, as well as the confirmation of targeted compounds from the ASTM E1618-14 protocol. Our findings showed that the established workflow can robustly distinguish between gasoline and diesel based on comprehensive non-targeted GCxGC-ToF-MS data. Importantly, it also enables the identification of representative compounds that enable the distinction between groups of gas stations. Moreover, 100 compounds were identified that could be used as markers for diesel oil or gasoline beyond the ASTM compounds. Similarly, 55 compounds, beyond the ASTM list, were identified as markers to distinguish different gas stations. Overall, the robust, open-access data processing and statistical analysis workflow can be a powerful tool to identify relevant marker compounds for the distinction of ILR types and sources for arson investigations easily adaptable to individual

6	Natasha	Porco	The Role of Bacterial Filamentation as a Defense Mechanism Against Antimicrobial Peptide LL-37	Urinary tract infections (UTIs) are one of the most common types of bacterial infection. Uropathogenic E. coli (UPEC) are themost common cause of UTIs. During UTI, bacteria ascend the urethra before surface coloniation and entry of bladder epithelial cells by UPEC. Bacteria then enter the epithelial cell and replicate, forming intracellular bacterial communities (IBCs). Following a period of replication, the bacteria inside these IBCs go through morphological changes including filamentation, which prevents them from dividing but allows them to keep growing. Filamentation can be triggered in response to environmental stressors like ROS and RNS which are produced during the immune response as well as by exposure to certain categories of antibiotics. The immune response against UTIs is complex and results in the recruitment of a variety of cell types as well as the release of antimicrobial peptides such as LL-37. Since filamentation is a stress response and LL-37 is secreted during infection we wanted to determine whether filamentation affects bacterial survival against LL-37. Our results show that filamentation driven through induced expression of queE, sulA or damX results in decreased susceptibility to LL-37 mediated killing. Next, we analysed LL-37 binding in filamentous and non-filamentous cells and determined that LL-37 binding does not differ between the two populations. Tracking LL-37 killing during live-cell imaging of dividing non-filamentous cells has shown that LL-37 mediates killing in cells that are undergoing division and have visible septums. We also noted that killing occurs after FtsN localization to the mid-cell suggesting that late division which is absent in filamentous cells may be a target for bacterial death. The ultimate goal for this work is to determine the mechanism by which filamentation increases LL-37 resistance and to understand how infection related filamentation contributes to virulence in UPEC.
7	Jennalee	Ramserr an	Degradation of Electrospun Polystyrene Nanofibers with Photoactive Dopants	Globally humans have heavily abused single-use plastics for more than 50 years. Single-use products include plastic containers, bags, cups, straws, and Styrofoam packaging. Despite recent laws in Canada, existing plastic waste accumulated in the environment remains challenging. Recent progress in electrospinning offers one possible outlet to repurpose waste plastic. Electrospinning utilizes an electric field to pull dissolved polymer solutions into fibres with nanometer diameters. As a result, several new properties and applications can be realized (vide infra) for repurposing waste plastics. This project seeks to repurpose waste polystyrene from single-use products using electrospinning, and determine if dopants added, could facilitate the decomposition of the polymer in sunlight. As a starting point, the electrospun nanofibers will be doped with carbon nanodots and titanium dioxide nanoparticles, where reactive oxygen species are formed. This study represents a reasonable starting point to explore how light can activate oxygen to induce degradation within the electrospun-based films.

8	Aasiya	Remtulla	MRCKα and GEF-H1 Signalling in Ovarian Cancer	The actin cytoskeleton is a network of filamentous actin and associated proteins that are implicated in ovarian carcinoma metastasis. Rho GTPases like Rho A, Cdc42, and associated kinases and exchange factors regulate this network. Regulators like myotonic dystrophy-related CDC42-binding kinases (MRCK) (serine-threonine myosin light chain kinases), and guanine exchange factor H1 (GEF-H1) (regulates Rho A) are over-expressed in some high-grade serous ovarian cancers. Data from our laboratory showed GEF-H1 and MRCKα interacting in ovarian cancer cells and knocking-out MRCKα and MRCKβ increased Rho A activity. Our work investigates how this association impacts MRCKα and GEF-H1 activities. Active GEF-H1 pulldown experiments showed MRCK inhibition increased GEF-H1 activity in A2780 ovarian adenocarcinomas, however, in vitro kinase assays indicate GEF-H1 had little effect on MRCKα activity. This suggests the increase in Rho A activity from MRCK inhibition/deletion occurs via GEF-H1 activation, thus improving our understanding of crosstalk mechanisms in the Rho protein superfamily.
9	Diana	Schwendener Forkel	Regulation of glycogen synthase kinase 3 by amino acids requires GATOR1 but is mTORC1-independent	Approximately 15% of breast cancer cases are triple-negative breast cancer (TNBC), for which the prognosis remains poor. The tumor microenvironment is usually poor in nutrients, which requires TNBC cells to sense and adapt to nutrient stress. We previously identified that some signals regulate glycogen synthase kinase 3 β (GSK3β) localization to the nucleus, leading to the degradation of its nuclear substrates such as c-myc, a central oncogene. However, how nutrient sensing regulates GSK3β to allow TNBC cell nutrient adaptation is incompletely understood. We identify a new mechanism by which the amino acid nutrient sensing GATOR1 complex regulates GSK3β nuclear localization in a manner independent from the canonical nutrient-sensitive kinase mTORC1. We thus find that regulation of GSK3β by GATOR1 is distinct during prolonged periods of nutrient deprivation, which can allow discovery of novel strategies that circumvent the adaptability of TNBC to therapies and thus the development of drug resistance.

10	Sumaiya	Soha	Improved imaging and preservation of lysosome dynamics using silver nanoparticle-enhanced fluorescence.	Fluorescence microscopy is an indispensable technique for investigating live cell dynamics. However, it necessitates the application of excessive light energy to achieve a high signal-to-noise ratio, which can lead to photobleaching and in photo-toxicity. Noble metal nanoparticles, such as silver nanoparticles (AgNP), can generate plasmons when exposed to light, enabling them to amplify the excitation of fluorophores in close proximity to their surface. This process alters the emission rate of fluorophores, leading to enhanced fluorescence. We observed that AgNP fed to cells accumulate within lysosomes and augments fluorescence of routinely used lysosome-targeted probes. This has no detrimental impact on key lysosomal properties. Importantly, AgNPs affords tracking lysosome motility using lower laser power, mitigating the risk of altering lysosome dynamics. Overall, AgNP-enhanced fluorescence may be a valuable approach for investigating dynamics of the endo-lysosomal pathway while minimizing photo-toxicity.
11	Corbin	Sparks	Assessing the airborne VOC biofiltration capacity and microbiome of a consumer-grade active hydroponic green wall system	Active hydroponic green walls use fans to direct airflow through plant roots, greatly increasing the surface area of roots accessible to air and water for bioremediation by microbes in the rhizosphere. In this study, the removal rates of several common indoor VOCs by an active hydroponic green wall were observed in a sealed chamber. Air samples were collected using sorbent tubes and were tested using thermal desorption-gas chromatography-mass spectrometry. Water samples, root swabs, and root-clippings were collected from the green wall and used for whole-microbiome metabolism testing and DNA sequencing of the bacterial and fungal communities present. The green wall reduced the concentrations of most VOCs by over 50% within 24 hours, and 90-95% within 72 hours. Shifts in the bacterial and fungal communities were observed, however little change was observed in whole-microbiome metabolism. With their bioremediation capacity, green walls are a promising supplement for improving indoor air quality.