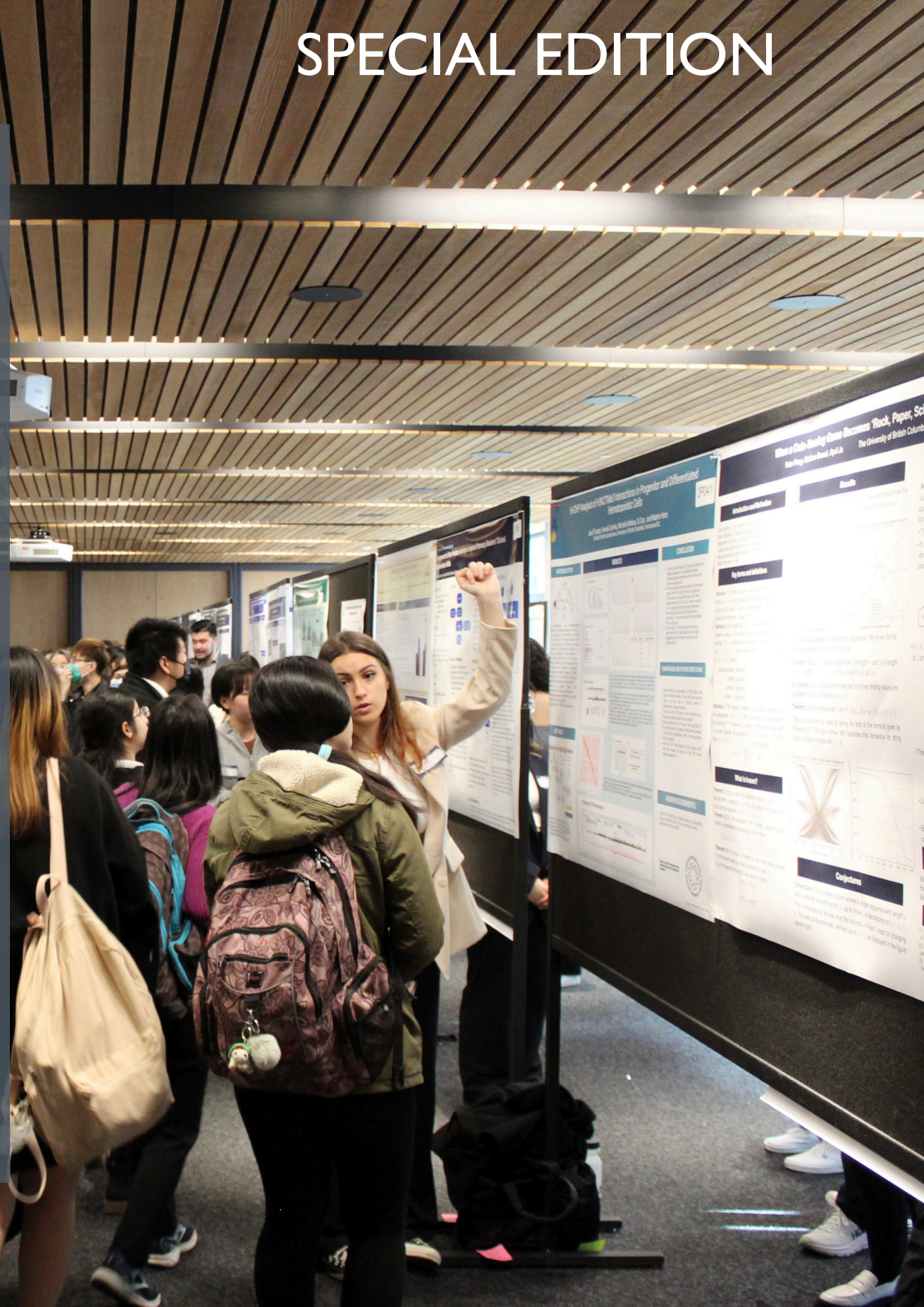MURCxCJUR

Multidisciplinary Undergraduate Research Conference 2023

UBC Vancouver

CANADIAN JOURNAL *of* UNDERGRADUATE RESEARCH

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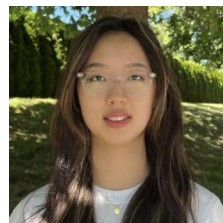
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Introduction from the MURC co-chairs

The Multidisciplinary Undergraduate Research Conference (MURC) is the University of British Columbia's largest undergraduate research conference, with over 500 presenters showcasing their research to the UBC community. MURC encourages students to communicate their findings using a multidisciplinary lens to make research accessible and understandable for everyone.

As the 20th iteration of the conference, MURC 2023's theme was "Aspire and Inspire", which aimed to draw aspiration from the generations before us, and to pass on inspiration to the future generations. By encouraging students to explore questions as holistic individuals, they were able to draw on diverse life experiences and collaborate to inspire innovative solutions.

MURC 2023 took place in person with an online component. The in-person components of the conference were held at the UBC Vancouver campus, with poster sessions in the Ponderosa Ballroom and oral presentations in Ponderosa Commons North and the West Mall Swing Space. Virtual presentations were held using the Zoom video-conferencing software. Researchers chose one of three formats to showcase their research: oral presentation, poster, or virtual presentation. Presentations were evaluated by UBC graduate students and faculty to provide students with feedback on their projects and presentation skills.

Isabel Huang

Monica Leca

Sex differences in muscular endurance at varying relative loads: The role of blood flow occlusion

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For resistance exercise at lower relative loads, sex differences in muscular endurance exist with females performing greater maximal repetitions than males. One proposed mechanism for this effect surrounds blood flow restriction (BFR). Due to males producing greater absolute forces than females for the same relative load, higher levels of intramuscular pressure generated occludes blood flow to and from active muscles. This reduction of muscular blood flow directly results in a decrease of oxygen delivery and metabolic by-product removal, increasing the onset of muscular fatigue. At higher relative loads, the female endurance advantage is eliminated due to high levels of intramuscular pressure and BFR in both sexes. However, studies examining sex differences in muscular endurance under manually induced BFR are inconclusive due to contradicting results. This study examined maximal elbow flexion repetitions under twelve conditions at varying percentages of one repetition maximum (1RM) with each load being performed in a free flow (FF) and BFR state. As the data represents a small sample involved in piloting for an ongoing study, no statistically significant sex differences were recorded. However, the trend of the data presents sex differences at lower relative loads in FF, which are eliminated $\geq 60\%$ 1RM, and no sex differences in all BFR loads. The results of this research offer additional evidence towards the role of BFR as an underlying mechanism for the female endurance advantage. Our protocol contributes to the field as a novel testing method of maximal repetitions performed using BFR through a range of relative loads.

Experiences of the Synergy Tool utilization among long-term care providers and leadership: A qualitative study

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Healthcare providers are experiencing challenges with providing residents of long-term care (LTC) homes a safe, secure, and caring environment. This is due to increasing resident complexity, acuity, and dementia rates in addition to inadequate staffing levels. The work demands in many LTC homes place a heavy burden on the psychological health of health-care providers and leaders, their ability to deliver quality and safe care to residents, and has led to high attrition rates among care home staff. This project implemented and evaluated the Synergy Tool, a resident-centered model of care aimed at understanding and operationalizing resident needs while fostering effective workload management. This study explored the experiences of long-term care staff and leaders with the Synergy Tool utilization and impact.

This study gathered qualitative data from four focus groups with LTC leaders (n= 7) and healthcare providers (n=7) in two LTC homes. The focus groups were audio-recorded, transcribed verbatim, and uploaded to NVivo for content analysis.

A total of five themes emerged from the data. The positive experiences are better care planning, better assessments, and improved staffing allocation. The negative experiences included extra workload and burnout among health care providers relating to the Synergy Tool utilization.

Although long-standing structural inadequacies created some barriers in implementing the Synergy Tool, the Tool resulted in positive changes in care delivery and workload management. Introducing new interventions to the LTC sector requires resources and support that enable their successful implementation.

The Relationship between Cognitive Function and Brain Structure in Patients with Long-COVID and Normal Recovery

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COVID-19 illness may result in lingering neurological symptoms such as fatigue, mood disturbances, and cognitive impairment. Such symptoms may correlate with changes to brain morphology. Previous research has largely focused on structural brain differences and cognitive function between infected and non-infected individuals, without consideration towards symptom duration. This study examines the relationship between cognitive function and brain structure in individuals who suffered COVID-19 symptoms for longer than two months (long-COVID) to individuals who recovered within two months (normal recovery). We aim to see how this relationship differs as a function of symptom duration. We hypothesized that individuals with long-COVID would have worse white matter integrity and lower cognitive scores than patients who recovered normally. Cognitive function was assessed using the National Institutes of Health's (NIH) Toolbox Cognition battery. Participants underwent Magnetic Resonance Imaging (MRI) with Diffusion Tensor Imaging (DTI) to assess brain structure. White matter diffusivity was examined using tract-based spatial statistics on key DTI metrics (FA and MD), and volumetric comparisons were conducted on brain regions of interest (ROIs). We found correlations between brain structure and cognition in the normal recovery group only, but a lack of group differences on these measures alone meant we could not conclude there were any structural brain differences between groups. No relationship was observed between brain volume and cognitive scores between groups. Our findings suggest that long-COVID may be associated with relational differences in cognition and brain structure between groups, yet further research is required to understand the reasons for these differences.

Are stressed-out calves predictable? Assessing the consistency of coping ability over time in dairy calves

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Every year, approximately one million Canadian dairy cows give birth to a calf. The calves are separated immediately and reared by the farmer. Many standard calf management practices are stressful, potentially compromising calf health and welfare. While current research has primarily focused on the ability of calves to cope with a specific stressful event, little attention has focused on whether they are able to consistently cope when subjected to multiple stressors over time. This aim of this study was to determine whether the coping strategies of calves are consistent across time and context when subjected to three different stressors reflecting routine management practices during the pre-weaning, weaning and post-weaning periods. We looked at three common stressors: 1) disbudding that often occurs pre-weaning, 2) weaning off of milk, and 3) regrouping with unfamiliar individuals post-weaning. Measures were specific to each stressor: in the days following disbudding we measured changes in reward intake; during weaning we monitored changes in play behaviours; and finally, we monitored changes in time spent feeding during their first regrouping. We expected that calves showing a large decrease in reward intake after disbudding, would exhibit greater decreases in play behaviour during weaning and time spent feeding when regrouped. Calves that are able to adequately cope when subjected to multiple stressors, maybe more resilient and thus able to show improved coping skills when subjected to subsequent stressors later in life. This consistency overtime may allow farmers to identify early on which individuals will be most successful in their herd.

The Effect of the Menstrual Cycle on the Way we Breathe During Exercise

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The sex hormones estrogen and progesterone fluctuate during the menstrual cycle (MC) creating the early follicular (EF) and midluteal (ML) phases. Females are often excluded from exercise research on the basis of these undulating hormones, despite increased female sport participation. The goal of this study was to provide insight into the interaction between progesterone, hypoxia (low oxygen), exercise intensity, and ventilation (breathing), in athletic females.

BACKGROUND: Sex hormones affect the control of ventilation. Hypoxia stimulates ventilation, as does whole-body dynamic exercise (e.g. cycling). There is evidence to suggest that, in males, the ventilatory response to hypoxia is potentiated with high- relative to low-intensity exercise. Progesterone is linked to increased resting ventilation at sea-level (normoxia) during the ML compared to the EF phase, but not during submaximal exercise in normoxia and hypoxia. The combined effect of hypoxia and progesterone on ventilation during severe-intensity exercise is not clear.

PURPOSE: To test whether ventilation is higher in the ML compared to the EF phase of the MC during severe-intensity exercise in hypoxia.

HYPOTHESIS: We hypothesized that peak progesterone levels (ML phase) are associated with a higher exercise ventilation in hypoxia compared to the EF phase.

METHODS: Eumenorrheic aerobically-trained females aged 18–35 completed a maximal exercise test to exhaustion. On the two subsequent days (one day in ML and EF) blood tests measuring estrogen and progesterone preceded severe-intensity exercise in hypoxia and normoxia.

RESULTS: Ventilation was higher in the ML compared to the EF phase of the MC during severe-intensity exercise in hypoxia.

Feasibility of Apparent Diffusion Coefficient in 129-Xe MRI for Monitoring Cystic Fibrosis in Pediatric Patients

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There is a current lack of sensitive lung function assessments in pediatric medicine. Hyperpolarized 129–Xenon magnetic resonance imaging of the lungs (XeMRI) is a new imaging technique that has promise to fill this gap. This non-invasive, radiation–free technique is currently being explored as a tool to monitor lung disease.1 Apparent Diffusion Coefficient (ADC), is an outcome measure from XeMRI that quantifies how well 129–Xenon gas diffuses through the airways.2 This hypothetical study aims to evaluate the feasibility of ADC as a measure to quantify and monitor lung disease progression in pediatric patients with cystic fibrosis (CF), which is a fatal genetic disease with severe presenting symptoms.3 XeMRI will be performed with 10 healthy children and 15 children with CF, aged 6 to 18 years. ADC will be quantified from the images using a published ADC algorithm. Imaging sessions will occur every 6 months for a total of 5 years, to observe disease progression over time. It is expected that ADC values will remain consistent in healthy individuals, but increase with worsening disease due to an increase in terminal airway size.4 By assessing if XeMRI can detect changes in disease over time, it can be determined if this tool is suitable for clinical use to monitor disease progression. Research in this field is crucial as to fill the lack of functional lung assessments for pediatrics.

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Wastewater-Based Surveillance of Infectious Diseases

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Due to the global reduction in clinical testing for SARS-CoV-2, wastewater-based epidemiology is an attractive alternative, providing crucial information for surveillance programs. Municipal wastewater samples provide a snapshot of the public's health at the community level, including the emergence and relative prevalence of COVID-19 variants of concern. Viruses are detectable, identifiable, and measurable by their genomic material found in wastewater, but the concentration and quality are often low. Therefore, the nucleic acids must be concentrated before effective genetic testing.

This study leveraged emerging nanoparticle technology (Nanotrap), offering the potential for easy handling, cost-effective and relatively equipment-free methods of viral concentration compared to current methods of polyethylene glycol (PEG) precipitation and Amicon Ultrafiltration. Raw samples were collected from Annacis Island Wastewater Treatment Plant, with genetic testing completed at BCCDC and UBC thereafter. After viral enrichment, downstream RT-qPCR testing and Oxford Nanopore long-read genome sequencing generated data to determine the concentration and quality of nucleic acids. It was found that PEG precipitation obtained the highest levels of concentration at 210 (±29) cp/mL, while Nanotrap 186 (±30) cp/mL and Amicon Ultrafiltration 179 (±29) cp/mL performed similarly. Furthermore, all methods obtained >99% SARS-CoV-2 genome coverage, indicating Nanotrap's ability to yield competitive RNA quality compared to current methods. Interestingly, Nanotrap did not increase mapping efficiencies and had greater variation between replicates contrary to expectations. Overall, Nanotrap concentrates viral genomes effectively for RT-qPCR detection and sequencing when compared with standard procedures, offering a potentially valuable alternative for testing in remote areas despite decreased mapping efficiencies.

Natural- and Vaccine-Induced Immunity against Future COVID-19 Infection

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Since the implementation of vaccinations, mortality rates of Coronavirus Disease 2019 (COVID-19) have decreased. However, new cases of COVID-19 among previously infected and vaccinated individuals continue to be reported. Although vaccination is shown to induce higher antibody levels, it remains unclear whether vaccination offers better protection against future COVID-19 infection than natural-induced immunity from a previous infection. We hypothesize that vaccination yields better immunity than natural infection and thus provides better protection against future infection. To evaluate the current evidence, we will carry out a systematic review by conducting literature searches for human observational studies on PubMed and MEDLINE databases using relevant Medical Subject Headings (MeSH) terms, including keywords relevant to COVID-19, vaccination, reinfection, protective effectiveness, antibodies, immune responses, social determinants of health, and public health measures. We will then screen through the abstract and exclude literature based on the inclusion/exclusion criteria that we constructed beforehand. Our main outcome of interest is infection after at least 90 days of vaccine administration or complete recovery from COVID-19. We expect to see that COVID-19 vaccination provides better protection against COVID-19 infection compared to prior natural infection. Better protection will be evaluated based on the ability to decrease the probability of developing COVID-19-related outcomes, such as severe diseases, hospitalization, and death. This work can inform future research on COVID-19 vaccination and booster regimens, and provide insight regarding the protection provided by vaccines against COVID-19 reinfection.

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The effects of interleukin-1 receptor antagonist on anti-depressant efficacy in a rat model of post-partum depression

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During the perinatal period, up to 20% of women experience depression. However, the efficacy of selective serotonin reuptake inhibitors (SSRIs), a commonly prescribed class of antidepressants, is currently limited in treating postpartum depression (PPD). PPD can be modelled in rats by administering high dosage corticosterone (CORT) through the post-partum period, which has been shown to cause depressive-like behavior such as increased passive coping. Our lab has previously found an association between limited fluoxetine efficacy and increased levels of hippocampal Interleukin-1β (IL-1β). We hypothesize that blocking IL-1β will improve the efficacy of fluoxetine (FLX), an SSRI, in reducing depressive-like behaviour in our rat model of PPD.

To model PPD, rat dams were treated with daily injections of either CORT or oil for 21 days during the postpartum starting on postnatal day (PND) 2 along with either FLX or dextrose (DEX). Moreover, starting on PND 9, either Anakinra (KIN), an inhibitor of IL-1β, or saline was administered. Maternal care behavior was measured in the early postpartum by measuring the time dams spent nursing their offspring. In the late postpartum, the forced swim test (FST) was used to measure active versus passive coping.

Our preliminary data demonstrates a partial interaction effect between FLX and KIN that decreases passive coping behaviour and increases active coping behaviour in both CORT and OIL treated groups. This study offers insight into new potential immunological pathways to improve SSRI efficacy in treating PPD. Further research is needed to evaluate the relationship between neuroinflammation and antidepressant efficacy in PPD.

Social Media "Friends" or Foes: How Gender, Website of Choice, and Time Spent Online Can Impact Cyberbullying Perpetration

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As we spend more time online, the incidence of negative digital interactions and cyberbullying may increase in tandem. Cyberbullying is unique because of the wider audience, its pervasive nature, anonymity, and lack of feedback from the victim. Despite growing concern over the rates and severe implications of cyberbullying, the potential factors that predict instances of cyberbullying remain unclear. Our research investigates how gender, website of choice, and time spent online can impact cyberbullying perpetation. We hypothesized that men, those who spend more time online, and websites that promote anonymity, would be linked with a higher incidence of cyberbullying perpetration. Data was collected online where participants (N = 1118; 73.8% women) responded to surveys regarding their social media usage and experiences with cyberbullying. A binary logistic regression supported our hypotheses and showed that being a man and spending more time online were associated with a higher likelihood of having engaged in cyberbullying perpetration. Contrary to our hypothesis, website of choice was not a significant predictor of cyberbullying perpetration. This research provides greater insight into the variables that influence cyberbullying to understand the conditions that could facilitate this online aggression. Therefore, this study can inform future cyberbullying interventions to ensure safer internet usage amongst vulnerable users.

Unsmothering Girlhood: The Geometry of the Sisterhood Wound

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Within our androcentric culture, patterned emotional violence between women has become imprinted into a socially constructed definition of womanhood that is assumed to be normal and natural. The widespread perpetuation of these patterns only reifies the assumption that women lack the capacity to have fortifying and fulfilling relationships with one another, failing to account for the sustained logic that informs how women actively reproduce behaviour underpinned by androcentric agendas with inwardly harmful effects. This research draws on autoethnographic analysis, grounded in seven months of participant-observation fieldwork, as well as four semistructured interviews with participants in a series of sisterhood circles – intentional and restorative gatherings of self-identified women. Exploring these regenerative circles and the process of bringing light and language to previously unarticulated experiences, this violence is conceptualised as a situational and relational process, rather than an inevitable facet of identity. By viewing the sisterhood wound as a category of analysis, androcentrically-instilled alienation and disconnection between women begins to dissolve, initiating a medicinal return to unity.

The Age Filter: An Investigation into the Priorities for Person Perception

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Previous psychological research shows that when people seek information about another person, they prioritize information about that person's honesty and interpersonal warmth. In those studies, the target persons were typically young adults. Do people prioritize obtaining the same—or different—information about elderly adults? No prior research has systematically addressed this question. We conducted an experiment in which participants (N = 205) imagined that they would soon encounter another person and then rated their interest in obtaining information about 16 different characteristics of that person (including personality traits, attitudes, and physical characteristics of various kinds). The age of the target persons was experimentally manipulated: They were either young adults (35 years old) or elderly adults (85 years old). Results showed substantial similarities across the two conditions (e.g., information about honesty and warmth was highly prioritized in both conditions; information was physical characteristics were generally rated to be a low priority), but there were some differences too. For example, information about honesty was especially highly prioritized when seeking information about young adults ($p = .002$); in contrast, information about health and physical strength was more highly prioritized when seeking information about elderly adults (p's $< .001$). These findings provide insights into the extent to which people's perception processes are influenced by the age of the person they are perceiving. They suggest that although there are some differences in the types of information people prioritize when seeking information, there are also similarities, adding to our understanding of what information they prioritize when seeking to understand them.

Investigating the association between Gliotactin and the Laminin Globular Domain protein Axotactin in the tricellular junctions of *Drosophila melanogaster*

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In animals, the formation of permeability barriers in epithelial cells is essential to prevent unwanted solutes and pathogens from passing from one cell region to another. Permeability barriers are found within septate junctions (SJ), where two epithelial cells meet and in tricellular junctions (TCJ), the point where three epithelial cells meet. In Drosophila melanogaster, Gliotactin is an essential TCJ proteinbarrier that is necessary for the formation of SJs and TCJs. Gliotactin is part of the Neuroligin family proteins (Gilbert et al., 2001) and contains a highly conserved extracellular domain. In vertebrates, Neuroligins bind the laminin globular (LamG) domains of Neurexin proteins (Suckow et al., 2008), however, the binding partner of Gliotactin in TCJs is unknown. I hypothesize that Gliotactin localizes to the TCJs by binding to the LamG domain protein Axotactin. To test this hypothesis, I used the GAL/UAS system to drive the expression of endogenously tagged epithelial barrier proteins and RNAi-mediated knock-down of Axotactin in the wing discs of Drosophila larvae. Currently, I am collecting data using fluorescence microscopy and analyzing the distribution of Gliotactin tagged with antibodies. If Gliotactin binds to the LamG domains of Axotactin, I expect that Gliotactin will not be localized to the TCJs when Axotactin is knocked down. This project can provide fundamental information required to fully understand the development of organ systems derived from epithelia. If more barrier proteins in TCJs become known, then we may also know more about potential treatments for epithelial barrier dysfunctions.

Measuring Interdisciplinary Thinking Using Weekly Student Reflections

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The need for interdisciplinary thinking is becoming a necessity in today's society due to the complex problems society faces. Interdisciplinary thinking is the idea of using knowledge from different disciplines to problem solve more effectively. For example, climate change and global pandemics require professionals from multiple disciplines to implement a multi-faceted approach. Problems like these have increased the urgency in higher education to instill individuals with the necessary skills and ways of thought so they can participate in interdisciplinary thinking. The Science One program at the University of British Columbia is one program that hopes to promote interdisciplinary thinking among students. This research study was conducted to assess whether students in this program are making interdisciplinary connections and if so, what types of connections are most common. Students' responses were assigned a level between 1-4, with 1 being basic connections between disciplines and level 4 being complex connections. Additionally, the goal was to determine on what themes students make the most interdisciplinary connections. Ultimately, it was determined that although students in the Science One program make interdisciplinary connections, they mostly make level 1 and level 2 connections. After analyzing all student reflections only 6% and 1% were level 3 and level 4 connections respectively. The common themes on which students made interdisciplinary connections were integration, Euler's method, differential equations, thermodynamics and quantum mechanics. The findings show that making more complex interdisciplinary connections is difficult for first year students and instructors play a key role in helping students identify these connections.

Rewilding Urban Cemeteries in Metro Vancouver

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The increasing density of urban areas reduces greenspace available to naturally sustain ecosystems from human activity and natural disturbances. Introducing rewilding into urban spaces is a potential solution to reduce intensive management practices and enhance ecosystem services that natural landscapes provide such as recreation, air quality, food, and ethical value. Urban cemeteries constitute some of the oldest and largest green and open spaces in the urban landscape. Limited research has been conducted on the effect of rewilding on ecosystem services and biodiversity on North American urban cemeteries. Also the practicality of rewilding urban cemeteries has been underexplored in existing research or literature. We hypothesize that rewilding urban cemeteries will restore natural habitats and biodiversity, while continuing to serve as spaces for people's cultural, recreational, and spiritual needs in a way that's not reliant on intensive management practices. Focus groups with knowledge holders will be conducted to grasp the feasibility of rewilding Mountain View Cemetery and determine a rewilding approach that will guide a spatial ecosystem service model. Spatial ecosystem service modelling is a modelling tool that can simulate possible ecosystem services Mountain View Cemetery can provide after rewilding. We will survey visitors and cemetery users' perceptions of rewilding cemeteries based on the results of the model. We predict locals to be in support of rewilding cemeteries once they are shown the improvements based on the spatial ecosystem service model simulating the biophysical changes. The results of our study will provide insight in the improvement of urban infrastructure, and influence future planning of other urban cemeteries to be more ecologically resilient.

Analyzing Racial Disparities in Endometrial Cancer Treatment through Genetic Markers
Theme – Obstetrics & Gynaecology, Cancer

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In recent years more women are seeking treatment for endometrial cancer (EC) (Lee, 2021). Whetstone et al. (2022) reported that healthcare professionals have observed significant differential EC treatment as a result of racial disparities. There are known specific EC markers such as HER2 that are associated with high–risk cancer progression (Javadian et al., 2021). Treatment differences such as stress in surgical environments can alter the genetic markers expressed in EC tumours (Pedersen et al., 2018). We hypothesize that significant alterations in genetic marker expression between racial groups are due to racial disparities experienced in the healthcare system and have cascading effects on other cancer progression markers (Urick & Bell, 2019). We will conduct a retrospective clinical chart review to assess ethnic differences in disease outcomes for women diagnosed with EC in British Columbia. We will conduct patient interviews to assess medical histories and demographics, in addition to sample collection for examining how medical treatments may alter the expression of EC genetic markers. We expect that there will be a change in genetic markers of marginalized groups due to environmental stressors caused by mistreatment in the healthcare environment. These results will elucidate the implications of racial disparity on genetic markers to better understand how differential treatment can impact EC severity. Future research can target equal treatment for women throughout their treatment and beyond.

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Investigating the evolution of SARS-CoV-2 variants using long-read sequencing

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The RNA virus SARS–CoV–2 has been observed to evolve rapidly, producing numerous new variants of clinical significance throughout the course of the covid–19 pandemic. This evolution is thought to result in increased transmissibility and resistance to existing antibodies, among other effects, highlighting the importance of viral detection and characterization strategies. Previous research has been largely focused on the spike protein, due to its direct involvement in host receptor–virus interaction. Moreover, such research has been primarily conducted using short–read sequencing. Here, we propose to consider regions outside of the spike protein and demonstrate the utility of long–read sequencing and hybrid analysis to better understand the evolution of SARS–CoV–2. Short–read sequencing allows 75–400 base pairs to be read at a time, whereas long–read sequencing allows 10,000–100,000 base pairs. Thus, long–read sequencing produces fewer fragments of larger size making it more suitable for analyzing the evolution of SARS–Cov–2 variants. Longer reads would allow for the identification of more complex sequence variants including repeats, duplications, or large deletions and insertions. We expect to see conservation in regions other than the spike protein and may identify additional potential vaccine targets. These results will provide more insight into the evolution and understanding of SARS–CoV–2 variants. This can lead to improved treatment options such as vaccines and therapeutics to reduce harmful pathogenesis such as long covid, as well as better preparation for future pandemics.

Food Worry and Parental Mental Health during COVID-19

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Food worry is the worry that arises from the lack of accessibility or availability of food. Food insecurity can be described as inadequate or insecure access to food due to financial constraints. As primary caregivers, parents report feeling responsible for buffering the effects of stressors on the household. In Canadian literature, few studies have examined the association between food-related concerns and mental health outcomes during COVID-19. We hypothesize that parents who experienced food-related worry during COVID-19 were more likely to report poorer mental health. Using a nation-wide survey, questions related to food worry, insecurity, socioeconomic demographics, and mental health outcomes will be asked. We will examine the parent subset of the sample and perform logistic regression analyses to determine the relationship between food-related worries and poor mental health outcomes. After examining univariate models, we will control for household income, number of children living in the household, single parent status, pre-existing mental health conditions, and financial worries to explore the potentially confounding effects of these variables. We expect to find statistically significant associations between food-related worry and poor mental health among parents. These results will provide a better understanding of prevalence of mental health implications related to stressors concerning food for Canadian parents during the COVID-19 pandemic. With growing concerns related to the affordability of food for Canadian families, having robust and timely evidence related to the associations between food worried and adverse mental health outcomes are valuable for informing interventions and policies to better support caregivers.

Substitution of Tailings in the Composite Matrix of Concrete to Improve its Material Properties

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The mining and concrete industries face great challenges in the status quo. Waste materials generated from mining processes are stored in tailings pond facilities which pose health and environmental risks in the event of failure. The depletion of fine aggregates—a key component of concrete—raises long-term concerns, but its replacement with dry mine tailings can achieve a mutually beneficial solution. In this study, we test the effects of copper mine tailings on the mechanical properties of concrete. Fine aggregate in the conventional concrete mixture was partially substituted with 10%, 20%, 30%, and 40% tailings and samples were tested for compressive strength according to ASTM C39 specifications. Results from the initial tests showed that compressive strengths fell within the accepted range of standard strength concrete of 25–45 MPa with the maximum compressive strength being 43.3 MPa at 30% tailings and the minimum is 36.9 MPa at 40% tailings. While additional compressive strength tests are required to improve its accuracy, preliminary results reveal that tailings-based concrete can offer a sustainable alternative to conventional concrete by establishing a circular economy in the mining and concrete industries. Since mine tailings embedded in the concrete matrix were prevented from reacting spontaneously with natural elements, the risk of acid mine drainage and exposure of surrounding ecosystems are also mitigated.

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(Not) meeting expectations? Comparing perceived responsibility for and frequency of White/European-Americans' Allyship

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Despite expectations, White allies are perceived to be less willing to engage in racial issues (Brown & Ostrove, 2013). Expanding on this research, our work directly compares White/European–Americans' perceptions of responsibility for versus frequency of allyship. In Study 1 (N = 157; CloudResearch), White/European–Americans perceived White agents as more responsible than Black agents for taking six forms of allyship (De Souza & Schmader, 2022). However, White/European–Americans uniquely perceived White agents to take less action than they were perceived to be responsible for. In Study 2 (N = 167; CloudResearch), we took inspiration from Ashburn–Nardo et al.'s (2008) Confronting Prejudiced Responses Model and investigated factors influencing White/European–Americans' own frequency of allyship. Specifically, we tested the effect of self–efficacy, social support/backlash, and recognition of opportunities on White/European–Americans' own allyship. Participants' confidence in being successful positively predicted their frequency of all forms of allyship. However, anticipating support or backlash from their own racial group did not predict how often White/European–Americans would take any allyship action. Finally, we found that recognition of opportunities uniquely predicted confronting one's own prejudice and one's own efforts to support and include others. This research elucidates why White/European Americans, even those interested in taking action, are not perceived to meet allyship expectations.

Characterizing the distribution of rTMS-induced electric fields due to anatomical, clinical, and demographic variables in patients with treatment-resistant depression.

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Transcranial Magnetic Stimulation (TMS) is a non-invasive neurostimulation therapy indicated for numerous neuropsychiatric disorders, including treatment-resistant depression (TRD). Individual differences in anatomy result in variance in the induced electric field (EF) when applying a standard stimulation intensity to healthy subjects using a H-coil for deep-TMS (Tzirini et al.,2022). The relationship between induced EF and variables specific to patients with TRD treated with a figure-eight coil is unclear. This study aims to quantify the rTMS-induced EF in individuals treated with high-frequency rTMS and investigate the relationship between, EF and clinical/demographic factors. The sample consists of 60 subjects from the THREE-D clinical trial, randomized to daily high-frequency rTMS to the left-DLPFC for 4-6 weeks (Blumberger et al.,2018). SimNIBS4.0 was used to simulate the rTMS-induced EF in subject head models, created with T1 and T2-weighted anatomical scans collected at baseline. The simulation was targeted to [-38,44,26] in MNI space, and a constant stimulation intensity was used. The EF intensity and stimulated volume had a mean of 90.3 ± 8.5 V/m and 5.4 ± 1.0 cm3 respectively. Sex and age were both significantly correlated to stimulated volume (p<0.04). Change in depressive symptoms, ATHF score as well as AD and BZD dosage were not associated with any EF variables (p>0.08). Significant differences in rTMS-induced EF distribution exist due to inter-subject anatomical variances. The results further suggest that clinical factors specific to patients with TRD treated with rTMS might not impact EF distribution.

Social Support as a Moderator of Core Belief Disruption and the COVID-19 Pandemic-related Posttraumatic Growth

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The COVID-19 pandemic has for many people undermined and challenged many key areas of life, including the core beliefs that people hold. These fundamental assumptions about life include human nature, religious and spiritual beliefs, relationships with others, the meaning of life, and personal strengths and weaknesses. At the same time, some people may experience growth after similar adverse events. The challenge of core beliefs has consistently been positively linked to post traumatic growth (PTG), referring to positive psychological changes that may occur due to a highly challenging event or experience. However, little research has examined whether COVID-19-related challenges will also be associated with PTG. Challenges from the pandemic may have rebuilt their core beliefs through coping processes and led to psychological growth (e.g., improving interpersonal relationships, appreciating life, and exploring new possibilities). Additionally, it is possible that such links are moderated by different availability of social support people had during the COVID-19 pandemic as many social connections were limited due to social distancing measures. We analyzed data collected from 88 participants who reported on their core beliefs, PTG, and social support during the pandemic (2021). Participants who report more core beliefs disruptions showed greater PTG scores. The interaction between social support and disruptions of core beliefs was not significant in predicting PTG scores. Results of this study give important insight into the role of core beliefs challenges in stressful events that are not holistically traumatic but might also offer a chance to grow.

Determining the effectiveness of the IBI302 protein in reducing abnormal blood vessel growth in wet AMD

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A leading cause of blindness in older generations is age-related macular degeneration (AMD). Particularly, the subtype wet AMD causes abnormal blood vessel growth, leading to leakage of blood and fluid in the macula, which processes central vision. Vascular endothelial growth factor (VEGF) is a protein that stimulates the growth of new blood vessels, and its overabundance plays a key role in the progression of wet AMD. Currently, wet AMD treatment consists of monthly intraocular injections of VEGF inhibitors, such as bevacizumab (Avastin). The protein IBI302 shows promise as a wet AMD treatment due to its capability of inhibiting VEGF and other molecules associated with inflammation. Even though IBI302's effectiveness is yet to be studied in humans, we hypothesize that IBI302 is more effective in slowing wet AMD progression than current anti-VEGF drugs, such as Avastin. Participants diagnosed with wet AMD will be divided into four experimental groups. Group 1 will receive monthly IBI302 injections, group 2 will receive monthly Avastin injections, group 3 will receive IBI302 injections as needed, and group 4 will receive Avastin injections as needed. Changes in visual acuity and retinal thickness will be measured and compared between all four groups, and the frequency of injections will be compared between groups 3 and 4. Our hypothesis predicts group 1 having greater improvement in visual acuity and retinal thickness than group 2, and group 3 requiring less frequent injections than group 4. These results may determine if IBI302 is a good candidate for wet AMD treatment in humans.

Mahalanobis Distance-based Fuzzy C-Means Algorithm in Breast Cancer Image Segmentation

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Background: Breast cancer is the second leading cause of cancer deaths in Canadian women. Early detection reduces treatment costs and offers a favourable prognosis for patients. Classical methods, like mammograms, rely on radiologists to detect cancerous tumours, which 1) makes them susceptible to errors, 2) are labour-intensive, and 3) depletes healthcare resources. Recent research supplements classical methods with automated mammogram analysis, including those based on Fuzzy C-Means (FCM) clustering. However, base FCM relies on the Euclidean distance, which is not optimized for non-spherical clusters.

Aim: We seek to apply FCM and Mahalanobis-distance-based FCM (FCM-M) to detect cancerous tumours in mammograms. To our knowledge, FCM-M has yet to be applied to mammograms. The objectives of the research are: a) to tune a Mahalanobis distance-based FCM algorithm to separate breast tumours in mammograms, and b) to evaluate the effectiveness of FCM-M compared to base FCM in this novel application.

Methods: We replace Euclidean distance with the Mahalanobis distance function to improve segmentation quality. We aim to improve runtime through parallelization. The algorithm will be tested using images from breast cancer datasets to evaluate its effectiveness to base FCM.

Results: The optimized FCM-M decreased computational efforts compared to the original FCM-M, with average runtime per iteration at 46.6s and 24m 25s, respectively. In examining the output images, FCM-M captures the elliptical structure of the tumour better than FCM. To further evaluate the segmentation, we will apply the following metrics: (1) the partition coefficient index, (2) the classification entropy index, and (3) the subarea coefficient index.

Comparative Study Testing Effects of Three Doses of Psilocybin Vs Thirty doses of SSRIs Administered Over a Month on Depressed Rats

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Depression is one of the most common and debilitating mental health disorders in the world. It can lead to self-harming behaviours, suicide ideation, suicide attempt, and death. Serotonin plays a pivotal role in maintaining good mental health, and serotonin deficit can lead to depression. In treatment of depression, SSRIs (Selective Serotonin Reuptake Inhibitors) may be prescribed to a patient along with therapy. Recent studies have also proven that Psilocybin, a 5-HT2A serotonin receptor agonist found in psychedelic mushrooms might be an alternative. There has been strong evidence of reduction in suicidal behaviour after just one dose of psilocybin. At the moment, there is a dire need for larger trials and longitudinal research in comparing the results of psilocybin and SSRIs. This study sheds light on the effects of psilocybin compared to SSRI-Prozac administered on depressed rats. It is expected to see that psilocybin will have better and long-lasting effects on treating depression than Prozac, along with synaptogenesis in the brain. One group of depressed rats will be given Prozac for 30 days and the second will receive three doses of psilocybin during the same 30 days, a third control group will get saline. Recovery from depression will be quantified by sucrose preference test in-vivo and coping in a forced swim test. Synaptogenesis in the prefrontal cortex and hippocampus in rats' brains will be investigated post-mortem via staining. These results will explicate that psilocybin may be a breakthrough treatment for depression and pave a strong argument for alternatives to SSRIs.

Triangle Packings & Transversals In Tripartite Graphs

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Graph theory studies abstract structures representing networks. These can be visualized as drawings of points with lines joining some of the points. Graphs whose points are divided into three non–overlapping parts are called tripartite graphs, and the lines between the points in any two of the parts is a side of the graph, which can be considered complete or incomplete.

In tripartite graphs, the lines between points can form triangles. Our research studies how many triangles can be packed into such a graph without sharing a common line, how many lines are needed to touch all triangles in the graph, and the conditions under which these two numbers are equal. In 2012, Lakshmanan et al. proved that if all three sides of a tripartite graph are complete, then the number of triangles that can be packed into it is equal to the number of lines needed to touch all the triangles. We proved the same result holds for tripartite graphs with two complete sides.

Why do Corporations Transition to Net Zero? A Case Study of Maple Leaf Foods

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Also called carbon neutrality, "net-zero" in climate change parlance refers to a state of balance between greenhouse gas emissions released into and absorbed from the environment. Scientists recommend how much emissions to release and absorb, governments make policies to implement those recommendations in society, and corporations are key targets of such policies, expected to align their processes. Therefore, to achieve net-zero emissions, science and policies require businesses to reduce their carbon emissions and offset the remainder. Previous research has shown why and how businesses analyze the costs and benefits of transitioning to net-zero (Simon and Simon 2022) and the challenges they may face (Millot and Maizi 2021), but we know very little about why they ultimately transition. This paper contributes to filling this knowledge gap based on a case study of Maple Leaf Foods. A Canadian company in the business of packaged meats, Maple Leaf Foods successfully achieved carbon neutrality in 2019. By reviewing investor and profit reports, backed by scholarly literature, this paper analyzes the reasoning of Maple Leaf Foods before and after its carbon neutrality transition to answer the question: 1) What motivates a company to transition to carbon neutrality? Findings are that the motivation is partly due to the values of the board members and shareholders and the market benefits that would come with the estimated demand for sustainable products in the net-zero transition. These results indicate factors to consider in incentivizing corporations to embrace net-zero emissions agenda.

Effect of blood flow restriction on maximum repetitions completed in a barbell curl exercise across a range of relative loads

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During resistance exercise, pressure within working muscle can increase to the extent that it occludes vasculature thereby reducing blood flow during each contraction. There appears to be a load threshold at which this occlusion occurs. Above this threshold, vasculature within the muscle is occluded limiting oxygen delivery and metabolic byproduct removal. Thus, resistance exercise bouts at higher relative loads result in less maximum repetitions performed than at lower relative loads where muscle vasculature is not occluded. This occlusion can be simulated using an exercise-specific blood flow restriction (BFR) cuff. No study has yet examined the effect of BFR on maximum repetitions performed at a range of relative loads in the upper body. Thus, this study examined maximum repetitions completed in a bilateral barbell curl exercise at six different relative loads (45%, 50%, 55%, 60%, 70%, and 80% 1RM) in both occluded (120% limb occlusion pressure) and free flow conditions. Data currently collected is pilot testing data for an ongoing study and findings are not significant due to a small sample size. The preliminary data suggests that occlusion reduces repetitions completed at all relative loads and to a greater extent at loads below 55%1RM. These findings imply that at loads below 55%1RM there is an increased reliance on aerobic metabolism. Future research should examine the adaptations elicited from training bilateral barbell curls below or above 55%1RM as these findings could be used to guide exercise prescription to elicit specific adaptations.

Partnering with Patients with Living and Lived Experience of Eating Disorders to Improve Inpatient Care on an Acute Pediatric Medicine Unit

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Introduction: Patient partners are a pillar in healthcare quality improvement, but there is a paucity of literature on patient engagement in adolescent eating disorder treatment. Acute medical stabilization is both often a time of crisis and an opportunity to engage youth and families. We examined the experience of patients with eating disorders to improve the quality of care in an acute pediatric medicine unit.

Objective: To describe the experiences of patients with living and lived experience of eating disorder treatment at BC Children's Hospital.

Methods: For this stakeholder engagement phase of our quality improvement project, we used a mixed-methods design of semi-structured interviews and focus groups with adolescents with eating disorders and caregivers. We used thematic analysis to analyze the qualitative data and descriptive statistics to analyze the quantitative data, and created a driver diagram to identify drivers and change ideas.

Results: We completed 8 interviews with patients with living experience, 1 interview with a patient with lived experience, and 1 focus group with patients and caregivers. Primary themes include: uncertainty, stress from new expectations, relational care, inclusion, and acknowledgement. While 100% of participants understood the goals for admission, participants averaged 3.7 on a 1 to 5 Likert scale when asked to rate their satisfaction on information they received. The majority of patients felt there was consistency in team communication.

Conclusion & Next Steps: Patients with eating disorders requiring acute medical stabilization have complex and unique needs. Change ideas include knowledge translation projects, such as admission-orientation documents and patient-centered rounds.

Understanding the Complex Dynamic encompassing the Pacific Northeast's Marine Food Web

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This research project and metadata study examines both the competitive and predator–prey relationships occurring within the Northeast Pacific Ocean, with an emphasis on the vitality of its apex and secondary predatory species. Our preliminary analyses of the data have shown the importance of cephalopods and schooling fish in the diets of different predator species in the North Pacific Ocean. Specifically, Gonatus sp., Scomber sp. and Loligo opalescens were vital components of ≥72% of predatory species diets. An interesting case study involved Sealchimorpha sp., known by their common clade name (Shark), which was classified as a prey species for 55% of the documented predators. Two species, Squalus acanthias, commonly known as the spiny dogfish and Galeorhinus galeus, commonly known as the tope shark, were frequent amongst these diets. Further analysis illustrated a key distinction between epipelagic and mesopelagic predatory species, as correlations between prey diversity and dive depth amongst all species showed no correlation ($R2 = 0.00086$), however, upon separation at 150 meters, epipelagic predators depicted a regression value of 0.2519, whilst mesopelagic predators depicted a regression value of 0.2111 – both depicting that diversity increased with depth. From Paulmier et. al, the Pacific Northeast's Oxygen Minimum Zone – a region of minimal biota due to poor oxygenation – occurs at ~150 meters, likely causing the evident rift between the areas. The multitude of interactions occurring throughout the Northeast Pacific, as evidenced through Network Analysis, coupled with the aforementioned data which clearly defines the epipelagic predators from those in the mesopelagic, reinforces the notion of a diverse, complex ecosystem, which is not only reliant on apex predators or 'keystone' species, yet also requires integral secondary predators, such as Blue and Shortfin Mako Sharks.

Exotic Electronic Transport in Ultrapure Metal Oxides

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The development of better conductors is one of the most significant research goals of current material and solid state physics. These could open the door to vastly more efficient energy transport systems, and applications in for example electronics and catalysis. It has recently been shown that ultrapure palladium cobaltate ($PdCoO_2$) exhibits a new regime of electron transport in cryogenic conditions. Furthermore, this regime's presence and properties seem to be dictated by the orientation of the material's nearly hexagonal Fermi surface relative to the current flow.

This transport regime shows similarities to those found in known high-purity conductors, indicating the potential for the development of a better understanding of electron transport in general. However, a better model of this new directional ballistic transport regime is necessary for this. Further development of these new models will require more studies on different systems. Specifically, it is necessary to find materials that can be grown into very pure crystals of sufficient size, and whose Fermi surfaces are very nearly polyhedral. A literature review was conducted in order to identify materials that exhibit these properties. It was found that oxides of noble metals, especially the platinoids, and p-group metal salts of f-block metals like $EuGa_4$ are the most appropriate for such studies. These can be grown into very pure crystals, and often exhibit faceted Fermi surfaces. Cataloguing these materials will provide a reference for future researchers hoping to investigate exotic regimes of electron transport, including the directional ballistic and hydrodynamic regimes.

Mind perception changes across digital and physical pictures in the Medusa effect

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People in pictures lack a certain quantity and depth of features when compared to their physical selves, causing them to become abstractions. Some pictures contain pictures within themselves, furthering this abstraction. We distinguish these abstractions with the assignment of levels: Level 1 abstractions (L1) refer to pictures of people within the environment, and pictures within pictures are Level 2 (L2). As the abstraction of a person increases (L1 to L2), mind perception decreases. This is known as the Medusa effect, referring to the mythical Gorgon whose image lacked the petrifying power of her gaze. Given that mind perception underpins moral judgment, when the former decreases, ethical consideration also reduces. While the Medusa Effect has been established using pictures in the digital medium, it has yet to be examined across physical pictures: a gap this experiment seeks to close. We hypothesize that physical pictures of people will be attributed with more mind perception than digital pictures. To compare these two mediums, we will measure mind perception of people in digital and physical pictures by asking participants to attribute measures of agency, experience, and realness across L1 and L2 abstractions using a two-alternative forced choice (2AFC) task. Results supported our hypothesis with participants attributing higher mind perception to people in physical pictures, narrowing the gap between L1 and L2. As use of online services continues to increase, understanding the cognitive biases in ethical consideration across pictorial abstractions is vital in domains such as health services, photographic evidence in court, and academic presentations.

Investigation of Sex Differences in the Rate of Cell Proliferation in Active Oncogenes and Loss of Function Tumor Suppressors in *Drosophila Melanogaster*

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An overwhelming amount of supporting evidence suggests that the activation of certain signalling pathways give rise to cell and tissue overgrowth in all animals. However, most studies have examined these pathways using cell cultures in which cell sex is abnormal, or in mixed–sex animal groups. Addressing the gap in knowledge with respect to sex–differences, our study used Drosophila melanogaster as a model organism and examined whether a sex difference exists in the magnitude of overgrowth caused by genetically induced overexpression of oncogenes and loss–of–function mutation in tumour suppressors. We hypothesized that a sex difference exists in the magnitude of tissue overgrowth in response to these activated signalling pathways. To stimulate organ overgrowth, the expression of activated Ras, Notch and Hipk were induced within the wing imaginal disc. To examine the effects of the overgrowth seen in the transgenes between sexes, the ratio of the area of the dpp line to the area of the disc was calculated and compared between the control and treatment group and categorized separately between the two sexes. The ratio of the dpp line was used for analysis to avoid the biological variable for sex differences in the size of the organ. The experiment results did not support our previously stated hypothesis of seeing a sex difference in the amount of tissue overgrowth as a result of the genetically induced oncogene and/or loss of function tumor suppressors. These findings are important as they provide us with data and can help steer and inform our future experiments.

Effects of Wood Smoke on Human Airway Epithelial Cells

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Exposure to wildfire smoke in western Canada has been an increasing problem over the last decade. From 2016 to 2018, the average annual ambient fine particulate matter ($PM_{2.5}$) levels were 8.2 mg/m^3 in the lower mainland region; however, after forest fire activity daily averages have been observed well above 100 mg/m^3 . Exposure to wood smoke (WS) is known to be harmful to health, with associated increases in heart attacks, asthma exacerbations and even death. However, the molecular effects of WS exposure on human lung cells is understudied. We hypothesize that exposure to high levels of WS will elevate oxidative stress levels and increase airway epithelial cell death likely through increasing inflammation. Immortalized human lung epithelial cells (BEAS-2B) were exposed to fresh WS generated from untreated dried cedar that was combusted in a quartz fire tube. WS was delivered to cell cultures using a Cultex live aerosol delivery system. Particle counts and gases (NO, NO_2, NO_x, CO, CO_2) were measured in real-time, with cells being exposed to ~1000 mg/m^3 for one hour. Oxidative stress and cytotoxicity were measured 24 hours post-exposure using fluorescent lipid peroxidation and Calcein AM assays. Significantly increased cytotoxicity and oxidative stress were observed in BEAS-2B cells 24 hours post-exposure compared to filtered air controls. These harmful effects on epithelial cells demonstrate how WS may be deleterious to human lung health. As global temperatures continue to rise, priming more fire seasons, it is important to understand the impact of these exposures on human respiratory health.

A Behavioral Analysis of Salt Modulation in Genetically Manipulated Fruit Flies

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Salt plays a critical role in many biological processes within animals and is therefore carefully monitored. Different salt–activated taste pathways function in either increasing or decreasing salt intake by altering an animal's behavior. Low salt concentrations are associated with increased attraction, whereas high salt concentrations are linked with aversive behavior. In the common fruit fly (*Drosophila melanogaster*), salt attraction is mediated via the receptor IR56b, while salt avoidance is mediated via the receptor IR7c. These pathways can be blocked by mutations in IR56b and IR7c, respectively. The mechanisms underlying modulation of these two pathways in response to salt need are unknown. We hypothesize that salt deprivation will enhance the attractive pathway and suppress the aversive pathway. Flies are genetically modified in the lab to yield an *IR56b* mutant, an *IR7c* mutant, and a double mutant (with both mutations). We compare these mutants to an unmutated (control) fly group. Each genotype is subjected to either a salt fed or salt deprived condition before experimentation. During experimentation the flies can choose between two solutions to ingest, one with NaCl and one without. We expect flies in the salt deprived group to have a higher preference for the NaCl solution compared to those in the salt fed groups. However, both groups with the double mutant flies are expected to be similarly averse to NaCl. This research has the potential to aid in agricultural work by providing insight on how other insects may alter crop output due to changes in their diet and behavior.

A quantitative analysis of the potential of assisted gene flow to combat the effects of climate change on Engelmann Spruce

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The impacts of climate change are affecting our ecosystems at increasing rates, causing reduced growth rates, extirpation and even extinction of species. Many plant species will struggle to adapt in time to these changes, particularly those with longer life spans and reproductive cycles, such as Engelmann Spruce (Picea engelmannii), a tree species with economic and environmental importance in British Columbia. Previous research has shown that Engelmann spruce seed yield may fail to be consistent as temperatures become more extreme. The species is somewhat drought-resistant, but changes in mean temperatures leave specimen vulnerable. One possible method of reducing the maladaptation of tree species to climate change is through the use of assisted gene flow, which involves moving individual trees within their natural range to identify tree populations that might do well in future conditions. In this study, we conducted a quantitative analysis of hypothetical data from provenance trials around the province of British Columbia, modified from a lodgepole pine project. We compared several recorded climatic and location-based variables and their influences on tree characteristics through statistical modeling and analysis, evaluating how assisted gene flow could support the future of the species as a management tool. Based on the available literature, we believe that assisted gene flow has the potential to be a valuable tool for aiding the resiliency of Engelmann Spruce. Planting populations that are adapted to the extremes which forests will likely experience could help mitigate the higher mortality rates and low reproductive rates that are anticipated as a result of climate change.

Calcium-dependent inactivation of voltage-gated calcium channels

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Voltage-gated calcium channels are proteins embedded in the membranes of cells throughout the body, including in the heart, brain, and nerves. Voltage-gated calcium channels allow for influx of calcium into cells in response to changes in electrical activity. The flow of calcium into cells is a signal that can activate many cellular processes but can be harmful if excessive, so controlling the amount of calcium in cells is important. Mutations in the voltage-gated calcium channel can cause conditions including arrhythmias, seizures, and developmental abnormalities. Another protein, calmodulin, is found inside cells. Calmodulin senses calcium to help regulate how much calcium is allowed through voltage-gated calcium channels. When more calcium is sensed, calmodulin interacts with the voltage-gated calcium channel, somehow causing a change in the channel's structure to inactivate it and prevent further entry of calcium. This phenomenon is known as calcium-dependent inactivation. While a partial structure of the voltage-gated calcium channel has been discovered using cryo-electron microscopy, the resolution is not high enough to see the part of the channel that binds calmodulin. This project aims to better understand structural changes during calcium-dependent inactivation using x-ray crystallography to see with more detail. To do x-ray crystallography, a crystal of the protein must grow, which can only happen under the right conditions. We found strategies to promote crystallization, including ways to minimize protein flexibility. When hit with x-rays, the right crystal should scatter light to generate a pattern that can be used to solve the structure.

Testing the effects of varying salinity levels on the growth rate of *Tetraselmis suecica*

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Salinity is the concentration of salts in water, and it is not homogenous throughout the oceans. For example, the Mediterranean Sea is more saline due to being closed off from the rest of the ocean and high rates of evaporation, whereas the North Pacific is less saline. As the ocean salinity is changing in response to climate change, more phytoplankton species will struggle to survive, thus impacting their growth rates. Phytoplankton survival is important for their ability to photosynthesize, ultimately providing every second breath of the oxygen we breath while only comprising 1% biomass. Not only do phytoplankton provide half of our oxygen, but they also help the oceans sequester carbon through the biological pump and undergo primary production. Overall, I tested the effects of varying salinity levels on the growth rate of the prominent green algal species, Tetraselmis suecica, and found that population growth is not related to a change in salinity.

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Towards the Total Synthesis of the Highly Potent Insecticide Rotundial

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Insect-borne diseases are a worldwide cause of illnesses and deaths, and prevention using insecticides remain the most practical option for prophylaxis treatment. Rotundial is a monoterpene dialdehyde isolated from the traditional medicinal plant *Vitex Rotundifolia* that possesses both greater repellency and bioactive longevity against mosquitoes than DEET. Naturally occurring (R)-rotundial is promising as a highly potent insecticide, but it rapidly degrades via oxidation to a non-bioactive carboxylic acid form. Consequently, research exploring the molecule as an insecticide target has been limited. We report a new 4-step total synthesis of rotundial via two synthetic routes that allows for rapid derivatization to increase its stability and bioactivity. This synthesis relies on a vinyl diazo precursor that undergoes a metal-catalyzed carbene-olefin cyclopropanation and ring-expansion sequence to generate the cyclopentene ring with the functional groups in the desired orientation. This synthetic method allows for the simple regioselective derivatization based on the choice of starting material and olefin. The synthetic route promises to access other monoterpene dialdehydes to find more bioactive, stable, and safe insecticides for the prevention of insect-borne diseases.

Analysis of differentially expressed genes in three raspberry species during postharvest storage

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Raspberries are a widely consumed and economically important fruit, providing numerous health benefits in the form of antioxidants, vitamins and fiber. The most common commercial raspberry species – *Rubus idaeus* L. (red raspberry), *Rubus occidentalis* L. (black raspberry), and *Rubus ellipticus* Sm. (golden Himalayan raspberry) – retain their freshness differently during storage, but why this happens is unknown. The goal of this study was to identify differentially expressed genes at different storage times in red, black, and golden Himalayan raspberry. We hypothesized that differences at the transcription level of genes underlying fruit quality traits (such as colour, firmness, sugar content, acidity) could impact the ability of different raspberry species to stay fresh after harvest. We conducted RNA-sequencing on an Illumina Hiseq platform and gene expression analysis via quantitative real-time PCR (qRT-PCR) of fruit samples from the three raspberry species, at different storage times (i.e., 4 days postharvest, 8 days postharvest, and 12 days postharvest). The following fruit quality parameters were measured: total soluble solids, titratable acidity and pH, firmness, color and total anthocyanin content. In raspberry species with limited fruit storability, we predicted: (i) to observe a significant increase of transcript levels (upregulation) of genes related to degradation pathways of important compounds for fruit quality (sugars, acids, pigments and cell wall materials); (ii) to observe a significant decrease in overall fruit quality parameters. Results from this study could represent a first step toward understanding molecular mechanisms in raspberry species that retain fruit freshness differently during storage.

The Regulation and Phenotypic Effects of miRNA-193a on Acute Myeloid Leukemia

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Acute myeloid leukemia (AML) is a blood cancer that begins in the bone marrow, where blood cells are produced. The disease interferes with the production of white blood cells, making them immature and malfunctional. With a 5-year survival rate of 21%, AML is a complex and deadly disease with no effective cure. However, recent research has shown that microRNAs (miRNA) may have therapeutic effects in treating AML. miRNAs are extremely small RNA molecules that regulate gene expression. They have been identified to play roles in normal and malignant processes, although the specific regulation mechanisms are unclear. One miRNA in particular, miRNA-193a (miR-193a), has been found to have anti-cancerous potentials and is found at low expression levels in AML patients with mutations in the Wilms Tumour 1 (WT1) gene. This study aims to understand the regulatory mechanisms and effects of miR-193a on AML in hopes of harnessing its therapeutic potential.

Analyses of DNA regions surrounding the miR-193a gene showed that WT1 is likely a transcription factor for miR-193a. To study this, we overexpressed WT1 wild-type and mutated genes in human AML cell lines using lentivirus, and results showed increased levels of miR-193a in the wild-type compared to controls. By overexpressing miR-193a in human AML cell lines using lentivirus, results also showed slower cell proliferation, decreased cell viability, and increased cell death compared to controls. This data suggests that miR-193a is regulated by WT1 and plays a tumour-suppressive role in AML, supporting its potential use in future miRNA-based therapies for AML.

Reporting of determinants of health inequities in randomized controlled trials of juvenile idiopathic arthritis in Canada: A scoping review

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It is important to consider inclusion and diversity in rheumatology research. We reviewed and synthesized randomized controlled trials (RCTs) for juvenile idiopathic arthritis (JIA), the most common type of arthritis among children and adolescents, in Canada with the aim of characterizing participants and identifying how determinants of health inequities are reported. To do so, we searched Medline (1990 to July 2022), Embase (1990 to July 2022), and CENTRAL (inception to July 2022) for articles meeting all of the following criteria: Canadian RCTs evaluating pharmacological or non-pharmacological interventions on JIA populations. Data extraction was guided by the Campbell and Cochrane Equity Methods Group's PROGRESS-Plus framework on determinants that lead to health inequities (e.g., Place of residence; Race; Occupation; Gender/Sex; Religion; Education; Socioeconomic status; and Social capital). Of 4,074 unique records, 5 were deemed eligible for inclusion. From these determinants of health inequities, Gender/Sex and Age were the only that were reported in all studies with most participants being female and 12.6 years old on average. In addition, Race, Socioeconomic status, Education and Features of relationships were each reported once in three different studies. Lastly, Place of residence, Occupation, Religion, Social Capital and Time-dependent relationships were not reported at all. This scoping review suggests limited reporting on determinants of health inequities in RCTs for JIA in Canada and a need for a reporting framework that reflects typical characteristics of juvenile patient populations. Establishing a standardized reporting criteria for equity factors in RCTs is important for informing accessible research for patients with JIA.

The Role of Pregnancy in Breast Cancer Growth and Metastasis

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Breast cancer is a heterogeneous disease resulting from the uncontrolled growth of cells in the mammary gland and is the leading cause of death for women between the ages of 20 and 49. During pregnancy, the hormones estrogen, prolactin, progesterone, and human chorionic gonadotropin (HCG) are released at elevated levels and act on the mammary gland to prepare for lactation. Whether or not these hormones encourage the proliferation and metastasis of cancer cells in the mammary gland remains unclear. We hypothesize that the increased secretion and subsequent activity of these hormones in the mammary gland during pregnancy increases the proliferation and invasion of mammary tumours. To determine if pregnancy will induce faster tumour growth and higher rates of metastasis, we will utilize mouse models engrafted with luciferase and GFP tagged human breast cancer cells before pregnancy. To investigate how pregnancy hormones alter tumour growth kinetics in vitro we will perform flow cytometry experiments to quantify proliferation numbers of cancer cell lines grown in the presence of pregnancy-associated hormones. Additionally, we will conduct 3D invasion assays with tumour spheroids grown with pregnancy hormones or mock-treated to determine how hormones may alter tumour invasion. We expect to observe increased tumour cell proliferation, and for invading cells to travel faster and further when cultured in the presence of pregnancy-associated hormones and in mice that become pregnant. These results could support the development of treatments for females who are at high risk of developing or are diagnosed with breast cancer during a pregnancy.

Standardization of a Model to Investigate the Effects of Cuprizone and Immune Boost on Demyelination and T Cell Infiltration in Black 6 Mice

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Multiple Sclerosis (MS) is a chronic autoimmune disease that causes severe disability. Although this disease is globally distributed, Canada has the highest incidence worldwide, making it a disease of concern. Because the cause of MS is unknown, there are currently only therapeutics available but no curative treatments. Understanding the relationship between sexes, autoimmunity, and MS pathology is a major research focus in MS. There are currently no mouse models that reflect the progressive phenotype of MS. To establish a better model for this progressive disease, we propose to administer cuprizone, a copper chelating agent, to humanised mice. Our study aims to determine whether the cuprizone model can reflect the autoimmune demyelination observed in individuals with progressive MS. We predict that cuprizone treatment will result in demyelination and infiltration of human lymphocytes.

Understanding Pre-Admission Overdoses in Concurrent Disorders Inpatients

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Overdose deaths continue to rise in British Columbia, and little is known about why this is. Previous research examining post-traumatic stress disorder (PTSD) and how it affects overdose incidence has established that PTSD frequently co-occurs with overdose. However, there is a lack of research on complex post-traumatic stress disorder (CPTSD) and overdose incidence. CPTSD is a more severe form of PTSD, with worse treatment outcomes. Therefore, individuals with CPTSD may be more likely to experience an overdose than those without CPTSD. As such, the purpose of the current study was to investigate the correlation between CPTSD and pre-treatment overdose incidence among concurrent disorders (concurrent substance use and psychiatric illness) inpatients in long-term treatment. The final sample size was n=37, with all participants in the same group. Participants were given three questionnaires to complete, with the first inquiring about their lifetime number of overdoses, the second being a diagnostic measure for CPTSD/PTSD, and the third collecting basic demographic information of age, education, gender, and race. Using Chi-Squared and an Independent Samples T-Test, we observed no significant differences among participants with CPTSD/PTSD and those with neither diagnosis in both overdose experience and lifetime number of overdoses, however the proportion of participants with CPTSD (38%) was far greater than in the general population. Thus, this research has enhanced our understanding of the interaction between CPTSD and overdose incidence and will provide valuable insight into how we can better study the concurrent disorders population, which is understudied and ill-understood.

What Bugs Bunnies: Investigating Rabbit Behaviour in an Animal Cafe Environment

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Despite being among the most popular companion animals, domesticated rabbits are commonly abandoned or relinquished to shelters and rescues in North America. To reduce rabbit welfare challenges and environmental degradation from overpopulation, rabbit rescue organizations trap, and sterilize feral rabbits. Rescues, shelters, and 'Rabbit Cafes,' also house rabbits to expose them to potential adopters while providing socialization opportunities. Understanding rabbit behaviour in these contexts is important given its significant role in assessing welfare and owner relinquishment. This observational study investigates the daily behaviour (maintenance, social, and locomotive) of rabbits living in a cafe by creating and analyzing activity budgets. Group-housed rabbits (n = 41) were observed in a 3-month study conducted in a rabbit cafe setting. Behavioural observations were made triweekly from admittance until adoption or the end of data collection and involved two 4-minute samples per rabbit daily. Observations were recorded using a zero-one sampling method with 30-second intervals, and each rabbit's percentage of time dedicated to each behaviour was calculated. Environmental monitoring of noise levels were recorded. Pending results will include activity budgets of rabbits and the impacts of rabbit café variables (including sound levels and the number of people present) on rabbit behaviour. Significant changes in activity budgets in the presence or absence of different variables could identify aspects to ameliorate. Results will help inform understanding of normal rabbit activity and the variables impacting rabbit behaviour and welfare in café settings.

Metric Search for Rank List Compatibility Matching with Applications

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As online dating has become more popular in the past few years, an efficient and effective algorithm to match users is needed. In this project, we proposed a new dating matching algorithm that uses Kendall–Tau distance to measure the similarity between users based on their ranking for items in a list. (e.g., their favourite sports, music, etc.) To increase the performance of the search process, we applied a tree–based searching structure, Cascading Metric Tree (CMT), on this metric. The tree is built on ranked lists from all the users; when a query target and a radius are provided, our algorithm can return users within the radius of the target. We tested the scaling of this searching method on a synthetic dataset by varying list length, population size, and query radius. We observed that the algorithm is able to query the best matching people for the user in a practical time, given reasonable parameters. We also provided potential future improvements that can be made to this algorithm based on the limitations. Finally, we offered more use cases of this search structure on Kendall–Tau distance and new insight into real–world applications of distance search structures.

Refining Research Prioritization in Infant Exploration

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Early infant development is closely tied to play, yet not much is known about the neural processes going on during infant learning during free play in a naturalistic environment. In a recent study led by Dr. Lauren Emberson (2022), infant neural responses during free play in an infant-directed environment were examined to provide insight into the neural-cognitive aspects of naturalistic play during infant development. As an extension of this project, this study intends to take the sociocultural factors of naturalistic infant play into account by considering parent perspective on the collected behavioral infant data. In the study led by Dr.Emberson, behavioral variables such as infant vocalization and infant mouthing were coded and analyzed. This study uses aspects of cognitive interviewing to further our understanding of infant behavior and provide parental context to the coded behaviors. Participant input in research has been found to be essential to align the goals of a study with community interest. In accordance with this finding, we also aim to understand participant experience in the previous study to enhance the next steps of our research on infant play and exploration. To accomplish this, data from the initial study was used to provide context for in-depth parent interviews that provided qualitative data regarding social and cultural factors that impact infant play. By conducting these interviews, we hope to gain a further understanding of the sociocultural aspects of infant learning and play.

It All Stems from Them: The First Step in the Framework of Understanding Hematopoietic Stem Cells in a Dynamic System

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Hematopoietic stem cells (HSCs) are a type of stem cell that can develop into any type of blood cell. The ability to regulate HSC function can be pivotal to sustaining proper blood production and homeostasis in an organism over its lifetime. This study aims to develop a framework whereby information about HSCs, or any differentiating cell can be collected and analyzed. To do so, the study utilized single–cell RNA sequencing (scRNA–seq), Cell–cell communication inference (CCC inference), Ordinary differential equations (ODE), and a Cellular Potts model (CPM). ScRNA–seq was used to determine the gene expression profile of individual hematopoietic stem cells. Specifically, scRNA–seq was performed on Peripheral Blood Mononuclear Cells. Results from scRNA–seq determined the genes most commonly expressed in mature blood cells. CCC was performed using the CellChat package in R to investigate the particular interactions of these genes involved in hematopoietic stem cell differentiation. The interactions between the genes were then modeled using a system of ordinary differential equations and visualized using Python. In order to validate our findings, a CPM was then created with Morpheus to model the cellular system in real–time. The use of a multiscale CPM can analyze the emergent and qualitative behavior of a group of cells through different cell–cell interaction pathways. Specifically in this project, a CPM model was created to analyze the proliferative behavior of Myeloid Progenitor Cells, while building a framework to study Notch, CD99, diffusive signaling, and other cell interaction pathways in the future.

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Implicit Cognition: Transliminality and Ideomotor Effects

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This project uses a Ouija board as a device to evaluate if ideomotor effects can surpass explicit cognition and access implicit cognition. Implicit cognition is cognition beyond conscious control, evoking knowledge encountered in the past. Due to the inability to directly study implicit cognition, ideomotor effects— or unintentional movements— are studied to investigate the phenomenon. Despite the spiritual connotations of the board, it is used purely to operationalize the measure of unconscious knowledge. Movements in response to questions can be explained by ideomotor effects. Differences are compared between conscious (control) and unconscious knowledge (experimental or Ouija phase) by comparing the accuracy of participants' answers to questions. Implicit cognition is indicated when the accuracy is higher during the Ouija phase than the verbal phase. A confederate is involved to insinuate another agent is involved in answering questions during the Ouija phase by pretending to put their hands on the planchette, taking away the conscious agency and evoking the unconscious of participants. Ideomotor performance has been implicated using a Ouija board, but the influence of transliminality is unknown. Transliminality is a psychological trait referring to an individual's sensitivity to crossing in or out of consciousness. I hypothesize that participants with a higher transliminality score will demonstrate a higher accuracy during the Ouija phase than participants with a lower score. I expect that high transliminality scores will correlate with high accuracy in responses. This study offers potential insight regarding the influence of transliminality on the likelihood of observing ideomotor effects via other devices.

Novel Predictive Biomarkers for Metastatic Triple-Negative Breast Cancer: IL-2 and CD16 Possibly Associated with High Survival Rates in Patients

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Triple-negative breast cancer (TNBC) is the most aggressive type of breast cancer due to its unique biology. Unlike other subtypes, TNBC lacks targetable hormone receptors or HER-2 (human epidermal growth factor receptor 2), rendering targeted therapy useless; therefore, chemotherapy is currently the sole mode of treatment.

TNBC is also considered the most immunogenic subtype of breast cancer, making it a suitable target for immunotherapy. However, there is a clinical need to utilize predictive biomarkers to find the treatment-sensitive cohort to avoid unwanted side effects. Interleukin-2 (IL-2), which contributes to T cell and natural killer cell development and activation, alongside CD16, a surface receptor expressed by the two cells to facilitate antibody dependent cell-mediated cytotoxicity, are a pair of potentially effective biomarkers to stratify TNBC patients who would benefit from immunotherapy. This pair was chosen because their functions are related and bridges the innate and adaptive immune response. Unstained slides will be obtained from a previous interventional phase 3 clinical trial, which included 902 participants randomly assigned to the experimental or placebo arm. Multiplex immunohistochemistry (IHC-P), anti-IL-2 and anti-CD16 antibodies will be used to measure biomarker levels and investigate their correlation with patients' survival. We hypothesize that patients with high levels of IL-2 and CD16 will respond better to immunotherapy than patients with lower levels. Results of this study would help TNBC patients receive the type of treatment they benefit most from.

Effects of viral geometry and receptor distribution on influenza motility

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Two surface receptor proteins, hemagglutinin (HA) and neuraminidase (NA), are located on an influenza A virion's surface. HA binds to sialic acid (SA) receptors on the cell surface, while NA cleaves the bonds and destroys the ligand. Through cycles of the formation and cleavage of HA–SA connections, the influenza virion is able to move across the surface of the cell. Distribution of NA on the viral surface, shape, and mode and directionality of motion vary between viruses, though the connections between these factors are not well-understood. This project will investigate how the geometry and NA distribution of a virion affect its motility. Stochastic simulation will be used to model the movement of an influenza virion. The receptors, viral surface, and cell surface will be modelled as simplified shapes, and the forces acting on them will be described in terms of their potential energies. Based on these forces, a set of stochastic differential equations simulating the virus's movement can be designed. It is expected that spherical virions will move more randomly compared to filamentous virions, whereas those with polar distributions of NA are expected to move more unidirectionally than virions with an equal distribution. The results of this study will clarify the relationship between viral geometry, receptor distribution, and virus motility and help better inform research into influenza. Future studies may choose to examine influenza through this lens to find ways to reduce infectivity and transmissibility.

EMPHASize – EModule on Professional Health Awareness on Eating Disorder and Weight Stigma

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Eating disorders (ED) can compromise many aspects of a person's quality of life. However, many barriers prevent accurate and timely diagnosis, leading to additional distress due to delays in diagnosis and treatment. As ED remains a persistent issue in society, EMPHASize, a set of educational modules encompassing both clinical and psychosocial aspects of ED, is developed to address the knowledge gaps in current education and practice. The aim of the pilot study is to develop a module specific to ED that can be used in healthcare education, and assess the practicability of its implementation.

The two self-paced online modules will be implemented in health science and nursing classrooms, as well as training for professional coaches. Participants will complete an anonymous online survey to provide feedback on several metrics, including satisfaction with content, self-perceived increase in knowledge, and overall suitability of the modules in post-secondary classrooms. The results collected from the survey will provide insight on the feasibility of module implementation to students and practicing professionals. This pilot will provide a foundation for future evaluation of EMPHASize as an effective tool in healthcare education, with the aim of implementing it as a part of standard curriculum in health science disciplines and continuing education for practicing health professionals. With increased education surrounding ED, it is anticipated that underdiagnosis of ED will reduce as healthcare providers gain a more comprehensive understanding of ED.

A daily diary investigation on Adverse Childhood Experiences (ACEs), coping efficacy, and negative affect

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Adverse childhood experiences (ACEs) have been linked to higher daily negative affect (NA) and less adaptive daily coping (Kong et al., 2021), while baseline coping efficacy (i.e., one's perception of how well they coped with a stressor) have been associated with more regular daily physiological stress responses (Drake et al., 2016). It is unknown how daily coping efficacy (within-persons) may predict daily NA and whether ACEs may interact with coping efficacy to predict NA.

In a sample of 229 community-based adults (aged 25–87), we examined the associations of daily coping efficacy and ACEs with end-of-day NA and the moderation of ACEs on the relationship between coping efficacy and NA. Participants reported ACEs at baseline and completed 4 surveys (3 daytime and 1 bedtime) per day for 14 days about coping efficacy for current stressors and NA.

Multilevel modeling found that daily coping efficacy predicted end-of-day NA within individuals, such that on days where participants reported higher coping efficacy than their average coping efficacy, they experienced lower evening NA. Additionally, between individuals, participants who reported less exposure to ACEs during childhood experienced lower average end-of-day NA. No interaction was found between coping efficacy and ACEs.

Findings highlight the importance of daily perceived coping efficacy in daily affective well-being and suggest that this relationship does not vary with childhood ACEs exposure. Future work should assess specific coping approaches, such as problem- or emotion-focused coping, to elucidate the links between stress-related coping, perceived coping efficacy, and daily affect.

Access to Pediatric Urology Care: A Pilot Study in British Columbia

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Canada's vast geography poses barriers for patients requiring access to specialized care. Currently, approximately one million children in British Columbia and Yukon depend on BC Children's Hospital (BCCH) to receive pediatric urology care. Two change ideas have been implemented to improve patients' access to care: an outreach program and virtual delivery of care. The outreach program consisted of pediatric urologists from BCCH traveling periodically to University Hospital of Northern BC in Prince George. Where suitable, patients also have the option for virtual provision of care.

This retrospective study included new consultations for hydronephrosis or non-urgent testicular pathologies in 2018 and 2021, which were before and after the implementation of the outreach program and virtual healthcare. Information on residences and appointments was extracted from their electronic medical records. The distances travelled by these patients to reach the urology clinic at BCCH were calculated on Google Maps using shortest driving distances possible. The wait times were calculated by subtracting referral dates from consultation dates.

Virtual provision of care did not affect the wait times but significantly reduced the average traveling distance by 40.6%, from 239.76km to 142.43km (p < 0.001) and saved patients 73,698km. The outreach program saved patients 15,899km.

Given this study's findings, the outreach program and virtual provision of care can potentially reduce barriers for patients to access pediatric urology care at BCCH. The findings from this study will help to inform health care delivery models, with the ultimate goal to improve access to necessary surgical care for pediatric patients.

Effects of a maternal high sucrose intake during pregnancy on glucocorticoid levels in maternal serum and amniotic fluid

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The World Health Organization recommends that less than 10% of total caloric intake should come from free sugars, including sucrose (table sugar). However, Canadian free sugar consumption accounts for 13.3% of total caloric intake on average, up to 25%. In rats, maternal high-sucrose intake starting from pre-pregnancy until lactation, decreases maternal serum corticosterone, an active glucocorticoid known to regulate development and the stress response, and increases female adult offspring blood corticosterone. However, it remains unclear how a maternal high-sucrose diet during gestation only affects glucocorticoids in the maternal serum and amniotic fluid. This project investigates whether a maternal high-sucrose diet during pregnancy affects maternal serum and amniotic fluid glucocorticoid levels. I hypothesize that a maternal high-sucrose diet is a stressor that alters glucocorticoids in the maternal serum and amniotic fluid. We fed 32 female Long-Evans rats either a control diet (1% sucrose) or a high-sucrose diet (26% sucrose), starting from the 1st day of pregnancy. Both diets are isocaloric and nutrient-matched. On the 20th day, we collected the maternal serum and amniotic fluid. We used a highly specific and sensitive liquid chromatography-tandem mass spectrometry assay to quantify glucocorticoid levels in the samples. I predict that a maternal high-sucrose diet will decrease glucocorticoids in the maternal serum and increase glucocorticoids in the amniotic fluid. This project will bring insight on whether a high-sucrose diet during pregnancy is sufficient to induce a change on glucocorticoids in the maternal serum and amniotic fluid, and overall, on how a diet impacts physiology, specifically steroids.

Eat, Fly, Love: unraveling the mysteries of maternal diet, Drosophila oocyte ageing, and metabolomics

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As women age ovarian function declines before other organs, and aged oocytes exhibit a range of defects dramatically reducing fertility. Changes in cellular metabolism have been proposed to drive cellular aging. To understand the potential role of metabolic changes to oocyte aging, we studied the metabolomes of young and aged Drosophila oocytes. Using mass spectrometry it was found that metabolites associated with cellular oxidative stress and maintenance of cellular redox potential were significantly altered in aged oocytes. We also wanted to know if it could be differences in the mother's diet that affect her ability to store eggs, and why we saw changes in metabolites. It is already known that flies can adjust their rate of oogenesis based on nutrient levels. We measured the hatch rates of young and aged oocytes from female flies reared on amino acid deficient diets. When flies were deprived of amino acids they laid fewer eggs but the eggs they made had the same hatch rate as eggs laid by non-amino acid deficient mothers. This shows that female flies take in environmental cues like nutrient starvation to ensure that they continue giving their offspring the best chance at survival by making high quality eggs, even if that means they make fewer oocytes. What is causing the changes in aged oocyte metabolites is still unknown. Continued exploration of the mechanism of ageing in oocytes is key to understanding the reduction in fertility seen in both aged human and fly oocytes.

The Proteins that Fuel a Pandemic: How SARS-CoV-2's Structure Sets It Apart from SARS-CoV and MERS-CoV

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CoVID-19, also known as SARS-CoV-2, surged in the year 2019, took the world by storm, and has claimed millions of lives since. According to data, SARS-CoV-2 is more infectious compared to other coronaviruses encountered in the past, namely SARS-CoV and MERS-CoV. This higher infectivity is one of the significant factors that lead to the pandemic. In this study, we aim to identify the regions that contribute to the high infectivity of the novel coronavirus.

We will be using Multiple Sequence Alignment to compare the sequences of the coronaviruses and use this data to build a phylogenetic tree. We will then be checking for signs of positive selection in the spike protein sequences of SARS-CoV-2. Finally, we will inspect if the positively-selected mutations lead to structural changes in the mature proteins that could affect binding to the ACE2 receptor and increase viral infectivity.

We expect to find that the higher transmissibility of SARS-CoV-2 is due to differences in the spike proteins of the viruses. The higher S-S interaction in the spike protein of SARS-CoV-2 compared to the other viruses may make it more virulent. Additionally, it can recognize and bind to receptors more effectively, which might also contribute to higher infection rates.

Vegetable Motor Project – A low impact alternative to 'green' electric vehicles

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Ecosystems are collapsing while society considers 'green' technology as the solution. Material extraction and technological redundancy are vital issues; how do we solve them? Producing a technology, or indeed anything new, has mass ecological implications due to mining, refining, manufacturing, and shipping. They create toxic ponds and cause deforestation, undermining food security. We need to transition away from fossil fuels, and we can do so in a way that does not shift urban air pollution in the global north to groundwater pollution in the south. If the cobalt required for EVs causes humanitarian atrocities in the Democratic Republic of the Congo, a region disproportionately impacted by imperial histories, is it a solution?

In this talk, I will describe how my team and I have improved upon a system that allowed enthusiasts to run their old diesel vehicles on vegetable oil– without the diesel startup and turn–off dependence. I will describe how it has a significantly lower environmental impact, both in terms of GHGs and ecologically, and how a simple paradigm shift has profound implications on global innovation practices.

Our prototype utilises a used, already–manufactured diesel engine, and we will run it exclusively on used vegetable oil. By designing a heated fuel tank that reaches 60°C and matching viscosity values to diesel, we expect to transport a human in a small vehicle reliably. The implications of this research will extend the working, low–impact life of millions of vehicles on the road today.

Interleukin-1 Alpha and Transforming Growth Factor-Beta 1 Crosstalk: Implications in Chronic Obstructive Pulmonary Disease

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Chronic Obstructive Pulmonary Disease (COPD) is an incurable lung disease, and the third-leading cause of death worldwide. In COPD, chronic inflammation leads to airway scarring (and obstruction) through fibroblast cells. We have previously shown that Interleukin-1 Alpha (IL-1α) is the primary airway inflammatory mediator of fibroblast-derived inflammation and extracellular matrix protein deposition, with transforming growth factor-beta (TGF-β) playing a pivotal role in the process. IL-1α also triggers the release of inflammation-regulating microRNAs such as miR-146a in airway fibroblasts. While IL-1α and TGF-β1 are co-occurring in COPD, only the individual roles of IL-1α and TGF-β1 are well-studied, meaning effects of their signal interaction, or crosstalk, are unknown. We hypothesize that miR-146a mediates the crosstalk between IL-1α and TGF-β1 in COPD. We mimicked COPD conditions by growing healthy airway fibroblasts in-lab, then treating with control (media), 1 ng/ml IL-1α, 50 ng/ml TGF-β1 and a combination of both. After 1 and 24 hours, miRNA produced by the fibroblasts was extracted to make DNA copies for quantitative polymerase chain reaction, to compare relative miR-146a expression in different conditions. At 24 hours, miR-146a expression was relatively increased by IL-1α alone and this was not altered upon the addition of TGF-β1 in the combination treatment. Our data shows that IL-1α is essential for modulating the response of TGF-β1 through miR-146a indicating that miR-146a may be a possible therapeutic target for the treatment of excessive inflammation and scarring in COPD.

Functional Assessment of the fMRI-derived Auditory Perception Network

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Functional magnetic resonance imaging (fMRI) is a method for tracking blood oxygen level–dependent (BOLD) signals as they move in different network configurations around the brain. The available network configurations are currently unknown. This study includes various analyses of fMRI signals during multiple cognitive tasks, curations of anatomical configurations that repeat over tasks, and interpretations of BOLD signal changes between task conditions. The project focuses on the discovery and study of the auditory perception (AUD) network involved in linguistic processing. Through two key cognitive tasks, the Thought Generating Task and the Radio Speech Task, the activation of the novel AUD network is measured during times of auditory perception. Data from the functional brain network and its associated hemodynamic responses (HDRs) were analyzed through fMRI Constrained Principal Component Analysis (fMRI-CPCA), two-way repeated-measures ANOVA, and SPSS Analysis of Predictor Weights.

Urban Design for Sustainability in Vancouver

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Vancouver, British Columbia, is a great example of a city where urban design has been utilized to shape more sustainable development, through the implementation of green spaces, community amenities and transportation networks. However, challenges such as non-affordable housing, green gentrification, inequality amongst demographics, climate change, and the expenses associated with carrying out urban developments are current challenges that hinder the city's sustainability efforts. The aim of this project is to understand Vancouver's urban planning initiatives, and identify the benefits provided on the social, environmental and economic levels, as well as any shortcomings. From conducting a literature review, it is depicted that while Vancouver has made great advances for green space distribution and transportation networks, there appears to be a money-maximizing approach that prioritizes economic values over citizen welfare and liveability. Through further analysis of the city's current action plans (e.g. Greenest City 2020 Action Plan, Transportation 2040, Metro Vancouver 2040), interviewing specialists in the field, and comparing Vancouver's situation with case studies from other cities, it is evident that a greater focus on socio-economic considerations must be implemented in order to interweave innovative urban planning with sustainability. Future considerations such as decreasing the differences in accessibility between high-income and low-income households, bridging the gap between political decision makers and community individuals, and encouraging the voices of underrepresented groups would aid in maximizing human health, social capital, cultural heritage, environmental conservation, economic productivity, and overall community rapport.

Glacial Retreat and Changes in Streamflow at the Temperate Lake-Terminating Bridge Glacier

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Glaciers supply water to downstream ecosystems and helps meet human water demands, especially during dry summer months. Mountain regions are sensitive to climate change which accelerates glacial retreat and impacts flows to glacier-fed rivers. This study examines glacial and climatic influences on the streamflow of Bridge Glacier in British Columbia's Coast Mountains. This glacier terminates at Bridge Lake and calves icebergs into the lake. Statistical Mann-Kendall tests were used to identify temporal trends in temperature, precipitation, and streamflow of Bridge River between 2010 to 2021. Linear regressions account for climatic variability on streamflow, then residuals were analyzed to identify glacial influences on streamflow. Statistically significant trends ($p < 0.05$) show increasing December precipitation, decreasing February temperatures, and increasing winter streamflow. Over the melt season temperature and precipitation were significant predictors of streamflow, as seen during the June 2021 heatwave where temperatures reached 33^0C, an increase of 19^0C from the average daily high, and streamflow reached 80 m^3/s, exceeding June and July averages of 24 m^3/s and 39 m^3/s, respectively. This suggests increased meltwater production with extreme temperatures. However, lack of clear trends in glacial influences on streamflow suggest that streamflow may currently be at a highest point, and future reductions of glacial area may produce lower flows. Overall, the glacier retreated 2.7 km^2 between 2010–2021, presumably retreating beyond the lake, and we expect increases in water temperatures. Ecological impacts of flow reductions and increased temperatures should be investigated due to the cascading influences of deglaciating processes in high mountain regions.

The Scent of the City: Investigating Odorous Pollutants in Metro Vancouver's Air Air Pollution, Atmospheric Science, VOCs, Odours, Mixed-Methods Approach

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While odour is often seen as only an annoyance, odour exposures can adversely impact human health, well-being, and quality of life. Odorous contaminants include mixtures of volatile organic compounds (VOCs) that can affect cognition and mood, irritate upper airways, contain toxic constituents, and produce secondary pollutants that are associated with premature mortality. Despite this, the current understanding of the sources and source-resolved health impacts is quite limited. As a part of the Smell Vancouver project, a community science app SmellVan was launched in 2020 to collect odour complaints from crowd scientists of the Metro Vancouver region. In this work, we used these complaints to examine the spatial relationships of sources of odorous air pollutants and their impacts using an open-source geospatial analysis tool QGIS. First, we developed a VOC emissions inventory for Metro Vancouver with time-resolved emission patterns of chemical signatures of VOCs across 12 different types of anthropogenic emission sources for the year 2021. Next, we spatially allocated that emission inventory to facilities across Metro Vancouver. Finally, we quantified the proximity of odour sources from our inventory to community odour reports in SmellVan using different approaches. We also estimated intra-industry and inter-industry variability of odour impact, and estimated policy-relevant metrics such as the separation distance that are relevant for urban planning of residential centres and industrial facilities. Findings from this research can inform the development of environmental regulations and policies around zoning and limit the odour and air pollutant exposures of community members living or working near odour sources.

Bubbleshooting: Troubleshooting and Enhancing the Microfluidics for Silicon Photonic Biosensors to Resolve Bubble Formation Issues

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Silicon photonic biosensing can detect the presence of a substrate in a sample by measuring the change in optical properties that occur as the substrate binds to a protein-functionalized detection zone. Our group aims to develop a silicon photonic biosensor capable of detecting multiple biomolecules in real-time, enabling on-site sample analysis. Microfluidic integration is an essential part of our biosensor for accurately quantifying substrates with minimal sample volume. The micro-scale channels facilitate the precise delivery of sample fluid to the detection zone. However, we found that sensor malfunctions can occur because of a small yet impactful phenomenon: bubbles. Bubbles are principally caused by the nucleation of supersaturated gas, which is dissolved in the moving fluid, onto the non-wetted crevices of microfluidic channels. The small bubble nuclei can enlarge into bubbles of various sizes, leading to flow rate fluctuations, channel obstructions, and abnormal sensor readings. We conducted "bubbleshooting" experiments with various polydimethylsiloxane(PDMS)-based microfluidic chips to identify the source of bubbles, and determined that channels with 1) incomplete wetting, 2) high surface roughness, and 3) misaligned layers had significantly more bubble nucleation. To resolve these issues, we explored 1) pre-wetting the channels with a low surface tension fluid, 2) comparing molds with different resolution and surface roughness, and 3) testing different microfluidic materials and fabrication strategies. Our new microfluidic chip fabrication method involves laminating acrylic (PMMA) layers with pressure-sensitive adhesives (PSA). This lamination technique is expected to produce PMMA-based chips with channels of improved wettability and quality at a low-cost and high-throughput.

Development of an ultra-rapid magnetic CRISPR screening method for genetic analysis of cellular glycosylation pathways

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Over the past 10 years, cancer research has undergone a major transformation. In 2018, the Nobel Prize in Medicine recognized the groundbreaking potential of cancer immunotherapies, drugs that allow the immune system to target and eliminate cancer cells. The human immune system functions by utilizing signaling receptors expressed on the surface of immune cells. Upon binding to specific targets (ligands), these receptors result in a decrease in the observed immune response. In diseases like cancer, the cell surface may be changed to allow cancerous cells to suppress immune cell activity and avoid detection by overexpressing certain ligands. The signaling pathways and genetic changes that lead to the alteration of the cell surface in cancer cells, however, are not well defined. Here, we propose a screening approach to identify genes and specific signaling pathways that can be targeted to reverse alterations of the cell surface in cancer cells, thus eliminating their ability to evade the immune response. We then optimized the approach using a co-culture assay to determine efficient conditions. With this approach in place, we conducted a genome-wide screen with MDA-MB-231 (breast cancer) cells, which revealed promising genes of interest that could be targeted. Our future steps aim to broaden the scope of the project to encompass multiple cancer cell lines to potentially identify new cancer targets, thereby generating novel therapeutic strategies for cancer treatment.

"Point-of-Care Testing: The Student Point-of-View" Current UBC E2P PharmD student interest in POC testing education

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Point-of-care (POC) testing refers to a form of testing in which the analysis is done at the point of care1 – at the time and place of patient care as opposed to within a laboratory. Results are available quickly and can be used to aid in determining diagnoses or creating treatment plans. Given the benefits they bring to the patient care process and their growing popularity amongst patients2, pharmacy students must also be equipped with knowledge of POC testing devices to ensure they are prepared for future practice.

Currently, only two POC tests are covered within the University of British Columbia (UBC) Entry-to-Practice PharmD (E2P PharmD) curriculum. Throughout the four-year program, detailed education and hands-on experience is only provided on blood glucose monitors. The purpose of our study was to receive feedback and assess student interest on further integration of POC testing education into the current curriculum.

All 33 students that participated in our survey responded that they would like to see more POC testing education within the curriculum. When asked why, students expressed a lack of familiarity/knowledge and motivation to provide better patient education. Many students shared various experiences where they were unable to answer questions or provide satisfactory instructions on how to use POC testing devices on rotations. Overall, our results showed that students are motivated to learn more if provided with the opportunity. The findings of this report will inform future decisions on further integration of POC testing education into the UBC E2P PharmD program.

Identification of H3K27me3 and H3S10T11phos as Potential Biomarkers in Pediatric Osteosarcoma

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The most common primary bone tumour, osteosarcoma, is often defined as genetically non-recurrent and heterogeneous. Chemotherapy after diagnosis is often followed by resection and assessment of treatment response, which helps inform further therapeutic choices. Identifying potential biomarkers that may affect survival could fuel clinical trials attempting to improve outcomes. Relative to conventional genetics, little is known about osteosarcoma epigenetics. We aim to characterize the methylation and phosphorylation status in osteosarcoma using histone markers found in primary diagnostic biopsies and their paired metastases. We constructed two tissue microarray sets from 58 primary cases, and 54 related metastatic and recurrent neoplasms, with tissue blocks available from 2002–2022. Clinical charts were reviewed for post-therapy response, development of metastasis, and overall survival. We evaluated 6 histone H3 residues using immunohistochemistry, including H3K4me3, H3K9me3, H3K27me2, H3K27me3, H3S10T11phos, and H3S28phos. Tumours were scored with low (<25%) or high (≥25%) nuclear staining of tumour cells. Diagnostic biopsies that showed low H3K27me3 nuclear staining were associated with poor treatment response (<90% necrosis) at the time of definitive excision ($P < 0.05$). Loss of H3S10T11phos expression at the first metastasis compared to the primary tumour was also observed ($P < 0.05$). Survival trends were also observed with loss of H3S10T11phos in the primary tumour. This pilot study identified H3K27me3 and H3S10T11phos as potential biomarkers for osteosarcoma which may predict a poor neoadjuvant response and signify changes to gene expression in metastases, respectively. Although studies with a larger cohort are needed, these results support the expanded evaluation for risk stratification of other histone markers.

Systematic Review For the Impacts of Marketing to Children Policy on Different Socio-Demographic Subgroups

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Background: Evidence demonstrates that food marketing can impact children's choices, particularly affecting those of low socioeconomic positions (SEP) or racialized communities due to disproportional exposure to unhealthy advertising. Restrictions in food marketing contribute to reduced purchase of unhealthy goods by or on behalf of children, thus benefiting public health. However, little research has investigated the relationship between the difference in SEP and food marketing with a focus on the marketing to children policy (M2K).

Objective: The aim of this project is to examine probable impacts of the M2K implementation on low SEP subgroups compared to high SEP, and differentiate the features experienced by each group.

Methods: Five databases and grey literatures will be examined following the PRISMA guidelines. Using the terms "marketing to children policy", "food marketing", "price", "social-economic factors", the review observes independent studies and literature reviews published between 2015-2022. The inclusion criteria for the observed population are parents' education and family income. Based on the data, the work consequently gathers information about specific affected ethnic groups. The publications that satisfy the criteria will be chosen for further analysis. The degree of intervention, randomization, inclusion of reliable sources, and overall credibility of the studies will be evaluated.

Anticipated Results and Conclusion: The findings from databases will be studied and linked to the development and utilization of M2K, further exploring the impacts of this food marketing strategy on children with high and low SEPs. This study can help policymakers and health professionals identify preferable components when implementing this policy. This systematic review will help understand and develop solutions for the low SEP subgroup with more studies that specifically target them. A deeper analysis of the studies we presented will be used to inform the implementation of M2K. By examining the impact of this strategy on children from both high and low SEP backgrounds, researchers can gain a better understanding of how socioeconomic factors influence consumer behavior and how marketing strategies can be tailored to meet the needs of different populations. The findings from databases will be studied and linked to the development and utilization of M2K, further exploring the impacts of this food marketing strategy on children with different SEPs.

Reclaiming the Rainbow: Queer Identity Formation and the Reclamation of Rainbow Capitalism

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Rainbow capitalism–a marketing technique in which corporations co-opt the language and imagery of queerness–is increasingly pervasive in modern North American markets. Existing studies attempt to identify this phenomenon and trace its growth alongside growing social acceptance of queerness. However, the voices of queer people themselves have been notably absent from this research. This study attempts to recenter queer voices in the study of rainbow capitalism in order to determine the relationship between queer identity formation and rainbow capitalism. Data was collected through semi-structured interviews with members of the Vancouver queer community, focused on topics of consumer sovereignty, identity formation, and reclamation. Preliminary findings indicate that some queer people approach rainbow capitalism as an opportunity to assert queer identity in subversive ways rather than as a source of marginalization. Further, queer people view themselves as active participants in the construction of a queer counterculture rather than passive recipients of rainbow marketing. This research shifts the agency in the advertiser-consumer relationship away from the advertiser and toward the consumer. Further, it examines the way in which everyday expressions of queer identity demonstrate anti-capitalist and anti-cisheteronormative attitudes.

Can we determine, using classification algorithms, whether a person's drawing of an Archimedean spiral was made using their dominant or non-dominant hand?

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Traditionally, motor function in Parkinson's disease (PD) has been assessed through a series of physical exams performed by medical professionals with expertise. This process requires longitudinal in–person assessments, placing considerable strain on the healthcare system and the predominantly geriatric patient population affected by PD. Although machine learning (ML) has shown promise in enhancing PD diagnosis, it has primarily augmented conventional diagnostic techniques. A home–based web–accessible platform that utilizes ML algorithms to analyze hand–drawings for initial diagnosis could greatly alleviate these challenges. However, obtaining sufficient volumes of hand–drawn data from PD patients for training ML algorithms remains a challenge. Therefore, this project proposes a web–based platform that classifies the tracing of the Archimedean spiral template in healthy individuals performed with their dominant or non–dominant hand using a computer mouse. This approach not only improves accessibility compared to tablet-based implementations but also approximates the diminished coordination capabilities characteristic of PD by examining the differences in dexterity between an individual's dominant and non–dominant hand. Three sophisticated classification methodologies, previously demonstrated as efficacious in related studies—statistical inference, Approximate Entropy method, and transfer learning on convolutional neural networks—were employed and pre–trained on a dataset of hand–drawn images, primarily collected from UBC students. Although the models' effectiveness is documented in the literature, their observed performance limitations point to potential constraints of data obtained through web platforms and the existence of confounding variables that warrants further investigation. This innovative web–based model lays a robust foundation for future endeavors to provide preliminary PD diagnosis.

Measuring the activity of a steroid-synthesizing enzyme in the avian brain

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Steroids act on the brain and modulate social behaviours, such as aggression. Steroids synthesized locally within the brain (termed "neurosteroids") can modulate behaviour without increasing steroid levels in the blood. Neurosteroids can be synthesized de novo from cholesterol or from circulating precursor steroids. 3β–hydroxysteroid dehydrogenase/Δ^{5-4} isomerase (3β–HSD) is an enzyme that catalyzes the conversion of dehydroepiandrosterone (DHEA), an inactive sex steroid precursor, to androstenedione (AE). AE is further converted into other active sex steroids, such as testosterone and estradiol, by different enzymes. 3β–HSD is present in the brain of many vertebrate species in a region–specific manner. The activity of 3β–HSD can alter the availability of active steroids within the brain, which can modulate behaviour. This study aims to develop and validate an accurate and specific enzyme activity assay to examine the activity of 3β–HSD within different regions of the song sparrow brain. The activity of 3β–HSD is quantified by measuring the amount of AE produced after brain samples are incubated with a known amount of DHEA. I will quantify AE and DHEA using liquid chromatography–tandem mass spectrometry (LC–MS/MS), an accurate and specific method for steroid quantification. I will use this method to measure the differences in 3β–HSD activity between areas of the social decision–making network in the adult male song sparrow brain. Preliminary results show that 3β–HSD activity can be measured in brain tissue using LC–MS/MS. Developing a more sensitive and specific method to measure 3β–HSD activity will help us understand the region–specific activity of 3β–HSD within the brain.

How Do You Know Who's the Bad Guy? 4-Month-Olds' Neural Responses to Helping and Hindering Scenarios

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The ability to access human interactions is crucial to have a successful social life. But, it remains unclear when and how sociomoral evaluations develop. Evidence from behavioural literature suggested an innate moral core as they show sensitivity to sociomoral behaviours as early as 3 months of age by showing a preference towards a prosocial character relative to an antisocial character. However, some question the validity of behavioural studies' results due to their limitations, such as infants' low physical ability to reach for their desired choice. One way to address these constraints is by examining infants' neural processing underlying their sociomoral evaluations via EEG (electroencephalography) while prosocial/antisocial events unfold. To date, only three studies examined infants' sociomoral evaluations via specific neural signatures associated with social (indexed by P400 and N290 ERP components) versus attentional processing (indexed by Nc components) and infants' preferences towards prosocial versus antisocial events via testing frontal alpha asymmetry (indexing approach /avoidance motivation) in 6- and 12-month-old infants. This study aimed to re-examine and clarify past results, adding to the developmental understanding of humans' sociomoral evaluations by testing younger infants. We hypothesize that this new age group will have results similar to the 6-month-old sample in the recent Tan & Hamlin, 2022 study. Frontal alpha asymmetry with greater right alpha power will be recorded for helping compared to hindering scenarios. While greater P400 & N200 amplitudes will be reported for hinderers compared to helpers, in comparison to no differential Nc components between trials. Data collection is ongoing.

Russia's Justification for Invasion: Role of a Compatriot Defender

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On 24 February 2022, Russian troops invaded Ukraine in what Russia termed "a special military operation." However, this invasion is not a standalone event in the former Soviet region. In 2008, Russia invaded the South Ossetian and Abkhazia regions of Georgia; in 2014, Ukraine's Crimean, Donetsk and Luhansk regions. These two significant events beg the question: "How did Russia justify its military actions? And how does Ukraine 2022 make a difference?"

This project seeks to illuminate how Russia uses the label of a "compatriot defender" to justify its former invasions, then how this failed to justify the 2022 Ukrainian invasion. To understand Russia's justification, the term "compatriot" used will follow the definition set by the 1999 Compatriot Law: "...peoples historically residing in the territory of the Russian Federation, as well as those who have freely chosen to be spiritually, culturally and legally linked to the Russian Federation, [and] those whose direct ancestors resided in the territory of the Russian Federation."

Notably, a comparative analysis is done on the justification used for Russia's invasion of Crimea in 2014 and the 2022 war with Ukraine. There is a three-component justification process employed by the Russian government. The Kremlin begins by identifying a Russian compatriot population in the region, then pinpoints an existential threat. This "forces" Russia to defend its compatriots, framing invasion as humanitarian intervention. However, in 2022, Russia's attempt to adopt the same pattern for its invasion of Ukraine was unsuccessful. The Russian compatriot population was largely manufactured through fast-tracked passports, and the threat of NATO's imminent armed conflict had no substantial evidence. Thus, the "special military operation" had no humanitarian justification, leaving Russia unable to get away with another "compatriot defence."

Implementation of the TLC-Act Drug Interaction Tool into Pharmacy Student Education as Part of Integration Activity Cases

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As drug interactions can lead to significant adverse effects and hospital stays, pharmacists play a vital role in preventing interactions and ensuring optimal drug therapy. As such, the TLC-Act tool is being developed to provide a systemized way of managing drug interactions based on the best current evidence. Through using the TLC-Act, students may build on their skills to meet the Association of Faculties of Pharmacy of Canada Educational Outcomes for pharmacy degree graduates. These outcomes outline the expected skills graduates are to have in order to provide competent patient care. The TLC-Act tool was introduced to Entry-To-Practice PharmD students at UBC through a background activity that taught how to use the tool as a separate entity. In this current follow-up project, the main focus is to integrate the TLC-Act as part of patient cases to practice using the tool in case-based learning. Pharmacist facilitator TLC -Act guides which included step-by-step walkthroughs of how to use the tool were created to lead students through ten patient cases involving disease states such as diabetes and epilepsy in year 2 of the program. These facilitator guides will be used by instructors to guide students through using the TLC-Act to formulate a patient-specific recommendation and manage drug interactions in these cases. This will allow students to enhance their drug interaction clinical thought process. Once implementation of the TLC-Act facilitator guides is complete, its usefulness as an integrated part of the case thought process will be evaluated as both a teaching and learning tool.

Investigating the effects of modulating the WNT signaling pathway in the production of T cell competent blood progenitor cells

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Pluripotent stem cells (PSCs) hold great promise in clinical applications because they can self-renew and differentiate into other cell types, such as hematopoietic stem/progenitor cells (HSPC) and T cells, that can be used in cell therapies to treat wide-range of diseases. Niche engineering can be used to recapitulate in vivo signals to direct differentiation of PSCs in vitro. The WNT signaling pathway involved in controlling biological processes, has been implicated as an important step during blood development. To understand the effects of the Wnt signaling pathway on the production of HSPCs and T cells, the timing and stimulation intensity of the pathway may become important. We hypothesize that with an increased activation of the Wnt-β-catenin pathway, the probability of generating HSPCs with T lymphoid potential will increase. The small molecule CHIR99021 (CHIR) is a Wnt agonist. We will modulate the Wnt pathway by manipulating CHIR concentration and time of addition in our in vitro cultures. To assess the cell phenotype, we will use flow cytometry at different time points. Specifically, we will characterize the effects of changing the initial concentration of CHIR between day 2-8 by measuring the counts and frequency of HSPCs and T cells in our in vitro differentiation system. This research reveals the possibility of controlling the stimulation of the Wnt-β-catenin signaling pathway in cell development to maximize the production of useful cell types for clinical applications.

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Investigating the potential penetrance of nano and micro-plastics in the mammalian nervous system

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Microplastics are small fragments measuring up to 5mm in size released into the environment due to daily activities related to using and consuming plastic materials. As the evidence of microplastic accumulation in humans continues to grow, concerns about the potential health impacts have also risen. While research has focused on the accumulation of microplastics in various organs, the central nervous system (CNS) has received less attention. Thus, the potential for neurotoxicity due to microplastic accumulation in the CNS is a growing concern, and further research is needed to understand the impact of microplastics on brain health. To study the bioaccumulation of polystyrene microplastics in the mammalian CNS in relation to their structural density and to evaluate any potential neurotoxic effects. We hypothesize that if a correlation exists between the structural density of polystyrene microplastics and their ability to penetrate the CNS, then microplastics with higher density will have a greater potential for accumulation in the CNS and lead to neurotoxicity. The present study will utilize magnetic levitation as a non-contact method to determine the structural density of microplastics by employing various concentrations of paramagnetic media. In addition, an in-vivo pilot study will be conducted using adult C57BL6 mice, where microplastics exposure will be induced through intranasal administration. The distribution of microplastics in the mammalian nervous system will be observed using histological analysis using epifluorescence microscopy. Moreover, the potential neurotoxic effects of microplastics will be investigated by microglia activation within the nervous system through immunohistochemical analysis. Our research demonstrated that a single dose intranasal administration of 2μm fluorescent labelled microplastics can reach the olfactory epithelia. However, visualization is limited to particle size, as we could not detect any fluorescent labelled 100nm microplastics in the olfactory epithelia. Further investigation is necessary to understand the accumulation and penetration of microplastics in the CNS, as this could lead to neurotoxic implications for human health.

Exploring the role of histone SUMOylation in the DNA damage response

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Many essential biological processes depend on chromatin remodeling for regulating DNA access, such as transcription, replication, and DNA repair. The basic packaging unit of chromatin is the nucleosome core, consisting of ~146 base pairs of DNA wrapped around a protein octamer constructed from two copies of each of the core histones: H2A, H2B, H3, and H4. Post-translational modifications are covalent biochemical alterations to proteins after biosynthesis. Histone post-translational modifications and histone variants regulate gene expression by remodeling chromatin structure. Small ubiquitin-like modifier (SUMO) protein is post-translational modification shown to be involved in the DNA damage response. SUMO can be reversibly linked to all histone proteins; however, it is unclear whether histone SUMOylation is correlated with DNA damage. Additionally, it is unknown the extent of which specific ligases involved in the SUMOylation pathway are involved with modifying histones.

Using *Saccharomyces cerevisiae* (brewer's yeast) as a model organism, SUMOylation of histones can be investigated through immunoprecipitation and western blotting. Yeast strains were transformed with plasmids containing HIS-tagged SUMO. Cells were grown in SC-LEU media to mid-log phase with methyl methanesulfonate (MMS) treatment and whole cell extract was collected. Immunoprecipitation (IP) was performed on the whole cell extract using Ni-NTA beads to isolate for his-tagged SUMO proteins. SUMOylation levels of H2A, H2B, H3, and H4 were then assessed through western blotting.

Preliminary results showed that SUMOylation occurs on H3 and H4 histones, with the involvement of E2 ligases in determining the amount of SUMOylation. H2A and H2B SUMOylation remains unclear. Additionally, current results showed a functional protocol in which SUMOylated histones can be isolated and DNA damage can be assessed.

Moving forward, MMS can continue to be used to stimulate a DNA damage response in *S. cerevisiae*, allowing SUMOylation in DNA damage conditions to be measured. Other strains of yeast with knockout ligases involved in the SUMOylation pathway have also been created. These can be used to investigate which specific ligases play major roles in histone SUMOylation. By establishing the foundational knowledge on how cells recover from DNA damage, this opens more pathways for treatment of genetic diseases.

The Everyday Power Relations in Shenzhen's International Baccalaureate Schools: Personal Stories from the Students, Parents, and Teachers

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The goal of this essay is to investigate the everyday power relations in Shenzhen's International Baccalaureate Schools. In the current academic field of IB studies, there is a lack of research on the micro-level experiences of IB educators, students and parents. As an IB student myself, I will be recording my own IB study experiences at school in order to fill in the current research gap. My research question is what are the everyday power relations that shape the exclusion in Shenzhen's International Baccalaureate Schools? I will be using a research method called auto-ethnography, which uses my personal experience to describe and interpret the cultural, social, educational, and political phenomena and practices happening around me. I hope that by sharing these micro-level stories about everyday power relations, future researchers, educators, or policymakers can consider these perspectives from teachers, students, and parents. The objective of this essay is to not only record the personal stories and experiences but also try to figure out whether there is a way to create real equitable global education embedded in nation-states.

Survey of Primate populations under increasing survival pressures in the forests of Central Kalimantan

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Hunting and deforestation for agricultural lands and resource extraction is posing a major threat to many mammal populations throughout the tropics. Primates are especially vulnerable to these threats due to their heavy reliance on forested habitats, larger body size and slow reproductive rates, with several primate taxa already pushed to extinction and many others threatened or endangered. Despite the growing body of research on primates, population distribution and richness for many species in Central Kalimantan remains unknown. This study aims to determine baseline population abundances and distribution for all primate species present in Butik Batikap, Central Kalimantan, Indonesia, which despite being a protected forest, is still threatened by anthropogenic disturbances. To do this, 30 camera traps were deployed across a grid system at 1000m intervals. Images of animals were captured through motion activation, with a total of 23206 images obtained between March 2020 to November 2021. All images were then analyzed using an independence threshold of 30 minutes, where a capture is considered independent if the same species appears within the set time frame. Using this threshold, the total number of animal detections were reduced to 1623. Within those images, 7 primate species were identified, with the highest number of detections being Macaca nemestrina (n=98), followed by Presbytis rubicunda (n=45). Hylobates muelleri (n=2) and Presbytis frontata (n=1) accounted for the least number of detections. The information gained from this study will provide baseline population data which can aid in future conservation planning regarding primate populations in Butik Batikap Protection Forest.

Say NO$_x$ to Parkinson's Disease: A narrative review exploring the effects of nitrogen oxide-induced nitrosative stress on Parkinson's Disease pathogenesis

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As the global demand for industrial and agricultural activity increases, so does the severity of health implications of toxic constituents found in ambient air pollution (AAP). While cardiovascular and respiratory health problems due to AAP are relatively well-documented, the role environmental pollutants play on neurodegenerative disease is unclear. A widespread neurodegenerative disease, Parkinson's Disease (PD) is marked by selective degeneration of A9-type dopaminergic (DAnergic) neurons coupled with the accumulation of α-synuclein protein aggregates (AS). The current literature suggests that traffic-based pollutants, namely nitrogen oxides, can induce neurotoxicity by facilitating the the formation of reactive nitrogen species (RNS), associated with increased physiological nitrosative stress (NS) in PD patients. Inducing various pathogenic mechanisms that can lead to the degeneration of DAnergic neurons, NS plays a critical role in PD pathogenesis, and understanding the environmental facilitation of RNS formation is instrumental. Under the premise that heightened exposure to AAP may unbalance physiological RNS levels and disrupt the natural antioxidant system, this narrative review paper synthesizes the literature and explores the various pathogenic mechanisms that may arise. This paper uniquely offers an environmental basis of human health, and ultimately aims to address significant knowledge gaps in the complex associations between AAP, RNS, NS, and PD. It does so by introducing the idea of the environmental-physiological interface, which is the site of intersection between exogenous and endogenous PD etiological drivers. In-depth exploration of these relationships will offer valuable insight into potential therapeutic targets and underscore environmental health as a powerful indicator and determinant of human health.

Clinical interpretation of rare human gene variants in Drosophila. Autism and beyond.

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Gene variant discovery is becoming routine, but it remains frustratingly difficult to interpret the functional consequence or disease relevance of most identified rare variants. Experimental assays are helping to fill this interpretation gap, but there remain many roadblocks in creating assays that can accurately interpret variant functions with clinical predictive value. These include issues with assay reproducibility, scalability to hundreds of variants, and relevance to the pertinent disease mechanism. We have been using Drosophila melanogaster as a versatile assay platform to minimize these roadblocks and enable large-scale clinical interpretation of rare variants in many human genes. We take advantage of Drosophila's molecular genetic tractability to perform inexpensive, reproducible, in vivo functional testing of hundreds of variants. These tests are calibrated for clinical interpretation in accordance with the quality requirement proposed by the ClinGen Sequence Variant Interpretation (SVI) Working Group guidelines for clinical interpretation of variant function. We exploit genetic interaction analysis to confirm disease-relevant functions of variants. Our project's contribution includes the development of: (i) An informatics pipeline for prioritizing genes amenable to Drosophila testing and identifying reference variants for calibrating assays. (ii) Generating the molecular genetic reagents for testing variants. (iii) Developing assays for Autism variants in the Raf, CTNNB1, and MECP2 genes for clinical interpretation in alignment with SVI guidelines.

A Review of the Recent Innovations in Rural Electrification

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As Earth's temperature rises, many nations, including Canada, has been searching for new ways to reduce carbon emissions and slow down the rate of climate change. Most rural communities found on Canada's Remote Communities Energy Database use diesel as their main source of energy. Research has shown that there are other sources of energy that can replace diesel and no longer produce carbon emissions. This literature review delves into innovations of rural electrification focussing on new types of power and energy storage systems that were studied via simulations.

Searches were conducted on the UBC Library for articles using keywords such as "rural electrification," "modular reactors." By the end of the systemic review, five articles were chosen; all articles were studies based on simulations of proposed electrification systems and published within the years 2019–2022 to ensure relevancy. Proposed power sources included modular reactors and renewable energy systems (wind, solar power). Proposed energy storage systems included power to hydrogen to power (P2H2P) system, and lithium-ion batteries.

Result of the review indicated in simulation, modular reactors more cost efficient in comparison to the traditional use of diesel and emit no carbon gas emissions; however, hybrid modular reactor + renewable energy systems were the most cost efficient in simulation. For storage systems, a hybrid system of P2H2P and lithium-ion battery was the most cost efficient as it utilizes an optimal size of both storages and avoids diminishing return of pure P2H2P and pure lithium-ion battery systems.

Perceived Coping Efficacy and Salivary Cortisol: Associations Between Coping and Physiological Stress

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Being able to cope with stress is an important aspect of navigating all of the challenging situations that individuals may experience in their daily lives. Previous studies show that high confidence in one's ability to deal with difficult situations is linked to decreased subjective ratings of stress. However, there has been less research on the association between perceived coping efficacy--defined as an individual's evaluation of how well they responded to a specific stressor--and biomarkers of chronic stress, such as cortisol dynamic range (CDR). Given the negative effects of prolonged stress on health, exploring these relationships provides insight into how successful coping may offset symptoms of stress. Thus, the current study seeks to examine the relationship between perceived coping efficacy and CDR. The data were collected from 250 community-dwelling adults in British Columbia between March 2021 and October 2022. Participants filled out short surveys five times per day for fourteen days about their daily experiences including stressful events and perceived coping efficacy. To collect salivary cortisol data, participants provided saliva samples three times per day for four consecutive days. We predicted that higher perceived coping efficacy and lower variability in perceived coping efficacy would be associated with higher CDR, but both of these relationships were not statistically significant. These findings revealed that successful coping may not be related to chronic stress burden. Future investigations should clarify this relationship by examining other measures of stress to gain insight into the physiological effects of coping.

Heterogeneity Analysis of The Effects of Inflation on Unemployment Rates in Different Industries

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Governments globally always encounter the trade-off between inflation and unemployment suggested by the Phillips Curve. However, it is still debated over the negative relationship between inflation and unemployment. Canada is currently encountering the challenge of dealing with high-level inflation after its employment has recently recovered. Therefore, knowing the relationship between employment situation and inflation levels in different industries will identify which segment of the workforce in society is prone to facing employment difficulties due to fluctuations in inflation. The present study empirically analyses Canada's quarterly time series data from 2003Q3 to 2022Q3 to examine the effects of inflation on the unemployment rates in six different industries. Based on Ordinary Least Square (OLS) regression and Vector Autoregression(VAR) analysis, it is concluded that Consumer Price Index (CPI) growth has negative effects on the unemployment rates in construction, manufacturing, and wholesale and retail trade industries, a positive effect on the unemployment rate in professional, scientific and technical services, and non-significant effects on the unemployment rates in transportation and warehousing as well as finance, insurance, real estate, rental, and leasing. Thus, the unemployment rates in different industries differently respond to CPI growth.

The effect of gut metabolites on cancer: Intermittent fasting-mediated changes in ursodeoxycholic acid, deoxycholic acid, and isovaleric acid

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Diet has been shown to shape gut microbes which hold implications for human health, including cancer prevention. Preliminary results from a feasibility trial found significant changes in the secondary bile acids, ursodeoxycholic acid (UDCA) and deoxycholic acid (DCA), and a branched-chain fatty acid, isovaleric acid (IVA), after intermittent fasting (IF) (limiting eating to an 8-hour window per day) for 3 months in a subset of patients with stage 0 chronic lymphocytic leukemia/ small lymphocytic lymphoma. It is unknown, however, what role these metabolites may play in the cancer process. The aim of this study was to conduct a preliminary literature review to support the trial's findings and answer, "What effect do IF-mediated changes in the gut microbiota associated with the production of metabolites UDCA, DCA, and IVA have on cancer?" MEDLINE and grey literature (ex. Google Scholar) were searched using a combination of subject headings and keywords such as, "UDCA", "DCA", "IVA", "bile acids" and "cancer." No literature was found directly answering the research question; however, 31 articles were identified as relevant. Pertinent information was extracted using a data extraction form describing the metabolites' origin, potential cancer crosstalk, and associations with IF. Understanding the impact of IF on the gut microbiome and the resulting metabolites may provide new insights into cancer treatment and/or prevention. To our knowledge, this is the first study to describe and investigate these metabolites together which, based on preliminary research findings, may be modified by IF and play a potential role in the cancer process.

Effect of Loss-of-Function PLCB4 on Skin Pigmentation

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Melanocytes are pigmentation cells found in the skin, hair and eyes. The genes *Gnaq* and *Gna11* affect the growth of melanocytes. Both gain-of-function mutations and loss-of-function mutations in these genes have been found to alter skin pigmentation. Loss-of-function mutations result in lighter pigmentation of the dermis. Phospholipase C beta 4 (*Plcb4*) is located downstream of *Gnaq* and *Gna11* in the heterotrimeric G protein signalling pathway. Loss-of-function mutations in *Plcb4* are common in cutaneous melanoma; however, significance of this is unknown. It is also unknown how loss-of-function *Plcb4* affects skin pigmentation. We hypothesize that loss-of-function *Plcb4* results in lighter pigmentation of the dermis, because *Plcb4* is downstream in the same signalling pathway as *Gnaq* and *Gna11*. To test this, we will examine the pigmentation of the epidermis and dermis in heterozygous and homozygous knockout *Plcb4* mouse tails. The skins will be isolated from the tailbone. To separate the epidermis and dermis, the skins will be incubated in sodium bromide. Then, they will be fixed with formalin and photographed. ImageJ software will be used to compare the pixel intensity between wildtype and mutant mice. We found both heterozygous and homozygous *Plcb4* mice had no change in pigmentation of the epidermis or dermis. The control group for our homozygous experiment were heterozygous for the *Baw* mutation and had lighter dermis pigmentation than expected for wildtype mice. This indicates that the *Baw* gene may cause lighter pigmentation of the dermis. Further research is needed to understand the role of the *Baw* mutation on pigmentation.

The Impact Fantasy Football Has on NFL Live Game Viewership

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Fantasy football is a multi-billion dollar industry in which millions around the world take part in. This well-established and highly popular game calls upon its participants to assemble imaginary National Football League (NFL) teams by drafting and trading real-life players. Existing research indicates that the rising popularity of fantasy football has had real-world implications for the league from a business and profitability standpoint, demonstrated by the increase in both stadium attendance of NFL games and global NFL fans. However, there remains uncertainty on how this domain can affect the largely profitable factor of live game viewership. I postulate that, given fantasy football's positive impact on the league, this domain should have a similar impact on NFL game viewership as well. This study explores this claim by investigating whether the ownership of certain players in fantasy football leagues influences the decision of participants to watch the NFL games in which their players are playing. By collecting and combining NFL viewership, fantasy football, and team performance data, and conducting a multiple linear regression, I found that fantasy football and the ownership of certain NFL players on fantasy teams impacts live game viewership. In particular, the number of fantasy-drafted players for a team playing in their home stadium is statistically significant in increasing viewership, whereas the number of fantasy-drafted players for an away team and the fantasy-value of players is not significant. This research can be used by professional sports leagues and their business partners in framing decisions surrounding viewership such as advertisement pricing or ownership of broadcasting rights.

Mapping Opportunities for HPV Vaccination and Screening Engagement and Uptake in Transgender and Gender Non-Binary (GNB) individuals: MOVE UP

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BACKGROUND: HPV–associated cancers and pre–cancers (e.g., cervical, anal) disproportionately burden sex and gender minorities (SGM). Though cisgender individuals have benefitted from research on HPV screening, a paucity of data exists on these issues for SGM – particularly, transgender and gender non–binary (GNB) individuals. This study aims to identify facilitators and barriers to the uptake of HPV–associated cancer prevention and screening interventions for transgender and GNB individuals.

METHODS: We conducted an evidence review for publications specifically focused on the management of HPV in transgender and GNB individuals. Additionally, we conducted an environmental scan for existing provincial, national, and international guidelines on these issues, as well as for transgender and GNB–specific HPV resources/programs. We will now conduct interviews with 40 transgender/GNB study participants, as well as 12 healthcare providers working in primary care and sexual health settings.

ANTICIPATED RESULTS: We identified a number of knowledge and evidence gaps in the literature that indicate fundamental deficiencies in HPV vaccination and screening for transgender and GNB individuals. The interviews will explore the knowledge, attitudes, and beliefs of transgender and GNB patients, as well as providers, around their experiences with HPV management.

DISCUSSION: This study will help inform the development of HPV prevention, vaccination, and screening resources and programs geared explicitly toward transgender and GNB individuals. To our knowledge, this is the first study on HPV–associated disease devoted to the unique needs and strengths of transgender and GNB individuals and communities in Canada, and as such represents a crucial first step in addressing this research disparity.

Task-based Brain Networks Detectable by fMRI

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Functional magnetic resonance imaging (fMRI) is a non-invasive technology used for indirect measurement of changes in brain activity. Because fMRI is sensitive to changes in blood-oxygen levels, its measurements can reflect the demand of brain cells for oxygen consumption. Currently, this technique is still rarely used in clinical diagnosis and treatment planning for neurocognitive disorders despite its capability of enhancing the reliability and precision of these assessments.

Previous research has mostly focused on either detecting resting-state brain networks or activation of individual brain regions during task performance. However, evidence suggested that there exists a consistent set of networks – groups of interconnected regions – in the brain that is detectable by fMRI when any task is carried out. Broadening our understanding about activation of these networks in task performance can open a window into brain diseases and individual differences in brain dysfunction. From this knowledge, underlying biological causes can be identified and effective treatments can be developed.

Thanks to Open Science, task-based fMRI data are nowadays publicly available through open repositories and will be downloaded for usage in this study. A computerized method called Constrained Principal Component Analysis will be applied on these data to generate corresponding graphical representations of changes in blood-oxygen level in the brain over time during task performance. Using classification algorithms on these graphs, functional brain networks that were activated can be identified and characterized. This will allow us to make meaningful connections with individual differences in demographics, personality, behavior, cognitive performance, and symptoms of mental illnesses.

Individual and breed differences in different features of learning of domestic dogs

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Over hundreds of years, as humans we have selectively bred dogs to cooperate with us for a variety of functions. The pure breeds resulting from this process have even developed enough genetic differences that is translatable into measurable behavioral differences between them. However, the extent to which an individual dog's learning history and previous life experiences can mask behavioural variations between breeds is yet to be determined. The objective of the present research is to identify variations in different features of learning among specific domestic dog breeds that vary considerably in terms of their physical structure and function (Herding, Retriever, and Asian Spitz dogs). The learning test was a nose-touch learning task determining dogs' a) speed of learning (acquisition), b) discrimination learning, c) reversal learning, and d) extinction (persistence). This combined with the results of the preliminary questionnaire focusing on behaviour of each individual dog allows us to identify the potential link between behaviour and learning. We hypothesized that differences in the learning performance between individuals can obscure variation between breeds of dogs. Furthermore, we expect to see generally higher aptitude for discrimination and faster acquisition in retriever and herding dogs compared to the ancient breeds due to that these dogs are bred to have more communication with humans. While differences between breeds was not significant, showing high variation among individuals within each breed, they showed some degree of variation in some features of learning. Retrievers showed the least persistence and Spitz dogs showed a generally faster acquisition compared to other breeds. The conclusions drawn from this research will help researchers to adapt behavioral standards for different individual dogs according to their learning capacity and past experiences.

Engineering and Directing Regulatory T Cells to Treat Type 1 Diabetes

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Type 1 diabetes (T1D) is an autoimmune disorder in which your own immune cells attack pancreatic cells, preventing the secretion of insulin, causing hyperglycemia. Untreated, this disorder can prove fatal, and while daily insulin shots are functional treatments, they remain an enormous burden on the lives of patients. A possible cure involves using specialized immune cells, called regulatory T cells (Tregs), to protect insulin-producing pancreatic cells.

Tregs suppress immune responses that harm your own body. A method under investigation to treat T1D is to increase the suppressive capacity of Tregs so that they can prevent the autoimmune attack by T cells on pancreatic cells. T cell suppression by Tregs to protect against T1D is not well understood; this study will analyze where in the body Tregs suppress effectively and how we can engineer them to an optimal location.

We will monitor T1D in non-obese diabetic (NOD) mice which spontaneously develop the disease similarly to humans. We'll start with Treg suppression assays to determine which cells are targets of suppression. We will then traffic the Tregs to desired locations within the mice and assess the impact of engineered Tregs on T1D symptoms. Flow cytometric phenotyping and confocal microscopy will be used to confirm that Treg trafficking is working and that the autoreactive T Cells and the engineered Tregs are interacting.

With T1D becoming increasingly common and having significant negative impacts on patients' day-to-day life, our goal is to find potential cures to T1D by determining where Treg suppression should be targeted.

11β-HSD1 enzyme activity in the maternal and fetal placental regions contributes to corticosterone production in rats

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Glucocorticoids are stress hormones that regulate many physiological processes and are vital in fetal neurodevelopment. However, high glucocorticoid levels during gestation can have detrimental effects on the developing brain. In adult rats, corticosterone (main active glucocorticoid in rats) is primarily produced in the adrenal glands. However, fetal rats have immature adrenal glands. Instead, a corticosterone precursor from maternal blood can be enzymatically converted to corticosterone in two regions of the placenta (fetal labyrinth zone and maternal decidua) and then reach the fetus. The placenta contains the enzyme 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1), which regenerates corticosterone from its inactive metabolite, 11-dehydrocorticosterone (DHC). However, little is known about 11β-HSD1 activity in different regions of the placenta. Thus, we developed a method to measure 11β-HSD1 activity in Long-Evans rat labyrinth zone and decidua near birth (embryonic day 19). We incubated the tissues with either DHC substrate or no added substrate (control), for three hours (n=3/treatment). After incubation, we measured corticosterone in each sample using liquid chromatography-tandem mass spectrometry, the gold standard for glucocorticoid quantification. We then compared corticosterone levels in samples incubated with DHC to controls to determine 11β-HSD1 activity. The data suggest that 11β-HSD1 activity is present in both regions. Currently, we are working to elucidate which region contributes more to corticosterone production in the placenta. Future research can use our results to further explore placental glucocorticoid contribution to fetal neurodevelopment.

"One flesh, one end": Examining the Mutation of Christian Theology into Horror Through Imaginative Apologetics in Tamsyn Muir's Gideon the Ninth

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Tamsyn Muir's Gideon the Ninth is a genre-defying science fantasy set in the far-future Empire of the Nine Houses, a galaxy-spanning empire of necromancy, the occult practice of communing with the dead. The Nine Houses revolve around their Emperor and God, who brought his Houses back from death in the Resurrection 10,000 years earlier. Each Nine Houses has a varied and rich history, filled with necromancy, powerful lineages, and battles for political influence. Unquestionably, Muir's works exist at a subversive axis of genres, a liminal space combining elements of gothic horror, science fiction, and Christian theology. My research explores how Muir's narrative takes advantage of the liminal fulcrum point at which belief systems, the conscious and the unconscious, dominant and resistant modes of religious discourse begin to break down. Gothic literature has historically explored Christianity and the notion of religion through its presence and absence in texts; traditionally, Gothic texts have evaluated religion according to its deviation from rationality, often placing Christianity in a dubious light. With the aid of imaginative apologetics (Greenaway 2020), this paper examines the novel through a theological lens, enabling a deeper understanding of how Muir uses religious motifs to mutate the orthodox revelation of God into the darkest narratives and cultures. This distortion opens tremendous possibilities enabling the text to rewrite Christian assumptions of immortality through a transgressive and horrifying exploration of necromancy.

Determinants of Depression Among Individuals with Inflammatory Arthritis

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The risk of depression is higher among Canadian adults with arthritis. We identified determinants of depression among individuals with inflammatory arthritis (IA), which is important to identify persons at risk and address risk factors.

Our cross-sectional study used baseline questionnaire data from a randomized controlled trial of an employment intervention in IA, 'Making It Work' .

Participants were recruited in British Columbia, Alberta and Ontario through rheumatologist practices, consumer organizations, arthritis programs, and a health benefit plan, between 07/2013 and 04/2017. The Patient Health Questionnaire (PHQ-9, range: 0-27) assessed depression. Potential determinants included sociodemographic, health and work-related variables (Table 1). Multivariable-linear regression analyses were performed with forward variable selection based on adjusted R-squared.

The sample included 564 adults (mean(SD) age: 45.7(9.9) years, 77.8% female, 81.5% Caucasian). Mean(SD) depression score was 7.20(5.08), indicating mild depression. Factors associated with depression in the final multivariable model included: insomnia, job strain, number of limiting comorbidities, fatigue, low job satisfaction. They explained 55.50% of the variance in depression. Insomnia contributed most (partial adjusted R-squared), explaining 17.66% of the variance after controlling for other variables.

Limitations include cross-sectional design, inability to assess causation. Insomnia (a symptom of depression), fatigue, job strain and low job satisfaction could be consequences of depression. Sample was workers predominantly Caucasian, highly educated, with longstanding disease. Results may not generalize to individuals with differing characteristics.

Insomnia, job strain, comorbidities, fatigue, and low job satisfaction are associated with depression. Discussing these during healthcare encounters may benefit patients. Further research is needed to assess causation.

Identifying Autism Causing Genetic Variants…Using Fruit Flies?

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Autism Spectrum Disorder (ASD) is a developmental condition in individuals with repetitive behaviours and social interaction deficits. Exome sequencing efforts in ASD patients have identified ~1000 genes with sequence variants (mutations), but the clinical significance of these variants is unknown. This project aims to determine the function of these gene variants in patients, in order to assess which genes have real disease implications for ASD. In this project, we selected ASD genes for testing using bioinformatic tools we developed. We then tested the function of these variants in experimental assays using *Drosophila melanogaster* as a model which provides a stable genetic background for testing the function of conserved gene variants in vivo. The assay was calibrated with clinically known pathogenic and benign variants to enable the clinical interpretation of these unknown ASD variants. Genetic interactions assays were also performed to ensure the functional assay is testing the disease–relevant pathways. We will discuss our progress with the human genes CTNNB1, MECP2, and BRAF. In these assays, we have been able to assess the clinical significance of multiple unclassified ASD variants. Future directions of this project are directed towards personalized medicine applications as assays can be developed to identify variants relevant to an individual's condition, and therapeutics can be selected to target the dysfunctional molecular pathway specifically.

How a Spiritual View of Nature Affects Well-being and Environmental Concern

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Spiritual connections to nature, or ecospiritual experiences, are ubiquitous and associated with a variety of positive outcomes. These experiences can benefit individuals by increasing their well-being and can benefit the environment by increasing people's level of environmental concern. Research aimed at improving mental and environmental health has grown in recent years, yet both are continuing to degrade around the world. Previous studies have found correlations between ecospirituality and both well-being and environmental behaviour, yet despite this promising evidence of a relationship, no experimental studies have looked at whether ecospirituality plays a causal role. To investigate this possibility, the present study will use a photo-taking task to induce a spiritual perspective of nature in participants in order to understand its causal effects on personal well-being and environmental concern. By comparing this spiritual view of nature to both a non-spiritual perspective of nature and a spiritual perspective of a human-built environment, we attempt to tease apart the independent effects of ecospirituality, general spirituality, and positive "non-spiritual" experiences in nature. We predict that a spiritual view of nature will lead to higher well-being and environmental behaviour scores compared to either general spirituality or exposure to nature alone, indicating a larger benefit of ecospirituality. If true, this would highlight another reason to preserve the environment and could increase focus on spiritual experiences in nature as an avenue to personal well-being.

Methane Reduction in Canada: Regulatory Capture and Solutions

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Since their founding in 2013, the Alberta Energy Regulator has been entirely funded by the oil, natural gas, and coal industry, while simultaneously being responsible for monitoring Albertan energy development. While the Canadian government has attempted to mitigate regulatory capture in its methane reduction program, the question remains whether its effort of involving the private sector has hindered this goal. Dominant research shows that there is a discrepancy between the AER's approach to methane reduction and that of the federal government and that the AER's record of financial and legal mismanagement further disproves their legitimacy as a regulatory agency. This paper, focussed on environmental regulatory capture, relies on the AER as a case study for the incompatibility of the public and private sector in climate change policymaking. Contrary to theories supporting collaborative governance, findings from this research dictate that the federal government should more actively interfere when provinces like Alberta demonstrate a lack of accountability for their regulatory bodies. Whether this interference comes in the form of federal laws such as the GHG Emissions Pricing Act, equalization payment mechanisms, stricter output-based pricing, or more aggressive approaches such as litigation, it is imperative for Canada to address how its history of federalist conflict has hindered climate reform.

Assessing pathological consequences of degraded MUC2 in colitis models

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Mucus is essential in regulating physiological activity of gut microbiota. MUC2, a glycoprotein secreted by goblet cells, forms polymers that comprise the foundation for mucus. Furthermore, MUC2 possesses O-linked glycosylation sites enabling attachment of structurally diverse oligosaccharides (O-glycans). Mucus function deficiencies are often prevalent in inflammatory gastrointestinal diseases, but disease characteristics depend on the type of dysfunction. Given this, it is still unknown whether degraded MUC2 has a pathological function. It is probable that removal of O-glycans influences the microbiota metabolism since microbes can now access thousands of core amino acids that were previously inaccessible due to connected glycans. We hypothesize that MUC2 plays a pathological role in saturating the lumen with millions of MUC2-derived amino acids, which induces an excess of inflammatory amino acid metabolites. We will investigate this by contrasting the colitis development in WT (wild-type), MUC2 KO (knock-out), O-glycan KO and MUC2:O-glycan KO mice using histological methods. Additionally, 16S sequencing on fecal samples and a comparison of luminal metabolites from WT and mutant littermates by Gas Chromatography-Mass Spectrometry will be utilized to examine how metabolic functions of microbiota are altered by the compound loss of MUC2 and O-glycan. We expect MUC2 KO and O-glycan KO mice to have more inflammation in the colon, a higher abundance of protein metabolites in fecal samples and higher dysbiosis in gut microbiota. The results will elucidate how MUC2 metabolism affects microbial metabolic activity in addition to its glycans, providing novel insight that can guide therapeutic strategies for gastrointestinal diseases.

Developing a small molecule inhibitor targeting AR-V7 nuclear import to overcome theapeutic resistance in advanced prostate cancer

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Prostate cancer (PCa) is a leading cause of cancer-related deaths in men worldwide. Given that PCa is highly dependent on androgen receptor (AR) signaling, targeting the AR signaling axis is the standard of care for treating metastatic or recurrent PCa. Despite initial efficacy, the tumour almost always recurs as the more aggressive disease of castration resistant prostate cancer (CRPC). There are varied mechanisms by which CRPC can acquire castration resistance, one of the most prominent being the expression of constitutively active, alternatively spliced variants of AR, such as splice variant 7 (AR-V7). Lacking the ligand-binding domain of the full length protein (flAR), AR-V7 is able to translocate to the nucleus and sustain AR signaling even in the absence of androgens. Recent work has demonstrated that flAR and AR-V7 utilize different nuclear import mechanisms, suggesting that targeting the cellular machinery critical for AR-V7 nuclear import could represent a novel therapeutic opportunity. In the present study, we propose to first identify proteins necessary for AR-V7 nuclear import, then based on pre-existing 3D structural data, design and test a library of small molecule inhibitors. These inhibitors will be screened for their effects on cell proliferation, transcription, and castration resistance and validated across numerous AR-V7 expressing cell line models. Currently, the five-year-survival rate for CRPC remains less than 30%. As such, developing a novel compound for inhibiting AR-V7 nuclear import could overcome AR-V7 mediated castration resistance and substantially improve outcomes for patients afflicted with this disease.

Steps Toward a Novel Bioinsecticide: Expression, Prufication, and Functional Characterization of Recombinant Chitinase

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The Chitinase C (ChiC) enzyme from the bacterium Pseudomonas aeruginosa has potential as a natural insecticide (bioinsecticide), but the bacteria can cause disease, making its development and use in agriculture undesirable. This enzyme can break down chitin, a crucial component of most insect exoskeletons. Previous studies attempted to genetically engineer a non–disease–causing E. coli to safely produce ChiC; however, they did not go further to isolate the protein. This study aimed to obtain purified and functional ChiC by measuring ChiC expression in E. coli under various conditions. We found that incubating the E. coli cells with 0.1 mM IPTG, an expression inducer, at 37°C for 2 hours produced the highest amount of expressed ChiC under the conditions tested. However, most of the obtained ChiC proteins were non–functional, as they were not in their correct three-dimensional structure. We also observed that isolating functional ChiC directly from E. coli comes at the cost of lower yield making it inefficient for industrial use. Thus, we focused on obtaining a high yield of initially non–functional ChiC, purifying, and manipulating it to achieve a functional form. After the manipulation, we observed promising functional activity in ChiC. The findings of this study pave the way for a novel bioinsecticide with potential applications in agriculture and industry.

Electroreception Sensory Systems in Acipenser transmontanus

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Organisms detect important sensory cues from their environment to guide behavior. One important signal arises from the faint electrical signature of potential predators or prey, and the detection of these voltages arises through the electrosensory system (a branch of the lateral line system). Despite the unusual nature of this sensory modality, it has independently evolved or re-evolved in at least 6 vertebrate lineages. Previous research has been done on the mechanosensory lateral line and electrosensory systems of elasmobranch and bony fishes; however, little is known about these systems in the sturgeon, an extant representative of the ancient chondrostean fishes.

This project investigates peripheral nervous system adaptations related to the electrosensory and lateral line systems in juvenile White sturgeon (Acipenser transmontanus), the largest freshwater fish in Canada and a keystone species in the Fraser River system. Adopting a comparative neuroanatomical approach, we analyze the distribution of peripheral electroreceptors and mechanosensory neuromasts across the body surface of multiple individual sturgeon with an eye towards the natural behaviors of sturgeons. These investigations explore the hypothesis that sturgeons have neural adaptations related to enhancement of their aquatic sensory systems (electroreception and lateral line) as they navigate through deep and murky water systems, as compared to other fishes.

Odd One Out: The Development of Semantic Feature Representation in Children

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Words are characterized by various semantic features, which encompass different dimensions of meaning. These can be functional (relating to use), perceptual (sensory information, such as color), taxonomic (relating to category), or encyclopedic (all other information). While adults flexibly encode different semantic features when learning new words, research suggests that early word learning is highly dependent on perceptual features. Such research often uses the 'odd-one-out' paradigm, where participants are presented with three words (e.g. apple, orange, bottle) and asked to pick the one which does not belong to the group via pointing, speaking, or key pressing. However, these measures are not accurate when used with preverbal children. The current study adapts the odd-one-out paradigm to infant- and toddler-age children by characterizing their choices based on looking time. Study 1 pilots different image alignments to determine the optimal screen layout for eye tracking. We expect looking patterns to be best distinguishable when objects are placed in a triangular shape on the screen. In Study 2, we will present children between 6 months and 4 years of age with sets of object images with different semantic features. We hypothesize that children categorize objects by attending to more complex and specific features as they grow older, and patterns of object categorization differ in bilingual and monolingual children. Through these studies, we hope to develop a new odd-one-out paradigm that can be reliably used with preverbal infants, and further our understanding of how humans begin to make sense of the world through language.

A guide for the development / modification of alternative habitats for migratory shorebirds at the Yellow Sea region

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As millions of shorebirds migrate annually along the East Asian–Australasian Flyway, they congregate and refuel along mudflats in the Yellow Sea region of East Asia. Unfortunately, anthropogenic activities have driven the unprecedented loss of mudflats at the Yellow Sea, magnifying population declines for many shorebird species, including the endangered Far eastern curlew and Great knot. While recent studies indicate that alternative habitats (i.e., habitats created or modified from their natural state) are used by shorebirds, little is known about how different alternative habitat types contribute to shorebird populations, or how these habitats complement natural wetlands. As such, this research aims to construct a holistic framework for managing alternative habitat development at the Yellow Sea region to better support migratory shorebirds. Data on shorebird abundance and richness, alongside physical characteristics unique to the landscape will be recorded for the three most pervasive alternative habitat types: rice paddies, semi-intensive shrimp farms and salt production sites. Statistical models will be employed to identify features within each habitat that impact shorebird populations, and guidelines will be developed for each habitat type. Alternative habitats in closer proximity to natural wetlands, and those that experience limited temporal disturbances, such as salt production sites, are expected to better support shorebird populations. While alternative habitats are certainly not analogous to natural wetlands, the results can help to integrate the two habitat types during conservation planning, and encourage a more holistic approach towards the conservation of migratory shorebirds at the Yellow Sea.

Comparative Analysis of Microneedle Electrode Designs for Electroencephalography: A Comprehensive Review

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Electroencephalography (EEG) is a non-invasive technique that is used to measure electrical activity in the brain. EEG can be used to diagnose and monitor a variety of brain disorders, including epilepsy, narcolepsy, and traumatic brain injuries. Currently, Ag/AgCl gel electrodes are the gold standard for EEG. However, to obtain high-quality signals for clinical diagnostics and research applications, hair must be removed, and skin must be properly prepared to reduce noise. Nevertheless, these processes can be arduous and uncomfortable, leading to low client compliance. To address these shortcomings, our team has explored using Microneedle Electrodes (MNAEs) for EEG. MNAEs are an alternative to gel electrodes which do not require extensive skin preparation and can provide higher accuracy in signal acquisition. Many studies have been conducted on the use and production of microneedle electrodes; however, little research has been done to standardize microneedle design parameters (such as needle size and material) for optimal EEG efficiency. Thus, in this study, several MNAEs with varying dimensions and materials will be investigated. The effect of modifying these parameters on the signal acquisition and patient comfort will be analyzed. Ultimately, the aim is to compare and contrast various parameters and find an optimal MNAE design to maximize signal acquisition efficiency while minimizing patient discomfort. Such a design could increase patient compliance and ease of data acquisition, increasing the quality of clinical diagnostics and neuroscience research.

Current treatments of osteoblastic suppression in multiple myeloma and their mechanism of action

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Multiple Myeloma (MM) is a disease of monoclonal plasma cells accumulating in the bone marrow. MM is the most frequent cancer involving the skeletal system, and is currently incurable. Osteolytic bone lesions affect up to 80% of MM patients (Terpos et al., 2018). They occur as a result of an imbalance between osteoblasts (OB, bone formation) and osteoclasts (OC, bone resorption) activity. Multiple signaling pathways, cytokines and chemokines induce OC hyperactivity and suppress OB activity, creating an environment prone to bone demineralization that leads to bone lesions and fractures (Marino et. al., 2017). The molecular basis of OB suppression in MM patients is not fully understood and few treatments are available for MM bone disease, most of which target OCs. Through utilizing electronic databases such as PubMed and Google Scholar, we answer the question of whether there are current treatments targeting OB suppression in MM. This electronic research was conducted using keywords such as "MM osteoblast suppression", "bone marrow stromal cells", "bone repair in MM", and "MM bone marrow microenvironment". Multiple published articles were then specifically selected and analyzed. Bisphosphonates were repeatedly mentioned and thus identified to be the principal medical intervention targeting OB suppression. Their main mechanism of action works through down regulating RANKL, a transmembrane protein that can result in excessive bone resorption in MM bone disease. All interventions introduced, however are accompanied with severe side effects such as osteonecrosis of the jaw and renal impairment for bisphosphonates. Thus, further research should be done to establish additional treatments.

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Development and Validation of a Tool for Semi-Personalization in Auditory Virtual

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An essential prerequisite for the survival of humans is the ability to detect and localize objects in our environment. One recent avenue that has broadened our ability to investigate these processes has involved the development and implementation of virtual reality (VR) paradigms. Yet, the utility of VR often remains limited to visual experience, neglecting other sensory modalities, such as hearing. One obstacle in the development of auditory VR is the individualization of sound signals as they enter our ears. To localize sounds, we rely on features of the sounds that change depending on our unique own head and ear shape. This experiment aimed to develop and validate a method of generating semi– personalized virtual auditory environments that remain perceptually faithful to the intended real–world experience. We have participants localize virtual auditory cues across eighteen pre-existing virtual environments (white noise bursts). Localization accuracy was then compared between real–world targets and virtual targets to assess the efficacy of each of the virtual worlds. We find that our task was able to identify one or more virtual environments matches real–world localization performance thus providing an immersive and realistic experience. This work has implications and benefits for researchers, clinicians, VR creators and other AVE users. Our findings can further be integrated with artificial intelligence for better performance in those models.

The Significance of Text-To-Speech Systems in Ojibwe Language Education and Revitalization

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Text-to-speech (TTS) systems can be powerful educational tools to aid the revitalization of indigenous languages such as Ojibwe. To use TTS systems in teaching Ojibwe, we must first determine whether learning from a TTS system is equivalent to a human teacher. This study aims to determine whether the cognitive load of listening to text-to-speech synthesised Ojibwe is the same as spoken Ojibwe. We will have two groups of participants: one listening to synthesised speech through headphones while the latter will be exposed to human speech. They will be instructed to stare at a computer screen throughout the experiment to measure pupil size using an eye-tracker called the SR Research Eyelink Portable Duo. This data will be utilised for analysis of the cognitive load. We chose this eyetracker while devising the methodology since it can be used easily in fieldwork. This study focuses on the utilisation of text-to-speech systems specifically for educational purposes. Since its creation, there have been requests from within the Ojibwe community to evaluate its prospective effectiveness. By conducting this evaluation, we can enhance the educational impact of our work and use this to create more ease in teaching indigenous languages, to support the preservation and continuation of the Ojibwe language. We expect that the results will show that listening to synthesised Ojibwe speech has a higher cognitive load than human speech. However, we hope the difference will be minimal, to demonstrate that TTS synthesised speech can be a good substitute for human speech in Ojibwe language education.

Pediatric Pain Prediction: A study to gather patient-reported outcome and experience measures to develop models for significant postoperative pain risk

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Approximately one in five children experience persistent postoperative pain for up to 12 months after surgery, which can be associated with undesired consequences, including poor quality of life, decreased trust in the healthcare system, increased opioid use, and additional use of healthcare resources such as emergency room visits. By identifying potential factors that may increase postoperative pain risk, preventative measures may be implemented to improve pain management. This study aims to develop a risk prediction tool to identify children at risk of significant postoperative pain. We will recruit 300 parents of children under 12 years and 100 adolescents undergoing anesthesia for surgery, as well as their parents, who will complete pre-and postoperative surveys augmented with data from the electronic medical record. Preoperative surveys capture parents' and patients' demographics, mental health, and other risk factors. Postoperative surveys periodically assess the patients' recovery for up to 90 days, capturing pain levels and satisfaction with recovery. Of 145 initial participants, patients are median (interquartile range) 5 (2–10) years old, undergoing procedures lasting 50 (30–105) minutes; 120/145 (83%) were day-case procedures. 97 participants indicated that their child is fully recovered. The 97 patients fully recovered in 7 (3–15) days and 87 (90%) of those who recovered were day-case procedures. Data will be used in risk modelling to predict risk factors for significant postoperative pain, which will be integrated into a risk communication tool to create personalized interventions for preoperative use in a future study.

How government policy helps post-secondary students and the economy after COVID

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The NEET youth, defined as the share of young people who are not in employment, education or training (NEET), can either be unemployed or not in the labor force. During the period 2008–2021, a variable rate of NEET can be observed due to the "Big Events" of the world as well as government interventions. The COVID–19 pandemic, one of the "Big Events" had caused a huge increase in the number of NEET teenagers in OECD countries, and thus there was a strong need to find practical policies that could go into effect quickly.

Living in Canada, I am thus interested in the change in the NEET rate of post–secondary students during the COVID–19 pandemic as well as government reactions to it.

The real effect of economic policies in the scale of a whole economy also largely aroused my interest and thus led me into my research thesis about the effect that the Canada government's policies had on Canadian post–secondary students during the COVID–19 pandemic.

Synaestivum: Engineering for heat-resilient wheat crops

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Agricultural supply-chains are strained due to key crops failing from record-breaking temperatures. Common wheat (Triticum Aestivum) is an international staple food, and yield loss has significant consequences for global food security. Through the use of synthetic biology, we at UBC iGEM aimed to develop a wheat strain permissive to new climates.

Our genetic circuitry combines 1-aminocyclopropane-1-carboxylate deaminase (ACCD) and sedoheptulose-1,7-bisphosphatase (SBPase) into a functional, co-expressed system. ACCD catalyzes the breakdown of a precursor to the biosynthesis of ethylene (plant stress hormone). SBPase is a Calvin-Cycle enzyme central to carbon fixation and photosynthetic capacity. These genes were cloned into plasmids with heat inducible promoters, followed by a transfection into isolated wheat protoplasts for heat shock to simulate temperature stress.

Results indicated increased fluorescence for both ACCD and SBPase containing protoplasts at higher temperatures. The system was designed such that if genes were expressed, protoplasts would fluoresce thereby demonstrating the functionality of our plasmids. The fluorescence maximized at 37°C, and was negligible until 30°C, demonstrating that the genes of interest would be upregulated only under increased temperatures This has the potential to provide wheat increased resilience to higher temperatures by increasing photosynthetic capacity. Wet-lab results were supported by bioinformatic exploration, mathematical modeling and hardware prototyping. Gene choice was supported by differential/pathway analysis, validating ACCD as a differentially expressed gene with plant development role. Introducing this heat resistant wheat strain could support agricultural systems struggling to adapt to extreme climate fluctuation, easing pressure on food supply-chains in an increasingly interconnected world.

When a coin-tossing game becomes "rock, paper, scissors"

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The statistics of a sequence of coin flips has been studied in mathematical literature since Bernoulli in the 18th century. Feller used this to formalize the concept of random walks and to develop tests for pseudo–randomness within a sequence of observations. To this day, coin flips are still used as the simplest model for random processes, including stock prices, randomized algorithms, and sending messages across a noisy channel. The study of "pattern matching", a classical problem in computer science, relies on this probabilistic model and led researchers to investigate toy versions of the pattern matching problem. We investigate a related probabilistic game known as "Penney's game", introduced by Walter Penney, in which a sequence of coin flips — either Heads (H) or Tails (T) — is generated, and two fixed sequences of coin flips, are "raced" against each other to see which sequence appears first. The first sequence to appear in the generated sequence is considered the winner. For a fair coin, one may guess that shorter sequences are more likely to win against longer sequences, but surprisingly, this is not always the case. Relying on a formula originally discovered by Conway and generalized by Li in 1980, we characterize properties that would make a longer sequence win over a shorter sequence. Additionally, if the coin is biased with a different probability of Heads, we conjecture and verify computationally that as the probability of Heads becomes very small, the probability that any sequence beats another converges to either 1, 0, or 1/2.

Investigation of Purine Activation of CD8+ T Cell Triggering Ferroptosis in Cancerous Tumours

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Ferroptosis is a relatively newly discovered type of cell death resulting from iron-dependent lipid peroxide accumulation and is characterised by cell volume shrinkage and increased density of mitochondrial membrane. The proliferation of cancerous tumour cells is controlled by ferroptosis, which can be induced through chemicals or the disruption of various biological pathways. Of particular interest is the antitumor immune response where ferroptosis can be activated by CD8+ T cells, a type of immune cells, through the production of IFN-gamma. Inducing ferroptosis further heightens antitumor immunity through the release of tumour antigens, supporting the overall efficacy of antitumor immunity. Previously, increased purine consumption has been established to increase IFN-gamma levels in CD8+ T cells. This study aims to identify whether antitumour immunity can be enhanced through increased serum purine levels. We will administer purine at a previously determined safe dose to OTI transgenic mice and harvest their CD8+ T cells to transfuse into Balb/c mice implanted with B16-OVA melanomas. We will measure tumour ferroptosis levels in the form of lipid ROS as wells as IFN-gamma levels produced by T cells through flow cytometry. The results will characterise a new potential route for cancer immunotherapies, that utilise the body's own cells to fight cancerous tumours. Future studies may focus on other methods to endogenously increase IFN-gamma production without the potential risk of hyperuricemia.

A Review of Privacy in TransLink's Compass Card System

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The concepts of the smart city and the green city are related city planning models that can both embrace big data; namely personal, spatio–temporally marked, traceable user data. As green cities and smart cities have become increasingly big data focused, the advent of unobtrusive, real–time collection of information from users raises questions of user privacy. Vancouver is a city that embraces both concepts and can be used to analyze the aspect of user privacy at the intersection of the two concepts. Specifically, the integration of personal and traceable data could pose severe privacy risks. For instance, concerns about surveillance in a city that collects data on its users arise (Bakker & Ritts, 2018). Additionally, vulnerabilities also lie in the potential disclosure of personal data if improperly collected and stored (Kitchin, 2013). Conducting an in–depth review of TransLink's Compass cards, which embrace big data collection, through the use of stakeholder interviews will provide insight into how privacy is maintained for Metro Vancouver transit users and how user information is handled within the project. Findings from this review will show how Vancouver specifically handles privacy issues in regards to big data, as well as highlight the drivers behind and barriers to privacy within a city that embraces both a smart and green city approach. This review would highlight privacy concerns within the Compass card initiative, and therefore could be used to inform future projects or reexamine similar projects in regards to their privacy policies.

The Effect of Cocaine on Motivational Level in Animal Models of Depression

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Both depression and chronic cocaine use are current widespread issues that significantly impact behaviour and cognition. Whereas depressed individuals often have motivational deficits, cocaine users maintain cocaine-seeking behaviours. We are interested in the combined effects of chronic cocaine usage and depression, and our hypothesis is that cocaine exposure in rodent models of depression will improve their motivational level in cocaine-seeking behaviour.

A 2x3 model was used; rodents were split into a depression and non-depression group. The Unpredictable Chronic Mild Stress Model (UCMS) was adopted to introduce environmental stressors upon the rodents in the depression group. Within the two groups, each rodent was randomly assigned to one of three treatment conditions: control (saline), control reward (sugar water), and experimental (cocaine). After a 14 day-long exposure to UCMS, all rodents were introduced to the motivational task, including a training phase and a testing phase. During training, rodents get 6 hours of intermittent access to cocaine, with intervals of 5 minutes of free access and 25 minutes of abstinence. Point of Maximum (Pmax), which indicates the maximum effort given by rodents to receive the reward and indicates the motivation level, was measured through progressive ratio lever pressing in the testing phase. C-Fos in the amygdala was quantified using immunohistochemistry and served as a marker of neural activity. A 2x3 ANOVA was used for statistical analysis of both C-Fos and Pmax data.

In cocaine conditions, depression-induced rodents display a significantly higher motivational level (Pmax) compared to healthy rodents ($F(1,18) = 19.43$, $p < 0.001$). There was a significant depression by reward type interaction ($F(2, 54) = 18.34$, $p < 0.001$). Depression-induced rodents exposed to cocaine also display a greater amygdala activation in comparison to healthy rodents. There was a significant main effect of reward condition ($F(2, 30) = 64.14$, $p = 0.016$). A simple main effects analysis revealed that in cocaine treated rats the chronic stress protocol increased motivation for cocaine ($F(1,10) = 8.31$, $p < 0.016$).

The proposed research is significant to further understand the interaction between cocaine addiction and major depressive disorder in anhedonic rodents with depression which could possibly provide insight into human subjects in future studies.

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Examining Fitness Variation in Annual Plant *Plectritis congesta*

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The endangered Garry Oak ecosystem has numerous threats, including invasive plant species and increased abundance of deer. To understand how the ecosystem will respond to threats, it is important to first understand the responses of key native species. One such species is *Plectritis congesta*, an annual plant that experiences high rates of deer herbivory. Since plants respond to herbivory of flowering stalks by making secondary flowers, individuals that can produce more or higher quality seeds on secondary flowers would have higher fitness. Previous research has found seed phenotype is related to deer abundance, such that areas experiencing higher herbivory tend to have more unwinged seeds than expected, though the cause is unknown. This project aimed to understand if unwinged phenotypes, which produce smaller seeds requiring less investment, compensated for herbivory differently compared to their winged counterparts. We grew winged and unwinged plants and simulated grazing (by clipping) for half the plants of each phenotype. We compared the relative fitness between the compensatory (i.e., those produced after the primary inflorescence had been clipped) and primary seeds within and across phenotypes. Our results indicate that first, both phenotypes were equally able to make compensatory seeds, and second, unwinged phenotypes produced a higher average number of compensatory seeds per plant compared to their winged counterparts; this could explain the higher-than-expected frequency of unwinged plants. Future research could evaluate how unwinged seeds influence dispersal and fitness, which could influence the ecosystem's biodiversity and resilience.

Creating and Urban Arts Commons: A case study of community arts practice in Vancouver

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Arts and culture, and by extension artists, artists' communities, arts spaces, and other artistic resources, are essential ingredients in the social inclusivity and connectivity, political and civic engagement, experience of well-being, and community resilience of urban communities. In the City of Vancouver, these urban artistic networks exist within the context of an evolving and intensifying housing crisis manifest in issues of unaffordability, instability, and displacement from urban spaces – commercial, retail, industrial, etc. as well as residential. Considering these intersecting urban dynamics, this research seeks to illuminate trends in how the spatial, material, and labour aspects of artistic practice are impacted by urban issues, as well as trends in the strategies and practices that artists individually and collectively employ to live and practice within the increasingly spatially and economically volatile and inequitable urban context of Vancouver. This research is carried out through a case study of a local, community-based arts collective, including members of the collective and of the local arts community in which the collective is embedded. The research employs mixed methodologies including multiple focus groups with different groupings of collective participants, collective mapping activities which seek to illuminate important spatial trends and locations in the local experiences and networks of artists, observation of participants' art spaces, and participant observation of various events organized and facilitated by the collective. The research finds that artists rely upon a complex and heavily interconnected system of institutions, actors, resources, networks, urban forces that intersect to constitute and enable this local community arts within the specific context of urban Vancouver. The research employs Lefebvre and Harvey's conceptualizations of the Right to the City and Howard Becker's conceptualization of Art Worlds to understand the barriers and limitations that artists face in equitably accessing spatial, economic, and social resources for their practice and labour, as well as to understand how artists actively assert and exercise the Right to the City through their artistic practice and labour.

Alternative Aridity Index for Dryland Expansion Prediction Model

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In the anthropocene, questions have emerged as to whether climate change is causing certain ecosystem types to expand or contract. For instance, Feng & Fu (2013) concluded that drylands, water-scarce areas with sporadic vegetation, had both expanded historically and were projected to expand. This expansion was predicted using a moisture metric known as the Aridity Index (AI). However, the AI's lack of consideration for vegetation and limited ties to mechanical processes has brought its validity (and that of studies based on it) into question (Berg & McColl, 2022). There remains a lack of consensus on the AI or on a viable replacement for it. Here, we propose one such alternative aridity metric, the Equilibrium Aridity Index (EAI), instead. This is a moisture metric that uses the surface flux equilibrium theory (McColl, Salvucci & Gentine, 2019) to physically classify drylands where the land surface is drier than atmospheric conditions (Kim et al., 2021). Using 26 climate simulations from the Coupled Model Intercomparison Project Phase 6 (CMIP6) (Eyring et al., 2016), we analyzed trends in drylands based on AI and EAI under a high GHG emission scenario (SSP5-8.5). We predict that, while the degree of change may vary, drylands will still be globally projected to expand significantly. Drylands host a third of the global population and are an important pillar in global agriculture, accounting 60% of international food supplies (Wang et al., 2022). Lack of knowledge about future dryland expansion can leave policy makers ill-prepared to make informed land-use & conservation decisions.

A White-Only Fishery – How Did Colonial Policymaking Impact the Economic Well-Being of Indigenous Communities in Northern British Columbia?

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For centuries, Canada's economic thinking has been dominated by the colonial notion of the staple theory, which can be best summarized by the argument that Canada should specialize in producing natural resources. As this theory is constructed upon the assumption that Canada is an unclaimed land that can be relentlessly developed by settlers, it rejects Indigenous peoples' rights and traditions. While Indigenous peoples have always been vital actors in establishing British Columbia's industrial, resource economy, many economic policies informed by the staple theory were designed to exclude them from it. Extensive research has investigated the impacts of such discriminatory policies on Indigenous communities using qualitative methods, but there have been fewer studies that quantify their impacts on the economic wellbeing. This project will study the effects of the 1912 Memorandum of Understanding between the Province of BC and the Federal Government of Canada (MOU), which aimed to create a white-only fishery. Specifically, I will use data from the 1911 and 1921 census to conduct a before-and-after and difference-in-differences analysis that estimates how it has disadvantaged Indigenous communities from the historical Indian Reserves in northern BC. I hypothesize that the 1912 MOU resulted in a drop in income of Indigenous communities that used to rely on fishery, widening the inequality between Indigenous and non-Indigenous populations. This research will help further elucidate the role that Canadian economic policies play in marginalizing Indigenous peoples, which will also contribute to the reconciliation discourse by developing a more thorough narrative of the country's colonial history.

Evaluation of infralesional muscle integrity following cervical spinal cord injury

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Background and aims: Cervical spinal cord injury (SCI) results in devastating impairments of volitional motor control. Despite the clinical implications associated with poor muscle health, it is not routinely assessed following SCI. We hypothesized that in the intermediate period after injury, cervical SCI patients would exhibit reduced US markers of muscle size and greater echogenicity values compared to able-bodied controls in functionally relevant upper limb muscles.

Methods: Thirteen individuals (47.7 ± 14.1 years; 1F, 12M) with C4–C6 motor complete (n = 8) and motor incomplete (n = 5) injuries were recruited a mean of 3.3 ± 1.3 months post-injury. Transverse B-mode images were captured bilaterally for extensor carpi ulnaris (ECU), extensor indicis (EI), flexor pollicis longus (FPL), and first dorsal interossei (FDI). Muscle cross-sectional area (CSA) and thickness (MT) were normalized to forearm circumference (n = 26 limbs). Able-bodied controls were scanned for comparison (49.1 ± 15.7 years; 1F, 12M).

Results: SCI individuals demonstrated reduced CSA for all muscles: ECU (p = .01), EI (p = .0006), FPL (p = 1.6×10^{-5}), and FDI (p = 5.7×10^{-10}). Differences in MT were observed for ECU (p = .004), EI (p = .0002), and FPL (p = 7.4×10^{-7}). Echogenicity values were higher in ECU (p = .01) and FPL (p = .0009).

Conclusion: SCI participants demonstrated atrophy of forearm and hand muscles supplied by C8–T1 myotomes. Evidence of fibrosis was observed in ECU and FPL. These results underscore the importance of incorporating muscle evaluation in cervical SCI assessment to optimize rehabilitation outcomes.

Novel Vibrio natriegens Low-Cost and Minimal Cell-Free Protein Synthesis System for Industrial-Scale Biomanufacturing

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Despite numerous findings regarding the microbial community and its application, industrial biomanufacturing technology has remained relatively constant. There are little options outside of the standard system such as E. Coli, B. Subtilis, and P. Pastoris. Batch or fed-batch fermentation remains as the gold standard. These technologies, while reliable, run into huge roadblocks with difficult to produce or toxic proteins. Cell-Free Protein Synthesis (CFPS) has emerged as a potential solution for production of these proteins in high-yields. However, it is relatively expensive and relies on E. Coli extracts. Despite being the fastest growing industrial microbe, E. Coli still grows relatively slowly (~60 min doubling-time on glucose and ~80 min doubling-time on glycerol respectively in minimal media). It also contains a significant amount of endotoxins which need to be removed thus significantly increasing downstream processing costs. In addition, sterility is a major concern as the media used can be easily contaminated. Vibrio Natriegens has emerged as a potential replacement for E. Coli since it has a doubling time half of E. Coli, less endotoxins and requires a simple high-salt media that reduces the chance of contamination. However, industrial V. Natriegens CFPS is relatively untested and unexplored because of its infancy. We have demonstrated for the first time that a low-cost, minimal industrial V. Natriegens system is possible with projection to achieve the same quantitative result as a commercial CFPS system in the foreseeable future. By relying on de-novo biosynthesis we are able to generate the necessary components for CFPS in-vitro with low-cost chemical substrates. This represents the first step in the production of a V. Natriegens system suitable for industrial usage.

Partial and Full N-terminus Truncation of Human P4-ATPase ATP8A2

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The P-type ATPase family, comprised of 5 known subfamilies (P1-P5), hydrolyzes ATP to translocate specific substrates across the plasma membrane. Our study focused on the P4-ATPases subfamily which translocates lipids from exoplasmic to the cytosolic leaflet of biological membranes to maintain lipid asymmetry that is crucial to cellular transport. Hence, mutations in human type 4 ATPases are associated with severe disorders. Consequently determining the mechanism of these enzymes is important for drug development. Unlike the well-studied P-ATPases (e.g. Na and K ATPases), the mechanism of the P4 subfamily is still not fully understood. Our study aimed to determine the mechanism of a specific P-4 ATPase known as hATP8A2 through a mutagenesis study. We hypothesized that the conserved region of hATP8A2's N-terminus has a specific function. So the full deletion of the N-terminus will have a higher effect on the hATP8A2 expression and activity level than its partial deletion. To test this hypothesis, three constructs were purified: wild-type, partially truncated (containing the N-terminus conserved region) and fully truncated. Then they underwent expression assay, ATPase activity assay, and immunofluorescence microscopy. Both mutations had lower expression and activity levels than the WT hATP8A2. The significantly lower activity level of the partially truncated hATP8A2 suggests that extra amino acids in the N-terminus can be important for translocating phosphatidylserine at a higher rate. Additionally, like the WT hATP8A2, the mutant with conserved N-terminus was localized in both Golgi and plasma membrane, although its Golgi localization was not as significant as that of WT.

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Novel Cell-Penetrating Platform for Gene Delivery

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Protein and nucleic acid–based drugs are notorious for their low absorption and high instability in the gastrointestinal tract. For these treatments, injections are currently the only feasible route of administration, leading to significant discomfort for patients. As an alternative, we are developing a cell–penetrating platform (CPP) to facilitate the absorption of large molecules. This delivery system would allow these drugs to penetrate into the blood through mucosal tissues in the patient's eyes, nose, or mouth without needing to be injected. Our CPP has displayed efficacy in delivering treatments in multiple disease models, such as insulin for diabetes or monoclonal antibodies for chronic rhinosinusitis. Furthermore, engineering the CPP into a nanoparticle form (Nano–CPP) has been shown to significantly increase the delivery of therapeutic proteins.

Given its exciting progress in protein delivery, we hypothesize that our platform could eventually be used for delivering CRISPR–Cas9, which would open opportunities for local treatment of genetic diseases. Since this would require the delivery of a protein–RNA complex, we first explored the capacity of our platform to deliver nucleic acids alone, using plasmid DNA transfection as a model. After our treatments were administered to cells, flow cytometry was used to quantify the expression of a fluorescent protein encoded by the plasmid. A two– to five-fold increase was found after treatment with our CPP and Nano–CPP respectively, indicating that our platform can successfully deliver nucleic acids. Ultimately, these results will contribute to the promising future of needle–free delivery of large therapeutics in numerous disease applications.

Towards the Total Synthesis of a Chemical Probe to Study LTCCs in Living Cells

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Calcium is a fundamental signalling ion that is involved in cellular processes that range from cellular adhesion to signal transduction in electrically active cells, such as cardiac tissue and neurons.[1] In post-synaptic neurons, L-type voltage-gated calcium channels (LTCCs), regulate the intracellular concentration of calcium based on membrane potential and stimulation from other neurons.[2] This regulation is essential for neuronal communication and synaptic plasticity and is an underlying factor in learning and memory.[3] In contrast, dysregulated neuronal calcium levels can lead to neurodegeneration, which is linked to diseases such as Alzheimer's, Parkinson's and Huntington's.[1,4] Therefore, it is imperative to study LTCCs to gain information about how these proteins behave in healthy and diseased tissue, and the effects of different modulators or pharmaceuticals on their function. The major LTCCs in neurons are the Cav1.2 and Cav1.3 isoforms.[5] Confocal microscopy is a common technique to visualize proteins in living cells, however this requires the use of a selective fluorescent probe to distinguish these proteins from others.[6] In this study, a new fluorescent probe to study Cav1.2 and Cav1.3 proteins is designed and synthesized. It has three components: a barbiturate inhibitor that has been shown to selectively bind Cav1.2 and Cav1.3 proteins, a 5-carboxyfluorescein fluorophore, and a 6-atom molecular linker holding the two together. This probe will allow the Cav1.2 and Cav1.3 channels to be visualized in their native environment, increasing the number of diverse experiments that can be performed to study these channels that have such a pivotal role in brain health.

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Investigating Barriers to Accessing Food Support at UBC

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Food insecurity amongst post-secondary students is an ongoing issue that has serious implications on academic performance and well-being. Previous research has found that 42% of university students experience food insecurity and are consistently more susceptible than the general population. Although many universities offer support such as food pantries, the effectiveness of these initiatives to the larger student population is questionable, given that rates of food insecurity are still high. This may be due, in part, to barriers preventing students from accessing food support. Despite this fact, no study about this topic has been conducted at UBC, where 40% of students experience food insecurity. While food insecurity cannot be eliminated without addressing its structural causes, it is possible to reduce the extent to which students face this issue with accessible and effective food assistance. Research in this area is crucial to understanding the accessibility of resources currently available at UBC and enabling measurable actions to support students. This study will use a mixed-methods approach to survey UBC students on their experiences accessing food support. Questions will assess the degree of usage of campus resources and barriers preventing students from doing so. The results of this study are expected to be consistent with previous research, where stigma and lack of awareness are the largest factors preventing students from using food assistance services. Through investigating barriers that prevent students from accessing available food support, we hope to contribute to the improvement of equitable food systems by easing access to food for all students.

Reflections and Recommendations from International Youth Advisors on the Need for Standardized Training

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Background: Research has shown that youth advisory (YA) boards can promote meaningful engagement in various aspects of pediatric research. However, around the world there are large inconsistencies in the training of YAs. Proper training will allow youth the tools to ensure their voice is heard and incorporated to protect their perspective. Previous research into YA groups has encouraged and recommended that youth training materials are standardized and unique for youth.

Goal: This paper investigates the current training protocols used by various global YA groups to highlight unmet needs that youth face when seeking to provide credible youth perspectives in the creation and implementation of international research.

Methods: Interviews of YAs from fifteen global advisory groups were conducted at the 2022 International Children's Advisory Network Summit in Lyon, France. All advisors were asked whether they received standardized training, the length and depth of their training, and if they could provide recommendations to improve future training.

Results: Standardized training was non-existent in a national and global context, and the number of reported training hours in advisory groups ranged from zero to sixteen hours. Three members had formal training and eleven advisors underwent continuous training. The topics covered varied greatly; most desired more training on the research process and medical terminology.

Conclusions: There remains a need for standardized training despite the existence of training platforms and YA groups. A standardized online resource where youth receive age-appropriate research training with buy-in from the network of global YA groups is critical for successful implementation.

Energy Transition For Space Heating In Single Family Residential Buildings In Vancouver, BC

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To address the impact of climate change, Metro Vancouver, BC aims to become carbon neutral by 2050 and reduce greenhouse gas emissions from buildings by 35% by 2030. More than 90% of building emissions come from space and water heating. To address this, Metro Vancouver, BC plans to transition buildings, particularly single-family houses, from natural gas furnaces to low-carbon energy systems such as electric heat pumps. This study aims to calculate the increased electricity demand due to this transition. In order to achieve this, historical ambient temperature data of Metro Vancouver, BC will be used to calculate the coefficient of performance (COP) of the most effective heat pump for this climatic region. Open source building inventory data from Statistics Canada will be used to compute the building heating energy demand. Subsequently, the energy and power demand towards electric heat pumps will be computed and compared to the present scenario. The results of this study will help identify potential opportunities of transitioning natural gas furnaces to electric heat pumps, and inform policy decisions on achieving a low-carbon energy system. Furthermore, this study will provide insights on how Metro Vancouver, BC can meet its goal of carbon neutrality by 2050 and reduce greenhouse gas emissions from buildings.

Inflammatory responses in the lung: Does age matter?

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Ageing involves an accumulation of cellular damage which results in a gradual decline of overall function, increasing risk of disease and death. This can involve dysregulation of the lung extracellular matrix (ECM) and immune response. This is a well-documented risk factor for chronic obstructive pulmonary disease (COPD), characterised by chronic bronchitis, airway remodelling and emphysema, typically ending with high mortality. Fibroblasts are the major structural cells within the lung that maintain the ECM. There is currently a knowledge gap regarding changes in inflammatory mediator release by lung fibroblasts as chronological age increases. This study aimed to investigate the differences in lung fibroblast inflammatory cytokine production, specifically interleukin 6 (IL-6) and interleukin 8 (IL-8), in relation to chronological age. Primary human lung fibroblasts were obtained from 8 younger (20-50 year old) and 8 older (70-83 year old) subjects with no respiratory disease. Cells were seeded 100k cells/well in 6 well plates and cultured until 90% confluent, then serum-deprived overnight and cultured for another 72 hrs. Cell-free supernatant was collected for IL-6 and IL-8 enzyme-linked immunosorbent assays (ELISA). Differences between groups were tested using the Mann-Whitney U test. It was found fibroblasts from older donors produced elevated IL-6 and IL-8 levels ($p < 0.05$) compared to younger donors. These results suggest that lung fibroblasts may contribute to the "inflammaging" observed in older individuals, which drives exaggerated immune responses and chronic inflammation. This link may be important to understanding the pathophysiology of chronic lung diseases like COPD.

A longitudinal study exploring temporal changes in amyloid beta and phosphorylated tau post traumatic brain injury in high-contact athletes: a research protocol

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Introduction: Every year, millions of athletes suffer from sports-related traumatic brain injuries (TBI), which increase their risk of developing Alzheimer's disease (AD) due to the accumulation of abnormal proteins in the brain, including amyloid-beta (Aβ) and phosphorylated tau (p-tau). However, there is limited research combining positron emission tomography (PET) scans with blood biomarkers and cognitive testing to track changes in these proteins longitudinally after TBI. This study aims to investigate the temporal changes in Aβ and p-tau after TBI and their correlation with cognitive performance.

Method: High-contact athletes will be recruited at the beginning of the season, and baseline levels of Aβ and p-tau will be assessed with PET scans and blood sampling. Memory performance will also be assessed using the Montreal Cognitive Assessment (MoCA). Participants who report TBI will undergo further assessments at 24 hours, 2 weeks, 6 weeks, and 6 months post-injury, and mixed-effects models will be used to analyze longitudinal changes in Aβ, p-tau, and memory performance.

Expected results: It is anticipated that the TBI group will exhibit higher levels of Aβ and p-tau in PET scans and blood samples during the acute phase of injury, followed by a subsequent decline over the following month. These changes are expected to correlate with memory testing performance positively.

Conclusion: As TBI is considered a risk factor for AD, investigating the temporal patterns in neurodegenerative biomarkers is essential to understand better the factors driving progression and recovery and the potential role of anti-amyloid therapies in TBI patients.

Age and sex difference in muscle fatigability – is the volume equal during isotonic repetitions to failure?

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Resistance training is an important part of meeting physical activity guidelines for both young and older adults. Exercise intensity, the load, is usually individualized in practice, but evidence showed that other aspects of exercise prescription, such as training volume, would also affect training effects (Sooneste et al., 2013). To simulate similar training outcomes for different populations, muscle fatigability, defined as the inclination to reduce force production, has drawn researchers' attention because people who are less fatigable tend to do more repetitions than others. Within-set fatigability, which was measured by comparing young and older adults' total volumes and relative volume indexes in the same set, and between-sets fatigability, which was measured by comparing the exercise performance of the same population among sets, were evaluated in the study. The study hypothesized that young adults would have greater within-set and between-sets fatigability than older adults, whether measuring absolute or relative fatigability since a review by Avin and Frey Law (2011) suggested that older people are less fatigable than young people. Due to the sampling size, only age-related differences were evaluated.

The study recruited seven healthy participants to do four sets of unlimited repetitions of unilateral leg presses, followed by knee extensions to failure at their 70% one repetition maximum (1RM). The study calculated the total volume participants could lift during the maximal strength exercise and the relative volume index (total volume/ bilateral 1RM) to compare their absolute fatigability and relative fatigability.

Results suggested young adults showed a greater absolute within-set fatigability than older adults during leg presses, indicating a greater absolute muscular fatigue of young people. However, there was no significant difference in within-set muscle fatigability between young and older populations under other conditions. For between-sets muscle fatigability, only young people showed a significant decrease in total volume during leg presses, indicating a greater absolute fatigability of the young population. Nevertheless, there was no significant fatigue under other conditions.

Based on the results, older people may benefit from shortening the rest period between leg press sets to emulate similar training effects as young people. Additionally, muscle fatigability can be exercise-dependent, so exercise prescription should differ depending on the exercise employed.

Early Neuropsychiatric Disorder Detection: Using DeepFace and Decision Tree Machine Learning to Analyze Abnormal Facial Expressions

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The onset of neuropsychiatric disorders, such as Parkinson's disease, major depression, anxiety, and bipolar disorders, may manifest as abnormal facial expressions. However, the identification of subtle alterations in facial expressions by medical professionals is subjective and potentially biased. Consequently, an automated facial recognition system is indispensable for the prompt diagnosis of these disorders. This study aims to discern abnormal facial expressions in patients using a Deepface-based machine learning (ML) system. A total of 653 facial images were analyzed: 601 images of healthy individuals come from LFWcrop and 52 images of patients with various neuropsychiatric disorders come from open-source databases and Beijing Tiantan Hospital. Images were manually categorized as "normal" for healthy individuals and "abnormal" for patients with neuropsychiatric disorders. Deepface, a deep learning facial recognition system, pre-trained with a convolutional ML neural network–based framework was employed for image analysis. Initially, Deepface assigned an Emotional Expression Score (EES) to each image, reflecting the individual's degree of emotional expressiveness. Subsequently, images with assigned EESs were arbitrarily allocated to either the training or testing group at an 8:2 ratio. The ML model was trained to classify images into normal or abnormal groups based on EES using a decision tree algorithm. Testing group images served for cross-validation of the pre-trained ML model. This procedure was reiterated 1000 times, yielding a mean accuracy of 95.5%. The proposed model exhibits significant potential as a component of neuropsychiatric disorder screening, particularly in communities with restricted healthcare access or suboptimal epidemiological conditions.

Effects of IL-13 during SARS-CoV-2 infection on Cathepsin S in the lung extracellular matrix

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Extracellular matrix (ECM) remodeling is one of the pathologies observed following respiratory infection by SARS–CoV–2, the virus causing COVID–19. Fibrous proteins, such as elastin, in the ECM contribute to the structure of the lungs; degradation of these fibers by Cathepsin S (CTSS) may remodel the ECM and induce pulmonary function impairment. Proinflammatory cytokine IL–13 is released during SAR–CoV–2 infection and plays a vital role in regulating elastin levels. Currently, it is unknown if COVID–19 induced IL–13 increase impacts CTSS levels. We investigated how SARS–CoV–2 infection affects IL–13 expression and levels of cathepsin–S in the ECM. We hypothesized that CTSS expression will be upregulated due to the increase in IL–13. SARS–CoV–2 spike protein gene was successfully cloned into the pCMV14 3x–FLAG expression vector, which was confirmed with DNA electrophoresis. Transfecting this plasmid into 16HBE bronchial epithelial cells, which was verified through western blotting, would model SARS–CoV–2 infection. Further experimentation was not conducted due to time constraint, however, western blotting can be used to compare levels of IL–13 and CTSS in transfected 16HBE and healthy cells. To assess the relationship between CTSS and IL–13 expression, western blotting would be used to measure CTSS levels in 16HBE cells containing anti–IL13 receptor neutralizing antibodies. The expected results would demonstrate an increased level of CTSS due to an increase of IL–13 in spike transfected bronchial epithelial cells. Understanding the role of IL–13 signaling and its impacts on CTSS expression is important in improving evidence–based practices for COVID–19 induced pulmonary fibrosis and discovering new therapeutic targets.

Treatments for osteoblastic suppression in multiple myeloma and their mechanism of action

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Multiple Myeloma (MM) is a disease of monoclonal plasma cells accumulating in the bone marrow. MM is the most frequent cancer involving the skeletal system, and is currently incurable. Osteolytic bone lesions affect up to 80% of MM patients (Terpos et al., 2018). They occur as a result of an imbalance between osteoblasts (OB, bone formation) and osteoclasts (OC, bone resorption) activity. Multiple signaling pathways, cytokines and chemokines induce OC hyperactivity and suppress OB activity, creating an environment prone to bone demineralization that leads to bone lesions and fractures (Marino et. al., 2017). The molecular basis of OB suppression in MM patients is not fully understood and few treatments are available for MM bone disease, most of which target OCs. Through utilizing electronic databases such as PubMed and Google Scholar, we answer the question of whether there are current treatments targeting OB suppression in MM. This electronic research was conducted using keywords such as "MM osteoblast suppression", "bone marrow stromal cells", "bone repair in MM", and "MM bone marrow microenvironment". Multiple published articles were then specifically selected and analyzed. Bisphosphonates were repeatedly mentioned and thus identified to be the principal medical intervention targeting OB suppression. Their main mechanism of action works through down regulating RANKL, a transmembrane protein that can result in excessive bone resorption in MM bone disease. All interventions introduced, however are accompanied with severe side effects such as osteonecrosis of the jaw and renal impairment for bisphosphonates. Thus, further research should be done to establish additional treatments.

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Sink or source? Responses of tundra carbon fluxes to warming in a high-Arctic polar oasis

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The Arctic is warming faster than predicted and faster than almost anywhere on the planet. Alexandra Fiord, NU is a High Arctic coastal polar oasis warming by 1°C per decade. Snowfall, snowmelt, and precipitation patterns are changing, and the active layer is deepening. Soil moisture regimes and plant growing season length/warmth are changing, affecting the flux of CO2 into and out of the tundra (net ecosystem exchange; NEE). Tundra regions may shift from sinks to sources of CO2 emissions with the changing climate.

We examined the effects of ambient and long–term (30 years) experimental warming on tundra net ecosystem exchange NEE of CO2. NEE is calculated as the sum of the rate of gross ecosystem photosynthesis (GEP) and ecosystem respiration (ER). NEE and ER were measured in and out of passively warmed (1–3°C) plots (n = 12) using a static chamber system connected to a portable infrared gas analyzer. Plots were divided evenly across 3 sites representing different soil moisture regimes and plant community types and measured 3 times over the growing season.

Using linear mixed models we found that warming significantly increased the magnitudes of the GEP and ER fluxes. Plot greenness significantly explained much of the variation in GEP and NEE. There was a trend of increasing NEE with warming, as the greenness–driven increase in the GEP flux outpaced ER. This evidence suggests that longer and warmer growing seasons may increase NEE and CO2 sequestration in these plant communities. Comparison with previous results suggest that interannual variability is still greater than varition in multiyear trends in the High Arctic tundra.

Characterizing *C. elegans* orthologs of Parkinson's Disease-associated genes across a broad array of phenotypes

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Parkinson's disease (PD) is a common progressive neurodegenerative disorder that affects more than 10 million people worldwide. Although a large number of PD risk genes has been discovered due to advancements in genomic sequencing, our understanding on the impact of these genes have been bottlenecked by methods to validate the functional significance of these genes in vivo. We will study these genes with *C. elegans* because the organism features three key advantages: 1. It is relatively cheap to maintain and has a short life cycle. 2. *C. elegans* has many orthologs to humans' PD genes. 3. Our lab's Multi Worm Tracker (MWT) facilitates the high-throughput phenotypic characterization of populations of freely living animals. Using the MWT, we will phenotype *C. elegans* strains with mutations in genes orthologous to PD-linked genes and generate a phenomic profile for each gene spanning up to 30+ phenotypes. Therefore, we will use *C. elegans* to highlight key risk genes that impair morphology and behavior metrics. We expect to see that mutations in orthologs of PD risk genes will influence morphological and behavioural metrics in strains of C. elegans. Through this work, we will gain more insights on how genes associated with PD contribute to disease pathogenesis, and potentially identify new pathways and genetic interactions. Follow-up research based on this work will contribute to advancing the understanding of the genetic architecture of PD for therapeutic development.

Meadowing effects on bird community composition and diversity in urban spaces

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Urbanization is a key driver of biodiversity loss alongside agriculture and deforestation. At present, the majority of cities host abundant populations of generalist bird species (e.g., crows), but urban growth is associated with the decline of specialist species, leading to simpler, homogenous bird communities. With the loss of diverse, specialist birds, we also lose the benefits they provide, like improved mental wellbeing, pollination, and pest control. Though many of the direct causes of the loss of this urban bird diversity are clear, indirect effects, such as the chain effects of the presence of nest predators and an abundance of food waste, are still understudied in cities. We hypothesize that abundant turfgrass lawns may drive the homogenization of bird communities in cities through direct and indirect pathways.

One proposed solution to increasing bird diversity in cities is 'meadowing', or the diversification of plant species by converting frequently-mowed turfgrass monoculture lawns to diverse native plant and wildflower communities. We will use point-counts surveys to assess bird diversity on residential yards throughout Vancouver, BC within three yard types; low (3–4 species), medium (9–13 species), and high (16–21 species) plant diversity. Within each type, we will attempt to control for the higher-order effects of the surrounding environment by spreading observations across a variety of surrounding spaces. We expect to find greater bird species richness on more diverse plant community yards. In addition to its scientific contributions, the information generated by this study would be relevant to urban decision-makers who increasingly seek ways to support biodiversity in cities.

Does consciousness matter?: A Novel Paradigm to Study Inattentional Blindness

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While the Invisible Gorilla Experiment is established as it displayed the relationship between what is in one's visual field and perception and how it is based more on attention than was previously thought, little is known about its underlying concept, inattentional blindness (IB). Even then, most previous methods studying IB are not robust -- they can only be carried out once, and no within-subject data is possible. IB describes the effect of failing to perceive stimuli due to attention being directed elsewhere. This could result in altered perception when evaluated with conscious versus unconscious thought, namely, identifying explicit and implicit stimuli. This project will investigate whether certain cues can be consciously noted when presented simultaneously with an more 'obvious' explicit cue that could unconsciously prime responses. This study uses a novel within-subject paradigm that measures IB robustly. Participants are shown a series of trials consisting of a few components: a target symbol that stochastically appears in the middle of the screen with distractors flashing away from it. Participants then have to answer a question about whether or not they saw the target symbol and perform additional distracting tasks immediately after the trial, to further limit attention allocation. Through measuring response times, we want to identify the effects of cues directing our attention consciously versus unconsciously. Findings from this study will provide further insight into how unconscious perception can aid learning and suggest that consciousness is unnecessary for things that we have already learned, but is needed to learn and use new things.

Reporting of determinants of health inequities and participant characteristics in randomized controlled trials of systemic lupus erythematosus in Canada: A scoping review

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Health inequities can impact disease progression and treatment; thus, it is important to consider inclusion and diversity in rheumatology research. We reviewed and synthesized randomized controlled trials (RCTs) for Systemic Lupus Erythematosus (SLE) in Canada to characterize participants and identify how determinants of health inequities are reported. Adequate representation in rheumatology research is critical for SLE patients due to the ongoing care required for patient improvement. We searched MEDLINE (Ovid 1990 to September 2021), Embase (1990 to September 2022), and CENTRAL (inception to September 2022). Eligible studies were: 1) published in English or French; 2) published between 1990 and September 2022; 3) conducted in Canada; 4) an RCT design; 5) assessing patients with SLE; 6) evaluating SLE-specific interventions; and 7) assessing participants greater than 18 years old (adult populations). Data extraction was guided by the PROGRESS-Plus framework which measures health inequities. Of 1901 unique records, 5 were selected for inclusion. Of these five studies, gender, sex and age were reported with most participants being female (ranged from 83% to 100%) and Caucasian. Reported mean ages of participants ranged from 31 to 47.7 years. Place of residence (n=4) and race (n=3) were reported in studies while socioeconomic status and social capital were only reported in one study. Language, culture, occupation, religion, education, features of relationships and time-dependent relationships were not reported. This scoping review suggests limited reporting on determinants of health inequities in RCTs for SLE in Canada and a need for a reporting framework to better reflect the SLE population.

Implications of Neighbourhood Redlining: Lasting Effects on College Graduation Rates in the US

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In the 1930s, the U.S. Home Owners' Loan Corporation (HOLC) divided and classified neighbourhoods according to their inhabitants' perceived risk of mortgage default. These housing policies have now come to be known as "redlining" – the persistent racial and socioeconomic segregation they brought about has received much academic attention. This study will identify differences in local property values between cities with similar characteristics that were and were not redlined to determine if said differences had long-run effects on the college graduation rates of local residents. Previous work has tied home values to educational outcomes through local property tax revenue, a vital source of K–12 school funding in the U.S. Our empirical strategy builds on the regression discontinuity design implemented by Aaronson et al. (2020), comparing similar neighbourhoods in cities that were and were not affected by the HOLC's policies. The sample includes the 53 US cities that, in 1930, had a population close to the threshold defined by the HOLC as the minimum required population for redlining. We combine home price information with census data from the Opportunity Atlas to compare historical college graduation rates in cities within our sample. We expect to find lower college graduation rates in redlined neighbourhoods compared to similar areas in non-redlined cities. We hypothesize that these differences are attributable to reduced home prices, lower school funding, lower household wealth, and the overall segregation of redlined areas.

Forbidden sour candy: Effects of ocean acidification on articulated coralline calcification and its defense against isopod herbivory

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Low oceanic pH levels caused by rising atmospheric carbon dioxide (CO_2) continue to threaten our marine ecosystems. This results in the endangerment of many calcified organisms. Corallines, a group of calcified red algae, are extremely vulnerable in such environments due to their easily dissolved high-magnesium calcite contents. This study will explore the effects of ocean acidification on two species of coralline algae that differ morphologically, *Corallina chilensis* and *Calliarthron tuberculosum*. The change in weight and calcium carbonate content was measured after acid treatment to mimic the effects of ocean acidification. Samples of corallines after acid exposure were then fed to the isopod, *Cirolana harfordi*, to evaluate if the change in calcification influenced grazing. When corallines were placed in acidic treatments for longer time periods, they exhibited greater amounts of calcium carbonate degradation. *C. chilensis* was found to be more susceptible to degradation in acidic environments, resulting in lower calcified content after exposure compared to *C. tuberculosum*. This supported the theory that responses to acidic environments were likely dependent on differing morphologies. No significant correlation was found between calcification and consumption in the two species. However, when calcification was disregarded, *C. chilensis* displayed a higher degree of consumption (20% ± 15%) suggesting there may be other species-specific attributes defending against herbivory. The relational ambiguity between ocean acidification, herbivory and calcification continues to be complex and requires further research.

TV Study: TV Programs Tailored to People Living with Dementia

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Background: Smart TV – referring to interactive TV programs – has been increasingly discussed for use among older adults. These interactions may include following TV instructions or activities, interacting with others via TV, or touching and selecting program options.

Study aim: This study investigated the psychosocial needs of long–term care (LTC) residents living with dementia, where the fulfilment of their needs fell short, and how Smart TV catered towards people living with dementia could assist staff and families in fulfilling these needs. The Smart TV program specifically used fewer words and was slower paced. It included videos promoting ADLs (activities of daily living) that included: encouraging water intake or nighttime self–care.

Method: Five focus groups were conducted among 23 interdisciplinary staff between two LTC sites in Vancouver, and these interviews were coded for thematic analysis.

Findings: The study found that staff reported psychosocial needs of the residents often centred around comfort, attachment, inclusion, occupation and identity. This aligns with the needs that Tom Kitwood had initially identified in "Person–Centred Care", as one of the first in his field to define it, especially regarding the needs of peoples living with dementia. However, previous research lacked insight into applying Tom Kitwood's model of psychological needs among non–English speaking clients. For this reason, this study was centred around cross–cultural topics (seasons, scenery, babies) or specific cultures (80s North American nostalgia or Cantonese self–care videos).

Implications: The study thus reveals that Smart TV is a tool that staff reported had helped remedy client agitation and initiate conversation and bonding among clients living with moderate to severe dementia and staff, in diverse linguistic and cultural settings.

Impact of diet density on *Drosophila suzukii* and its parasitoid, *Leptopilina japonica*

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Drosophila suzukii, also known as spotted-wing drosophila, feeds on numerous cultivated and wild fruits in British Columbia. Current management strategies for *D. suzukii* rely heavily on regular application of broad-spectrum insecticides, necessitating additional control methods for sustainable management. Candidate biological control agents include *Leptopilina japonica* and *Ganaspis brasiliensis*, both introduced within British Columbia and specialised on *D. suzukii*. Previous studies have shown that penetration force determines some *D. suzukii* host fruit selection, with preferences across different host plants dependent on fruit ripeness and fruit tissue density. Fruit tissue density can also influence parasitoids' fitness as oviposition success depends on their ability to probe with their ovipositors through fruit to locate larvae. We explored the optimal conditions and fitness effects on both *D. suzukii* larvae and *L. japonica* using a novel plant-based diet at different agar, resource and antimicrobial concentrations. These findings may benefit future research for laboratory or mass rearing of *D. suzukii* and its associated larval parasitoids for augmentative release, as well as increase our understanding of the natural history of this pest and its associated parasitoids.

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Investigating the potential effects of cis-acting RNA-protecting elements on circular RNA stability and translation

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Recent advancements of RNA production, purification, and delivery have greatly broadened the application of RNA therapeutics. Compared to conventional messenger RNA (mRNA), circular RNA (circRNA) are not subjected to standard mRNA degradation pathways due to lack of free ends. Therefore, they are 2 – 5 times more stable, making them a promising class of novel RNA-based expression vectors for therapeutic applications such as vaccination. However, naturally-occuring circRNA exhibit much lower translation efficiency due to lack of cap-dependent translation mechanism. While recent studies (i.e. Chen et al. 2022) have shown that incorporation of various RNA elements can considerably enhance circRNA translation, these efforts were parmarily focused on increasing translation amplitude, which leaves improving stable translation of circRNA over time unexplored. To address this, we aim to investigate whether incorporation of RNA-protecting elements, such as Zika virus (ZIKV) exonuclease-resistant RNA (xrRNA), could prolong the stable translation of circRNA over time by protecting them from degradation. We designed a Nano luciferase (NLuc) and enhanced green fluorescence protein (eGFP) dual reporter. A viral 2A "stop-go" element is inserted between NLuc and eGFP to ensure efficient co-translational separation of the two proteins. RNA-protecting elements were then systematically incorporated into the reporter. Finally, the entire construct was flanked by a split permuted self-splicing intron which directs circularization of RNA. We transfected circRNA into mammilan cells and monitored their translation level over time based on NLuc luminescence: We observed robust translation of circRNA from 6 to 96 hours post-transfection (h.p.t) that peaked at 72 h.p.t. Furthermore, when protection elements were incorporated at downsteam of eGFP, translation level appreard to remain stable at 96 h.p.t. compared to unprotected circRNA. These findings established a platform for our ongoing high-throughput characterization of circRNA stability and translation. Together, our work provides a framework for identifying RNA-protecting elements that can be effectively utilized for prolonged protein expression in future RNA-based therapeutic applications.

Analysis of bacterial inoculation effectiveness against *Phytophthora spp.* in red raspberry

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The Root Rot Wilting Complex (RRWC) is a disease that affects red raspberry plants (*Rubus idaeus L.*) and represents a major threat to raspberry cultivation. Symptoms of RRWC include leaf wilting, root dieback, and ultimately plant death. Fungi belonging in the *Phytophthora spp.* group have been identified as the main agents causing RRWC. Conventional techniques to control fungal infections include spraying with fungicides, but such practices are harmful for the environment. The availability of environmentally friendly methods to control *Phytophthora spp.* would considerably benefit the raspberry industry. Promising opportunities could be offered by biological control agents. The bacterium *Bacillus subtilis* has been previously associated with improved plant performance of healthy raspberries. Recent research conducted in vitro has also shown that root inoculation with bacterial mixtures aided the growth of raspberry roots in a *Phytophthora spp.* contaminated medium. The objective of this study was to test the effect of bacterial inoculation on plant performance and health of *Phytophthora spp.*–infected plants. A greenhouse experiment was set up, including two raspberry cultivars ('Cascade Delight' and 'Saanich') with different susceptibility to *Phytophthora spp.*, two bacterial mixtures ('cocktails' A and B) and two soil conditions (infected with *Phytophthora* or not). Measurements to assess plant performance and health (e.g., stem and root growth, leaf area and total chlorophyll content) were conducted through the duration of the project. Results from this study could provide further evidence on the benefits of bacterial inoculations on raspberry plants and could open opportunities for further experimentation in field trials.

How Climate Change and Population Growth will affect BC Parks Attendance

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BC Parks must provide British Columbians with opportunities for outdoor recreation while simultaneously protecting the natural environment. As a result of this dual mandate, park managers often find themselves on the front lines of Human-Wildlife Conflict issues. Thus, in decision-making processes, it is important for managers to know what factors underpin the volume of people that might be expected to attend on any given day. Our goal was to understand how environmental conditions and population growth will interact to shape BC Parks attendance over the next century. We modelled relationships between attendance and weather at over 250 provincial parks using a decade's worth of attendance records. We found that as temperatures increase over the year, parks generally have more visitors. With these findings, we generated projections of how BC Park attendance might be expected to change over the coming century. BC population is expected to grow substantially; even under a low population growth scenario, we can expect an increase of almost 600,000 residents by 2100. Over this same timespan, climate change in BC is projected to cause hotter summers, earlier springs, and later autumns. Our analyses showed that attendance is positively correlated to higher temperatures. Consequently, parks should anticipate a rise in visitors during the extended warm season. This information will provide BC Parks with key information required for management planning in the face of human-induced climate change, thus proactively conserving British Columbian wildlife and landscapes.

Participatory Sense-making in Dance Improvisation

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Participatory sense-making (PSM) provides a rich theoretical framework for empirical investigations of social interactions. According to PSM, the rise and fall of synchrony between individual actors provides useful information about the organization of social interactions. By extension, it's hypothesized that synchrony may be a suitable index of social understanding. Representing interpersonal synchrony, however, remains a challenge, and existing research is limited to quantitative, nondirectional accounts of synchrony. Using a dance-improvisation-based task, the goals of the present study are threefold: (1) to evaluate the suitability of different measures of behavioural synchrony, (2) to investigate the dynamics of interpersonal synchrony and information transfer between two dancers during improvisation, and (3) to observe how subjective experiences of synchrony reflect objective measures of synchrony. To do this, measurements of participants' hand trajectories are used to calculate speed time series', which provide the basis for all further computations, including three different approaches to measuring synchrony and a measure of information transfer between individuals. Using these measures, we look at moments of observed high and low synchrony and evaluate how individuals' subjective experiences of emotion, intention, and action reflect quantitative measures of synchrony and information transfer. We expect to find strong accordance between measures of synchrony and subjective experience and argue these results would not only corroborate hypotheses derived from PSM but support an emerging shift in the study of social cognition away from individuals' mental processes and toward interactional processes.

Assessing and Treating Cognitive Deficits in Depression

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Major depressive disorder (MDD) is a common mood disorder and the leading cause of disability worldwide. While various treatments reduce depressive symptoms, many patients never fully recover their previous functional abilities prior to the onset of MDD. This inability to functionally recover is attributed to the chronic and recurrent nature of residual symptoms, which disrupt daily functioning after recovery from severe depressive episodes. A collection of these residual symptoms, known as cognitive dysfunction, most significantly mediates functional impairment and manifests as deficits in attention, memory, response time, and planning among patients with MDD. However, evidence-based guidelines outlining the assessment and treatment of cognitive deficits in MDD remain unestablished. To identify the risk factors, practical diagnostic tools, and effective treatment options that address cognitive deficits in MDD, this review examines data from clinical interviews, computerized cognitive tests, self-report questionnaires, and medication trials conducted by the Canadian Biomarker Integration Network in Depression (CANBIND) on patients with MDD. These findings support the use of practical cognitive assessment tools, such as the newly developed THINC-it screener that combines neuropsychological tests and self-report measures, to guide the treatment of patients with MDD. The results also highlight the importance of assessing patient history, as patients with MDD who experienced maltreatment during childhood are more likely to experience severe cognitive deficits. Lastly, evidence suggests multimodal antidepressants are one of the best therapeutic classes of medication that minimize cognitive deficits in MDD. This review of CANBIND and related studies provides an opportunity to improve clinician care, optimize functional outcomes, and reduce the healthcare burden from MDD.

Ovarian Cancer Risk with Long-term Use of Gonadotropins Fertility Medication

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Background : 1 in 78 women risk getting ovarian cancer during their lifetime. Long-term effects of fertility drugs remain poorly understood. Theories suggest uninterrupted ovulation and exposure to high gonadotropin levels induced by fertility medications could lead to increased ovarian cancer risk. Recent studies found no such relationship, except in long-term users who remained unpregnant after treatments. Emerging evidence suggests the prescription of gonadotropin medication increases ovarian cancer risk.

Objective: We aim to determine whether increased hCG/LH/FSH levels after prolonged gonadotropins fertility medication use increases ovarian cancer risk.

Methodology: This is a prospective, survey-based, longitudinal study. Our cohort includes pre-menopausal adult women undergoing fertility treatments in Vancouver fertilization centers. Participants are given one validated survey per year until they reach menopause that inquires about medication use, contraception use, pregnancy history, pain severity and bleeding. We will test hCG/LH/FSH levels in participants' urine samples every six months, at 2 weeks after ovulation. Those who become pregnant are excluded from the treatment group and kept as a comparison group. We will control for confounding variables including contraception use, pregnancies, and breastfeeding duration.

Anticipated Results: We hypothesize that a higher percentage of participants who took over 12 cycles of gonadotropin treatments without getting pregnant develop ovarian cancer in their later life than those who do not undergo long-term treatment.

Conclusion: There are no long-term studies on the effect of fertility medication. It is important to understand the long-term effects of fertility treatments as they are commonly used by the general population.

Optimizing and Monitoring the Growth and Extraction of Phaeodactylum Tricornutum for Biofuel Production

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With the increasing effects of climate change and the depletion of fossil fuels, sustainable sources of energy are required. Biofuels have long been considered and used, but not to their full capacity. A promising candidate is algae as it has a high lipid content and can be sourced sustainably. One of the main barriers to using algae is the expense associated with the extraction of the lipids and the conversion process to fuel. Our current research is focused on increasing the lipid yield of the marine algae species, *Phaeodactylum tricornutum*, through improvements to the growth conditions and increased efficiency of the extraction process. By decreasing the nitrogen concentration, we predict the lipid yield will increase. Our methods include gathering growth rate data at conditions with no added nitrogen first to gain a baseline growth curve in our bioreactor. The next growth cycle will contain three trials of differing nitrogen levels in the form of sodium nitrate, 0 mg/L, 15 mg/L, and 30 mg/L. For the extraction process, research was done on multiple methods to determine which would be viable and the most efficient, both in cost and yield. The primary extraction method analyzed is the Bligh & Dyer method. An impact analysis is done on the energy and resource usage, student enrichment, and cost. The measurements taken will include lipid yield per trial, as well as total impact. This research will help to gain more knowledge on *P. tricornutum* and improve the economic viability of algae-based biofuels.

Creating A market for China's Lithium-ion battery industry with e-bikes and low-speed electric vehicles

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From 2017 to 2021, China's lithium battery industry tripled in output, the exponential growth suggests that China was able to facilitate industrial development without precedent elsewhere. In addition to innovative subsidies and tariffs that implicate direct government support, the Chinese government utilized its top-down system advantage to mobilize cross-sector cooperation. The subtle yet coordinated strategy facilitated the growth of the lithium-ion battery industry while minimizing the damage to existing corporate champions. This study conducts documentary analysis of Chinese government policies at both the national and regional levels, in the original Mandarin language text. Combining data under the principle of traced sales against production figures, the study analyzes how the government takes advantage of the grassroot popularity of electric bicycles, low-speed electric vehicles (LSEVs), and electric three-wheelers. It examines how the state agencies strengthen lithium-ion battery production in these three sectors by strategic policy planning. It was found that the government effectively created a market for the country's small lithium-ion batteries by forcing these manufacturers away from lead-acid batteries. This exemplifies the Chinese national government's ability to curtail certain sectors for industrial development in others. This approach demonstrates how complex, sometimes conflicting, policy initiatives guided the growth of the Chinese lithium-ion industry.

A novel DNA-siRNA hybrid lipid nanoparticle

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Small interfering RNA (siRNA)-based therapeutics holds great promise for treating cancer, hereditary genetic disorders, and neurological and infectious diseases. Lipid nanoparticles (LNPs) have been successfully used in Patisiran (ONPATTRO™), the first clinically approved siRNA drug, for the treatment of transthyretin-mediated amyloidosis. LNP-based siRNA delivery is currently of great interest for the development of the next siRNA formulation. However, the mechanism whereby LNPs are delivering siRNA to the cell cytoplasm is not well studied. DNA nanostructures have been emerging as powerful tools for biomedical and biological applications, which may contribute to a better understanding of the LNP-based siRNA delivery mechanism. In this research, we aim to exploit a novel hybrid LNPs system by integrating fluorescent DNA nanostructure into a siRNA-LNP system. The DNA-siRNA hybrid LNP system is formed from lipid mixtures dissolved in ethanol that is rapidly mixed with siRNA and fluorescent DNA duplex probes in aqueous buffer at pH 4. The resulting LNP dispersions are then dialyzed against saline buffers at variable pHs to remove residual ethanol and adjust the pH to desired value. Hybrid LNPs containing siRNA and DNA probes are characterized by dynamic light scattering, cholesterol assay and cryo-electro microscopy for particle size, lipid content and morphological analysis. The integration of fluorescent DNA probes into LNPs is confirmed by fluorescent measurements. This work will pave the way for integrating functional nucleic acids and complex DNA nanostructures into LNPs for sensing, imaging and biomedicine.

Data-Driven Spectral Classification of Stars with Machine Learning

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We present a study using machine learning and feature engineering techniques, including column transformation and recursive feature elimination (RFE), for the multi-class classification of stars' spectral types using their photometry information. Our proposed supervised learning approach (Random Forest and Support Vector Machine) was trained on labeled stellar datasets. Two models were developed and compared to evaluate their performance. The experimental results demonstrated that the proposed method with feature engineering improved the classification accuracy and computational efficiency of the models. This research demonstrates the potential of using machine learning algorithms for improving the accuracy and efficiency of star classification tasks, which could be particularly beneficial for quicker classification of a large number of objects compared to traditional classification methods.

New methodologies for Construction of Supported Excavations

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With the development of future cities and as the population of metropolitan areas increases, urban areas are getting more and more congested. Reliable underground construction can play an essential role in addressing environmental pollution, ensuring resilient infrastructure, and managing project costs. In fact, by looking at current underground construction methods, it may be necessary to replace many of the current construction practices with more sustainable and efficient underground methods. The eight-lane underground tunnel in Boston and the Path in Toronto are quintessential examples that reflect the potential of highly acceptable performance of underground construction. The aim of our study is to make use of the current knowledge and experience in practice in order to show how the city's commercial vitality and sustainability can be improved by bringing into account available methodologies for fast and reliable construction of deep basements. Our aim is to raise the idea of using cost-efficient and sustainable underground construction methodologies to save urban construction land while also expediting the process and diminishing the costs. Our effort is to respond to the queries 'What are the current methodologies for the construction of underground stories of mid-rise structures,' and "How can this practice be possibly improved?' Our hypothesis is that in the early stages of a construction project, the foundation systems in the construction area may not be stable, leading to settlement issues. To address this problem, we explore novel methods of design and preparation of supported excavations to create a reliable work area for the underground phase of construction of multi-storey buildings. This could include various options such as pile walls, diaphragm walls, caisson walls, etc. It may be determined that there is a positive correlation between the use of certain excavation systems, increased speed and decreased costs of construction. The possibility of using such materials as soil-rubber mixtures, which have high damping ratios and may greatly dissipate the dynamic loads, on the soil-foundation interface will also be briefly discussed, followed by further suggestions for future research.

Infrastructure Digitalization for a Decarbonized Built Environment

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The world has seen a joint effort from different institutions and agencies to work to meet Canadian 2050 sustainability goals. We have been developing new technologies, adopting new policies and improving systems. However, the scale of the climate emergency we are living through demands that we act with even greater urgency. Reliable construction and infrastructure lifecycle management method is an intrinsic part of future developments that may need to replace most current practices. London Forge project and the Maggie's Centre at York are quintessential examples reflecting Building Information Modelling(a process supported by various tools, technologies and contracts the generation) construction's necessity and importance. Our aim is to raise the idea of using cost-efficient and sustainable pre-construction methodologies to reduce construction risks while also expediting the process and diminishing the costs. Our research responds to the query 'How can we improve current lifecycle management methods through digitalization technologies such as BIM' We hypothesize that the construction teams are familiar with different BIM-related software during an early stage, and using them to build a strong collaboration for construction may be an option. The data are collected from present projects and combined with state-of-the-art of projects. It was found that there is a positive correlation between the use of BIM and increased construction speed and performance. The possibility of aspects such as time management, cost management, carbon reduction, etc. are briefly discussed, followed by further suggestions for future research.

Applying the incessant ovulation theory to non-hormonal methods of ovarian cancer prevention

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Background: Ovarian cancer affects approximately 3100 Canadian individuals each year. With less than 50% expected to live five years past their diagnosis. The incessant ovulation theory hypothesizes that repeated minor trauma inflicted on the ovaries' surface epithelium during ovulation can potentially increase the risk of ovarian cancer. Research has shown that oral contraceptives can minimize this risk by up to 50%. However, oral contraceptives can have potential side effects, such as weight gain, acne, and mood changes.

Objective : This study aims to investigate whether non-hormonal drugs that minimize or inhibit ovulation can reduce the risk of ovarian cancer, such as cyclooxygenase-2 (COX2) inhibitors. These inhibitors decrease follicular prostaglandin production, which is crucial in ovulation. Results of studies show that using COX2 inhibitors decreased ovulation rates while removing the side effects of oral contraceptives.

Study Design/Methodology: We will conduct a prospective, longitudinal study to assess differences in potential ovarian cancer outcomes of people aged 18-50 years in BC with or without a genetic predisposition. The study will compare oral contraceptive users and daily COX2 inhibitor users. We will collect variables such as duration of use and outcomes like cancer diagnoses, pain, and bleeding. We will then run statistical tests on the various factors.

Anticipated Results: Based on the incessant ovulation theory, we expect oral contraceptives and COX2 inhibitors to reduce ovarian cancer risk.

Implications: This study aims to add to the body of literature centred on ovarian cancer prevention, proposing a strategy that does not have hormonal side effects.

Levels of SUSD4 and SEZ6 in Post-Mortem Brain Tissue of Patients with Schizophrenia and Bipolar Disorder

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Schizophrenia (SCZ) is a debilitating psychiatric illness. Symptoms, which include psychosis, negative symptoms, and cognitive impairment, typically first present during late adolescence or early adulthood. Bipolar Disorder (BD) presents itself through recurring episodes of mania, hypomania, and/or depression. While research has uncovered some biological mechanisms that underlie these disorders, further studies are needed to deepen our understanding. There have been recent investigations of the complement immune system in the central nervous system, with growing interest in relationships between psychiatric disorders and complement system regulator proteins, such as Sushi Domain Containing 4 (SUSD4) and Seizure Related 6 (SEZ6). In this study, mRNA levels of SUSD4 and SEZ6 complement system inhibitors were measured using qPCR in post-mortem human brain tissue of patients with SCZ, BD, or neither. A hyperactive immune system due to decreased inhibition, SCZ, and BD have all been shown to be related to increased synaptic pruning and synapse loss. Therefore, it was hypothesized that there will be lower levels of both SUSD4 and SEZ6 in patients with SCZ or BD, compared to individuals with neither disorder. Independent t-tests have revealed that there is a significantly lower level of SEZ6 mRNA in SCZ brain tissue compared to individuals with neither disorder ($p<0.05$). Further research is required to confirm a direct relationship between SEZ6 and SCZ, as well as whether SEZ6 levels can be manipulated to treat SCZ.

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Promoting Positive Multiracial Identity Offline and Online: A Literature Review

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Globally, multiracial populations are growing more rapidly than monoracial populations. Nevertheless, attitudes toward mixed-race individuals can often be negative, with identity-targeted discrimination being particularly common. Such discrimination adversely affects well-being, thus making it critical to study factors that can support positive racial-ethnic identity among multiracial people. With the rise of social networking sites, this literature review examined how online spaces may benefit multiracial identity development, using research on other marginalized communities and offline peer influences to inform conclusions. Offline, peers and friends promote positive multiracial identity via validation, sense of belongingness, and conversations that facilitate meaning-making. In addition to extending these offline benefits beyond physical limitations, online spaces hold great potential for promoting positive identity through their unique affordances, such as global connection; freedom of identity construction; and engagement in digital activism, which can strengthen multiracial pride. Furthermore, this review explored how third space theory might inform the construction of positive online spaces for multiracial people. Third space theory defines spaces that challenge categorical understandings of identity, thus enabling individuals to create new cultural hybrid identities. Online spaces may be uniquely suited to function as third spaces for multiracial people, as they offer creativity, autonomy, and anonymity in contesting monoracism and negotiating identity. Overall, this review foregrounds online spaces as a rich and exciting area for future research. Specifically, focus on how mixed-race individuals currently use online spaces and the construction of online third spaces would advance the vital goal of supporting mixed-race individuals in developing a positive racial-ethnic identity.

Investigating the role of Tom5 on the assembly of mitochondrial protein import channel subunit, Tom22

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Mitochondria is the powerhouse of the cell which produces essential metabolites including ATP. Healthy mitochondrial functions are essential for normal cellular activities, which largely depends on mitochondrial proteins. Most mitochondrial proteins are synthesized in the cytosol and require import into mitochondria. Translocase of outer membrane (TOM) complex is the common import gate for most of mitochondrial proteins. A subunit of TOM called Tom5 has been studied to play an important part in maintaining structural integrity of the complex and is important for the assembly of Tom40, a main subunit that is responsible for the recognition and translocation of the preproteins that need to be imported. However, many functions and mechanisms related to Tom5 still remain unclear. Previous studies have shown a number of similarities in the role of Tom40 and another subunit Tom22. As a result, Tom5 possibly contributes to the assembly of Tom22 into the TOM complex as well. This study will focus on whether Tom5 is responsible for this process. We will use Tom5-deficient cells to check for its effect on the assembly of Tom22 through blue native gel electrophoresis. Based on this, we may also use co-IP to test if Tom5 is directly interacting with Tom22 to regulate its assembly. The results of this study will provide better understanding of the biogenesis of mitochondria import machineries and suggest new roles for the small import channel subunits.

Diagnosis of Parkinson's disease through digitalized spiral drawings and machine learning

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Parkinson's disease is a neurodegenerative disorder that affects movement and coordination. Limb tremors, bradykinesia, and rigidity occurring in the hands and fingers are early onset symptoms that are often overlooked. Early diagnosis can help patients seek medical treatment early on to slow down the progression of the disease, leading to an improvement in quality of life. Currently, there are no specific tests to diagnose Parkinson's, as most diagnoses are determined by neurologists that monitor a patient's symptoms overtime. A limitation is that the diagnosis is quite a lengthy process, leading to patients not receiving care early on. In this study, we use kinematic features extracted from digitally drawn spirals as a diagnostic model for Parkinson's disease, using a website called NeuroPrior AI in anticipation of creating an efficient and inexpensive means of diagnosis. We collected digitally drawn samples from two groups: those diagnosed with Parkinson's disease, and a group of healthy controls. Both groups traced a spiral template, in which 3 different models of CNN, K-nearest neighbors, and SVC C-support machine learning were used in this order to build an approach that could determine the presence of Parkinson's disease based on features including deviation of the drawn spiral from the template. We discovered that the drawings from patients with Parkinson's had many spikes not following the template, while the group of healthy controls traced the spirals accurately. Our approach could be valuable for early diagnosis of movement disorders, such as Parkinson's disease.

Effects of soy protein supplements on bone health in vegan postmenopausal women

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Background: The impacts of vegan diets on bone health have been intensively discussed recently. Vegans may experience low Bone Mineral Density (BMD) at the lumbar spine and femoral neck, thus more prone to fractures, likely due to low body mass index (BMI), reduced protein, calcium, vitamin D and B12 intake. Age and hormonal also changes exacerbate bone loss in postmenopausal women. Therefore, research has shown supplements may be an effective solution to prevent and reduce bone issues in this population. While supplements are shown to improve BMD, current literature is limited on the effectiveness of soy protein (SP) supplements in vegans. This project investigated the effects of SP supplements on BMD in vegan postmenopausal women in North America. I expect to observe SP supplements with isoflavones will have a dose-dependent protective effect on BMD.

Methods: UBC Library and Pubmed databases were used with the keywords: "postmenopaus*", "isoflavones", "bone", "osteoporo*" and "BMD". 48 articles were screened to 7 peer-reviewed English articles relevant to the research question.

Results: There was an emergent dose-dependent effect of isoflavones for SP supplementation. The dose of isoflavone between 110-165mg/d had protective effects on BMD predominantly on the femoral neck, total hip and spine; doses near 90mg/d isoflavone had no-to-low protective effects on BMD; while Isoflavones < 90mg/d had no effect.

Conclusions: These results demonstrate a dose-dependent effect of isoflavones, which will help to improve bone health for vegan postmenopausal women. Longer-term studies will lead to reduced preventable bone issues and updated dietary recommendations for vegan women.

The Role of Gay-Straight Alliances in Mitigating Harassment for Canadian and United States Queer

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Gay-straight alliances in subnational Canadian and United States regions have received mixed support from legislators, school authorities, and parents of Two Spirit, lesbian, gay, bisexual, transgender, and queer (2SLGBTQ+) youth. However, emerging research reveals that students in gay-straight alliances experience more secure relationships, greater comfort with their gender or sexual orientation, higher self-worth, and less physical danger and social isolation. As such, this research aims to understand how youth membership in Canadian and U.S. gay-straight alliances shapes 2SLGBTQ+ self-image and safety. Through semi-structured focus group interviews with 18-to-25-year-old participants from Canada and the U.S., we will gather information about the experiences of these participants, specifically concerning their exposure or lack thereof to high school gay-straight alliances. Narrative analysis will be used to interpret the participants' accounts of minoritization and the role of gay-straight alliances in their high school experiences. This enables us to understand how they make sense of their lived experiences and construct and communicate meaning through their narratives. By identifying patterns and themes in the participants' responses, we anticipate gaining valuable insights into the social context and outcomes of participation and exclusion from gay-straight alliances. The comparative nature of this study will allow for a cross-cultural examination of 2SLGBTQ+ youth experiences and uncover how cultural, political, and sociodemographic differences inform their perspectives. This research has the potential to direct policy and programming to foster safer environments for 2SLGBTQ+ youth, as well as support existing evidence concerning the value of gay-straight alliances in education settings.

The Silent Struggle of Muslims Suffering with Substance Use Disorders

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This study explores the effectiveness of self-help groups that integrate Islamic perspectives for Muslims with substance use disorders (SUDs). British Columbia, specifically the Lower Mainland, is the location where this mode of treatment is being proposed due to the increase in drug-related deaths. Convenience and snowball sampling was used to recruit participants. Mosques and Islamic organizations in Canada were informed about the project and connected the co-investigator with individuals who interacted with Muslims with SUDs. Five Muslim community leaders were recruited from this process, all were male and none shared the same profession or role within the Muslim community. Semi-structured interviews were conducted with Muslim community leaders. Participants were asked open-ended questions related to how they addressed SUDs in their communities. An inductive thematic analysis approach was used to determine the main themes discussed. Using NVivo, an initial coding scheme was created based on open coding in the first two interviews to identify the themes that emerged. Six main themes were coded for: addiction stigma, faith, community, education, identity, and love. The two themes that were mentioned the most often by participants were addiction stigma and faith. The analysis revealed that community leaders believe self-help groups may not be beneficial due to the stigma surrounding addiction. However, there was a consensus that religion needs to be integrated regardless of the mode of treatment, as it reminds individuals with SUDs of God's presence and helps them feel close to God. Thus, aiding them in the recovery process and in many instances preventing relapse. Understanding the perspectives of community leaders within a Muslim-Canadian context and incorporating cultural sensitivity into addiction treatment, can in turn aid in providing comprehensive, effective health care to Muslim Canadians with SUDs.

The Role of Nostalgia and its Associations with Eudemonic Wellbeing during the COVID-19 Pandemic

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Nostalgia is a sentimental longing for one's past, often including contents such as personally meaningful recollections of childhood or social relationships. Historically considered a pathology, increasing attention is given to positive aspects of nostalgia including nostalgia's ability to induce positive affect. However, nostalgia can be associated with both positive and negative experiences. In fact, nostalgia could be a coping mechanism, which can accompany negative affect during the process of dealing with a difficult encounter but may eventually be associated with meaningful experiences. Furthermore, while some prior findings report that nostalgia is associated with lower hedonic wellbeing, it is unclear whether nostalgia–wellbeing associations differ between hedonic and eudemonic facets of well-being. The purpose of this research was to examine if nostalgia is correlated with higher wellbeing, especially its eudemonic aspects. The data utilized in this project were collected as part of an intensive longitudinal study including a Canada-wide adult sample (N=97, M= 44.52, SD= 18.60, 81% female; data collected from April to October of 2021) collected during the Covid-19 pandemic. A regression analysis was conducted to analyze relationships between two operational definitions of nostalgia and two dimensions of eudemonic well-being (Purpose in Life and Self-Acceptance). Contrary to our predictions, no significant associations were found between reported frequency of nostalgia and ratings of eudemonic wellbeing. Further research may provide clarifications as to whether nostalgia is associated with greater life satisfaction and/or purpose.

Design and Testing of an Augmented Reality-Assisted Vein Detection Device: A Low-Cost Solution for Difficult Intravenous Access in Healthcare Settings

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Difficult intravenous access (DIVA) is a prevalent healthcare issue that is currently leading to repeated insertion attempts by healthcare staff that may be (1) uncomfortable and stressful for patients, 2) frustrating and time consuming for healthcare professionals, and 3) promoting unnecessary waste of single use medical supplies. Correct establishment of patient vein access is essential for maintaining fluid and electrolyte balance, administering critical medications, and preparing for subsequent potential medical imaging and surgeries, intravenously. Unfortunately, existing vein-finding technologies face heavy user and technological limitations, and are prohibitively costly. In this research, we conducted a detailed literature review on current vein-finding applications, and accordingly developed an innovative hands-free augmented reality (AR)-based system that can support healthcare professionals' ability to establish intravenous access in difficult cases. The proposed low-cost solution is backed by a machine learning (ML) architecture which improves vein detection efficiency through computer vision and IR depth detection technology, which maps the depth of the vein during the scanning. In the next step of the research, the ML model will be informed by a wide collection of patient image data, which will be collected in various Canadian Blood Services donation clinics. The complete ML tool will be eventually integrated into a smart glass or a head-mounted display (ie. Microsoft Hololens) to be a wearable design.

Perception of retinal images: Can artificial intelligence help us discover new diagnostic features?

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Medical images are a rich source of health information. Diagnosticians are trained to sift through them to detect subtle signs of pathological processes. Retinal images are routinely used in ocular disease diagnosis and management. Might there be signs of pathology within retinal images, beyond eye diseases, hiding in plain sight, but currently overlooked? Convolutional neural networks (CNN) trained on retinal images can classify sex, a trait invisible to the diagnostician. Recent work in interpreting a CNN model has elucidated features within fundus images relevant to sex classification. We investigated whether human observers can be trained to recognize "invisible" patient traits from fundoscopic images, such as sex. We examined diagnosticians (Expert, N=23) and a comparison group of adults 18-50 years-old (Non-expert, N=31). In the pre-training phase, baseline sex recognition was assessed via a 2-alternative forced-choice (2-AFC) task between male-female retinal image pairs without feedback. Then followed a training phase and practice trials with feedback. Finally, a post-training 2-AFC sex recognition test and a novel object memory test (NOMT) of object recognition ability were completed. Pre-test results are consistent with chance-level performance, as expected, mean=52% for both Experts and Non-experts. Post-test performance significantly improved for Experts mean=66.1% (d= 2.38, p<<0.01) and Non-experts mean=66.2% (d=1.67, p<<0.01). NOMT test performance was not related to improvements in fundus classification. Together, results demonstrate that diagnosticians can be trained to recognize novel retinal features suggested by artificial intelligence. Future work with this approach can be extended to discover signs of systemic and neurodegenerative disease in retinal images.

Studying the impact of mood on domestic dog's learning and resilience to the environmental distractions

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Mood is an affective state that might last hours to days. Previous research found mood as a significant contributor to the cognitive performance; however, the empirical findings are controversial. The purpose of this research is to examine whether the short-term mood of pet dogs can influence their speed of learning and focus on the task. Dogs (n=20) were divided into the experimental group, having 15 minutes of positive experiences (walking, playing with toys, and nose-work with treats) and the control group, experiencing a relatively boring situation in a room. Both groups then performed a hand-touch learning task. Once the learning criteria (six consecutive touches, each within three seconds) was met, a remote-control car (stressor) moved in a transparent box for two minutes. Number of responses until the learning criteria, latency to return to the task, time spent interacting with the car, frequency of gazing at the owner and the car, and the incidence of emotional responses (e.g., barking) were recorded for each dog. A normality test was conducted and based on the data distribution, either a Mann-Whitney or an unpaired T-test was conducted to compare the two groups. Results showed the control dogs (mean = 10.10±4.748 trials) had a higher learning speed (p = 0.002) compared to the experimental dogs (mean = 19.70±7.987 trials). However, the two groups did not differ in the other measured variables. It can be concluded that a short-term positive mood might either decrease the information processing or lead to a motivational decline in learning.

Was it a just punishment or were they just punishing? How children evaluate the morality of third-party authority figures who punish previous antisocial others

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Developmental psychologists have recently begun exploring children's reasoning in grey areas of morality. However, past research yielded mixed evidence regarding whether young children could make context-dependent sociomoral judgements. While some studies suggested that preschoolers would positively evaluate third-party punishers of previously antisocial individuals, others did not replicate this finding. Specifically, it has been shown that children dislike intentional harm, but will they condone intentional harm in the form of a deserved punishment, especially when done so by an authority? The current study explores whether preschoolers would justify the punishment of previously antisocial characters when done so by third-party authority figures. Three- and four-year-olds first watch a puppet show featuring a prosocial rabbit that helps a duck and an antisocial rabbit that hinders the same duck. Then, randomly choosing the prosocial or antisocial rabbit, the second puppet show entails the chosen rabbit asking for help. Next, an authority figure will refuse the request, hence punishing the rabbit. Another authority figure will agree to the request, helping the rabbit instead of enforcing punishment. The children then answer a series of questions about their sociomoral perceptions of the two authority figures. We hypothesize preschoolers to express that the third-party punishment was justified, given that it was done by an authority. The findings of our study would indicate whether children perceive the morality of punishment to be influenced by the social role/status of the punisher, ultimately informing parents and policymakers about the developmental process of context-specific moral reasoning.

Integration of a Markerless Motion Capture on Post-stroke Participants in 2D and 3D

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Stroke is the 10th largest contributor to disability-adjusted life in Canada [1]. Post-stroke patients undergoing rehabilitation of the affected limb(s) often experience weakness and fatigue during rehabilitation exercises, such as arm reaching and leg kicking, which can lead to improper technique and slower rehabilitation progress. However, understanding and motivating the patient's rehabilitation exercises using conventional marker-based motion capture systems can be difficult and cumbersome for post-stroke patients due to the physical markers restricting their movement. DeepLabCut is a markerless motion capture system that uses pose estimation algorithms to track and quantify movements across mammalian species. Using DeepLabCut, we hypothesize obtaining 2D position data with an error rate of 5 pixels or less [2], as well as creating 2D kinematic plots and 3D positioning graphs. This is accomplished by recording a video of common rehabilitation exercises and extracting a certain number of desired frames to manually label joints/body parts of interest. These frames are used to train the pre-set Resnet machine learning model for hundreds of thousands of iterations and tested to evaluate accuracy. We can create fully marked videos and corresponding 2D position data using the trained model. From this data, we can extract joint angles and point velocities and a fully calibrated 2-camera setup would allow us to acquire 3D position data and model these as graphs. With the results of this project, visualizing and quantifying post-stroke patients' movements in rehabilitation exercises at specified points of interest is achieved with a markerless motion capture system.

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Adult Education in US Correctional Facilities: A critical review of their shortcomings compared to other developed nations.

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Adult education is most commonly termed as an integral sub-division of a global scheme for lifelong education and learning. One important defining quality of adult education is its emphasis on being education for every adult. Thus, adult education should aim to provide an unbiased, judgement-free learning opportunity void of rigid criteria since people are multifaceted and at different stages in life. For our project, we aimed to explore adult education within the context of prisons and correctional facilities. We sought to access the benefits and constraints of these institutions through our review of the literature, since correctional facilities are in charge of reintegrating inmate back into the society. Our focus was primarily on the United States (US), as it is by far the world leader in imprisoning its adult population. Through our review of the US system, three important questions emerged. Firstly, how does the lack of qualitative data impact adult education in prisons? Second; how do different education programs (basic literacy, vocational training, etc.) in correctional facilities impact recidivism rates? And lastly, what are the implications of higher level and more diverse adult education programs for prison inmates? To answer these questions, we resorted to literature from the Nordic Nations and the UK not just to fill in the gaps, but to also outline points of improvement that can be implemented in the US system. Of course, this discussion is delivered in the context of inherent sociopolitical constraints and existing hegemonies that entangle the US as a nation.